Local Water Management Strategy

Ascot Racecourse Local Structure Plan

Project No: EP23-109(03)

Prepared for Perth Racing
July 2024



Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

Document Control

Doc name:	Local Water Management Strategy Ascot Racecourse Local Structure Plan				
Doc no.:	**EP23-109(03)--001B JM**				
Version	**Date**	**Author**		**Reviewer**	
1	May 2024	Joyti Mabruk	JM	David Coremans	DPC
	For project team review				
A	May 2024	Joyti Mabruk	JM	David Coremans	DPC
	For submission to Agencies				
B	July 2024	Joyti Mabruk	JM	David Coremans	DPC
	For submission to Agencies				

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Executive Summary

Perth Racing (the 'proponent') proposes to progress a local structure plan (LSP) over its landholdings in Ascot. The area is bounded by the Swan River to the North, Grandstand Road to the west and south, Matheson Road and Resolution Drive to the south and residential areas to the east, referred to herein as 'the site'. The structure plan area also includes the existing Ascot Racecourse. The site is located approximately 8.5 km east of Perth central business district (CBD) and is approximately 62 ha in size, within City of Belmont (CoB). The LSP consists of six precincts: Precinct A, Precinct B (largely unchanged form existing), Precinct C, Precinct D, Precinct E, and the racecourse. The layout of LSP and precinct plan is shown on **Figure 1** and provided in **Appendix A**. The site is currently zoned "Urban", "Parks and Recreation", and "Private Recreation" under the Metropolitan Regional Scheme (MRS) (WAPC 2023b). Under the Local Planning Scheme (LPS) No. 15 (WAPC 2023a), the site is zoned as "RC – Place of Public Assembly: Racecourse", Mixed Use", "Parks and Recreation" and "Parks and Recreation: Water Supply Sewerage and Drainage".

This Local Water Management Strategy (LWMS) outlines the water management approach as required for the site by *Better Urban Water Management* (WAPC 2008b) and supports the Ascot Racecourse Structure Plan. It is intended to satisfy the expectations of the Department of Water and Environmental Regulation (DWER) and City of Belmont (CoB). The LWMS also aids in achieving the goals and objectives outlined in the *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth Action Plan 2* (DWER 2023d).

The first step in applying integrated water cycle management in urban catchments is to establish agreed environmental values for receiving environments. In summary, the environmental investigations conducted to date indicate that:

- The site is being used for horse racing, mixed uses (i.e. car park, stables and entertainment/hospitality venues, and commercial). Some portions of the site are only used infrequently (e.g. for parking or events).
- The site is located in an area of moderate to high rainfall, receiving 756.3 mm on average annually with the majority of rainfall received between June and August.
- The majority of the site has a relatively flat topography of 1 mAHD at the northwest (along the Swan River) and 2 mAHD to the south and rising to 7 mAHD to the east of the site.
- The site is within the Swan River Terraces system and displays Guildford formation soils of alluvial and leached yellow sand described as:
    - **Ms2 –** Sandy Silt: Strong brown to mid grey, mottled, blocky, fine sand, hard when dry, variable clay content of alluvial origin
    - **Ms4 –** Sandy Silt: light yellow brown, blocky, mottled some fine to medium sand, soft when moist, variable clay content
    - **S8 –** Sand: very light grey at surface, yellow at depth, fine to medium-grained, sub rounded quartz, moderately well sorted of eolian origin
- The groundwater depth below the surface of Precinct A varies from 1.09 m mBGL to 2.37 mBGL (Douglas Partners 2024).
- The highest groundwater level beneath the site is reported 3.03 mBGL during February 2024 (Galt 2024), located beneath Precinct D.

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- Most of the site is considered to have a high to moderate risk of ASS occurring, however some portions of Precinct B, Precinct C and the Racecourse are considered to have a moderate to low risk of ASS occurring within the 3 m of the natural surface.
- The northern portion of the site along the Swan River is identified as an ESA.
- The entirety of the site is classified as a SSA and classified as:
  - a) Estuary catchments on the Swan and Scott Coastal Plains.
  - f) The area is <1 km up-groundwater-gradient and 250 m down-gradient of a significant wetland; or where the groundwater gradient is unknown within 1 km of the significant wetland.
- The following wetlands are located within the site and these are classified as:
  - Multiple Use category wetland (MUW) area (UFI 8424, UFI 8425, UFI 8426).
  - Resource Enhancement wetland (REW) area (UFI 8423).
- The dominant hydrological feature of the site is the Swan River estuary. The northern boundary of the site falls within the Swan Canning Development Control Area (DCA) (CoB 2018) and Swan Canning River Park.
- The floodway of the Swan River is immediately adjacent to but not within the site. The 1% AEP flood elevation of the Swan River adjacent to the site is 2.8 mAHD.
- There are two existing major drainage network systems within or adjacent to the site include:
  - The Central Belmont Main Drain (CBMD), managed by the Water Corporation. This currently receives runoff from Precinct C (via the CoB drainage network) and Precinct E.
  - The CoB local piped drainage network, which exists along Matheson Road, Grandstand Road and the northern portion of Resolution Drive.
- There are three lakes (Irrigation Lake, Lined Lake and Wetland Lake) located within the centre of the racecourse. These are understood to receive runoff from the Grandstand buildings in Precinct B and stables/buildings in Precinct C.
- The groundwater beneath the site is a multi-layered system consisting of the Superficial, Kings Park Formation, Leederville and Yarragadee aquifers.
- Regional groundwater mapping indicates that the groundwater levels across the site are at approximately 0.5 m AHD.
- Local groundwater level monitoring indicates that annual maximum groundwater levels (recorded in August 2022) were measured at 1.26 m AHD and 1.70 m AHD at Bore 1 and Bore 2 respectively. Groundwater levels in adjacent areas included Precinct A levels at 1.09 mBGL to 2.37 mBGL and Precinct D levels of approximately 3.03 mBGL.
- Water quality monitoring indicates that EC, TDS and pH values do not exceed guideline trigger values. However, TN and TP concentrations continually exceed the ANZECC guideline trigger value of 1.2 mg/L and 0.065 mg/L respectively.

The design criteria and the manner in which they are proposed to be achieved are presented in **Table E1**.

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Table E1: Water management criteria and compliance summary

Management Aspect	Criteria Number	Criteria Description	Manner in which compliance will be achieved	Responsibility for implementation	Timing of implementation
Water Conservation	WC1	For residential dwellings consumption target of 60 kL/person/year scheme water.	Provide advice to Precinct A and Precinct D residents on water conservation measures	Proponent	Point of sale
			RWTs can be utilised for non-potable uses	Lot owner	Post-house construction
			Promotion and use of WWG in lots within Precinct D and other open spaces across all precincts	Proponent/Lot owner	Point of sale/Post-house construction
			Promotion and use of water efficient appliances within Precinct A and Precinct D	Proponent/Lot owner	Point of sale/Post-house construction
			Mandate water efficient fittings within Precinct A and Precinct D	CoB	Building approval
	WC2	Ensure the efficient use of all water resources.	Use of waterwise landscaping principles in all open spaces and verges	Proponent	Landscape design
			Open spaces designed to use no more than allocated groundwater		
			Minimise water requirements for open spaces and verge maintenance		
			Use of water efficient appliances within Precinct A and Precinct D	Lot owner	Post-house construction
			Use of WWG principles within Precinct A and Precinct D		
	WC3	Non-potable irrigation water to be sourced from existing groundwater licences held over the area.	The proponent holds a groundwater Licence with an allocation of 347,000 kL per annum which will meet the irrigation requirements of the racecourse.	Proponent	Landscape design

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Table E1: Water management criteria and compliance summary (Continued)

Management Aspect	Criteria Number	Criteria Description	Manner in which compliance will be achieved	Responsibility for implementation	Timing of implementation
Stormwater Management	SW1	Retain and treat the first 15 mm of rainfall as close to source as possible	Lots within Precinct D and Precinct E to retain the first 15 mm of rainfall on lot in soakwells/soakage. Lot storage will be the responsibility of the lot owners.	Lot owner/developer	Construction
	SW2	Retain up to 1% AEP rainfall event on-site.	Runoff up to the 1% AEP to be detained within the FSA in Precinct A. Precinct A and a portion of Precinct C will ultimately discharge to the centre of the track.	Proponent	Construction
			Runoff up to 1% AEP to be managed with the sub-surface storage in Precinct D.	Proponent	Construction
	SW3	Post-development critical 1% AEP peak flows leaving the site to mimic pre-development peak flows.	Runoff up to 1% AEP event to be detained in the detention basin and subsurface storage which will maintain the pre-development peak flow of 0.95 m^3/s from Precinct E and 0.463 m^3/s from Precinct D respectively.	Proponent	Construction
	SW4	Finished floor levels must have a minimum of 300 mm clearance above the 1% AEP TWL in the FSA.	It is anticipated that the FSA and detention basin invert will be set so that the Finished floor levels must have a minimum of 300 mm clearance above the 1% AEP TWL in the basins.	Proponent	Detailed drainage design
	SW5	All lots must have a minimum of 500 mm clearance above the 1% AEP flood level in the Swan River.	The 1% AEP flood level in the Swan River is 2.8 mAHD. The preliminary bulk earthworks concept provided in shows that finished floor level will be at 4.0 mAHD.	Proponent	Detailed drainage design
	SW6	Nutrient concentrations within surface water discharging from the site to the Swan River are to meet regional water quality targets.	BRA will be designed so that after treatment the nutrient concentrations within surface water meet the regional water quality target.	Proponent	Detailed drainage design
	SW7	Reduce nutrient loads by applying appropriate non-structural measures	• Minimise use of fertilisers within POS and road verges. • Street sweeping at regular intervals. • Use of drought tolerant turf species. • Education of residents regarding fertiliser use	Landscape/Maintenance Contactor/Proponent	Landscape Implementation/ Point of Sale
	SW8	Design infiltration areas to avoid creating mosquito habitat	Stormwater infrastructure will be designed to ensure all runoff is infiltrated within 96 hours.	Proponent	Detailed drainage design

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Table E1: Water management criteria and compliance summary (Continued)

Management Aspect	Criteria Number	Criteria Description	Manner in which compliance will be achieved	Responsibility for implementation	Timing of implementation
Groundwater Management	GW1	Surface based infiltration should have 300 mm clearance above MGL.	Basin inverts will be set at 300 mm above the MGL, and subsoil drainage will be provided in the POS.	Proponent	Detailed drainage design
	GW2	Finished floor levels should have a clearance to the MGL of at least 1.2 m.	Lots will be set at least 1.2 m above the MGL.	Proponent	Detailed drainage design

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Central Belmont Main Drain Water Corporation

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
ANZECC	Australian and New Zealand Environment and Conservation Council
BoM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation and Attractions
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
CoB	City of Belmont
WC	Water Corporation of Western Australia (Water Corp)

Table A2: Abbreviations – General terms

General terms	
AEP	Annual exceedance probability
ASS	Acid sulfate soils
CCW	Conservation category wetland
CEMP	Construction Environmental Management Plan
DCA	Development Control Area
DMP	Drainage management plan
EC	Electrical conductivity
FMP	Foreshore management plan
LWMS	Local Water Management Strategy
MGL	Maximum groundwater level
MRS	Metropolitan Region Scheme
NWQMS	National Water Quality Management Strategy
POS	Public open space
SCWQIP	Swan and Canning Water Quality Improvement Plan
SRA	Swan River Alluvium
TDS	Total dissolved solids
TEC	Threatened ecological community
TKN	Total Kjeldahl nitrogen
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids

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General terms	
TWL	Top water level
UFI	Unique feature identifier
UWMP	Urban Water Management Plan
WSUD	Water sensitive urban design
WWG	Water wise gardening

Table A3: Abbreviations – units of measurement

Units of measurement	
cm	centimetre
ha	hectare
m	metre
m^2	square metre
m^3	cubic metre
m^3 / s	cubic metres per second
mAHD	metres in relation to the Australian height datum
mBGL	metres below ground level
mm	millimetre
mS / cm	millisiemens per centimetre
µg/L	micrograms per litre
mg / L	milligrams per litre

Table A4: Terminology – design rainfall

Rainfall event	Annual exceedance probability (AEP)	Approximate equivalent average recurrence interval (ARI)
Small	1 exceedance year (EY) event (frequent)	1 in 1 year ARI event
Minor (residential purposes)	20% AEP event	1 in 5 year ARI event
Minor (commercial purposes)	10% AEP event	1 in 10 year ARI event
Major	1% AEP event	1 in 100 year ARI event

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1 Introduction

1.1 Background

Perth Racing (the 'proponent') proposes to progress a local structure plan (LSP) over its landholdings in Ascot. The area is bounded by the Swan River to the North, Grandstand Road to the west and south, Matheson Road and Resolution Drive to the south and residential areas to the east, referred to herein as 'the site'. The structure plan area also includes the existing Ascot Racecourse and Perth Racing Administration lot/building on Grandstand Road. The site is located approximately 8.5 km east of Perth central business district (CBD) and is approximately 62 ha in size, within City of Belmont (CoB). The LSP consists of six precincts: Precinct A, Precinct B, Precinct C, Precinct D, Precinct E, and the racecourse. The layout of LSP and precinct plan is shown on **Figure 1** and provided in **Appendix A**.

1.2 Town planning context

The site is currently zoned "Urban", "Parks and Recreation", and "Private Recreation" under the Metropolitan Regional Scheme (MRS) (WAPC 2023b). Under the Local Planning Scheme (LPS) No. 15 (WAPC 2023a), the site is zoned as "RC – Place of Public Assembly: Racecourse", Mixed Use", "Parks and Recreation" and "Parks and Recreation: Water Supply Sewerage and Drainage".

1.3 Purpose of this report

This Local Water Management Strategy (LWMS) outlines the water management approach as required for the site by *Better Urban Water Management* (WAPC 2008b) and supports the Ascot Racecourse Structure Plan. It is intended to satisfy the expectations of the Department of Water and Environmental Regulation (DWER) and CoB. The LWMS also aids in achieving the goals and objectives outlined in the *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth Action Plan 2* (DWER 2023d).

1.4 Policy Framework

There are a number of State Government legislation and policies of relevance to the site. These policies include:

- *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth Action Plan 2* (DWER 2023d)
- *Swan and Canning Rivers Management Act 2006* (Government of WA 2006)
- *Policy 49 – Planning for stormwater management affecting the Swan Canning Development Control Area* (DPaW 2016)
- *Local Planning Scheme No. 15 (City of Belmont)* (WAPC 2023a)
- *State Water Plan* (Government of WA 2007)
- *Draft State Planning Policy 2.9: Planning for Water Guidelines* (DPLH 2021)
- *State Planning Policy 2.10 Swan Canning River System* (WAPC 2006b)
- *Guidance Statement No. 33: Environmental Guidance for Planning and Development* (EPA 2008)
- *Liveable Neighbourhoods* (WAPC 2009a)
- *Planning Bulletin No. 64: Acid Sulfate Soils* (WAPC 2009b)

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In addition to the above policies, there are a number of published guidelines and standards available that provide direction regarding the water management characteristics that urban developments should aim to achieve. These are key inputs that relate either directly or indirectly to the site and include:

- *Better Urban Water Management* (WAPC 2008b)
- *Urban Water Management Plans: Guidelines for Preparing Plans and for Complying with Subdivision Conditions* (DoW 2008)
- *National Water Quality Management Strategy (NWQMS)* (ANZECC 2000)
- *Australian Runoff Quality* (Wong et al. 2006)
- *National Water Quality Management Strategy* (ANZECC 2000)
- *Stormwater Management Manual for Western Australia* (DoW 2007)
- *Decision Process for Stormwater Management in Western Australia* (DWER 2017)
- *Australian Rainfall and Runoff* (Ball J et al. 2019)
- *Swan and Canning Water Quality Improvement Plan* (SCWQIP) (SWT 2009)
- *Swan and Canning Rivers Foreshore Assessment and Management Strategy* (SRT 2008)
- *Golden Gateway Structure Plan* (CoB 2019).

1.5 Previous Studies

1.5.1 Golden Gateway Local Water Management Strategy

The draft Golden Gateway LWMS (Essential Environmental 2018b) was prepared to support the Golden Gateway Structure Plan (CoB 2019) by Essential Environmental. The LWMS was prepared in consideration of *Better Urban Water Management* (WAPC 2008b) and *State Planning Policy 2.9: Water Resources* (WAPC 2006a). The key objectives and design criteria of the draft LWMS (Essential Environmental 2018b) included:

Water Conservation:

- Ensure the efficient use of all water resources in the redeveloped urban form and aim to achieve highest value use of fit-for-purpose water.
- Maintain opportunities for future generations by using water more efficiently.

Stormwater management:

- The first 15 mm of rainfall is to be retained within all lots through a combination of raingardens, water tanks and soakwell systems.
- Raingardens and tree-pits are to be installed in all new or upgraded streets to provide infiltration of the first 15 mm of rainfall.
- Minor event runoff from events larger than 15mm total depth are to be managed in accordance with serviceability requirements of the City of Belmont.
- Roads and public open spaces are to be designed to cater for the surface overflow for more severe storm events with habitable floors at least 0.3 m above the 1% AEP flood or storage level at any location.
- Habitable floors are to be constructed at least 0.5m above the 1% AEP flood level in the Swan River adjacent to the development area.

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- Water quality treatment systems and stormwater management structures should be designed in accordance with the *Stormwater Management Manual for Western Australia* (DoW 2007) and *Australian Runoff Quality: A guide to water sensitive urban design* (Wong et al. 2006).

Groundwater management:

- Groundwater management systems are to be designed as free discharging under normal operating conditions.
- Flows from groundwater management systems are to be treated prior to discharge.

1.6 LWMS objectives

Whilst the criteria proposed in the Golden Gateway LWMS are relevant to some parts of the Ascot Racecourse structure plan area, it is not representative of all areas and site characteristics and therefore only partially applicable. This LWMS supports the Ascot Racecourse Structure Plan, which proposes an alternate layout (to the Golden Gateway Structure Plan) to some of the land uses surrounding the Ascot Racecourse. The design criteria and objectives proposed in this LWMS are generally based on those proposed in the Golden Gateway LWMS, though with additional consideration for site and Precinct- specific characteristics. This LWMS adopts the following major objectives:

- Protect water quality in the Swan River by providing appropriate water quality treatment at source.
- Mitigate potential flooding within the Structure Plan area and immediate surrounds.
- Take account of existing drainage infrastructure capacity and ensure that sufficient land is set aside to manage stormwater.
- Provide a broad level stormwater management framework to support future urban development.
- Incorporate appropriate best management practices (BMPs) into the drainage systems that address the environmental and stormwater management issues identified.
- Minimise development construction costs, which will result in reduced land costs for future home owners.
- Minimise transport of nutrients/pollutants to groundwater.
- Develop a non-potable water conservation strategy that will accommodate existing groundwater allocation constraints for the area.
- Gain support from DWER, DBCA, CoB and Water Corporation for the proposed method to manage stormwater within the site.

Detailed objectives for water management within the site are further discussed in **Section 4**.

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2 Proposed Development

A total of approximately 62.0 ha is proposed to be developed as shown on **Figure 1**. The Ascot Racecourse Structure Plan proposes six precincts with different objectives and character, and these include:

- **Precinct A –** Approximately 3.0 ha for retirement living/village and mixed use purposes
- **Precinct B –** Approximately 9.3 ha for the use of public assembly (i.e. entertainment/office purposes)
- **Precinct C –** Approximately 8.0 ha for the use of public assembly (i.e. racecourse/stabling purposes)
- **Precinct D –** Approximately 1.5 ha for residential/childcare purposes
- **Precinct E –** Approximately 4.2 ha for mixed use (i.e. commercial/retail purposes)
- **The Racecourse –** Approximately 36.0 ha of retained 'Place of Public Assembly: Racecourse' uses.

The proposed land uses surrounding Ascot Racecourse will be integrated into the Racecourse Precinct. Management of surface and groundwater will take a water sensitive urban design (WSUD) approach that will integrate the management of water within the Precincts with the Racecourse and immediately surrounding infrastructure.

The WSUD measures that will be adopted within the Structure Plan area will include:

- Bio-retention areas (BRAs) to meet water quality treatment requirements
- Subsurface infiltration cells that will facilitate at-source infiltration
- Flood storage integrated into existing surface water bodies located centrally within the Racecourse
- Flood storage areas (FSAs) to provide flood detention, retention and infiltration as close to source as possible.

The WSUD approaches are further discussed in **Section 6**.The detailed concept plan and preliminary civil drawings are provided in **Appendix A** and **Appendix C**.

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3 Pre-development Environment

3.1 Sources of information

The following sources of information were used to provide a broad regional environmental context for the site:

- *Geological Survey of Western Australia* (Gozzard 2007)
- *Map Viewer Plus* (Landgate 2023)
- *Water Register* (DWER 2024c)
- *Perth Groundwater Map* (DWER 2024a)
- *Weather and Climate Statistics Data* (BoM 2024)
- *Acid Sulfate Soil Mapping* (DWER 2023a)
- *Water Information Reporting* (DWER 2024b).

In addition to the above information, site-specific investigations have been conducted. These have aimed at providing more detail to the existing regional information. These site-specific investigations and information have been available from the following sources:

- *Draft Golden Gateway Structure Plan* (CoB 2019)
- *Draft Golden Gateway LWMS* (Essential Environmental 2018b)
- *Draft Golden Gateway Environmental Report* (Essential Environmental 2018a)
- *Draft Infrastructure Assessment Report : Golden Gateway Precinct* (Cardno 2017)
- *Swan and Canning Water Quality Improvement Plan* (SCWQIP) (SWT 2009)
- *Swan and Canning Rivers Foreshore Assessment and Management Strategy* (SRT 2008).

3.2 Land use context

The site has been used as the Ascot Racecourse since 1892 (Landgate 2023). The northeast portion of the site is being used for horse racing and training purposes and the surrounding area is being used for stabling, training and entertainment venues which support the above purposes. Some portions of the site are predominantly cleared (e.g. Precinct A, Precinct E) and are occasionally used for parking or other temporary uses. The Precinct D area is used for commercial purposes, being the current Perth Racing administration building.

3.3 Climate

The site experiences a dry Mediterranean climate of hot dry summers and cool wet winters and is located in an area of moderate to high rainfall, receiving 756.3 mm on average annually with the majority of rainfall received between June and August (BoM 2024). The region experiences rainfall for 84.8 days annually (on average).

3.4 Topography

The site is mostly flat with a slight downward slope from east to north and northwest, with a few low points. The variance in topography of the Precincts is described further as:

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- The Racecourse slopes from Precinct C towards the Swan River with topography approximately 7 m Australian Height Datum (mAHD) to 1m AHD and from 7 mAHD (east) to 3 mAHD (west). There are a few local depressions (i.e., lakes and swale) observed within the centre of the racecourse.
- Precinct A has a generally flat topography of 2 mAHD with a high point of 3 mAHD to the west adjacent to Grandstand Road.
- Precinct B slopes from south to north (4 mAHD to 2 mAHD) and from west to east (3 mAHD to 2 mAHD). Precinct D and E are generally flat with a topography of 3 mAHD and 2 mAHD respectively.
- Parts of Precinct C (existing stables and buildings) drain towards the Racecourse, however most of Precinct C is currently carpark that drains towards Precinct E and the Southern Main Drain.
- Precinct D is generally flat with a topographic level 3 mAHD.
- Precinct E has a gentle slope from east to west. The topography of the precinct ranges from 4 mAHD to the east to 2 mAHD to the west.

The topographic contours of the site are shown on **Figure 2**.

3.5 Geotechnical conditions

3.5.1 Geology and soils

The Perth Metropolitan Region 1:50,000 Environmental Geology Series (Gozzard 1986) *and Sea to scarp - geology, landscape, and land use planning in the southern Swan Coastal Plain* (Gozzard 2011) describes that the site lies in the Swan River Terraces system, being underlain by the Guildford formation of alluvial and leached yellow sand. The regional geological mapping indicates that the site soils include:

- **Ms2 –** Sandy Silt: Strong brown to mid grey, mottled, blocky, fine sand, hard when dry, variable clay content of alluvial origin
- **Ms4 –** Sandy Silt: light yellow brown, blocky, mottled some fine to medium sand, soft when moist, variable clay content
- **S8 –** Sand: very light grey at surface, yellow at depth, fine to medium-grained, sub rounded quartz, moderately well sorted of eolian origin

The regional geological mapping is shown on **Figure 3**.

3.5.2 Precinct A geotechnical investigation

A detailed geological investigation has been carried out in January 2024 (Douglas Partners 2024) for Precinct A (see **Appendix B**). This investigation generally confirms the regional geological mapping, and the ground conditions of Precinct A are described as:

- Uncontrolled Fill
  - Granular FILL - SAND, Organic SAND, Gravelly SAND, Silty SAND and Sandy GRAVEL
  - Cohesive FILL - Clayey SAND, Sandy CLAY, CLAY
- Overlying natural soils includes
  - Clayey soils including Clayey SAND and CLAY
  - Sandy soils including SAND and Silty SAND

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Douglas Partners (2024) concluded that if unmodified, Precinct A is considered unsuitable for on-site stormwater disposal due to the low permeability soils and shallow groundwater depth. To meet geotechnical requirements, stormwater should be managed by connecting to a suitable outflow (Douglas Partners 2024).

3.5.3 Precinct D geotechnical investigation

Galt has undertaken a geotechnical study in March 2024 (Galt 2024) for Precinct D (provided in **Appendix B**) and has described the Precinct D ground conditions as:

- **Surficial Topsoil** (in landscaped areas) up to 0.3 m thick and **Hardstand Fill Layers** (in carparks and access ways); overlying
- **FILL: SAND / SAND (SP)**, fine to medium grained, sub-rounded to sub-angular, yellow / brown / grey layers, includes trace gravel / Sandy GRAVEL layers, trace / with fines, some typically medium dense to dense, extending to depths of about 0.4 m to 0.9 m; overlying
- **In BH03 and BH04 only: Silty SAND / Clayey SAND (SM/SC)** fine to medium grained, sub-rounded to sub-angular, brown / grey, low to medium plasticity fines, some typically medium dense to dense, extending to depths of about 0.7 m to 1.2 m; overlying
- **Sandy CLAY / CLAY (CI)**, medium plasticity, brown / orange / grey, trace sand to sandy, trace gravel in some zones, desiccated, CPT traces indicate presence of occasional sand layers, typically very stiff to hard, extending to the maximum depth investigated of 10 m.

Whilst detailed geotechnical investigations have not been undertaken in each Precinct, it is expected that the soils encountered will be generally consistent with regional geological mapping and the investigations undertaken for Precincts A and D and will consist of generally shallow layers of sand overlying sandy clay of the Guildford formation. Such soils are unlikely to be suitable for onsite infiltration of all stormwater and onsite detention unless modified and stormwater management will need to be supplied with an outlet so that flood storage areas have a way to drain between storm events.

3.5.4 Acid sulfate soils

The acid sulfate soil (ASS) risk mapping (DWER 2023b) indicates that most of the site is considered to have a high to moderate risk of ASS occurring within the 3 m of the natural surface. Some portions of Precinct B, Precinct C and the Racecourse are mapped to have a moderate to low risk of ASS occurring within the 3 m of the natural surface.

The ASS risk mapping is shown on **Figure 4**.

3.6 Environmental assets

3.6.1 Environmentally sensitive area

The northern portion of the site (along the Swan River) is identified as an environmentally sensitive area (ESA). ESAs are shown on **Figure 5**.

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3.6.2 Sewerage sensitive area

The entirety of the site is classified as a sewage sensitive area (SSA) by the *Government Sewerage Policy* (DPLH 2019). The two classifications of relevance to the site define a SSA as:

- a) Estuary catchments on the Swan and Scott Coastal Plains.
- f) The area is <1 km up-groundwater-gradient and 250 m down-gradient of a significant wetland; or where the groundwater gradient is unknown within 1 km of the significant wetland.

3.6.3 Geomorphic wetlands

The *Geomorphic Wetlands of the Swan Coastal Plain* dataset indicates the following wetlands within the site:

- Multiple Use Category Wetland (MUW) area (UFI 8424, UFI 8425, UFI 8426).
- Resource Enhancement Wetland (REW) area (UFI 8423)

The Swan River, situated immediately adjacent to the northern boundary of the site, is recognised as a "Conservation Category Wetland" (CCW) (UFI 1316 - Estuary waterbody) within the *Geomorphic Wetlands of the Swan Coastal Plain* dataset and has additional significant ecological, cultural and heritage values (DEC 2011).

The location of the geomorphic wetlands is shown on **Figure 5.**

3.7 Hydrology

3.7.1 Surface water

3.7.1.1 Water Resources

The dominant hydrological feature of the site is the Swan River estuary. The estuary is subject to marked seasonality, which controls the salinity of the site, and particularly the foreshore area. This seasonality is a result of the short winter rainfall patterns, a small tidal range and the landform of the estuary (Hodgkin and John 1986).

The northern boundary of the site falls within the Swan Canning Development Control Area (DCA) (CoB 2018) and Swan Canning River Park (shown on **Figure 6**). Any proposed development on land adjacent river within the DCA and/or partly within DCA are subject to assessed and approved by the Department of Biodiversity, Conservation and Attraction (DBCA) under Part 5 of the *Swan and Canning Rivers Management Act 2006* and the *Swan and Canning River Management Regulations 2007* (CoB 2018).

Water management strategies will be needed to ensure protection (i.e. water quality improvement) of the Swan River. The catchments of the Swan Canning River system are the subject of the Swan Canning Water Quality Improvement Plan (SRT 2009) which contains catchment management measures and control actions.

The major event flood levels in the Swan River have been documented in recent studies undertaken on behalf of DWER (DWER 2023c).These flood levels, along with the extent of floodway/floodplain

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are shown in the DWER online floodplain mapping tool. This tool indicates that the anticipated 1% AEP flood level adjacent to the site is 2.8 mAHD – noting that this level includes consideration for future climate change. The extent of floodway/floodplain from the Swan River adjacent to the site is shown on **Figure 6**.

3.7.1.2 Lakes

There are three lakes within the racecourse including:

- **Irrigation lake** – located adjacent to the Production Bore 1 (PB01) and has a volume of 6,000 m^3 to 7,000 m^3. Water is pumped out from PB01 into the lake, and irrigation water is drawn from the Irrigation Lake. During winter the Irrigation Lake overflows into the adjacent Lined Lake. The current irrigation demand for the Racecourse is approximately 3,000 m^3/day, there is no shortage of irrigation water supply as the lake has sufficient storage capacity. The top water level (TWL) of the Irrigation Lake is approximately 3.1 mAHD.
- **Lined Lake** – this Lake is sealed with a natural clay liner and fed via a 225 mm overflow pipe from the Irrigation Lake. The Lined Lake overflows into the Wetland Lake. The elevation of the Lined Lake is approximately 2.1 mAHD.
- **Wetland lake** – is the largest of the three lakes and has approximately 2.6 ha of surface area. The Wetland Lake has a TWL of approximately 0.4 mAHD. Two overflow pipes at the northern end of the Wetland Lake allow excess water within the Lake to flow to the Swan River.

Peak water levels within the Lined Lake and Wetland Lake were predicted for a 10% AEP storm event (Evangelisti & Associates 1997). The peak water level for was 2.68 mAHD in the Lined Lake which then discharged to the Wetland Lake. The Wetland Lake discharged to the Swan River after reaching the peak water level of 0.53 mAHD. The lakes are connected by 450 mm RCP pipes. The outfall into the Swan River is directed via two pipes (450 mm RCP and 375 mm RCP). The pipes are fitted with headwall and tidal control gate to mitigate inundation from the Swan River (Evangelisti & Associates 1997).

The location of the lakes and overflow pipes are shown on **Figure 6**.

3.7.1.3 Drainage network systems

The Central Belmont Main Drain (CBMD) is managed by the Water Corporation and is the regional drainage system and has a catchment area of 189 ha and which discharges into the Swan River. Catchment plans for the CBMD indicate that inflow from the site occurs in the southwestern corner of Precinct E, where an open drain connects to the CBMD at node CAN008 as shown in **Appendix E** and **Figure 6**.

The CoB has a local drainage piped network located beneath Hardey Road adjacent to Precinct C and which discharges to the CBMD within Precinct E. A larger local CoB network extends along Matheson Road to the East. This is currently connected to the 900 mm pipe that discharges northwards to the lined lake within the centre of the racecourse.

CoB local drainage pipes also exist beneath Grandstand Road adjacent to Precinct A however there is no current connection between Precinct A and the local drainage network. The same network also extends past/adjacent to Precinct D along the northern end of Resolution Drive, however there is no

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current connection from Precinct D to the local pipe network. The pipe network along Resolution Drive includes a 450 mm and 525 mm pipe which are understood to discharges into the CBMD. Whilst the CoB catchment has not been modelled to determine peak flows under differing storm durations, an estimate can be made based on the capacity of the pipes which discharge to the CBMD. The combined capacity of the two existing pipes is estimated to be 0.62 m^3/s, and therefore the allowable discharge from Precinct C and Precinct E is estimated to be 0.33 m^3/s.

Within the Racecourse an existing swale is being used around the racecourse to convey water from the track into the central Wetland Lake.

The location of the swales within the Racetrack Precinct and outlet to Swan River from the Wetland Lake is shown on **Figure 6**.

3.7.2 Groundwater

3.7.2.1 Groundwater Resource

The groundwater beneath the site is a multi-layered system comprised of the following:

City of Bayswater – Perth Superficial Swan unconfined aquifer. The Superficial Aquifer is approximately 20 m thick under the Ascot Racecourse, with the base of the aquifer under the racecourse at approximately - 20 mAHD (Davidson, 1995). The aquifer is recharged directly by rainfall and from the Swan River.

King Park Aquifer. The Kings Park Aquifer is 155 m thick starting from - 20 mAHD and is recharged laterally from the adjacent northern Mirrabooka Aquifer and Superficial Aquifer. The Kings Park Aquifer comprises 2 members: the Mullaloo Sandstone and Como Sandstone. Only the Mullaloo Sandstone member is present at the Ascot site (Davidson, 1995). The Mullaloo Sandstone member is underlain by the Kardinya Shale confining bed of the Osborne Formation.

The groundwater salinity in the aquifer in 1995 was mapped as 500 mg/L to 1,000 mg/L TDS (Davidson, 1995). However, data in recent years indicates the aquifer salinity levels are increasing due to saltwater intrusion.

Perth South – Perth Leederville confined aquifer is below -160 mAHD and is approximately 370 m thick. In the Ascot area the Leederville Aquifer is confined but further to the south and north of Perth it is hydraulically connected to the Superficial Aquifer. The Leederville Aquifer comprises of four formations under the Ascot Racecourse, namely Henley Sandstone, Pinjar Member, Wanneroo Member and the Mariginiup Member.

Groundwater flow is generally westwards through the Leederville Aquifer. Lateral discharge can occur to the Kings Park Aquifer but depends on levels of abstraction in the Leederville Aquifer adjacent to the discharge area.

Generally, groundwater salinity in the Leederville Aquifer can be divided into an upper and a lower zone. The upper zone is generally fresh with salinity ranging from 250 to 1,000 mg/L. Salinity in the lower zone (below -400 mAHD) ranges from 1,000 mg/L to greater than 3,000 mg/L.

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Groundwater is abstracted from an artesian production bore (PB1) assigned to the Leederville Aquifer to meet the irrigation demand of the Racecourse and surrounds. The bore is located adjacent the Irrigation Lake at the south corner of the Ascot Racecourse track. The bore is screen in the upper Leederville Formation which extends between -160 mAHD and -400 mAHD.

The allocation status of aquifers is further discussed in **Section 5.1.2**.

3.7.2.2 Groundwater levels

Perth Groundwater Map indicates (DWER 2023e) that the regional groundwater level sits at 0.5 m AHD across the site. Therefore, the groundwater clearance from southeast to northwest of the site ranges from 6.5 m to 0.5 m.

There are two groundwater level and quality monitoring bores (Bore1 and Bore2) and one production bore (PB1) within the Racecourse (see **Figure 2**) which are monitored by Perth Racing. Groundwater levels in these are monitored monthly.

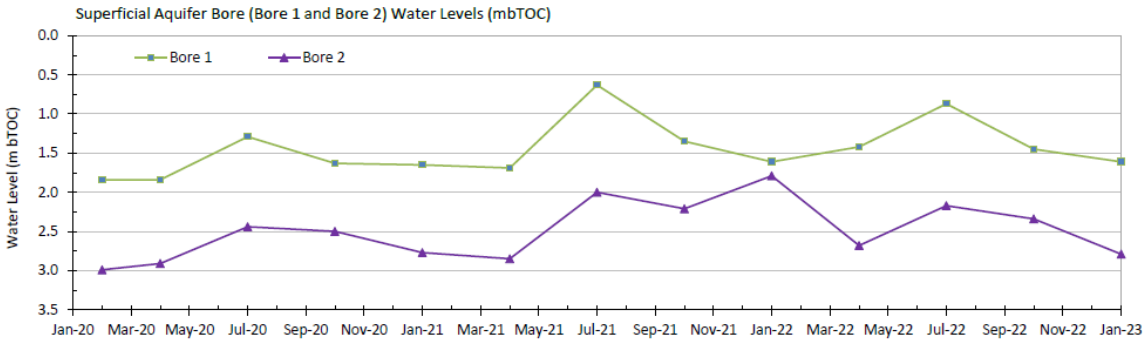


Plate 1: Groundwater levels within the Superficial Aquifer at Bore1 and Bore2 (JDA 2023)

Plate 1 depicts the groundwater levels observed within the Racecourse which clearly indicates the rise and fall of groundwater levels seasonally. The peak groundwater level at Bore 1 and Bore 2 were recorded 1.26 m AHD and 1.70 m AHD respectively, during August 2022.

Monitoring has recently been undertaken within Precinct A. Six monitoring wells were installed for the Precinct A geotechnical investigation. The groundwater depth below the surface of the Precinct A (during January 2024) varied from 1.09 m below ground level (mBGL) to 2.37 mBGL (Douglas Partners 2024).

Monitoring has also recently been undertaken within Precinct D by Galt Geotechnics during the geotechnical investigation. The highest groundwater level beneath Precinct D is reported as 3.03 mBGL during February 2024 (Galt 2024).The various monitoring data/sources have been collated to prepare estimated maximum groundwater contours beneath the site. These have also considered the surface elevation of swales adjacent to the racetrack and the reported TWL of the Wetland Lake. The regional groundwater levels are shown in **Figure 2,** with spot heights recorded at the various locations also provided. It is noted that these do not necessarily represent the annual maximum groundwater levels at all parts of the site given the various timing of measurement of groundwater. Notwithstanding the variability of timing, it is likely that the management of stormwater (and in

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particular infiltration) will more likely be influenced by localised soil conditions than seasonal peak groundwater levels in the superficial aquifer.

3.7.2.3 Groundwater quality

Water quality monitoring was conducted monthly at PB1 and quarterly at Bore1 (JDA 2023). Water quality parameters those were analysed during the monitoring period include:

Monitoring Bore (Bore1)

- EC
- pH
- TDS
- Total phosphorus (TP)
- Filterable Reactive Phosphorus or Phosphorus in Orthophosphate (PO_4-P)
- Total Nitrogen (TN)
- Nitrogen in Total Oxidised Nitrogen (NO_x-N)
- Nitrogen in Ammonia (NH_3-N)
- Total Kjeldahl Nitrogen (TKN)

Production Bore (PB1)

- Electrical conductivity (EC)
- pH
- Total Dissolved Solids (TDS)

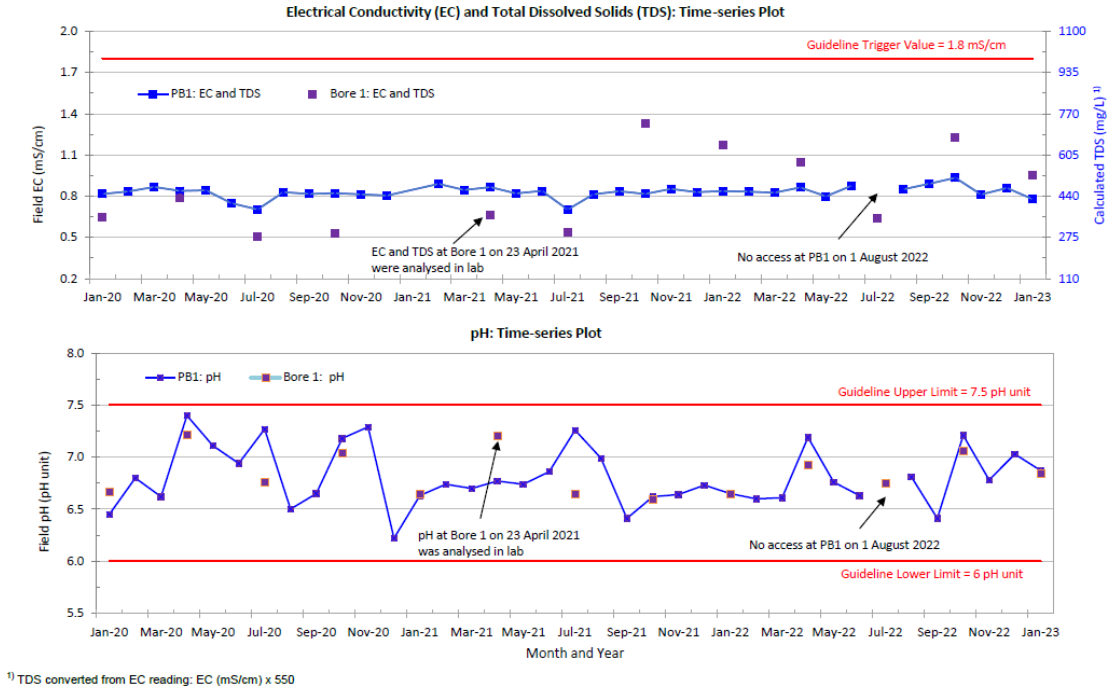


Plate 2: Water Quality (EC, TDS and pH) Monitoring results (JDA 2023)

Plate 2 and **Plate 3** illustrate the water quality of the groundwater within the site is generally consistent over the monitoring periods with typically low variance in parameters tested. EC, TDS and

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pH values did not display any exceedances of the trigger values. However, TN and TP regularly exceeded the ANZECC guideline trigger value of 1.2 mg/L and 0.065 mg/L (respectively). It is also noted a large exceedance in TN occurred in August 2022 however this does not appear to be representative of long-term values.



Plate 3: Water Quality (TN and TP) Monitoring results (JDS 2023)

3.8 Summary of existing environment

In summary, the environmental investigations conducted to date indicate that:

- The site is being used for horse racing, mixed uses (i.e. car park, stables and entertainment/hospitality venues, and commercial). Some portions of the site are only used infrequently (e.g. for parking or events).
- The site is located in an area of moderate to high rainfall, receiving 756.3 mm on average annually with the majority of rainfall received between June and August.
- The majority of the site has a relatively flat topography of 1 mAHD at the northwest (along the Swan River) and 2 mAHD to the south and rising to 7 mAHD to the east of the site.
- The site is within the Swan River Terraces system and displays Guildford formation soils of alluvial and leached yellow sand described as:
    - **Ms2 –** Sandy Silt: Strong brown to mid grey, mottled, blocky, fine sand, hard when dry, variable clay content of alluvial origin
    - **Ms4 –** Sandy Silt: light yellow brown, blocky, mottled some fine to medium sand, soft when moist, variable clay content
    - **S8 –** Sand: very light grey at surface, yellow at depth, fine to medium-grained, sub rounded quartz, moderately well sorted of eolian origin
- The groundwater depth below the surface of Precinct A varies from 1.09 m mBGL to 2.37 mBGL (Douglas Partners 2024).

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- The highest groundwater level beneath Precinct D is reported 3.03 mBGL during February 2024 (Galt 2024).
- Most of the site is considered to have a high to moderate risk of ASS occurring, however some portions of Precinct B, Precinct C and the Racecourse are considered to have a moderate to low risk of ASS occurring within the 3 m of the natural surface.
- The northern portion of the site along the Swan River is identified as an ESA.
- The entirety of the site is classified as a SSA and classified as:
  - a) Estuary catchments on the Swan and Scott Coastal Plains.
  - f) The area is <1 km up-groundwater-gradient and 250 m down-gradient of a significant wetland; or where the groundwater gradient is unknown within 1 km of the significant wetland.
- The following wetlands are located within the site and these are classified as:
  - Multiple Use category wetland (MUW) area (UFI 8424, UFI 8425, UFI 8426).
  - Resource Enhancement wetland (REW) area (UFI 8423).
- The dominant hydrological feature of the site is the Swan River estuary. The northern boundary of the site falls within the Swan Canning Development Control Area (DCA) (CoB 2018) and Swan Canning River Park.
- The floodway of the Swan River is immediately adjacent to but not within the site. The 1% AEP flood elevation of the Swan River adjacent to the site is 2.8 mAHD.
- There are two existing major drainage network systems within or adjacent to the site include:
  - The CBMD, managed by the Water Corporation. This currently receives runoff from Precinct C (via the CoB drainage network) and Precinct E.
  - The CoB local piped drainage network, which exists along Mathieson Road, Grandstand Road and the northern portion of Resolution Drive.
- There are three lakes (Irrigation Lake, Lined Lake and Wetland Lake) located within the centre of the Racecourse. These are understood to receive runoff from the grandstand buildings in Precinct B and stables/buildings in Precinct C.
- Allowable discharge to the CBMD from the local drainage network is 0.95 m^3/s based on Water Corporation modelling.
- The groundwater beneath the site is a multi-layered system consisting of the Superficial, Kings Park Formation, Leederville and Yarragadee aquifers.
- Regional groundwater mapping indicates that the groundwater levels across the site are at approximately 0.5 m AHD.
- Local groundwater level monitoring indicates that annual maximum groundwater levels (recorded in August 2022) were measured at 1.26 m AHD and 1.70 m AHD at Bore 1 and Bore 2 respectively. Groundwater levels in adjacent areas included Precinct A levels at 1.09 mBGL to 2.37 mBGL and Precinct D levels of approximately 3.03 mBGL.
- Water quality monitoring indicates that EC, TDS and pH values do not exceed guideline trigger values. However, TN and TP concentrations continually exceed the ANZECC guideline trigger value of 1.2 mg/L and 0.065 mg/L respectively.

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4 Design Criteria and Objectives

This section outlines the objectives and design criteria that this LWMS and future management plans must achieve. The water management strategy includes water conservation, groundwater management and stormwater management.

4.1 Integrated water cycle management

Better Urban Water Management (WAPC 2008a) endorses the promotion of integrated water cycle management and application of WSUD principles to provide improvements in the management of stormwater, and to increase the efficient use of other existing water supplies.

The key principles of integrated water cycle management include:

- Considering all water sources, including wastewater, stormwater and groundwater
- Integrating water and land use planning
- Allocating and using water sustainably and equitably
- Integrating water use with natural water processes
- Adopting a whole catchment integration of natural resource use and management.

Integrated water cycle management addresses not only physical and environmental aspects of water resource use and planning, but also integrates other social and economic concerns. Water management design objectives should therefore seek to deliver better outcomes in terms of:

- Potable water consumption
- Stormwater quality management
- Groundwater management.

The first step in applying integrated water cycle management in urban catchments is to establish agreed environmental values for receiving environments. The existing environmental context of the site has been discussed in **Section 3** of this document. Guidance regarding environmental values and criteria is provided by a number of national and state policies/guidelines and site-specific studies undertaken in and around the site. These were detailed in **Section 1.4** and **Section 1.5** respectively.

4.2 Water conservation

This LWMS proposes the following water conservation criteria:

Criteria WC1 For residential dwellings, consumption target of 60 kL/person/year.

Criteria WC2 Ensure the efficient use of all water resources

Criteria WC3 Non-potable irrigation water to be sourced from existing groundwater licences held over the area.

The manner in which this objective will be achieved is further detailed in **Section 5**.

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4.3 Stormwater management

The principle behind stormwater management at the site is to mimic the pre-development hydrological conditions and utilise existing infrastructure where sensible to do so, as described in **Section 3.7**. This principle and the guidance documents discussed in **Section 1.4** and **Section 1.5** and have guided the stormwater management criteria.

Criteria SW1 Retain and treat the first 15 mm of rainfall as close to source as possible and within site.

Criteria SW2 Detain up to 1% AEP rainfall event on-site.

Criteria SW3 Post-development critical 1% AEP peak flows leaving the site to mimic pre-development peak flows.

Criteria SW4 Finished floor levels must have a minimum of 300 mm clearance above the 1 % AEP TWL in the FSA.

Criteria SW5 All lots must have a minimum of 500 mm clearance above the 1 % AEP flood level in the Swan River.

Criteria SW6 Nutrient concentrations within surface water discharging from the site to the Swan River are to meet regional water quality targets.

Criteria SW7 Reduce nutrient loads by applying appropriate non-structural measures.

Criteria SW8 Design infiltration areas to avoid creating mosquito habitat.

The manner in which these objectives will be achieved is further detailed in **Section 6**.

4.4 Groundwater management

The principle behind the groundwater management strategy is to maintain the existing groundwater hydrology. The groundwater management criteria for the site include:

Criteria GW1 Surface based infiltration structures should have 300 mm clearance above the MGL.

Criteria GW2 Habitable floor levels should have a clearance to the MGL of at least 1.2 m.

The manner in which the groundwater management objectives will be achieved is further detailed in **Section 7**.

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5 Water Conservation Strategy

5.1 Fit for purpose water use

Conservation of water through fit-for-purpose use and best management practices is encouraged so that scheme water is not wasted. Fit-for-purpose describes the use of water that is of a quality suitable for the required use of the water. Fit-for-purpose principles have been utilised in the water conservation strategy for the site and will achieve **Criteria WC1**.

5.1.1 Scheme water supply

Scheme water will be supplied by the Water Corporation Integrated Water Supply System. Scheme water is proposed to be used for all potable uses. Scheme water will also service some external uses, where fit-for-purpose alternatives are not available.

5.1.2 Groundwater

As discussed in **Section 3.7.2.1**, the site is located beneath a multi-layered system comprising of the Superficial Swan, Kings Park Formation, Leederville and Yarragadee aquifers.

The proponent holds a groundwater allocation from the Perth South Leederville confined aquifer for the following:

- GWL 178519 - 347,000 kL

This licence will be used to meet the irrigation requirements for the Racecourse Precinct, Precinct A, Precinct B and part of Precincts C and E.

The above-mentioned measure will achieve **Criteria WC3**.

5.1.3 Rainwater tanks

Rainwater tanks (RWTs) can be used within private lots to harvest roof runoff. This water is considered non-potable but can be used to supplement non-potable water uses.

5.2 Lot scale water conservation measures

This LWMS proposes that the water conservation measures to be adopted would include RWTs, waterwise principles for lot scale gardens and within estate landscaping (WWG) and water efficient fixtures and appliances (WEFA) to ensure that the residential portion of the development minimises the use of water. These are summarised in the following sections.

5.2.1 Rainwater tanks

The use of RWTs will not be mandated, and the stormwater quantity management strategy does not rely on their use. They are therefore only considered to be a water conservation measure. Given that rainwater tanks will not be mandated or supplied by the proponent, it has been assumed that these would be implemented by 7.5% of households within Precinct D. Whilst they may be considered for

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Precinct A they are not proposed to be taken up in other Precincts. The assumed uptake rate has been based on data obtained from the Australian Bureau of Statistics (ABS 2013). It is assumed (for the purposes of the water balance analysis) that all rainwater tanks have a capacity of 3 kL.

5.2.2 Water efficient fixtures and appliances

Water conservation strategy for the site proposes the use of WEFA. Water efficient fittings will be mandated through the building licence, while uptake of water efficient appliances can be encouraged by State and Local Government rebates in addition to education from the proponent at point of sale. WEFA are relevant to Precinct A and Precinct D. It is assumed that water efficient appliances will be implemented by 40% of households within Precinct A and Precinct D, which has been based on data obtained from the Australian Bureau of Statistics (ABS 2013, 2014).

5.2.3 Waterwise gardens

Landscape packages will not be provided as a part of the land sale contract. Lot scale waterwise gardening principles (WWG) are only relevant for Precinct D. These will be achieved by promoting Waterwise gardening principles (WWG) (WC 2003) at the time of sale of land within Precinct D. It is assumed that 75% of households in Precinct D will implement WWG principles within lot gardens (ABS 2013). WWG principles include:

- Soil to be improved with soil conditioner certified to Australian Standard (AS) 4454 to a minimum depth of 150 mm where turf is to be planted and a minimum depth of 300 mm for garden beds.
- The irrigation system shall be designed and installed according to best water efficient practices:
  - The controller must be ‘hydrozoned’.
  - Emitters must disperse coarse droplets or be subterranean.
- Garden beds to be mulched to 75mm with a product certified to AS4454.
- Increasing community awareness of water conservation by promoting Waterwise practices, fixtures and fittings at the point of sale.

WWG principles will also be considered for Precinct A and Precinct E, however it is anticipated that these areas will have minimal irrigated landscaping to which this would apply. The current approach to irrigation within the Racecourse Precinct, Precinct B and Precinct C adopts a range of water conservation measures (including non-irrigated area and retention of existing trees/vegetation) to ensure that Perth Racing operates within the available groundwater allocation. This approach is not proposed to be significantly modified.

The above measures will assist in achieving **Criteria WC1** and **WC2**.

5.3 Water use analysis

5.3.1 Lot scale water use analysis

A water use analysis has been undertaken for Precinct D to estimate the expected individual residential lot water use to demonstrate the effectiveness of the water conservation strategy. The water use analysis has been based on the rates and calculation methodology presented in the Water

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Corporation (2011) spreadsheet *AltWaterSupply_Water_Use_Model.xls*. This spreadsheet has been adapted to model the effects of using the water conservation measures proposed, and key assumptions include:

- Lot area has been based on a conceptual lot layout (see **Appendix A**).
- Average residency of 2.6 people per single lot dwelling. This value has been calculated from data provided by ABS for new housing developments in Perth (ABS 2022).
- Assumed up-take rates include:
  - 100% uptake of water efficient fittings
  - 40% uptake of water efficient appliances
  - 7.5% uptake of RWTs
  - 55% uptake of WWG principles.

The results of the water balance indicate that if households in Precinct A and Precinct D adopt the proposed water conservation measures (e.g. efficient fittings, RWT, WWG principals) at typical uptake rates they will use an average of 33.0 kL/year/person. This achieves the water target of no more than 60 kL/year/person of scheme water and satisfies **Criteria WC1**.

5.4 Wastewater management

The wastewater generated from the site will be managed by connecting the development to the Water Corporation deep sewer network.

5.5 Water conservation management criteria compliance

A summary of the proposed water conservation management criteria and how these are addressed is provided within **Table 1.**

Table 1: Water conservation management criteria compliance

Criteria number	Criteria description	Manner in which compliance will be achieved
WC1	Residential consumption target of 60 kL/person/year scheme water.	Provide advice to residents in Precinct A and Precinct D on water conservation measures
		RWTs can be utilised for non-potable uses within Precinct D
		Promotion and use of WWG in lots within Precinct D
		Promotion and use of water efficient appliances to Precinct A and Precinct D
		Mandate water efficient fittings within Precinct A and Precinct D
WC2	Ensure the efficient use of all water resources.	Use of waterwise landscaping principles in open spaces
		Open spaces designed to use no more than allocated groundwater
		Minimise water requirements for open space and verge maintenance
		Use of water efficient appliances within Precinct A and Precinct D
		Use of WWG principles in lots in Precinct D

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Table 2: Water conservation management criteria compliance (Continued)

Criteria number	Criteria description	Manner in which compliance will be achieved
WC3	Non-potable irrigation water to be sourced from existing groundwater licences held over the area.	The proponent holds a groundwater Licence with an allocation of 347,000 kL per annum which will meet the irrigation requirements of the Racecourse and surrounding Precincts.

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6 Stormwater Management

The principle behind the stormwater management strategy for the site is to maintain the existing hydrology by detaining, retaining and treating runoff from the small rainfall event (i.e. first 15 mm) as close to source as possible and detaining/retaining the major event (1% AEP) on site prior to discharge to either the centre of the Racecourse (i.e. self-retained) or to the CBMD the pre-development outflow rates. Due to the existing soil conditions (See **Section 3.5**), the site is not well suited for structural controls utilising infiltration of stormwater unless modified. However, given that fill will be utilised to ensure that habitable floor levels are above the 1% AEP flood elevation of the Swan River, final elevations will be approximately 4 mAHD. Where fill is used to achieve this there will be sufficient clearance to MGL and permeability of soils to adopt WSUD measures which utilise infiltration.

WSUD measures proposed will vary across the Precincts and will include:

- BRAs to achieve water quality treatment (Precincts A, C, D and E)
- FSAs to detain runoff prior to discharge to the adjacent road network system
- Subsurface infiltration cells that will facilitate at-source infiltration (Precinct D)
- Flood storage integrated into existing surface water bodies located centrally within the Racecourse (for Precinct A and C)
- FSAs to provide flood detention and infiltration as close to source as possible (Precinct E).

The overall approach to precinct drainage is shown on **Figure 7**.

The WSUD measures that will be implemented as a part of the development are described in the following sections. Precinct B has been assumed to be self-retained and a portion of Precinct C (already connected to the Lakes in the centre of the track) has been assumed to be the same as it is now. Surface runoff modelling undertaken using XPSWMM has been used to inform the design of stormwater infrastructure as detailed in the following sections. Assumptions used to represent the post-development environment are provided in the modelling assumptions report in **Appendix D**.

6.1 Lot scale drainage measures

Lots within Precinct D and Precinct E will retain the first 15 mm rainfall event runoff within soakwells/soakage which will need a capacity of 150 m^3/ha. Lot storage is the responsibility of the lot owner and will be assessed as part of the building approval process prior to construction.

The use of soakwells/soakage areas will assist in achieving **Criteria SW1**.

6.2 Development drainage measures

6.2.1 Bio-retention areas

Runoff from the first 15 mm of rainfall will be captured and retained within a vegetated BRA located in open spaces. The BRA is assumed to have a depth of 500 mm with 1:3 side slopes. Treatment of

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runoff will be provided through interaction with vegetation and adsorption to sand particles through infiltration prior to reaching groundwater.

The BRA will be underlain by material with an appropriate PRI (nominally a PRI of 20 at 150 mm or equivalent). It is acceptable for this to be achieved with a thicker layer of lower PRI soil (e.g. 300 mm of PRI 10). This will be finalised prior to detailed design. The location of the BRA will either be in a drainage reserve, an open space or they may be within the centre of the Racecourse as a separate treatment area (separate from the existing Lakes). The sizing and spatial requirements of BRAs will be confirmed in the detailed designs.

The use of BRA will assist in achieving **Criteria SW1, SW6,** and **SW8**.

6.2.2 Flood detention/storage

An FSA will be utilised to detain runoff above the first 15 mm and up to the 1% AEP rainfall event. To achieve this, the invert of the FSA will have sufficient clearance above groundwater 300 mm. FSAs are assumed to be 1.2 m depth with 1:6 side slope and will be integrated into POS or drainage reserve, and will overflow to the Water Corporation drainage network. The sizes and spatial requirements for the FSA will be confirmed in the detailed designs and development stages.

The use of an FSA will assist in achieving **Criteria SW1, SW2, SW4,** and **SW6.**

6.2.3 Subsurface storage

Surface runoff generated by lots, stables and hardstand/carpark areas will be directed into sub-surface storage. Precinct D will have an independent drainage pipe network within individual precincts which convey flows to downstream sub-surface retention structures.

These structures have been sized to accommodate up to the 1% AEP rainfall event and have been designed as a 1 m deep structure. The detailed configurations could be modified to suit site constraints. These will either be location beneath road reserve/verge or beneath an open space and will require an overflow connection to the local (CoB) drainage network to ensure that they can dry out. The sizes and spatial requirements for the subsurface storages are provided in **Table 2** and illustrated in **Figure 7A**: Precinct A Stormwater Management Plan

Figure 7B: Precinct C Stormwater Management Plan

Figure .

The use of the sub-surface storage will assist in achieving **Criteria SW1, SW2,** and **SW6.**

6.2.4 Lake storage

Precinct A and Precinct C (stables) will first direct runoff to a bio-retention areas, however overflow from these will be catered for in the Wetland Lake. In a 1% AEP storm event an additional 78 mm of depth will occur within the Wetland Lake from both Precincts.

As indicated in **Section 3.7.1.2**, the Wetland Lake is connected/discharges to the Swan River via a 375 mm and 450 mm culvert. These are not proposed to be modified. The combined nominal flow capacity of the 375 mm and 450 mm pipes is approximately 0.4 m^3/s. The inlet, length, grade, etc of

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these pipes is not proposed to be modified and therefore the current overflow regime from the site to the Swan River will remain unchanged.

The use of the Wetland Lake storage will assist in achieving **Criteria SW1, SW2, SW3,** and **SW6.**

6.3 Precinct based drainage approach

6.3.1 Precinct A

There is no current connection point for drainage to be exported from site to the local CoB network. Runoff will therefore need to be managed within Precinct A and the Racecourse. Precinct A will require a single BRA that will address treatment of water quality; this will be located within Precinct A as close to source as possible. The BRA should have the following characteristics:

- Base will be vegetated with reeds/rushes as per a biofilter
- 1:3 side slopes
- Depth of 300 – 500 mm pending final design
- Volume of the BRA will need to achieve 194 m^3
- Nominal surface area of 450 m^2.

In addition to the volume achieved by the BRA, in a major (1% AEP) storm event a further 1,345m^3 of flood retention storage will be required. The proposed earthwork level of Precinct A (4.0 mAHD) means that it is possible to direct runoff exceeding BRA capacity to the Wetland Lake in the centre of the Racecourse. This approach will add approximately 52 mm to the central 2.6 ha Wetland Lake.

The volumes of storage required and locations of storage across the Precincts is summarised in **Table 2**. The approach to water management in Precinct A is shown in **Figure 7A**.

6.3.2 Precinct B and Racecourse

As indicate previously, there are no substantial changes proposed to Precinct B. Precinct B currently manages surface runoff within the precinct and adjacent Racecourse, largely via at source infiltration, swales around the perimeter of the track surface and the existing lake system Precinct B and the Racecourse are proposed to be retained largely as is.

As indicated in **Section 3**, the Wetland Lake currently has a piped overflow connection to the Swan River. This overflow pipe(s) reportedly rarely overflow and can be controlled via a structure at the outlet (which also prevents tidal influence on the Wetland Lake). The Wetland Lake has a 2.6 ha surface area, and therefore can provide significant volume of stormwater retention in the event of a major storm event. There are no new connections proposed to the Swan River and there are no changes proposed to the management approach currently taken for the Wetland Lake and the current piped outlets.

6.3.3 Precinct C

Precinct C is the existing stables area, adjacent carparks and future stables areas along the south and east of the Structure Plan area. The existing buildings currently either infiltrate runoff at source or

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discharge to the Lined Lake in the centre of the Racecourse. This approach is proposed to be retained.

Surface runoff generated by hardstand/carpark areas of Precinct C will be directed and discharged towards Precinct E via the existing connections to the CoB drainage network along Matheson Road or via the existing pipe connection in the southwest of the Structure Planning area to the existing connection to the CBMD (Water Corporation drainage system) within Precinct E.

The drainage requirements for the southern (carpark) portion of Precinct C are therefore detailed with those proposed for Precinct E.

For the two currently undeveloped portions of Precinct C (future stables along the south and east of the Structure Plan area), the post-development drainage system will collect the runoff from these areas and direct them to the centre of the Racecourse. Initial treatment will be provided by a BRA which accommodates 418 m^3, with a nominal surface area of 924 m^2.

Runoff exceeding the capacity of the BRA (which will be 684 m^3) will be directed to the Wetland Lake. The direction of major event stormwater runoff to the Wetland Lake will add 26 mm to the top water level of the Wetland Lake.

The volumes required to be treated and for flood mitigation for Precinct C are summarised in **Table 2**. The approach to water management in Precinct A is shown in **Figure 7B**.

6.3.4 Precinct D

As indicated in **Section 6.1**, private lots and the childcare building within Precinct D are assumed to retain the first 15 mm within the lot boundary, most likely within soakwells, which should be appropriate given that some measure of imported fill will be required to meet clearance above regional flood levels. Based on the density of lots proposed in Precinct and lack of open space, this precinct will need 42 m^3 of subsurface storage to accommodate and detain the 1% AEP storm event to ensure that the post development peak flow rates will mimic the pre -development conditions. This is assumed to be located adjacent to Resolution Drive as shown in **Figure 7C**. The outflow from this Precinct will likely be predominantly overland flow once the first 15 mm of storage has reached capacity, however a low flow to ensure that these can adequately drain between storm events is recommended.

The volumes required to be treated and for flood mitigation for Precinct D are summarised in **Table 2**.

6.3.5 Precinct E

Surface runoff from across Precinct E (inclusive of Precinct C hardstand/carpark) will be conveyed via the drainage network firstly to a BRA for water quality treatment and then this will overflow to an FSA (detention drainage structure) at the south western corner of Precinct E for detention of the 1% AEP storm event. Overflow from Precinct E basin will discharge into the CBMD (Water Corporation drainage system) at existing flow rates. The Water Corporation surface runoff modelling of the CBMD indicates that the local drainage network contributes 0.95 m^3/s at node CNA008. This is understood to be contributed to by existing 450 mm and 525 mm pipes beneath Resolution Drive and therefore it is assumed that 0.62 m^3/s is taken up by the existing pipe network, and approximately 0.33 m^3/s of

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capacity is available to convey runoff from Precinct C, Precinct E and upstream contributing catchments.

The volumes required to be treated and for flood mitigation for Precinct E are summarised in **Table 2**. The approach to water management in Precinct E is shown in **Figure 7D**.

6.3.6 Precinct drainage summary

The requirements for water quality treatment within the Precincts is summarised in **Table 2**.

Table 2: Precinct drainage summary

Precinct	First 15 mm requirement (m^3)	Location of first 15 mm	1% AEP flood mitigation requirement (m^3)	Location of 1% AEP flood mitigation requirement	1% AEP outflow from site
Precinct A	194	BRA located within Precinct A	1,345	Wetland Lake, centre of Racecourse	0
Precinct B	No change to existing	Precinct B	No change to existing	Precinct B	Self-retained
Precinct C (Stables)	418	BRA located in the centre of the Racecourse	684	Wetland Lake in centre of Racecourse	0
Precinct C (carpark)	Combined with Precinct E volumes	BRA in Precinct E	Combined with Precinct E volumes	FSA in Precinct E	
Precinct D	28	Subsurface storage cells beneath road reserve/drainage reserve	42	Subsurface storage cells beneath road reserve/drainage reserve	0.402 m^3/s to local drainage network/road pavement
Precinct E	365	Southwest corner of Precinct E, adjacent to FSA	930	South west corner of Precinct E	0.32 m^3/s to CBMD

There will be no new connections to the Swan River or to the CBMD, and the existing flow regimes at these outlet points will be maintained. Specifically with regard to overflow from the Wetland Lake which occurs via gravity, the peak flow rates that the existing 375 mm and 450 mm pipes are capable of achieving (approximately 0.4 m^3/s) will not change given that the inlet, length, grade and outlet of these pipes is not proposed to be modified.

Precinct D will require a connection to the local drainage network, however the outflow rate will be nominal, and has not been accounted for when sizing the subsurface storage cells within Precinct D. The direction of runoff from Precinct A and a portion of Precinct C to the centre of the Racecourse will require a BRA with a surface area of 1,105 m^2 (for Precinct C) and will add a total of 78 mm depth to the top water levels within the Wetland Lake.

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The precinct areas and a summary of the approach to surface water management are shown on **Figure 7**.

6.3.7 Non-structural measures

A number of non-structural measures will be implemented to help reduce nutrient loads within stormwater runoff. These measures include:

- Minimising fertiliser use to establish and maintain vegetation within POS and road verges.
- Street sweeping at regular intervals.
- Ongoing management of nutrient application to Precinct B and the Racecourse.
- Precinct A to adopt a similar nutrient application management regime as that currently applied to Precinct B.
- Minimising the use of turf within open spaces.
- Active management of equine waste within Precinct C and the Racecourse. This includes manual collection and remove of manure from site.
- Education of residents regarding fertiliser use and nutrient absorbing vegetation species within lots.

The above measures will assist in achieving **Criteria SW7**.

6.3.8 Earthwork levels

Finished floor levels of the entire development will be set at minimum of 4.0 mAHD (See **Appendix C**) which will assist in achieving **Criteria SW5**.

6.4 Stormwater criteria compliance

A summary of the proposed stormwater design criteria and how these are addressed is provided in **Table 3**.

Table 3: Stormwater management criteria compliance

Criteria number	Criteria description	Manner in which compliance will be achieved
SW1	Retain and treat the first 15 mm of rainfall as close to source as possible	Lots within Precinct D and Precinct E to retain the first 15 mm of rainfall on lot in soakwells/soakage. Lot storage will be the responsibility of the lot owners.
SW2	Retain up to 1% AEP rainfall event on-site.	Runoff up to the 1% AEP to be detained within the FSA in Precinct A. Precinct A and a portion of Precinct C will ultimately discharge to the centre of the track.
		Runoff up to 1% AEP to be managed with the sub-surface storage in Precinct D.
SW3	Post-development critical 1% AEP peak flows leaving the site to mimic pre-development peak flows.	Runoff up to 1% AEP event to be detained in the detention basin and subsurface storage which will maintain the pre-development peak flow of 0.32 m^3/s from Precinct E and 0.463 m^3/s from Precinct D respectively.
SW4	Finished floor levels must have a minimum of 300 mm clearance above the 1% AEP TWL in the FSA.	It is anticipated that the FSA and detention basin invert will be set so that the habitable floor levels must have a

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		minimum of 300 mm clearance above the 1% AEP TWL in the basins.
SW5	All lots must have a minimum of 500 mm clearance above the 1% AEP flood level in the Swan River.	The 1% AEP flood level in the Swan River is 2.8 mAHD. The preliminary bulk earthworks concept provided in shows that finished floor level will be at 4.0 mAHD.
SW6	Nutrient concentrations within surface water discharging from the site to the Swan River are to meet regional water quality targets.	BRA will be designed so that after treatment the long term nutrient concentrations within surface water meet the regional water quality targets.

Table 4: Stormwater management criteria compliance (Continued)

Criteria number	Criteria description	Manner in which compliance will be achieved
SW7	Reduce nutrient loads by applying appropriate non-structural measures	• Minimise use of fertilisers within open space and road verges. • Street sweeping at regular intervals. • Use of drought tolerant turf species. • Education of residents regarding fertiliser use
SW8	Design infiltration areas to avoid creating mosquito habitat	Stormwater infrastructure will be designed to ensure all runoff is infiltrated within 96 hours.

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7 Groundwater Management

7.1 Groundwater management approach

The principle behind groundwater management is to maintain the existing hydrology across the site, provide appropriate protection from groundwater inundation, and maintain or improve existing groundwater quality.

7.2 Groundwater level management

The regional groundwater map (DWER 2023e), localised measurement of groundwater and the surface contours of the site (see **Section 3.4** and **Figure 2**) indicate that there is sufficient clearance to groundwater beneath the site to facilitate infiltration of stormwater runoff, on the basis that fill is being imported to raise finished levels to 4.0 mAHD.

Whilst the underlying parent soils have demonstrated generally low permeability, the earthworks approach will require import of fill to 4.0 mAHD to achieve clearance above the 1% AEP flood level in the Swan River for Precinct A, Precinct D and Precinct E. Therefore, stormwater will be encouraged to infiltrate at source wherever possible to minimise stormwater runoff and to adopt an at-source approach to management of runoff where possible. This will occur within soakwells, permeable portions of lots and BRAs which will have at least 300 mm of clearance above the MGL. The above-mentioned measure will assist in achieving **Criteria GW1**.

For Precinct C (stables) runoff will be directed to the centre of the racetrack. The stables facilities do not require a specific separation from groundwater, and in order to accommodate equine uses the land between buildings/facilities should be as flat as possible. The most appropriate response is therefore to accommodate stormwater quality treatment and flood retention within the centre of the racetrack. Given the low permeability of soils in the centre of the racetrack, the BRA is unlikely to achieve separation from groundwater or the low permeability soil layer. This is however considered acceptable as it is consistent with the presence of the three Lakes currently within the centre of the racetrack.

The control of groundwater by subsoil drainage is not proposed due to requirements to provide adequate clearance above the 1% AEP flood levels and the proximity of the Swan River. Rather, groundwater separation requirements will be achieved by the use of imported fill as described above. The earthworks strategy provided in **Appendix C** shows that all habitable floor levels will be greater than 1.2 m above the MGL. The above-mentioned measure will assist in achieving **Criteria GW2**.

As previously discussed, there are no changes proposed to the form of development within Precinct B or to the Racecourse. These areas are currently managed by the swales aligned with the existing racetrack which control soil moisture conditions in these areas, and which discharge to the Wetland Lake. This approach will be retained in the post-development environment.

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7.3 Groundwater quality management

Whilst not specified in a design criterion, the main objective for groundwater quality management is to maintain or improve the existing groundwater quality. This can be achieved by reducing the total nutrient load into the groundwater that originates from the site. Groundwater that originates from the site is surface runoff that has infiltrated into the soil profile. Therefore, improving groundwater quality can be achieved by treatment of the surface runoff prior to infiltrating to groundwater.

The reduction of nutrient load to the groundwater will be achieved by:

- Retention of existing trees within open spaces wherever possible.
- Directing stormwater to a vegetated (with native wetland species) BRA.
- The BRA will be underlain by material with an appropriate PRI (nominally a PRI of 20 at 150 mm or equivalent). It is acceptable for this to be achieved with a thicker layer of lower PRI soil (e.g. 300 mm of PRI 10).
- Minimise fertiliser use to establish and maintain vegetation within open space areas and road verges.
- Ongoing management of nutrient application to Precinct B and the Racecourse.
- Precinct A to adopt a similar nutrient application management regime as that currently applied to Precinct B.
- The use of turf will be minimised, however where adopted a drought tolerant turf species that require minimal water, and nutrients will be used.
- Roll-on turf will be used within the open space areas and road verges, to prevent the high nutrient input requirement during establishment of the turf.
- Garden beds should not be immediately adjacent to BRAs to reduce nutrient transportation into these infiltration areas.
- Active management of equine waste within Precinct C and the Racecourse. This includes manual collection and remove of manure from site.

The above measures will improve the quality of water prior to it infiltrating into the underlying groundwater.

7.4 Groundwater criteria compliance summary

A summary of the proposed groundwater quantity design criteria and how these are addressed within the site is provided in **Table 4**.

Table 4: Groundwater criteria compliance summary

Criteria number	Criteria description	Manner in which compliances will be achieved
GW1	Surface based infiltration should have 300 mm clearance above MGL.	Basin inverts will be set at 300 mm above the MGL, the exception being the BRA in the centre of the racetrack.
GW2	Finished floor levels should have a clearance to the MGL of at least 1.2 m.	Lots will be set at least 1.2 m above the MGL.

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8 Subdivision and Urban Water Management Plans

The requirements to undertake preparation of more detailed water management plans to support subdivision is generally imposed as a condition of subdivision. This will be most relevant to Precinct D. Other precincts may be developed under a Development Approval and therefore water management will likely be documented within a Stormwater Management Plan (SMP). The development of future UWMP/SMPs should follow *Urban Water Management Plans: Guidelines for preparing plans and for Complying with Subdivision Conditions* (DoW 2008).

While strategies have been provided within this LWMS that address planning for water management within the site, it is a logical progression that future subdivision designs and the supportive UWMP/SMP will clarify details not provided within the LWMS. The main areas that will require further clarification within future UWMP/SMPs may include (pending which precinct is being addressed):

- Extent of land uses within Precincts
- Connection to local and Main Drainage networks
- Surface runoff modelling
- Implementation of water conservation strategies
- Non-structural water quality improvement measures
- Management and maintenance requirements
- Construction period management strategy.

These are further detailed in the following sections. As stated above, ongoing (post-development) monitoring of groundwater will be detailed in the UWMP/SPM, however in this LWMS is outlined broadly in **Section 9**.

8.1 Extent of land uses within Precincts

It is expected that the layout and extent of land uses within Precincts may evolve over time. Future water planning documents will need to be updated to align with the most up to date spatial plans for each Precinct. Changes to the spatial plans will likely have an implication on the size of stormwater infrastructure and possibly their location, and should be revised and clarified in future UWMP/SMPs.

8.2 Connection to local and Main Drainage networks

This LWMS has made assumptions regarding connectivity to the CoB local drainage network and to the Water Corporation's CBMD. These are assumptions are made based on the information available at the time of preparing this LWMS and may need to be revised pending feedback from these agencies. This could result in updates to surface runoff modelling (see **Section 8.3**).

8.3 Surface runoff modelling

It is acknowledged that the water management strategies documented in this LWMS are based upon broad-scale assumptions and to some extent regional data. These assumptions are considered

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adequate for development of this LWMS and are of an appropriate level of detail. However, verification of proposed subdivision drainage designs will be undertaken once the specific basin designs and extent of inclusion of finer scale WSUD elements are confirmed.

It is expected that future UWMP/SMPs will update surface runoff modelling as appropriate, and this may result in evolution of the spatial layout of the structure plan/future subdivisions or detailed civil design approach.

8.4 Implementation of water conservation strategies

The non-potable water needs from the Precincts are to be accommodated from the existing groundwater allocation and therefore, track water usage is a significant consideration. Notwithstanding licensed volumes available, there is minimal new open space areas proposed within the Precincts that would demand significant additional groundwater allocation, and it is therefore anticipated that non-potable water needs can be met by the existing licence held by Perth Racing.

A number of potential measures to conserve water have been presented within this LWMS. These water conservation strategies will be incorporated into design and the on-going maintenance of the Precinct A, B and C open spaces and where relevant. Landscape concept design measures that will be incorporated into the water conservation strategy will be further detailed within the future UWMP/SMPs produced for the development.

The manner in which the developer intends to promote water conservation measures discussed in this LWMS to future lot owners will also be discussed within the future UWMP/SMPs.

8.5 Non-structural water quality improvement measures

Guidance for the development and implementation of non-structural water quality improvement measures is provided within the *Stormwater Management Manual for Western Australia* (DWER 2022). Some measures will be more appropriately implemented by CoB for local roads, such as street sweeping, however many can be implemented relatively easily within the design and maintenance of the subdivision and the open space areas. It is expected that any privately managed development areas (e.g. Precinct A, Precinct B and Precinct C) will be managed by Perth Racing or another appropriate management body, and that the management of areas exposed to equine uses (Precinct C and the Racecourse) will continue to adopt contemporary best practice nutrient management.

Future UWMP/SMPs will provide an implementation plan/timing/responsibility for measures such as street sweeping, public education (through measures such as signage that may be implemented to raise awareness), etc.

8.6 Management and maintenance requirements

The management measures to be implemented to address surface water quality (such as the use of vegetation within WSUD assets) will require ongoing maintenance. It is therefore expected that the future UWMP/SMPs will detail management and maintenance procedures that will set out required maintenance actions (e.g. gross pollutant removal), timing (e.g. how often it will occur), locations (e.g. exactly where it will occur) and responsibilities (e.g. who will be responsible for carrying out the

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actions). Given that approval from the CoB will be sought for the proposed measures, it is anticipated that consultation will be undertaken and referral to guiding policies and documents will be made.

8.7 Construction period management strategy

It is anticipated that the construction stage will require some management of various aspects (e.g. soil erosion, sedimentation of downstream water bodies, dust, surface runoff, noise, traffic etc.). The management measures undertaken for construction management will be addressed either in the future UWMP/SMPs or a separate Construction Management Plan (CMP).

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9 Monitoring

9.1 Post-development monitoring

The post-development monitoring of water quality should be undertaken within groundwater immediately upstream and downstream of BRAs within Precinct A, Precinct C and Precinct E. It should also be undertaken at the outlet to or adjacent to the subsurface detention system in Precinct D. This should be undertaken via shallow groundwater bores installed immediately upstream and immediately downstream based on local groundwater flow direction, based on information available at the time (or in the case of Precinct D it could be at the outlet from the subsurface storage cells).

The monitoring should also consider and be generally consistent in the approach with the monitoring undertaken to comply with conditions of Groundwater Licence GWL 178519.

The WSUD measures (BRAs) should also be monitored to ensure their continued effectiveness. This should occur at the outlets from BRAs prior to their discharge to the Wetland Lake. It is noted that this may be difficult to achieve as it will require a rainfall event > 15 mm and to be timed to occur when overflow is occurring or alternatively auto samplers could be employed.

Monitoring of the outlet to the Swan River from the Wetland Lake is not proposed to be undertaken given the infrequent nature of overflow from the Lake to the River. Further, the Lake intersects shallow groundwater and any discharge from the pipes to the River is likely to be influenced by local groundwater quality.

9.1.1 Trigger values

The water quality targets from the *National Water Quality Management Strategy* (ANZECC and ARMCANZ 2000) and the trigger criteria are acknowledged as long term targets for the site, being 1.2 mg/L for TN and 0.065 mg/L for TP. However, it is also recognised that recent site monitoring undertaken (and reported in **Section 3**) shows repeated exceedances of the NWQMS default trigger criteria. Therefore, short term trigger values are proposed based on the approximate average nutrient concentrations measured in groundwater, and these are shown in **Table 5**.

Table 5: Post-development trigger values

Analyte	pH	EC (uS/cm)	TN (mg/L)	TP (mg/L)
Value	6-7.5	1800	3.0	0.15

Monitoring should be undertaken on a quarterly basis and should include:

- pH
- Conductivity
- Dissolved oxygen
- Temperature
- Nutrients (TN, TP)
- Nutrient Species (Ammonium, NH_4, Oxides of nitrogen, NO_x ortho-phosphorous (ORP))

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9.1.2 Condition monitoring

It is proposed that the overall condition of the Precincts will be monitored on a bi-annual basis. This monitoring will be implemented after the completion of the civil and landscaping works and will continue for a period of two years.

A visual assessment will be undertaken to monitor the overall condition of the Precincts, with the aim to ascertain that the maintenance activities are achieving the overall management objectives for the development. The parameters that will be monitored include:

- Gross pollutants
- Terrestrial weeds
- Irrigation
- Vegetation density
- Paths, benches, walkways and other infrastructure.

The management and maintenance objectives will be detailed within future UWMPs along with details of the corresponding monitoring program.

9.1.3 Contingency Action Plan

If the results from the initial monitoring occasion indicate that nutrient concentrations exceed the nominated (short term) trigger values, a number of contingency measures may be employed.

The first action that should be undertaken if groundwater trigger criteria are exceeded is to repeat the monitoring to remove the potential for sampling error. If the repeat monitoring still shows results which breach the trigger value, the next action will be to compare the upstream (incoming) nutrient concentrations with the outgoing (downstream) nutrient concentrations. If the downstream nutrient concentrations are >50% higher than the upstream nutrient concentrations, the following actions should be undertaken:

- Review open space nutrient application practices to identify source if possible.
- Conduct surveillance of Precincts and drainage infrastructure to determine any other potential and obvious nutrient inputs.
- Remove source if possible (i.e. fertiliser input, etc.).
- Remove sediment–bound nutrients by removing basin sediments.
- Manual removal of plant material from BRAs to facilitate further nutrient uptake.

If the downstream nutrient concentrations are found to be generally consistent with the upstream concentrations the next action will be to conduct a site – specific comparison of long-term background data presented in this LWMS. There is some amount of variability (temporally) in nutrient concentrations experienced across the site, and this is the reason for the proposed short and long term trigger values. The comparison of measured values to trigger values and historical monitoring data should then be used as a management tool to determine if the trigger values should be revised.

Following the implementation of the above contingency measures the groundwater quality will be re – sampled. If the results of the analysis still show water quality characteristics which breach the trigger values an additional set of upstream/downstream monitoring bores may be installed. The

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additional bores would be sampled as per the ongoing sampling regime already being undertaken for the first two bores. If the additional locations demonstrate results consistent with the initial monitoring, an assessment will be undertaken as to whether the results are representative of a broader site management concern, and whether any additional contingency actions need to be implemented onsite.

9.2 Reporting

A post-development monitoring report will be prepared on conclusion of the two-year monitoring period and will be provided to CoB on request. This will be undertaken per Precinct once development within the Precinct has occurred. Interim results (spreadsheet) can be provided to either CoB, DWER or DBCA on request during the monitoring program.

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10 Implementation

10.1 Roles and responsibility

The LWMS provides a framework that the proponent can utilise to assist in establishing stormwater management methods that have been based upon site-specific investigations, are consistent with relevant State and Local Government policies and have been endorsed by DWER, DBCA and CoB. The responsibility for working within the framework established within the LWMS rests initially with the proponent, although it is anticipated that a future UWMP/SMP will be developed in consideration of other relevant policies and documents. A summary of roles and responsibilities relevant to the current and future planning stages and ongoing management of the site is summarised in **Table 6**.

Table 6: Roles and responsibilities for various planning stages

Stakeholder	Perth Racing	City of Belmont	Water Corporation	DWER	DBCA	WAPC
LWMS preparation	√					
LWMS review and advice		√	√	√	√	
LWMS approval				√		√
UWMP/SMP & civil design preparation	√					
UWMP/SMP review and approval		√				
Precinct implementation	√					
Post development Precinct management	√					
Public roads/open space ongoing management	√	√				

10.2 Funding

The proponent will fund all subdivision, civil and landscape works within the public realm (roads and open spaces) and within Precincts that are being privately managed (Precinct A, Precinct B and Precinct C). Development of individual lots will be the responsibility of the lot owner at the lot-scale development application stage.

10.3 Review

It is not anticipated that this LWMS will be reviewed unless the Ascot Racecourse Structure plan undergoes significant change post-lodgement of the LWMS. If the proposed layout of the

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development is substantially modified, the surface runoff modelling undertaken for this LWMS may need to be reviewed and the criteria revised to ensure that all are still appropriate.

The next stage of water management for most of the Precincts is UWMP preparation to support subdivision (relevant to Precinct D) or SMP preparation to support Development Approval (relevant to all other precincts). The UWMP/SMP is largely an extension of the LWMS, as it should provide detail to the designs proposed within this LWMS and will demonstrate compliance with the criteria proposed in **Section 4**. Regardless of whether a UWMP or SMP is prepared, these should be prepared as per *Better Urban Water Management*.

The next stage of development following the UWMP is single lot development. It is recognised that certain elements of the LWMS and the UWMP will not be implemented until this late stage, and that there is little or no statutory control that can be applied to ensure the implementation of any remaining measures. While the remaining measures are unlikely to be enforced at this stage their implementation could be encouraged by the CoB through policy (or modification of these where necessary), building licence or awareness programs (such as the Water Corporation Waterwise program).

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11 References

11.1 General references

The references listed below have been considered as part of preparing this document.

Australian Bureau of Statistics (ABS) 2013, *4602.0.55.003 - Environmental Issues: Water use and Conservation, Mar 2013*, Canberra <https://www.abs.gov.au/ausstats/abs@.nsf/mf/4602.0.55.003>.

Australian Bureau of Statistics (ABS) 2014, *4602.0.55.001 - Environmental Issues: Energy Use and Conservation, Mar 2014*.

Australian Bureau of Statistics (ABS) 2022, *Housing Occupancy and Costs 2019-2020*, Canberra, <https://www.abs.gov.au/statistics/people/housing/housing-occupancy-and-costs/latest-release>.

Australian and New Zealand Environment and Conservation Council (ANZECC) 2000, *Australia and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy* Australian and New Zealand Environment and Conservation Council.

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC and ARMCANZ) 2000, *National Water Quality Management Strategy - Australian Guidelines for Urban Stormwater Management*.

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M and Testoni I (Editors) 2019, *Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia (Geoscience Australia).

Bureau of Meteorology (BoM) 2024, *Climate Data Online* <http://www.bom.gov.au/climate/data/>.

Cardno 2017, *Infrastructure Assessment Report : Golden Gateway Precinct*, B.

City of Belmont (CoB) 2018, *Belmont Foreshore Precinct Plan*.

Taylor Burrell Barnett Town Planning and Design (CoB) 2019, *Golden Gateway Structure plan*, City of Belmont.

Douglas Partners 2024, *Report on Preliminary Geotechnical Investigation - Part of Lot 9002 Grandstand Road, Ascot WA*, 219164.03.R.001.Rev0, 0.

Department of Water (DoW) 2007, *Stormwater Management Manual for Western Australia*, Perth.

Department of Water (DoW) 2008, *Urban Water Management Plans: Guidelines for Preparing Plans and for Complying with Subdivision Conditions*, Perth.

Department of Parks and Wildlife (DPaW) 2016, *Corporate Policy Statement No 49 - Planning for stormwater management affecting the Swan Canning Development Control Area*.

Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

Department of Planning, Lands and Heritage (DPLH) 2019, *Government Sewerage Policy*, Perth.

Department of Planning, Lands and Heritage (DPLH) 2021, *Draft State Planning Policy 2.9 Planning for Water Guidelines*, Perth, Western Australia.

Department of Water and Environmental Regulation (DWER) 2017, *Decision Process for Stormwater Management in Western Australia*, Government of Western Australia, Perth.

Department of Water and Environmental Regulation (DWER) 2022, *Stormwater Management Manual for Western Australia, updated 2022*, Government of Western Australia, Perth.

Department of Water and Environmental Regulation (DWER) 2023a, *Acid Sulfate Soil Risk Map, Swan Coastal Plain (DWER-055)*, <https://catalogue.data.wa.gov.au/dataset/acid-sulphate-soil-risk-map-swan-coastal-plain-dwer-055>.

Department of Water and Environmental Regulation (DWER) 2023b, *ASS Risk Maps*, <https://gmapgis.com/acid_sulfate_soils_risk_map_western_australia.htm>.

Department of Water and Environmental Regulation (DWER) 2023c, *FPM Floodplain Area (DWER-020)*, <https://catalogue.data.wa.gov.au/dataset/fpm-floodplain-area>.

Department of Water and Environmental Regulation (DWER) 2023d, *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth Action Plan 2*, Government of Western Australia, Western Australia.

Department of Water and Environmental Regulation (DWER) 2023e, *Perth Groundwater Map*, <https://maps.water.wa.gov.au/Groundwater/>.

Department of Water and Environmental Regulation (DWER) 2024a, *Perth Groundwater Map*, Western Australia <https://maps.water.wa.gov.au/Groundwater/>.

Department of Water and Environmental Regulation (DWER) 2024b, *Water Information Reporting* Western Australia <https://wir.water.wa.gov.au/Pages/Water-Information-Reporting.aspx>.

Department of Water and Environmental Regulation (DWER) 2024c, *Water Register*, Perth, WA, <https://maps.water.wa.gov.au/#/webmap/register>.

Environmental Protection Authority (EPA) 2008, *Guidance Statement No. 33. Environmental Guidance for Planning and Development*, Perth.

Essential Environmental 2018a, *Golden Gateway Environmental Report*, Draft.

Essential Environmental 2018b, *Golden Gateway Local Water Management Strategy*, Draft.

Evangelisti & Associates 1997, *Mathieson Road Drain Diversion - Final Design Report*.

Galt 2024, *Geotechnical Study Proposed Development Lot 452 Resolution Drive Ascot*, WAG230750-01 002 R Rev0, 0.

Government of WA 2006, *Swan and Canning Rivers Management Act 2006*, Perth.

Government of WA 2007, *State Water Plan*, Perth.

Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

Gozzard, J. 2011, *Sea to scarp - geology, landscape, and land use planning in the southern Swan Coastal Plain*, Geological Survey of Western Australia.

Gozzard, J. R. 1986, *Perth, Sheet 2034 II and Prt of Sheets 2034 III and 2134 III*, Perth Metropolitan Region 1:50 000 Environmental Geology Series. Geological Survey of Western Australia, Perth.

Gozzard, J. R. 2007, *Geology and Landforms of the Perth Region*, Geological Survey of Western Australia, Perth.

Hodgkin, E. P. and John, J. 1986, *The Hydrology of the Swan River Estuary: Salinity the Ecological Master Factor*, in *The Swan River Estuary: Ecology and Management.* Environmental Studies Group, Curtin University of Technology, Perth, Western Australia.

JDA 2023, *Ascot Racecource: Leederville Bore Monitoring Report 2022/23*, J7169a.

Landgate 2023, *Map Viewer Plus*, <https://map-viewer-plus.app.landgate.wa.gov.au/>.

M.P. Rogers and Associates 2017, *Belmont Park Precinct D Marine Engineering Concept Design Report*.

Swan River Trust (SRT) 2008, *Swan and Canning Rivers Foreshore Assessment and Management Strategy*, Perth.

Swan River Trust (SRT) 2009, *Swan Canning Water Quality Improvement Plan*, Government of Western Australia, East Perth.

Swan River Trust (SWT) 2009, *Swan Canning Water Quality Improvement Plan*, Government of Western Australia, Perth.

Western Australian Planning Commission (WAPC) 2006a, *State Planning Policy 2.9: Water Resources*, Gazetted in December 2006, Perth.

Western Australian Planning Commission (WAPC) 2006b, *State Planning Policy 2.10: Swan-Canning River System*, Perth.

Western Australian Planning Commission (WAPC) 2008a, *Better Urban Water Management*, Perth.

Western Australian Planning Commission (WAPC) 2008b, *Better Urban Water Management* Perth.

Western Australian Planning Commission (WAPC) 2009a, *Liveable Neighbourhoods (Edition 4)*, Western Australian Planning Commission and Department for Planning and Infrastructure, Perth.

Western Australian Planning Commission (WAPC) 2009b, *Planning Bulletin 64/2009: Acid Sulfate Soils*, Perth.

(WAPC) 2023a, *Local Planning Scheme No. 15 (City of Belmont)*, <https://www.wa.gov.au/government/document-collections/city-of-belmont-planning-information>.

Western Australian Planning Commission (WAPC) 2023b, *Metropolitan Region Scheme*.

Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

Water Corporation (WC) 2003, *Domestic Water Use Study in Perth, Western Australia 1998-2001*, Perth.

Water Corporation (WC) 2011, *AltWaterSupply_Water_Use_Model.xls*, Perth.

Wong et al. 2006, *Australian Runoff Quality: A Guide to Water Sensitive Urban Design*, Engineers Australia.

11.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 11.1**, with access date information provided in **Table R1**.

Table R1 Access dates for online references

Reference	Date accessed	Website or dataset name
(ABS 2013)	19/4/2024	ABS: Water Use and Conservation Data
(ABS 2014)	19/4/2024	ABS: Energy Use and Conservation Data
(DWER 2023a)	12/04/2024	Acid Sulfate Soil Risk Map
(BoM 2024)	12/04/2024	Climate Data
(Landgate 2023)	31/01/2024	Landgate Map Viewer Plus
(WAPC 2023a)	11/12/2023	Local Planning Scheme No. 15 Map
(DWER 2024a)	12/04/2024	Perth Groundwater Map
(DWER 2024b)	12/04/2024	Water Information Reporting
(DWER 2024c)	12/04/2024	Water Register
(DWER 2023c)	26/04/2024	FPM Floodplain Area (DWER-020)

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Figures

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Figure 2: Topographic and Groundwater Contours

Figure 3: Geological Mapping

Figure 4: Acid Sulfate Soil Mapping

Figure 5: Environmental Assets

Figure 6: Hydrological Features

Figure 7: Ascot LSP Precinct Plan surface water management

Figure 7A: Precinct A Stormwater Management Plan

Figure 7B: Precinct C Stormwater Management Plan

Figure 7C: Precinct D Stormwater Management Plan

Figure 7D: Precinct E Stormwater Management Plan

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Figure 1: Site Location

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F23

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

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Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

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Figure 2: Topographic and Groundwater Contours

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F24

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

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Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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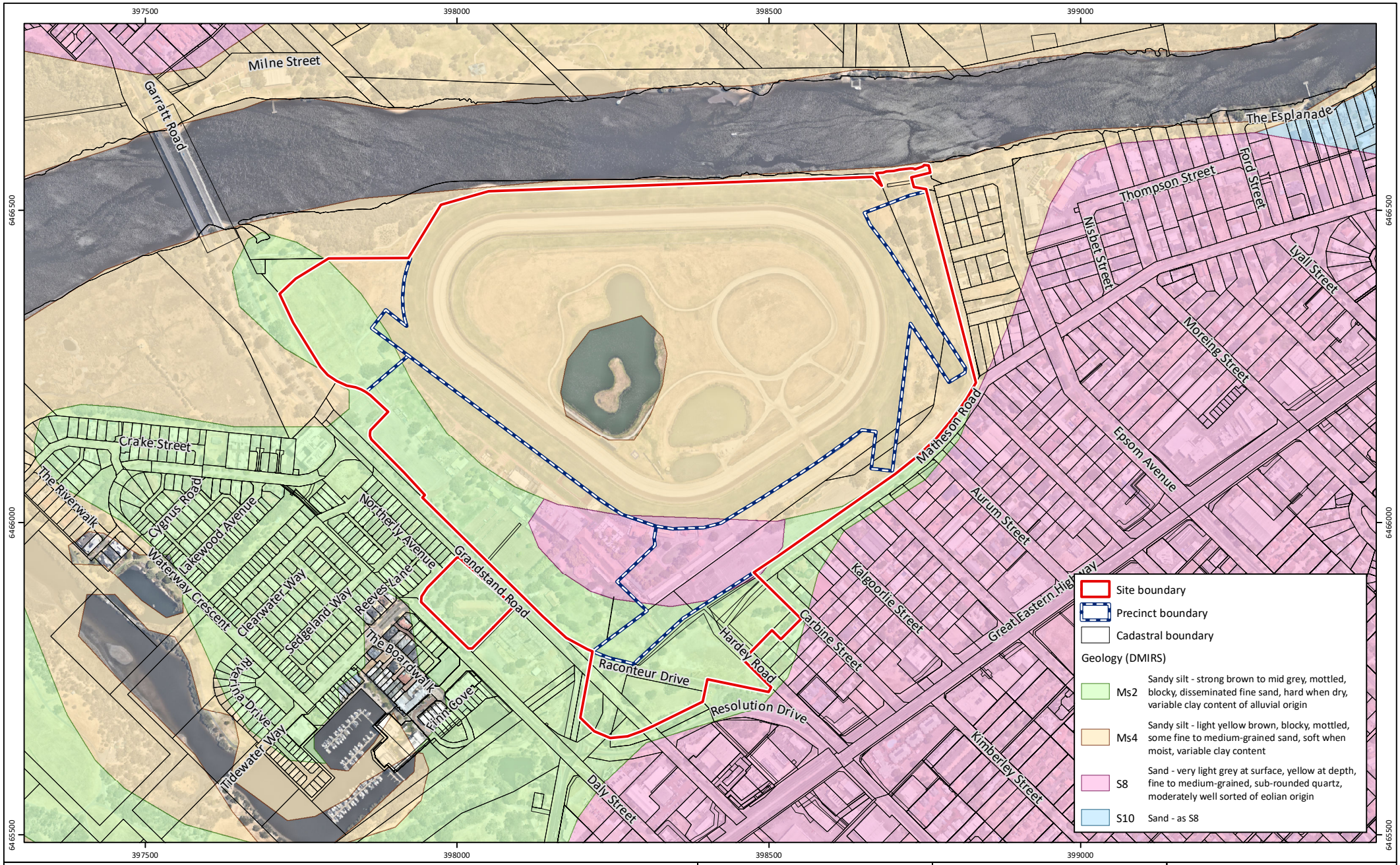


Figure 3: Geological Mapping

Project: Local Water Management Plan
Golden Gateway Local Structure Plan

Client: Perth Racing

Plan Number:
EP23-109(03)--F25

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

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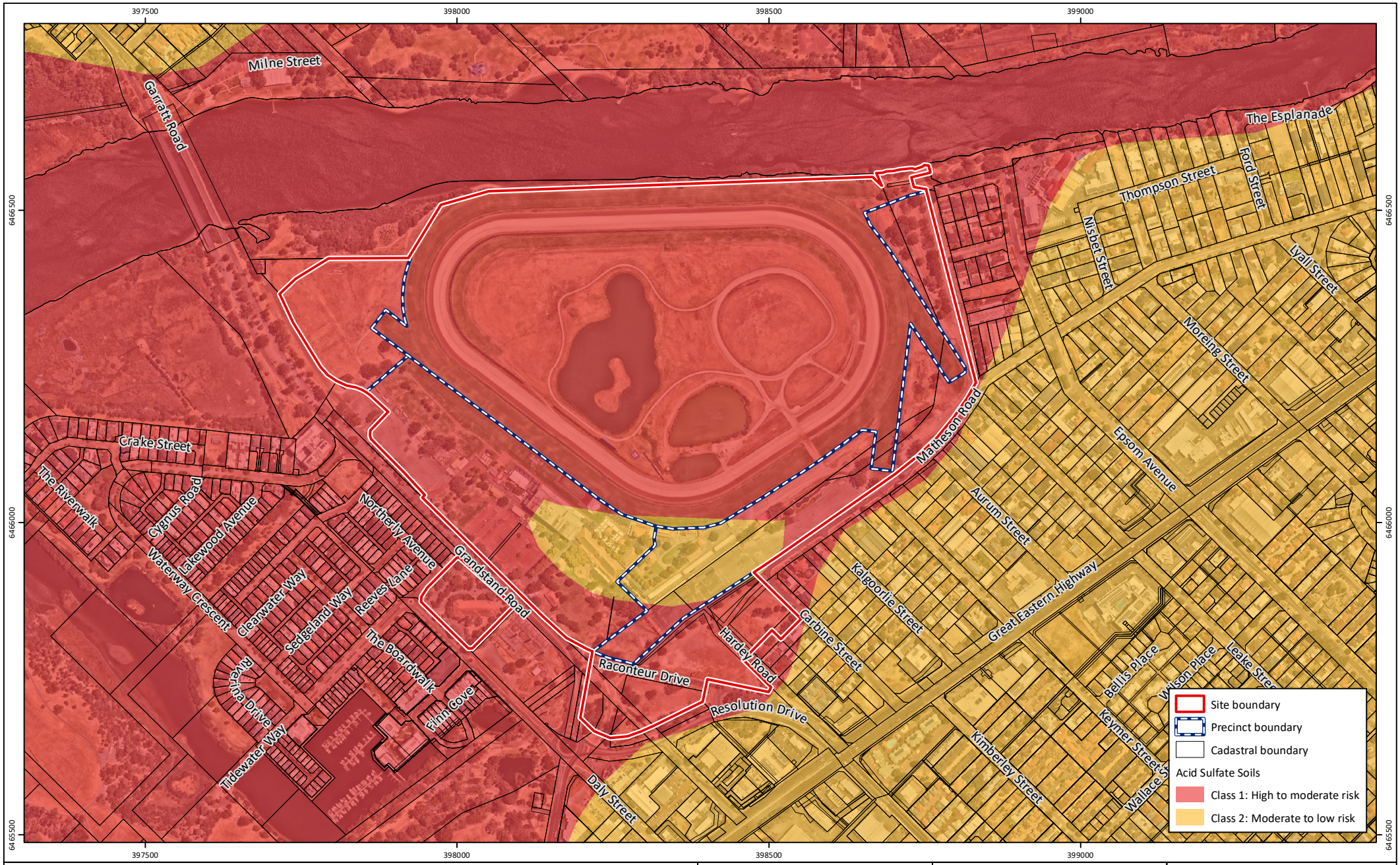


Figure 4: Acid Sulfate Soil Mapping

Project: Local Water Management Plan
Golden Gateway Local Structure Plan

Client: Perth Racing

Plan Number:
EP23-109(03)--F26

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

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Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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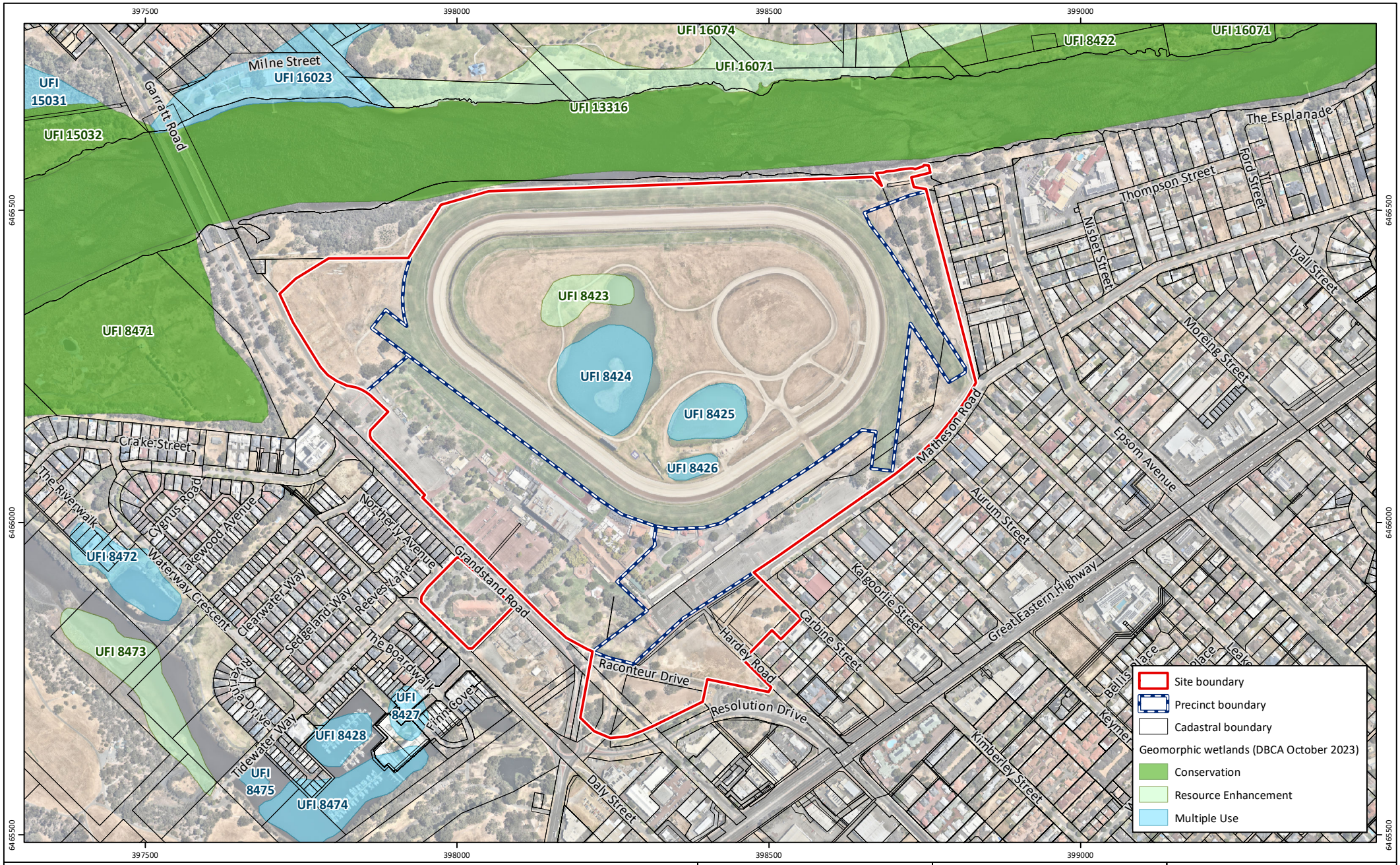


Figure 5: Environmental Assets

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Client:	Perth Racing

Plan Number:
EP23-109(03)--F27

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

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GDA2020 MGA Zone 50

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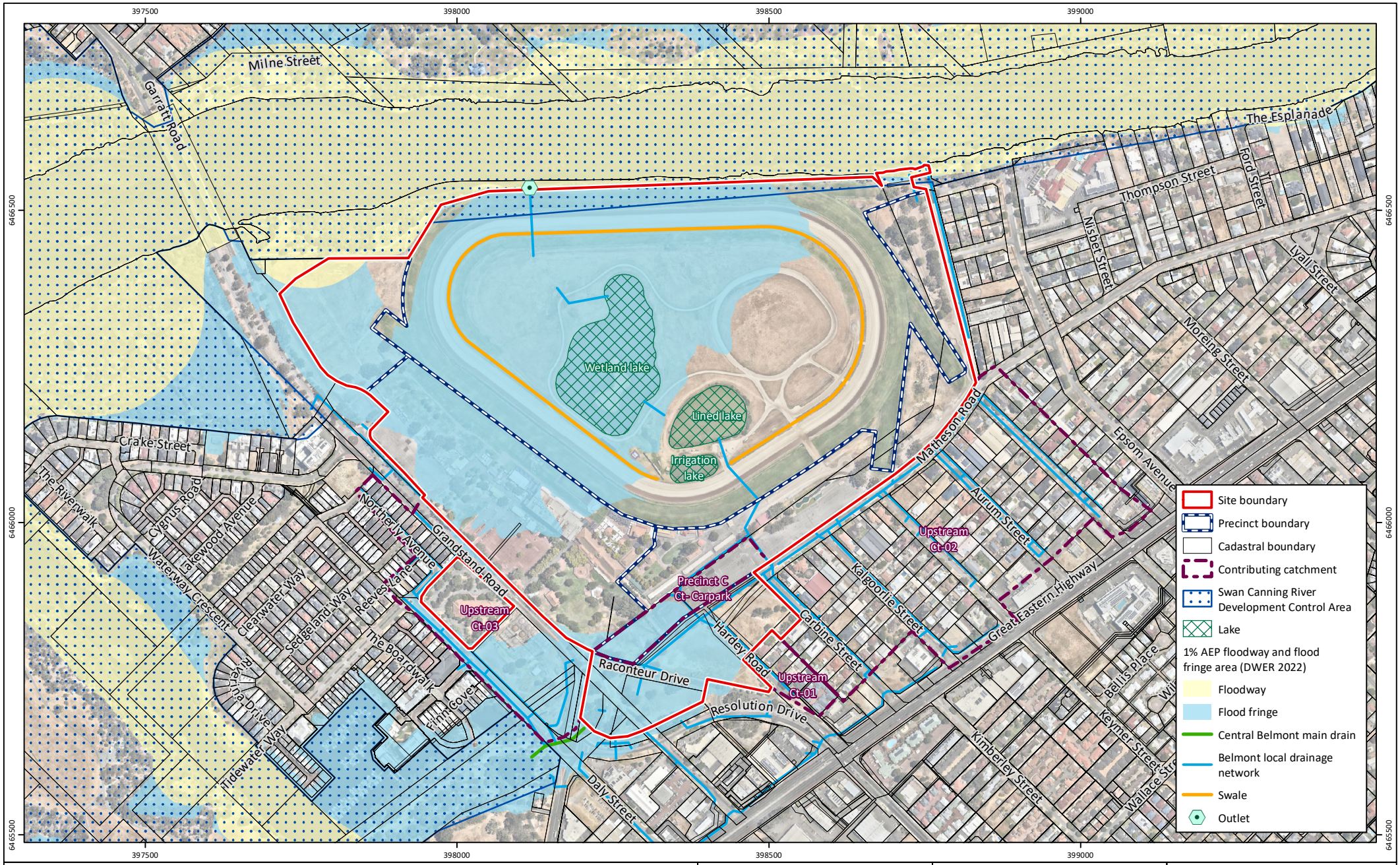


Figure 6: Hydrological Features

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F28

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

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GDA2020 MGA Zone 50

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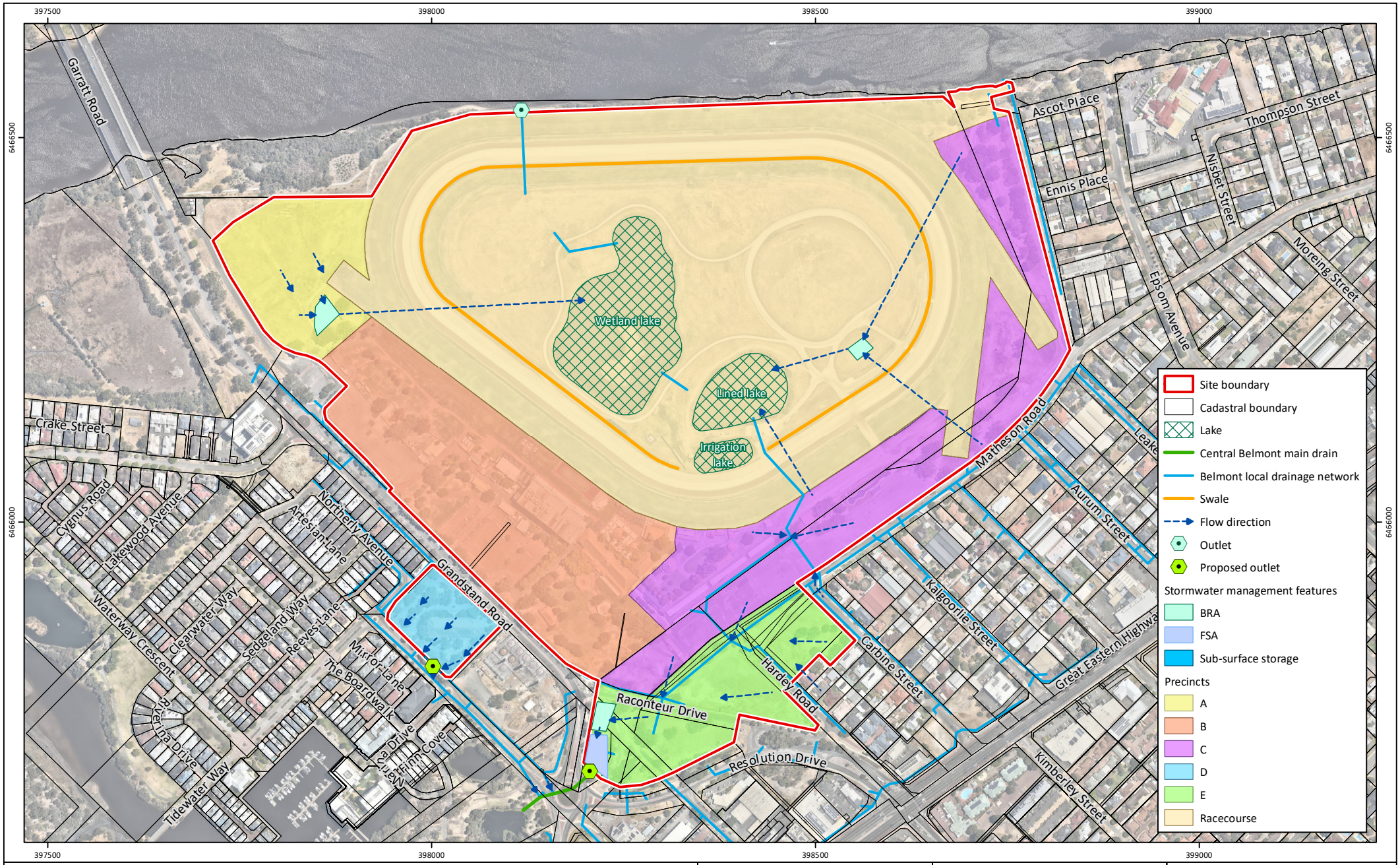


Figure 7: Ascot LSP Precinct Plan

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F29

Drawn:	WJC
Date:	01/05/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

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GDA2020 MGA Zone 50

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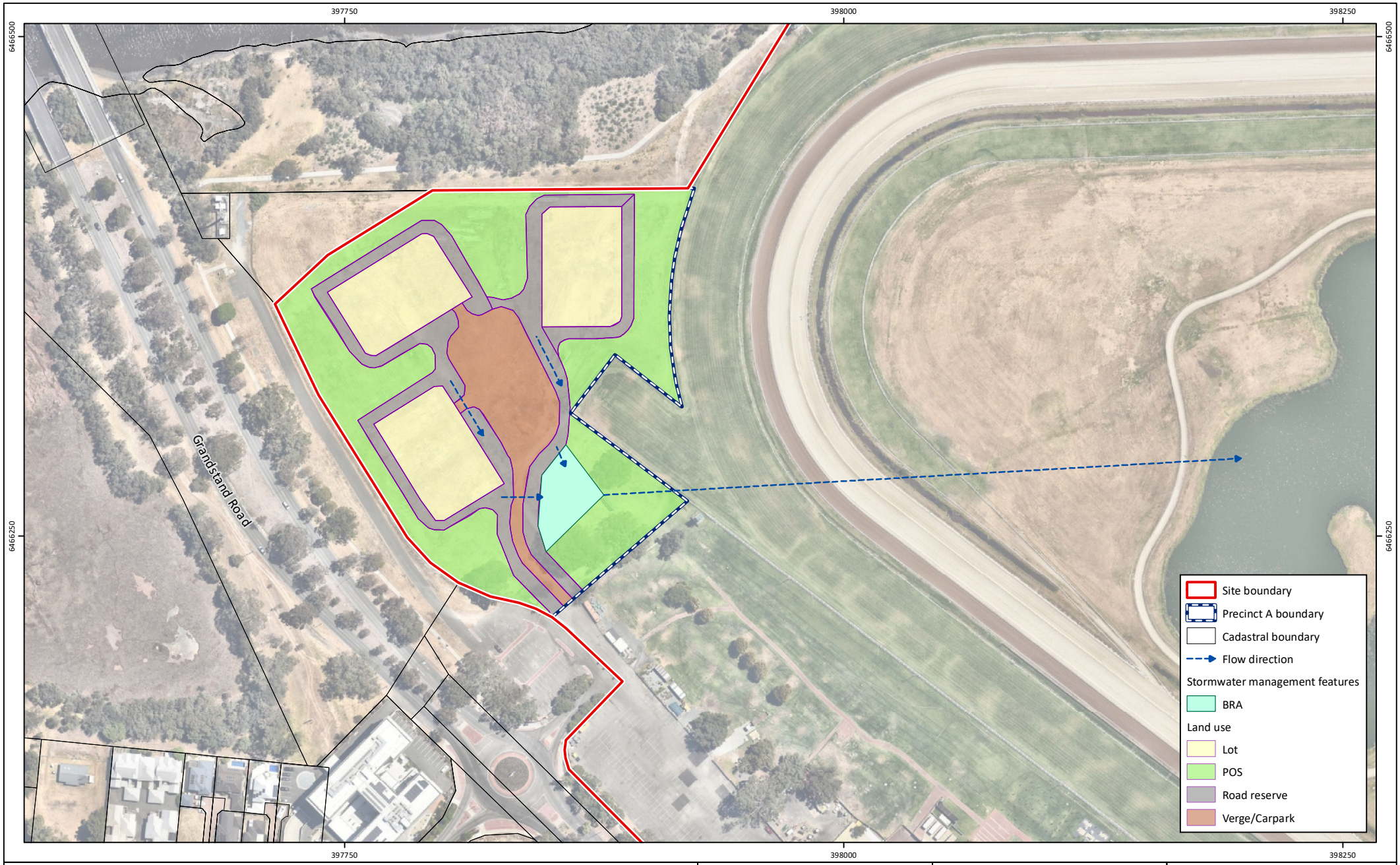


Figure 7A: Precinct A Stormwater Management Plan

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F32

Drawn:	WJC
Date:	01/05/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

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Scale: 1:2,500@A4

GDA2020 MGA Zone 50

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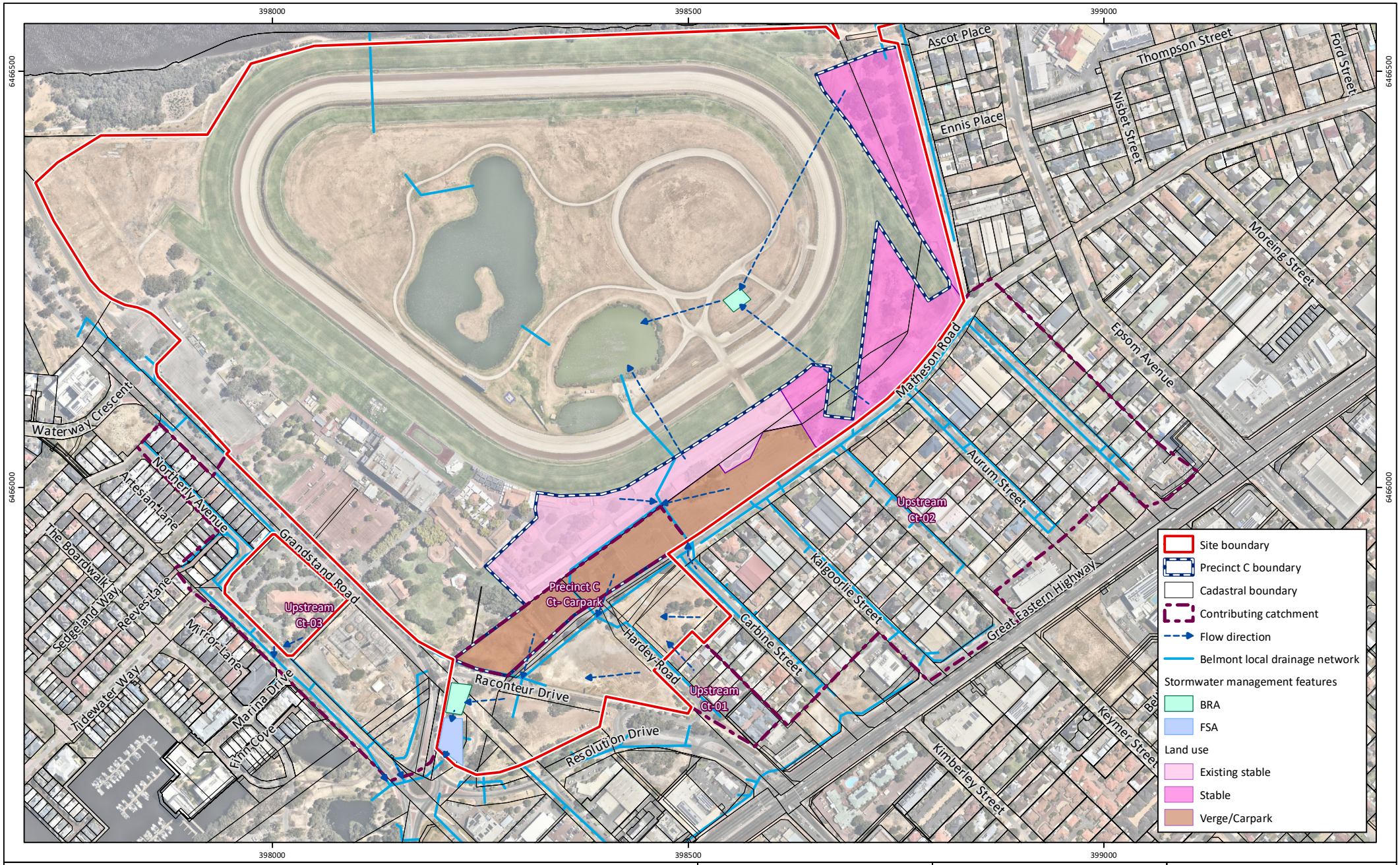


Figure 7B: Precinct C Stormwater Management Plan

Project: Local Water Management Plan
Golden Gateway Local Structure Plan

Client: Perth Racing

Plan Number:
EP23-109(03)--F33

Drawn:	WJC
Date:	01/05/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

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Metres

Scale: 1:6,000@A4

GDA2020 MGA Zone 50

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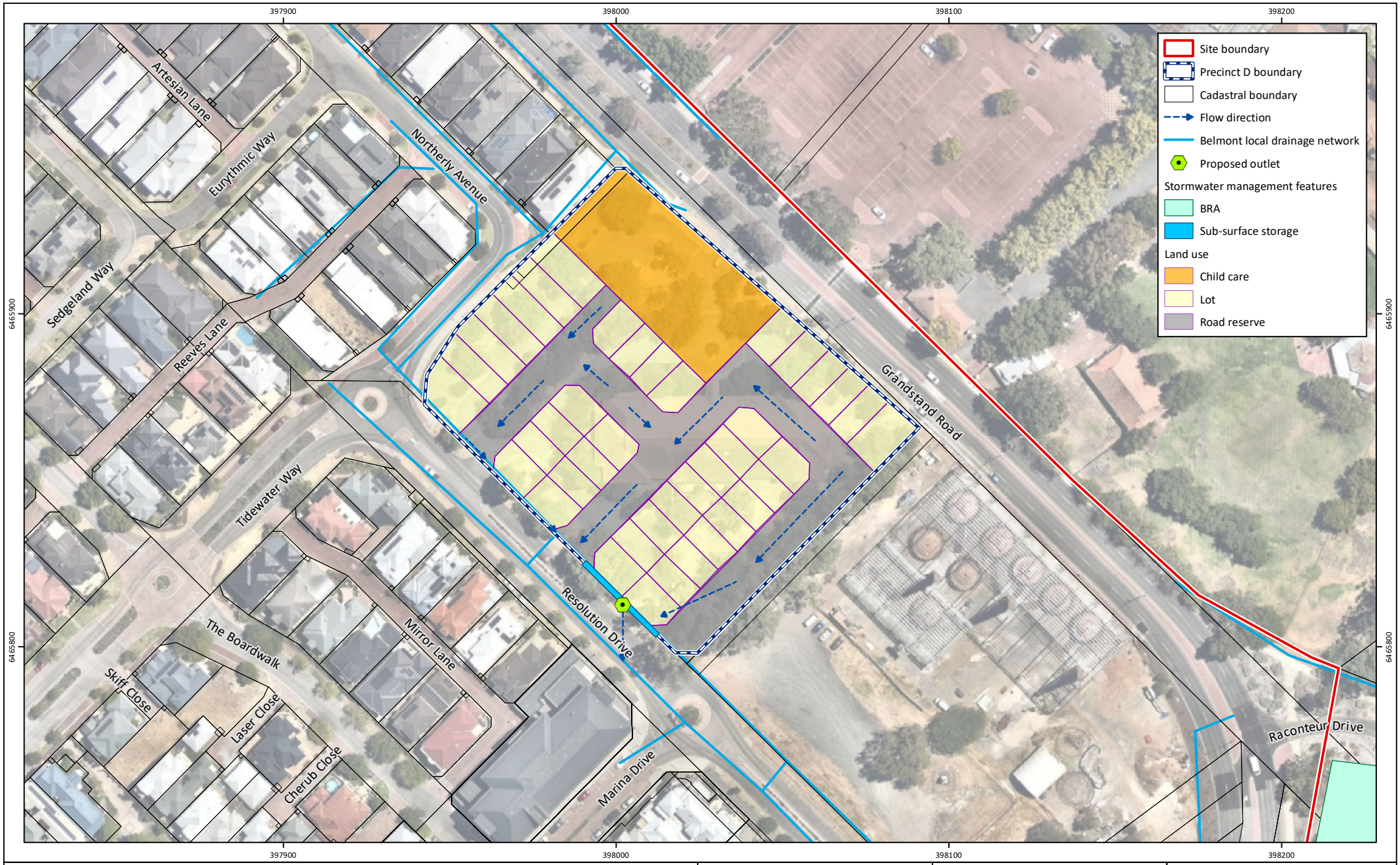


Figure 7C: Precinct D Stormwater Management Plan

Project: Local Water Management Plan
Golden Gateway Local Structure Plan

Client: Perth Racing

Plan Number:
EP23-109(03)--F34

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Checked:	JM
Approved:	DPC
Date:	17/05/2024

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Metres

Scale: 1:1,500@A4

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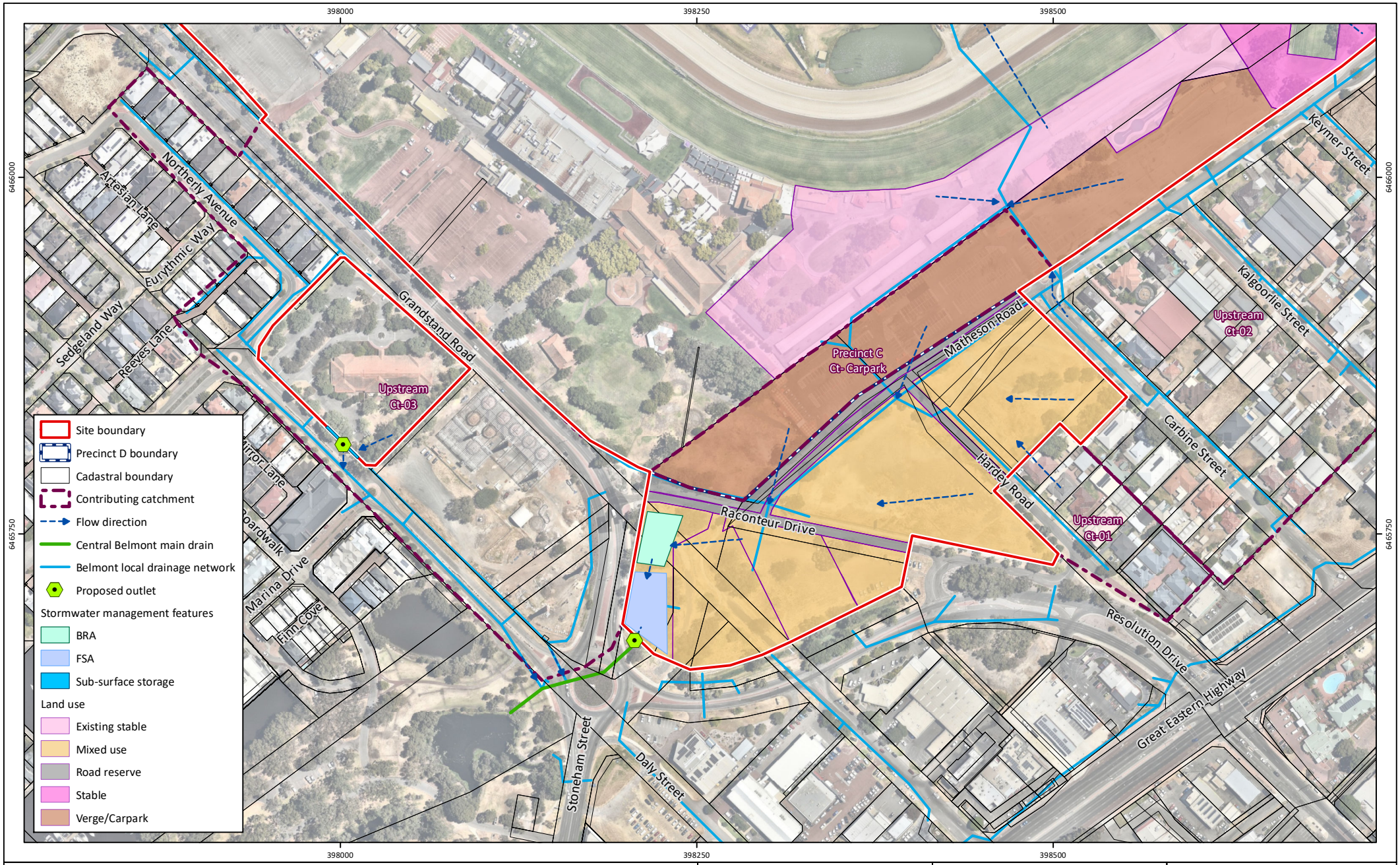


Figure 7D: Precinct E Stormwater Management Plan

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F35

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Checked:	JM
Approved:	DPC
Date:	17/05/2024

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Metres

Scale: 1:3,500@A4

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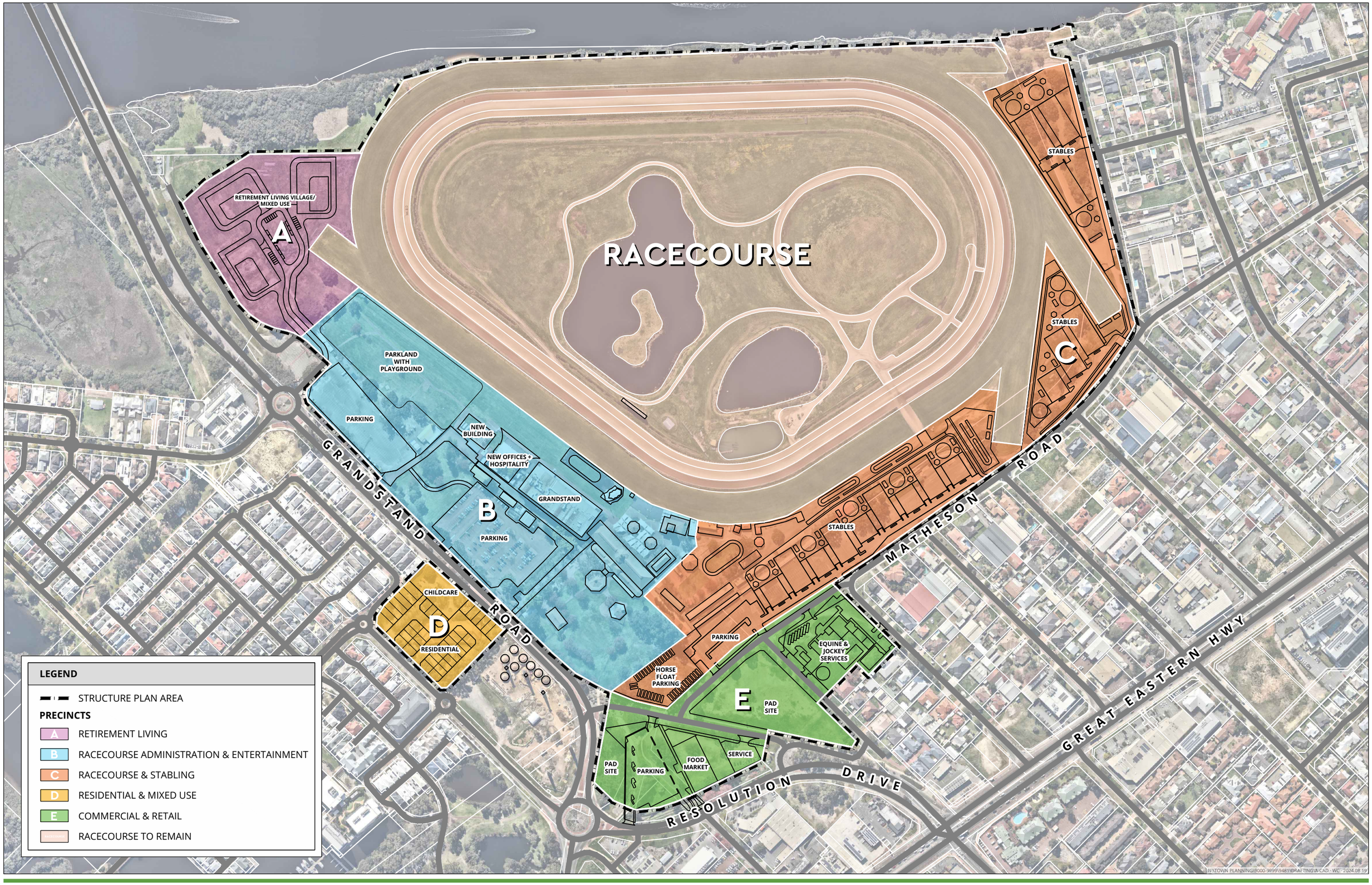
Appendix A

Concept plan

ROWE Group Design (2023)

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Version: 1, Version Date: 18/09/2024



DRAFT MASTER PLAN CONCEPT

VARIOUS LOTS - ASCOT RACECOURSE

ASCOT

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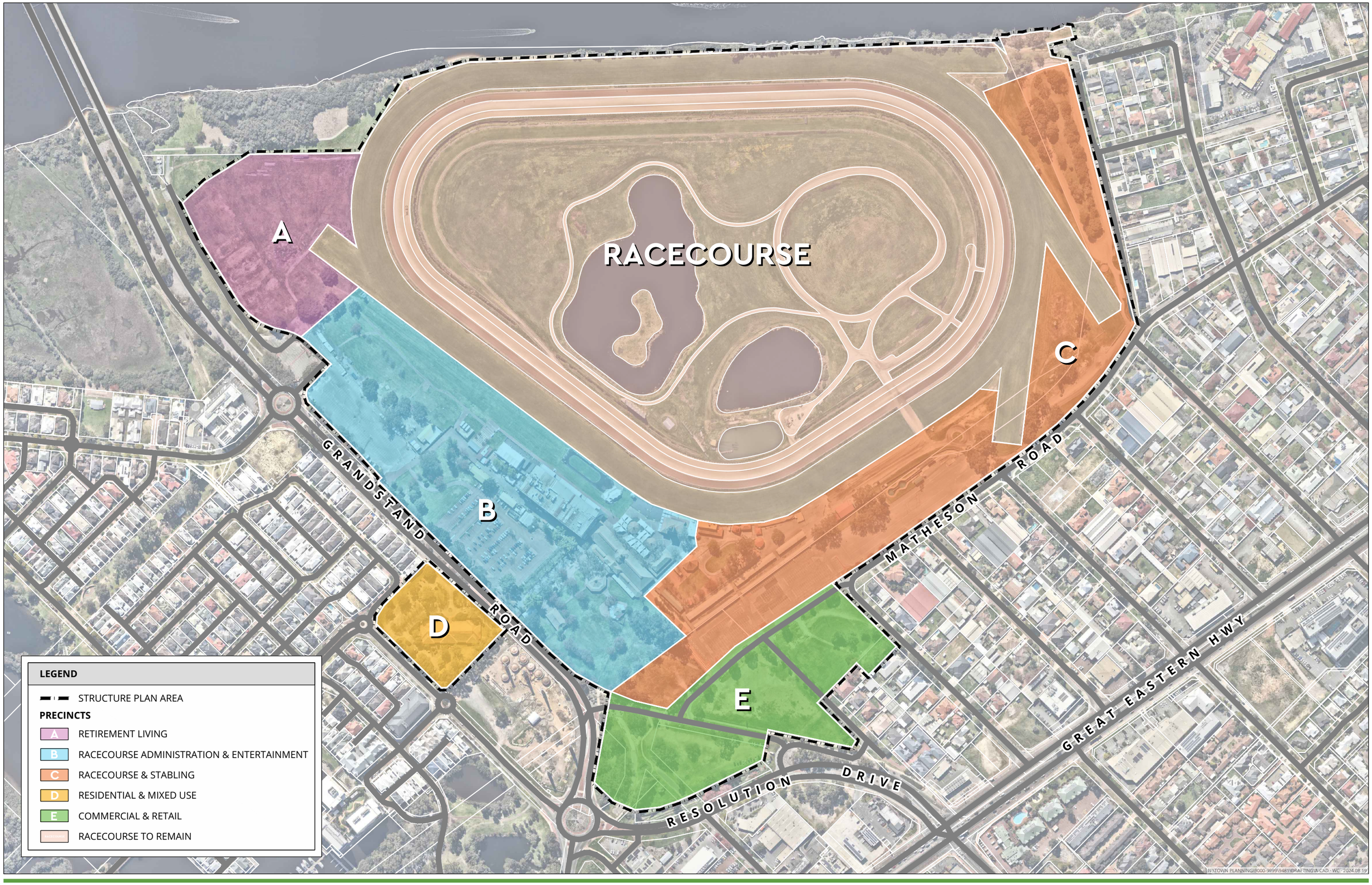
9481-CON-01-D

DRAWN:	WC
DATE CREATED:	2024.08.19
PROJECTION:	MGA50 GDA94
CADASTRE:	LANDGATE
AERIAL:	NEARMAP 20230831

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ROWE GROUP DESIGN

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STRUCTURE PLAN PRECINCTS

VARIOUS LOTS - ASCOT RACECOURSE

ASCOT

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0 100 m

SCALE @ A3: 1:4000

9481-FIG-02-C

DRAWN: WC
DATE CREATED: 2024.08.19
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE
AERIAL: NEARMAP 20230831

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ROWE GROUP DESIGN

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Appendix B

Geotechnical Reports

Precinct A – Douglas Partners 2024

Precinct D – Galt 2024

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

Douglas PARTNERS

GROUNDED EXPERTISE

Report on Preliminary Geotechnical Investigation

Proposed Residential Development

Part of Lot 9002 Grandstand Road, Ascot WA

Prepared for Perth Racing

Project 219164.03

25 January 2024

Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

Douglas Partners Pty Ltd
ABN 75 053 980 117
douglaspartners.com.au
36 O'Malley Street, Osborne Park, WA 6017
(08) 9204 3511

Document History

Details

Project No.	219164.03
Document Title	Report on Preliminary Geotechnical Investigation
Site Address	Part of Lot 9002 Grandstand Road, Ascot WA
Report Prepared For	Perth Racing
Filename	219164.03.R.001.Rev0

Status and Review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Venkat Vallurapalli/Brendan Divilly	Frederic Verheyde	25 January 2024

Distribution of Copies

Status	Issued to
Revision 0	Perth Racing

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature	Date
Author	25 January 2024
Reviewer	25 January 2024

FS604853

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Report on Preliminary Geotechnical Investigation
Proposed Residential Development
Part of Lot 9002 Grandstand Road, Ascot WA

1. Introduction

This report presents the results of a preliminary geotechnical investigation undertaken for a proposed residential development across Part of Lot 9002 Grandstand Road, Ascot WA. The investigation was commissioned by Mr. James Oldring of Perth Racing in a signed order to proceed dated 8 August 2023 and was undertaken in accordance with Douglas' proposal dated 8 May 2023.

It is understood that Perth Racing is evaluating the feasibility of developing the northwest portion of Lot 9002 for possible residential use (the 'site').

The objective of the investigation is to assess the subsurface soil and groundwater conditions at across the site to provide preliminary comments on:

- The geotechnical suitability of the site for the proposed development.
- Geotechnical opportunities and constraints relevant to the proposed development.
- Areas of foundation risk including the presence of aggressive soils and strategies to address identified risks.
- Site preparation, including the possible reuse of existing soil as controlled fill.
- Excavation conditions.
- The likely site classification in accordance with the requirements of AS 2870-2011.
- Appropriate earthquake design factor for the site, in accordance with AS 1170.4-2007.
- Suitable foundation systems, including preliminary design parameters.
- Preliminary design parameters for the design of retaining structures and batter slopes.
- Depth to groundwater at the time of the investigation.
- Recommendations on additional geotechnical investigation at detailed design phase or to address specific ground conditions encountered.

The investigation included eight cone penetration tests, 16 test pits and one borehole excavated and drilled as a part of detailed site investigation (for contamination), and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

The investigation was conducted concurrently with a detailed site investigation (for contamination), which has been reported under separate cover (219164.01.R.001.Rev0). The detailed site investigation (for contamination) report should be read in conjunction with this report.

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2. Site Description

The site comprises an irregular shaped area, approximately 36.2 ha in size, that covers a part of Lot 9002 Grandstand Road, within the Ascot Racecourse.

At the time of the field work, the majority of the site was vacant and vegetated with short grass. A few mature trees, about 5 m to 10 m in height, occupied the southern part of the site. A parking lot and small loading area were located at the south-western corner of the site. Some fly-tipped rubbish, including fences and posts, were observed at several locations across the site.

According to publicly available LiDAR data (DEM derived to 5 m), the topography across Lot 9002 is relatively flat with existing surface levels ranging from approximately RL 2 m relative to the Australian Height Datum (AHD) in the western part of the site to RL 3.5 in the north-eastern corner of the site.

The Perth 1: 50 000 Environmental Geology sheet indicates that shallow sub surface conditions beneath the western two thirds of the site comprise sandy silt of the Guildford Formation, and beneath the north-eastern corner and eastern corner of the site comprise alluvium.

The Perth Groundwater Atlas (2004) indicates that in May 2003, the groundwater level beneath the site was less than RL 1 m, or between approximately 1.0 m and 2.5 m below the existing surface level. The Atlas also indicates that the groundwater flow direction beneath the site in May 2003 was approximately northwest towards the Swan River.

The published acid sulfate soil risk mapping indicates that the site is located within an area which is mapped as "*high to moderate risk of acid sulfate soils occurring within 3 m of natural soil surface*".

3. Field Work Methods

Field work for the investigation was carried out between 11 October and 9 November 2023 and comprised:

- The excavation of 16 test pits.
- The drilling of one borehole.
- Perth sand penetrometer (PSP) or Dynamic cone penetrometer (DCP) testing adjacent to each test pit or borehole location.
- The performance of cone penetration tests at 8 locations (CPT24 to CPT31A). A total of 14 CPTs were undertaken after repeating CPTs at some locations in attempt to achieve greater testing depth following shallow refusal in uncontrolled fill.

The test pits (locations 7 to 22) were excavated using a 5-tonne excavator, equipped with 450 mm toothed bucket, and the borehole (location 23) was drilled using a 250 mm diameter power auger attached to the same excavator. The ground conditions at each test pit and borehole were logged in accordance with Australian Standard (AS 1726, 2017) by a geo-environmental engineer from Douglas. Soil samples were recovered from selected locations for subsequent laboratory testing.

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Dynamic cone penetrometer (DCP) and Perth sand penetrometer (PSP) tests were undertaken adjacent to the test pit and borehole locations in accordance with Australian Standards (AS 1289.6.3.3, 1997; AS 1289.6.3.2, 1997) to assess the in-situ density of the shallow soils.

The CPTs use a 36 mm diameter instrumented cone with a following 130 mm long friction sleeve attached to rods of the same diameter, pushed continuously at a rate of 20 mm/sec into the soil by hydraulic thrust from a truck rig. Strain gauges in the cone and sleeve measure resistance to penetration and friction along the sleeve during penetration. This data is recorded on a computer and analysed to assess the type, properties and condition of the materials penetrated. The CPT's were pushed to termination depths of up to 20.2 m. Upon withdrawing the CPT probe, each test hole was dipped in an attempt to measure groundwater levels. CPTs were repeated at several test locations to attempt achieving greater testing depth following shallow CPT refusal on inferred hard foreign inclusions in the uncontrolled fill.

Test locations were determined using a handheld GPS and site features and are marked on Drawing 1, Appendix B. Surface elevations were recorded using a differential GPS with a reported accuracy of 0.1 m.

4. Field Work Results

4.1 Ground Conditions

The logs of the ground conditions and results of the field testing are presented in Appendix B, together with notes defining descriptive terms and classification methods, in Appendix A.

- **Uncontrolled FILL**
    - **Granular FILL - SAND, Organic SAND, Gravelly SAND, Silty SAND and Sandy GRAVEL (SP, SP-SM, SM and GP-GM)** – generally sandy fill (or gravelly material associated with pavement layers at location 23), uncontrolled (apart from the pavement layers), from surface to depths of between 0.6 m and 3.6 m depth, encountered at all locations. A layer of organic sandy fill layer was observed between 1.4 m and 1.8 m depth at location TP8. The sandy fill was generally loose to medium.
    - **Cohesive FILL - Clayey SAND, Sandy CLAY, CLAY (SM, SC, CI and CL-CI)** – generally stiff to very stiff, either underlying the aforementioned sandy fill material or interbedded within layers of sandy fill, encountered at test pit locations 9, 20, 21, 23, and CPT locations 24, 24A, 29 and 29A.

  A considerable amount of foreign inclusions such as fragments of brick, glass, timber, geo-fabric, concrete, plastic, rubber, scrap metal, terracotta pipes, redundant cables and PACMs were observed at all test pit locations, except location 22. A layer of asphalt was encountered at 0.95 m depth at TP9. The fill materials across the site are uncontrolled.

  It is noted that the fill extended below groundwater level at many locations.

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Overlying natural soils including:

- **Clayey soils including Clayey SAND and CLAY** – ranging between very soft to soft and stiff to very stiff, encountered under the fill materials at CPTs 25, 30 and 31A to depths between 4.2 m and 14.9 m.
- **Sandy soils including SAND and Silty SAND** – underlying and interbedded within the above clayey soils at CPTs 25, 30 and 31A. The sand was generally very loose and loose to medium dense to depths between 10.5 m and 14.9 m, becoming medium dense and dense below.

4.2 Groundwater

Groundwater level observations between 18 September and 9 November 2023 are summarised in Table 1 and are shown on the logs in Appendix B.

The test holes were immediately backfilled following sampling, which precluded longer-term monitoring of groundwater levels. Six monitoring wells (MW01 to MW06) were installed as part of the preliminary environmental investigation (reported separately) and groundwater observations available from these wells at the time of report writing have been included in Table 1.

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Table 1: Summary of Groundwater Levels

Location	Date of Measurement	Ground Surface Level [1] (m AHD)	Groundwater Depth (m)	Groundwater Level [2] (RL m AHD)
MW01	18 September 2023	1.9	1.30	0.6
MW02		2.0	1.46	0.5
MW03		3.2	2.37	0.8
MW04		2.4	1.59	0.8
MW05		2.5	1.21	1.3
MW06		2.2	1.09	1.1
TP7	9 November 2023	2.9	2.30	0.6
TP9		2.1	2.10	0.0
TP12		2.1	2.10	0.0
TP13		2.8	2.50	0.3
TP15		2.2	2.40	-0.2
TP16		2.6	2.50	-0.1
TP17		2.2	2.10	0.1
TP19		2.2	1.80	0..4
TP20		2.0	2.10	-0.1
TP21		2.1	1.80	0.3
TP22		2.3	1.80	0.5
BH23		2.4	1.70	0.7
CPT25	11 October 2023	3.4	3.00	0.4
CPT28		1.9	1.30	0.6
CPT29A		2.3	2.20	0.1
CPT30		3.2	2.80	0.4
CPT31A		2.1	2.00	0.1

Notes for Table 1: [1]: Surface level measured using a differential GPS.
[2]: Groundwater Level = Surface Level – Groundwater Depth.

It should be noted that groundwater levels are affected by climatic conditions and land usage and will therefore vary with time. In addition, owing to the proximity of the Swan River, the groundwater levels are expected to be impacted by the tidal river conditions and river flood levels.

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5. Laboratory Testing

A geotechnical laboratory testing programme was carried out by a NATA accredited laboratory and comprised:

- the particle size distributions on seven samples;
- the Atterberg Limits and linear shrinkage on three samples; and
- the organic content on four samples.

Results of the laboratory testing are summarised in Tables 2. The test certificates are presented in Appendix C.

Table 2: Results of Laboratory Testing for Soil Identification

Location	Depth (m)	Fines (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)	LS (%)	OC (%)	Material
TP8	1.5	9	61	30	-	-	-	-	6.8	FILL / Organic SAND SP-SM, with gravel and silt
TP13	1.5	4	95	1	-	-	-	-	1.6	FILL / SAND SP, trace gravel and silt
TP19	2.5	5	83	12	-	-	-	-	1.5	FILL / SAND SP, trace gravel and silt
TP21	2.0	40	51	9	37	24	13	8.5	-	Sandy CLAY CI, medium plasticity, trace gravel
TP22	2.0	7	93	0	NO	NP	NP	-	-	SAND SP-SM, with silt
TP23	2.0	45	48	7	44	22	22	9.5	-	FILL / Sandy CLAY CI, medium plasticity, trace gravel
TP23	2.5	12	87	1	-	-	-	-	1.2	FILL / SAND SP-SM, with silt, trace gravel

Notes: Fines = Finer than 75 µm.
Sand = Between 2.36 mm and 75 µm.
Gravel = Larger than 2.36 mm.
LL – liquid limit PL – plastic limit PI – plasticity index LS – linear shrinkage
OC – organic content NO – not obtainable NP – non plastic

6. Proposed Development

At the time of preparing this report, the details for the proposed development were not yet available. Notwithstanding, it is understood that the proposed development is likely to be residential and, given the location, is presumed would likely be multistorey and possibly include a basement level.

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7. Comments

7.1 Site Suitability

The investigation indicates that the site is generally underlain by uncontrolled fill overlying very soft to stiff clayey materials and very loose sandy soils becoming medium dense and dense with depth as described in Section 4.1 above.

From a geotechnical standpoint, there are several significant geotechnical constraints that will adversely impact on any development of the site including;

- Deep uncontrolled fill, unsuitable to support shallow foundations, and will impact on construction activities associated with deep piled foundations.
- Deep very soft and very loose natural soils under the uncontrolled fill, unsuitable to support shallow foundations.
- Shallow groundwater which will make earthworks across the site any possible remediation works of the above difficult. It should be noted that the abovementioned uncontrolled fill and soft soils both extend below groundwater.

Owing to the significant geotechnical constraints, any possible development will likely require a piled foundation solution into the medium dense and dense sandy soils, encountered below depths of approximately 10 m to 15 m. Additional geotechnical investigation will be required to confirm the foundation design and suitable pile design parameters. Also, noting that any proposed additional loading of the ground (for instance from the placement of fill to raise site levels, if proposed) would generate further consolidation of the soft soils underlying the site and cold result in some possible significant ground settlement. Therefore, surcharging areas (by placing temporary fill prior to construction of any structure) outside the proposed building envelopes might also be required during the site preparation to manage the risk of differential settlements between proposed buildings and adjacent ground, following their construction.

7.2 Site Classification

The shallow ground conditions beneath the site comprise uncontrolled fill materials and deep loose and soft soil deposits. Based on the results of the investigation and in accordance with Australian Standard (AS 2870, 2011), a site classification of 'Class P' applies to the site, owing to the presence of the uncontrolled fill and deep loose and soft soil.

7.3 Site Seismic Classification

Owing to the uncontrolled fill and deep very loose and very soft soil deposits across the site, an earthquake design soil sub-class of Ee is considered appropriate for this site in accordance with Australian Standard (AS 1170.4, 2007). The Hazard Factor (Z) for the site is 0.09, according to Australian Standard (AS 1170.4, 2007). Due to the deep loose soil below the water table, the site also has a significant potential for liquefaction. An assessment on the liquefaction potential of the site should be considered during any detailed investigation, when more details can be collected on the extent of deep loose soils.

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7.4 Excavation Conditions

The encountered ground conditions generally comprise uncontrolled fill, with some large foreign inclusions within the fill, extending below groundwater. Conventional earthmoving equipment (such as large excavators, say at least 20 t) should be generally suitable for shallow excavations in the surficial uncontrolled fill. Shallow groundwater is likely to impact excavations across the site.

The majority of the uncontrolled fill encountered during this preliminary investigation is considered to be geotechnically unsuitable for re-use as structural fill in its current condition. Any further consideration to reuse the uncontrolled fill would require some specific geotechnical provisions, such as screening and disposing its unsuitable components. Separating the re-useable granular components (e.g. the sandy fill) from its cohesive components (e.g. clayey fill) might also prove to be practically difficult. Owing to the significant variability of uncontrolled fill materials across the site, any re-use potential from a geotechnical standpoint should be confirmed on-site by a geotechnical engineer. Some environmental considerations (i.e. contamination) are also anticipated to be required. Overall, at this stage of the study, the reuse of the encountered uncontrolled fill should be considered to be associated with some significant constraints that might preclude such reuse.

7.5 Slope Stability

During construction, it is recommended that temporary batter slopes across the site are maintained flatter than 2:1 (H:V) if not retained. This batter angle is valid provided no surcharge loads (including live loads such as vehicles and machinery) apply at the top of the slope. In uncontrolled fill materials, a safe batter angler not steeper than 3:1 (H:V) is recommended for design for slopes not greater than 3 m in height, however, owing to variability of the uncontrolled fill materials, this value should be adjusted during construction based on the encountered conditions.

The design of unpropped flexible or rigid walls should be undertaken using a triangular pressure distribution and the earth pressure parameters given in Table 4. In addition to the soil pressure, wall design should also allow for external loads such as buildings, live loads and hydrostatic pressure. Owing to the likely significant settlements associated with the uncontrolled fill and deep soft soils, the requirement to adopt a piles foundation system to support proposed retaining walls is anticipated.

Table 4: Preliminary Soil Parameters for Earth Retaining Design

Soil Type and Density	Soil Unit Weight Above Water γ (kN/m^3)	Submerged Soil Unit Weight γ' (kN/m^3)	Drained Angle of Friction Φ' (°)	Undrained Shear Strength Cu (kPa)	Coefficient of Earth Pressure – Active K_a	Coefficient of Earth Pressure – Passive K_p	Coefficient of Earth Pressure – at Rest K_0
Uncontrolled Fill Materials	16	6	28	-	0.36	2.7	0.5

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It should be noted that the passive earth pressure coefficient (second last column of Table 4) is an ultimate value and does not incorporate a factor of safety. Because the stress-strain relationship curve for lateral loading is not linear, relatively large strains are required to mobilise full passive pressure, but only relatively small strains are required to mobilise half the passive pressure, therefore it would be prudent to incorporate a factor of safety of at least 2 for uncontrolled fill materials, to derive design values from the ultimate values.

7.6 Foundation Options

Shallow footings are not considered suitable across this site, owing to the significant thickness of uncontrolled fill and deep loose and soft soils.

7.6.1 Piles

It is anticipated that a piled foundation system, with deep bored piles that penetrate the deep loose and soft soils into the medium dense and dense sandy soils at depth, would likely be required for any foundations on-site.

Bored piles will require temporary or permanent casing throughout the uncontrolled fill materials, noting that possible obstructions within the uncontrolled might cause some difficulties when driving the casing or drilling the pile hole. This pile type will involve soil excavation to target founding level and hence would produce spoil that needs to be handled and disposed of in a suitable manner, which will need to also be considered from an environmental standpoint.

Installation through the uncontrolled fill materials could be affected by the possible presence of large, hard inclusions and the design of the pile installation methodology should take this possibility into consideration.

The settlement of the uncontrolled fill will exert negative skin friction on the piles, which the piles will need to be designed to accommodate or be constructed in sleeves.

Additional deep geotechnical boreholes will be required across the site to inform on the pile design.

7.6.1 Controlled Modulus Columns

Controlled modulus columns could be installed as an alternative to conventional pile foundations, allowing shallow footings to be used whilst controlling settlements to acceptable limits.

Installation of controlled modulus columns involves displacing a column of material using a reverse flight auger, densifying the soil around the auger, and backfilling the resulting hole with cement ground under moderate pressure to create a 'hard' inclusion in the ground. The columns are typically 250 mm to 500 mm in diameter. Column spacings of columns typically 1.8 m to 2.5 m but would need input from a specialist ground improvement contractor. Columns can be installed to depths of up to 50 m, so could penetrate to the base of the uncontrolled fill and deep loose and soft soils. However, if large hard inclusions such as concrete slabs or beams, are encountered then the auger may experience refusal, as the CPTs did at several locations during the preliminary geotechnical investigation.

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A load transfer platform, such as a granular, well compacted fill layer, possibly reinforced with geogrid or geotextile, would be needed to transfer loads from shallow foundations to the columns.

One main benefit of this ground improvement option (compared to piling) would be to minimise differential settlement across the site and notably between buildings and surrounding grounds. However, it would likely be limited to low level development (say 2 to 3 level buildings), and this option is anticipated to likely be prohibitively expensive, with likely significant mobilisation and installation costs. The advice of a specialist ground improvement contractor, such as Menard Oceania, is suggested to be sought to further assess the suitability of this ground improvement to the proposed development.

7.7 Pavement Construction

The uncontrolled fill across the site does not form a suitable subgrade material for pavement in its current condition. Depending on the expected loading of proposed pavement, the requirement for some over-excavation of uncontrolled fill is likely. Construction should involve the use of a geo-composite layer (such as Global Synthetics' Combigrid) across the base of the over-excavation, overlain by a 500 mm thick layer of compacted crushed limestone, placement of a layer of geogrid (such as Global Synthetics' Secugrid), and a further 500 mm of compacted sand fill. The base of the constructed floating pavement footprint should be at least 2 m wider on each side than the total pavement width (4 m wider in total) to account for a suitable batter and transfer of load. Standard flexible pavements could then be constructed on the 1 m thick raft of stiffened subgrade. Placement of the initial base layer of composite geogrid may be difficult across areas of exposed uncontrolled fill. As such, depending on the site conditions, a 300 mm thick capping layer of clean fill may be required.

Regardless of the above site preparation, some settlement of the pavement should be expected over its service life and should be considered in the selection of the pavement surfacing. The use of pavers should be considered as such surfacing treatment would deform without cracking. Alternatively, a bituminous seal should be preferred over say an asphalt, owing to greater flexibility and to decrease maintenance and repair requirements, noting however that seals are less resistant than asphalt to shearing forces from tyres of turning heavy vehicles. The use a specialised asphalt, such as a stone mastic asphalt, could also be considered, noting it would be less resistant to the risk of cracking than a seal. Some allowance for regular maintenance and repairs should be allowed during the serviceability of the pavement.

7.8 Stormwater Drainage

Owing to the occurrence of low permeability soils and groundwater at shallow depth, the site is considered unsuitable for on-site stormwater disposal. It is suggested that stormwater is controlled using positive drainage or a subsoil drainage network, connected to a suitable outflow.

7.9 Additional Geotechnical Investigation

Additional geotechnical investigation across the site, by way of deep geotechnical boreholes (as a minimum), further CPT and additional laboratory testing, should be undertaken to help refine the ground model, provide pile design parameters, confirm suitable bearing strata for piles, and assess the soil aggressivity and exposure classification for piles. It is recommended that the detailed investigation programme be developed once some details of the proposed development

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are known, if possible, in order to target specific geotechnical issues associated with the development.

The investigation covered in this report should be considered preliminary and as noted in selected sections of the report, additional detailed geotechnical testing at a greater testing frequency is anticipated once the project design has progressed.

8. References

AS 1170.4. (2007). *Structural Design Actions, Part 4: Earthquake Actions in Australia.* Reconfirmed 2018. Incorporating Amendments 1 & 2: Standards Australia.

AS 1289.6.3.2. (1997). *Methods for testing soils for engineering purposes - Soil strength and consolidation tests - Determination of the penetration resistance of a soil - 9kg dynamic cone penetrometer test.* Reconfirmed 2013: Standards Australia.

AS 1289.6.3.3. (1997). *Methods for testing soils for engineering purposes - Soil strength and consolidation tests - Determination of the penetration resistance of a soil - Perth sand penetrometer test.* Reconfimed 2013: Standards Australia.

AS 1726. (2017). *Geotechnical Site Investigations.* Standards Australia.

AS 2159. (2009). *Piling - Design and Installation.* Standards Australia.

AS 2870. (2011). *Residential Slabs and Footings.* Standards Australia.

9. Limitations

Douglas Partners (DP) has prepared this report for this project at Part of Lot 9002 Grandstand Road, Ascot WA in accordance with DP's proposal dated 8 May 2023 and acceptance received from Mr James Oldring in a signed services order dated 8 August 2023. The work was carried out under DP's Engagement Terms. This report is provided for the exclusive use of Perth Racing for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

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The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope of work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of fill of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such fill may contain contaminants and hazardous building materials.

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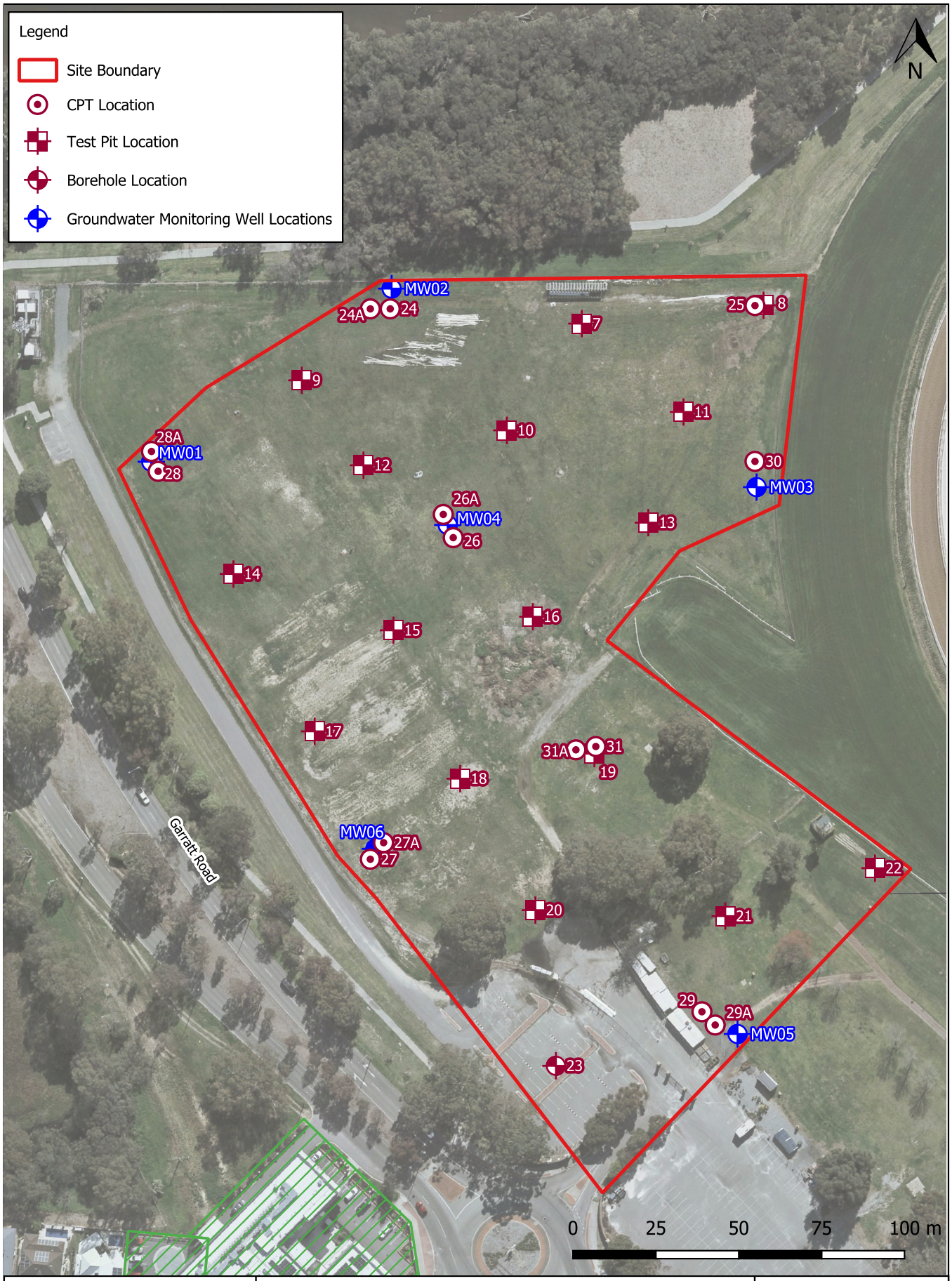
Appendix B

Test Location Plan

Test Pit and Borehole Logs

CPT Results

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Douglas PARTNERS	**Test Location Plan** **Proposed Residential Development** **Lot 9002 Grandstand Road, Ascot, WA**	PROJECT: 219164.03 Drawing No: 1 REV: 0
	CLIENT: Perth Racing	DATE: 24/1/2024

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BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 1.9 AHD
COORDINATE: E:397722.0, N:6466365.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 01
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
		0.00	FILL / SAND (SP-SM), with silt, trace rootlets: grey-brown; fine to medium; poorly graded.		FILL											
		0.40	FILL / SAND (SP-SM), with silt, trace rootlets: grey - brown; fine to medium.		FILL			M		ASS		0.50				
	1	1								ASS		1.00				
Ground Water Measured at 1.3 m 18/09/23										ASS		1.50				
	0	2								ASS		2.00				
		2.10	SAND (SP), trace silt: grey; fine to medium.		ALV			W		ASS		2.50				
	-1	3								ASS		3.00				
		3.60	Clayey SAND (CL-Cl): grey; fine to medium; low to medium plasticity clay.		ALV					ASS		3.50				
	-2	4								ASS		4.00				
			Borehole discontinued at 4.00m depth. Target Depth Reached.													
	-3	5										5				
	-4															

Backfill: 0.0 Bentonite Concrete; 0.5 Gravel backfill; 50mm Class 18
Well pipe: 50mm Class 18

NOTES (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.0 AHD
COORDINATE: E:397795.0, N:6466418.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 02
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
Ground Water Measured at 1.46 m 18/09/23	2	0	FILL / SAND (SP-SM), with silt, trace gravel: grey; fine to medium.		FILL			M		ASS		0.50			0.5 m Bentonite Concrete	50mm Class 18
			From 0.40m: becoming orange-brown							ASS		1.00			0.5 m Gravel backfill	
	1	1	From 1.10m: becoming grey-brown, trace limestone gravel							ASS		1.50				
			1.60m: trace brick, limestone gravel, wet @ 1.6 m							ASS		2.00				
		2.20	Sandy CLAY (CL-CI): grey; low to medium plasticity; fine to medium sand.		ALV					ASS		2.50				
	0	2.70	SAND (SP), trace rootlets, trace silt: grey; fine to medium.		ALV			W		ASS		3.00				
	-1	3								ASS		3.50				
	-2	4	Borehole discontinued at 4.00m depth. Target Depth Reached.							ASS		4.00				
	-3	5										5				

NOTES (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log

Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 3.2 AHD
COORDINATE: E:397905.0, N:6466358.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 03
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	3		FILL / SAND (SP), trace silt: orange; fine to medium. From 0.30m: becoming grey, trace clay, limestone gravel		FILL										Bentonite Concrete	50mm Class 18
	2															
	1	1.60	FILL / Clayey SAND (SC), trace gravel: grey; fine to medium; low to medium plasticity clay.		FILL							1			Gravel backfill	
	1	2.20	FILL / SAND (SP), trace silt: orange - grey; fine to medium. 2.80m: trace brick		FILL							2				50mm Class 18
Ground Water Measured at 2.37 m 18/09/23	0	3.00	FILL / Clayey SAND (SC): grey; fine to medium; low to medium plasticity clay. 3.30m-3.50m: with bitumen layer		FILL							3				
	-1	3.60	FILL / CLAY (CL-CI), trace sand: grey - green; low to medium plasticity.		FILL							4				
	-2	4	Borehole discontinued at 4.00m depth. Target Depth Reached.									5				

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.4 AHD
COORDINATE: E:397812.0, N:6466346.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 04
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	TESTING AND REMARKS: RESULTS AND REMARKS	BACKFILL	WELL PIPE
	2		FILL / SAND (SP-SM), with silt, trace rootlets: orange grey; fine to medium.		FILL					ASS		0.50			Bentonite Concrete	50mm Class 18
		0.60	FILL / SAND (SP), with gravel, trace clay: grey; fine to medium; fine to medium gravel.							ASS		1.00			Gravel backfill	
	1	1								ASS		1.50				
▼			1.50m: trace brick, wet													
Ground Water Measured at 1.59 m 18/09/23					FILL											
	0	2	2.00m: trace brick							ASS		2.00				
										ASS		2.50				50mm Class 18
		3	3.00m: trace brick							ASS		3.00				
		3.20	SAND (SP), trace silt: grey-orange; fine to medium.		ALV											
	-1	3.40	Clayey SAND (SC): orange-grey; fine to medium; low to medium plasticity clay.		ALV					ASS		3.50				
		3.60	Sandy CLAY (CL): grey; low to medium plasticity; fine to medium sand.		ALV											
		4	Borehole discontinued at 4.00m depth. Target Depth Reached.							ASS		4.00				
	-2															
		5										5				
	-3															

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.5 AHD
COORDINATE: E:397900.0, N:6466193.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 05
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*) MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	2	0.00	FILL / SAND (SP-SC), with rootlets, with silt: orange-grey; fine to coarse. 0.30m: trace gravel		FILL				ASS		0.50			Bentonite Concrete	50mm Class 18
		0.60	FILL / Clayey SAND (SC): orange-grey; fine to medium; low to medium plasticity clay.		FILL				ASS		1.00			Gravel backfill	
▼ Ground Water Measured at 1.21 m 18/09/23	1	1.40	SAND (SP), trace silt: orange-grey; fine to medium.		ALV				ASS		1.50				
	0	2.60	Sandy CLAY (CL): grey-black; low to medium plasticity; fine to medium sand.		ALV				ASS		2.00				50mm Class 18
		3.10	SAND (SP): grey; fine to medium.		ALV				ASS		2.50				
	-1	3.40	Sandy CLAY (CL): grey-black; low to medium plasticity; fine to medium sand.		ALV				ASS		3.00				
		4.00	Borehole discontinued at 4.00m depth. Target Depth Reached.						ASS		3.50				
	-2										4.00				
	-3														

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397790.0, N:6466249.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 06
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	TESTING AND REMARKS: RESULTS AND REMARKS	BACKFILL	WELL PIPE
▼ Ground Water Measured at 1.09 m 18/09/23	2	0.40	FILL / SAND (SP) : Sand, with rootlets, trace silt: orange-grey; fine to medium.		FILL										Bentonite Concrete	50mm Class 18
	1		FILL / SAND (SP), with gravel: grey-brown; fine to medium.							ASS		0.50				
			From 0.80m: becoming grey, no gravel													
			From 1.10m: becoming orange-grey		FILL											
	0	2.20	From 1.80m: becoming grey and trace brick												Gravel backfill	50mm Class 18
			FILL / Clayey SAND (CL): grey; fine to medium; low to medium plasticity clay; may be natural.		FILL											
		2.60	SAND (SP): grey; fine to medium.		ALV											
	-1	3.10	Sandy CLAY (CL): dark grey; low to medium plasticity; fine to medium sand.		ALV											
	-2	4	Borehole discontinued at 4.00m depth. Target Depth Reached.													
	-3	5										5				

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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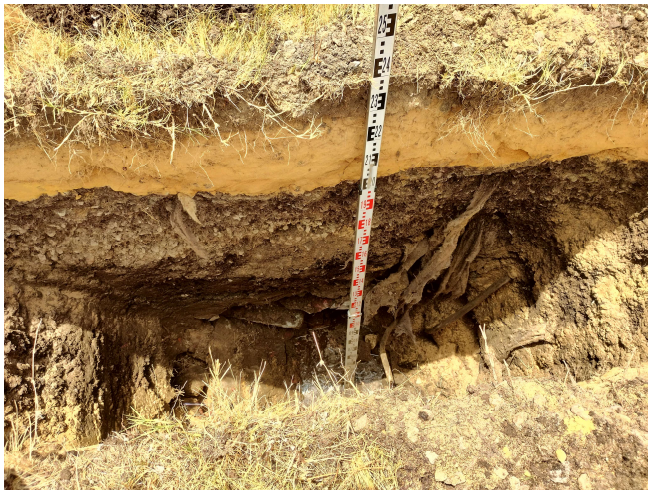
TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.9 AHD
COORDINATE: E:397852.9, N:6466410.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP07
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
			FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL	MD to VD	D to M		ES		0.10	PID	<1ppm
			From 0.17m: becoming orange									DCP9/150	5 10 15
			0.54m: trace geo-fabric						ES		0.40	PID	<1ppm
		0.60									0.50		
			FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL								
			0.84m: trace geo-fabric										
	2	0.90	FILL / GRAVEL (GP-GM) : Gravel, with mulch, with sand: dark brown and dark grey-brown; with silt.		FILL				ES		1.00	PID	<1ppm
	1										1.10		
		1.40	FILL / SAND (SP-SM), with silt: dark grey; fine to medium.		FILL	ND	M	ASB9, ASB10 AF/FA	D		1.50	PID	<1ppm
			1.50m: trace PACM fragment						ES		1.60		
			From 1.60m-2.60m: with fragments of bricks, concrete and metal roofing sheetings										
	0	2			FILL				ES		2.00	PID	<1ppm
09/11/23							W				2.10		
									ES		2.50	PID	<1ppm
			Test Pit discontinued at 2.60m depth. (Collapsing conditions).								2.60		





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.3 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:397905.7, N:6466414.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP08
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
			FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.			VD				ES		0.10	PID	<1 ppm
			From 0.43m: becoming pale grey, trace gravel		FILL								PSP/150	5 10 15 Refusal 20
										ES		0.50 0.60	PID	<1 ppm
		1	From 1.20m: becoming grey							ES		1.00 1.10	PID	<1 ppm
		1.40	FILL / organic SAND (SP-SM), with silt, with gravel: dark grey-brown; fine to medium; trace fragments of brick and concrete.		FILL	ND		M	AF/FA ASB 8	D ES MAT		1.50 1.60	PID	<1 ppm
			1.55m-2.00m: with fragments of brick, concrete and PVC											
		1.80	FILL / SAND (SP), trace gravel, fragments of brick and concrete, trace silt: dark grey; fine to medium.							D ES		2.00 2.10	PID	<1 ppm
		2	2.20m: trace metal sheet, PVC		FILL									
			2.40m: trace rubber pipe, metal bar							ES		2.50 2.60	PID	<1 ppm
			Test Pit discontinued at 2.70m depth. (Test Pit terminated due to slow digging).											





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.1 AHD
COORDINATE: E:397768.9, N:6466392.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP09
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
	2	0	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL	D to VD	D to M		ES		0.10	PID	<1ppm
		0.45	FILL / Clayey SAND (SC): orange-brown; fine to medium; low to medium plasticity clay.		FILL				D		0.50	PID	<1ppm
									ES		0.60		
		0.95										PID/150	5 10 15 REFUSAL 25 25
		0.98	FILL / ASPHALTIC CONCRETE: black, 7 mm sized nominal aggregate.										
	1		FILL / Silty SAND (SM): brown; fine to medium. From 1.15m: becoming grey-brown From 1.20m: with fragments of brick, concrete slab of 0.4 m in thickness, geo-fabric, metal bar and terracotta pipe 1.40m: trace metal sheet		FILL	ND	M		ES		1.00	PID	<1ppm
											1.10		
									ES		1.50	PID	<1ppm
											1.60		
▼ 09/11/23		2	1.90m-2.10m: trace pockets of Clayey SAND SC						ES		2.00	PID	<1ppm
	0						W				2.10		
			Test Pit discontinued at 2.30m depth. (Collapsing conditions).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.1 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.4 AHD
COORDINATE: E:397829.1, N:6466375.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP10
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	2	FILL / SAND (SP-SM), with silt, trace rootlets: bands of grey, orange-brown and pale grey; fine to medium.		FILL	MD to D		DUP 2	ES		0.10	PID	<1ppm
		0.70m: trace geo-fabric						ES		0.50	PID	<1ppm
	0.80	FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL						0.60		
	1							ES		1.00	PID	<1ppm
	1.20	FILL / SAND (SP), trace rootlets, trace silt: grey -brown; fine to medium.		FILL	ND					1.10		
		From 1.40m-1.80m: with fragments of brick and concrete						ES		1.50	PID	<1ppm
		From 1.80m: becoming dark grey, trace fragments of brick and concrete								1.60		
	2							ES		2.00	PID	<1ppm
		Test Pit discontinued at 2.15m depth. (Test Pit terminated due to slow digging).								2.10		

PSP/TID: 5 10 15





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NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

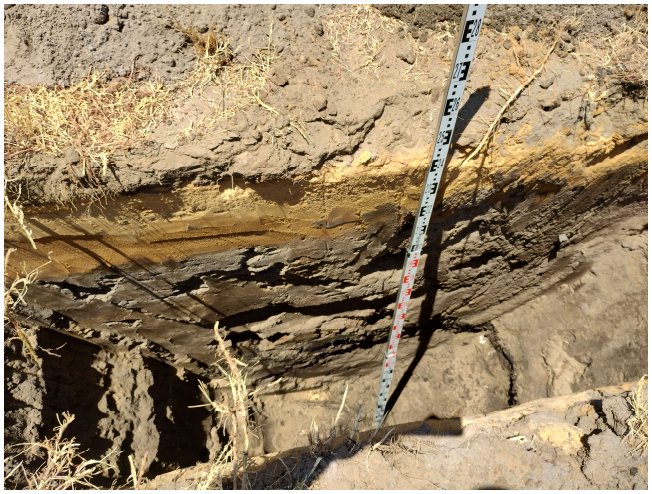
TEST PIT LOG

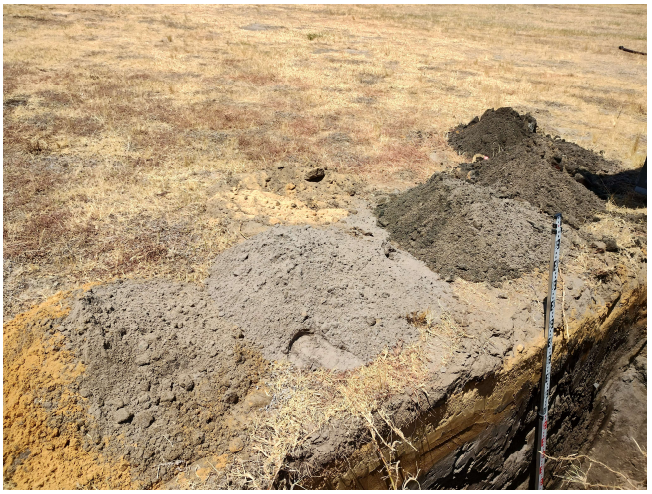
CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 3.1 AHD
COORDINATE: E:397881.2, N:6466387.1
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP11
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†) / DENSITY.(†)	MOISTURE		REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	3 / 0	FILL / SAND (SP-SM), with silt: grey and orange-brown; fine to medium.		FILL	VD	D to M			ES		0.10	PSP/150	5 10 15 REFUSAL 25 25
		From 0.35m: becoming grey							ES		0.50 0.60		
	2 / 1							DUP 3	D ES		1.00 1.10		
		From 1.60m: becoming dark grey, trace fragments of brick			ND	M			D ES		1.60 1.70		
		From 1.70m-2.40m: with fragments of brick and concrete											
	1 / 2	1.80m: piece of concrete boulder (1 m x 0.5 m) observed							ES		2.00 2.10		
		2.10m: trace plastic bottle, glass bottle, concrete rubble											
		2.30m: trace fragments of wooden plank and timer							D		2.30		
		Test Pit discontinued at 2.40m depth. (Test Pit terminated due to slow digging).											





NOTES: [#] Soil origin is "probable" unless otherwise stated. [†] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.1 AHD
COORDINATE: E:397785.4, N:6466366.6
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP12
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
	2		FILL / SAND (SP-SM), with silt, trace gravel and rootlets: grey; fine to medium.						ES		0.10	PID	<1ppm
			From 0.20m: becoming yellow-brown		FILL	D to VD	D to M						
									ES		0.50	PID	<1ppm
											0.60		
		0.85											
		0.90	FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL								
	1	1							D		1.00	PID	<1ppm
			FILL / SAND (SP), trace fragments of brick, scrap metal, timber and rubber cable, trace silt: dark grey-brown; fine to medium.					AF/FA, ASB 6, ASB 7	ES		1.10		
			1.30m-1.80m: with fragments of plastic waste, insulation material, terracotta pipes and concrete, trace PACM fragments		FILL	ND	M		ES		1.50	PID	<1ppm
											1.60		
			From 1.90m: becoming green-grey, trace pockets of CLAY CL-CI						B		2.00	PID	<1ppm
▼ 09/11/23	0	2					W		ES		2.10		
			Test Pit discontinued at 2.30m depth. (Collapsing conditions).										

PSP/TID: 5, 10, 15, 25





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:

REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.1 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.8 AHD
COORDINATE: E:397872.7, N:6466350.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP13
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†) / DENSITY.(†)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
			FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium; 10% non-plastic fines. From 0.15m: becoming orange. 0.70m: trace geo-fabric		FILL	D to VD	D to M		ES		0.10	PID	<1ppm
		0.75							D		0.50	PID	<1ppm
	2								ES		0.60	PSP/150	5 / 10 / 15 / 25
	1		FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand. 1.20m: trace geo-fabric		FILL				ES		1.00	PID	<1ppm
		1.30									1.10		
			FILL / SAND (SP), trace gravel, fragments of brick and concrete, trace silt: dark grey; fine to medium. 1.50m-2.40m: with fragments of bricks and concrete slab				M		D		1.50	PID	<1ppm
	1					ND			ES		1.60		
		2			FILL				ES		2.00	PID	<1ppm
▼ 09/11/23											2.10		
							W		ES		2.50	PID	<1ppm
											2.60		
	0		Test Pit discontinued at 2.70m depth. (Collapsing conditions).										





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NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.5 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397745.6, N:6466334.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP14
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	2 / 0.25	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL	D to VD	D to M		ES		0.10	PID	<1ppm
		FILL / Silty SAND (SM): brown and grey-brown; weakly to moderately cemented.									DCP9/150	29 30
								D		0.50		
								ES		0.60	PID	<1ppm
		0.65m: trace fragments of brick and glass										
		0.72m-2.00m: with framgnes of brick, metal sheet and insulation material										
	1	0.92m: trace fragments of plastic waste, glass and limestone boulders						ES		1.00	PID	<1ppm
										1.10		
				FILL	ND	M						
								ES		1.50	PID	<1ppm
										1.60		
	2	2.00m: becoming gren-grey, trace fragments of timber, brick and concrete blocks, with pockets of Clayey SAND SC						ES		2.00	PID	<1ppm
										2.10		
		From 2.20m: with fragments of brick and scrap metal						D		2.40		
		Test Pit discontinued at 2.50m depth. (Test Pit terminated due to slow digging).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397794.3, N:6466319.4
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP15
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
			FILL / SAND (SP-SM), with silt, trace gravel and rootlets: orange-brown; fine to medium.						ES		0.10	PID	<1ppm
			From 0.24m: becoming grey		FILL	VD	D to M					DCP9/150	
			From 0.42m: becoming pale grey						D		0.50	PID	<1ppm
									ES		0.60		
		0.75	FILL / Sandy GRAVEL (GP-GM), with silt: dark brown and grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL	ND							22
		0.95	FILL / SAND (SP), with fragments of brick and concrete, trace silt: grey; fine to medium.						D		1.00	PID	<1ppm
									ES		1.10		
			1.20m: trace fragments of timber, terracotta pipe and scrap metal										
			1.50m: trace redundant cable				M		ES		1.50	PID	<1ppm
											1.60		
			From 1.80m: becoming orange-brown		FILL	ND							
			2.00m: trace PACM pipe					AF/FA, ASB 5	ES		2.00	PID	<1ppm
			2.10m: trace fragments of timer								2.10		
▼ 08/11/23			From 2.40m: becoming dark grey				W		ES		2.50		
											2.60		
			Test Pit discontinued at 2.70m depth. (Test Pit flooded with water seepage).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.4 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885127
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TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.4 AHD
COORDINATE: E:397837.5, N:6466321.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP16
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.34	FILL / SAND (SP-SM), with silt, trace gravel and rootlets: grey; fine to medium.		FILL				ES		0.10	PID	<1ppm
	0.84	FILL / Sandy (GP-GM), with silt: grey; fine to medium sand.		FILL	ND	D to M		ES		0.50 0.60	PID	<1ppm
		0.80m: trace fragments of plastic waste										
		FILL / SAND (SP), with fragments of brick and concrete, trace silt: grey; fine to medium.		FILL	MD to D	M		ES		1.00 1.10	PID	<1ppm
		1.50m: trace fragments of plastic waste						D ES		1.50 1.60	PID	<1ppm
		2.00m: trace metal plate (0.5 m x 0.5 m) 2.10m: with limestone boulders			ND			ES		2.00 2.10	PID	<1ppm
▼ 08/11/23						W		D ES		2.50 2.60	PID	<1ppm
		Test Pit discontinued at 2.60m depth. (Collapsing conditions).										

DCP9/150: 5, 10, 15





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:

REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.5 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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Version: 1, Version Date: 18/09/2024

TEST PIT LOG

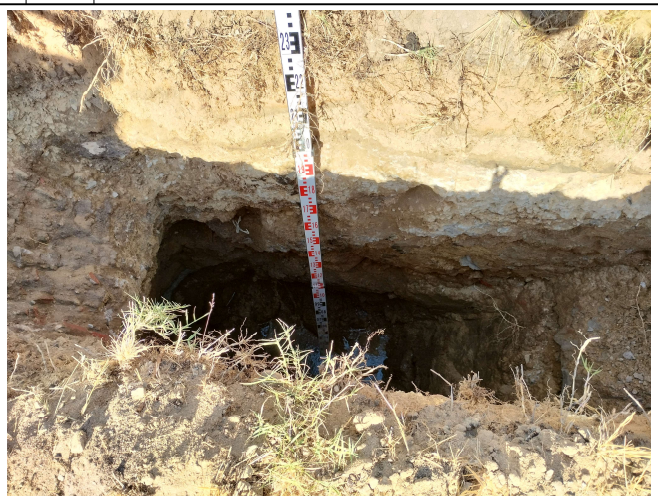
CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397775.7, N:6466289.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP17
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†) / DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.15	FILL / SAND (SP-SM), with silt, trace rootlets: orange - grey; fine to medium.		FILL	L to VD	D to M		ES		0.10	PID	<1ppm
		FILL / Sandy GRAVEL (GP-GM), with fragments of concrete, with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL				ES		0.50 0.60	PID	<1ppm
	0.90	FILL / SAND (SP), with fragments of brick and concrete, trace silt: grey; fine to medium.		FILL	ND	M		ES		1.00 1.10	PID	<1ppm
		1.10m: trace fragments of plastic waste										
		1.60m: trace metal sheets					ASB 3	ES		1.50 1.60	PID	<1ppm
		1.90m: piece of concrete block observed										
▼ 08/11/23						W	ASB 4	ES		2.00 2.10	PID	<1ppm
		Test Pit discontinued at 2.50m depth. (Collapsing conditions).										

DCP9/150: 5, 10, 15, 25





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.1 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397816.0, N:6466272.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP18
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.26	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium; weakly cemented.		FILL		D to M		ES		0.10	PID	<1ppm
	0.45	FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL	ND							
	1	FILL / SAND (SP), with fragments of brick and concrete, with clay: grey; fine to medium. 0.50m-1.50m: with fragments of tile and brick, trace PACM fragments 0.75m: trace metal bar 1.00m: trace fragments of redundant cables, glass, geo-fabric and limestone blocks From 1.20m: with limestone boulders		FILL	MD to VD ND	M	ASB 1	ES D ES ES		0.50 0.60 1.00 1.10 1.40	PID PID PID	<1ppm DCP 9/150 5 10 15 <1ppm <1ppm
	2	Test Pit discontinued at 1.50m depth. (Test Pit terminated due to slow digging).								1.50 2		





NOTES [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397856.8, N:6466280.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP19
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN [#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
	2	0.20	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL			DUP 1	ES		0.10	PID	<1ppm
			FILL / Sandy GRAVEL (GP-GM), with silt: orange-brown; medium to coarse; fine to medium sand; Gravel is crushed limestone.		FILL	ND	D		D		0.50		
									ES		0.60	PID	<1ppm
		0.70	FILL / SAND (SP-SM), with silt, trace gravel: grey-brown; fine to medium.										
			0.75m: trace concrete slab, fragments of brick and terracotta pipes										
	1		From 0.90m: with fragments of brick			MD			ES		1.00	PID	<1ppm
			From 1.20m: becoming grey, trace fragments of timber		FILL		M				1.10	PSD 150	5 10 15
			From 1.60m: becoming grey-brown						ES		1.50	PID	<1ppm
▼ 09/11/23											1.60		
		1.90	FILL / SAND (SP), trace roots, trace silt: dark grey; fine to medium.						ES		2.00	PID	<1ppm
	2					ND					2.10		
	0				FILL		W						
			2.40m: trace fragments of sea shells						D		2.50	PID	<1ppm
									ES		2.60		
			Test Pit discontinued at 2.60m depth. (Collapsing conditions).										





NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:

REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 1.8 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.0 AHD
COORDINATE: E:397838.6, N:6466231.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP20
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
		0.05	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL				ES		0.10	PID	<1ppm
		0.34	FILL / Sandy GRAVEL (GP-GM), with silt: yellow-brown; medium to coarse; fine to medium sand.		FILL		D to M						
			FILL / SAND (SP-SM), with silt, trace gravel: grey and orange-brown; fine to medium.			MD to VD			ES		0.50	PID	<1ppm
			0.50m: with fragments of brick and concrete								0.60		
			0.80m: trace fragments of rubber waste and scrap metal										
	1				FILL				D		1.00	PID	<1ppm
									ES		1.10		
			From 1.20m: becoming dark grey, with fragments of brick				M						
			1.30m-2.10m: with hydrocarbon odour										
			1.50m: with pockets of Clayey SAND SC						D		1.50	PID	9.4ppm
									ES		1.60		
		1.80	FILL / Clayey SAND (SC): dark grey; fine to medium; low to medium plasticity clay.			ND							
08/11/23	0	2							ES		2.00	PID	1.4ppm
			From 2.10m: becoming green-grey		FILL						2.10		
							W						
									ES		2.50	PID	1.1ppm
			Test Pit discontinued at 2.60m depth. (Collapsing conditions).								2.60		

PSP/10





NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.1 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.1 AHD
COORDINATE: E:397896.5, N:6466231.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP21
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
	2	0.17	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL				ES		0.10	PID	<1ppm
			FILL / Sandy GRAVEL (GP-GM), with silt: grey; fine to coarse; fine to medium sand; Gravel is crushed limestone.		FILL	MD to D	D to M		ES		0.50 0.60	PID	<1ppm
		0.70	FILL / SAND (SP-SM), with fragments of brick and concrete, with silt: grey; fine to medium.										
	1	1							ES		1.00 1.10	PID	<1ppm
			1.20m: trace fragments of rubber waste and scrap metal		FILL	ND	M						
▼ 08/11/23									D ES		1.50 1.60	PID	<1ppm
			From 1.80m: trace pockets of CLAY CL-CI										
		1.90	FILL / Sandy CLAY (CI), trace fragments of brick and timber, trace gravel: dark grey; medium plasticity; fine to medium sand.		FILL		w>PL		B ES		2.00 2.10	PID	<1ppm
	0	2	Test Pit discontinued at 2.10m depth. (Collapsing conditions).										

PID DCP 9/150 — 5 — 10 — 15

NOTES [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 1.8 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.3 AHD
COORDINATE: E:397941.6, N:6466244.9
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP22
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
	2	0	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL	MD	D to M		ES		0.10	PID	<1ppm
			From 0.22m: becoming orange										
			From 0.40m: becoming brown						ES		0.50	PID	<1ppm
			From 0.70m: becoming dark grey-brown								0.60		
	1	1					M		ES		1.00	PID	<1ppm
											1.10		
		1.40	SAND (SP-SM), with silt: pale yellow-brown; fine to medium.		possibly ALV	ND			ES		1.50	PID	<1ppm
▼ 09/11/23			From 1.70m: becoming orange-grey								1.60		
	0	2					W		B		2.00	PID	<1ppm
									ES		2.10		
			Test Pit discontinued at 2.20m depth. (Collapsing conditions).										

PSP/10





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 1.8 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.4 AHD
COORDINATE: E:397844.9, N:6466181.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP23
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†) DENSITY.(†)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
		0.05	ASPHALT: black, 7 mm sized nominal aggregate.		FILL		D						
		0.15	FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand; BASECOURSE, gravel is crushed rock.		FILL	ND							
		0.30			FILL		M						
	2		FILL / Sandy GRAVEL (GP-GM), with silt: red-brown; medium to coarse, angular to sub-angular; fine to medium sand; SUB-BASE, gravel is granitic and lateritic.						ES		0.50	PID	<1ppm
		0.65									0.60		
			FILL / Silty SAND (SM), trace gravel: brown; fine to medium; with pockets of Clayey SAND SC. 0.90m: trace fragments of brick			MD to D							
	1		FILL / Clayey SAND (SC): orange-grey; fine to medium; low to medium plasticity clay.		FILL		M		D		1.00	PID	<1ppm
									ES		1.10		
		1.40	FILL / SAND (SP), trace silt: grey; fine to medium; trace pockets of Clayey SAND SC.		FILL				ES		1.50	PID	<1ppm
▼ 08/11/23	1		1.80m: trace fragments of brick								1.60		
		1.90	FILL / Sandy CLAY (CI), trace gravel: dark grey; medium plasticity; fine to medium sand.		FILL	ND	W		D		2.00	PID	<1ppm
	2								ES		2.10		
		2.20	FILL / SAND (SP-SM), with silt: dark grey; fine to medium.		FILL				D		2.50	PID	<1ppm
	0								ES		2.60		
			Borehole discontinued at 2.60m depth. (Collapsing conditions).										

PID DCP9/150 5 10 15





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
METHOD:
OPERATOR: SLE Earthmoving
LOGGED: VV
CASING: Nil

REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 1.7 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Appendix C

Geotechnical Laboratory Test Certificates

Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18256-18262_1_ORG
Project:	Proposed Residential Development	*Sample No.*	WG23.18256-18262
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	Various See Below	*Date Tested:*	15/11/2023

TEST RESULTS - Organic Content

Sampling Method: Sampled by Client, Tested as Received

Testing Completed By: WGLS-LC

Furnace Temperature (°C): 440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG23.18256	TP13/1.5	98.4	1.6
WG23.18257	TP8/1.5 m	93.2	6.8
WG23.18258	TP19/2.5	98.5	1.5
WG23.18262	BH23/2.5 m	98.8	1.2

Comments:

Approved Signatory: Coneill

Name: Cody O'Neill

Date: 16/November/2023

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SOIL | AGGREGATE | CONCRETE | CRUSHING

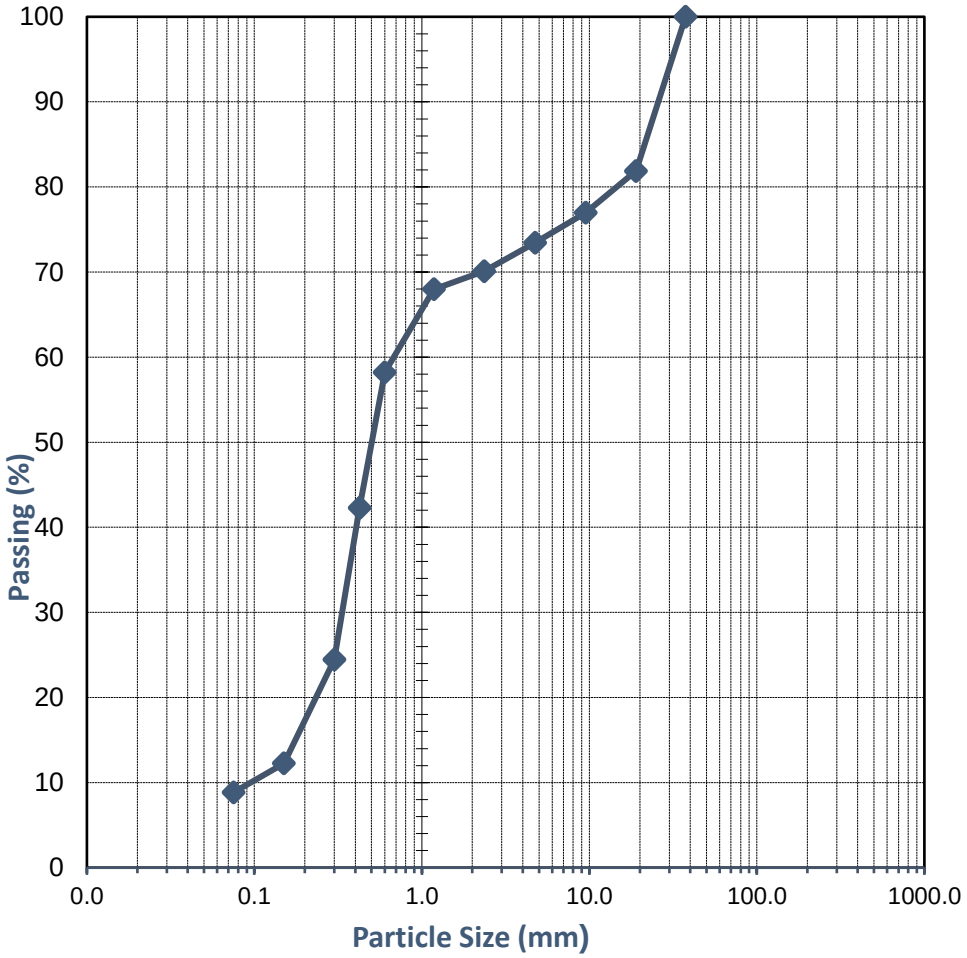
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18257_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18257
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP8/1.5 m	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	82
9.5	77
4.75	73
2.36	70
1.18	68
0.600	58
0.425	42
0.300	24
0.150	12
0.075	9



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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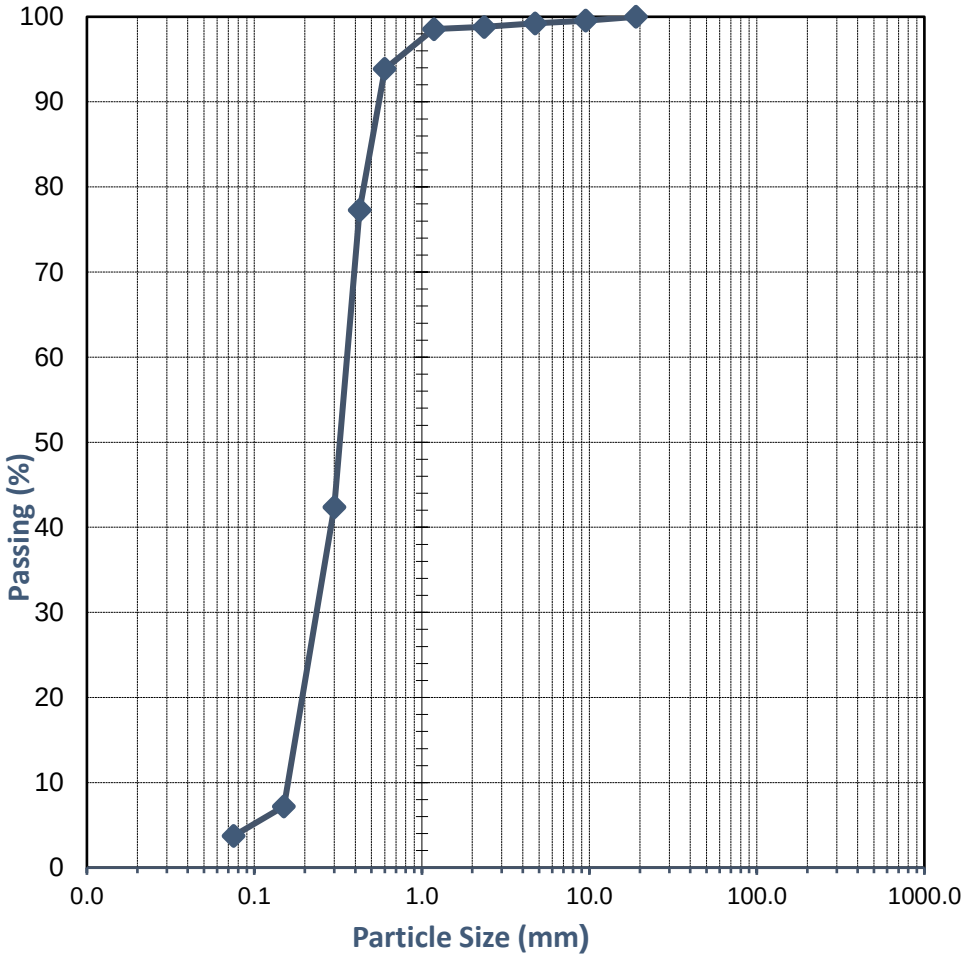
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18256_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18256
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP13/1.5	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	99
2.36	99
1.18	99
0.600	94
0.425	77
0.300	42
0.150	7
0.075	4



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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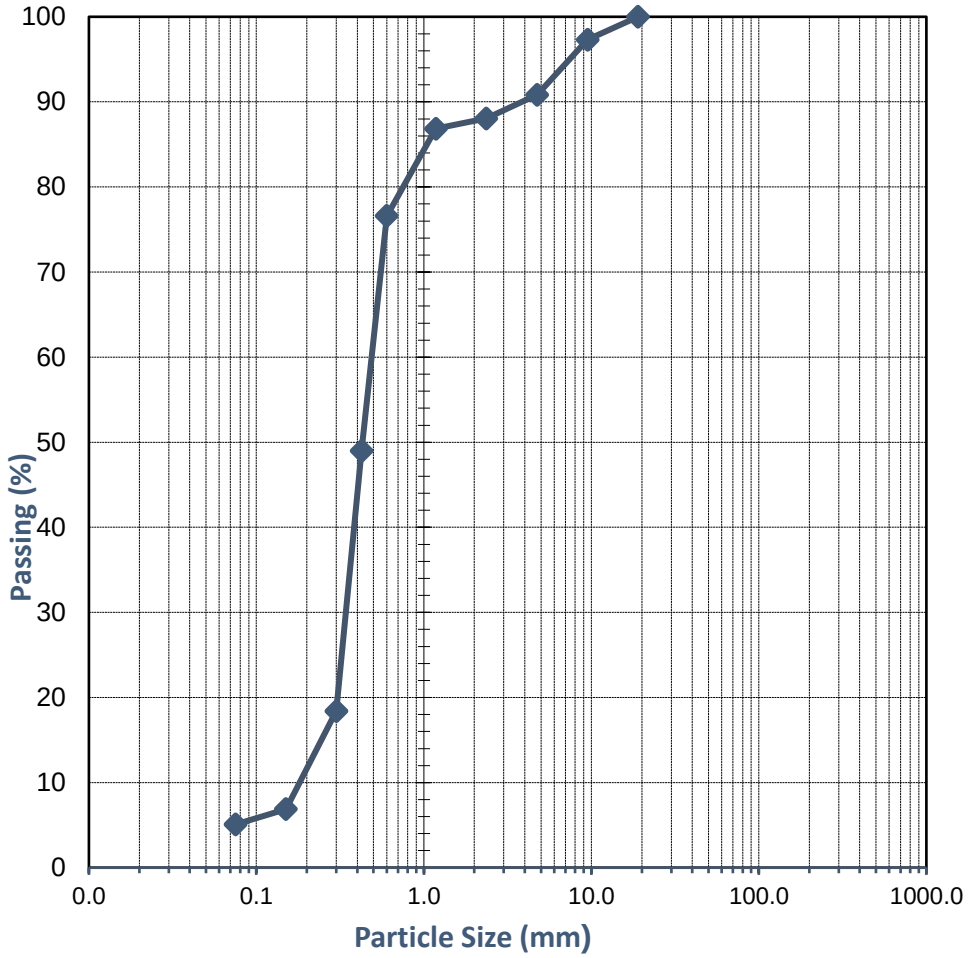
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18258_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18258
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP19/2.5	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	97
4.75	91
2.36	88
1.18	87
0.600	77
0.425	49
0.300	18
0.150	7
0.075	5



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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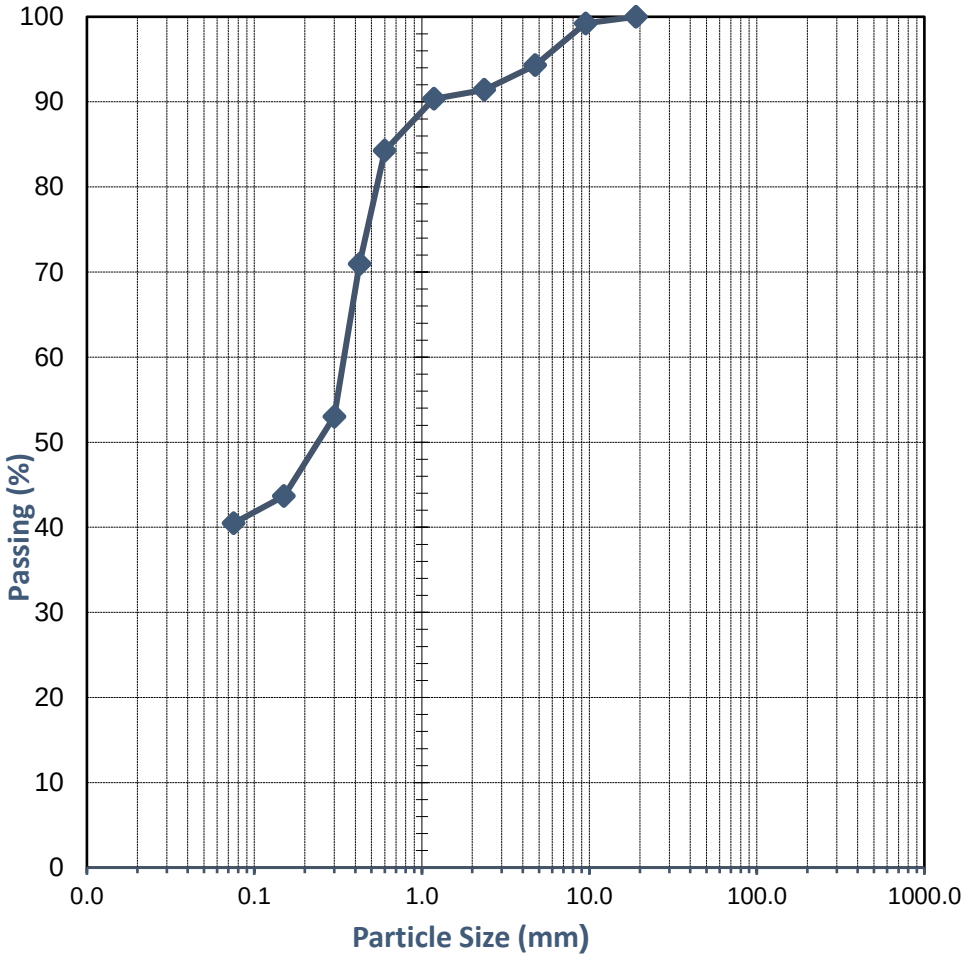
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18259_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18259
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP21/2.0 m	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	99
4.75	94
2.36	91
1.18	90
0.600	84
0.425	71
0.300	53
0.150	44
0.075	40



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18259_1_PI
Project:	Proposed Residential Development	*Sample No.*	WG23.18259
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP21/2.0 m	*Date Tested:*	17/11/2023

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**37**
AS 1289.3.2.1	**Plastic Limit (%)**	**24**
AS 1289.3.3.1	**Plasticity Index (%)**	**13**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**8.5**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Curled**

Comments:

Approved Signatory:

Name: Madhav Basnet

Date: 20/November/2023

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SOIL | AGGREGATE | CONCRETE | CRUSHING

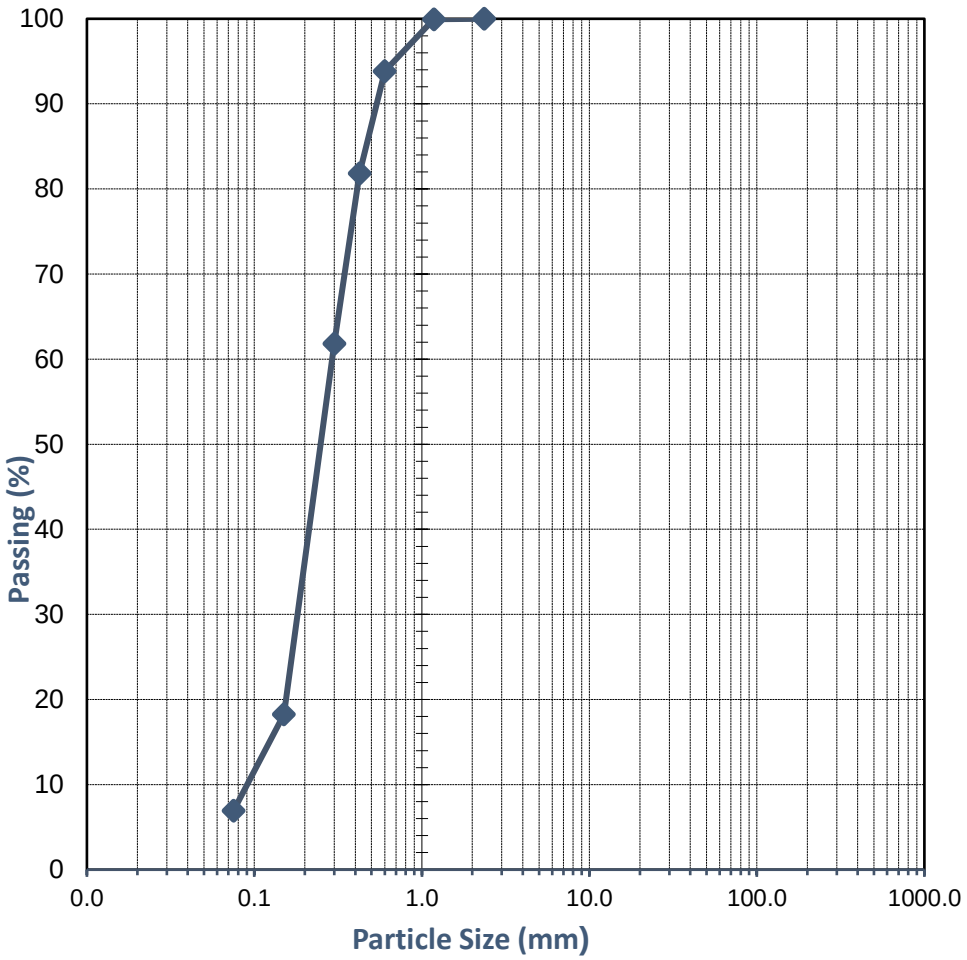
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18260_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18260
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/2023
Sample Identification:	TP22/2.0	*Date Tested:*	22/11 - 23/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	94
0.425	82
0.300	62
0.150	18
0.075	7



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 23/November/2023

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18260_1_PI
Project:	Proposed Residential Development	*Sample No.*	WG23.18260
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP22/2.0	*Date Tested:*	23/11/2023

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Matthew Lichon

Date: 24/November/2023

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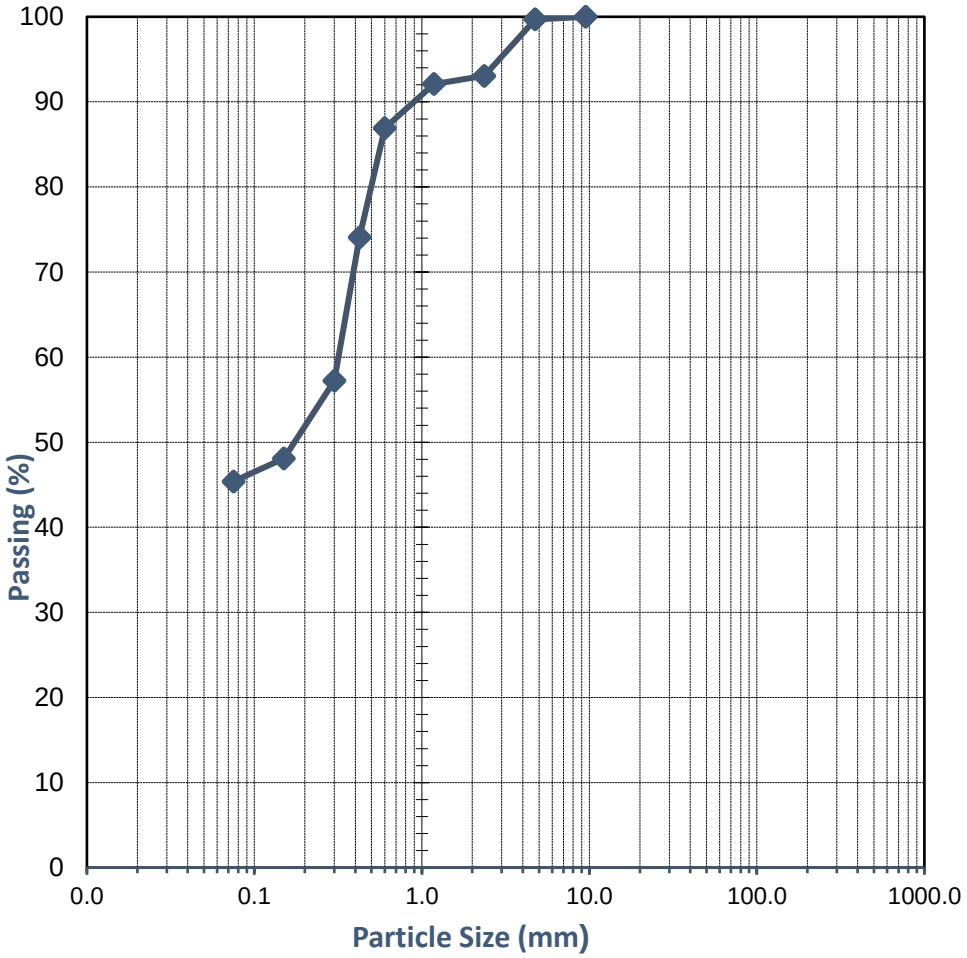
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18261_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18261
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	BH23/2.0 m	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	93
1.18	92
0.600	87
0.425	74
0.300	57
0.150	48
0.075	45



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18261_1_PI
Project:	Proposed Residential Development	*Sample No.*	WG23.18261
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	BH23/2.0 m	*Date Tested:*	17/11/2023

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**44**
AS 1289.3.2.1	**Plastic Limit (%)**	**22**
AS 1289.3.3.1	**Plasticity Index (%)**	**22**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**9.5**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Curled**

Comments:

Approved Signatory:

Name: Madhav Basnet

Date: 20/November/2023

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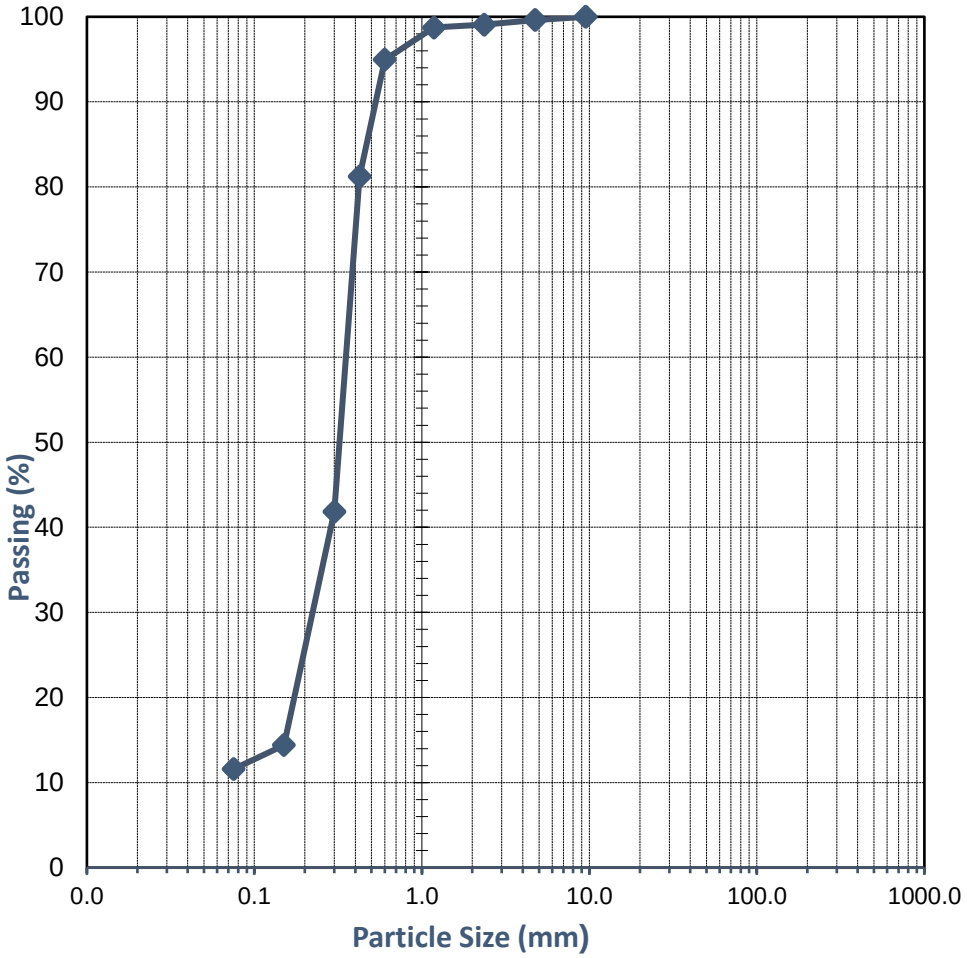
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18262_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18262
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	BH23/2.5 m	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	99
1.18	99
0.600	95
0.425	81
0.300	42
0.150	14
0.075	12



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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Report on:

GEOTECHNICAL STUDY PROPOSED DEVELOPMENT LOT 452 RESOLUTION DRIVE ASCOT WA

WAG230750-01 002 R Rev0

Submitted to:

Tabec Pty Ltd

PO Box 409

West Perth WA 6872

12 March 2024

Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

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Figure 1: Site and Location Plan

Appendix A: Site Photographs
Appendix B: Cone Penetration Test Results
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Appendix D: Laboratory Test Results

Standard Geotechnical Definitions, Recommendations, Requirements and Limitations

Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

1. INTRODUCTION

This report presents the outcomes of Galt Geotechnics' (Galt's) geotechnical study for the proposed development at Lot 452 Resolution Drive, Ascot ("the site").

This report is to be read in conjunction with the appended "Geotechnical Definitions, Recommendations, Requirements and Limitations". 'Clause GDR1', etc. refer to this Appendix, found at the back of this report.

2. KEY FINDINGS

Site Description

Table 1: Summary of Site

Item	Comment
Site Extent	Refer Figure 1.
Site Area	About 1.14 Ha.
Current Site Surface Levels[1]	About RL 3 m AHD.
Vegetation	Mature trees, shrubs and lawn in landscaped areas covering a large portion of the site.
Existing Infrastructure	Single Storey building (used by Perth Racing Security Services) with surrounding accessways, car parking and landscaped areas.
Site History[2]	**Prior to 1953**: two residences in northern portion of site. Remainder of site relatively clear. **1953 to 1985**: Relatively unchanged. Undeveloped portion of site used as laydown area, car park area, and to stockpile materials at different times. **1989**: Existing Perth Racing Security Services development (as described above) is present **1989 to Present**: Site relatively unchanged.

NOTES: ***1.*** *Site level based on correspondence with client.*

2. *Site history based on aerial imagery (Landgate).*

3. PROPOSED DEVELOPMENT

Table 2: Summary of Proposed Development

Item	Comment
Proposed Development	Unknown, assumed subdivision for commercial/residential purposes.
Proposed Finished Level	Assumed within about 1 m of current ground levels.
Cut/Fill	Assumed ± 1 m with up to 5 m excavation to connect development to existing sewer.
Assumed Foundation Type	Shallow Footings.
Assumed Retaining Walls	Gravity walls up to 1 m in height.
Assumed Stormwater Disposal	Off site into council network.
Assumed Sewage Disposal	Off site via reticulated sewer.

NOTES: ***1.*** *FFL – finished floor level*

2. *Proposed development details based on supplied information.*

4. PROJECT OBJECTIVES

The objectives of the study were to:

- Assess the geotechnical suitability of the site for the proposed development;

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- Geotechnical opportunities and constraints relevant to the proposed development;
- Areas of foundation risk including the presence of aggressive soils and strategies to address identified risks;
- Site preparation including possible reuse of existing soil as controlled fill;
- Excavation conditions;
- The likely site classification;
- Suitable foundation systems including preliminary design parameters;
- Preliminary design parameters for the design of retaining structures and batter slopes;
- Depth to groundwater at time of investigation; and
- Recommendations on additional geotechnical investigation at detailed design phase or to address specific ground conditions encountered.

5. FIELDWORK

Fieldwork was carried out in the presence of a representative from Galt between the 8 and 14 February 2024 and comprised:

Table 3: Summary of Field Data

Type	Results Appendix	Summary	GDR Clause	Equipment Used	No. Tests	Depth Range (m)
Site Plan	Figure 1	-	-	Hand held GPS[1]	-	-
Photographs	A	-	-	-	-	-
Cone Penetration Tests (CPTs)	B	Section 8	GDR3.2	14-tonne truck	5	1.6 to 10.1
Machine Auger Boreholes (BH)	C	Section 8	GDR3.3	AMS Power Probe	4	0.7 to 6.5
Monitoring Well (MW)	C	Section 8	GDR3.3	AMS Power Probe	1	6.0

NOTES: ***1.*** *Hand held GPS is accurate to ±5 m.*

6. LABORATORY TESTING

Laboratory test certificates are presented in Appendix D, and summarised in Attached Tables 1 and 2.

7. SITE CONDITIONS

7.1. Geology

Table 4: Summary of Geology Mapping

Map Sheet	Map Scale	Mapped Soils	Typical Site Findings
Perth	50K	Guildford Formation, described as: "*SANDY SILT - strong brown to mid grey, mottled, blocky, disseminated fine sand, hard when dry, variable clay content of alluvial origin.*"	**Thin topsoil** (landscaped areas) **and pavement materials** (car parks / access ways) **over FILL: SAND / SAND** to about 0.4 m to 0.9 m depth, **over Sandy CLAY / CLAY**.

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7.2. Groundwater

Table 5: Summary of Groundwater Levels

Item	Date	Depth Range (m)	Elevation Range (m AHD)	Comment
Perth Groundwater Atlas	1997	-	3.0	Historical maximum
Department of Water and Environmental Regulation (DWER) Flood Mapping	-	-	2.7 to 2.9 (DWER mapped 1% AEP flood event level)	Portion of site along southern and south western site boundaries, and the northern side of Grandstand road are mapped as being part of flood fringe by DWER. **Advice on development within the defined flood event (DFE) floodplain is provided by DWER on a case by case basis.** **DWER recommends a minimum building floor level of 0.50 metres above this level** (**RL 3.4 m AHD**).
Site observations in MW01	February 2024	3.03	-	Based on highest recorded water levels in monitoring well.
Site observations in CPT test probes	February 2024	1.90 to 2.80	-	CPT probes may not have had sufficient time to recharge to hydrostatic levels.
Recommended Design	-	-	2.7 to 2.9	Groundwater likely to perch on clay soils at site. Proposed development must be designed for DWER DFE flood event.

NOTES: ***1.*** *Depths for site observations based on the site surface level at the time of investigation.*

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8. GROUND MODEL

The encountered subsurface conditions are summarised as comprising:

- **Surficial Topsoil (in landscaped areas)** up to 0.3 m thick **and Hardstand Fill Layers** (in carparks and access ways); **overlying**
- **FILL: SAND / SAND (SP)**, fine to medium grained, sub-rounded to sub-angular, yellow / brown / grey layers, includes trace gravel / Sandy GRAVEL layers, trace / with fines, some typically medium dense to dense, extending to depths of about 0.4 m to 0.9 m; overlying
- **In BH03 and BH04 only: Silty SAND / Clayey SAND (SM/SC)** fine to medium grained, sub-rounded to sub-angular, brown / grey, low to medium plasticity fines, some typically medium dense to dense, extending to depths of about 0.7 m to 1.2 m; overlying
- **Sandy CLAY / CLAY (CI)**, medium plasticity, brown / orange / grey, trace sand to sandy, trace gravel in some zones, desiccated, CPT traces indicate presence of occasional sand layers, typically very stiff to hard, extending to the maximum depth investigated of 10 m.

Geotechnical design parameters for the generalised subsurface units described above are presented in Table 6.

Table 6: Geotechnical Model Units and Design Parameters

Unit Name	γ_{bulk} (kN/m^3)	ϕ' (°)	c' (kPa)	S_u (kPa)	E_v (MPa)	ν	k_0	Wall Friction=0		Wall Friction=0.5ϕ	
								k_a	k_p	k_a	k_p
Compacted Approved FILL	18	36	-	-	50	0.25	0.41	0.26	3.85	0.22	6.54
SAND / Silty SAND / Clayey SAND	18	35	-	-	25	0.3	0.43	0.27	3.69	0.24	6.08
Sandy CLAY / CLAY	18	21	0 to 5	150	30	0.45	Earth pressure coefficients can be calculated for undrained or drained conditions as outlined in GDR11.2.2 using Firm parameters (undrained) or Fines Content >35% & PI 40% (drained).				

NOTES:

1. *These units are a generalization of results from individual tests, which should be referred to for more information.*
2. *Conditions at CPT locations below depth of soil sample recovery are inferred (refer to clause GDR3.2)*
3. *Surficial topsoil and hardstand layers are not included as discrete units.*
4. *Compacted approved fill is as described in Table 7.*
5. *For all earth pressure coefficients (retaining wall design) refer to clause GDR11.2 for more detail and interpretation. Unit weights for retaining structure design should be as per GDR11.2 or 1 kN/m^3 greater than the values in the table above.*

γ_{bulk} – bulk unit weight
ϕ' – effective friction angle
S_u – undrained shear strength
c'– effective cohesion
E_v – vertical elastic modulus
ν – Poisson's Ratio
k_a – coefficient of active earth pressure (Coulomb – AS4678-2002, Appendix E)
k_p – coefficient of passive earth pressure (Coulomb – AS4678-2002, Appendix E)
k_0 – coefficient of at-rest earth pressure (Jaky)

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9. GEOTECHNICAL ASSESSMENT

9.1. Summary

Table 7: Summary of Geotechnical Assessment

Type	Clause	Parameter	Comment
Site Suitability	-	-	We consider the site to be geotechnically suitable for the proposed subdivision development. Standard site preparation measures will apply. However, groundwater could impact construction if it occurs during winter. Flood levels will impact site levels (refer Table 5).
Construction Methodology and Suitability	-	-	Shallow footings in accordance with AS2870-2011 will be suitable for this site. Mass retaining will be suitable for retaining however, must be designed for potential flooding of the site. Stormwater disposal via infiltration is **not** suitable.
Site Classification (AS2870)	GDR5	S	Where **no less than 0.7 m of sand** (including insitu silty sand and clayey sand layers encountered in BH03 and BH04) is present **over in situ CLAY / Sandy CLAY.**
Site Subsoil Class (AS1170.4)	-	Ce	Base of superficial formation mapped to be about 25 m below ground.
Site Preparation	GDR6	-	**GDR6.2.1 Common Measures** followed by **GDR6.2.4 Clayey Sites** followed by **GDR6.2.5 Sand Topping Layer.**
Approved Fill	GDR8	-	**Approved Fill** for this site is to comprise **Permeable Sand**. Only relatively thin surficial layers of sand at the site (excluding topsoil) are suitable as approved fill. If additional fill is required, imported **Permeable Sand** will be needed. Although not classed as 'approved fill', where clay is encountered in trench excavations, this material could possibly be reused to backfill the same portion of the trench (excluding any special fill materials required around buried elements). However, this material will be difficult to work and moisture condition to near optimum (particularly if removed from below the groundwater table).
Compaction Control	GDR7	-	A PSP may be used for compaction control on **Permeable Sand.** Deemed to comply values for 'Tamala' sand in GDR7.4 are applicable. Where filling with clay is done (in trenches, etc), compaction control must be done with the NDG as outlined in GDR7.3 Nuclear Density Gauge.
Shallow Footings	GDR9	q_{all} = 100 kPa to 250 kPa	Design tables for shallow footings are presented in Section 9.2. Estimated settlements are not considered excessive. 70% of the settlement is expected to occur during construction.
Earth Pressure Coefficients	GDR11	Table 6	Earth pressure coefficients are presented in Table 6.
Unsaturated Hydraulic Conductivity	GDR13	-	On site disposal of stormwater unlikely to be suitable due to shallow depth to clay and potential for flooding adjacent the site. Off site disposal of stormwater likely to be required.
Pavement Subgrade CBR	GDR16	CBR = 10%	Subgrade to comprise compacted **Approved Fill no less than 0.6 m thick.**
Soil Aggressivity	GDR17	-	Refer Section 9.3
Batters	GDR12	**Temporary:** Sand: 1V:2H Clay: 1V:1H **Permanent:** 1V:3H	Batter angles apply to soil units (refer Table 6) above the water table, as per GDR12.3. Dewatering and possibly retention (i.e. shoring) required below the groundwater table.
Excavations	GDR12.1	20 Ton Excavator	Potential for obstructions (buried concrete, Soakwells etc…), cemented soils and surficial pavement layers must be considered when selecting earthmoving plant.

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NOTES:
1. q_{all} – *allowable bearing pressure (maximum for all footings, refer to footing tables for further details)*

9.2. Shallow Footings

Table 8: Isolated Pad Footing Allowable Bearing Pressures and Estimated Settlements

d_e (m)	b (m)	q_{all} (kPa)	s (mm)
0.5	0.5	120	< 5
0.5	1.0	130	< 5
1.0	1.0	240	5 - 10
1.0	2.0	250	10 - 15
1.0	3.0	250	20 - 25

NOTES:
1. d_e – *minimum embedment depth (below finished ground level or floor slab)*
2. *b – Footing breadth (footings assumed approximately square)*
3. q_{all} – *allowable bearing pressure (peak). Limited to keep estimated settlements less than 25 mm. Higher q_{all} may be possible if higher settlements can be tolerated – refer queries to us.*
4. *s – estimated settlement (excludes shrink/swell from site class)*
5. *Refer to GDR9*
6. *Groundwater assumed to be at ground level.*

Table 9: Isolated Strip Footing Allowable Bearing Pressures and Estimated Settlements

d_e (m)	b (m)	q_{all} (kPa)	s (mm)
0.5	0.5	100	< 5
0.5	1.0	130	5 - 10
1.0	1.0	190	10 - 15
1.0	2.0	250	20 - 25

NOTES:
1. d_e – *minimum embedment depth (below finished ground level or floor slab)*
2. *b – Footing breadth (footings assumed long relative to breadth)*
3. q_{all} – *allowable bearing pressure (peak). Limited to keep estimated settlements less than 25 mm. Higher q_{all} may be possible if higher settlements can be tolerated – refer queries to us.*
4. *s – estimated settlement (excludes shrink/swell from site class)*
5. *Refer to GDR9*
6. *Groundwater assumed to be at ground level.*

9.3. Soil Aggressivity

Results of aggressivity testing on clay samples is summarised in Attached Table 2. The results indicate the clay is 'non aggressive' to concrete and steel (in accordance with AS2159-2009) with a AS3600-2009 classification of 'A1'.

Based on regional experience, we anticipate the sand will have the same aggressivity classifications as the underlying clay where above the groundwater. However, for concrete in sand below the water table, an AS2159-2009 'mild' classification, and AS3600-2009 'A2' classification is appropriate.

Groundwater was not tested.

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10. CLOSURE

GALT GEOTECHNICS PTY LTD





Owen Woodland CPEng
Geotechnical Engineer

Tyrone Mardesic CPEng
Geotechnical Engineer

https://galtgeo.sharepoint.com/sites/wag230750/shared documents/01 tabec si/03 correspondence/wag230750-01 002 r rev0.docx

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Attached Table 1: Summary of Geotechnical Index Test Results

Test Name	Sample Depth (m)	Soil Class (AS1726 2017)	Fines (%)	Sand (%)	Gravel (%)	LL (%)	PI (%)	LS (%)
BH03	1.5 - 2.2	CLAY (CI)	89	11	0	46	28	12.5
BH04	1.0 - 1.3	Sandy CLAY (CI)	54	43	3	34	20	8.5

Notes

1. *Particle size distribution (by mass)*
   Gravel: 2.36 mm – 63 mm *Sand: 0.075 mm – 2.36 mm* *Fines: <0.075 mm*
2. *Atterberg Limits*
   LL: Liquid limit *PI: Plasticity index* *LS: Linear shrinkage*
   NO: Not obtainable *NP: Non-plastic*

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Attached Table 2: Summary of Chemical Test Results and Exposure Classification

Location	Sample Depth (m)	Soil Description	Soil Condition	pH	SO_4 (ppm)	Cl (ppm)	AS2159 Steel EC	AS2159 Concrete EC	AS3600 Concrete EC
BH03	1.5 - 2.2	CLAY (CI)	B	8.8	100	210	Non-Aggressive	Non-Aggressive	A1
BH04	1.0 - 1.3	Sandy CLAY (CI)	B	7.5	170	94	Non-Aggressive	Non-Aggressive	A1

NOTES:

1. *Soil condition*
   A – high permeability soils (sands and gravels) which are below water table. *B – Low permeability soils (silts and clays) and all soils above water table*
2. *Sulfate expressed as SO_4*
3. *Cl – Chloride*
4. *ER – Electrical Resistivity*
5. *EC – Exposure Classification*
5. *Exposure Classification for AS2159-2009 (for steel and concrete piles)*
   [Exposure Classification for AS3600-2009 (for buried concrete structures)]

Non-aggressive [A1]	*Mild [A2]*	*Moderate [B1]*	*Severe [B2]*	*Very Severe [C2]*

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Figures

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Legend

- Site Boundary
- Borehole
- Cone Penetration Test

N

0 10 20 30 40 50
Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP



SCALE	1:750 (A3)
DRAWN	CED
DATE DRAWN	13/2/2024
CHECKED	–
DATE CHECKED	–
PROJECTION	GDA 1994 MGA Zone 50

Galt Geotechnics Pty Ltd
ACN : 138 490 865
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Osborne Park WA 6017

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CLIENT	**TABEC CIVIL ENGINEERING CONSULTANTS**
PROJECT	PROPOSED DEVELOPMENT
LOCATION	LOT 452 RESOLUTION DRIVE ASCOT
TITLE	SITE & LOCATION PLAN
Job No	WAG230750-01
Fig No	FIGURE 1
Rev	**A**

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Appendices

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Appendix A: Site Photographs

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Photograph 1: Near CPT02 facing south



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Photograph 2: Near CPT02 facing south west



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Photograph 3: Site photo from near northern portion of site



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Appendix C: Machine Borehole and Monitoring Well Logs

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EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS

METHOD OF DRILLING OR EXCAVATION

AC	Air Core	E	Excavator	PQ3	PQ3 Core Barrel
AD/T	Auger Drilling with TC-Bit	EH	Excavator with Hammer	PT	Push Tube
AD/V	Auger Drilling with V-Bit	HA	Hand Auger	R	Ripper
AT	Air Track	HE	Hand Excavation	RR	Rock Roller
B	Bulldozer Blade	HQ3	HQ3 Core Barrel	SON	Sonic Rig
BH	Backhoe Bucket	N	Natural Exposure	SPT	Driven SPT
CT	Cable Tool	NMLC	NMLC Core Barrel	WB	Washbore
DT	Diatube	PP	Push Probe	X	Existing Excavation

SUPPORT

T	Timbering

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

VE	Very Easy	E	Easy	F	Firm
H	Hard	VH	Very Hard		

WATER

►	Water Inflow	▼	Water Level
◄	Water Loss (complete)		
◁	Water Loss (partial)		

SAMPLING AND TESTING

B	Bulk Disturbed Sample	P	Piston Sample
BLK	Block Sample	PBT	Plate Bearing Test
C	Core Sample	U	Undisturbed Push-in Sample
CBR	CBR Mould Sample		U50: 50 mm diameter
D	Small Disturbed Sample	SPT	Standard Penetration Test
ES	Environmental Soil Sample		Example: 3, 4, 5 N=9
EW	Environmental Water Sample		3,4,5: Blows per 150 mm
G	Gas Sample		N=9: Blows per 300 mm after
HP	Hand Penetrometer		150 mm seating interval
LB	Large Bulk Disturbed Sample	VS	Vane Shear; P = Peak
M	Mazier Type Sample		R = Remoulded (kPa)
MC	Moisture Content Sample	W	Water Sample

ROCK CORE RECOVERY

TCR = Total Core Recovery (%) $= \frac{CRL}{TCL} \times 100$

RQD = Rock Quality Designation (%) $= \frac{ALC>100}{TCL} \times 100$

TCL	Length of Core Run
CRL	Length of Core Recovered
ALC>100	Total Length of Axial Lengths of Core Greater than 100 mm Long

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METHOD OF SOIL DESCRIPTION
BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG & SOIL CLASSIFICATION SYMBOLS

Graphic	USCS	Soil Name
		FILL (various types)
		COBBLES / BOULDERS
	GP	GRAVEL (poorly graded)
	GW	GRAVEL (well graded)
	GC	Clayey GRAVEL
	GM	Silty GRAVEL
	SP	SAND (poorly graded)
	SW	SAND (well graded)
	SC	Clayey SAND

Graphic	USCS	Soil Name
	SM	Silty SAND
	ML	SILT (low liquid limit)
	MH	SILT (high liquid limit)
	CL	CLAY (low plasticity)
	CI	CLAY (medium plasticity)
	CH	CLAY (high plasticity)
	OL	Organic SILT (low liquid limit)
	OH	Organic SILT (high liquid limit)
	Pt	PEAT

NOTE: Dual classification given for soils with a fines content between 5% and 12%.

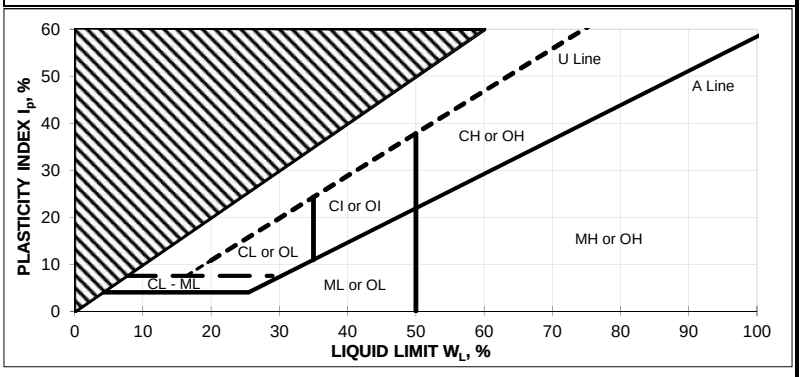
SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil descriptions are based on AS1726-2017. Material properties are assessed in the field by visual/tactile methods in combination with field and laboratory testing techniques (where used).

NOTE: AS 1726-2017 defines a fine grained soil where the total dry mass of fine fractions (<0.075 mm particle size) exceeds 35%.

PARTICLE SIZE		
Soil Name		**Particle Size (mm)**
BOULDERS		>200
COBBLES		63 to 200
GRAVEL	Coarse	19 to 63
	Medium	6.7 to 19
	Fine	2.3 to 6.7
SAND	Coarse	0.6 to 2.36
	Medium	0.21 to 0.6
	Fine	0.075 to 0.21
FINES	SILT	0.002 to 0.075
	CLAY	<0.002

PLASTICITY - MODIFIED CASAGRANDE CHART - AS1726-2017



RESISTANCE TO EXCAVATION		
Symbol	**Term**	**Description**
VE	Very easy	All resistances are relative to the selected method of excavation
E	Easy	
F	Firm	
H	Hard	
VH	Very hard	

MOISTURE CONDITION	
Symbol	**Term**
D	Dry
M	Moist
W	Wet

CEMENTATION	
Cementation	**Description**
Weakly cemented	Soil may be easily disaggregated by hand in air or water
Moderately cemented	Effort is required to disaggregate the soil by hand in air or water

CONSISTENCY		
Symbol	**Term**	**Undrained Shear Strength (kPa)**
VS	Very Soft	0 to 12
S	Soft	12 to 25
F	Firm	25 to 50
St	Stiff	50 to 100
VSt	Very Stiff	100 to 200
H	Hard	>200

ORGANIC SOILS	
Material	**Organic Content % of dry mass**
Inorganic soil	<2%
Organic soil	2% to 25%
Peat	>25%

DENSITY		
Symbol	**Term**	**Density Index (%)**
VL	Very Loose	<15
L	Loose	15 to 35
MD	Medium Dense	35 to 65
D	Dense	65 to 85
VD	Very Dense	>85

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REPORT OF BOREHOLE: BH01/MW01

Job No	: WAG230750-01	Easting	: 0.00	Sheet	: 1 OF 1
Client	: Tabec	Northing	: 0.00	Logged	: MDS
Project	: Proposed Development	UTM	:	Logged Date	: 08/02/2024
Location	: Lot 452 Resolution Drive, Ascot	Drill Rig	: AMS Super Rig	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 25/02/2024

General comments: Monitoring Well Installed at this location

Drilling Method	Depth (m)	Water	Classification Code	Soil Origin	Graphic Log	Consistency/Density	Moisture	Material Description	Structural and Additional Observations	Well Diagram
90mm Solid Auger	0.3		SP	Natural			D	Natural SAND: dark brown and black, fine to coarse grained, with low plasticity clay, (trace organics present in upper 200mm).	(trace organics present in upper 200mm)	Backfill (Drill Spoil)
	0.45		SP	Natural		MD-D		Natural SAND: pale yellow, fine to coarse grained, trace low plasticity clay.		50mm PVC Solid
			SP	Natural				Natural SAND: dark brown and black, fine to coarse grained, trace low plasticity clay.		Bentonite (Sealed above Slotted PVC)
	0.9									
	1		CI	Natural		VSt-H		Natural Sandy CLAY: medium plasticity, brown and pale orange, fine grained sand, inorganic, clay is highly desiccated.	Clay is highly desiccated	
	2									
	2.3		SC	Natural				Natural Clayey SAND: low plasticity clay, brown and dark brown, fine to coarse grained, trace fine to medium sized gravel.		
	2.5		CI	Natural		VSt-H			Clay is desiccated at shallower depths	Filter Pack (Gravel Filter Medium Installed)
	3	▼						Natural CLAY: medium plasticity, brown and pale orange, trace fine to medium grained sand, inorganic, clay is desiccated at shallower depths.		
	4									50mm PVC Slotted
	5									
	6							**BH01/MW01 Terminated at 6m (Target Depth GW @3.03m)**		
	7									
	8									



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REPORT OF BOREHOLE: BH02

Job No	: WAG230750-01	Easting	: 0.00	Sheet	: 1 OF 1
Client	: Tabec	Northing	: 0.00	Logged	: MDS
Project	: Proposed Development	UTM	:	Logged Date	: 08/02/2024
Location	: Lot 452 Resolution Drive, Ascot	Drill Rig	: AMS Super Rig	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 25/02/2024

Drilling Method	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
90mm Solid Auger				Natural		SP	Natural SAND: dark grey and black, fine to coarse grained, trace low plasticity clay, (trace organics present in upper 200mm).	M-D	MD-D		
			1 2 3 4 5 6 7 8				**BH02 refusal at 0.7m (Refusal on Desiccated Clay Groundwater not encountered)**				

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REPORT OF BOREHOLE: BH03

Job No	: WAG230750-01	Easting	: 0.00	Sheet	: 1 OF 1
Client	: Tabec	Northing	: 0.00	Logged	: PA
Project	: Proposed Development	UTM	:	Logged Date	: 14/02/2024
Location	: Lot 452 Resolution Drive, Ascot	Drill Rig	: AMS Super Rig	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 25/02/2024

Drilling Method	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
90mm Solid Auger			0.1	Topsoil		SP	Topsoil SAND: dark grey, fine to medium grained, trace medium plasticity clay, with roots / organics.	D	MD-D		
			0.25	Fill		SP	Fill SAND: brown, medium dense to dense, fine to medium grained, trace low plasticity clay.				
			0.4	Fill		GP	Fill Sandy GRAVEL: grey, medium dense to dense, fine to medium sized, fine to medium grained sand, trace low to medium plasticity clay.				
				Natural		SM	Natural Silty SAND: grey brown, fine to medium grained.				
			0.7	Natural		CI	Natural CLAY: medium plasticity, grey, with fine to medium grained sand, inorganic, trace organics, clay is desiccated at shallow depths.		VSt-H		
			1								
			1.5	Natural		CI	As above, brown, trace organics.				
			2								
			3								
			4	Natural		CI	As above.	M			
			5								
			6				**BH03 Terminated at 6m (Target depth. Groundwater not encountered)**				
			7								
			8								



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REPORT OF BOREHOLE: BH04

Job No	: WAG230750-01	Easting	: 0.00	Sheet	: 1 OF 1
Client	: Tabec	Northing	: 0.00	Logged	: PA
Project	: Proposed Development	UTM	:	Logged Date	: 14/02/2024
Location	: Lot 452 Resolution Drive, Ascot	Drill Rig	: AMS Super Rig	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 25/02/2024

Drilling Method	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
90mm Solid Auger			0.25	Topsoil		SP	Topsoil SAND: grey, fine to medium grained, trace medium plasticity clay, trace / with organics.	D			
			0.5	Fill		SP	Fill SAND: brown, fine to medium grained, trace low plasticity clay.				
			1	Natura		SC	Natural Clayey SAND: medium plasticity clay, brown, fine to medium grained.				
			1.2	Natura		Cl	Natural Sandy CLAY: medium plasticity, brown mottled red, fine to medium grained sand, trace fine to medium sized gravel, inorganic, clay is desiccated.		VSt-H		
			1.5	Natura		Cl	Natural CLAY: medium plasticity, brown, with fine to medium grained sand, inorganic, clay is desiccated at shallow depths.				
			2								
			3	Natura		Cl	As above.	M			
			4								
			4.5	Natura		Cl	As above.	W			
			5								
			6								
							BH04 Terminated at 6.5m (Target depth. Groundwater possibly at 4.5 m depth)				
			7								
			8								



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Appendix C

Preliminary Civil Drawing

Tabec 2024

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SWAN RIVER

NO EARTHWORKS OR REGRADING OF RACETRACK OR INTERNAL OPEN AREAS IS ENVISAGED .

RETIREMENT VILLAGE / MIXED USE SITE TO BE FILLED TO MINIMUM LEVEL OF 3.2m AHD TO SATISFY 500mm MIMIMUM CLEARANCE TO 100 YEAR SWAN RIVER FLOOD EXPECTATIONS.

A
FILL to 3.2m. min.

EXISTING PARKING AND OPEN SPACE TO ONLY REQUIRE FILL FOR APPEARANCE OR DRAINAGE PURPOSES. OTHERWISE MAY REMAIN AT EXISTING LEVELS.

PROPOSED STABLES TO BE FILLED TO RL 6.1m TO SUIT SURROUNDING LEVELS AND CLEARANCE TO GROUNDWATER.

C
FILL to 6.1m

PROPOSED STABLES TO BE FILLED TO RL 7.3m TO SUIT SURROUNDING LEVELS AND CLEARANCE TO GROUNDWATER.

C
FILL to 7.3m

PROPOSED STABLES TO BE FILLED FROM RL 4.2m - 6.1m TO SUIT SURROUNDING LEVELS AND CLEARANCE TO GROUNDWATER.

FILL to 3.2m min.
B

NEW OFFICES AND HOSPITALITY BUILDINGS MAY HAVE REQUIREMENT TO BE FILLED TO MINIMUM LEVEL OF 3.2m AHD TO SATISFY 500mm MIMIMUM CLEARANCE TO 100 YEAR SWAN RIVER FLOOD EXPECTATIONS.

C
FILL VARIES
4.2m to 6.1m

MAXIMUM GROUNDWATER CONTOURS FROM GOLDEN GATEWAY - LWMS - 2018

CHILDCARE AND RESIDENTIONAL SITE TO BE FILLED TO MIN. RL OF 3.2m AHD TO SATISFY MINIMUM CLEARANCE TO FLOOD EXPECTATIONS.

D
FILL to 3.2m

FILL to 4.5m

DEVELOPMENT SITE TO BE FILLED TO MIN. RL OF 4.5m AHD TO ACHIEVE LEVEL SURACE.

E
FILL to 3.2m

FILL to 3.2m

MINIMAL FILLING AND REGRADING OF EXISTING ROADS MAY BE REQUIRED.

EXISTING BUILDINGS AND GRASSED PARKLAND FUNCTION AREAS TO REMAIN AT EXISTING LEVELS WITH ONLY LANDSCAPE AMENDMENTS TO BE MADE.

FOODMARKETS AND DEVELOPMENT SITE TO BE FILLED TO MIN. RL OF 3.2m AHD TO SATISFY MINIMUM CLEARANCE TO FLOOD EXPECTATIONS.

ASCOT PL
ENNIS PL
MATHESON RD
AURUM ST
KALGOORLIE ST
KEYMER ST
CARBINE ST
KIMBERLEY ST
GREAT EASTERN HWY
CR
GOLF STREET
SEDGELAND WAY
GRANDSTAND DRIVE
RESOLUTION DR
THE BOARDWALK
TIDEWATER WAY
CRCS
RIVERINA DR
RACONTEUR DRIVE

3.0 4.0 5.0 6.0 7.0

SCALE 1:2000 0 40 80 120

WAPC No.

A1

No.	DATE	DRAWN	APPROVED	AMENDMENT
C	21.06.24	PK	JZ	MINIMUM FILL LEVELS AMENDED IN LINE WITH THE LWMS
B	18.06.24	PK	JZ	PRELIMINARY ISSUE FOR INFORMATION ONLY
A	24.01.24	PK	JZ	PRELIMINARY ISSUE FOR REVIEW

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COLOUR
This drawing is required to be printed in full colour. Failure to do so may result in loss of information.

CLIENT: PERTH RACING

DESIGNED	CHECKED	APPROVED
PK	JZ	
DRAWN	CHECKED	DATE
PK	JZ	

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PROJECT: ASCOT RACECOURSE - LOCAL STRUCTURE PLAN

TITLE: EARTHWORKS CONCEPT PLAN

DRAWING NUMBER: 2541-00-100

ISSUE: C

Plotted By: pkeenan Plot Date: 21/06/24 - 14:47 Cad File: C:\TABS\data\TB-100\2541 - Ascot Racecourse LSP_127\CAD\LCAD\2541-00\2541-00-100.dwg

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Appendix D

Modelling Assumption Report

Emerge Associates 2024

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Modelling Assumptions Report

Golden Gateway Local Structure Plan

Project No: EP23-109(03)

Prepared for Perth Racing
May 2024



Document Set ID: 5885127
Version: 1, Version Date: 18/09/2024

Document Control

Doc name:	Modelling Assumptions Report Golden Gateway Local Structure Plan				
Doc no.:	EP23-109(03)--008 JM				
Version	Date	Author		Reviewer	
1	May 2024	Joyti Mabruk	JM	David Coremans	DPC
	Appendix to the LWMS				

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1 Background

Perth Racing (the 'proponent') proposed to progress a local structure plan (LSP) over its landholdings in Ascot. The area is bounded by the Swan River to the North, Grandstand Road to the west and south, Matheson Road and Resolution Drive to the south and residential areas to the east, referred to herein as 'the site'. The structure plan area also includes the Ascot Racecourse area. The site is located approximately 8.5 km east of Perth central business district (CBD) and is approximately 62 ha in size, within City of Belmont (CoB). The LSP consists of six precincts: Precinct A, Precinct B, Precinct C, Precinct D, Precinct E, and the racecourse.

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2 Methodology

XPSWMM hydrologic and hydraulic modelling software (v21.3) was used to calculate the surface water runoff volumes within the road reserves and lots associated with the development of Ascot Racecourse.

The hydrologic component of the software uses the Laurenson non-linear runoff-routing method to simulate runoff from design storm events. Key assumptions regarding the hydrologic model include:

- Runoff is proportional to slope, area, infiltration and percentage of imperviousness of a catchment.
- Sub-catchment areas and slopes are determined from surveyed topographical data and earthworks plans.
- Infiltration rates and percentage imperviousness have been selected based on experience with model preparation for similar soil conditions.

Runoff from each sub-catchment is routed through the catchment using the hydraulic component of XPSWMM. Generally, assumptions associated with the hydraulic component of the model include:

- Virtual links (i.e. purely for model construction, not equivalent to flow path onsite) between nodes within a sub-catchment are given the length of 10 m and slope of 0.05 to minimise the lag time of conveying the water from a sub-catchment node to a 'storage' node, a 'dummy intermediate' node or a conduit/link.
- Links between sub-catchment storages act as conveyance channels (e.g. sheet flow within roads in a 1% annual exceedance probability (AEP)). These links are given lengths and slopes that are representative of the site conditions and actual pathway lengths between catchments.
- All channels are designed with a width of 5 m, roughness of 0.014 (Manning's n) and are trapezoidal in shape. This allows for easy conveyance and represents concrete pipes and road surfaces within the model.
- Where relevant median swales, bio-retention areas (BRAs), and flood storage areas (FSAs) are modelled as nodal-reservoirs with infiltration depth-rating curves to account for differential infiltration rates with changing depth.

2.1 Rainfall

The ensemble temporal patterns obtained from the Australian Rainfall and Runoff (AR&R) Data Hub (AR&R 2019) were used for the rainfall analysis.

Durations ranging between 15 min and 72 hours were tested, with the peak flood elevation being assessed as the determining result.

Following the process suggested by AR&R (Ball J et al. 2019), the highest mean duration was selected as the critical duration. AR&R also recommends that when it is not practical to run the entire ensemble array, the ensemble that produces the result closest to the mean (for the critical duration) should be adopted and provided in **Table 1**.

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Table 1: Critical Duration Analysis

Catchment	Critical Duration (20% AEP)	Critical Duration (10% AEP)	Critical Duration (1% AEP)
Precinct A	3 hour duration ensemble 4	3 hour duration ensemble 1	3 hour duration ensemble 1
Precinct C	30 min duration ensemble 6	30 min duration ensemble 7	30 min duration ensemble 8
Precinct D	1 hour duration ensemble 1	30 min duration ensemble 5	30 min duration ensemble 1
Precinct E	45 min duration ensemble 6	30 min duration ensemble 5	30 min duration ensemble 8

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3 Pre-development model

The catchment parameters determined for Precinct D within the LWMS for the initial loss – continuous loss model have been adopted to account for catchment losses. The pre-development loss parameters used are given in **Table 2**.

Table 2: Pre-development loss parameters

Land type	Initial loss (mm)	Continual loss (mm)	Roughness
Existing residential/Carpark	15	0.1	0.014

Catchment analysis for pre-development scenario was based on topographic contour data, site visit and aerial photography. Pre-development catchment area within Precinct D is 1.145 ha.

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4 Post-development model

An initial loss continuing loss model was adopted to account for post-development catchment losses. The post-development catchment area, land types and loss values were based on the structure plan design, typical infiltration rates for the soils which occur onsite and based on project team experience. Post-development catchment areas and land types within the site were informed by sub-division plan provided by LPD surveyors. **Table 3** summarises the loss parameters used within the post-development model.

Table 3: Post-development loss parameters

Land type	Initial loss (mm)	Continual loss (mm)	Roughness
Road Surface	1	0.1	0.02
Road Verge	9	1.5	0.05
Fully Impervious	1	0.1	0.02
Roof	1	0.1	0.02
Lot IMP	1	0.1	0.02
Gardens	25	2	0.05
POS	25	2	0.05
Precinct E Lots	15	0.1	0.014

A summary of post-development catchment information is provided in **Table 4** with the catchment plan and basin location shown in Figure 08 of the LWMS.

Table 4: Post-development catchment areas (ha)

Road reserve	Lots	Road Reserve	POS	Fully Impermeable	Child Care
Precinct A	0.714	0.606	1.360	0.330	-
Precinct C	-	5.903	-	-	-
Precinct D	0.526	0.421	-	-	0.199
Precinct E	3.622	0.365	0.219	-	-

The following assumptions were incorporated into the model:

- Precinct A
  - Lots will have 100% roof areas and road reserve contains 5% pervious verge and 95% impervious bitumen areas.
  - POS will be 100% pervious.
  - There is no current connection point for drainage to be exported from Precinct A.
  - 1 single basin/Flood storage area (FSA) for both treatment and flood mitigation.
  - Base of the FSA will need to be vegetated with reeds/rushes as per a biofilter.
  - FSA will have 1:6 side slopes and maximum depth 1.2m in a 1% AEP – to avoid the need for fencing or access control.

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- A hydraulic conductivity of 1m/day is assumed.

- Precinct C
  - The existing portion of Precinct C already connected to the centre of the track (existing buildings and stables) and no change has been assumed.
  - Rest of the Precinct C were modelled as two separate catchments i.e., carpark and stables which are 95% impervious and 5% pervious.
  - 1m deep sub-surface storage has been designed to accommodate 1% AEP event.
  - A hydraulic conductivity of 1m/day is assumed.
  - The storage configuration could be changed/modified to suit site layout/constraints.
  - The carpark in Precinct C that discharges to the southwest will discharge to Precinct E.

- Precinct D
  - Lots will have 50% roof areas, 45% paved areas and 5% pervious garden areas, the childcare has roof areas and Road reserve contains 20% pervious verge and 80% impervious bitumen areas.
  - 1m deep sub-surface storage has been designed to accommodate and detain upto 1% AEP events that will mimic pre-development flow of 0.4.
  - A hydraulic conductivity of 1m/day is assumed.
  - The storage configuration could be changed/modified to suit site layout/constraints.

- Precinct E
  - The carpark in Precinct C discharges to Precinct E.
  - Outflow of pre-development Water Corporation (WC) drain is 0.95 m^3/s as per WC modelling.
  - All lots of Precinct E retain 15mm of rainfall.
  - Runoff above 15 mm rainfall up to the 1% AEP will be managed by a detention basin which will mimic pre-development 1% AEP peak flow of 0.463 m^3/s.
  - The basin will have 1:6 side slopes and maximum depth 1.2m in a 1% AEP – to avoid the need for fencing or access control.
  - A hydraulic conductivity of 1m/day is assumed.

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5 References

5.1 General references

The references listed below have been considered as part of preparing this document.

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M and Testoni I (Editors) 2019, *Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia (Geoscience Australia).

5.2 Online references

Australian Rainfall and Runoff (AR&R) 2021, ARR Data Hub, viewed 1 December 2021, Available from: <https://data.arr-software.org/>.

Bureau of Meteorology (BoM) 2021a, Climate Data Online, viewed 1 December 2021, Available from, <http://www.bom.gov.au/water/designRainfalls/revised-ifd/>.

Bureau of Meteorology (BoM) 2021b, Design Rainfall Data System (2016), viewed 1 December 2021, Available from, <http://www.bom.gov.au/water/designRainfalls/revised-ifd/>.

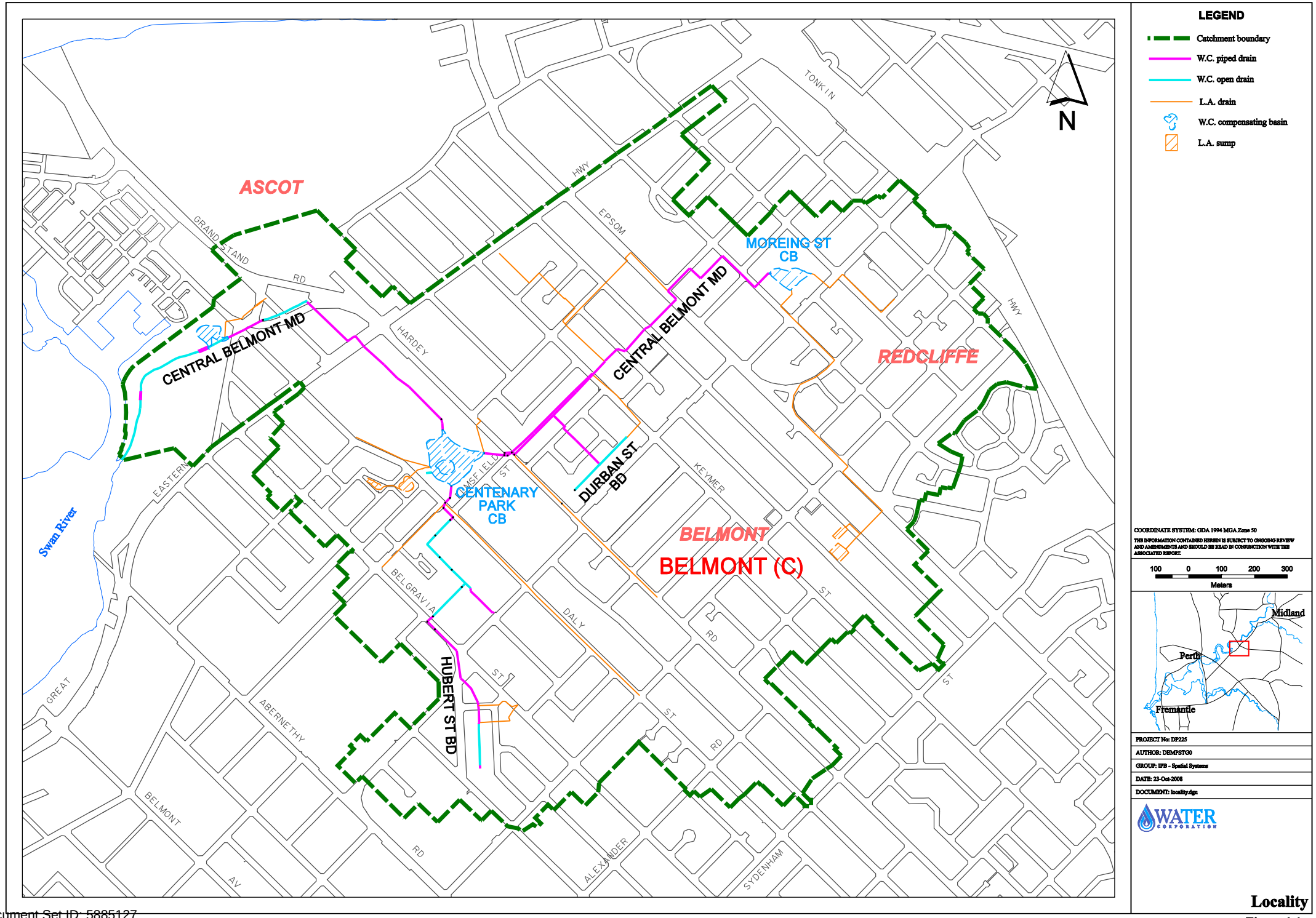
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Appendix E

Central Belmont Main Drain Water Corporation

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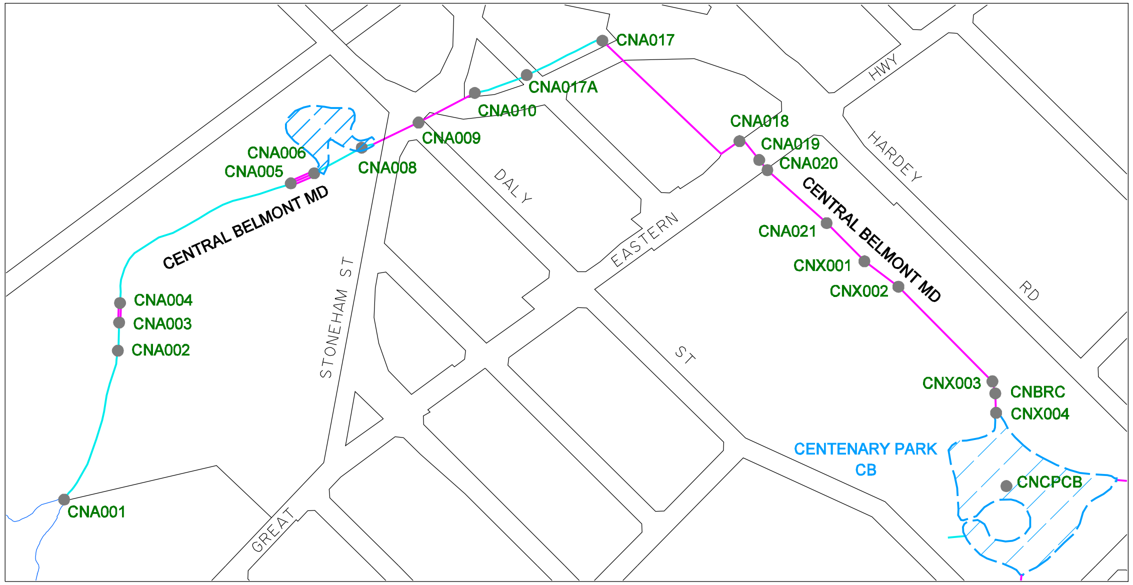


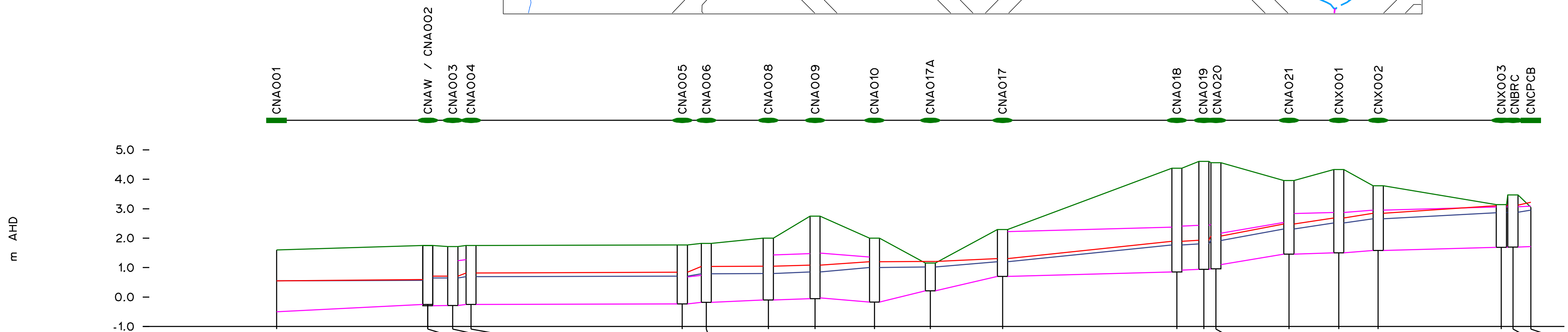
Locality

Figure 1.1

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THE INFORMATION CONTAINED HEREIN IS SUBJECT TO ONGOING REVIEW AND AMENDMENTS AND SHOULD BE READ IN CONJUNCTION WITH THE ASSOCIATED REPORT.





Chainage (m)	Ground level (m AHD)	10 year ARI HGL level (m AHD)	100 year ARI HGL level (m AHD)	Invert level (m AHD)	Invert level (m AHD)
0	1.60	0.55	0.55	-	-0.50
169	1.75	0.57	0.59	-0.25	-
169	1.75	0.65	0.71	-	-0.30
197	1.71	0.65	0.71	-0.29	-0.29
217	1.75	0.69	0.81	-0.25	-0.25
454	1.77	0.71	0.84	-0.23	-0.23
481	1.82	0.79	1.04	-0.18	-0.18
550	2.00	0.80	1.05	-0.10	-0.10
603	2.75	0.85	1.08	-0.05	-0.03
669	2.00	0.99	1.20	-0.17	-0.17
732	1.16	1.01	1.21	0.21	0.21
813	2.29	1.19	1.30	0.70	0.70
1008	4.37	1.75	1.88	0.85	0.91
1038	4.60	1.79	1.92	0.94	0.94
1052	4.56	1.90	2.06	0.96	1.10
1133	3.96	2.30	2.47	1.46	1.46
1189	4.33	2.50	2.67	1.50	1.50
1233	3.78	2.63	2.82	1.58	1.58
1371	3.14	2.83	3.07	1.69	1.69
1384	3.47	2.85	3.09	1.70	1.70
1404	3.05	2.92	3.18	1.71	-

Size (mm)	Max 10 year ARI flow (m3/s)	Max 100 year ARI flow (m3/s)
11000x2000	1.80	2.80
	-	-
11000 x2000	1.78	2.73
2/ 1524	1.78	2.72
11000x2000	1.78	2.72
3/ 910	1.80	2.78
11000 x2000	1.79	2.78
1524	1.43	1.83
1524	1.43	1.83
5600 x1200	1.43	1.83
5600x1200	1.44	1.83
1524	1.36	1.74
1500	1.27	1.62
1500	1.27	1.62
1070	1.27	1.62
1370	1.23	1.55
1370	1.23	1.55
1370	1.23	1.55
1370	1.23	1.55
1370	1.23	1.55

CENTRAL BELMONT MAIN DRAIN

LONGITUDINAL SECTION

Hgls and Flows Existing Scheme (1 of 2)

Figure C1.1

AUTHOR: DEMPSTER DESIGN FILE: Central Belmont MD.dgn

WATER CORPORATION

PROJECT No: [illegible] DATE: 05/01/2009 COORDINATE SYSTEM: MGA94 - Zone 50

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