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Sampling Analysis Quality Plan
Perth Entertainment and Sports Precinct Burswood Peninsula, WA

Prepared For: Main Roads WA

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EXECUTIVE SUMMARY

PROJECT OVERVIEW

Aurora Environmental (Aurora) was commissioned by Main Roads Western Australia (Main Roads) to prepare a Sampling and Analysis Quality Plan (SAQP) to support the investigation and management of potential contamination within the proposed Perth Entertainment and Sports Precinct (PESP). The PESP, located on the Burswood Peninsula less than 5km southeast of the Perth CBD, is proposed to be redeveloped into a high-profile, multi-use venue featuring an outdoor amphitheatre, motorsport track, function centres, and extensive landscaping and infrastructure upgrades. The project site covers approximately 28.15 hectares and is underlain by complex fill material, including areas of historic uncontrolled landfill.

BACKGROUND AND ENVIRONMENTAL CONTEXT

The Burswood Peninsula has a long history of anthropogenic modification, including its use as a landfill from the mid-20th century. Historic fill materials include dredge spoil, demolition rubble, industrial waste (including asbestos), and domestic refuse. The area also hosted cement and asbestos manufacturing, market gardens, and wastewater treatment activities. The site geology comprises up to 8m of fill overlying organic-rich Swan River Alluvium (SRA), with groundwater present 0.5-2m below ground surface (bgs). As a result, the PESP area is subject to known environmental risks, including potential contamination of soil, groundwater, surface water, and ground gas generation.

Several parts of the PESP site have previously been assessed and remediated, most notably Lot 2001 (Perth Stadium Precinct) and Lot 551 (Crown Towers), both of which are now classified as “Remediated for Restricted Use” (RRU) under the *Contaminated Sites Act 2003 (WA)* (the CS Act). However, other cadastral lots within the PESP footprint remain classified as “Possibly Contaminated – Investigation Required” (PCIR) or are of unknown status.

PURPOSE AND OBJECTIVES

The purpose of this SAQP is to provide a detailed framework for conducting a targeted Detailed Site Investigation (DSI), that will assess potential environmental risks across the PESP footprint and inform future site management and redevelopment. Specifically, the SAQP aims to:

- Identify data gaps in the current Conceptual Site Model (CSM);
- Define investigation methodologies to fill those gaps;
- Support environmental risk assessments;
- Inform land classification under the CS Act; and
- Facilitate development approvals and construction risk management.

The SAQP has been developed in alignment with key regulatory guidance documents, including the *NEPM (ASC) 2013*, DWER (2021) *Contaminated Sites Guidelines*, *PFAS NEMP v3.0* (HEPA, 2023), and DoH (2021) *Asbestos Guidelines*.

DATA GAPS AND RISK DRIVERS

The SAQP identifies six primary data gaps in the CSM:

1. Nature, extent, and composition of landfill material;

2. Integrity and effectiveness of landfill capping;
3. Ground gas generation and migration potential;
4. Groundwater quality and plume delineation;
5. Surface water quality impacts; and
6. Potential for acid sulfate soils (ASS) and disturbance risks.

These gaps correspond to key risk drivers, including potential receptor exposure to contaminants, migration of contaminants to groundwater and surface waters, and generation of methane and other landfill gases. The risk of disturbing residual contamination or ASS during construction also presents regulatory, health, and project delivery implications.

PROPOSED INVESTIGATION APPROACH

The SAQP outlines a comprehensive multi-media investigation program including:

- Soil and capping layer characterisation via test pits, soil bores and geophysical assessment;
- Asbestos in soil screening and laboratory analysis;
- Ground gas monitoring (installation and multi-round sampling);
- Groundwater sampling and well installation;
- Surface water and sediment sampling; and
- Acid sulfate soils field testing and laboratory analysis.

IMPLEMENTATION STRATEGY

The outcomes of the SAQP and subsequent DSI will be to provide input to construction environmental management plans, and guide future land use planning. It will also enable Main Roads to understand and mitigate potential environmental liabilities and health risks associated with the development.

Mr Andrew Lau (JBS&G) has been engaged by Main Roads to undertake contaminated site on a voluntary basis as a DWER-accredited Contaminated Sites Auditor for the Project. Post construction of the PESP, an auditor’s report will support the reclassification of affected lots under the CS Act.

Engagement with stakeholders such as land owners, land managers, regulatory bodies including the DWER and DoH, the Town of Victoria Park, and interested community groups will be essential to ensure alignment of the investigation with broader project objectives.

1 INTRODUCTION

Aurora Environmental (Aurora) was engaged by Main Roads Western Australia (Main Roads) to prepare a Sampling and Analysis Quality Plan (SAQP) for the investigation and assessment of potential contamination in the vicinity of the proposed 'Perth Entertainment and Sporting Precinct' (PESP) located at Burswood Peninsula (the Project). The PESP is located less than 5km southeast of the Perth central business district (CBD) and has a conceptual footprint of 28.15ha (See Figure 1). The current layout of the PESP area is shown on Figure 2.

1.1 PROJECT BACKGROUND

The Western Australian State Government plans to develop the PESP area to create a high-profile, multi-use destination including a large outdoor amphitheatre, a versatile track for motorsport and community use, and new buildings for events and functions. These works, along with extensive landscaping and infrastructure upgrades to improve access and connectivity with other existing portions of the Burswood Peninsula (the Peninsula), including the Perth Stadium Precinct.

The Peninsula was originally mudflats with a series of island sand bars. The shape and form of the present land surface is a result of riverbank works and infilling over the Peninsula with river material as well as landfill disposal and other uncontrolled fill. The current surface layer over un-remediated portions of the PESP footprint is understood to comprise a thin veneer of clean sandy fill, overlaying 4-8 metres (m) of uncontrolled fill, including industrial and general landfill. Beneath this is the Swan River Alluvium (SRA), a soft compressible mud extending to a depth of 26m. Groundwater is present at approximately 1-2m below ground surface (bgs).

Landfill previously encountered across the Peninsula includes localised asbestos contamination resulting from the previous activities of James Hardie Industries and Swan Portland Cement to the north of the PESP footprint. These areas been remediated and capped with a layer of clean fill.

Septic waste filter beds were previously located on the Peninsula outside of the PESP footprint, to the west and northwest. Wastewater from these filter beds was discharged into the adjacent Swan River.

The main contamination sources on the Peninsula have been identified as including extensive unconsolidated fill across the Peninsula from the time that the Peninsula was used for waste disposal, which has included spoil from river dredging, ash slurry from the East Perth Power Station, demolition rubble, railway waste and general household refuse. In addition to the placement of these industrial and residential wastes, other potentially contaminating historical land use activities over the peninsula include market gardens, piggery and dairy.

1.2 SITE IDENTIFICATION

The conceptual boundary of the PESP (PESP footprint) as provided by Main Roads during preparation of this SAQP, is located on portions of several cadastral lots as defined in Table A below. The conceptual PESP footprint is shown in Figure 3.

TABLE A: SITE DEFINITION

LOT IDENTIFICATION DETAILS	SITE USE	DESCRIPTION - LANDOWNER/ MANAGER	CURRENT CS ACT CLASSIFICATION
Lot 2001 on Plan 414942	Multi-use Stadium, Sports, Recreation and Entertainment Precinct ('Perth Stadium Precinct'). Includes internal carriage ways Roger Mackay Drive, Marlee Loop, Warndoolier Bvd, Crane Place and northern portion of Camfield Drive.	Crown Reserve Under Management WA Sports Centre Trust c/o Venues West	Remediated for Restricted Use (RRU)
Lot 2002 on Plan 414942	Public Open Space – Parks and Recreation	Crown Reserve Under Management by Burswood Park Board	Possibly Contaminated – Investigation Required (PCIR)
Lot 2006 on Plan 414942	Southern portion of Camfield Drive 'Camfield Drive Extension'	Under Management Town of Victoria Park	PCIR
Lot 551 on Plan 76986	Crown Towers	Burswood Nominees Pty Ltd	RRU
Lot 555 on Plan 77026	Public Open Space and Portion of Camfield Drive	Crown Reserve Under Management by Burswood Park Board	PCIR
Lot 557 on Plan 4250402	Public Open Space and Portion of Camfield Drive	Crown Reserve Under Management by Burswood Park Board	PCIR
Lot 42 on Plan 47265	Old Burswood Canal	Crown Reserve Under Management by Burswood Park Board	Uncertain
Land ID Numbers 3407163; 30098897; 4160076	Victoria Park Drive	Town of Victoria Park	Uncertain

1.3 REGULATORY BACKGROUND

Current cadastral Lots 2001, 2002, 2006, 551, 555 and 557 within the PESP footprint defined in Section 1.1 above, formerly comprised three cadastral lots which have since been cancelled (Lot 300 on Plan 42394, Lot 12057 on Plan 218634 and Lot 301 on Plan 42394). These three cadastral lots were previously classified under the *Contaminated Sites Act 2003* (WA) (the CS Act) by the Department of Water and Environmental Regulation (DWER) as '*Possibly Contaminated – Investigation Required'* (PCIR) on the 28 July 2010, on the basis that the area had been used as a landfill for disposal of domestic and commercial waste since 1946 and investigations undertaken between 2007 and 2008 had identified impacts to soil and groundwater potentially resulting from landfill materials buried at the site. It is uncertain if portions of the PESP footprint relating to Victoria Park Drive and the Old Burswood Canal have been classified under the CS Act.

During redevelopment activities associated with both the Perth Stadium Precinct and the Crown Towers these former land parcels were cancelled, and the State of Western Australia progressed the realignment of cadastral boundaries into the current cadastral Lots. As part of these redevelopment works, investigation and remediation works were undertaken at Lot 2001 (for the Perth Stadium Precinct) and Lot 551 (for Crown Towers). A Mandatory Auditor's Report (MAR) which Aurora understands was prepared by AECOM; however, this document was not reviewed by Aurora. A Voluntary Auditor's Report (VAR) (JBS&G, 2023) was also prepared for Lot 2001. The Auditor's reports supported the reclassification of these lots from PCIR to RRU. It is noted that the PESP footprint overlaps with portions of Lot 551 and Lot 2001. The inferred boundaries of the previous MAR and VAR are presented on Figure 4a.

Aurora understands that the balance of former Lots 300, 12057 and 301 (i.e., current Cadastral Lots 2002, 2006, 55 and 557 which forms a16.5ha portion of the PESP footprint as shown on Figure 3a) has not been subject to assessment and/or remediation management that support reclassification under the CS Act beyond their status as PCIR. On this basis, Aurora understands that Main Roads has engaged Mr Andrew Lau (DWER-accredited contaminated sites auditor) from JBS&G to prepare a VAR to assist with the management of contamination, the environmental approval aspect of its project and contract risks during construction of the PESP.

1.4 OBJECTIVES

The objectives of this SAQP are to identify the data gaps in the preliminary Conceptual Site Model (CSM) for the proposed PESP project and develop a plan to collect a suitably robust dataset during the DSI to fill the identified gaps, facilitate refinement of the CSM, assess potential risks and support making decisions for future remediation, management and/or further investigation for the PESP footprint.

Investigation of these data gaps will support the assessment of potential risks to human health, the environment, and environmental values of the site, considering the proposed final landform and intended land uses. The outcomes will inform appropriate management measures and guide the design and delivery of the PESP project.

As the SAQP will support the investigation, assessment and management of contamination and re-classification of land parcels under the CS Act, it has been prepared in a manner consistent with the following guidelines.

- National Environmental Protection Council (NEPC) (1999) *National Environment Protection (Assessment of Site Contamination) Measure,* 1999 as amended 2013 (ASC NEPM).
- Heads of Environmental Protection Authority Australia and New Zealand (HEPA) (December 2023) *PFAS National Environmental Management Plan Version 3.0*. HEPA, Australia. (PFAS NEMP V3.0).
- DWER (2021) *Assessment and Management of Contaminated Sites*.
- Department of Health (DoH) (2021) *Guidelines on the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia*.

- New South Wales Environmental Protection Authority (NSW EPA) (2020) *Assessment and management of hazardous ground gases.* Contaminated Land Guidelines.

1.5 SCOPE LIMITATIONS

The scope of work presented in this SAQP has been developed based on preliminary information provided by Main Roads and the current concept design for the PESP. This information is limited and does not include detailed data on the extent, depth, or nature of sub-surface disturbance, nor does it reflect a finalised development design, which remains subject to change.

As such, this SAQP provides a framework for initial data collection to inform a targeted Detailed Site Investigation (DSI). The DSI will offer a snapshot of site conditions prior to construction commencement; however, further investigation may be required to meet the project objectives outlined in Section 1.4, particularly if site conditions or design elements evolve.

Furthermore, Aurora considers that portions of the PESP footprint within Lot 2001 – previously subject to a VAR, will be excluded from further intrusive investigation under this study. These areas have already been assessed and are currently managed through an engineered sub-surface barrier, which may present a risk if disturbed. In the absence of additional investigation, existing data from the assessment data which were reviewed by the VAR will be relied upon to inform the assessment of this portion of the PESP.

2 BACKGROUND DOCUMENT REVIEW

The Peninsula area has been subject to numerous environmental and geotechnical investigations to support past and ongoing development activities which provide context to this investigation.

Specifically relating to the PESP footprint, the Burswood Park Board engaged Tetra Tech to prepare a Sub-surface Management Plan (SMP) (Tetra Tech, 2024) for the areas under its management. A summary of the SMP is provided in Section 2.1.

Aurora has also reviewed the relevant off-Site reports for the Perth Stadium Precinct, Crown Towers and Mirvac Burswood on the Peninsula sites which inform the scope of this SAQP. The reviewed documents for these off-Site areas are listed in Table B.

TABLE B: REVIEWED DOCUMENTS RELATING TO SURROUNDING SITES

PERTH STADIUM PRECINCT	
Desktop Study and Review of Previous Environmental Reports – Proposed Perth Major Stadium –	Golder Associates, 2012a
Detailed Site Investigation (Golder Associated, 2013) Proposed Perth Major Stadium –	Golder Associates, 2013a
Environmental Compliance Completion Report (ECCR) Perth Stadium	Westadium Project Co Pty Ltd, 2018
Sub-Surface Site Management Plan Perth Stadium Rev 6	Westadium Project Co Pty Ltd, 2022
CROWN TOWERS	
Crown Towers Detailed Site Investigation Rev C Draft	Golder Associates, 2013b
Crown Towers Detailed Site Investigation Addendum Rev 1	Golder Associates, 2013c
Contaminated Site Management Plan – Crown Towers	Golder Associates, 2014
MIRVAC – BURSWOOD ON THE PENINSULA	
2024 Groundwater and Surface Water Monitoring Report Burswood Lakes: Ministerial Statement 526	Emerge Associates, 2025

In addition to the above documents, Main Roads provided Aurora with 89 historical reports for review to inform the development of this SAQP. A complete list of these documents is provided in Appendix 1. These documents included geotechnical and other investigation reports relating to the suitability of the Peninsula and adjacent Claisebrook area for future development works. From this set, five key documents have been identified as providing significant background to the current investigation.

- H36 Burswood Park Board – site plan showing bores, pump stations and lakes (Burswood Park Board, 2011).
- H37 Burswood Park Board Exploration Drilling Program and site history (Burswood Park Board, 2006).
- H40 Burswood Park Board – Plan and drillers logs of Exploratory water bores 2000 (Water and Rivers Commission, 1998).
- H42 Burswood Park Board - Plan showing extent of dumped materials (Burswood Park Board, Unknown date).

- H63 Construction of Lakes for Burswood Golf Course (Golder Associates, 1987).

These documents are summarised in Section 2.5.

2.1 SUB-SURFACE MANAGEMENT PLAN – BURSWOOD PARK BOARD (TETRATECH, 2024)

The SMP establishes a structured approach for managing the risks associated with sub-surface contamination during civil and maintenance works at Burswood Park.

The document provides a summary of potentially contaminating activities that have been undertaken across the Peninsula which are managed by the SMP. These contaminating activities are associated with historic landfilling activities which are summarised below and shown in Figure 4b:

- Cement and asbestos manufacturing (e.g., Swan Portland Cement, James Hardie);
- Sewerage treatment and dumping;
- Railway cinder and solid waste dumping; and
- Land reclamation using uncontrolled fill (including industrial, domestic, and dredged materials).

While the SMP does not present detailed quantitative data, it does summarise multiple investigations (Table D of the SMP) confirming contamination consistent with historical site uses. Contaminant levels in some cases exceeded NEPM and DWER guideline criteria for human health (recreational land use setting) and environmental values, prompting the implementation of sub-surface management and control protocols.

The provided framework to ensure that any intrusive activities which may disturb contaminated soil, groundwater, or vapour are handled safely, and in accordance with environmental and health regulations. It also outlines when the SMP must be applied, particularly when contamination is suspected or known, and provides a decision flowchart to guide implementation. Potential hazards associated with sub-surface conditions at the Site are outlined, as are the responsibilities of various parties (i.e., Burswood Park Board, Town of Victoria Park etc.,).

The SMP outlines expected sand cover thickness over the underlying landfill at various locations within the plan boundary. In the 1960s, the Perth City Council placed imported sandy fill across much of the Burswood Peninsula, creating a general fill cap of approximately 1.0 to 1.5 metres in thickness. However, in areas such as the 'South Nine Parkland' (which is inferred by Aurora to be the southern portion of the former Burswood Gold Course; within the PESP footprint), sub-surface waste has been historically encountered at depths as shallow as 0.15 metres bgs, suggesting that the capping thickness is locally variable and may have been reduced by settlement or erosion.

The key performance indicators (KPIs), presented in the SMP, for the implementation of the SMP are outlined below.

- No unregistered sub-surface disturbance.
- Appropriate health and safety precautions are taken in performing works.
- Area of disturbance is appropriately reinstated/integrity of warning barriers is maintained.
- Appropriate environmental management precautions are taken in performing works.
- No unacceptable discharges or emissions or other environmental incidents.

- All surplus contaminated soil or dewatered groundwater effluent is appropriately disposed of in accordance with the SMP.
- SMP remains suitable to the needs of sub-surface disturbance work and site conditions.

Landfill gas is identified in the SMP as a contaminant of potential concern (CoPC) due to the historical disposal of putrescible waste and biosolids. Vapour inhalation risks are specifically noted for site users undertaking sub-surface or confined space activities, particularly where volatile organic compounds (VOCs) or residual waste gases may be present. The SMP anticipates that Site-specific Health and Safety Plans may incorporate occupational vapour monitoring—both real-time and delayed—when vapours are suspected. A risk pathway analysis was provided in Table E of the SMP and highlights inhalation of contaminated soil vapours as a key exposure route during intrusive works, recommending the use of appropriate Personal Protective Equipment (PPE), implementation of work controls such as positioning workers upwind and dust suppression, and consultation with a suitably qualified contaminated land consultant to determine the need for air quality monitoring.

2.2 PERTH STADIUM PRECINCT REPORTING

2.2.1 Desktop Study and Review of Previous Environmental Reports – Proposed Perth Major Stadium – (Golder Associates, 2012)

The Public Transport Authority engaged Golder Associates to undertake a desktop study reviewing previous environmental and contamination investigations in the vicinity of the Perth Stadium Precinct. The objectives of the study were to review available reports and collate readily available environmental information to assess the presence of site contamination, identify environmental constraints, and consider what actions (if any) may be required in relation to environmental matters prior to development.

The study found that a number of investigations had been undertaken across the Peninsula, and that the landscape and topography had been significantly altered, due to historic industrial activity and the Peninsula's use as a disposal landfill. This industrial activity has created a legacy of contamination, potential contamination, and data gaps associated with unknown contamination issues across the Peninsula.

The following is a summary of the Burswood Peninsula history, taken from the PSI:

- At the time of European settlement in 1829, the Burswood Peninsula and adjacent Swan River consisted largely of sand bars and islands, described at the time as "mudflats". Settlement was attempted, but agricultural activity proved difficult due to recurrent flooding.
- In 1895, the peninsula became home to Perth's first public golf course and, in 1899, a horse racing track (now Belmont Racecourse), located north of the railway line which had been constructed in 1893 beyond the northern boundary of the study area.
- To facilitate river transport, a 250m canal was excavated through the Burswood Peninsula in 1831. The canal was ultimately unsuccessful and used predominantly for drainage until the 1950s, when it was replaced with a 1m diameter concrete drainage pipe laid within the backfilled canal alignment.

- Between 1906 and 1912, 22 acres on the western side of the Peninsula were resumed for use as a sewerage filtration system. The beds consisted of 15m wide concrete ponds supported by timber piles. These were abandoned in 1934 and subsequently backfilled with aggregate.
- From 1945 until the early 1970s, one of Perth's major rubbish tips was located on the western side of the Peninsula.
- As a result of this historical activity, the site has been filled with uncontrolled materials from various origins. Investigations identified landfill material at depths of up to 8m, including solid waste, asbestos, industrial waste, cinder ash, biosolids, medical waste, and general putrescible waste.
- Asbestos waste present on the Peninsula and is primarily associated with previous activities by James Hardie Industries and Swan Portland Cement. These areas have been remediated and capped with clean fill and are outside of the PESP footprint.
- Septic waste filter beds, previously located on the edge of the peninsula, discharged directly into the Swan River.
- In approximately 1974, Main Roads imported fill material to the southern portion of the Perth Stadium Precinct as part of a trial embankment for the proposed Graham Farmer Freeway. The freeway and Windan Bridge were ultimately constructed north of the study area.
- In 1984, remedial works were undertaken to enable construction of the Burswood Casino and Resort (located south of the Site), as well as a golf course on the Site.
- The Burswood Golf Course encompassed Lot 300 (northern nine holes), Lot 301 (southern nine holes and public open space), and Lot 12057 (golf course clubhouse and maintenance areas). Earthworks for the golf course commenced in 1985, including the construction of clay-lined lakes.
- The golf course continued operating until mid-2013, when it was closed in preparation for the Pre-Construction Phase (PCS) of the Perth Stadium development project.

The desktop study concluded the following:

- No comprehensive investigation related to soil groundwater or landfill investigations have been undertaken in the proposed Stadium Precinct Area and no landfill gas monitoring has been completed.
- Acid sulfate soils (ASS) are present in the study area.
- Elevated concentrations of hydrocarbons, organochlorine pesticides (OCPs), heavy metals, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) have been reported in previous investigations.
- Groundwater investigations have reported elevated levels of metals and nutrients.
- Elevated concentrations of PAHs, heavy metals, and pesticides have been recorded in Swan River sediments.
- Given the potential for contamination issues and the existence of data gaps, Golder recommended that further environmental investigations be undertaken in the form of a DSI. This would support the development of appropriate site management plans, including a

Construction Environmental Management Plan, ASS Management Plan, Validation Plan, and ongoing monitoring program.

2.2.2 Detailed Site Investigation (Golder Associated, 2013a)

2.2.2.1 Contaminated Soils

Soil sampling undertaken as part of the DSI (Golder Associates, 2013a) recorded elevated concentrations of metals (arsenic, cadmium, copper, lead, manganese, mercury, nickel, tin and zinc), PAHs (benzo(a)pyrene, fluoranthene, phenanthrene, pyrene) and dieldrin exceeding adopted ecological investigation levels (EILs). In addition, concentrations of copper, lead, benzo(a)pyrene and total PAHs exceeding adopted health investigation levels (former HIL-D which was previously used to evaluate risk of soil contamination for residential land use with minimal access to soil) in three soil samples.

A total of 301 samples were submitted for the confirmation of asbestos presence/absence. The results for nine samples (relating to eight locations) were positive for the presence of asbestos (cement fragments [asbestos containing materials; ACM] and fibre bundles [amosite, chrysotile and crocidolite]). Asbestos was detected at depths ranging between 0.6m below ground level (bgl) to 6.0m bgl (recorded in the uncontrolled Fill material).

Based on the DSI data (Golder Associates, 2013), soils within the Site were not considered to represent a significant risk to ecological receptors and were approved to remain in-situ subject to implementation of a capping strategy to mitigate potential risks to Site users.

2.2.2.2 Ground Gases

The Perth Stadium Precinct DSI investigation boundary is underlain by a former landfill. The typical material encountered included sandy fill, building rubble, ash and what appeared to be burnt wastes (Golder Associates, 2013). Waste encountered contained only very limited putrescible waste (Golder Associates, 2013). The SRA is reported to be an organic rich clayey formation, with the potential to degrade anaerobically and produce methane gas.

A total of 84 ground gas monitoring wells were installed in shallow fill at the Site during the DSI (Golder Associates, 2013a) on an approximate 100m x 100m grid (50m x 50m beneath the Perth Stadium Precinct). Six ground gas monitoring events were undertaken between 17 September 2012 and 7 December 2012. Results are summarised as follows:

- A total of 17 out of 84 wells monitored during the six rounds contained combustible gas concentrations greater than the project trigger value of 25% of the Lower Explosive Limit (% LEL) (Golder Associates, 2013).
- The DSI provides clarification that combustible gas concentrations expressed as % gas as methane and percent lower explosive limit (%LEL) as methane were measured and recorded using a GEMTec 5000 ground gas monitor and a QRAE II combustible gas meter, respectively. The GEMTec 5000 measures combustible gases as % gas as calibrated using a specific calibration gas. For this project, the calibration gas used was methane. Therefore, or this project, the instrument measures combustible gases as % gas as methane.
- A total of 14 wells contained combustible gas concentrations equal to or greater than 100% LEL (Golder Associates, 2013).

- Methane was detected at up to a maximum concentration of 72.4% v/v in ground gas monitoring wells (Golder Associates, 2013).
- Concentrations of carbon dioxide were recorded ranging from 1.6 to 50% v/v and hydrogen sulfide concentrations ranging from 0 to 11ppm (Golder Associates, 2013a).
- A maximum flow rate of 0.18L/hr was applied to the recorded ground gas data to calculate a Gas Screening Value (GSV) in accordance with Figure 8.1 of CIRIA C665.
- The methane GSV provided by Golder ranged from 0.02 to 0.13.
- The carbon doxide GSV provided by Golder ranged from 0.003 to 0.090.
- Based on the results of the Gas Screening Values calculations, Golder concluded that the recorded methane and carbon dioxide concentrations presented a low risk (in accordance with CIRIA C665) Perth Stadium Precinct and surrounds in their configuration at the time.
- Carbon monoxide and hydrogen sulfide concentrations were recorded below the National Occupational Health and Safety Commission (NOSHC):1003 (1995) Time Weighted Average (TWA) and Short Term Exposure Limit (STEL) values across the site with the exception of GS07 which recorded a hydrogen sulfide concentration of 11 parts per million (ppm) above the TWA of 10 ppm but below the STEL of 15 ppm. It is considered that these concentrations also pose a low risk.

2.2.2.3 Acid Sulfate Soils

The DSI (Golder Associates, 2013a) indicated that the Site and surrounding land are in an area with a high to moderate disturbance risk of actual acid sulfate soils (AASS) and, potential acid sulfate soils (PASS) occurring generally at depths greater than 3m. It was noted from the DSI (Golder Associates, 2013) that waste fill encountered contained only very limited putrescible material, however it was acknowledged to have the potential to become sulfidic if the right geochemical conditions were generated i.e., a low oxygen environment with a source of iron and sulfate, and a pH of 4 or above.

Based on results from the chromium reducible sulphur (CRS) analyses, all boreholes (except MW118) and most test pits, indicate ASS exists in the study area. Of the 155 samples analysed, 93 exceeded the 0.03%S criterion for CRS analysis with a maximum concentration of 1.99%S (sample logged as Fill: Waste) which equated to an effective liming rate of 188kg/m^3 assuming 100% effective neutralising value (ENV).

Exceedances were greater than 50% of analysed samples for all three tested material types (Fill: Sandy Clay, Fill Waste and Natural SRA). Most exceedances occurred within the Fill Waste and natural materials. ASS are identified from 0.1m bgl at LGSB65 (orange/brown sand (Fill)) to 7.2m bgl at LGSB31 (dark grey silty CLAY).

The study noted that results suggest that:

- Fill material placed on the Peninsula was originally ASS;
- Fill material became ASS due to the groundwater conditions – low oxygen levels within groundwater may promote ASS conditions; or
- Night soil (Fill Waste) may become ASS due to the putrescible component containing organic matter. The oxidation of organic matter promotes the formation of oxygen depleted

environments, these are conducive to bacterial sulfate reduction which in turn forms the sulfide in the soil.

Golder did not consider it possible to delineate specific areas/depths where ASS exists within the study area due to the variability of the material encountered and limited number of samples analysed.. Based on the samples tested and results of the CRS testing, all lithologies tested exhibit the characteristics of acid generating soils.

The DSI recommended that any material required to be excavated (e.g., as part of bulk earthworks) from above the groundwater table was permitted to be reused on-Site above the groundwater table without ASS treatment; however, any material excavated from below the groundwater table was required to be treated and reused above the groundwater or, if treatment was not practical the material would be required to be disposed of appropriately off-Site.

2.2.3 Environmental Compliance Completion Report (ECCR) Perth Stadium (Westadium Project Co Pty Ltd, 2018)

The ECCR was prepared to document information gathered from environmental management and monitoring programs implemented and summarises environmental outcomes for the construction phase of the Perth Stadium Project.

2.2.3.1 Conceptual Site Model

The CSM identified key CoPC including heavy metals, hydrocarbons, OCPs, PAHs, PCBs and ACMs. These were primarily associated with historical fill and landfill activities. Key sources included:

- Historic landfill deposits containing putrescible and industrial waste;
- Asbestos contamination from James Hardie and Swan Portland Cement operations;
- ASS and potentially sulfidic fill material; and
- Ground gases are generated from anaerobic degradation within organic clays and waste materials.

2.2.3.2 ASS and Contaminated Soils

Sub-surface conditions were generally consistent with those recorded in the DSI (Golder Associates, 2013). There was no mandate to remove contaminated soils within the Site except for the following materials which were required to be managed because of cut/fill activities, which were validated by EKJV as suitable for reuse in the Perth Stadium Precinct (EKJV, 2014):

- Treated ASS material which was excavated from the infilled Lake (No. 1);
- Dewatering treatment area stockpile;
- Areas where hydraulic spills had occurred;
- Mulch stockpiles;
- Topsoil stockpiles;
- Limestone (980m^3) excavated from beneath a portion of the former Golf Clubhouses; and
- General fill relating to hardstands (e.g., haul roads, workshops).

In addition, approximately 409,702m^3 of material (comprising both imported and site won material) was left on-Site as part of surcharging activities.

The materials left on-Site following the PCS Phase were documented in the EKJV Closure Report (EKJV, 2014) and based on the information provided, Westadium proposed to reuse the material in accordance with the provisions made in the Construction Environmental Management Plan (CEMP).

2.2.3.3 Groundwater Quality Project Concept Phase

Analysis and chemical testing of groundwater undertaken as part of the DSI (Golder Associates, 2013) indicated that there are concentrations of contaminants, in particular nutrients and metals that exceed the applicable water quality guidelines at the time of reporting (Department of Environmental Conservation [DEC], 2010; Marine Water, Fresh Water, Long Term Irrigation Water, Drinking Water and Swan River Trust [SRT] interim trigger levels). The results from the groundwater sampling also indicated that nutrient concentrations in the SRA are higher by an order of magnitude than concentrations detected elsewhere in the Waste Fill.

2.2.3.4 Surface Water Quality - Project Concept Phase

Nutrients in surface water samples analysed from the Swan River-fed Lake during the DSI (Golder Associates, 2013) indicated that levels exceeded the SRT interim trigger levels for phosphorus and total nitrogen. Metals including aluminium, boron, iron and zinc were also detected in the Swan River and River-fed Lake and considered to represent background water quality which is seasonally variable.

2.2.3.5 Surface Water Quality – Pre-Construction Phase

Surface water quality monitoring of the Swan River and River-fed Lake was undertaken at regular intervals during the PCS phase of works (weekly to fortnightly). No discernible trends in concentrations of nutrients or other CoPC were identified beyond those that are seasonal or tidally influenced. EKJV concluded that the surface water monitoring data indicated that PCS works were not considered to have adversely impacted these surface waters.

2.2.3.6 Groundwater Quality – Pre-Construction Phase

The primary analytes that were considered to assess the effects of surcharging on groundwater quality in the Fill were nutrients (Total Nitrogen) and salinity (electrical conductivity [EC] / total dissolved solids [TDS]), because these were identified at concentrations up to approximately seven and four times greater in the SRA than in the Fill, respectively.

A groundwater management system was installed during the PCS Phase to manage potential risks associated with the mobilisation of nutrient groundwater from surcharging activities. A spear point was installed (330 spears at 1.5m spacing) to abstract groundwater along a length of 416m. The spears were advanced to the maximum depth of Fill, but not into the SRA, to target the greater nutrient concentrations that were considered likely to be mobilised along the bottom of the Fill. Dewatering operations commenced on the 11 November 2014.

Initially, the dewatering system operated using three independent suction pumps discharging to a water treatment system, located north of a turkeys nest. During effluent treatment, the discharge pipework for the suction pumps were connected to the treatment plant where water underwent a four-stage treatment process, which consisted of pH adjustment; aeration; clarification and filtration. The treated water was then discharged to intermediate holding tanks prior to being discharged to the turkeys' nest where the water was subsequently used for surcharge conditioning/site dust suppression.

On the 7 March 2014, the dewatering treatment plant was decommissioned, and dewatering effluent was disposed to sewer via a Water Corporation approved sand/silt trap. Monitoring of the abstracted groundwater showed sporadic elevations of total nitrogen, with no concentrations of total nitrogen consistently being recording at or above 12mg/L (EKJV, 2014). The dewatering system was placed on stand-by on the 29 April 2014, and ultimately decommissioned on the 20 August 2014. A total volume of 15,155.74kL of groundwater was abstracted form the fill during the PCS Phase. EKJV (2014) concluded that based on the groundwater monitoring results recorded during the PCS Phase, the management measures implemented, as outlined above, were effective in mitigating risks from ground improvement activities to groundwater quality.

With respect to other groundwater quality parameters e.g., metals and ASS indicators, wells located between the river-fed Lake and the Swan River (peripheral wells) demonstrated rising trends in concentrations of boron and potassium. Arsenic (in groundwater monitoring wells MW14 and BH08) and manganese (in groundwater monitoring well MW38) were also considered to be demonstrating an increasing trend. Given the location of the wells, observed groundwater levels and flow directions, Golder Associates (2013) concluded that none of these trends were caused by the surcharging operations and in general, groundwater monitoring data did not indicate any significant deterioration in groundwater quality that could not be justified by seasonal variations.

Trends in concentrations of aluminium, iron, arsenic and pH, particularly in groundwater monitoring well MW75, were attributed to the unprecedented seasonal decline in groundwater levels due to a lack of recharge from the historical irrigation exposing a localised area ASS that previously was saturated throughout the year. It is considered likely that the oxidation of the ASS has been occurring with the seasonally decreasing water table, however remained undetected until heavy rainfall events percolated through the oxidized soils and elevating groundwater levels for the first time since decline. EKJV (2015) indicated that pH subsequently increased as groundwater was replenished with up gradient higher pH (and alkalinity) groundwater and concentrations of metals returned to within baseline trigger values.

EKJV considered that the low level sporadic detects of pesticides, PAHs and Total Recoverable Hydrocarbons (TRH) were attributable 'to concentrations that are known to be present in groundwater, reminiscent of historical activities undertaken prior to the PCS Phase and not due to site operations' (EKJV, 2014).

Based on the data recorded during the DSI and PCS Phase, Westadium developed a groundwater monitoring program which was implemented during the construction phase.

2.2.3.7 Remediation Strategy

The remediation strategy focused on mitigating unacceptable risks to human health and the environment while enabling site development. Key remediation objectives included:

- Breaking exposure pathways between site users and CoPCs;
- Preventing migration of contaminants into surface and groundwater;
- Managing ground gases to mitigate explosion or health risks; and
- Providing long-term containment through engineered barriers.

2.2.3.8 Remediation and Validation

Soil Contamination

Remediation verification focused on:

- Correct implementation of the soil capping strategy;
- Confirmation that clean fill met import criteria; and
- Validation of excavation areas where the impacted soil was removed.

The capping strategy involved placing a geofabric warning barrier followed by a layer of certified clean fill across areas with residual contamination. This strategy was consistently implemented across the Northern, Southern, Eastern, Western, and Central Precincts, as well as around underground utilities.

Data Quality Objectives (DQOs) were applied to guide sampling and ensure consistency with the Remediation Action Plan (RAP). Soil validation confirmed that all areas met the remediation targets. Recommendations included:

- Maintaining integrity of the capping layer;
- Adhering to restrictions on land use (non-residential); and
- Incorporating sub-surface information into management plans.

Groundwater

Groundwater quality was assessed through an extensive monitoring network. Key validation elements included:

- Analysis of contaminants such as nutrients, metals, and hydrocarbons;
- Dewatering monitoring and discharge quality control; and
- Establishment of site-specific trigger values for operational monitoring.

Dewatering activities were conducted during amphitheater footing installation and stormwater infrastructure works. All activities were monitored for pH, turbidity, and contaminants. Results confirmed compliance with DWER guidelines.

Based on the extensive monitoring completed and observations recorded, it was concluded that the management and remediation objectives with respect to groundwater quality were achieved for the Construction Phase. The ECCR recommended that the abstraction of groundwater from the superficial aquifer beneath the Perth Stadium Precinct should be restricted unless monitoring is undertaken to demonstrate that water quality is suitable for the proposed use.

The abstraction of groundwater for the Perth Stadium Precinct is from the Leederville Aquifer and is permitted in accordance with licensed groundwater abstraction, which is subject to complying with licence conditions.

Surface Water

The project recognised that the river-fed Lake and adjacent Swan River contained low levels of contaminants (metals and nutrients) prior to construction. Given the potential for construction activities—particularly ground improvement works—to impact water quality, the project established several key objectives: to maintain environmental and ecosystem protection, minimise construction-related impacts, and manage the site in accordance with relevant State policies.

To meet these objectives, a comprehensive surface water monitoring program was implemented throughout the Construction Phase. The monitoring network included both the river-fed Lake and Swan River and evolved over time as construction progressed and risks to receptors were reassessed. Monitoring frequencies ranged from weekly to quarterly, and both field (e.g., pH, EC, dissolved oxygen [DO]) and laboratory parameters (e.g., nutrients, metals, hydrocarbons, pesticides) were analysed. Site-specific trigger values were derived using pre-construction data and national guidelines.

During construction, trends in water quality showed that:

- Nutrient concentrations, particularly total nitrogen, mirrored seasonal inputs and were linked to upstream sources, contributing to algal blooms in 2016.
- ASS indicators remained mostly stable, though pH fluctuations were observed during bloom events.
- Metal concentrations (iron, aluminium, zinc) showed sporadic spikes but generally decreased compared to pre-construction.
- Other CoPCs: Organic compounds (e.g., PAHs, OCPs) were mostly undetected. Dieldrin was occasionally detected at low levels.
- In 2016, algal blooms were recorded in the river-fed Lake and Swan River following heavy rainfall. These events were monitored with support from the Department of Parks and Wildlife (DPaW), and sampling continued through August 2016.

Although no ongoing risk was identified, surface water monitoring is required under the Operational Environmental Management Framework. Quarterly monitoring was recommended to continue at key locations, and trigger values will be updated to reflect observed seasonal trends. Restrictions and precautions should remain in place regarding public interaction with the River-fed Lake, especially related to cyanobacteria and pathogen risks from stormwater inputs.

Ground Gas

Ground gas was a significant risk due to the presence of organic-rich fill and alluvial clays capable of generating methane and carbon dioxide.

Following the DSI (Golder, 2013a), further gas monitoring and quantitative risk assessment was undertaken with the project area classified as Characteristic Situation 2. This classification was based on multiple rounds of ground gas monitoring which recorded elevated methane concentrations, with a peak of 69.3% v/v observed in borehole GG202, and carbon dioxide concentrations up to 14.6% v/v. While hydrogen sulphide and carbon monoxide were occasionally detected, their levels were low and did not warrant further assessment. The ground gas monitoring program included regular sampling over extended periods to capture temporal variability and inform the risk assessment.

In response to the assessed risks, gas mitigation measures were incorporated into the design and construction of the stadium and associated infrastructure, including the installation of verified gas protection membranes.

A Ground Gas Management Plan (GGMP) was implemented, including:

- Installation of gas proof membranes beneath enclosed structures;
- Indoor air monitoring within buildings; and
- Quality Assurance and Quality Control (QA/QC) documentation for each stadium sector.

Validation monitoring recorded:

- Methane up to 85% v/v in early phases, with reduced levels post-remediation;
- Carbon dioxide levels up to 50% v/v; and
- No exceedance of indoor air quality guidelines post-construction.

Post-construction, verification monitoring which included indoor air quality testing in confined or occupied spaces, confirmed negligible risk to human health and deemed the enacted protection measures were effective, and no non-compliances were recorded.

To ensure ongoing safety, the SMP mandates continued controls for intrusive works and recommends additional indoor air monitoring for at least two years post-construction to validate the effectiveness of installed gas barriers.

2.2.4 Sub-Surface Site Management Plan Rev 6 (Westadium Project Co Pty Ltd, 2022)

2.2.4.1 Document Summary

A Sub-surface Site Management Plan (SMP) was developed by Westadium to manage residual contamination beneath the Perth Stadium Precinct on Lot 2001, Burswood. The SMP outlines measures for the long-term management of sub-surface constraints including contaminated soils, ground gases and groundwater. It forms part of the broader Operational Environmental Management Plan (OEMP) and is intended to remain in effect in perpetuity.

The SMP provides a structured approach to:

- Maintain the integrity of engineered remediation systems (e.g., capping layers, gas membranes).
- Identify and manage contaminated fill, ASS, and landfill gases.
- Guide safe excavation and ground disturbance activities.
- Ensure continued protection of human health and environmental receptors.
- Meet statutory obligations under the CS Act and related DWER and NEPM guidelines.

Summary of Sub-surface Constraints and Remediation Outcomes:

- Historic uncontrolled fill (including asbestos, metals, hydrocarbons and other industrial waste) remains in-situ beneath engineered barriers.
- Methane and carbon dioxide are present due to landfill and organic-rich SRA; a gas membrane system was installed and verified to be effective.
- Post-construction monitoring (2018–2019) of groundwater and surface water confirmed no significant or sustained impacts to water quality. Monitoring has since ceased, but sub-surface risks remain and are managed via this SMP.

The SMP relies primarily on robust engineering controls to isolate residual contaminants and prevent exposure.

Warning Barriers

- High-visibility geotextile or geogrid layers have been placed above contaminated fill.
- The warning barrier acts as a trigger during excavation to alert workers they are approaching potentially contaminated materials or ASS.
- Required where capping is <0.5 m thick or in landscaped zones.

Approved Fill Capping Layer

- Clean or validated fill placed above contaminated zones, ranging in depth from <0.1m to >0.5m depending on location and use.
- Functions to physically separate receptors from contamination, reduce infiltration, and prevent erosion.
- Subject to validation during construction and routine post-construction maintenance and inspection.

Gas Proof Membrane

- Installed beneath enclosed structures (e.g., Stadium) to prevent ingress of methane and CO_2.
- Designed for “Characteristic Situation 2” as per CIRIA C665.
- Verified effective through ground gas monitoring (2018–2019); membrane integrity must be maintained or reinstated during future works.

Hardstand and Landscaping Elements

- Includes concrete pavements, turf, mulch, and dense planting.
- Prevents surface erosion, discourages access to underlying fill, and reduces water infiltration.
- Some play areas include additional containment via geosynthetic clay liners (e.g., in the Western Precinct).

Other Physical Barriers

- Includes compacted layers, root barriers, and sealed service corridors.
- Where services must be installed, alignment is planned to remain within clean fill zones wherever feasible.

2.2.4.2 Implications of the SMP (Westadium Project Co Pty Ltd, 2022) on PESP footprint DSI

Any proposed intrusive investigation that overlaps with areas managed under the SMP for Lot 2001 must be carefully planned, to ensure compliance with existing control measures and land use restrictions. The engineered controls such as capping layers, gas protection membranes, and warning barriers that must not be compromised without appropriate authorisation. As such, works involving ground disturbance within or adjacent to SMP-managed zones will require review and approval by the VenuesWest, including completion of a Sub-surface Controls Assessment Form. Planning and execution of any investigation must incorporate the SMP's requirements into Safe Work Method

Statements (SWMS), Health and Safety Plans (HSP) and, where applicable, Environmental Management Plans (EMP). Additionally, existing memorials on title restrict the use of the site to non-sensitive land uses, and any proposed works must not increase risk to site users or undermine existing containment measures.

2.3 CROWN TOWERS (LOT 551)

2.3.1 Detailed Site Investigation (Golder Associates, 2013b)

The Crown Perth Towers DSI, conducted by Golder Associates in 2013, evaluated contamination risks across the southern portion of the Burswood Golf Course and adjacent carpark in preparation for development of a new hotel (Crown Towers). The investigation targeted four key Areas of Potential Environmental Concern (APECs):

- Historical uncontrolled landfill;
- Acid sulfate soils (ASS);
- Contamination in lake sediments and surface water water on the Crown Towers site; and
- An alkaline groundwater plume from the former Swan Portland Cement factory.

To investigate these APECs, soil and ground gas samples were collected on a 50m grid spacing in this DSI. Samples were collected from 44 soil borehole locations (35 soil bores plus nine ASS bores), 33 ground gas monitoring wells, 14 groundwater monitoring wells, nine sediment locations and five surface water locations.

Key findings from the DSI are outlined below.

2.3.1.1 Soil Assessment

The soil assessment identified multiple exceedances of the former EILs, particularly within fill materials. Exceedances were noted for several metals, including arsenic, cadmium, copper, lead, tin, and zinc, as well as for PCBs, benzo(a)pyrene, fluoranthene, pyrene, and OCPs such as dieldrin and the sum of dichlorodiphenyltrichloroethane (DDT), dichloro-diphenyl ethane (DDE), and dichlorodiphenyldichloroethane (DDD). Two samples also exceeded HILs for commercial/industrial use (former HIL-F values), specifically lead in sample SB012 and benzo(a)pyrene in sample SB011.

2.3.1.2 Ground Gas Monitoring

Ground gas monitoring was undertaken across 33 wells installed on a 50m grid. Field screening using a bubble flow meter indicated no measurable gas flow in any well, while static pressures were low (2 to 16 Pa) in only eight wells. Despite this, significant concentrations of combustible gas (as defined in Section 2.2.2.2 above) were identified, with 16 out of 30 wells exceeding the trigger value of 25% of the LEL. Of these, 10 wells recorded concentrations exceeding 100% LEL (equivalent to 5% methane by volume). Elevated concentrations of carbon dioxide (up to 15%) and low oxygen levels (as low as 0.5%) were also recorded, indicating potential for anaerobic conditions. Hydrogen sulfide and carbon monoxide were detected at low levels, with maximum concentrations of 4.1ppm and 31ppm, respectively. While some VOCs were detected in gas samples, none exceeded the draft NEPM (2011) Health Screening Levels (HSLs) for soil gas based on assessment levels derived by the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) for commercial or residential land use or the California Human Health Screening Levels 2005 for soil gas developed using standard exposure assumptions and toxicity values published by the U.S Environmental Protection Agency.

The spatial distribution of elevated methane concentrations did not correlate with observed fill thickness, suggesting that gas generation may originate from the underlying organic-rich SRA. Methane accumulation appeared more likely beneath clay-lined lakes and asphalt-capped areas, indicating potential for confined gas buildup.

Based on these results and in accordance with CIRIA C665 guidance, the DSI study area was considered to fall within Characteristic Situation 2 or 3 (CS2–CS3). This classification represents a moderate ground gas risk, requiring basic to enhanced gas protection measures in new building design. Such measures may include ventilated sub-floor voids, gas-resistant membranes with fully sealed joints and penetrations, and appropriate ongoing monitoring. These risk mitigation strategies should be incorporated into construction design and validated in consultation with the site auditor. Given the potential for gas accumulation in confined spaces, proactive management were required during both construction and operation phases of the Crown Towers development.

Further assessment of ground gas was undertaken as part of an addendum to the DSI which is summarised in Section 2.3.2 below.

2.3.1.3 Groundwater Monitoring

Groundwater levels recorded in November 2012 were generally encountered within 1m of the surface and ranged from 0.4m bgl to 1.1m bgl. A second groundwater sampling event in January 2013 showed seasonal fluctuation between 0.5 and 1.0m.

Groundwater monitoring identified localised exceedances of the now superseded Department of Environmental Conservation (DEC, 2010) Long Term Irrigation Water assessment criteria for boron (SB025 and BH04), molybdenum (BH04), manganese (SB035) and phosphorous (multiple locations); the superseded Domestic Non Potable Groundwater (DEC, 2010) for ethylbenzene (SB004), total nitrogen (all locations), ammonia (multiple locations), and the DEC (2010) Marine Water guidelines for total cyanide (multiple locations on the western side of the study area) and nickel (BH04).

Groundwater flow is predominantly from east to west toward the Swan River, although a possible groundwater divide in the northeast of the Crown Towers requires further investigation due to potential influence from an unknown pumping bore.

2.3.1.4 Surface Water Quality

Surface water quality in Lake 1 also showed elevated copper concentrations exceeding the DEC (2010) freshwater guidelines at two locations (SW005 and SW006), both situated within the lake. The elevated copper levels are consistent with the study area's stormwater inputs and may reflect contributions from surrounding infrastructure and landscaped areas.

2.3.1.5 Sediment Sampling

Sediment sampling from Lake 1, the largest lake on site and the receiving body for stormwater from the Crown Entertainment Complex, identified exceedances of the Sediment Quality Guidelines Low (SQG-L) for cadmium and nickel (SS001) and for lead (SS009). These findings suggest ongoing inputs of metals to the sediment, likely linked to surface runoff from the developed areas.

2.3.1.6 Acid Sulfate Soils

A total of nine targeted ASS boreholes were drilled across the Crown Towers study area as part of the DSI, supplemented by screening of additional soil boreholes where potential ASS indicators (e.g., dark, organic-rich material, shell fragments, odours) were observed. Laboratory analysis was undertaken using the SPOCAS (Suspension Peroxide Oxidation Combined Acidity and Sulfur) method, with some confirmatory CRS (Chromium Reducible Sulfur) testing.

The Crown Towers is located in a mapped "high to moderate risk" area for ASS occurring within 3m of the surface, according to Landgate ASS risk maps. The investigation confirmed the presence of widespread PASS, particularly within the saturated natural sediments consistent with the SRA. Elevated net acidity values (≥ 0.03% S) were identified in samples collected from within the fill material as shallow as 0.3m bgl, as well as in the underlying natural SRA. Concentrations of CRS net acidity ranged from 0.03%S to 1.71%S (natural dark green clay 4.5-5.0m bgl) were recorded in multiple samples, exceeding the DWER (2015a) action criterion.

Notably, AASS were not identified in the investigation. This outcome is consistent with field conditions, as groundwater levels were generally shallow, and most sulfidic material remained saturated and unoxidised, thereby limiting the development of AASS conditions. However, the geochemical conditions at the Site are conducive to AASS formation if disturbance or dewatering were to occur, highlighting the importance of managing soil handling and groundwater levels during construction.

The distribution of PASS was widespread across the Site, particularly in the organic-rich clays and silty clays at depths generally below 0.5–1.0m. PASS was present in both capped and uncapped areas, and results indicate that excavation or dewatering in these zones could trigger acid generation. Of note, PASS was identified within fill materials that had been reworked with natural soils (organic rich sediments which contained shell fragments).

Accordingly, Golder recommended the preparation of an ASS Management Plan (ASSMP) or inclusion of ASS controls within a broader Contaminated Sites Management Plan, particularly to address construction activities that may disturb these materials.

Summary

Overall, while the DSI determined that most contamination levels were low and manageable, the presence of ground gases, particularly methane, posed a key risk requiring mitigation in the hotel's design and construction. Golder recommended a Contaminated Site Management Plan (CSMP), and consideration of ground gas protection measures consistent with CIRIA C665 guidance, including ventilation and structural controls for enclosed spaces. The Site was considered suitable for commercial use provided these risks are effectively managed.

2.3.2 Addendum Detailed Site Investigation (Golder Associates, 2013c)

The addendum to the DSI presented the findings of an additional ground gas assessment, which was conducted over two monitoring rounds across 33 wells at the Crown Towers Perth site. Static flow was not detected using sensitive bubble flow meters, although low flow rates (up to 0.3L/h) were recorded using field instrumentation. Despite minimal flow, elevated concentrations of methane (up to 76.6%) and carbon dioxide (up to 16.4%) were recorded, with depleted oxygen levels (as low as 0.4%) indicating anaerobic conditions in several areas. Combustible gas concentrations exceeded the 25% LEL trigger value in 17 wells, with 12 wells exceeding 100% LEL (equivalent to 5% methane by volume).

Spatially, higher methane levels were concentrated beneath clay-lined lakes and asphalt surfaces, suggesting gas confinement and accumulation. Hydrogen sulfide exceeded occupational exposure limits in five wells, with a maximum concentration of 54 parts per million by volume (ppmv) in SB009.

Summa canister sampling was undertaken during Rounds 1 and 2 of the ground gas monitoring program to collect representative gas samples for laboratory analysis of VOCs using US EPA Method TO-15. Samples were collected from selected wells, with results confirming the presence of low-level VOCs; however, all detected concentrations were below the then current , Draft NEPM (2011) HSLs for soil gas based on assessment levels derived by the CRC CARE for commercial or residential land use and the California Human Health Screening Levels 2005 for soil gas developed using standard exposure assumptions and toxicity values published by the US EPA.

Using CIRIA C665 methodology, GSVs indicated a low risk (Characteristic Situation 1) due to the very low gas flow rates, despite elevated gas concentrations. However, due to incomplete monitoring frequency (only three of six recommended events), Mr Jason Clay of AECOM, the appointed Auditor recommended a conservative classification of Characteristic Situation 3 (CS3). This requires two levels of ground gas protection, including ventilated sub-floor voids and gas-resistant membranes with sealed joints and service penetrations. These measures were incorporated into the design and construction of enclosed structures. Additionally, Golder recommended that site workers be protected during intrusive works and construction via appropriate safety procedures and confined space protocols, due to the presence of methane, carbon monoxide, and hydrogen sulfide.

2.3.3 Contaminated Site Management Plan – Crown Towers (Golder Associates, 2014)

A CSMP was prepared by Golder Associates in 2014 for the Crown Towers development. The CSMP was developed in response to a ‘PCIR’ classification by the DWER, based on earlier DSI.

Key Findings:

- The study area is underlain by variable materials with the following generalised profile:
  - Sandy Fill (inferred by Aurora to be a capping Layer) from the surface t depths of between 0.3m and 1.7m with an average thickness of 1.0m.
  - Refuse Fill: Underling the Sandy Fill, extending to depths between 3m and 5m bgs, with an average depth of 3.8m bgl. Waste fill material consisted primarily of sand with inclusion of construction and demolition waste, plastics and limited occasions ash/burnt material.
  - SRA: Extending to depth of between 7.7m and 26m bgl.
  - Guildford formation extending to depths of between 17m and 33m.
  - Mullaloo Sandstone extending to depths between 33m and 52m.
- Soil contamination: Elevated concentrations of metals (e.g., lead, cadmium, arsenic, zinc), PAHs, PCBs, and pesticides were identified within waste fill. Some concentrations exceeded human health (commercial/industrial) and ecological guidelines (EILs).
- Asbestos: No asbestos was encountered during investigation works within the site boundary, although its presence cannot be ruled out given nearby detections.

- ASS: ASS and PASS were found below RL 2.3m Australian Height Datum (AHD) and 3.0m AHD in various locations. Some fill material also exhibited sulfidic characteristics. Net acidity values are summarised in Section 2.3.1.6 above.
- Ground gas: Monitoring confirmed elevated methane concentrations, requiring ongoing assessment.
- Receptors: Sensitive receptors include nearby residential areas, the Swan River, Crown Perth guests, Lake A and the underlying groundwater system. Aurora notes that Lake A mentioned in this document was divided into three surface water lakes during construction of the Crown Towers and subsequent upgrade to Camfield Drive as pa. Lake A1 is in the PESP (Aurora reference Lake 3), Lake A2 is located to the south of the PESP (Aurora reference Lake 6), and the balance of Lake A is to the west of the PESP footprint (Aurora Reference Lake 5).

Management Strategies:

- Excavation and stockpile controls: A permit-to-work system and reuse restrictions were recommended, with waste classification prior to off-site disposal. ASS materials required liming and containment.
- Monitoring: A comprehensive groundwater, surface water, sediment, and air quality monitoring program was implemented, including contingency planning for water quality or dust exceedances.
- Soil reuse: Clean fill above the water table could be reused under certain conditions. Waste fill or ASS required treatment or disposal.
- Controls and oversight: A material tracking system and clear roles, responsibilities, and audit processes were outlined. Excavation near known exceedance areas (e.g., former Lake 2) was to be minimised.

The CSMP formed part of a broader environmental management strategy alongside a Dewatering Management Plan (DMP) and Construction Environmental Management Plan (CEMP), ensuring regulatory compliance and minimising risk to human health and the environment during construction.

2.4 MIRVAC BURSWOOD ON THE PENINSULA SITES

2.4.1 2024 Groundwater and Surface Water MONITORING REPORT Burswood Lakes: Ministerial Statement 526 (Emerge Associates, 2025)

Emerge Associates was engaged by Mirvac (WA) Pty Ltd to conduct groundwater and surface water monitoring at Burswood Lakes, to meet conditions M13-4 and M13-6 of Ministerial Statement (MS) 526, which governs the post-remediation environmental performance of the former Swan Portland Cement site (now Mirvac Burswood on the Peninsula Sites). The former Swan Portland Cement site is down hydraulic gradient of the PESP footprint. The former Swan Portland Cement site features a series of seven artificial lakes designed to treat and convey stormwater prior to discharge to the Swan River. It is noted that five of these lakes form the Burswood Canal of which four lakes (Aurora reference Lakes 10, 11, 12 and 13) are within the PESP footprint.

The monitoring program adheres to the EMP by ATA Environmental (2002) and the original monitoring guidelines by ERM (2001), with some approved modifications to analyte requirements over time.

The scope of the investigation included two groundwater monitoring events across a network of 17 monitoring wells (April and October 2024) and four surface water monitoring events (January/February, April, July and October/November 2024) at 13 locations, including seven artificial lakes, two drains and off-site outlets of stormwater to the Swan River.

The groundwater study noted the following key findings:

- pH values ranged widely, with some wells (e.g., RMW14A) reaching up to pH 12.18, primarily due to legacy cement kiln dust (CKD).
- TDS levels varied, indicating groundwater across the Site ranges from fresh to brackish. For example, MW17A showed a seasonal decrease in TDS from 8,866mg/L in April to 819mg/L in October.
- Dissolved metals such as aluminium and zinc occasionally exceeded freshwater (FW) and non-potable use groundwater (NPUG) criteria, but these exceedances were generally consistent with historical data and considered minor.
- Overall groundwater quality remained stable, and no new contamination issues were identified.

The surface water study noted the following key findings:

- pH was within acceptable EMP criteria at all key points, with only marginal exceedances of FW criteria at some locations (e.g., Swan River Outlet in October 2024).
- TDS frequently exceeded the EMP criterion of 1,000mg/L at lake locations (e.g., Lake 1 reached up to 2,670mg/L), but values remained well below that of the Swan River (9,410mg/L at Swan 2), indicating limited environmental risk.
- Metal concentrations were mostly compliant. The most notable exceedance was zinc at Lake 1 (0.02mg/L in July 2024), which was minor and isolated.
- Lake 6B and BDS Man (1) serve as final control points before discharge. These locations consistently met EMP requirements for metals and pH. TDS exceeded EMP criteria but remained consistent with previous data and significantly lower than Swan River background levels.

The study recommended:

- Continue routine groundwater and surface water monitoring in 2025 in accordance with MS 526 and the EMP.
- Complete scheduled sediment removal and surface level restoration in Lake 7 and other targeted locations.
- Maintain engagement with DWER to confirm any future monitoring scope changes.

2.5 OTHER HISTROICAL REPORTS

2.5.1 H36 – Burswood Park Board - site plan showing bores, pump stations and lakes Burswood Park Board (2011)

This site plan documents the locations of bores, irrigation storage lakes, and irrigation pump stations on the Site. Details regarding the role and condition of each bore are noted (i.e., salty, superficial etc.,). This document also shows the layout of the former Burswood Golf Course.

2.5.2 H37 – Burswood Park Board Exploration Drilling Program and site history Burswood Park Board (2006)

This document includes the below items.

- A map showing locations of test bores which were installed for the purpose of identifying a suitable location to construct a production bore.
- A Western Australian Recreational Water Sports Association (WARWSA) position statement that outlines their use of the Burswood Peninsula and adjoining waters. This statement includes multiple references to the importance of maintaining the Burswood Water Sports Centre.
- A map (showing areas of historic dumping on the Burswood Peninsula, delineating between different sources and types of waste. Details provided on the different fill types in this section of the document are outlined below. Aurora notes that this map is consistent with the mapped fill types appended to the Golder, 2013a DSI which is reported on Figure 4b of this report.
  - Cinders – included the ashes and slag of coal from Western Australian Government Railways (WAGR) steam locomotives.
  - Domestic Rubbish – included most household material such as plastic, paper, rags, polyvinyl chloride (PVC), polythene, rubber, cardboard and putrescible material.
  - Industrial Fill – consisted of anything that can be moved by truck including building rubble, glass, timber, metal, bricks, tyres, pipes, concrete and reinforcing steel. Most of the material is described as inert being contained in a sandy matrix.
  - General Fill – was a combination of industrial and domestic fill.
  - Main Roads Department (MRD) Sand Fill – was clean granular fill which was used in the building of the road embankment.
  - Tree Burning Area – used to burn trees, stumps, pruning, and car tyres.
  - Nightsoil – effluent and septic tank wastes, mostly untreated.
  - Asbestos – this was dumped at the eastern end of the MRD Burswood Interchange but has since been buried within the sand fill embankment.
- A site history summary that outlines the use of Burswood Peninsula (formerly Burswood Island) since 1829. Specific details on historic dumping activities and the different types of fill present on the Burswood Peninsula are provided.
- A paper on the implementation of an administrative model for the Burswood redevelopment.

2.5.3 H40 – Burswood Park Board - Plan and drillers logs of Exploratory water bores 2000 Water and Rivers Commission (1998)

This document includes a map showing locations of test bores which were installed for the purpose of identifying a suitable location to construct a bore (like that described in Section 2.5.2). This map also shows the location of the 'current' production bore hole (named Bore 5A in this document, but previously referred to as Bore 2B). However, it notes that it was abandoned due to salt intrusion. Logs of the test bores, a well construction diagram for Bore 5A (previously referred to as Bore 2B), and a groundwater well license are also presented in this document. The location of this bore based on the figure provided in the document is located in the southern portion of the PESP footprint.

2.5.4 H42 – Burswood Park Board – Plan showing extent of dumped materials Burswood Park Board (Unknown Date)

This document is a slightly updated version of the map presented in Section 2.5.2 (including the same fill types) that shows historic dumping on the Burswood Peninsula. Note that historic dumping areas match quite closely with those presented in Tetra Tech (2024) and presented on Figure 3b.

2.5.5 H63 – Construction of Lakes for Burswood Golf Course Golder Associates (1987)

This document was prepared for Newscape on the construction of lakes for the Burswood Golf Course prepared by Golder Associates. It describes the geotechnical work behind the construction of Lakes A-H. It was noted that clay from Forrestfield Tip was imported for use as lining in lake excavations, however it was determined to be unsuitable as a complete clay lining, meeting the requirements for use as a lower layer of lining only. Overall, this document suggests that construction of the lakes was done poorly (i.e., the application of lining in one layer rather than two and the lack of quality control), which heightened the risk of seepage.

2.6 INVESTIGATION DATA RELATING TO THE PESP FOOTPRINT

As discussed in Section 1.1 portions of the PESP footprint have been subject to previous investigation and/or remediation to a sufficient standard to support reclassification of those land parcels to RRU. Aurora has reviewed these documents and datasets where intrusive sampling has overlapped the PESP footprint, with the aim of using this data to supplement the proposed DSI. Three previous environmental investigations have been conducted that are deemed particularly relevant to the Site and are listed below. Figure 4c presents the various portions of these investigations that overlap the Site.

- New Perth Stadium – Stage 1 Detailed Site Investigation Interpretive Site Contamination Report (Golder, 2013a).
- Soil Characterisation Assessment – Extension of Marlee Lawn to Roger McKay Drive, Perth Stadium (Aurora, 2018).
- Crown Perth Towers Detailed Site Investigation (Golder, 2013b).

2.6.1 Northern Portion of the Site (Perth Stadium Precinct DSI, Golder 2013a)

Ground conditions encountered during the DSI comprised of the following three main lithological units.

- Surface Fill (Sand to Sandy Clay) – fill material containing gravels, red brick fragments and limestone gravels encountered at depths ranging from surface to 7.5m bgl.
- Waste Fill (Sand to Gravelly SANDS and CLAYS – waste material containing black ashy material, plastics and glass fragments encountered at depths ranging from 0.8m bgl to 6.2m bgl. Asbestos in the form of AF/FA was also confirmed by laboratory analysis at select locations.
- Underlying natural soil (SRA), predominantly sand and silty clay encountered at depths ranging from 4.95m bgl to 10m bgl.

Eight soil bores were installed in the scope of the Stadium DSI that overlap the Site (Figure 3c). A summary of exceedances, which were noted in one of the soil bores, is presented in Table 1.

Overall, most exceedances were of historical/current EIL criteria with all results below HIL-C.

- LGSB120 (5.5-5.8m bgl).
  - Arsenic concentration – 230mg/kg;
  - Cadmium concentration – 5.6mg/kg;
  - Manganese concentration – 940mg/kg; and
  - Nickel concentration – 94mg/kg.

The DSI noted that generally metal concentrations were indicative of background levels. ASS was noted to exist across the Perth Stadium Precinct, in both fill and natural materials at varying depths.

2.6.2 Northeastern Portion of the PESP footprint (Marlee Lawn Investigation) (Aurora, 2018)

The southeastern portion of Lot 2001 between Victoria Park Drive and Roger Mckay Drive, with an area of approximately 6,000m^2 (Marlee Lawn), was subject to assessment by Aurora Environmental as part of validation works for the Perth Stadium Precinct. The findings of this assessment were documented in Soil Characterisation Assessment – Extension of Marlee Lawn to Roger McKay Drive, Perth Stadium (Aurora, 2018).

The objective of the study was to characterise soils in the upper 0.5m below finish design level, to assess their suitability to form part of the capping strategy, given that there was no warning barrier installed in this area and landfill materials had been historically mapped to underly this area. This portion of Lot 2001 was not disturbed below ground surface as part of the Stadium development.

13 test pits (TP1 – TP9 and TP11 – TP14) and 10 soil bores (SB1 – SB10) were installed (Figure 3c) and no visible signs of contamination were noted. A summary of data collected during this study is provided in Table 2. Of note, no ACM was identified within the capping layer during the investigation.

The typical lithology encountered comprised the following two units.

- Topsoil (light brown, fine to medium grained, poorly sorted, loamy sand with frequent rootlets).
- Sand (pale yellow/cream/yellow/orange, fine to medium grained, well sorted with some fine, well rounded limestone gravels).

Analysis of samples from TP1 and TP2 demonstrated that concentrations of metals collected from the upper 0.5m of finished design level were less than the assessment criteria for recreational/public open space.

The report concluded that the material was suitable to form a caping layer in consideration that 150mm of addition clean fill topsoil would be imported to the area, to support landscaping (turfing) without the need to install a warning barrier in this portion of Lot 2001.

This document was reviewed and conclusions endorsed by the Auditor as part of Addendum 2 to the VAR (JBS&G, 2020).

2.6.3 Southern Portion of the PESP footprint (Crown Towers DSI Golder, 2013b)

Ground conditions encountered during the DSI comprised of the following three main lithological units as detailed in Section 2.3.3.

- Sandy Fill: SAND, Gravelly SAND.
- Waste Fill: SAND, Silty SAND, Clayey SAND, SILT.

- Underlying natural materials, predominantly CLAY and Clayey SILT encountered at depths ranging from 3m bgl to greater than 6m bgl.

Seventeen soil bores were installed in the scope of the Crown Towers DSI that overlap the Site (Figure 3c). A summary of exceedances, which were noted in 14 soil bores, is presented in Table 3.

Overall, most exceedances were of historical EIL criteria with most results below the assessment criteria of the time (DEC, 2010; HIL-C protective of human health in a public open space land use setting). Four exceptions to this are listed below.

- SB003 (2.5-3.0m bgl) – PCB concentration of 3.34mg/kg.
- SB005 (5.8-6.0m bgl) – Lead concentration of 1,080mg/kg.
- SB011 (3.5-4.0m bgl) – Benzo(a)pyrene concentration of 5.3mg/kg.
- SB012 (3.0-4.5m bgl) – Lead concentration of 46,300mg/kg.

Golder (2013b) noted that there was no evidence for widespread impacts of lead in soil and that benzo(a)pyrene is not very soluble in water and thus unlikely to significantly impact nearby ecological receptors. SB011 and SB012 were located near the southern end of a lake which has since been completely infilled, with clean fill placed on top of the existing clay lake lining.

Several gas wells were identified as containing concentrations above trigger values (i.e., LEL).

- Wells containing combustible gas concentrations >25% LEL:
  - ASS002;
  - SB003;
  - SB008;
  - SB011;
  - SB012; and
  - SB018.
- Wells containing combustible gas concentrations >100% LEL:
  - SB008;
  - SB009; and
  - SB011.
- Wells containing combustible gas concentrations >5% Gas:
  - SB008;
  - SB009; and
  - SB011.

Golder (2014) also notes that all excavated material below 2.3m AHD, in the vicinity of the carpark, and 3.0m AHD for the remainder of the investigation area should be considered ASS.

2.7 SUMMARY OF PREVIOUS INVESTIGATIONS

The Burswood Peninsula area, including the Site, has been subject to extensive environmental and geotechnical investigations supporting various development activities, including the Perth Stadium, Crown Towers, and Mirvac developments. Key findings from these investigations provide essential context for the current SAQP.

2.7.1 Sub-surface Management Plan (Tetra Tech, 2024)

- Prepared for the Burswood Park Board, the SMP provides a framework for managing contamination risks during intrusive works.
- It outlines when the SMP must be applied and includes KPIs for environmental and safety compliance.

2.7.2 Perth Stadium Precinct Investigations (Golder Associates, 2012–2013; Westadium, 2018)

- Desktop Study (2012): Identified widespread historical landfill use, contamination, and data gaps. Contaminants included heavy metals, hydrocarbons, pesticides, PCBs, and asbestos.
- Detailed Site Investigation (2013): Confirmed elevated soil concentrations of metals, PAHs, and asbestos including ACM, asbestos fines (AF) and fibrous asbestos (FA) in the waste fill materials. ASS and ground gas (methane up to 85% v/v) risks were identified.
- Groundwater and Surface Water: Contamination included elevated nutrients and metals; dewatering and treatment systems were implemented during construction to manage impacts.
- Environmental Compliance Completion Report (2018): Validated soil capping, groundwater protection, surface water management, and ground gas mitigation. The Perth Stadium Precinct (Lot 2001) was deemed suitable for restricted commercial/recreational use, subject to ongoing monitoring of surface water.

2.7.3 Crown Towers (Golder Associates, 2013)

- The DSI identified metal, pesticide, PCB, PAH, and asbestos exceedances, along with ground gas risk classification of CS3.
- ASS risks were confirmed within both fill and natural soils, requiring management during excavation.
- Recommendations included gas protection measures and development of a CSMP.

2.7.4 Mirvac Burswood (Emerge Associates, 2025)

- Groundwater and surface water monitoring under Ministerial Statement 526 showed stable quality with some localised exceedances of pH, TDS, and metals.
- Monitoring confirmed legacy issues (e.g., cement kiln dust) but no new contamination concerns. Continued monitoring and sediment management were recommended.

2.7.5 Historical Records (1987–2011)

- Documents from the Burswood Park Board and Golder Associates provide maps and descriptions of historic fill types and waste dumping (e.g., domestic refuse, industrial waste, asbestos, nightsoil). Poorly constructed lake linings were noted as increasing seepage risk.

2.7.6 Data Relevant to the PESP Footprint

Three key investigations overlapped the current Site:

- New Perth Stadium DSI (2013a): Identified localised DEC, 2010 EIL exceedances; ASS observed; no widespread exceedances of the DEC, 2010 HIL-D for residential land use with minimal access to soils.
- Marlee Lawn Assessment (Aurora, 2018): No contamination observed in shallow soils (top 0.5m); suitable for use as capping material overlying landfill material without the requirement for warning barrier. Findings of this assessment were endorsed by the Auditor in Addendum 2 of the VAR (JBS&G, 2020).
- Crown Towers DSI (2013b): Identified isolated DEC (2010) HIL-F exceedances for PCBs, lead, and PAHs, along with elevated ground gas. ASS present below 2.3-3.0m AHD.

3 ENVIRONMENTAL SETTING

3.1 TOPOGRAPHY

A review of the Department of Primary Industries and Regional Development (DPIRD) 2m interval contour mapping (DPIRD-072) (DPIRD, 2023) (accessed 06 June 2025), indicates that the PESP is situated between approximately 2m Australian Height Datum (AHD) to 7m AHD. The Site's elevation appears to lowest in the west and highest in the east. There are several elevation changes throughout the Site likely associated with the former Site use as a golf course.

3.2 PUBLISHED GEOLOGY

Geology at the PESP is mapped on the Perth Metropolitan Region – Perth 1:50,000 Environmental Geology Series (Gozzard, 1983) as a 'Holocene age alluvial deposits of CLAY, described as mid to dark grey, soft, saturated, prominent 0.2m thick oyster shell bed near the surface' (see Appendix 2).

In chronological order from youngest to oldest, the stratigraphy underlying the PESP footprint are as follows.

- Capping Fill: Typically, a relatively thin layer of sandy fill which was imported to the Site in the 1980s to cap the landfill and facilitate use as a golf course.
- Uncontrolled Fill: A layer of uncontrolled fill underlies the capping layer. The uncontrolled fill comprises landfill which based on previous reports from surrounding areas is assumed to contain sand, ash, gravel, domestic municipal waste, putrescible waste and construction and demolition (C&D) waste including, but not limited to steel, plastic, asbestos, concrete, bricks clay pipes, etc. The uncontrolled fill generally extends to between 4m and 8m in depth.
- Swan River Alluvium (SRA): Consisting of dark grey to black, soft, organic, highly compressible clayey silt to silty clay of up to 26m thickness. These materials are still being deposited within the Swan River and infill an ancient river channel (paleochannel) that runs beneath the PESP.
- Sandy channel deposits (SCD): Generally dominated by medium dense to very dense fine to coarse-grained sand and sandy silts or clays. The thickness of this unit varies between 10m and 25m.
- Kings Park Formation (KPF): Typically encountered as very dense sand to gravelly sand interpreted to be the Mullaloo Sandstone Member of the KPF. Although the name suggests a rock-like material, it is likely to be a variably cemented sand (Douglas *et al*., 2015)

Two cross sections of the inferred stratigraphy of the Peninsula, as presented in Summary of Available Geotechnical Information – Proposed Master Plan Burswood Peninsula (Golder Associates, 2012b), have been included in Appendix 3 for reference.

3.3 ACID SULFATE SOILS

3.3.1 DWER ASS Risk Mapping

Review of DWER ASS risk mapping, Swan Coastal Plain (DWER-055) (DWER, 2024a) (accessed 26 March 2025) indicates that the PESP footprint (and the entire Peninsula) is mapped as having high to moderate risk of ASS occurring within 3m of natural soil surface. A figure showing the ASS risk mapping is provided in Appendix 4.

3.3.2 Perth Stadium Precinct

The Perth Stadium Precinct DSI (Golder Associates, 2013a) indicated that the Perth Stadium Precinct and surrounding land are located in an area with a high to moderate disturbance risk of AASS and PASS occurring generally at depths greater than 3m. Waste fill encountered during the DSI contained only very limited putrescible material, however it was acknowledged to have the potential to become sulfidic if the right geochemical conditions were generated i.e., a low oxygen environment with a source of iron and sulfate, and a pH of four or above. Consistent with the approach adopted for low level contaminated soils, ASS material was permitted to remain in-situ during the Stadium construction. Any material required to be excavated (e.g., as part of bulk earthworks) from above the groundwater table was permitted to be reused on-Site above the groundwater table without ASS treatment; however, any material excavated from below the groundwater table was required to be treated and reused above the groundwater or disposed of appropriately off-Site.

3.4 HYDROGEOLOGY

3.4.1 Regional Hydrogeology

A review of DWER's Water Register (DWER, 2024f) (accessed 06 June 2025) indicates that groundwater beneath the Site is in the Perth – unconfined Superficial Swan Aquifer, which is underlain by the confined Perth – Leederville Aquifer and Perth Yarragadee North aquifer below that. The regional groundwater flow beneath the Site appears to be in a be both west and east toward the Swan River, with a groundwater divide through the central portion of the Peninsula and the Site. The Water register suggests that the maximum depth to groundwater is likely to be 2.2m bgs.

Review of Hydrogeology and Groundwater Resources of The Perth Region (Davidson, 1995) indicates the Fill, SRA and SCD in the Peninsula area are all collectively included in the Superficial Aquifer for the Perth. Below the Superficial Aquifer are the confined Kings Park and Leederville Aquifers. Across the Burswood Peninsula, variations in both the thickness and presence of the three superficial units exist.

3.4.2 Site-specific Hydrogeology

The Perth Stadium ECCR (Westadium, 2018) noted that at the western side of the Perth Stadium Precinct, towards the river, the SCD and Fill are separated by up to 24m thickness of SRA, which acts as a semi-confining unit for the SCD. However, in parts of the north and east areas, the SRA is absent, and the Fill is in direct contact with the SCD unit. These three units are generally considered to be hydraulically connected and part of a regional unconfined aquifer system. The Superficial Aquifer is connected to the Swan River. A schematic hydrogeological conceptual section showing these relationships as presented in Appendix N of the Golder (2013a) DSI has been included as Appendix 5 for reference.

The 2024 groundwater investigation of the Mirvac Burswood on the Peninsula Sites conducted by Emerge has 10 groundwater monitoring wells located within the PESP footprint (MW07A, MW08 - MW12, MW17a, MW18a and MW19a). These contained standing groundwater during the most recent sampling round (October 2024) ranging from 0.6m bgs in wells located in the southern portion of the PESP footprint, 0.9m bgs in the eastern boundary of the PESP footprint and 1.5m bgs in the northeast corner of the PESP.

3.4.3 Beneficial Groundwater Use

Public Drinking Water Source Areas (PDWSA) are areas of land where water is or will potentially be extracted from. This can refer to surface water bodies or groundwater, which undergoes treatment to remove contaminants and is used as a scheme (drinking) water supply.

The PDWSA Map (DWER-033) (DWER, 2024d) (accessed 6 June 2025), indicates the PESP does not fall within a PDWSA. Additionally, no PDWSAs were identified within a 2km radius of the PESP.

DWERs Water Register database (DWER, 2024e) (accessed 6 June 2024) indicates that there are four groundwater abstraction licences associated within the PESP footprint, which are inferred by Aurora to be used for irrigation of public open spaces. The location of abstraction bores for the below licences is resented on Figure 5.

- Licence 54299 is registered to the Burswood Park Board (issued on the 17 November 2021) for use on multiple lots abstracting 170,000 kilolitres (kL) from the Perth Leederville aquifer. The licence is spread over several of lots including the PESP.
- Licence 99023 (issued 17 November 2021) located in the PESP footprint, is registered to the Burswood Park Board, and has an allocation of 300,000kL per year permitted to be taken from the Swan Superficial aquifer. The licence is spread over several of lots to the south of the PESP.
- Licence 99023 (issued 14 November 2016) located on Lot 2001, is registered to the Western Australian Sports Centre Trust, and has an allocation of 160,000kL per year permitted to be taken from the Perth Leederville aquifer.
- Licence 184440 (issued 05 May 2017) for use on Lot 551 (Crown Towers) and other lots that form the Crown Casino Complex, is registered to the Burswood Nominees Ltd, and has an allocation of 51,750kL per year permitted to be taken from the Swan Superficial aquifer. The corresponding abstraction point for this licence is located on Lot 551 approximately 100m to the southeast of the southern margin of the PESP footprint boundary.

Two additional groundwater abstraction licences were identified within a 500m radius of the PESP within the Peninsula, these are summarised below.

- Licence 167466 registered to Town of Victoria Park (issued on the 26 February 2024) abstracting 476,405kL from the Perth Superficial Swan Aquifer. The abstraction location is immediately east of the PESP associated with the Mirvac Burswood on the Peninsula Sites.
- Licence 56483 (issued 05 November 2020) located approximately 1km north of the PESP footprint (beyond the Graham Farmer Freeway) is registered to the Chairman of the Committee of the Western Australian Turf Club, and has an allocation of 320,000kL per year permitted to be taken from the Perth Leederville Aquifer.

3.5 HYDROLOGY

The closest natural surface water body is the Swan River located adjacent to the west, north and east of the PESP footprint. The Swan River estuary is listed in the *Directory of Important Wetlands in Australia* (DIWA), which identifies over 800 nationally important wetlands across the country. Furthermore, The Swan River Estuary is classified as a Conservation Category Wetland (CCW) by DWER and the Department of Biodiversity, Conservation and Attractions (DBCA). This designation identifies it as a high-ecological value wetland warranting the highest level of protection. The Swan River is a permanent water body which is saline all year round in the vicinity of the Peninsula. It is subject to tidal fluctuation and is recharged by groundwater, various anthropogenic surface water drains and natural upstream tributaries in the catchment

The PESP footprint is contained within the Swan River Floodplain and is prone to inundation during winter months and periods of high rainfall. The PESP and surrounds contain several anthropogenically created surface water lakes (see Figure 2), which are understood to be clay lined and contain freshwater which have been created to manage on-Site stormwater during the previous use as a golf course and to intercept alkaline groundwater from the former Portland Cement Site (now Mirvac Burswood on the Peninsula Sites). There is also anecdotal evidence to suggest that groundwater from the confined Leederville Aquifer is supplemented into these surface water lakes and subsequently aerated to reduce iron concentrations prior to use for irrigation.

There are three anthropogenically constructed surface water bodies (Lakes 1, 2 and 3 on Figure 2) within the PESP footprint. There are four constructed surface water bodies (Lakes 4, 5, 6 and 7 on Figure 2) to the immediate west and south of the PESP footprint.

In addition to these surface water lakes the Old Burswood Canal located along the eastern boundary of the PESP footprint contains a further five surface water bodies. These surface water features have been identified as Lakes 9-13 on Figure 2.

The river fed lake on Figure 2 is located to the north of the PESP and is to the immediate west of the Perth Stadium . This is a natural surface water body that is fed by the Swan River and is subject to management and monitoring by Venues West.

3.6 ABORIGINAL CULTURAL HERITAGE

The *Aboriginal Heritage Act 1972* defines Aboriginal Heritage Sites and provides for the preservation of places and objects customarily used by or traditionally important to Aboriginals, and prohibits the concealment, destruction or alteration of any Aboriginal Heritage Sites. An Aboriginal site may:

- Exist in any area of Western Australia;
- Not have been recorded in the register of Aboriginal sites or elsewhere; and
- Not have been identified in previous heritage surveys or reports on that area but remains fully protected under the Act.

The Department’s online Aboriginal Cultural Heritage Inquiry System (ACHIS) (see Appendix 6) indicates that there are no known Registered Sites or Lodged Places situated within the PESP footprint. It is noted that while not mapped, there is still the possibility of encountering Aboriginal objects/sites during fieldwork.

3.7 HISTORIC HERITAGE

The presence of historical or current Historic Heritage sites was investigated using the Department of the Environment and Energy Australian Heritage database. The Australian Heritage database contains information regarding more than 20,000 natural, historic and indigenous places throughout Australia and includes sites recorded on the:

- World Heritage List;
- National Heritage List;

- Commonwealth Heritage List; and
- State Heritage list.

The search of the Department of the Environment and Energy Australian Heritage database did not identify any registered Historic Heritage sites within the PESP footprint.

The presence of State historical or current Historic heritage sites was investigated, using the Heritage Council State Heritage Office database (https://inherit.dplh.wa.gov.au/Public/ accessed on 11 June 2025). The inherit search (see Appendix 7) indicated that three heritage places exist within a 1km radius of the PESP footprint

- Heritage Place 2060 Former Burswood Tip. The Place is registered by the Heritage Council of WA and does not warrant assessment such as Local Heritage Survey. The place is associated with the development of Perth's waste management, including the development of sewerage treatment and prior use as a rubbish dump. The place demonstrates the post-war redevelopment of the Swan River into recreation areas, including rehabilitation areas of previous industrial or waste management use.
- Heritage Place 3570 Old Burswood Canal (portions within the PESP footprint) is registered as a Heritage Place by the Heritage Council of Western Australia and has been assigned Management Category 2 by the Local Heritage Survey, meaning that it has considerable significance, is very important to the heritage of the locality and has a high degree of integrity/authenticity. Old Burswood Canal, a section of a disused boat canal, has cultural heritage significance for the following reasons:
  - The place is a remnant of one of the earliest public works projects carried out by the Stirling Administration and represents a commitment to supporting settlement in the Swan River Colony;
  - The place is a relic of Western Australia's transport history and demonstrates the importance of the Swan River as a transport route in the 1830s;
  - The place is indicative of the experimental nature of early public works in a new colony; and
  - The place illustrates a way of life and mode of transport that is no longer practiced in this part of Western Australia.
- Heritage Place 1699 Burswood Resort and Casino (off-Site) is not registered by the Heritage Council of Western Australia and has been Management Category 3 by the Local Heritage Survey meaning that it has some/moderate significance, contributes to the heritage of the locality and has lower integrity/authenticity, not necessarily detracting from the overall significance of the place. Crown Resort and Casino has cultural heritage significance for the following reasons:
  - The place has aesthetic value as an example of innovative architecture that has changed the horizon viewed from the north side of the Swan river. Extensive parklands enhance the aesthetic impact of the Casino and Hotel Complex; and
  - The place has historic value for its associations with early pioneers and developers of the land such as Henry Camfield and Dallas Dempster.

4 PRELIMINARY CONCEPTUAL SITE MODEL

The CSM describes the sources, pathways and receptors. Where there is a complete linkage between a source of contamination, an exposure pathway and a receptor there may be potential risks to human health or the environment. The CSM provides the framework for understanding the contamination status of the Site as a whole, with consideration of information already identified.

Aurora has developed a preliminary CSM based on review of available data which recognises and addresses all potential sources of contamination within the PESP footprint.

The CSM also considers workers, nearby residential land use and environmental receptors which may be exposed to potential contaminants during the execution of the Project. The management of potential risks during the Project execution will be managed by the development and adherence of the Construction Environmental Management Plan, as well as relevant sub-surface management plans for portion of the PESP footprint which overlap remediated portions of Lot 2001 (Perth Stadium Precinct) and 501 (Crown Towers).

A schematic representation of the preliminary CSM is shown on Figure 5.

4.1 POST-CONSTRUCTION LAND USE

Following completion of the Project, public open space will best describe the generic land use noting that there may be some permanent buildings which may be used as a workplace. The PESP will also be a workplace for people conducting landscaping and maintenance works and other contract works on the future infrastructure. It is understood that land use activities in the PESP footprint will include:

- Public open space – landscaped parks and gardens;
- Amphitheatre for public events;
- Sealed multi use track for a range of sports including cycling, motorsports and community sport;
- Multi-use buildings for events and office meeting spaces; and
- Upgrade of existing parking and bus marshalling areas.

4.2 SOURCES

4.2.1 Soil, Groundwater, Surface Water

Potential sources of contamination and CoPC associated with historic land use activities are summarised in Table C below:

TABLE C: FORMER LAND USE AND COPC

LAND USE ACTIVITY	COPCS
Closed Landfill containing variable waste materials.	Potential contamination source soil, groundwater surface water and ground gas. • Metals (antimony, arsenic, barium, beryllium, cadmium, chromium [total], cobalt, copper, lead, manganese, mercury, nickel, selenium, and zinc). • Asbestos in soil (ACM), FA and AF. • Petroleum hydrocarbons – TRH; benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEX-N). • PAHs and PCBs. • OCPs.

TABLE C: FORMER LAND USE AND COPC

LAND USE ACTIVITY	COPCS
	• Phenols. • Dioxins (former wood [and possibly other waste] burning area). • Per- and Polyfluoroalkyl Substances (PFAS). • Nutrients (ammonia, sulphate, nitrate, nitrite, total nitrogen, and total phosphorus). • Potential source of ASS where it has been reworked or sulfide rich/organic material. • Source of ground gas.
Capping Layer (Fill of Unknown Quality)	Potential contamination source soil, groundwater surface water. • OCPs. • Hydrocarbons. • Asbestos in soil (ACM/AF/FA). • Herbicides. • Insecticides. • Metals (e.g., aluminium, arsenic, cadmium, copper, iron, lead, magnesium, and potassium).
Swan River Alluvium	• Potential ASS. • Potential Source of Ground Gas.

Aurora notes that other historic potentially contaminating land use activities including piggery, dairy and market gardening identified in the background document review have not been considered as their location is uncertain and predates the placement of fill across the Peninsula. Potential contaminants associated with these land uses are also likely to be covered by the comprehensive analysis suite proposed across the PESP footprint.

4.2.2 Ground Gas

Previous investigations at the Perth Stadium Precinct and Crown Towers have collected ground gas data demonstrating the presence of methane, carbon dioxide and other gases emanating from the former landfill and underlying SRA. However, this data has been collected to target areas to the north and south of the PESP footprint and is insufficient (on its own) to provide the basis for comprehensive assessment of the risk posed by ground gas for the proposed PESP project.

The landfill located on the Peninsula was operational between 1946 until its closure in the early 1970s, over 50 years ago. Based on reviewed information, it appears that majority of the PESP footprint was filled with general municipal waste, and not commercial or industrial waste disposed at other portions of the Peninsula. Typically, municipal landfills which accepted putrescible materials generate landfill gases for approximately 30 years, with peak gas generation occurring in the 10-20-year period (NSW EPA, 2020), with gas generation rates declining after this period.

The former landfill body may have reached the point where landfill gas generation no longer occurs and gas concentrations have reduced, with attenuation from previous emissions to the surface through the sandy capping layer. The current gas composition and concentrations, whether there is any active measurable flow of ground gas and the potential accumulation of ground gas following the installation of impermeable surfaces and infrastructure are currently uncertain factors which require understanding so that potential risk levels can be assessed, any risk mitigation measures can be planned and implemented.

Previous studies have also identified that the SRA which is encountered beneath the landfill layer is an additional potential source of ground gases. Organic-rich natural soils produce methane and hydrogen sulfide gas through biological reactions under reducing conditions. Typically, these gases are naturally released and attenuated to the atmosphere in undisturbed swamps. However, these gases can accumulate and migrate in the sub-surface when covered with fill materials.

Given that there two sources of gas in the sub-surface, the landfill materials and the organic rich SRA, the term ground gas has been used from this point. It encompasses gases from both sources, with landfill gas being recognised to be a type of ground gas.

Ground gases can be hazardous to human health through:

- Creating an explosive atmosphere where flammable compounds, principally methane, accumulate to a concentration within an explosive range (between the lower explosive limit and upper explosive limit);
- Create an asphyxiating atmosphere where oxygen is displaced by other gases; and/or
- Concentration of gases with chemical toxicity.

4.3 RECEPTORS

Potential receptors include persons, ecological receptors, users of groundwater from known abstraction locations (i.e., potable water) but also for future beneficial/non-potable use where groundwater may be adversely affected by the CoPCs. Potential receptors which have exposure pathways that may be complete include the following:

4.3.1 Human Health

The potential human health receptors will comprise:

- Construction Workers/Contractors (adults) during PESP development activities;
- Nearby off-Site Residents (adults and children) during PESP development activities;
- Future temporary visitors and open space users (children and adults);
- Future workers/occupants (adults) in permanent buildings;
- Future workers (adults) conducting maintenance works on the built infrastructure, including intrusive sub-surface works;
- Off-Site users of licensed superficial groundwater abstraction for irrigation use at Crown Towers (Lot 551); and
- Off-Site users of surface water lakes within the Peninsula and the Swan River Estuary.

4.3.2 Ecological

Ecological receptors on-Site include:

- On-Site terrestrial fauna and flora.
- On-Site freshwater environment (i.e., flora and fauna within constructed surface water lakes).

- Off-Site environment (i.e., discharge point of groundwater): Terrestrial and marine/estuarine aquatic ecology of the Swan River (a CCW).
- Off-Site freshwater environment (i.e., flora and fauna within constructed surface water lakes).

4.4 POTENTIAL PATHWAYS

4.4.1 Potential exposure pathways

For exposure to the identified potential receptors to be considered possible, some mechanism (pathway) must exist by which CoPCs from a given source can reach a given receptor. A general discussion on potential exposure pathways is provided below.

Potential pathways are evaluated for completeness based on the existence of:

- A source of chemical impact;
- A mechanism for release of CoPCs from identified sources;
- A CoPC retention or transport medium (e.g., soil, air, groundwater);
- Potential receptors of CoPCs; and
- A mechanism for chemical intake by the receptors at the point of exposure (ingestion, dermal contact, inhalation, or a combination of these).

A summary of potential exposure pathways is presented below.

4.4.1.1 Chemical CoPCs in soil:

The following soil exposure pathways have been identified as potentially complete, based on the presence of contaminated soils and the current and proposed land uses of the Site:

On-Site Human Exposure:

- Direct and indirect contact with contaminated soils may occur through ingestion or direct contact.

On-Site Ecological Exposure:

- Terrestrial flora and fauna may be exposed to contaminants via direct contact with impacted soils (e.g., rooting depth, burrowing) or indirect exposure through uptake of contaminants into plants or bioaccumulation.

4.4.1.2 Asbestos in Soil

The only relevant potential exposure pathway for asbestos (in any form) to humans is inhalation of airborne respirable fibres. The primary exposure pathway is the airborne transportation of asbestos fibres through dust generating activities. Exposure can also occur through secondary inhalation impacts associated with off-Site transport of asbestos in clothing or vehicles. Surface water runoff/infiltration of rainfall into soil – leaching and/or vertical migration (via permeable strata) of chemical CoPCs from unsaturated soils to groundwater.

- On-Site inhalation of asbestos fibres during construction;
- On-Site inhalation of asbestos fibres post construction if capping layer is not adequate; and

- Off-Site inhalation of asbestos fibres nearby residents, hotel occupants, sporting spectators and open space users if dust generated during construction of the PESP is not appropriately managed.

4.4.1.3 Ground Gas

The potential human health receptors to ground gases will comprise:

- On-Site workers (adults) occupying the permanent buildings post-PESP construction;
- On-Site workers (adults) conducting maintenance works on the built infrastructure, including intrusive sub-surface works; and
- On-Site general public open space users (adults and children) of the constructed buildings, hardstands and public open space.

Ecological receptors to ground gases are typically restricted to deep rooted vegetation which are unable to tolerate low-oxygen ground conditions experienced in deeper soils. Shallow-rooted species may also be susceptible where they are located in hardstand areas, where ground gases may accumulate at the near surface and the shallow soil becomes deficient in oxygen.

4.4.1.4 Groundwater

Primarily lateral (but also potentially vertical) migration of chemical CoPCs within the aquifer. The potential exposure pathways for impacted groundwater are:

- On-Site abstraction of groundwater during PESP construction works (dewatering or excavations into the saturated zone);
- Off-Site abstraction of groundwater from the superficial aquifer at Lot 551 (Crown Towers), and Mirvac Burswood on the Peninsula and southern extremities of the Burswood Park Board managed landscaped areas;
- On-Site ecological uptake and bioaccumulation of over time of impacted surface or groundwater.
- Off-Site marine and estuarine ecology of the Swan River as the receiving environment for impacted groundwater.

It is noted that licensed groundwater abstraction for irrigation of the PESP footprint, Perth Stadium Precinct and Belmont Racecourse is via licensed groundwater abstraction, which is sourced from the confined Leederville aquifer. Licensed groundwater abstraction for the Crown Towers and the Mirvac Burswood on the Peninsula Sites is from the Perth Swan Superficial Aquifer.

4.4.1.5 Surface Water

- Future site users (adults and children) maintenance workers (adults) may be directly exposed to surface water via skin contact or incidental ingestion, particularly during periods of ponding or flooding.
- On-Site and off-Site Aquatic and semi-aquatic freshwater biota may be exposed to contaminants in surface water via direct uptake, bioaccumulation, or contact with contaminated sediments, potentially affecting ecological health.
- If surface water is reused for irrigation, contaminants may be transferred to vegetation.

4.4.2 Potential Contaminant Migration/Transport Pathways

4.4.2.1 Soil Contamination

- Disturbance of contaminated soils during construction of the PESP or inadequate capping post-construction may result in the generation and dispersion of fugitive dust, posing a risk of inhalation exposure and contaminant transport via wind outside of the PESP boundary.
- Contaminants present in near-surface soils or buried materials may be mobilised by infiltrating rainfall or irrigation water, leading to leaching through the vadose zone and subsequent impact to shallow groundwater within the superficial aquifer.
- Volatile and semi-volatile contaminants in buried waste or impacted soils may allow for vertical migration of vapours through the soil profile, potentially accumulating in sub-surface structures or enclosed spaces, posing inhalation risks to site users or occupants.

4.4.2.2 Asbestos in Soil

Transport mechanisms for ACM require the disturbance of the cement matrix, binding the asbestos, to the point where the asbestos fibres are potentially released to soil and atmosphere. These mechanisms include:

- Soil disturbance/future Site activities could damage ACM fragments, disturb AF/FA, and spread contamination across the Site.
- Wind erosion at the surface causing the breakdown of ACM, AF, or FA, with potential deposition of asbestos fibres from atmospheric dispersion occurring.
- Stormwater and subsequent surface water runoff causing breakdown of ACM, AF, or FA, with asbestos fibres released into surface and sub-surface soils.

4.4.2.3 Ground Gas

Future underground services, such as utility trenches and service conduits, may act as preferential pathways for the lateral migration of ground gases. These features can create low-resistance channels that bypass natural attenuation zones, potentially facilitating gas movement toward on-Site and off-Site receptors, including buildings and excavations

4.4.2.4 Groundwater

- The abstraction of groundwater or encountering shallow groundwater during sub-surface dewatering activities (e.g., excavations for infrastructure or PESP construction) may alter local groundwater gradients, potentially mobilising contaminants and enhancing vertical or lateral migration within the superficial aquifer.
- Ongoing superficial aquifer abstraction at Lot 551, Mirvac Burswood on the Peninsula and southern extremities of the Burswood Park Board managed area (all used for irrigation of landscaping) may exert a drawdown effect, influencing the direction and rate of shallow groundwater flow. This abstraction may act as a receptor or migration driver for mobile contaminants or leachate associated with historical land uses (e.g., landfill).
- The proximity of the PESP to the Swan River Estuary introduces tidal fluctuation effects within the superficial aquifer. These periodic changes can influence groundwater levels, potentially

reversing or dampening flow directions and enhancing mixing of contaminant plumes, particularly near buried waste or areas of elevated fill.

4.4.2.5 Surface Water

Surface water runoff from rainfall or irrigation may result in overland flow, mobilising surficial contaminants (e.g., from exposed fill, impacted soils, or disturbed areas). Where permeable soils are present, this surface water can infiltrate to the underlying superficial aquifer, potentially acting as a mechanism for vertical contaminant transport into groundwater.

5 DATA GAPS

The data gaps identified by Aurora in relation to understanding the potential contamination issues and risks to human health, the environment and environmental values within the Site are based on the preliminary CSM and are presented below.

5.1 DATA GAP 1 – NATURE, EXTENT AND COMPOSITION OF LANDFILL MATERIAL (SOURCE ZONE)

There is insufficient information on the type, volume, and lateral/vertical extent of waste material within the PESP footprint. Whilst some previous assessment at the Perth Stadium Precinct and Crown Towers has overlapped the PESP, further investigation is required to define the physical and chemical characteristics of the waste body to assess risk to receptors and inform CSM refinement to inform construction phase soil handling and ongoing future management decision making.

5.2 DATA GAP 2 – INTEGRITY AND EFFECTIVENESS OF LANDFILL CAP (SOURCE/PATHWAY CONTROL)

Limited data specific to the PESP footprint exists on the presence, thickness, composition, and condition of any engineered or natural capping materials overlying the landfill materials. This affects understanding of infiltration potential, gas migration control, and exposure risks at the surface during construction phase activities and final land use.

Aurora notes the extent composition and quality of the capping layer is a key data gap, however it is also acknowledged that the capping layer will likely be disturbed by the development, and it is unclear how and where it will be relocated across the Site based on the conceptual plan.

5.3 DATA GAP 3 – GROUND GAS GENERATION AND MIGRATION (SOURCE-PATHWAY-RECEPTOR LINKAGE)

Existing ground gas data collected for the Perth Stadium Precinct and Crown Towers provide a useful amount of background information relating to likely ground gas risk at the Site (previously determined to be CS 2 [Stadium] and CS 3 [Crown Towers]). However, no comprehensive ground gas is available on the presence and concentration of landfill gas (e.g., CH_4, CO_2, VOCs) in consideration of the proposed developed (proposed hardstand areas and permanent building footprint). Characterisation is required to confidently assess potential migration to proposed infrastructure and to evaluate the effectiveness of the cap or sub-surface conditions as barriers.

5.4 DATA GAP 4 – GROUNDWATER QUALITY AND CONTAMINANT PLUME DELINEATION (SECONDARY SOURCE AND PATHWAY ASSESSMENT)

Groundwater beneath the PESP footprint is likely to have been in contact with the landfill body or situated directly beneath it, and therefore subject to potential leaching of chemical contaminants from waste materials over time. Aurora notes that existing groundwater data collected for the other development sites in the Peninsula provides good background information, however, groundwater quality beneath the PESP footprint has not been specifically assessed, Further groundwater investigation is required to characterise groundwater quality within the PESP footprint and assess risks. Where impacts are identified, lateral delineation may be necessary to define the extent of the contaminant plume and to assess risk to potential receptors (taking into account the broad existence of landfill materials across the Peninsula). Groundwater quality data collected during the DSI will also provide a preconstruction baseline data set which will be utilised in environmental performance monitoring during the development.

5.5 DATA GAP 5 – SURFACE WATER QUALITY IMPACTS (RECEPTOR PATHWAY)

Whilst it is acknowledged that surface water features in the PESP footprint may be drained or infilled as part of the future development, there is a data gap regarding the potential for contaminant migration from landfill waste materials on the Site to impact nearby natural or constructed surface water systems. Specifically, there is insufficient information on whether contaminants from the landfill — via overland flow, leachate mobilisation, shallow groundwater discharge, or existing drainage infrastructure — have reached or are impacting surrounding water bodies. The absence of baseline surface water quality data limits the ability to assess current or potential ecological and human health risks to receiving environments downstream of the PESP and provide baseline data for surface water quality of the Swan River prior to construction activities. Targeted surface water sampling is required to characterise potential pathways outside of the PESP footprint, particularly during high rainfall or runoff events, and to determine whether mitigation or management measures are necessary to protect adjacent surface water ecosystems.

5.6 DATA GAP 6 – POTENTIAL FOR ASS AND DISTURBANCE RISK (SOURCE AND EXPOSURE ASSESSMENT)

The PESP footprint is mapped as a high-risk area for ASS under the DWER ASS risk mapping for the Swan Coastal Plain. Previous investigations at other development sites on the Peninsula have confirmed the presence of PASS below the water table. No Site-specific ASS investigations have been undertaken to confirm the presence, depth, or severity of actual or potential ASS within the sub-surface profile.

Targeted ASS characterisation is necessary to assess site-specific risks and determine the appropriate management measures required during development, particularly where soils may be disturbed through excavation or dewatering as part of the PESP construction.

Disturbance of sulfidic materials without appropriate management can result in acid generation, leading to the mobilisation of metals, degradation of soil and groundwater quality, and potential off-Site impacts to surface water ecosystems.

6 DATA QUALITY OBJECTIVES

The DQOs for soil and groundwater investigation are based on guidance presented in NEPC (1999) ASC NEPM, 1999 as amended 2013.

6.1 DQO PROCESS

The DQOs provide the framework for the investigation design and are intended to ensure that representative data are collected to address residual data gaps in the preliminary CSM. In accordance with the ASC NEPM, the DQOs are a combination of qualitative and quantitative criteria that:

- Clarify the study objectives.
- Define appropriate types of data to collect.
- Specify the tolerable levels of potential decision-making errors.

The DQO process, as defined in the ASC NEPM, consists of seven distinct steps, as shown below:

- **Step 1:** State the problem.
- **Step 2:** Identify the decision.
- **Step 3:** Identify the inputs to the decision.
- **Step 4:** Define the boundaries of the study.
- **Step 5:** Develop the decision rule.
- **Step 6:** Specify tolerable limits on decision errors.
- **Step 7:** Optimise the design for obtaining data

The DQOs are documented in Table D.

TABLE D: DATA QUALITY OBJECTIVES PROCESS

DQO Element	Data Gap 1: NATURE, EXTENT AND COMPOSITION OF LANDFILL MATERIAL (SOURCE ZONE)	DATA GAP 2 – INTEGRITY AND EFFECTIVENESS OF LANDFILL CAP (SOURCE/PATHWAY CONTROL)	DATA GAP 3 – GROUND GAS GENERATION AND MIGRATION (SOURCE-PATHWAY-RECEPTOR LINKAGE)	DATA GAP 4 – GROUNDWATER QUALITY AND CONTAMINANT PLUME DELINEATION (SECONDARY SOURCE AND PATHWAY ASSESSMENT)	DATA GAP 5 – SURFACE WATER QUALITY IMPACTS (RECEPTOR PATHWAY)	DATA GAP 6 – POTENTIAL FOR ASS AND DISTURBANCE RISK (SOURCE AND EXPOSURE ASSESSMENT)
Step 1 **State problem**	There is insufficient information on the type, volume, and lateral/vertical extent of waste material within the PESP footprint. Whilst some previous assessment at the Perth Stadium Precinct and Crown Towers has overlapped the PESP, further investigation is required to define the physical and chemical characteristics of the waste body to assess risk to receptors and inform CSM refinement to inform construction phase soil handling and ongoing future management decision making.	Limited data specific to the PESP footprint exists on the presence, thickness, composition, and condition of any engineered or natural capping materials overlying the landfill materials. This affects understanding of infiltration potential, gas migration control, and exposure risks at the surface during construction phase activities and final land use. Aurora notes the extent composition and quality of the capping layer is a key data gap, however it is also acknowledged that the capping layer will likely be disturbed by the development, and it is unclear how and where it will be relocated across the Site based on the conceptual plan.	Existing ground gas data collected for the Perth Stadium Precinct and Crown Towers provide a useful amount of background information relating to likely ground gas risk at the Site (previously determined to be CS 2 [Stadium] and CS 3 [Crown Towers]). However, no comprehensive ground gas is available on the presence and concentration of landfill gas (e.g., CH_4, CO_2, VOCs) in consideration of the proposed developed (proposed hardstand areas and permanent building footprint). Characterisation is required to confidently assess potential migration to proposed infrastructure and to evaluate the effectiveness of the cap or sub-surface conditions as barriers.	Groundwater beneath the PESP footprint is likely to have been in contact with the landfill body or situated directly beneath it, and therefore subject to potential leaching of chemical contaminants from waste materials over time. Aurora notes that existing groundwater data collected for the other development sites in the Peninsula provides good background information, however, groundwater quality beneath the PESP footprint has not been specifically assessed, Further groundwater investigation is required to characterise groundwater quality within the PESP footprint and assess risks. Where impacts are identified, lateral delineation may be necessary to define the extent of the contaminant plume and to assess risk to potential receptors (taking into account the broad existence of landfill materials across the Peninsula). Groundwater quality data collected during the DSI will also provide a preconstruction baseline data set which will be utilised in environmental performance monitoring during the development.	Whilst it is acknowledged that surface water features in the PESP footprint may be drained or infilled as part of the future development, there is a data gap regarding the potential for contaminant migration from landfill waste materials on the Site to impact nearby natural or constructed surface water systems. Specifically, there is insufficient information on whether contaminants from the landfill — via overland flow, leachate mobilisation, shallow groundwater discharge, or existing drainage infrastructure — have reached or are impacting surrounding water bodies. The absence of baseline surface water quality data limits the ability to assess current or potential ecological and human health risks to receiving environments downstream of the PESP and provide baseline data for surface water quality of the Swan River prior to construction activities. Targeted surface water sampling is required to characterise potential pathways outside of the PESP footprint, particularly during high rainfall or runoff events, and to determine whether mitigation or management measures are necessary to protect adjacent surface water ecosystems.	The PESP footprint is mapped as a high-risk area for ASS under the DWER ASS risk mapping for the Swan Coastal Plain. Previous investigations at other development sites on the Peninsula have confirmed the presence of PASS below the water table. No Site-specific ASS investigations have been undertaken to confirm the presence, depth, or severity of actual or potential ASS within the sub-surface profile. Targeted ASS characterisation is necessary to assess site-specific risks and determine the appropriate management measures required during development, particularly where soils may be disturbed through excavation or dewatering as part of the PESP construction. Disturbance of sulfidic materials without appropriate management can result in acid generation, leading to the mobilisation of metals, degradation of soil and groundwater quality, and potential off-Site impacts to surface water ecosystems.
Step 2 **Identify decisions**	• *Does soil in the PESP footprint pose a risk to relevant human health and ecological receptors?* • *What are the physical and chemical characteristics of the landfill materials and fill across the PESP footprint, are they broadly consistent enough with materials effectively capped and contained in-situ in the stadium precinct?* • *What is the lateral and vertical extent of the landfill waste*	• *Is a capping layer present across the landfill footprint?* • *What is the composition, thickness, and permeability of the existing capping material?* • *Does the cap meet the functional requirements to support site reclassification to 'RRU'?*	• *Are ground gases (e.g., methane, carbon dioxide) being generated beneath the PESP footprint?* • *Confirm the ground gas concentrations and flow rates to determine the appropriate GSV and CS.* • *Does the ground gas regime, GSV and the CSM indicate there is a potential unacceptable gas risk, and if so, is gas mitigation or ongoing monitoring measures*	• *Has the groundwater beneath the landfill been impacted by leachate or other contaminants?* • *What is the extent (lateral) of groundwater impacts, if present?* • *Do groundwater conditions pose risks to potential receptors, including surface water or abstraction points?* • *Are groundwater management measures required as part of*	• *Are contaminants migrating from the landfill or surrounding soils into adjacent surface water bodies?* • *Are there transport pathways via overland flow, shallow groundwater discharge, or site drainage infrastructure?* • *Is intervention required to manage surface water risks to receiving environments?*	• *Are actual or potential ASS present within the PESP footprint?* • *At what depths and locations do sulfidic materials occur, if present?* • *Could proposed soil disturbance or dewatering activities mobilise acidity or associated contaminants?* • *Are ASS management strategies required to mitigate potential impacts to soil, groundwater, or*

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	materials for the purpose of planning any sub-surface construction works? • *Is there sufficient delineation of landfill materials to assess risks and guide future development or remediation?* • *Is the soil suitable for reuse within the PESP footprint, or will it require management or off-site disposal?*		*required to protect future site users or infrastructure?*	*PESP construction and future site management?*		*surface water during PESP construction?*
Step 3 **Identify the Inputs to the Decision**	• Review and apply available historical documentation, including previous environmental investigations completed within the PESP footprint and surrounding areas (e.g., Perth Stadium Precinct, Crown Towers), to identify known fill areas and inferred waste composition. • Conduct systematic soil sampling across the former landfill footprint, with targeted sampling analysis from within the capping layer and underlying waste or fill to characterise soil quality and assess contaminant distribution. • Select representative samples for laboratory analysis of CoPC as relevant to the site history. • Interpret soil results in conjunction with findings from the groundwater and surface water assessments, particularly where leaching or mobilisation of contaminants from soil to other media is suspected (e.g., elevated ammonia or EC in shallow groundwater). • Incorporate laboratory analytical results into the refined CSM to inform the delineation of the landfill body, refine risk assessments for human health and the environment values. The Electrical Resistivity Tomography (ERT) assessment discussed in	• Review existing soil logs and geotechnical records from previous environmental and geotechnical investigations within the PESP footprint to identify evidence of a capping layer, including material type, thickness, and continuity. • Conduct visual inspection and detailed soil logging during the installation of soil bores, groundwater wells, and ground gas monitoring points to confirm the presence, composition, and integrity of any capping material overlying the landfill body. • The capping layer is essentially fill of unknown origin and quality and therefore the quality of the material should be characterised to ensure it is of suitable quality to act as a barrier for direct exposure. • Supplement intrusive investigations with ERT to map the lateral extent and thickness of the capping layer and underlying waste body, and to develop interpretive 2D cross-sections and a 3D conceptual model of sub-surface conditions. • Compare capping characteristics against expected or regulatory performance criteria, considering current and future land use (e.g., suitability to, isolate waste, and	• Review existing soil and ground gas data collected from within the PESP footprint to understand the known or inferred extent of landfill materials, depth of waste, and potential for ongoing organic degradation and gas generation. • Aurora has been provided with the conceptual locations of the permanent buildings (pit lane) building and proposed hardstand areas (track and amphitheatre) to be constructed for the Project. The investigation has targeted these areas as well as the broader PESP footprint to provide further confidence on broader Project-wide gas risk conditions. • Discrete ground gas monitoring wells to be screened in the response zone where groundwater is not present. Ground gas monitoring wells will be screened in the overlying the landfill material is in the saturated zone. The natural SRA is expected to always be in the saturated zone. • Identify the location and proximity of sensitive receptors, including proposed buildings, enclosed spaces, underground services, utilities, and hardstand areas, to inform risk-based monitoring locations.	• Review historical site documentation, including previous environmental reports and the most recent groundwater monitoring data from the Mirvac Burswood on the Peninsula Sites (e.g., Emerge, 2025), to understand known impacts and existing data gaps. • Undertake a site inspection of the existing groundwater monitoring well network to assess the condition, construction details, and spatial distribution of wells for ongoing suitability. • Install additional groundwater monitoring wells within and around the landfill footprint to address spatial data gaps and enable lateral delineation of potential impacts. • Conduct groundwater sampling from both existing and newly installed monitoring wells using low-flow sampling methods. • Record field parameters and observations, including pH, EC, DO, redox, temperature, and any visual or olfactory signs of contamination, to support interpretation of analytical data. • Submit samples for laboratory analysis targeting relevant CoPC to assess groundwater quality and potential risk to receptors.	• Review historical site documentation and environmental reports for any existing surface water quality data or references to surface water features on or adjacent to the PESP footprint. • Undertake a site inspection to confirm the presence, condition, and connectivity of surface water features (e.g., ponds, swales, drainage lines, constructed basins) and their relationship to the landfill footprint. • Map surface water catchments and flow paths using topographic data and site grading plans to understand potential contaminant migration pathways via overland flow, shallow groundwater discharge, or drainage infrastructure. • Identify potential off-Site receptors, including nearby wetlands, rivers, constructed drainage systems, or stormwater discharge points, that could receive contaminants from thePESP. • Conduct targeted surface water sampling during or shortly after significant rainfall events to assess contaminant mobilisation under high-flow conditions, with consideration for first-flush effects and typical flow regimes.	• Review historical site investigations (if available) for any incidental pH or sulfate-related data that may indicate the presence of PASS or AASS. • Undertake a site inspection and desktop assessment to understand planned development activities (e.g., excavation depth, dewatering requirements), which may disturb sulfidic materials and trigger acid generation. • Collect soil samples from targeted boreholes within areas identified as high risk, including areas below the natural groundwater table and zones of proposed ground disturbance (e.g., foundations, trenching). • Undertake soil screening tests, including field pH (pHF) and peroxide pH (pHFOX), to assess the presence of sulfidic material and guide further sampling. • Submit representative soil samples for laboratory analysis, including Chromium Suite (SCR) and Total Actual Acidity (TAA). • Assess depth to groundwater and seasonal fluctuations, as ASS risk is higher in permanently or intermittently saturated horizons. • Cross-reference with groundwater quality data, particularly for pH, acidity,

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	Data Gap 2 will be useful to provide additional data to provide delineation of the landfill body as well as the capping layer.	support recreational or urban redevelopment).	• Assess sub-surface conditions by reviewing findings from soil and groundwater investigations, with specific focus on: - Soil stratigraphy and permeability (which influence gas generation and migration). - Depth to groundwater and seasonal fluctuation. - Presence, type, and integrity of any capping layer. • Develop a targeted ground gas monitoring program, including the installation of dedicated gas wells across the PESP footprint, ensuring adequate spatial coverage relative to proposed permanent structures • Capture temporal and atmospheric variability by conducting multiple rounds of gas monitoring under varying barometric conditions, including: - Methane (CH_4), carbon dioxide (CO_2), oxygen (O_2). - Flow rates and ambient atmospheric pressure. - Monitoring to be timed to capture worst-case (falling pressure) conditions. • Compare results to relevant guidelines.		• Submit surface water samples for laboratory analysis of CoPC and compare results to relevant guidelines. • Evaluate site drainage infrastructure, such as pits, culverts, and subsoil drains, for potential roles in mobilising or directing contaminated runoff to receptors external to the PESP.	alkalinity, sulfate, aluminium, and dissolved metals, which may indicate mobilisation of acid and metals from ASS.
Step 4 **Define the Boundaries of the Study**	• Spatial: Within the suspected landfill footprint, external to areas previously investigated on Lots 2001 and 551. Ensuring the full lateral extent of known or inferred waste materials, extending to the boundary of the PESP footprint where potential migration or mixing of contaminants may occur. • Vertical: From near ground surface down to the maximum depth of buried materials or	• Spatial: Within the suspected landfill footprint, focusing on areas where a capping layer is expected or inferred, including the full lateral extent across the PESP footprint to assess continuity and variability. • Vertical: From the ground surface down through the full thickness of the capping layer and immediately underlying waste material, generally within the	• Spatial: The ground gas investigation a combination of targeted sampling corelating to future building footprints and hardstand areas and systematic monitoring locations across the PESP footprint given it is underlain by the closed landfill and SRA. • Vertical: The investigation will extend to into the landfill waste body to ensure that ground gas investigation wells are screened	• Spatial: PESP footprint ensuring adequate coverage of the Site including upgradient concentrations and downgradient (west and east) delineation of potential impacts. • Vertical: Upper portion of the shallow Superficial Aquifer (0.5-5m bgl). • Temporal: July/August 2025.	• Spatial: Identified surface water features of the Site (Lakes 1-13 and the Swan River targeting any outlets such as pipe, drains or swales. • Vertical: Surface water column only (i.e., no sediment or pore water assessment at this stage); potential connectivity with shallow groundwater (Superficial Aquifer) may be inferred through integration with groundwater data.	• Spatial: Areas of the PESP footprint mapped as high risk under the DWER ASS risk mapping, with particular focus on locations likely to be disturbed during proposed earthworks (e.g., excavations, service trenches, foundations, and areas requiring dewatering). • Vertical: From ground surface to at least one metre below the natural groundwater table, or to the maximum depth of proposed

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	landfill waste, estimated at approximately 9.0m bgl.wth drilling to target the upper 6m of the ground surface. • Temporal: July/August 2025, coordinated to align with other site investigations and prior to major construction activities.	upper 3-5m bgl, or as identified from existing soil logs. • Temporal: July/August 2025, timed to coincide with intrusive investigations.	within the response zones i.e., the source of the gas, and above the groundwater level to provide a conservative assessment of the potential gas risk associated with proposed infrastructure. • Temporal: Three rounds of ground gas sampling between July/August 2025.		• Temporal: July/August 2025, preferably coinciding with or shortly following significant rainfall events.	disturbance (Nominally 6m bgl) (whichever is greater), to capture the full depth of potential ASS horizons. • Temporal: Q3 2025, prior to commencement of intrusive works, to allow integration of results into construction planning and environmental management measures.
Step 5 **Develop a Decision Rule**	• Risks associated with soil, ground gas, groundwater, water surface water and ASS impacts will be screened by comparison of analytical data with the Tier 1 assessment criteria and data considered to reflect pre-existing background conditions. • If concentrations of CoPCs are below assessment criteria or background results, risks are acceptable. • If concentrations of CoPCs are above assessment criteria or background results, further investigation, and evaluation (e.g., higher tiered risk assessment) or remediation/management may be required.					
Step 6 **Specify Tolerable Limits on Decision Errors**	• Qualitative assessment of potential for sampling and measurement errors will be undertaken based on investigation scope, methodology and results using professional judgment of the experienced contaminated site scientist/s conducting the DSI. Data quality will be assessed using data quality indicators described in Table E and QA/QC requirements defined in Table G and methods as detailed in Schedules B (2) and B (3) of the NEPM (NEPC, 1999). • A tolerable error limit of 5% will be adopted during consideration of data quality and assessment of results to Tier 1 assessment criteria. If this tolerable limit is exceeded, due consideration will be given to the potential effect of the issue on the outcome of the investigation (i.e., whether there is 95% confidence that the Tier 1 risk assessment outcome is correct). Uncertainties and any residual data gaps which may contribute to decision error will be discussed. • Field supervision by suitably qualified and experienced Aurora personnel to ensure accurate and representative data acquisition. • All Field screening equipment used will be appropriately calibrated. • During the ground gas assessment, the worst-case meteorological conditions will be defined as the fifth percentile three-hour pressure decrease for the previous two years for the Perth Metro Bureau of Meteorology (BoM). • Quality assurance (QA) and quality control (QC) program in accordance with ASC NEPM, DWER (2021) and PFAS NEMP guidance requirements. • Data quality indicators (DQIs) to be applied to assess the usability of data prior to making decisions, based on precision, accuracy, representativeness, comparability, and completeness.					
Step 7 **Optimise the Design for Obtaining Data**	The methodology outlined in Section 7 has considered the specific identified data gaps and the identified inputs described in Step 3 of the DQO process. It is considered that the methodology described will provide a dataset suitable for making risk-based decisions in relation to potential contamination in the PESP footprint.					

6.2 DATA QUALITY INDICATORS

Several actions, procedures, checks and decisions will need to be undertaken to ensure the accuracy and reliability of analytical results and to ensure the representativeness and integrity of the collected samples and environmental data. Table E provides a summary of the Quality Assurance (QA) procedures and Quality Control (QC) indicators to be adopted.

TABLE E: SUMMARY OF QUALITY ASSURANCE PROCEDURES

QUALITY ASSURANCE PROCEDURE	DESCRIPTION
Record Keeping	• Detailed records of all field activities comprising surface inspections, soil sampling locations, soil descriptions, ground gas and groundwater monitoring well installation logs, groundwater gauging and groundwater and surface water sample collection (including stabilisation of field parameters), weather data and ground gas monitoring will be recorded on standard field sheets. • Soil descriptions of encountered lithology at each sampling location and during the installation of ground gas and groundwater monitoring wells will be photographed and logged on standard field logging sheets. • Photographs are required to be taken at sampling locations and any points of interest. • Field records of measurements during ground the DSI will be appended to the report.
Competency in Asbestos Assessment	• The lead field scientist is required to show competency at undertaking assessment of asbestos in soil as outlined in Section 1.9 of the DoH (2021) guideline document *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*. Evidence of competency will be provided in the DSI report.
Equipment Calibration	Photo-ionisation detector (PID), groundwater and surface water sampling equipment and landfill gas analyser will be calibrated by supplier before each monitoring event. The calibration certificates will be appended to the report.
Sample Labelling	Individual sample numbers are required to be used for each sample location and depth to clearly specify the sample origin.
Chain of Custody	Chain of Custody (CoC) documentation is required to be used for all sample transfers to laboratory. CoC forms to include sample identities, sample date, sample container types and quantity, type of analysis required and signed by the persons transferring and accepting custody of the samples.
PFAS Sampling controls	PFAS sampling of surface water and groundwater will be undertaken in accordance with PFAS Sampling' guidance provided in Section 18 of the NEMP V3.0.
Sample Storage	• Soil, groundwater and surface water samples are required to be transferred in approved sampling containers, with appropriate preservation as required and maintained in a cooled condition prior to dispatch to the laboratory where applicable, noting that samples destined for analysis for asbestos and inorganic CoPCs can be maintained under ambient conditions. • ASS samples will be collected (zero headspace) and stored in a manner (i.e., frozen in a vehicle freezer unit) to minimise potential for oxidation before analysis. • All soil samples will be held at the laboratory in appropriate storage conditions for additional analysis if required e.g., vertical delineation.

TABLE E: SUMMARY OF QUALITY ASSURANCE PROCEDURES

QUALITY ASSURANCE PROCEDURE	DESCRIPTION
Decontamination	• Soil sampling equipment are to be brushed, wiped or washed clean, as required, of any soil material adhering to them. • All non-disposable soil and groundwater sampling equipment such as hand auger, drilling rods, drilling equipment, sampling towel, water level meter, low flow pump and water quality meter will be decontaminated between sampling locations which will consist of a three-step process: washing/scrubbing in tap water followed by washing/scrubbing in laboratory grade PFAS-free detergent (e.g., Neutracon/Liquinox) and a final rinse using distilled water. In addition, all samples (and corresponding containers) will be handled using disposable nitrile gloves, which were replaced between each sampling location.
Quality Control Samples	• Duplicate and triplicate soil samples will be collected by splitting a sample volume. They will be analysed at a frequency of 1 per 20 primary samples for each analyte and 1 per 10 primary samples for PFAS. Duplicate samples are required to be analysed by the same laboratory and triplicate samples by a different laboratory. The acceptance limit for relative percentage differences (RPDs) will be 30%, with the causes and implications of RPDs greater than 30% reviewed. • Rinsate blank soil samples are not considered necessary for the soil investigation, as samples will be primarily collected directly into sample jars/bags and there is a low likelihood for cross-contamination of CoPCs across soil sample equipment. Sampling equipment will be readily cleared of adhered soils. • One field blank and one equipment rinsate sample will be collected during both the drilling program and groundwater sampling. The rinsate sample will be collected by running de-ionised water over the drilling rods during the soil assessment and from a piece of non-disposable groundwater sampling equipment (after being decontaminated) and collection into sample bottle. • PFAS free deionised water provided by a laboratory is to be used for the field blank and rinsate samples.
Laboratory Internal QA/QC	• A National Association of Testing Authorities (NATA) accredited laboratory is required to be contracted to undertake soil and water sample analysis using NATA-accredited methods. • Laboratory QC procedures are required to be consistent with Schedule B3 of the NEPM (NEPC, 1999).

7 SAMPLING METHODOLOGY

7.1 PRELIMINARIES

7.1.1 Site Access

Aurora understands that Main Roads will laisse with the Landowners/Managers identified in Section 10 for Site access.

Any intrusive works will be subject to the requirements of the following Site Management Plans:

- Lot 2001 Sub-Surface Site Management Plan Perth Stadium Rev 6 (Westadium Project Co Pty Ltd, 2022).
- Lots 2002, 555, 557, 42) Sub-Surface Site Management Plan Burswood Park Board (Tetra Tech 2024).
- Lot 551 Contaminated Site Management Plan – Crown Towers (Golder, 2014).

7.1.2 Occupational Health and Safety

Personnel undertaking sampling at the Site will complete a SWMS for the tasks undertaken before any intrusive works. Before the disturbance of soil at investigation locations, a series of procedures will be undertaken to reduce the likelihood of encountering underground services. These will include:

- Inspection of Dial Before You Dig (DBYD) plans;
- Inspection of features indicative of underground services;
- Detection and marking of services by a Telstra accredited underground service locator; and
- Non-destructive soil boring methods (hand augering) where possible, close to buildings or identified underground assets.

All the investigation locations are indicative and may change subject to constraints associated with underground infrastructure. It is expected underground infrastructure may remain within the bounds of the Site which may impede sampling.

7.2 SOIL ASSESSMENT OF LANDFILL MATERIAL AND CAPPING LAYER QUALITY CHARACTERISATION

7.2.1 Soil Sampling Program

It is proposed to install a total of 33 soil bores and 33 mechanical test pits across the balance of the PESP footprint (16.5 hectares [ha]) that has not previously been subject to environmental assessment or statutory audit. The proposed locations of these soil bores are presented in Figure 4. A combined sampling approach including both test pits and mechanical soil bores has been nominated, as it allows for inspection of the capping layer and upper portion of the landfill material, whilst providing ability to vertically delineate the depth of the landfill body and depth of the underlying natural soils at each sampling location.

The rationale for the location of the 33 proposed soil investigation locations is based on the following:

- Five sample locations targeting to proposed pit lane area where permanent buildings will be constructed;

- Eight samples targeting the footprint of the proposed amphitheatre;
- 10 samples targeted the alignment of the proposed hardstand track;
- Six samples targeting the former wood burning area; and
- Six samples targeting the balance of Site where 'general fill' is understood to have been placed.

The proposed soil sampling plan is shown in Figure 7.

7.2.1.1 Test Pitting Methodology

Test pits will be used to provide visual assessment of the capping layer and underlying fill material and will be also used so that ACM field screening can be undertaken (see Section 7.2.2). At each test pit location, a mini (3-5t) digger will be used to open test pits approximately 1m wide by 2m in length to a depth of 2.0m bgs. Excavation will be undertaken in 0.3m lifts with each layer placed in separate piles around the test pit in the order of that excavated. After sampling, each test pit will be reinstated in the reverse order to that removed, ensuring that no landfill materials are left at the surface. At each test pit location, soil samples will be collected at regular depth intervals: near surface (e.g., 0.1m bgl), 0.5m bgl, 1.0m bgl and 1.5m bgl. At the completion of reinstatement, the test pit footprint will be track rolled for compaction.

7.2.1.2 Soil Bore Methodology

Each soil bore will be installed using a track-mounted direct push drill rig, with the top 1.5m manually drilled using a hand auger to minimise disturbance to shallow infrastructure. Boreholes will be advanced from the ground surface through the capping layer, landfill material, and terminated at a target depth of 6.0m bgs or at the intersection of underlying natural soils (assumed to be SRA). It is noted that maximum drilling depth may be subject to refusal caused by saturated conditions or obstructions (e.g., buried concrete, steel, or other debris commonly found in uncontrolled fill).

At each location, soil samples will be collected at regular depth intervals: Commencing at 2.0m bgs and at 1.0m increments thereafter to target depth.

7.2.1.3 General Sampling Methodology

A minimum of two samples per major stratigraphic unit (i.e., capping layer, landfill/fill, and natural soils) will be collected. Additional samples will be collected where:

- Significant changes in lithology are observed;
- Visual or olfactory evidence of contamination is present (e.g., staining, odour, debris); and
- Field instrument readings (PID) indicate potential chemical presence.

At each sampling depth, two samples will be collected:

- One into a laboratory-supplied jar for chemical analysis; and
- One into a laboratory ziplock bag for assessment of asbestos in soil.

All samples will be collected directly from the drill core using disposable or decontaminated equipment and immediately placed into laboratory-supplied containers, to minimise the potential for cross-contamination. All non-disposable sampling equipment will be decontaminated between each sample location in accordance with the procedures outlined in Section 6.1.

All samples will be visually inspected in the field, and comprehensive lithological logs will be completed. Logs will include descriptions of:

- Soil type and classification consistent with AS1726 (Standards Australia, 2017);
- Colour, moisture, grain size, plasticity, and angularity;
- Presence of minor inclusions (e.g., ash, glass, metal); and
- Odours, staining or any signs of anthropogenic influence or contamination.

Where hydrocarbons are CoPCs or field evidence suggests their presence, soil vapours will be screened using a PID. PID readings will be recorded and used as supporting evidence for selecting samples for laboratory analysis.

All samples will be labelled with a unique Aurora job number, sample ID, and date of sampling. Samples will be placed in a chilled esky and transported to a NATA-accredited laboratory under appropriate CoC procedures.

7.2.2 Asbestos in Soil Assessment

At each test pit location excavated soils from the caping layer and underlying fill material will be field screened for the presence of ACM. A 10L representative sample of each 0.3m excavation lift will be collected and subject to field screening. The 10L sample will be passed through a sieve (≤7mm x ≤7mm), with ≥7mm sized fragments visually assessed for the potential presence of ACM. In the unlikely event that soils are unable to be sieved (e.g., high clay content), the 10L sample will instead be spread out on a plastic sheet (contrasting colour to the soils) and inspected.

Where ACM (≥7mm x ≥7mm) is identified, the fragments will be collected and inspected, and their condition and weight recorded. In accordance with DoH (2021), the concentration of asbestos in soil will be calculated using either of the equations presented in:

$$\%\ (w/w)\ \text{asbestos} = \frac{\text{proportion (expressed as \%) of asbestos x weight of ACM (kg)}}{\text{Soil weight (kg)}}$$

Where it is assumed:

- Asbestos content of ACM is 15%.
- Soil bulk density of 1.65kg/L (Perth sandy soils).
- Sample volume is 10L.

7.2.3 Laboratory Analysis Program

In the first instance, three samples will be selected for laboratory analysis comprising of two samples from the capping layer, three samples from the landfill body.

The sampling analysis program is provided in Table F below.

TABLE F: SOIL SAMPLING ANALYSIS PLAN

STATA	NUMBER OF SAMPLES TO BE ANALYSED	COPCS ANALYSIS
Capping Layer	• 66	• Metals (antimony, arsenic, barium, beryllium, cadmium, chromium [total], cobalt, copper, lead, manganese, mercury, nickel, selenium, and zinc). • Petroleum hydrocarbons – TRH, BTEX-N. • OCPs. • Herbicides. • Insecticides. • Asbestos in Soil (field screening) and collection of 500mL sample for AF/FA analysis.
Fill Material	• 99	• Metals (antimony, arsenic, barium, beryllium, cadmium, chromium [total], cobalt, copper, lead, manganese, mercury, nickel, selenium, and zinc). • Asbestos in Soil (field screening where test pit depth intersects the fill material) and collection of 500mL sample for AF/FA analysis. • Petroleum hydrocarbons - TRH, BTEX-N. • PAHs and PCBs. • OCPs. • Phenols. • Dioxins (six sampling locations targeting landfill waste in the former wood burning area).

7.3 MAPPING OF LANDFILL BODY AND CAPPING LAYER

7.3.1 Review of bore log data

Aurora will review of historical soil logging data and soil logs collected during this investigation, to develop an understanding of thickness of the capping layer overlying the landfill body. This desktop assessment will assist in identifying areas of consistent capping, potential gaps, or anomalies. Results of the desktop assessment will be tabulated to provide a summary of the capping layer vertical and lateral distribution across the PESP footprint.

7.3.2 ERT

In addition to the desktop study, the verification of the capping layer will be supplemented by ERT will be employed to non-invasively map the spatial extent, continuity, and thickness of the capping layer across the PESP footprint. Aurora will engage MNG Surveys to implement the ERT program. A copy of relevant soil logging data reviewed in the desktop study will be provided to the MNG geophysicist to calibrate their models. ERT to ERT is a non-invasive geophysical method that maps sub-surface resistivity variations, which reflect differences in material type, moisture content, porosity, and saturation—factors relevant to identifying engineered or natural capping layers.

The survey will be completed using a multi-electrode resistivity system, where electrical current is injected into the ground and the resulting voltage differentials are measured. These measurements are automatically acquired across various electrode pairs and processed through inversion modelling to generate 2D resistivity profiles (geo-electrical cross-sections).

The capping layer is anticipated to present a recognisable resistivity contrast relative to underlying fill, waste, or natural soil layers. This resistivity signature will assist in mapping the lateral extent and verifying the presence and thickness of the capping layer.

Ground-truthing of ERT results will be undertaken using soil stratigraphy information collected from:

- Soil logging data during soil assessment activities;
- ASS investigations;
- Groundwater monitoring well installation logs; and
- Ground gas monitoring well installation logs.

This integrated approach will enhance interpretation accuracy, improve confidence in sub-surface models, and support validation of capping layer compliance across the Site.

Should the ERT method prove inconclusive or unsuitable in certain areas (e.g., due to interference, geological complexity, groundwater interference or poor contrast), consideration will be given to intrusive verification methods, such as additional soil bores, test pits or Cone Penetration Testing (CPT). However, it is noted that the reliability of intrusive methods is constrained by the spatial accuracy and resolution of individual sampling locations and may not capture localised variability between points.

7.4 GROUND GAS ASSESSMENT

7.4.1 Ground Gas Monitoring Bore Installation

Aurora will install 12 ground gas monitoring wells using direct push drilling methods beneath the surface and screened in the landfill material (i.e., in the response zone), where practical. The proposed location of these ground gas monitoring wells is provided on Figure 8. It is expected that groundwater may saturate the landfill materials at some locations. Where it does not, 0.5-1m screens will be installed in landfill material above the groundwater level. Where landfill material is saturated, 0.5-1m screens will be installed 0.5-0.75m above the groundwater level, ensuring that screens do not get installed within 1m of an unsealed surface. The lithological profiles will be logged in a manner consistent with AS1726 (Standards Australia, 2017) and NSW EPA (2020).

The monitoring wells will be constructed with 50mm PVC casing, with the screen interval slotted with machine cuts. The boreholes will be backfilled with clean gravel pack surrounding the screened interval and then backfilled with bentonite and grout from 0.5m above the screen to the surface. The wells will be fitted with a gas tap at the top of the casing, finished above the ground in steel monument risers.

The ground gas monitoring well locations have been selected to target highest gas risk locations and to provide a distribution across the Project footprint underlain by the closed landfill and natural SRA. The rationale for each location is explained below.

- Two ground gas monitoring wells will target the location of conceptual location of ‘pit lane’ where permanent buildings will be constructed.
- One ground gas monitoring well will be installed targeting the footprint of the proposed amphitheatre.

- One ground monitoring gas well will be installed central to the inferred former tree burning area.
- The remining eight ground gas monitoring wells will be installed to provide sufficient coverage over the remaining PESP footprint, noting that no ground gas well will be installed on portions of the Site which overlap the Perth Stadium Precinct, as these areas have been previously investigated.

Based on reviewed groundwater data, it is anticipated that depth to superficial groundwater in some locations of the PESP is likely to be shallow (i.e., less than 1.5m bgs). Where shallow groundwater is encountered during installation of ground gas wells, the location of the proposed well may have to be relocated or abandoned. The citing of ground gas monitoring wells (with respect to groundwater depth) will be guided by the outcomes of groundwater monitoring well installation and intrusive soil investigation.

7.4.2 GROUND GAS MONITORING

A calibrated landfill gas analyser fitted with an infra-red probe will be used to measure carbon dioxide, methane, hydrogen sulfide, carbon monoxide and oxygen concentrations. The same device will be used to measure mass flow rate in the wells. Weather conditions, peak and stable gas and flow readings (as prescribed by NSW EPA [2020]) will be recorded on standard field sheets.

The prevailing atmospheric conditions during measurement periods will be compared to the fifth percentile three-hour continuous decrease in barometric pressure from the Perth Metro BoM station over two years to establish whether worst-case conditions were prevailing. Aurora has determined this to be 1.7mbar (hPa).

The first monitoring event will be undertaken at least 24 hours after the installation of gas monitoring bores. Prior to the completion of any sampling and leak test will be conducted on each bore. Leak testing of the bore's integrity (i.e., effectiveness of the seal) is not considered required due to the ground gas bores being screened more than 1m beneath the surface, and confidence in the drilling contractor to seal the bore with bentonite and grout from 0.5m above the screen all the way to the surface. A leak test of the gas tap connection with the gas analyser will be undertaken by wrapping a piece of cloth soaked with iso-propyl alcohol around the outside of the connection and the measuring VOC content in air from the bore with a PID.

Initially, three gas monitoring events will be undertaken in July and August 2025. These will be scheduled based on forecasted decreasing atmospheric pressure conditions within that month.

7.5 GROUNDWATER ASSESSMENT

Aurora proposes to monitor the upper limits of the superficial groundwater aquifer across the PESP footprint using a network of 13 groundwater monitoring wells. The monitoring network is illustrated in Figure 9. The groundwater assessment does not include allowance to vertically delineate any groundwater impacts identified by the assessment of the upper portion of the shallow groundwater aquifer.

The program will include sampling from six existing monitoring wells; MW07A, MW11, MW13, MW17A, MW18A, and MW19A, which are all located primarily along the eastern and southern boundaries of the PESP footprint.

To enhance spatial coverage, Aurora will install seven new groundwater monitoring wells across the central and western portions of the PESP footprint.

It is noted that no new monitoring wells are proposed within areas intersecting Lot 2001, as these portions of the Site have been subject to prior investigation and environmental audit. Existing data and audit findings for Lot 2001 are considered sufficient, and as such, further installation or monitoring within this area is not warranted at this stage.

7.5.1 Existing Monitoring well suitability

Aurora has requested monitoring well installation logs from the Burswood Park Board for the six existing wells nominated for inclusion in the proposed monitoring program. It is understood that MW11 and MW13 were installed circa 2014, while MW07A, MW17A, MW18A, and MW19A were installed more recently in 2023. Therefore it is provisionally presumed that they will be appropriately constructed and screened across the shallow groundwater table for the purpose of the DSI. All six wells are currently monitored on an annual basis to fulfil requirements under an existing Ministerial Statement condition. Upon receipt, Aurora will review the installation logs to confirm the suitability of each well for inclusion in the current groundwater monitoring scope. In addition, Aurora will undertake a site inspection of the wells, to verify that they are in serviceable condition prior to the installation of the proposed new wells across the PESP footprint. If the existing wells are not deemed to be suitable for the purpose of this assessment then additional monitoring wells will need to be installed.

7.5.2 Monitoring well installation

Each of the new groundwater monitoring well installed using a motorised drilling rig as follows:

- Constructed with one 3m length of 50mm diameter, Class 18, PVC, 0.050mm factory slotted well screen positioned 1m above and 2m below the encountered groundwater table.
- A 50mm diameter, class 18 PVC end cap will be threaded to the bottom of each well, with the screened portion threaded to a length of 50mm diameter, Class 18, PVC well casing.
- An appropriately graded sand/gravel pack will be placed around the well screen from the bottom of the borehole to approximately 0.5m above the top of the well screen.
- A bentonite seal will be placed on top of the sand/gravel pack with clean sands (i.e., not drill cuttings) placed on top of the bentonite to approximately 0.3m bgl.
- Cement grout will be placed from approximately 0.3m bgl to the ground surface.
- A locking expansion cap will be placed on the open portion of each monitoring well.
- A 200mm diameter steel well gatic cover (suitable for vehicles traversing over – installed flush with ground surface) or a or a steel monument cover will be placed over each monitoring well/seated within the cement grout.

Following construction, all groundwater monitoring wells will be developed using a high-flow submersible pump until either the water runs clear and visibly clear of fines, four well volumes are purged, or the well is pumped dry. Monitoring well construction details (e.g., depth of screen interval) will be recorded on log sheets.

7.5.3 Existing Monitoring well suitability

7.5.4 Survey

All newly installed groundwater monitoring wells will be accurately located and levelled by an accredited surveyor. Data will be recorded for elevation (ground surface and top of well casing) in m

AHD along with easting and northing coordinates in Map Grid Australia (MGA) coordinates to the nearest millimetre.

7.5.5 Groundwater Sampling

Prior to sampling, the depth of standing water will be gauged from a marked position on the top of casing using an interface probe and recorded on field data sheets. Post-gauging, each monitoring well will be purged using a low flow pump and inert low-density polyethylene (LDPE) tubing. The upper end of the tubing will be connected to the flow cell of a water quality meter positioned to prevent entrapment of oxygen. The pump intake will be placed approximately 0.5m below the standing water level (where water column permitted), to ensure collection of samples at comparable depths relative to groundwater level in other monitoring locations.

Measurement of water quality parameters will be undertaken immediately after the flow cell is full and continued thereafter at two-to-five-minute intervals during the purging process. Field groundwater quality parameters including pH, DO, redox potential (ORP), EC, TDS and temperature, will be measured and recorded on field data sheets during purging until stabilisation was achieved.

Representative groundwater samples will be collected directly from the LDPE tubing into laboratory supplied pre-preserved sample containers. All bottles will be filled (i.e., no headspace). Samples collected for metals analysis will be field-filtered using a 0.45µm filter, with the filter placed in-line at the end of the sampling tube.

Sample bottles will be labelled with a unique Aurora job number, sample identification and sampling date. All samples will be placed in a chilled esky for transport to the laboratory and accompanied with CoC documentation.

7.5.6 Groundwater Analytical schedule

All 12 primary groundwater samples will be subject to laboratory analysis for the following parameters:

- Dissolved Metals (antimony, arsenic, barium, beryllium, cadmium, chromium [total], cobalt, copper, lead, manganese, mercury, nickel, selenium, and zinc).
- Petroleum hydrocarbons – TRH and BTEX-N.
- PAHs, OCPs and Phenols.
- PFAS full suite with ultra trace analysis (Laboratory limit of reporting [LOR] 0.0001µg/L [Perfluorooctane sulfonic acid; PFOS]).
- Nutrients including ammonia, nitrate, nitrite, total nitrogen, total reactive phosphorus and total phosphorus.
- Acidity, total alkalinity.
- Dissolved organic carbon.
- Major anions and cations (alkalinity, chloride, sulfate, nitrate, sodium, potassium, calcium, magnesium, hardness and ionic balance [calculated by the laboratory]).

Groundwater samples will also be analysed for ASS indicators which are discussed in Section 7.7.4 below.

7.6 SURFACE WATER ASSESSMENT

Surface water samples will be collected at 16 locations based on the following:

- Two sample locations per on-Site surface water Lakes (Lakes 1-3);
- Two sample locations from off-site down topographical surface water lakes (Lakes 4 and 5);
- Two sample locations from the Swan River;
- One sample location from each of the four lakes that form the Burswood Canal (Lakes 10-13) that are within the PESP boundary..

The locations of the proposed surface water samples are presented in Figure 10.

Surface water samples will be collected in general accordance with AS/NZS 5667.11:1998 – *Water quality – Sampling – Guidance on sampling of groundwaters*. Sampling will be undertaken at each location from approximately 0.1m below standing water level. Water will be collected using a grab pole and disposable bottle. Collected surface water will be placed in a 1L cell to measure surface water parameters. The volume of water will be left to equilibrate over a 20-minute period with measurements recorded every five minutes. All water samples will be collected whilst wearing nitrile gloves, directly into laboratory-supplied bottles, then sealed, labelled and placed on ice in an insulated cooler prior to transport to laboratories under strict CoC protocols.

Each primary surface water sample will be analysed for the following parameters:

- Dissolved and Total Metals (antimony, arsenic, barium, beryllium, cadmium, chromium [total], cobalt, copper, lead, manganese, mercury, nickel, selenium, and zinc).
- Petroleum hydrocarbons – TRH and BTEX-N.
- PAHs, OCPs and Phenols.
- PFAS.
- Nutrients including ammonia, nitrate, nitrite, total nitrogen, total reactive phosphorus and total phosphorus.
- Acidity, total alkalinity.
- Major anions and cations (alkalinity, chloride, sulfate, nitrate, sodium, potassium, calcium, magnesium, hardness and ionic balance [calculated by the laboratory]).

7.7 ACID SULFATE SOILS

As part of the soil bore installation works described in Section 7.2, Aurora will undertake a preliminary assessment of actual and potential acid sulfate soils (ASS/PASS) within the PESP footprint. ASS sampling will be conducted at each of the 33 proposed soil bore locations. At each location, two samples will be collected from the fill material and two samples from the underlying natural soils (SRA). Sampling will be targeted to commence approximately 0.5m above the groundwater table, with intervals selected to characterise geochemical conditions immediately above and below the saturated zone. Samples will be collected to a nominal target depth of 6.0m bgs in consideration that disturbance soil depths associated with the development are currently unknown.

7.7.1 Field Testing

Aurora will collect 132 samples for field testing which will be completed by NATA accredited laboratory for analysis under laboratory conditions.

Each field test will include:

- Field pH_F; and
- Field pH_{FOX} (after oxidation with hydrogen peroxide).

Field test will be interpreted in consideration of applicable DWER (2015a) guideline criteria discussed in Section 9.4.1.

7.7.2 Laboratory Soil Analysis

Aurora will select 66 samples (two per soil bore, one from the fill and one from the SRA) for analysis of the CRS suite from soils identified as potentially having ASS or PASS soils to obtain a spread of sample data laterally and vertically through the soil profile. The analysing laboratory will be NATA accredited for the analysis method.

The total acidity in soils samples was calculated by summing the titratable actual acidity and potential sulphide acidity and excluding any acid neutralisation capacity.

7.7.3 Sample Preservation and Storage

All soil samples will be collected and properly preserved in accordance with DWER guidelines (DWER, 2015a).

Representative samples collected from the soil core will be immediately placed within laboratory supplied plastic zip lock bags, sealed and placed on into a portable car freezer to minimise the potential oxidation of sulfidic material. Samples will be appropriately packed, stored and dispatched for laboratory analysis in chilled eskies under CoC protocols. Soil samples will be frozen by the laboratory until sub-sampled and analysed.

7.7.4 ASS Groundwater Parameters

As part of the groundwater sampling round described in Section 7.5, Aurora will collect samples from the 12 on-Site groundwater monitoring wells. All groundwater samples will be submitted to a NATA-accredited laboratory. Samples will be analysed for the DWER ASS suite, which includes pH, total alkalinity/acidity, sulfate, chloride, sodium, ammonia (as nitrogen), TDS, EC, total nitrogen, total phosphorus, dissolved aluminium, total aluminium, and total iron. In addition, groundwater samples will be analysed for dissolved metals, including arsenic (As), chromium (Cr), cadmium (Cd), iron (Fe), manganese (Mn), nickel (Ni), selenium (Se), and zinc (Zn).

8 FIELD AND LABORATORY QUALITY ASSURANCE/ QUALITY CONTROL

8.1 SAMPLE STORAGE AND TRANSPORT

8.1.1 Containers and preservation

The selection of appropriate sample containers, preservation procedures, sample storage requirements and holding times will be undertaken in accordance with those recommended in AS 5667.1 – 1998.

8.1.2 Storage and transport

All samples will be kept cool/within ice filled eskies during the working day, with ice replaced prior to dispatch to the laboratory. All primary samples and associated QA/QC samples will be shipped to the laboratory within required holding times and under CoC documentation. The laboratory will be notified of the shipment of samples their expected arrival.

8.1.3 Holding times

All samples will be delivered and extracted within permissible holding times requirements set out in AS 5667.1 – 1998.

The laboratories will be instructed to retain all the sampling extracts obtained for analysis under refrigeration for at least 30 days after the issue of the laboratory report. This will allow time for the laboratory report to be reviewed and repeat tests or additional tests to be scheduled within the extract holding time.

Laboratories selected will be NATA accredited for the proposed analytical suites and adhere to a thorough QA/QC protocol which reports the full sequence of laboratory samples receipt, handling, processing/reporting, and storage against specified storage times, ensuring that samples can be tracked and compared against the standards.

8.2 DOCUMENTATION

All sample documentation including field notebooks, site photographs, reporting records, CoCs and equipment calibration certificates will be retained on the project file, with specific requirements for QA/QC record keeping summarised in Table G.

TABLE G: QA/QC RECORD KEEPING REQUIREMENTS

QA/QC ASPECT	RECORD KEEPING REQUIREMENTS
Field records	• Sampling time, date, and the name of the sampler. • Weather conditions. • Sample collection method. • Calibration records. • Sample equipment decontamination procedures (reusable sampling equipment). • Site photographs.
Sample labels	• Project number, date, unique sample number and name or initials of the sampler.
COCs	• Accompany the samples to the laboratory for submission for analysis. • Completed in blue or black ink pen. • All information requirements will be completed on the form.

TABLE G: QA/QC RECORD KEEPING REQUIREMENTS

QA/QC ASPECT	RECORD KEEPING REQUIREMENTS
	• Convey analysis instructions to the laboratory. • On delivery to the laboratory, the receiving person will inspect the cooler boxes, note the presence or otherwise of ice or cooler blocks if specified on the form, measure the temperature of the cooler boxes, and record each value on the relevant form. • Completed form will be returned to Aurora within 24 hours of the delivery of samples to the laboratory for confirmation of instructions.
Laboratory reports	• Issued in accordance with the requirements of NATA endorsement. • Primary sample results. • Laboratory in-house duplicate results. • Laboratory in-house surrogate and matrix spike recovery determinations. • Extraction (where applicable) and analysis dates used to determine compliance with permitted holding times. • Include CoC form.

8.3 QC SAMPLING AND ANALYSIS

QC samples will be collected at the frequencies summarised in Table H, with further detail provided below:

- Field duplicate/split duplicate samples (i.e., pair) will be analysed for all CoPCs scheduled for the corresponding primary sample and measure the precision via intra-laboratory (within the primary laboratory) and inter-laboratory (between laboratories).
- Rinsate blanks will be collected by contacting decontaminated re-usable sampling equipment with laboratory provided deionised water and analysed for all CoPCs.
- Field blanks will be collected by pouring laboratory provided deionised water in a sample container which will be left uncapped/exposed to ambient conditions during sampling activities and analysed for all CoPCs.
- Transport blanks will consist of a clean sample provided by the laboratory and transported back to the laboratory with the primary samples without having been exposed to sampling procedures and analysed for volatile CoPCs (e.g., TRH F1 and BTEX-N).

TABLE H: FIELD QC SAMPLING SUMMARY

QC SAMPLE	COPCS	
	NON-PFAS	PFAS
Duplicate and split	1 pair per 20 samples	1 pair per 10 samples
Rinsate Blank	1 per piece of reusable equipment per day	
Field Blank	1 per day	1 per day
Transport Blank	1 per day, specific to volatile CoPCs (e.g., hydrocarbons)	-

8.4 ANALYTICAL DATA VALIDATION

Individual analytical laboratories conduct assessments of their own laboratory QC program internally however these results will also be independently reviewed and assessed by Aurora to ensure that no non-compliance issues are identified and where a non-compliance are identified, the significance of this with regards to the suitability of the data set. Specific elements that will be checked and assessed include:

- Preservation and storage of samples upon collection and during transport to the laboratory.
- Sample holding times.
- Use of appropriate analytical and field sampling procedures.
- Required LORs (i.e., below adopted assessment criteria referred to in Section 8).
- Frequency of conducting quality control measurements.
- Rinsate, field and transport blank results.
- Laboratory blank results.
- Field duplicate and triplicate results.
- Laboratory duplicate results.
- Matrix spike results.
- Surrogates spike results.

8.5 REPORTING

QA/QC sampling, analysis and reporting will be undertaken to demonstrate that field and laboratory data are reliable and defensible.

Analytical data validation will be undertaken to assess whether data are following method requirements and project specifications. Data validation will involve the checking of analytical procedure compliance and an assessment of the accuracy and precision of data based on a range of quality control measures, generated from both the field sampling and analytical programs.

9 TIER 1 ASSESSMENT CRITERIA

9.1 SOIL

COPCS AND GUIDANCE	HUMAN HEALTH	ECOLOGICAL	MANAGEMENT LIMITS
Hydrocarbons (ASC NEPM and CRC CARE [2011])	• HSL-C and intrusive maintenance workers (sand, direct contact, depth dependent). • HSL-C and intrusive maintenance workers (Sand, vapour intrusion, depth dependent).	ESL - URPOS.	Coarse soils – Residential, parkland and public open space.
Asbestos (DoH, 2021)	• Accessible ground surface (nominally 0.1m depth) free of all visible ACM. • Residential land use: 0.01% weight/ weight (% w/w) bonded ACM. • All site uses: 0.001% w/w asbestos fibres/fibrous asbestos.	-	-
Non-Hydrocarbon/ PFAS CoPCs (e.g., metals) (ASC NEPM)	• HIL-C.	• EIL - URPOS.	-
PFAS CoPCs (PFAS NEMP)	• HIL-C.	• Direct exposure. • Indirect exposure.	-
HIL = Health Investigation Level. HSL = Health Screening Level. C = Recreational land use scenario. URPOS = Urban residential and public open space land use scenario. EIL = Ecological Investigation Level. ESL = Ecological Screening Level.			

9.2 GROUND GAS

Ground gas concentration and flow rate measurements will be used to calculate GSVs for each location and monitoring event consistent with CIRIA (2007) and BS 84585:20145+A1:2019.

Where negative flow rates are recorded, the potential influence of atmospheric conditions will be considered, and a conservative approach will be adopted (including adoption of absolute values). The GSVs will be evaluated to identify a conservatively representative overall GSV (nominally the maximum result) for comparison to the assessment criteria from CIRIA (2007) along with carbon dioxide and methane concentrations to perform the risk assessment.

Where appropriate and the results support it, a GSV will be identified for each source of ground gas being the landfill materials and the SRA.

The GSV(s) will be used to determine the CS using the modified Wilson and Card classification (CIRIA, [2007] and NSW EPA [2020]). A weight of evidence approach will be used for any adjustments based on the additional factors.

Consideration will be given to installing additional ground gas monitoring wells or undertaking further ground gas monitoring, either continuously or as discrete events, based on review of the dataset and the atmospheric conditions. A level of professional judgement will be used to evaluate whether the data gaps identified in Section 5.3 have been adequately addressed, along with the decision rules described in Table D.

9.3 GROUNDWATER AND SURFACE WATER

On-site groundwater and surface water analytical results will be compared to the following assessment criteria defined in Table I below.

TABLE I: GROUNDWATER AND SURFACE WATER TIER 1 ASSESSMENT CRITERIA

COPCS AND GUIDANCE	HUMAN HEALTH	ECOLOGICAL
Non-PFAS (ASC NEPM, DWER [2021] and ANZG [2018])	• NPUG – health and aesthetic.	• Surface Water: Freshwater (99% species protection level) • Groundwater: Marine water (99% species protection level)
PFAS (ASC NEPM and PFAS NEMP)	• Drinking water. • Recreational water.	• Surface Water Freshwater/ interim marine water (99% species protection level). • Groundwater: marine water (99% species protection level).
NPUG = Non-potable Use Guidelines.		

9.4 ACID SULFATE SOILS

9.5 FIELD PH$_F$ AND PH$_{FOX}$ SCREENING CRITERIA.

The following criteria were applied to provide an evaluation for presence/absence of ASS indicators upon all collected soil samples based upon pH$_F$ and pH$_{FOX}$ measurements.

Field based indicator of AASS

- pH$_F$ of ≤4;

Field based indicator of PASS

- pH$_{fox}$ of ≤3;
- ΔpH of ≥3; and
- Moderate to extreme reaction rate.

9.5.1 Laboratory Assessed Action Criteria

The adopted assessment criterion for ASS in WA is a “Texture based ASS Action criteria” and is detailed within the applicable DWER Guidelines (DER, 2015a).

As detailed within the above guidelines, for proposed developments with a soil disturbance volume of greater than 1000 tonnes, the DER has derived an “Action Criterion” of 0.03 %S or 18 moles/tonne Equivalent Acidity.

In consideration of the location and geology at the proposed development Site, the aforementioned “Action Criterion” of 0.01 %S will be used to confirm the presence of ASS and whether an ASSMP is required prior to works commencement.

9.5.2 Groundwater

The groundwater quality at the Site monitoring wells was compared with guidance criteria provided in DER (2015a) to assess whether ASS processes may have taken place at or in the vicinity of the Site. Criteria used for this assessment include the following:

- Alkalinity: Sulfate ratio: <5.
- pH: <5.
- Dissolved Al: >1mg/L.

In addition to these parameters, visually observable indicators are also applied during the investigation of groundwater, these include:

- Waterlogged soils;
- Water pH neutral or acidic; and
- Presence of oily looking iron bacterial surface scum (similar appearances of iron bacterial scum and a hydrocarbon slick differentiable by disturbing surface and noting if material disperses or adheres).

The results are also compared with Table 5 in DWER (2015) to assess the vulnerability of groundwater to acidification (i.e., buffering capacity. These criteria are replicated in Table J below:

TABLE J: GROUNDWATER BUFFERING CAPACITY CRITERIA

CLASS	DESIGNATION	ALKALINITY	pH	DESCRIPTION
1	Very High Alkalinity	>180	>6.5	Adequate to maintain acceptable pH level in the future
2	High Alkalinity	60-80	>6.0	Adequate to maintain acceptable pH level in the future
3	Moderate alkalinity	30-60	5.5-7.5	Inadequate to maintain stable acceptable pH level in areas vulnerable to acidification
4	Low Alkalinity	10-30	5.0-6.0	Inadequate to maintain stable acceptable pH
5	Very low alkalinity	<10	<6.0	Unacceptable pH under all circumstances

9.6 ASS INDICATORS

The DWER (2015a) guidelines provide geomorphic and site criteria that can be used as indicators to determine if ASS is likely to be present at a Site during a Site investigation. The following geomorphic and site criteria should be used to determine if ASS is likely to be present:

- Sediments from recent geological age (Holocene);
- Marine or estuarine sediments and tidal lakes;
- Coastal wetlands or back swamp areas;
- Waterlogged or scalded areas;

- Interdune swales or coastal sand dunes (if deep excavation or drainage proposed);
- Areas where the dominant vegetation is mangroves, reeds, rushes and other vegetation associated with areas of shallow water tables such as flooded gums (Eucalyptus rudis and Eucalyptus robusta), paperbarks (Melaleuca spp.) and Casuarina spp;
- Areas identified in geological descriptions or in maps as bearing sulfide minerals, coal deposits or former marine shales/sediments (geological maps and accompanying descriptions may need to be checked); and
- Deep older estuarine sediments >10 metres below ground surface, Holocene or Pleistocene age (if deep excavation or drainage proposed).

10 COMMUNITY CONSULTATION

Main Roads has identified the potential stakeholders related to the Site to include:

- Main Roads as the responsible agency for the planning and delivery of PESP;
- Burswood Park Board as the manager for large portion of the PESP (Lots 2002, 555, 557, 42);
- Venues West as manager for the Perth Stadium Precinct (Lot 2001);
- Burswood Nominees as the land oner for Crown Towers (Lot 551);
- Town of Victoria Park as Manager for Camfield Drive Extension (Lot 2006) and Victoria Park Drive (Land ID Numbers 3407163; 30098897; 4160076); and
- The Contaminated Sites Auditor.

It is understood that Main Roads will notify the Venues West, Burswood Park Board, Burswood Nominees and the Town of Victoria Park on the proposed timing and scope of the DSI.

This SAQP and the DSI report will be provided to Mr Andrew Lau who is the Contaminated Sites Auditor for review. The DSI report will be prepared in accordance with guideline requirements of the amended NEPM (NEPC, 1999) and the DWER (DWER, 2021).

11 REFERENCES

AECOM (date unknown). Mandatory Auditor's Report (MAR) – Lot 2001, Perth Stadium Precinct. [Not sighted].

AS/NZS 5667.11:1998 (1998) Water quality – Sampling – Guidance on sampling of groundwaters. Sydney/Wellington: Standards Australia/Standards New Zealand, 1998.

ATA Environmental (2002) Environmental Management Plan – Burswood Lakes.

Aurora Environmental (2018) Soil Characterisation Assessment – Extension of Marlee Lawn to Roger McKay Drive, Perth Stadium.

Australian & New Zealand Guidelines (2018) Fresh & Marine Water Quality.

Australian Standard 1726 – 2017 "Geotechnical site investigations".

Australian Standard 5667.1 – 1998 "Water quality – Sampling: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples".

Burswood Park Board (2006) Exploration Drilling Program and Site History.

Burswood Park Board (2011) Site Plan Showing Bores, Pump Stations and Lakes.

Burswood Park Board (Unknown) Plan Showing Extent of Dumped Materials.

Construction Industry Research and Information Association (CIRIA) (2007) C665 - Assessing risks Posed by Hazardous Ground Gases to Buildings.

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) (2011) *Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater*.

Davidson, W.A. (1995) *Hydrogeology and Groundwater Resources of the Perth Region, Western Australia*. Western Australia Geological Survey, Bulletin 142.

Department of Environment and Conservation (DEC) (2010) Water Quality Guidelines.

Department of Health (2021) Guidelines on the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia.

Department of Primary Industries and Regional Development (DPIRD) (2023) *2 Metre Interval Contour Mapping – Western Australia (DPIRD-072)*. Government of Western Australia. Available at: https://catalogue.data.wa.gov.au/dataset/dpird-072.

Department of Water and Environmental Regulation (2024a) Water Information Reporting Register accessed from https://wir.water.wa.gov.au/Pages/Water-Information-Reporting.aspx on 06 June 2025.

Department of Water and Environmental Regulation (2024b) Water Register accessed from https://maps.water.wa.gov.au/#/webmap/register on 06 June 2025.

Department of Water and Environmental Regulation (2024c) Public Drinking Water Map accessed from https://dow.maps.arcgis.com/apps/webappviewer/index.html?id=63ddb4ec2a6e463f84028aa3977bab2b on 06 June 2025.

Department of Water and Environmental Regulation (DWER) (2021) Assessment and management of contaminated sites.

Department of Water and Environmental Regulation (DWER) (2025) *Review of DWER Acid Sulfate Soil (ASS) Risk Mapping, Swan Coastal Plain (DWER-055)*. Government of Western Australia. Available at: https://catalogue.data.wa.gov.au/dataset/dwer-055 (accessed 26 March 2025).

Douglas, G.B., Trefry, M.G., Wylie, J.T., Wilkes, P.G., Puzon, G.J., & Kaksonen, A.H. (2015). Potential biogeochemical impacts of heat rejection in the Mullaloo aquifer, Western Australia. *Geothermics*, 53, 429–445.

EKJV (2014) *Closure Report – Pre-Construction Phase (PCS), Perth Stadium*.

EKJV (2015) *PCS Dewatering Summary Report*.

Emerge Associates (2025) 2024 Groundwater and Surface Water Monitoring Report Burswood Lakes: Ministerial Statement 526. Rev 1. January 2026.

Golder Associates (1987) *Construction of Lakes for Burswood Golf Course*.

Golder Associates (2012a) Desktop Study and Review of Previous Environmental Reports - Proposed Perth Major Stadium.

Golder Associates (2012b) Summary of Geotechnical Information – Proposed Master Plan – Burswood Peninsula. Revision 2. March 2012.

Golder Associates (2013a) Stage 1 Detailed Site Investigation Interpretative Site Contamination Report - Proposed Perth Major Stadium. April 2013.

Golder Associates (2013b) Crown Towers Detailed Site Investigation Rev C Draft.

Golder Associates (2013c) Crown Towers Detailed Site Investigation Addendum Rev 1.

Golder Associates (2014) Contaminated Site Management Plan – Crown Towers.

Gozzard, J.R. (1983) *Perth, Western Australia: 1:50,000 Environmental Geology Series Map and Explanatory Notes*. Geological Survey of Western Australia, Perth.

Heads of the Environment Protection Authority (2020) PFAS National Environmental Management Plan Version 3.0 – January 2020 (PFAS NEMP).

JBS&G (2017) Voluntary Auditor's Report – New Perth Stadium.

JBS&G (2018) Voluntary Auditor's Report – New Perth Stadium. Addendum 1.

JBS&G (2020) Voluntary Auditor's Report – New Perth Stadium Addendum 2.

JBS&G (2023) Voluntary Auditor's Report – New Perth Stadium Addendum 3.

National Environmental Protection Council (1999) National Environment Protection (Assessment of Site Contamination) Measure, 1999 as amended 2013 (ASC NEPM).

National Health and Medical Research Council (2019) Guidance on Per and Polyfluoroalkyl substances (PFAS) in Recreational Water.

National Occupational Health and Safety Commission (NOSHC) (1995) *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment*. [NOHSC:1003(1995)].

National Uniform Drillers Licensing Committee (2020) Minimum Construction Requirements for Water Bores in Australia – Fourth Edition.

New South Wales Environmental Protection Authority (NSW EPA) (2020) Assessment and management of hazardous ground gases. Contaminated Land Guidelines.

Standards Australia (2017) AS1726 Geotechnical Site Investigations.

Tetra Tech Coffey (2024) Subsurface Management Plan – Burswood Park Board. June 2024.

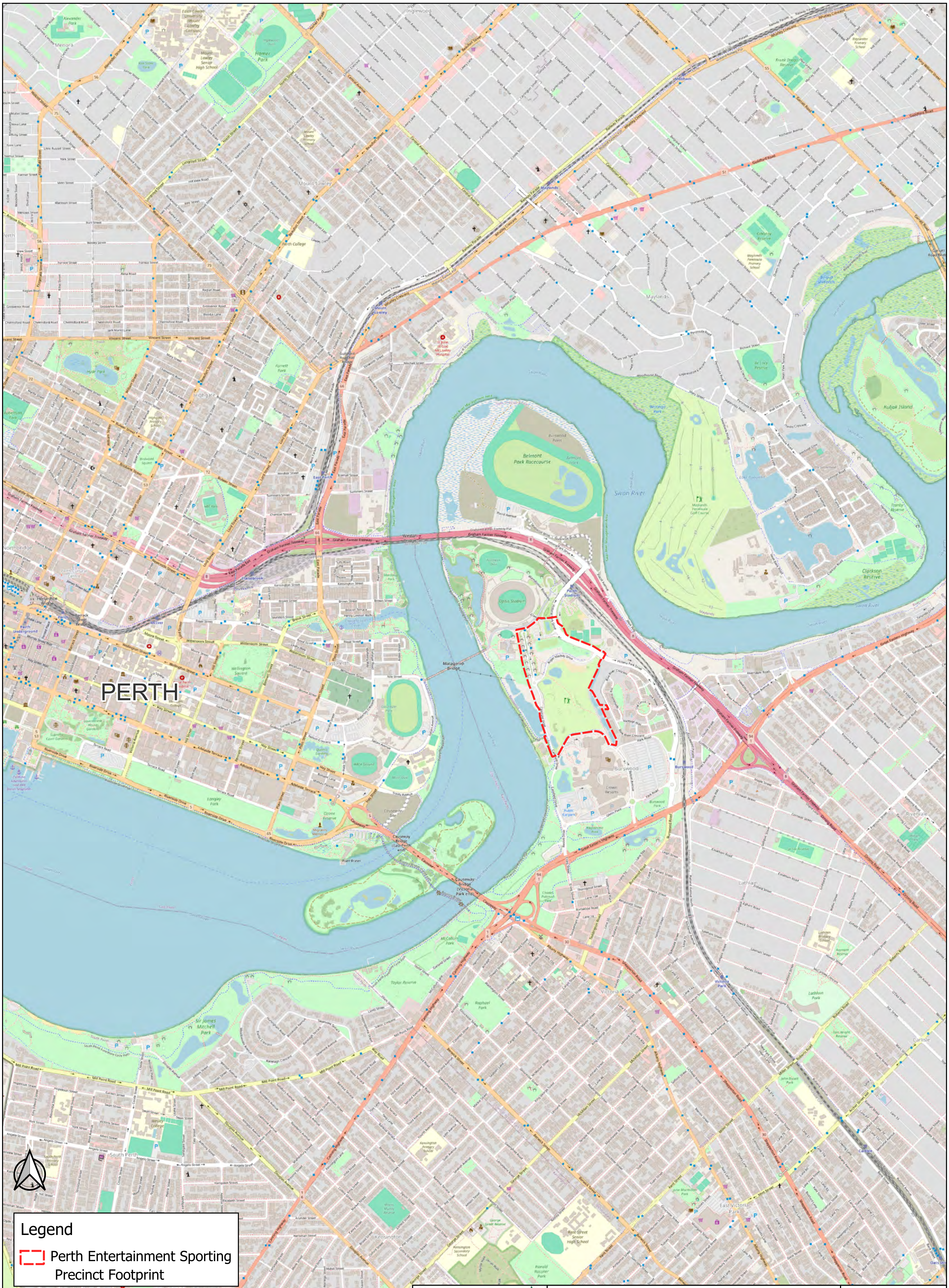
United States Environmental Protection Agency (US EPA) (2005) *California Human Health Screening Levels (CHHSLs) for Soil Gas – Standard Exposure Assumptions and Toxicity Values*.

Water and Rivers Commission (1998). *Plan and Drillers Logs of Exploratory Water Bores*.

Westadium Project Co Pty Ltd (2018) Environmental Compliance Completion Report (ECCR) Perth Stadium. Rev 01. February, 2018.

Westadium Project Co Pty Ltd (2022) Sub-Surface Site Management Plan Perth Stadium Rev 6. September 2022.

FIGURES



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Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula

Figure 1
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Drawn: JWS | Date: 11 June 2025

Site Location

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Sampling and Analysis Quality Plan
Burswood Peninsula

Site Layout

Figure 2
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Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula

Conceptual PESP Layout

Figure 3
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Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula

Figure 4a
Job:MRW-PP03809

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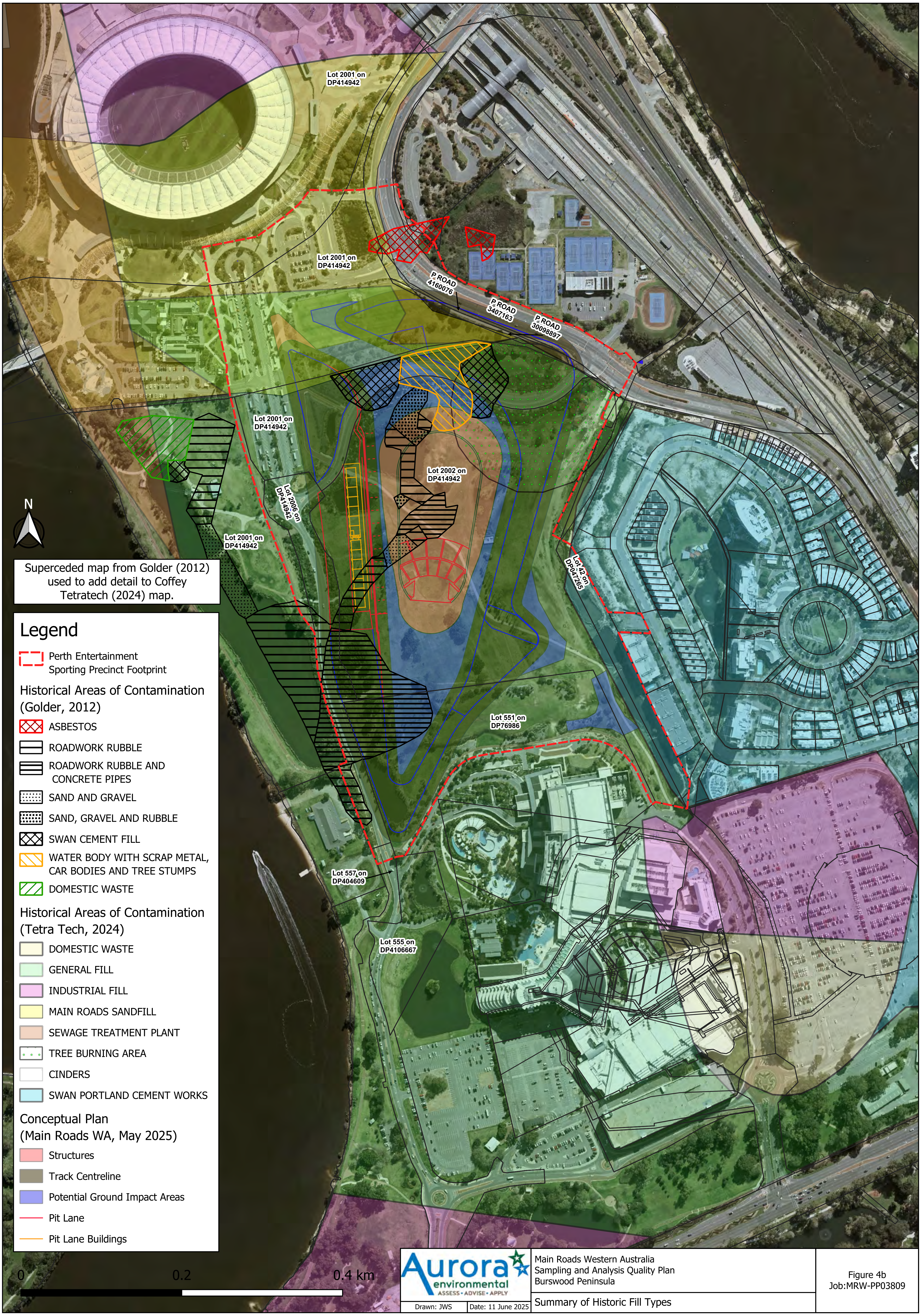
Boundary of Previous Investigations



Lot 2001 on DP414942
Lot 2001 on DP414942
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P ROAD 3407163
P ROAD 30098897
Lot 2001 on DP414942
Lot 2002 on DP414942
Lot 2006 on DP414942
Lot 2001 on DP414942
Lot 42 on DP047265
Lot 551 on DP76986
Lot 557 on DP404609
Lot 555 on DP4106667
N
Superceded map from Golder (2012) used to add detail to Coffey Tetratech (2024) map.
Legend
Perth Entertainment Sporting Precinct Footprint
Historical Areas of Contamination (Golder, 2012)
ASBESTOS
ROADWORK RUBBLE
ROADWORK RUBBLE AND CONCRETE PIPES
SAND AND GRAVEL
SAND, GRAVEL AND RUBBLE
SWAN CEMENT FILL
WATER BODY WITH SCRAP METAL, CAR BODIES AND TREE STUMPS
DOMESTIC WASTE
Historical Areas of Contamination (Tetra Tech, 2024)
DOMESTIC WASTE
GENERAL FILL
INDUSTRIAL FILL
MAIN ROADS SANDFILL
SEWAGE TREATMENT PLANT
TREE BURNING AREA
CINDERS
SWAN PORTLAND CEMENT WORKS
Conceptual Plan (Main Roads WA, May 2025)
Structures
Track Centreline
Potential Ground Impact Areas
Pit Lane
Pit Lane Buildings
0
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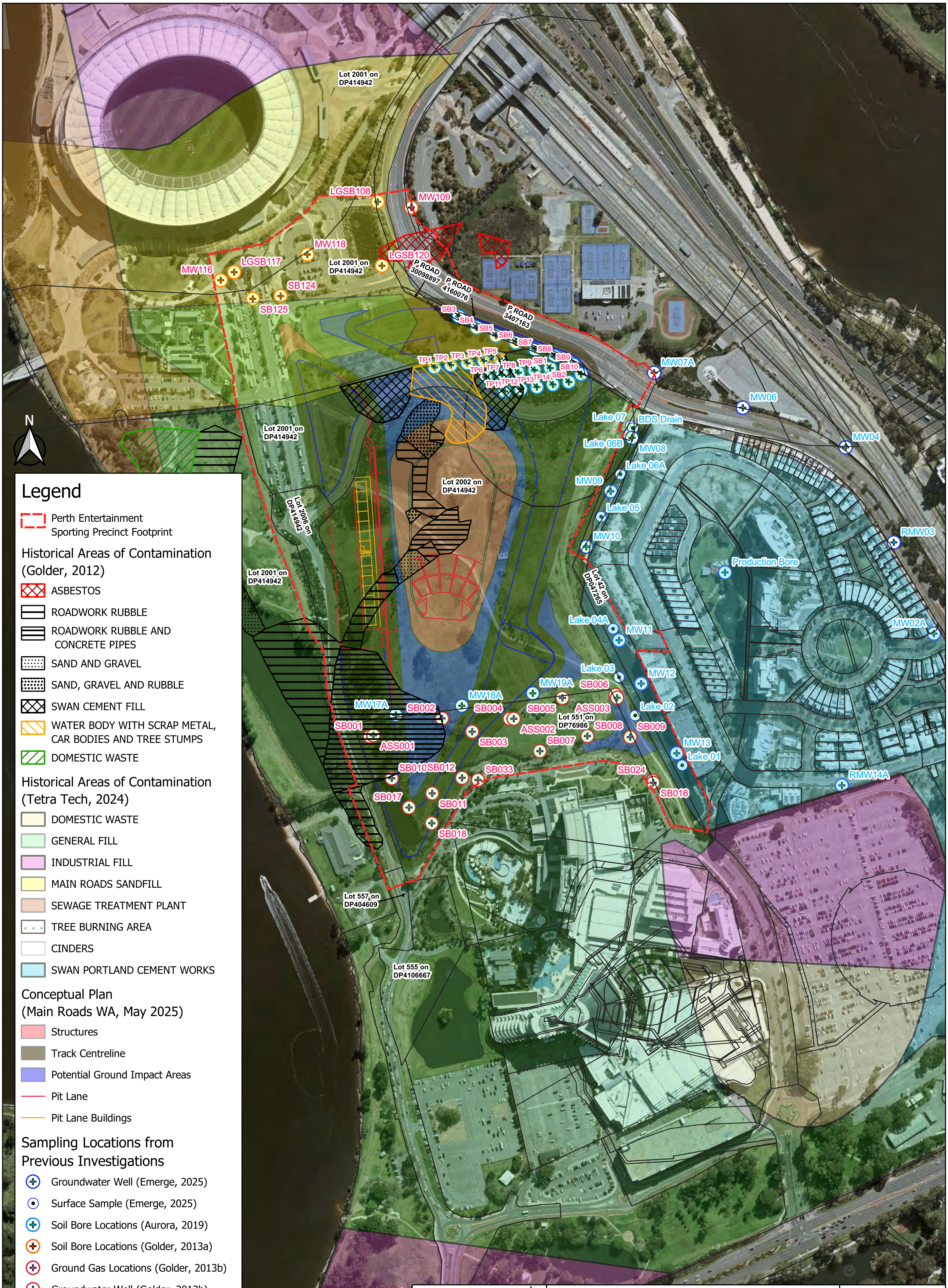
Date: 11 June 2025
Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula
Summary of Historic Fill Types
Figure 4b
Job:MRW-PP03809



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Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula

Summary of Relevant Historic Sampling Locations

Figure 4c
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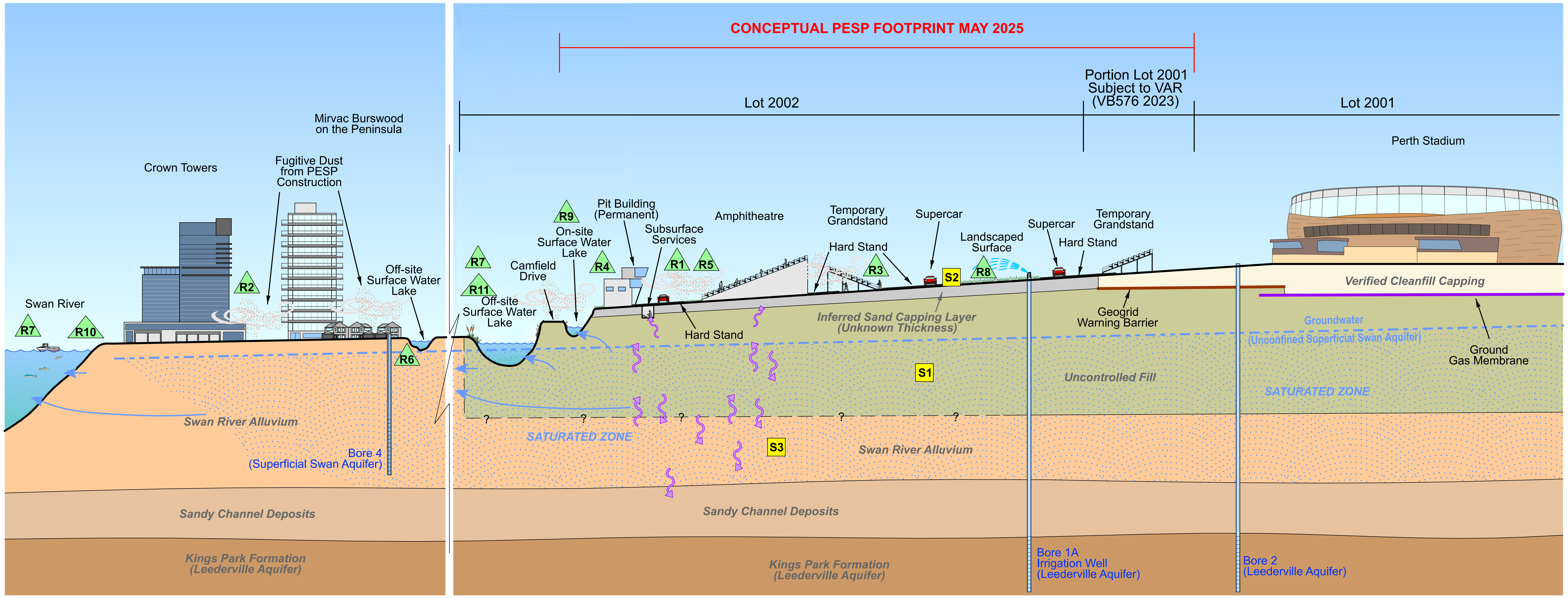
Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula

Beneficial Groundwater Use

Figure 5
Job:MRW-PP03809



Exposure Pathways:

Soils

P1 Direct and indirect contact with contaminated soils may occur through ingestion or direct contact.

P2 Terrestrial flora and fauna may be exposed to contaminants via direct contact with impacted soils (e.g. rooting depth, burrowing) or indirect exposure through uptake of contaminants into plants or bioaccumulation.

Asbestos

P3 On-site inhalation of asbestos fibres during construction.

P4 On-site inhalation of asbestos fibres post construction if capping layer is not adequate.

P5 Off-site inhalation of asbestos fibres nearby residents and open space users if dust is not managed appropriately during PESP construction.

Ground Gas

P6 On-site workers (adults) occupying the onsite permanent buildings post construction.

P7 On-site workers (adults) conducting maintenance works on the built infrastructure, including intrusive sub-surface works.

P8 On-site general public open space users (adults and children) of the constructed buildings, hardstands and public open space.

Exposure Pathways:

Groundwater

P9 On-site abstraction of groundwater during PESP construction works (dewatering or excavations into the saturated zone).

P10 Off-site abstraction of groundwater from the superficial aquifer at Lot 551 (Crown Towers).

P11 On-site ecological uptake and bioaccumulation of over time of impacted surface or groundwater.

P12 Off-site marine and estuarine ecology of the Swan River as the receiving environment for impacted groundwater.

Surface Water

P13 Future site users (adults and children) maintenance workers (adults), may be directly exposed to surface water via skin contact or incidental ingestion, particularly during periods of ponding or flooding.

P14 Off-site users if sediment/surface water is not appropriately controlled during PESP development.

P15 Aquatic and semi-aquatic freshwater biota may be exposed to contaminants in surface water via direct uptake, bioaccumulation, or contact with contaminated sediments, potentially affecting ecological health.

P16 If surface water is reused for irrigation, contaminants may be transferred to vegetation.

Potential Sources:

S1 Uncontrolled landfill materials - Potential contamination source soil, groundwater surface water and ground gas.

S2 Capping Layer (Fill of unknown quality) - Potential contamination source soil, groundwater surface water.

S3 Swan River Alluvium (SRA) - Potential source of ASS and ground gas.

Potential Receptors (Human):

R1 Construction workers/contractors (adults) during PESP development activities.

R2 Nearby off-site residents/hotel occupants (adults and children) during PESP development activities.

R3 Future temporary visitors and open space users (children and adults).

R4 Future workers/occupants (adults) in permanent buildings.

R5 Future workers (adults) conducting maintenance works on the built infrastructure, including intrusive sub-surface works.

R6 Off-site users of licensed superficial groundwater abstraction for irrigation use at Crown Towers (Lot 551) and Mirvac Burswood On Swan.

R7 Off-site users of surface water lakes within the Peninsula and the Swan River Estuary.

Potential Receptors (Ecological):

R8 On-site terrestrial fauna and flora.

R9 On-site freshwater environment (i.e. flora and fauna within constructed surface water lakes).

R10 Off-site environment (i.e. discharge point of groundwater): terrestrial and marine/estuarine aquatic ecology of the Swan River (a CCW).

R11 Off-site freshwater environment (i.e. flora and fauna within constructed surface water lakes).

NOTES:
- Not to scale.
- This is one interpretation only, other interpretations are possible
- All extents are approximate, inferred and/or schematic

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Main Roads Western Australia
SAMPLING ANALYSIS QUALITY PLAN
LOTS 2001 AND 2002 BURSWOOD PARK

PRELIMINARY CONCEPTUAL SITE MODEL

Figure 6

Drawn: S. Patmore | Date: 13 Jun 2025 | Job: MRW-PP03809

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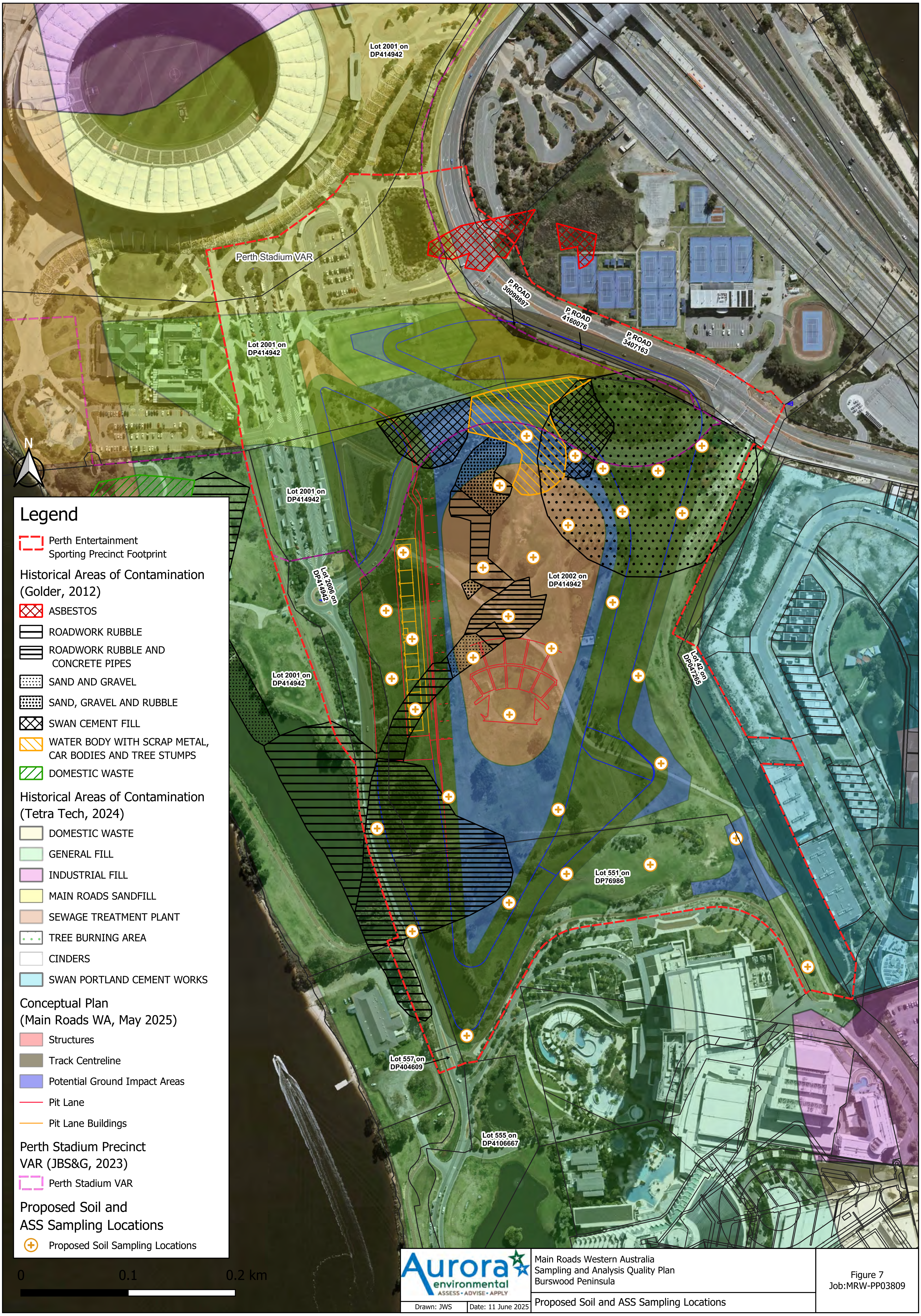

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Perth Stadium VAR
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P ROAD 4160076
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Lot 2006 on DP414942
Lot 2002 on DP414942
Lot 42 on DP47265
Lot 2001 on DP414942
Lot 551 on DP76986
Lot 557 on DP404609
Lot 555 on DP4106667
N
Legend
Perth Entertainment Sporting Precinct Footprint
Historical Areas of Contamination (Golder, 2012)
ASBESTOS
ROADWORK RUBBLE
ROADWORK RUBBLE AND CONCRETE PIPES
SAND AND GRAVEL
SAND, GRAVEL AND RUBBLE
SWAN CEMENT FILL
WATER BODY WITH SCRAP METAL, CAR BODIES AND TREE STUMPS
DOMESTIC WASTE
Historical Areas of Contamination (Tetra Tech, 2024)
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Potential Ground Impact Areas
Pit Lane
Pit Lane Buildings
Perth Stadium Precinct VAR (JBS&G, 2023)
Perth Stadium VAR
Proposed Soil and ASS Sampling Locations
Proposed Soil Sampling Locations
0
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Aurora environmental
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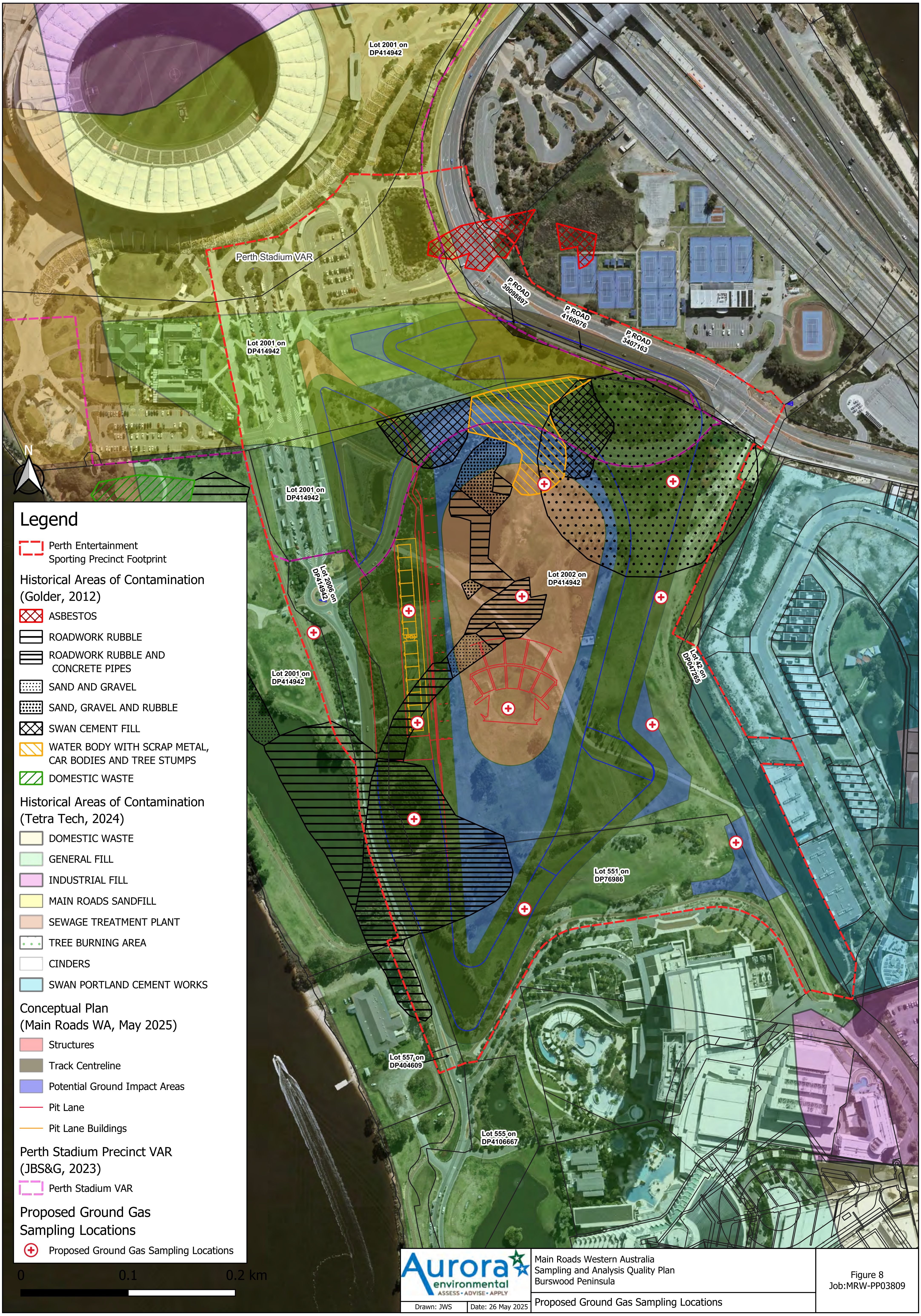
Drawn: JWS
Date: 11 June 2025
Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula
Proposed Soil and ASS Sampling Locations
Figure 7
Job:MRW-PP03809


Lot 2001 on DP414942
Perth Stadium VAR
P ROAD 3009897
P ROAD 4160076
P ROAD 3407163
Lot 2001 on DP414942
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Lot 2006 on DP414942
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Lot 557 on DP404609
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Perth Entertainment Sporting Precinct Footprint
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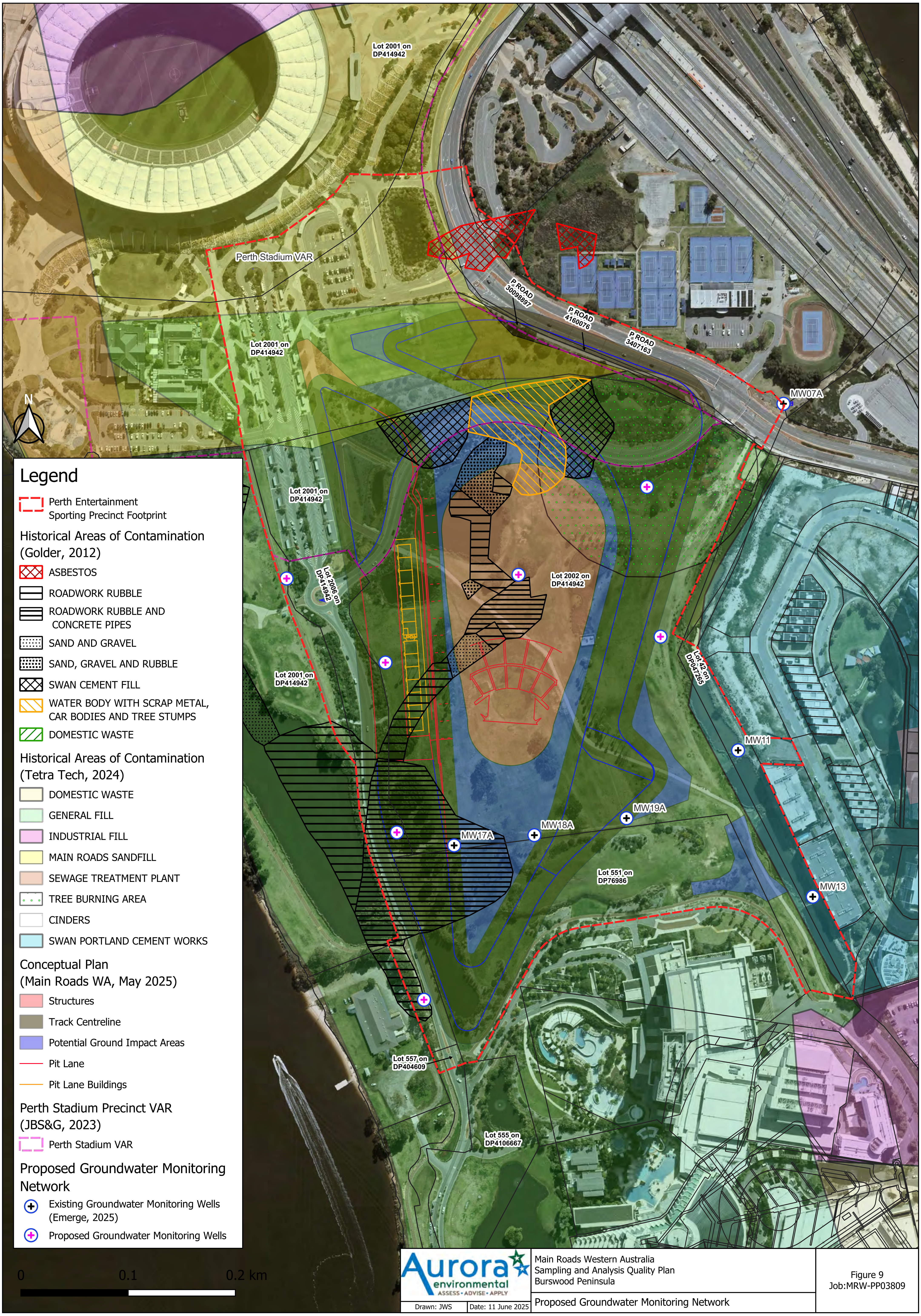
ROADWORK RUBBLE AND CONCRETE PIPES
SAND AND GRAVEL
SAND, GRAVEL AND RUBBLE
SWAN CEMENT FILL
WATER BODY WITH SCRAP METAL, CAR BODIES AND TREE STUMPS
DOMESTIC WASTE
Historical Areas of Contamination (Tetra Tech, 2024)
DOMESTIC WASTE
GENERAL FILL
INDUSTRIAL FILL
MAIN ROADS SANDFILL
SEWAGE TREATMENT PLANT
TREE BURNING AREA
CINDERS
SWAN PORTLAND CEMENT WORKS
Conceptual Plan (Main Roads WA, May 2025)
Structures
Track Centreline
Potential Ground Impact Areas
Pit Lane
Pit Lane Buildings
Perth Stadium Precinct VAR (JBS&G, 2023)
Perth Stadium VAR
Proposed Ground Gas Sampling Locations
Proposed Ground Gas Sampling Locations
0
0.1
0.2 km
Aurora environmental
ASSESS • ADVISE • APPLY
Drawn: JWS
Date: 26 May 2025
Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula
Proposed Ground Gas Sampling Locations
Figure 8
Job:MRW-PP03809



Aurora environmental — ASSESS • ADVISE • APPLY

Drawn: JWS | Date: 11 June 2025

Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula

Proposed Groundwater Monitoring Network

Figure 9
Job:MRW-PP03809

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Drawn: JWS | Date: 11 June 2025

Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula

Proposed Surface Water Monitoring Network

Figure 10
Job:MRW-PP03809

TABLES

Table 1. Summary of Relevant Analytical Data Exceedences – Perth Stadium Precinct DSI (Lot 2001) (Golder 2013a)

Analyte			Metals			
			Arsenic	Cadmium	Manganese	Nickel
Units			mg/kg			
Assessment Criteria[1]		HIL F*	500	100	6000	2400
		Historical EIL*	20	3	500	60
		URPOS EIL	100	NE	NE	30
		HIL C	300	90	19000	1200
		HIL D	3000	800	60000	6000
Sample ID	Source	Lithology				
LGSB120 (5.5-5.8m BGL)	Stadium DSI	SAND	230	5.6	940	94

Table 2. Summary of Relevant Data – Chracterisation of Capping Material Marlee Lawn Extension Perth Stadium Precinct (Lot 2001) (Aurora, 2018)

Sediments - Total Concentrations	**Analyte**	**Arsenic**	**Barium**	**Beryllium**	**Boron**	**Cadmium**	**Chromium (VI)**	**Copper**	**Lead**	**Mercury**	**Molybdenum**	**Nickel**	**Selenium**	**Zinc**
	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Limit of Reporting	5	1	0.1	5	0.1	1	1	1	0.02	2	1	2	1
ASSESSMENT CRITERIA[1]	**EIL - URPOS[2]**	**100**	NE	NE	NE	NE	**190**	**60**	**1,100**	NE	NE	**30**	NE	**70**
	HIL-C[3]	**300**	NE	**90**	**20,000**	**90**	**300**	**17,000**	**600**	**80**	NE	**1,200**	**700**	**30,000**
Sample ID	**Sample Date**													
Pond 1 - Clay + Seds	20-Oct-17	<5	**9**	<0.1	<5	**0.2**	<1	**6**	**12**	**0.05**	<2	**1**	<2	**27**
Pond 2 - Liner	20-Oct-17	<5	**7**	<0.1	<5	**0.5**	<1	**4**	**8**	**0.18**	<2	<1	<2	<1
Pond 2 - Sediment	20-Oct-17	**6**	**16**	<0.1	<5	**0.6**	<1	**9**	**20**	**0.07**	<2	**2**	<2	**24**
Pond 3 - Sediment 1	20-Oct-17	<5	**3**	<0.1	<5	<0.1	<1	**1**	**14**	<0.02	<2	<1	<2	**5**
Pond 3 - Sediment 2	20-Oct-17	<5	**6**	<0.1	<5	<0.1	<1	**1**	**2**	<0.02	<2	<1	<2	**5**
Pond 3 - Sediment 3	20-Oct-17	<5	**5**	<0.1	<5	**0.1**	<1	**4**	**2**	<0.02	<2	<1	<2	**3**
Pond 3 - Sediment 4	20-Oct-17	<5	**3**	<0.1	<5	<0.1	<1	**1**	**5**	**0.02**	<2	<1	<2	**7**

Abbreviations, References and Notes

mg/kg - milligrams per kilogram
EIL - Ecological Investigation Level
HIL - Health Investigation Level
URPOS - Urban Residential Public Open Space
NE - Not Established

1. NEPM Schedule B2 'Guideline on Investigation Levels for Soil and Groundwater' (NEPC, 1999 as amended 2013).
2. Most conservative (lowest) value adopted in each instance in the absence of Site specific pH and cation exchange capacity (CEC) data
3. HIL C - Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. This does not include undeveloped public open space where the potential for exposure is lower and where a site-specific assessment may be more appropriate.

Sediments - Leachate Data	**Analyte**	**Arsenic**	**Cadmium**	**Chromium**	**Nickel**	**Lead**	**Selenium**
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Limit of Reporting	5	0.1	1	1	1	
Concentration Limit Assessment Criteria	**Upper Limit of CL 1/2**	**0.5**	**0**	**1**	**0.2**	**0.1**	**0.5**
	Upper Limit of CL 3	**5**	**1**	**5**	**2**	**1**	**5**
	Upper Limit of CL 4	**50**	**10**	**50**	**20**	**10**	**50**
Sample ID	**Sample Date**						
Pond 1 - Clay + Seds	20-Oct-17	**0.001**	<0.002	<0.01	<0.01	<0.01	<0.001
Pond 2 - Liner	20-Oct-17	**0.001**	<0.002	<0.01	<0.01	<0.01	<0.001
Pond 2 - Sediment	20-Oct-17	**0.002**	<0.002	<0.01	<0.01	<0.01	<0.001
Pond 3 - Sediment 1	20-Oct-17	**0.006**	<0.002	<0.01	<0.01	<0.01	<0.001
Pond 3 - Sediment 2	20-Oct-17	**0.001**	<0.002	<0.01	<0.01	<0.01	<0.001
Pond 3 - Sediment 3	20-Oct-17	**0.002**	<0.002	<0.01	<0.01	<0.01	<0.001
Pond 3 - Sediment 4	20-Oct-17	**0.002**	<0.002	<0.01	<0.01	<0.01	<0.001

Abbreviations, References and Notes

mg/L - milligrams per litre
ASLP - Australian Standard Leaching Procedure
*Concentration thresholds based on hexavalent chromium

x	Cells shaded green exceed the Upper Limit of the ASLP 1/2 value for Class I/II in accordance with DEC (2009)
xx	Cells shaded yellow exceed the Upper Limit of the ASLP 3 value for Class III in accordance with DEC (2009)
xxx	Cells shaded orange exceed the Upper Limit of the ASLP 4 value for Class IV in accordance with DEC (2009)

DEC (2009) Landfill Waste Classification and Waste Definitions 1996, As amended December 2009

Soil - Metals Data	**Analyte**	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
	LOR (mg/kg)	5	0.1	1	1	0.02	1	1	1
Units	**Sample Date**	mg/kg							
TP01 (0-0.3m)	12/02/2018	<5	<0.1	6	3	<0.02	<1	8	10

Soil - Asbestos in Soil Data	**Sample Date**	**Sample Type**	**Sample Weight (Approx. g)**	**Asbestos in Soil Sample**
TP1 (0.0–0.3)	12/02/2018	Soil	1300	No Asbestos Detected
TP1 (0.3–0.5)	12/02/2018	Soil	1300	No Asbestos Detected
TP2 (0.0–0.1)	12/02/2018	Soil	1400	No Asbestos Detected
TP2 (0.1–0.5)	12/02/2018	Soil	1400	No Asbestos Detected

Soil - 10L Seives	**Sample Date**	**Result**
TP1	12/02/2018	ND
TP2	12/02/2018	ND
TP3	12/02/2018	ND
TP4	12/02/2018	ND
TP5	12/02/2018	ND
TP6	12/02/2018	ND
TP7	12/02/2018	ND
TP8	12/02/2018	ND
TP9	12/02/2018	ND
TP11	12/02/2018	ND
TP12	12/02/2018	ND
TP13	12/02/2018	ND
TP14	12/02/2018	ND
SB1	12/02/2018	ND
SB2	12/02/2018	ND
SB3	12/02/2018	ND
SB4	12/02/2018	ND
SB5	12/02/2018	ND
SB6	12/02/2018	ND
SB7	12/02/2018	ND
SB8	12/02/2018	ND
SB9	12/02/2018	ND
SB10	12/02/2018	ND

ND = No ACM Detected

Table 3. Summary of Relevant Analytical Data Exceedences
Crown Towers DSI (Lot 551) (Golder, 2013b)

Sample ID/ Assessment Level	Depth (m bgl)	Lithology	As (mg/L)	Ba (mg/L)	Pb (mg/L)	Mo (mg/L)
Class I/II[1]	N/A	N/A	0.5	NA	0.5	0.5
Class III[1]			0.7	NA	1	5
Long-term Irrigation Water[2]			0.1	NA	2	0.01
Freshwater[3]			NA	NA	0.0034	NA
Domestic non-potable groundwater use[4]			0.07	7	0.1	0.5
SB012	3 to 4.5	FILL (Waste): SAND	0.01	0.4	0.58	0.02

			Metals						Sulfur	PCBs	OCPs		PAHs		
Analyte			Arsenic	Cadmium	Copper	Lead	Tin	Zinc	Sulfur (as S)	PCB	DDT+DDE+DDD	Dieldrin	Benzo(a)pyrene	Fluoranthene	Pyrene
Units			mg/kg						mg/kg	mg/kg	mg/kg		mg/kg		
Assessment Criteria[1]		**HIL F***	**500**	**100**	**5000**	**1500**	**610000**	**35000**	**NE**	**50**	**1000**	**NE**	**5**	**22000**	**17000**
		Historical EIL*	**20**	**3**	**100**	**600**	**50**	**200**	**600**	**1**	**1**	**0.2**	**1**	**10**	**10**
		URPOS EIL	**100**	NE	**60***	**1100**	NE	**70***	NE	NE	**180**	NE	**0.7**	NE	NE
		HIL C	**300**	**90**	**20000**	**600**	**NE**	**30000**	**NE**	**2**	**400**	**9**	**4**	**400**	**400**
		HIL D	**3000**	**800**	**250000**	**1500**	**NE**	**400000**	**NE**	**8**	**4000**	**50**	**40**	**4000**	**4000**
Sample ID	**Source**	**Lithology**													
SB002(1.8-2.2)	**Crown DSI**	**FILL (Waste): Clayey Silty SAND**											**2**		
SB002(4-4.5)	**Crown DSI**	**FILL (Waste): SAND**					**74**								
SB003(2.5-3)	**Crown DSI**	**FILL (Waste): Gravelly SAND**			**101**			**307**	**2400**	**3.34**					
SB004(2.6-3)	**Crown DSI**	**FILL (Waste): SAND**					**52**	**241**							
SB005(5.8-6)	**Crown DSI**	**Silty CLAY**				**1080**		**502**		**1.44**					
SB006(2.2-2.6)	**Crown DSI**	**FILL (Waste): Clayey SAND**	**61**				**122**		**1000**						
SB007(3-4.5)	**Crown DSI**	**FILL: SAND (3 to 3.2) FILL (Waste): SAND (3.2 to 4.5)**					**53**	**607**	**1000**	**1.16**					
SB007(5-5.5)	**Crown DSI**	**CLAY**						**502**							
SB008(1.5-3)	**Crown DSI**	**FILL: SAND**							**800**						
SB008(3-4.5)	**Crown DSI**	**FILL: SAND**							**900**						
SB009(3.5-4.5)	**Crown DSI**	**FILL (Waste): Gravelly SAND**						**708**					**4**	**12.1**	**11.3**
SB009(5.8-6)	**Crown DSI**	**SAND**						**245**	**21300**						
SB011(3-3.5)	**Crown DSI**	**FILL (Waste): SAND**							**700**						
SB011(3.5-4)	**Crown DSI**	**FILL (Waste): SAND**						**985**					**5.3**	**13.2**	**15.8**
SB012(2.5-3)	**Crown DSI**	**FILL: SAND (2.5 to 2.7) FILL (Waste): SAND (2.7 to 3)**							**600**			**0.61**			
SB012(3-4.5)	**Crown DSI**	**FILL (Waste): SAND**				**46300**									
SB012(4.6-5)	**Crown DSI**	**CLAY**						**222**							
SB012(5.6-5.9)	**Crown DSI**	**CLAY**						**254**							
SB017(2.5-3)	**Crown DSI**	**FILL (Waste): Silty SAND**	**34**												
SB017(3.2-4)	**Crown DSI**	**FILL (Waste): Gravelly SAND**							**2400**		**1.74**				
SB018(1.6-2)	**Crown DSI**	**FILL (Waste): SAND**							**700**						
SB018(5-5.5)	**Crown DSI**	**Silty CLAY**						**358**							
SB024(4.5-6)	**Crown DSI**	**FILL (Waste): SAND**						**571**							
SB033(3-3.2)	**Crown DSI**	**FILL (Waste): SAND**		**11**			**54**	**633**	**700**						
SB033(4.6-4.9)	**Crown DSI**	**CLAY**						**240**	**32100**						

***HIL F now superscded by HIL C.**

APPENDIX 1

List of Documents Provided by Main Roads

Package A - Historical Reports listing

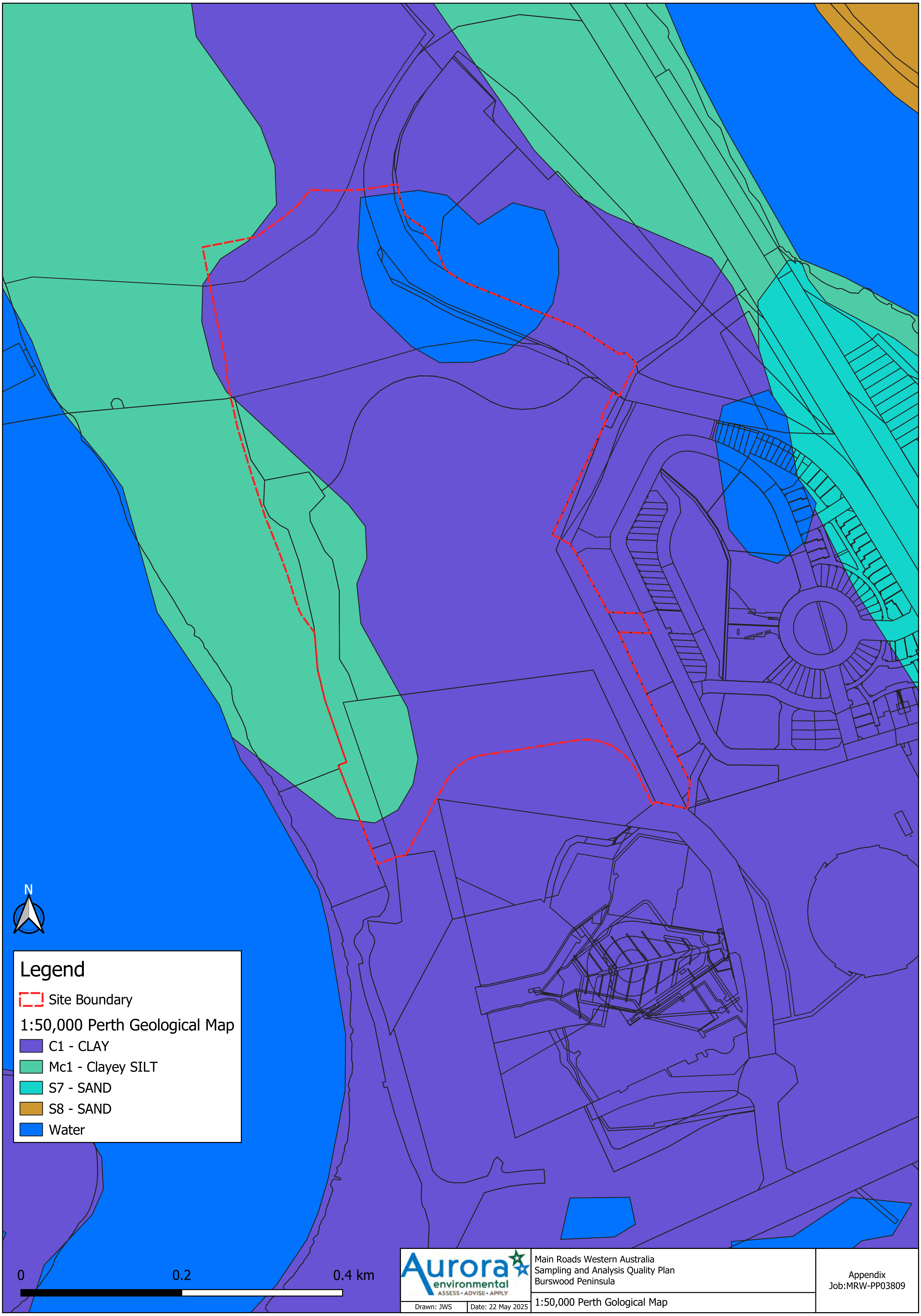
Document Number	Title	Author	Publication Date
H01	Report On A Desk-Top Aboriginal Heritage Assessment Of Goongoongup Bridge Works Areas	R. & E. O'Connor Pty Ltd	2010
H02	Report Of A Survey For Aboriginal Sites Proposed Alignment Of The Burswood Road and Bridge Great Eastern Highway To Charles Street	McDonald, Hales & Associates	1992
H03	Gallop Historical paper on Burswood Peninsula	Dr Geoff Gallop	1991
H04	Safe Disposal Of Asbestos Waste On Burswood Peninsula	Main Roads WA	1984
H05	(1944 to 1970) Swan River Bed Soundings	P.W.D.	Unknown
H06	The Swan River Estuary Development, Management and Preservation	Swan River Conservation Board	1905
H07	Sustainability and History: Building a Sense of Place	Dr Sue Graham-Taylor	2003
H08	Review Of Epra's Proposal Claisebrook Inlet Construction And Dewatering	Golder Associates	1993
H09	Detailed Numerical Modelling East Perth Gasworks	Mackie Martin - PPK	1994
H10	Claisebrook Inlet Feasibility Study- Ground water Investigation and Numerical Modelling	Mackie Martin - PPK	1905
H11	Report For Phase 1 Site Assessment Arden Street, East Perth	Egis Consulting	2001
H12	Analysis Of Stability Of Embankment	Main Roads WA	1974
H13	Burswood Project Vertical Drainage/Surcharge Optimization	Main Roads WA	1984
H14	Desktop Review of Geotechnical Conditions on the Burswood Peninsula	Coffey Partners International Pty Ltd	2006
H15	Report Geotechnical Investigations City Northern Bypass Hamilton Interchange To Swan River	Dames & Moore	1985
H16	Burswood Project Pavement Design Cha 13000 - Cha 13160 (Cement Sludge Section)	Main Roads WA	1985
H17	Geotechnical Investigation Burswood Link Road	Golder Associates	1999
H18	Geotechnical Investigation St - Ep 81 Poles 89 - 94 & 958 Goodwood Parade, Burswood	Golder Associates	2004
H19	Goongoongup Railway Bridge Geotechnical FE Analysis of GRB	WorleyParsons Services Pty Ltd	2005
H20	Burswood Project An Estimate Of Seepage Into Sub-Soil Drainage Cha 13050 - Cha 13250	Main Roads WA	1985
H21	Geogrid Reinforcement For Embankments On Soft Soils: A Case Study For Burswood Bridge Approaches	Main Roads WA	1984
H22	G14 - 1986-3M Burswood Project - Pavement Design, Foundation	Main Roads WA	1905
H23	G15 - 1989-9M City Northern Bypass Burswood Peninsula Section	Main Roads WA	1905
H24	Geotechnical Investigation Bunbury Rail Bridge Eastern (Burswood) Embankment	Golder Associates	1993
H25	Geotechnical Investigation Bunbury Rail Bridge Eastern (Burswood) Abutment	Golder Associates	1993
H26	Burswood Project Geotechnical Studies Factual Data (Volume 1)	Coffey Partners International Pty Ltd	1995
H27	Burswood Project Geotechnical Studies Factual Data (Volume 2)	Coffey Partners International Pty Ltd	1995
H28	Burswood Bridge Western Approaches Preliminary Soil Survey	Main Roads WA	1975
H29	Burswood Project Geotechnical Studies Interpretive Report	Coffey Partners International Pty Ltd	1995
H30	Geotechnical Investigation Burswood Bridge And Road Project (Swan River Section)	Golder Associates	1995
H31	Geotechnical Investigation Burswood Bridge And Road Project (Rivervale Section)	Golder Associates	1995
H32	Design Of First Stage Of Surcharge Embankment Eastern Approach To Burswood Bridge City Northern Bypass (Swan River Section)	Main Roads WA	1996
H33	Geotechnical Engineering Evaluation Bunbury Rail Bridge Distribution: Swan River, East Perth	Golder Associates	1993
H34	Geotechnical Investigation Bunbury Rail Bridge Eastern (Burswood) Embankment	Golder Associates	1993
H35	Geotechnical Investigation Bunbury Rail Bridge Western Embankment And Swan River Crossing	Golder Associates	1993
H36	Burswood Park Board - site plan showing bores, pump stations and lakes	Burswood Park Board	2011
H37	Burswood Park Board Exploration Drilling Program and site history	Burswood Park Board	2006
H38	Bunbury Bridge - East Perth, Proposed Rail And Road Bridges Bore Hole Plan & Information	Bruechle Gilchrist and Evans Pty Ltd	1992
H39	The Development Of Methods Of Predicting The Behaviour Of Embankments On Highly Compressible Soils & Waste Materials	Main Roads WA	1975
H40	Burswood Park Board- Plan and drillers logs of Exploratory water bores 2000	Water and Rivers Commission	1998
H41	City Northern By-Pass Burswood Bridge Eastern Approach Embankment Stage 1 Preload Design Factual Geotechnical Data Report	Main Roads WA	1996
H42	Burswood Park Board - Plan showing extent of dumped materials	Burswood Park Board	Unknown
H43	Burswood Park Board - Photos showing slumped ground around bores 1 & 2	Burswood Park Board	Unknown
H44	Seismic Hazard Assessment: The Goongoongup and Windan Bridges	Guria Consulting	2004
H45	Shear Strength of Estuarine Muds of the Swan River	Main Roads WA	1984
H46	Tennis West Proposed State Tennis Centre Burswood Island Geotechnical Investigation Final Report	Gutteridge Haskins & Davey Pty Ltd	1993
H47	Geotechnical investigation Stage 1, Bunbury rail bridge, Eastern (Burswood) abutment	Golder Associates	1992
H48	Bunbury Rail Bridge East Abutment Removal Of Ash Deposits	Golder Associates	1992
H49	Geotechnical Studies, Burswood Bridge and Road Project, Swan River Section	Golder Associates	1995
H50	Burswood Trial Embankment: Determination Of Consolidation Coefficient From Piezometers Installed In 1980	Main Roads WA	1983
H51	Geotechnical Investigation City Northern Bypass Stage 2 Carriageway, Rail Realignment And Ancillary Works	Golder Associates	1997
H52	Geotechnical Investigation Swan River Crossing City Northern Bypass Stage 2	Golder Associates	1997
H53	A Study Of Measuring In Situ The Coefficient Of Consolidation Of Soft Clay Using Cavity Expansion Methods	Allan Woon Hong Lee Goh, UWA	1994
H54	City Northern Bypass New Alignment Electric Friction Cone Probing	Main Roads WA	1988
H55	Burswood Bridge and Road Project Further Classification of Previously Tabulated Information	Main Roads WA	1994
H56	Factual geotechnical report, Stage 1 preload embankment, Eastern approach, Burswood Bridge	Main Roads WA	1996
H57	Nilcon Shear Vane Test Profiles adjacent Bunbury Rail Bridge	Main Roads WA	1996
H58	Characterization Of Soft Soils For Deep Water Developments Report On Field Tests At Burswood Site	S. F. Chung & M. F. Randolph, UWA	2002
H59	Penetration resistance in soft clay for different shaped penetrometers	S. F. Chung & M. F. Randolph, UWA	2004
H60	Claisebrook - Bunbury Bridge over Swan River Geological Details	Western Australian Government Railways	1977
H61	Burswood Trial Embankment: Determination Of Cα From 1972-74 Site Investigation Results	Main Roads WA	1983
H62	Site investigation, old Bunbury Bridge site	Wimpey and Co	1905
H63	Construction of Lakes for Burswood Golf Course	Golder Associates	1987
H64	Geotechnical Investigation - Burswood Golf Course Club House	Golder Associates	1994
H65	Burswood Project 1972 - 1974 - A Review	Main Roads WA	1983
H66	Goongoongup Railway Bridge Engineering Geological Model	Worley Pty Ltd	2004
H67	Goongoongup Railway Bridge Geotechnical Interpretative Report	WorleyParsons Services Pty Ltd	2005
H68	Burswood Trial Embankment: Analysis Of Shear Strength	Main Roads WA	1983
H69	Gloucester Park Development Geotechnical Report	WorleyParsons Services Pty Ltd	2008
H70	Goongoongup Railway Bridge Inclinometer Borehole Factual Information	WorleyParsons Services Pty Ltd	2004
H71	G72 - WorleyParsons(2005) Goongoongup Rail Bridge, Continuous	WorleyParsons Services Pty Ltd	1905
H72	Goongoongup Railway Bridge CPTU Investigation 2004	WorleyParsons Services Pty Ltd	2004
H73	Goongoongup Railway Bridge Land Use/Loading History	WorleyParsons Services Pty Ltd	2006
H74	Claisebrook Valley Field And Laboratory Test Results	Coffey Partners International Pty Ltd	1992
H75	Claisebrook Valley Geotechnical Studies Interpretive Report	Coffey Partners International Pty Ltd	1992
H76	Claisebrook Inlet Geotechnical Stijdies For Inlet And Plain Street Bridge (Supplementary Interpretive Report)	Coffey Partners International Pty Ltd	1992
H77	East Perth Redevelopment Authority Claisebrook Valley Extent Of Organic Clay	Coffey Partners International Pty Ltd	1993
H78	Burswood Project: Surcharge Analysis Based On 1982/83 Site Investigation	Main Roads WA	1983
H79	East Perth Project Constitution A Venue Precinct Geotechnical Studies (Factual Data)	Coffey Partners International Pty Ltd	1993
H80	G80 - Coffey (1993) East Perth Project- Constitution Avenue	Coffey Partners International Pty Ltd	1993

Package A - Historical Reports listing

Document Number	Title	Author	Publication Date
H81	Claisebrook Inlet- Engineering Logs of Sediment Cores recovered from Swan River	Coffey Partners International Pty Ltd	1993
H82	Constitution Hill (Part Sector 6) Geotechnical Investigation First Report	Coffey Partners International Pty Ltd	1995
H83	Constitution Hill (Part Sector 6) Geotechnical Investigation	Coffey Partners International Pty Ltd	1995
H84	Constitution Hill- Sector 6 - Stage 2 East Perth Geotechnical Investigation	Coffey Partners International Pty Ltd	1995
H85	Sector 6 Quadrant Site Report On Geotechnical Studies	Coffey Partners International Pty Ltd	1996
H86	Gloucester Park Redevelopment Geotechnical Issues	Coffey Partners International Pty Ltd	1998
H87	Lots 42 To 54 And Part Lot 9 Arden Street East Perth Preliminary Geotechnical Report	Coffey Partners International Pty Ltd	1999
H88	East Perth Project Trafalgar Precinct Assessment Of Foundation Conditions For Proposed Commercial & Residential Developments	East Perth Redevelopment Authority	1989
H89	Burswood Project: Surcharge Analysis And Slope Stability With Wick Drains Installed	Main Roads WA	1984

APPENDIX 2

Perth Metropolitan Region – Perth 1:50,000 Environmental Geology Series summary of surface geology



Aurora environmental
ASSESS • ADVISE • APPLY

Drawn: JWS | Date: 22 May 2025

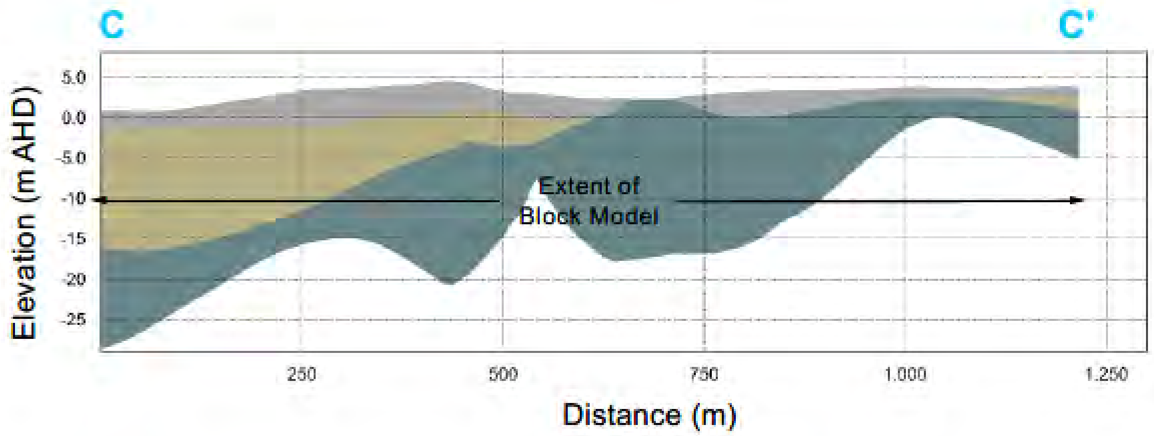
Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula

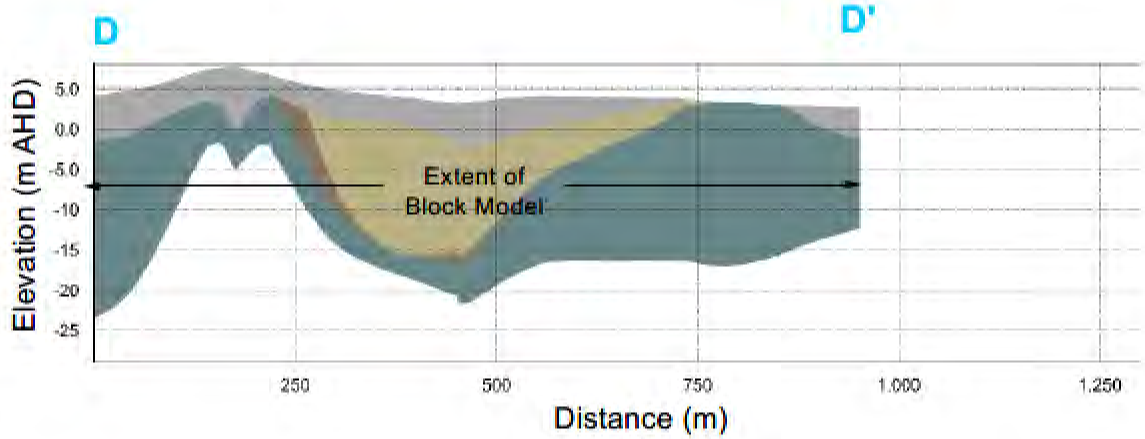
1:50,000 Perth Gological Map

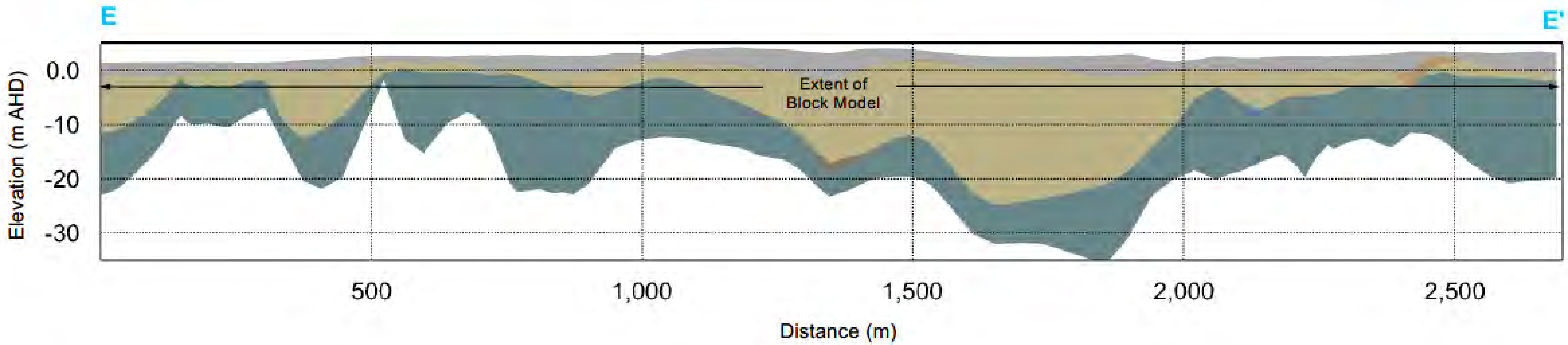
Appendix
Job:MRW-PP03809

APPENDIX 3

Geological Cross Sections of the Burswood Peninsula
(Golder, 2012b)







LEGEND

- Borehole Location
- Section Line
- Site Boundary

Modelled Geology

- Fill
- Tamala Sand
- Swan River Alluvium
- Guildford Formation Weak
- Guildford Formation Strong

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Nearmap imagery provided by client.

NOTES

The investigation locations have be obtained from various sources ranging from hand-drawn plans to documents that report surveyed coordinates. As such, some locations will be indicative and a degree of spatial variability is expected from the interpretations derived from this data.

Note that the horizontal and vertical scales are not the same.

Golder Associates

CLIENT	PTA
DOCUMENT	117642147-001-R-Rev1
DATE	20 Mar 2012
COMPILED	GGW
APPROVED	HEN

Summary of Available Geotechnical Information

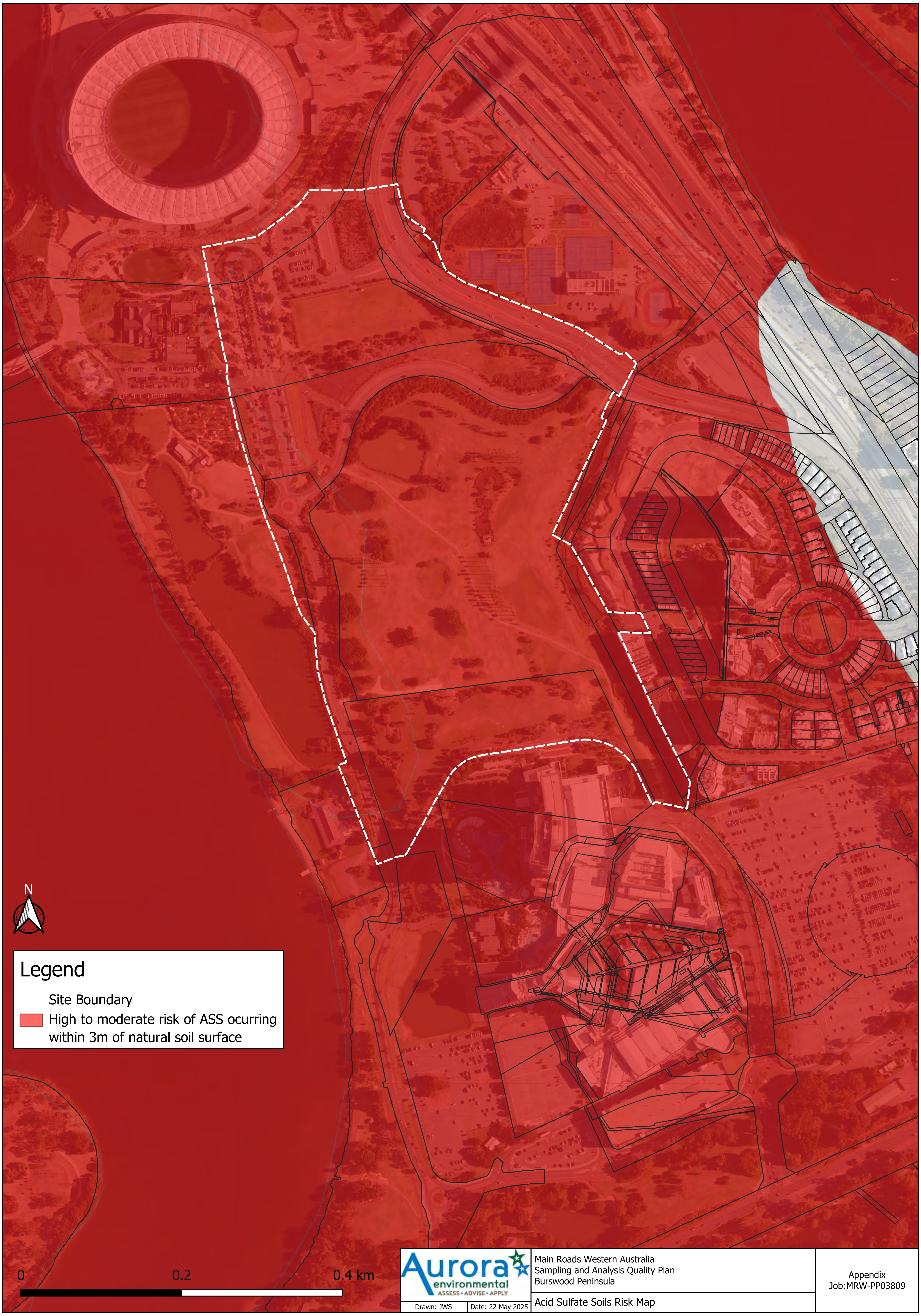
BURSWOOD PENINSULA SECTIONS CC', DD' AND EE'

APPENDIX D3

File Location: G:\Spatial_Information_Group\GIS_WORKSPACE_AUSTRALIA\01_WA\M6100_BURSWOOD\117642147\Projects\R001\Rev1\117642147-001-R-F0D3-Rev1-Cross_Section_CC'_DD'_EE'.mxd

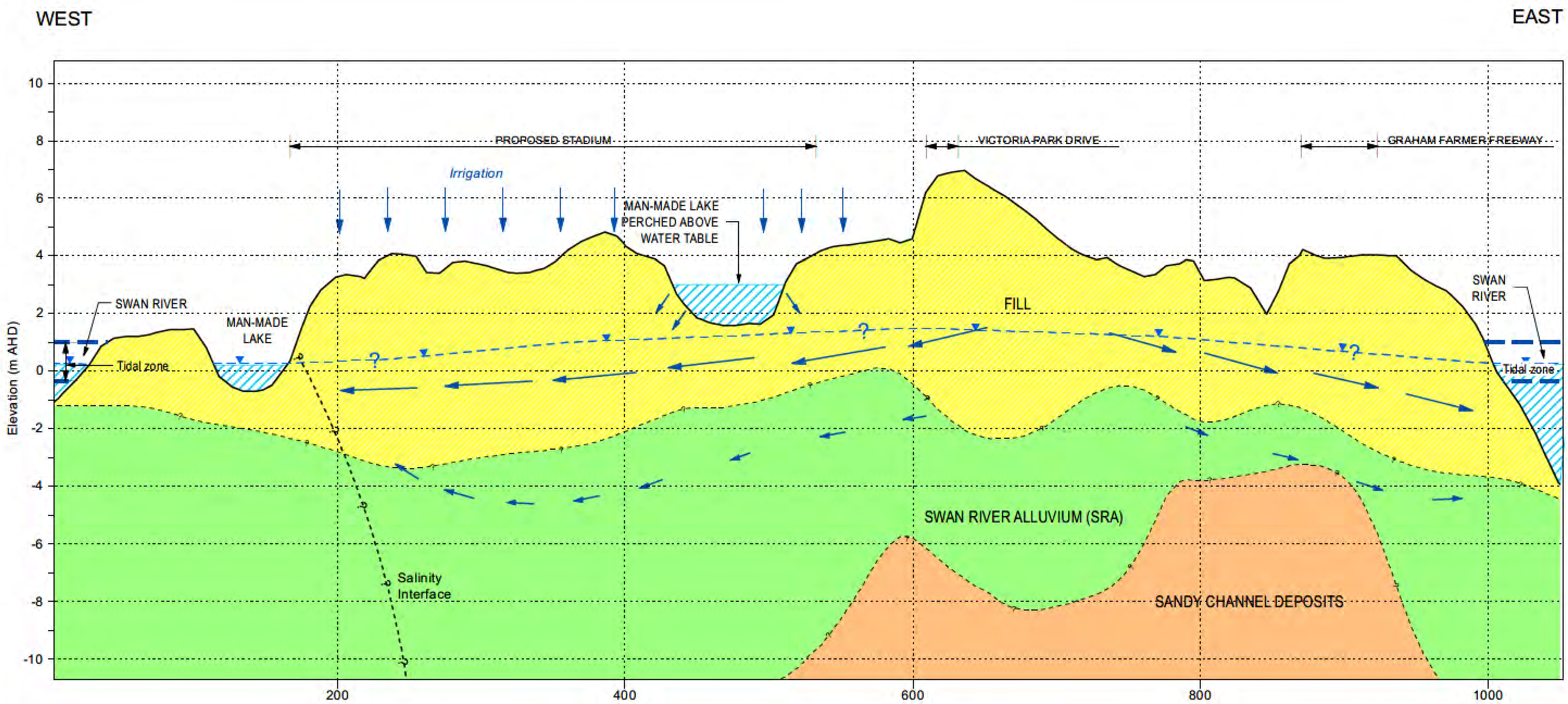
APPENDIX 4

DWER ASS risk mapping, Swan Coastal Plain
(DWER-055) (DWER, 2024a)


N
Legend
Site Boundary
High to moderate risk of ASS ocurring within 3m of natural soil surface
0
0.2
0.4 km
Aurora environmental
ASSESS • ADVISE • APPLY
Main Roads Western Australia
Sampling and Analysis Quality Plan
Burswood Peninsula
Acid Sulfate Soils Risk Map
Drawn: JWS
Date: 22 May 2025
Appendix
Job:MRW-PP03809

APPENDIX 5

Schematic Hydrogeological Conceptual Section Golder (2013a)



LEGEND

Estimated Groundwater Flow Path

Groundwater Level

Groundwater Contour (May 2003)

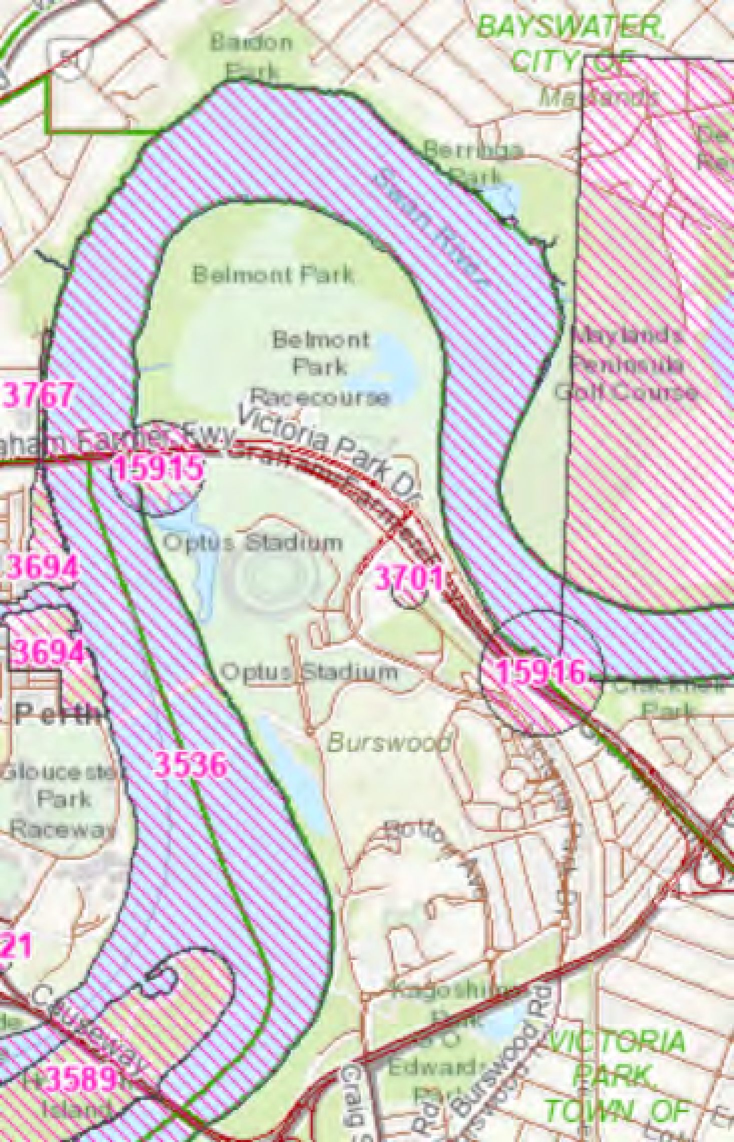
Section Location

Golder Associates	CLIENT: Public Transport Authority		PROJECT: New Perth Stadium, Burswood
	DRAWN: SR	DATE: 29 Oct 2012	TITLE: HYDROGEOLOGICAL CONCEPTUAL SECTION
	APPROVED: DPS		
	SCALE:	A3	PROJECT No: 127642046-008-R-Rev2 — FIGURE 5

File Location: G:\Spatial_Information_Group\GIS_WORKSPACE_AUSTRALIA\01_WA\M6100_BURSWOOD\117642087\Projects\Working\117642087_SK022_Section_Geology_regionalx25z.mxd

APPENDIX 6

Department of Planning Lands and Heritage Online Aboriginal Cultural Heritage Inquiry System (ACHIS) Search Results


BAYSWATER,
CITY OF
Baidon
Park
Maylands
Berringa
Park
Belmont Park
Belmont
Park
Racecourse
Maylands
Peninsula
Golf Course
3767
Victoria Park Dr
Graham Farmer Fwy
15915
Optus Stadium
3694
3701
3694
Optus Stadium
15916
Perth
Burswood
3536
Gloucester
Park
Raceway
21
3589
Craig St
Burswood Rd
VICTORIA
PARK,
TOWN OF
Edwards

APPENDIX 7

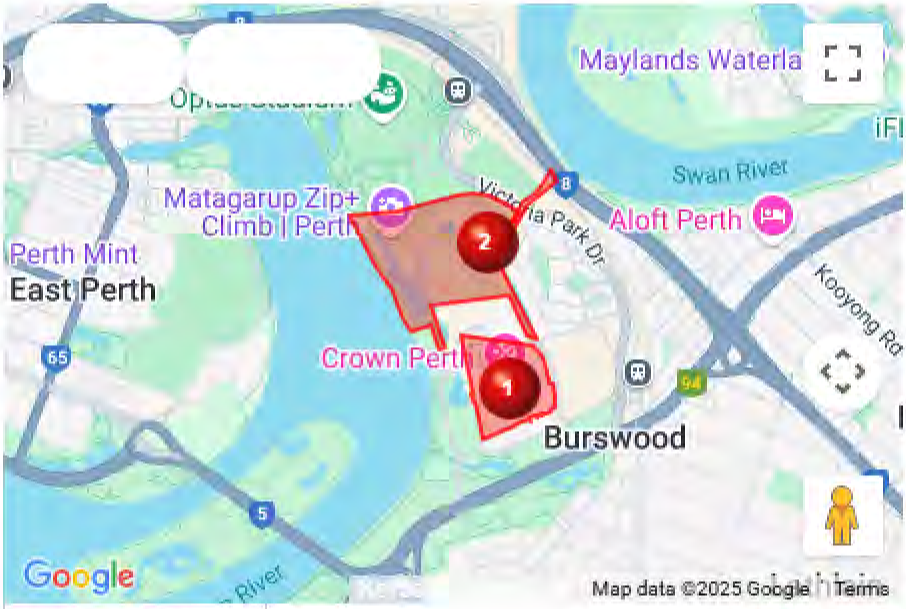
Heritage Council State Heritage Office Database Search Results

New search

Search Results

Showing 1-3 of 3 results

Jump to page: 1



Enlarge Map

- Print summary of results
- Print all records on this page
- Print all 3 records
- Export all 3 records in CSV format
- New Search

3 Place(s) found, including **1 State Registered Place(s)**

Place	View information about this place
Burswood Resort & Casino 23-81 Bolton Av Burswood Heritage Place No. 1699	Town of Victoria Park
Old Burswood Canal near Goodwood Pde Burswood State Registered Place Heritage Place No. 3570	Heritage Council Town of Victoria Park 
Burswood Tip (fmr) (Burswood Island Golf Course, Rivervale Tip) 201 Great Easterm Highway Burswood Heritage Place No. 26080	Heritage Council

Export all 3 records in CSV format

New Search

Jump to page: 1