LOCAL WATER MANAGEMENT STRATEGY

Part of Lot 96 Henley Brook

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Prepared by:

RPS

Joycelyn Siew
Senior Hydrologist

Level 3, 500 Hay Street
Subiaco, WA 6008

T +61 8 9211 1111
E water@rpsgroup.com.au

Prepared for:

Ellenbrook Management Pty Ltd

Jordan Williams
Senior Development Manager

Level 3, 27-31 Troode Street
West Perth, WA 6005

T +61 8 9368 9000
E jordanw@satterley.com.au

Contents

Tables

(contained within report text)

(compiled at rear of report)

Figures

(contained within report text)

(compiled at rear of report)

Graphs

Appendices

SUMMARY

This Local Water Management Strategy (LWMS) has been prepared to support a Local Structure Plan (LSP) to develop part of Lot 96 (also known as Lot 203) Starflower Road, Henley Brook (the site), which is approximately 16.69 ha in size.

The site is situated within the City of Swan, located approximately 19 kilometres (km) north-east of the Perth Central Business District. It is located immediately west of the Henley Brook LSP, immediately south of The Bridges, Ellenbrook – Outline Development Plan No.71 (ODP), and immediately south-west of the Woodlake Village Ellenbrook – Outline Development Plan No.45 (ODP, Department of Planning, Lands and Heritage) (DPLH 2022a).

The objective of this LWMS is to demonstrate that the land can support the proposed land use change with best practice water management outcomes regarding stormwater and surface water management, groundwater management and water supply. This report provides broad-level management strategies for future development.

The proposed development will incorporate total water cycle management principles and objectives guided by the Better Urban Water Management Framework (WAPC 2008). This has been completed by assessing the current hydrological characteristics of the site. A summary of the key LWMS elements detailed in this report are listed in Table 1.

Table 1: Key LWMS reporting elements

LWMS elements	Design objectives/comments
Planning background (Section 1.2)	• The majority of the site is zoned Urban under the MRS, with a small portion zoned public purposes-special uses (DPLH 2022a). The site is zoned residential development and reserved public purposes under the City of Swan Local Planning Scheme No. 17. An MRS Amendment is underway to rezone the Public Purposes-Special Uses to Urban.
Current land use (Section 3.1)	• Historic aerial photographs show the site was largely comprised of native scrubland in 1953, which was partially cleared by 1965 for agricultural purposes (i.e. livestock grazing) with scattered trees remaining (Landgate 2022a). Today approximately 10.97 ha is cleared, and 5.71 ha comprises of remnant shrubs and trees. The site is intersected by pedestrian pathways and informal access tracks and has not been developed further.
Groundwater (Section 3.12)	• The site is situated within the Gnangara groundwater system, which includes four aquifers, Superficial (unconfined), Mirrabooka (semi-confined), Leederville (confined), and Yarragadee North (confined). • The site is within a P3* and P2 Public Drinking Water Source Area (PDWSA) of the Gnangara Underground Water Pollution Control Area (Figure E). • Wellhead protection zone (WHPZ) formed by 300 m radius from public drinking sources partially overlaps the site's north-eastern extent (service commercial lot and portion of neighbourhood centre lot). Building envelopes must be located outside WHPZ boundary. • The site is within the Mirrabooka Groundwater Management area and the Whiteman Park subarea for the Perth Superficial Swan aquifer.
Topography (Section 3.4)	• The elevation of the site ranges from approximately 42 metres Australian Height Datum (mAHD) in the north to approximately 39 mAHD to the south (Figure B). The site is generally flat, with an average grade of approximately 0.4%.
Geology and soils (Sections 3.5 and 3.6)	• The Environmental Geology Series (Perth Sheet; (Gozzard 1986)) indicates that the site is comprised of thin Bassendean Sand over the Guildford Formation. • The DWER's risk mapping for acid sulfate soils (ASS) in the Swan Coastal Plan identified that the site has a moderate to low risk of ASS occurring within three metres of the natural soil surface (Landgate 2022b) (Figure C).
Surface water hydrology and wetlands (Sections 3.11 and 3.13)	• There are no drainage lines or streams within the site. It is assumed that the site in pre-development condition receives negligible run-off from its northern boundary and discharges the locally generated run-off through its south east corner. Better understanding of the site's surface hydrology will become possible following surveying of the site. • The Department of Biodiversity, Conservation and Attractions (DBCA) mapping of Geomorphic Wetlands of the Swan Coastal Plain identified one Multiple Use (MU) wetland overlapping the site (Landgate 2022b) (Figure D). The MU wetland, UFI 13396, covers most of the site and is classified as a palusplain wetland (seasonally waterlogged flats).

LWMS elements	Design objectives/comments
Water source planning (Section 4)	• The site is situated within the Water Corporation's Ellenbrook Gravity water supply zone and will be supplied from a main along Starflower Road, which is currently being upgraded to a 500 mm main. • There are no groundwater licences within the site. A groundwater licence application for 10,506 kL is currently being assessed by DWER. • As the site is in a P3* area, it must be connected to reticulated sewerage. The site is proposed to be connected to the gravity sewer in the Henley Brook area. The Barrambie pump station to the north of the site will be upgraded to accommodate the new developments in the Henley Brook area (Cossill & Webley 2022).
Water conservation strategies (Section 6)	• Water conservation will focus on reducing scheme water use through household water conservation, resident education and Waterwise landscaping. • It is proposed that POS areas will be irrigated from groundwater abstracted from the Superficial aquifer.
Stormwater management (Section 7)	• Small events (first 15 mm of the run-off) will be treated and infiltrated as close as possible to the source via soakwells on the lots greater than 300 m^2, and bioretention basins or swales located in road reserves. • The piped drainage system will be designed to convey the 20% AEP minor event to maintain the serviceability and amenity for roads and POS. • Flows exceeding the 20% AEP up to and including the 1% AEP will be conveyed via overland flow paths within road reserves to three proposed infiltration basins. • People and property will be protected from flooding by constructing building habitable floor levels with 0.5 m minimum clearances above the 1% AEP flood level.
Groundwater management (Section 8)	• The first 15 mm of rainfall run-off from impervious areas will be treated prior to infiltration in line with best practice. • Subsoil drainage is not likely to be required given the depth to MGL, to be confirmed following a geotechnical investigation.
Future monitoring requirements (Section 9)	• Three years of post-development monitoring for groundwater and surface water is recommended. • Trigger values and contingency planning will be developed in the UWMP.

1 INTRODUCTION

1.1 Background

This Local Water Management Strategy (LWMS) has been prepared to support a Local Structure Plan (LSP) to develop part of Lot 96 (also known as Lot 203) Starflower Road, Henley Brook (the site).

The site is situated within the City of Swan, located approximately 19 kilometres (km) north-east of the Perth Central Business District. It is located immediately west of the Henley Brook LSP, immediately south of The Bridges, Ellenbrook – Outline Development Plan No.71 (ODP), and immediately south-west of the Woodlake Village Ellenbrook – Outline Development Plan No.45 (ODP, Department of Planning, Lands and Heritage) (DPLH 2022a).

The total site area is 16.69 hectares (ha). Approximately 10.98 ha of the site has been previously cleared for agricultural purposes and the site is intersected by pedestrian pathways and informal access tracks. The site is bound by Starflower Road to the east, Drumpellier Drive to the west and Gnangara Road and Barrambie Way to the north.

The site location is presented in Figure A.

1.2 Planning context

1.2.1 Zoning

The majority of the site is zoned Urban under the MRS, with a small portion zoned Public Purposes-Special Uses (DPLH 2022a). The site is zoned residential development and reserved public purposes under the City of Swan Local Planning Scheme No.17. An MRS Amendment is underway to rezone the Public Purposes-Special Uses to Urban (Amendment 1410).

1.2.2 Site concept plan

A concept plan (Appendix A) has been prepared by town planner Hatch to illustrate the proposed land uses for the site, which include:

- Residential
- Service commercial
- Neighbourhood centre
- Public Open Space (POS) / drainage
- Road reserves.

1.3 Key documents and previous studies

This report has been prepared with reference to the following guidance documents and their design objectives:

- State Planning Policy 2.9: Water Resources (WAPC 2006)
- State Water Plan 2007 (Government of Western Australia 2007)
- Better Urban Water Management (WAPC 2008)
- Interim: Developing a local water management strategy (DoW 2008a)
- Water resource considerations when controlling groundwater levels in urban development (DoW 2013)

Frameworks, management strategies and previous studies relevant to the site are listed below. The key outcomes and considerations for the site have been summarised from each document.

1.3.1 North-East Subregional Planning Framework

The North-East Subregional Planning Framework (the framework (DPLH 2018) provides strategic guidance on land use, land supply, land development, environmental protection and infrastructure delivery for the north-east subregion to meet the growth demand for Perth and Peel @3.5 million. The site's eastern extent was shown as Urban Expansion , which is land that has been identified for future urban development. Key considerations have not been developed for urban expansion areas in the framework.

In the context of best practice drainage and nutrient management for urban expansion areas, the framework states:

> Areas identified for future urban and industrial development in the framework will be required to address the management of drainage systems to ensure that biodiversity and ecological functions and water quality of wetlands and river systems are maintained, that people and property are protected from flooding and inundation, and that amenity of public open space is enhanced.
> This will require the incorporation of best practice water-sensitive urban design and nutrient management and may be required to include the use of detention basins and nutrient/sediment stripping facilities. Subsequent levels of planning for drainage in the sub-region will be guided by the regional water management strategy prepared to support the framework.

1.3.2 Regional Water Management Strategy

A Regional Water Management Strategy (RWMS) highlighting key water considerations has been developed for the North-East subregion (Essential Environmental 2014). This strategy identifies a number of issues including water scarcity, irrigation for POS and protection of Public Drinking Water Source Areas (PDWSAs). The RWMS is unpublished, however is referred to in the framework (DPLH 2018), which states:

> The regional water management strategy will inform subsequent stages of water planning in the subregion at the district and local levels which will be undertaken in accordance with the WAPC's Better Urban Water Management framework.

In the absence of this RWMS, it is appropriate to use the outcomes of the North East Corridor Urban Water Management Strategy (GHD 2007) to inform the DSP and DWMS (RPS 2023).

1.3.3 North East Corridor Urban Water Management Strategy (GHD 2007)

The North East Corridor Urban Water Management Strategy (UWMS) (GHD 2007) was developed to support the North East Corridor structure plan. The site is located within the North East Corridor structure plan area and the UWMS study area.

The UWMS was completed at a time when state government agencies were proposing a more integrated approach to urban water management and land use planning. Under the proposed framework, a Regional Drainage and Water Management Strategy should support Regional Structure Plans and the UWMS states that it should be considered akin to a Regional Drainage and Water Management Strategy under the proposed framework:

> As a Regional Drainage and Water Management Strategy it should be used as the foundation for developing more detailed District and Local Drainage and Water Management Plans that will support District and Local Structure Plans.

1.3.3.1 Surface water

The UWMS recommends for specific water quality targets to be established for DWMSs in order to protect water quality in the Swan River and other receiving wetlands and waterways (GHD 2007). These must be consistent with the long-term Swan River targets. The UWMS outlines the short-term and long-term receiving waterway water quality targets for nutrient concentrations in tributaries of the Swan-Canning river system, which were developed in the Swan-Canning Cleanup Program.

The UWMS discusses arterial drainage, identifies the surface water catchments, areas of shallow groundwater and environmental constraints.

For water quantity management in the North East Corridor, the UWMS specifies that pre-development flow rates will be maintained in the design of flood storages and downstream waterways are not to be impacted upon. It states:

> In developing District and Local Drainage and Water Management Strategies, existing waterways should be reviewed to assess their capacity to convey the increased run-off from major events. This may require streamflow monitoring or modelling. This stream capacity should form the basis for determining the necessary flood storage within the District Structure Plan Area.

1.3.3.2 Groundwater

In relation to groundwater management, the UWMS states that District Drainage and Water Management Strategies should provide guidance for controlled groundwater levels (CGLs). However, these should be reviewed in Local Drainage and Water Management Strategies at the LSP scale to protect specific environmental values, and after the results of more detailed groundwater monitoring information are available. The UWMS also states:

> The District Drainage and Water Management Strategy will require groundwater modelling to investigate the effect of land use change on groundwater levels, to determine need for imported fill and subsoil drainage, to examine the potential use of shallow groundwater as a resource and to assess any potential impacts on wetlands and Groundwater Dependent Ecosystems.

The UWMS strategy is summarised in Table 2.

Table 2: Summary of UWMS strategy (GHD 2007)

Topic	Strategy
Water quantity	• Maintain the pre-development hydrology by managing run-off from rainfall up to the 1-year ARI event • Safe conveyance of run-off from extreme events, up to the 100-year ARI event • Ensure that the flood channel capacity of the receiving waterway is not exceeded.
Water quality	• Include specific water quality design targets • Run-off treatment for all flows up to the 1-year ARI event • Structural and non-structural measures
Groundwater management	• Nutrient export from the site will not be increased • Subsoil drainage is laid at or above the CGLs to protect groundwater dependent ecosystems • Although District Drainage and Water Management Plans should provide guidance for CGLs, these should be reviewed at LSP scale to protect specific environmental values and after the results of more detailed groundwater monitoring information is available
Wetland and waterways management	• Drainage must ensure protection of important wetlands
District drainage and water management plans	• It is recommended that as District or Local Structure Plans are prepared for the North East Corridor, they are supported by Drainage and Water Management Plans

1.3.4 Hydrological and nutrient modelling of the Swan Canning coastal catchments

The (then) Department of Water (DoW 2010) used the Streamflow Quality Affecting Rivers and Estuaries (SQUARE) model to estimate flow, and nitrogen and phosphorus loads from the Swan Canning catchments into the rivers and estuaries. Water quality objectives for these catchments were defined based on the modelling and are the basis for the water quality targets set in the Swan Canning Water Quality Improvement Plan (Swan River Trust 2009).

1.3.5 District Water Management Strategy

A District Water Management Strategy (DWMS) (RPS 2023a) was prepared to support the MRS Amendment. The DWMS was not approved, however the MRS Amendment was progressed by the Western Australian Planning Commission (WAPC) with the understanding that water issues could be addressed at the local structure planning stage. Comments provided by the Department of Water and Environmental Regulation (DWER) on the DWMS have been addressed in this LWMS, which includes additional detail to support the LSP.

2 WATER MANAGEMENT PRINCIPLES AND OBJECTIVES

The following principles and objectives have been adapted for the site from the North East Corridor Urban Water Management Strategy (GHD 2007), Better Urban Water Management (WAPC 2008), Decision process for stormwater management in Western Australia (DWER 2017), the Water Quality Protection Note (WQPN) No. 38 Priority 3* (P3*) areas (DWER 2018) and the Waterwise Perth Action (DWER 2022d).

Table 3: LWMS principles and objectives

Key element	Principles	Objectives
Water conservation	• No potable water should be used outside of homes and buildings with the use of water to be as efficient as possible.	• Meet the State Water Plan (Government of Western Australia 2007) and more recently the Waterwise Perth Action Plan target to reduce the average annual scheme water use to 91 kL/ person. • Irrigation of public spaces to be by groundwater or an alternate water supply scheme. The use of recycled water[1] within a P3* PDWSA is generally not supported by DWER, subject to the level of treatment and the WQPN No. 25 Land use compatibility tables for public drinking water source areas (DWER 2021)
Water quantity	• Maintain the pre-development hydrologic regime and meet the ecological water requirements of the receiving environment. • Protection of property and infrastructure by the safe conveyance of excessive run-off from extreme events. This includes the protection of property and infrastructure within the site as well as downstream and so needs to consider the impact of peak discharge from the study.	• Design stormwater management systems to provide serviceability, amenity and road safety during minor rainfall events. • Maintain the 1% annual exceedance probability (AEP) pre-development flood regime (flood level, peak flow rates and storage volumes). • Safely convey run-off from extreme events up to the 1% AEP event and ensure that the flood channel capacity of the receiving waterway is not exceeded by retaining or detaining the run-off from storm events where appropriate. • Protect people and property from flooding by constructing building habitable floor levels with appropriate minimum clearances above the 1% AEP flood level.
Water quality	• Maintain surface water quality at pre-development levels and, if possible, improve the quality of water leaving the development area to maintain and restore ecological systems in the sub-catchment in which the development is located.	• Manage, retain and/or detain and treat (if required), stormwater run-off from constructed impervious surfaces generated by the first 15 mm of rainfall at source as much as practical.
Groundwater management	• Protect buildings and other infrastructure by providing adequate separation from maximum groundwater levels. • Maintain ground water quality at pre-development levels and, if possible, improve the quality of water leaving the development area to maintain and restore ecological systems in the sub-catchment in which the development is located.	• Should subsoil drainage be required, the Controlled Groundwater Level (CGL) will be set according to DWER policy and at a level to protect Groundwater Dependent Ecosystems and infrastructure. These should be reviewed at the local structure plan scale to protect specific environmental values and after the results of more detailed groundwater monitoring information is available. Subsoil drainage to be laid at or above the CGL. • Nutrient export from the site will not be increased. • Site-responsive design to direct surface water and subsoil drainage away from drinking water extraction points (i.e. slopes and road cambers).

[1] Recycled water is defined as water generated from sewage (including greywater, yellow water, black water) or from industry that is treated to a quality where it can be recycled for beneficial uses (Department of Health 2011).

3 PRE-DEVELOPMENT ENVIRONMENT

3.1 Existing and historical land use

The site was largely comprised of native vegetation in 1953, which was partially cleared by 1965 for agricultural purposes (i.e. livestock grazing) with scattered trees remaining (Landgate 2022a). The site is intersected by informal access tracks and has not been developed further.

3.2 Key site elements

The key elements for the site are provided below, with further detail provided in the Environmental Assessment Report (RPS 2022).

The site, part of Lot 96 Henley Brook, is approximately 16.69 ha in area and consists of:

1. Priority 3* (P3*) and Priority 2 (P2) PDWSAs of the Gnangara Underground Water Pollution Control Area.
2. A 5.71 ha area of scattered native vegetation in poor condition, which comprises potential black cockatoo habitat, and land that was historically cleared.

The key elements of the site are presented in Figure 1.

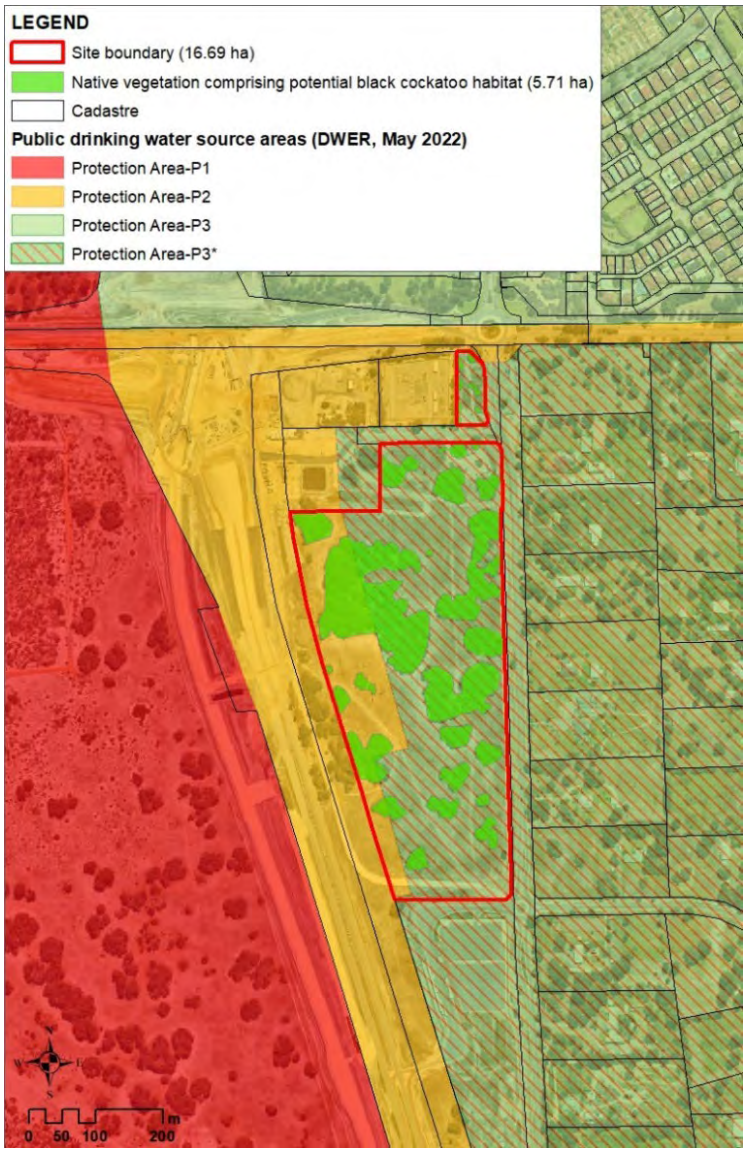
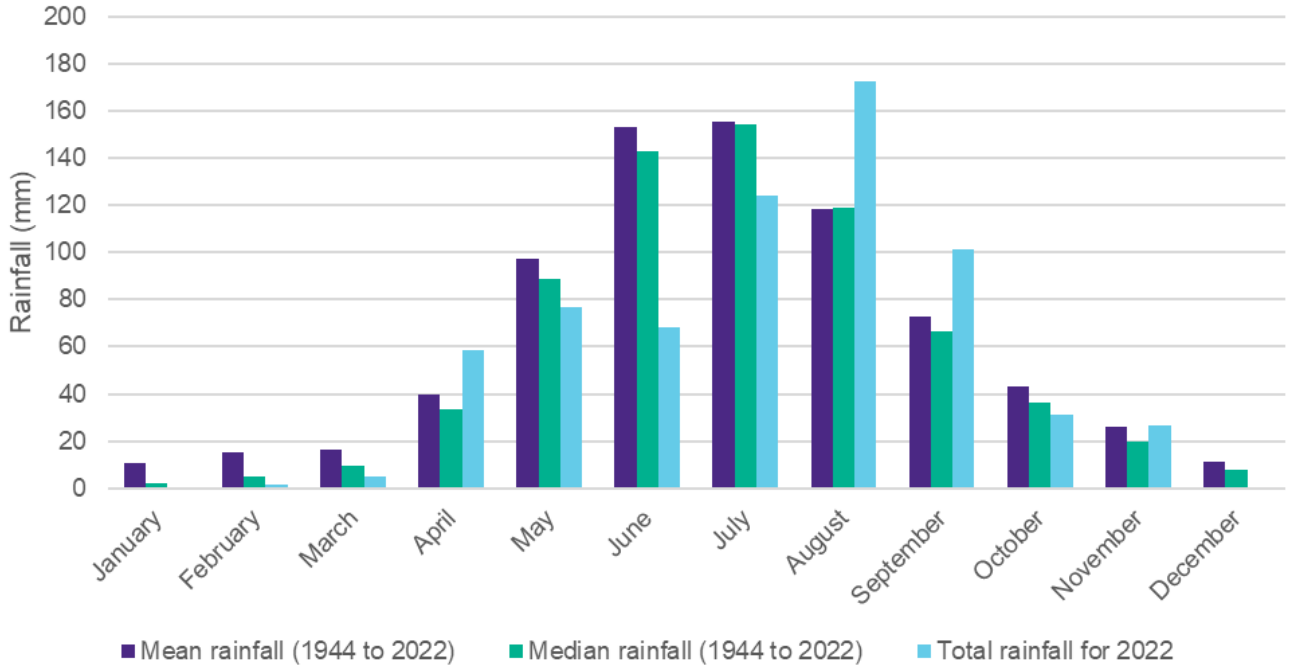


Figure 1: Key elements of the site

3.3 Climate and rainfall

The site experiences a Mediterranean climate, characterised by a distinctly dry and hot summer and a cold and wet winter. The closest weather station to the site is the Perth Airport (No. 009021), located approximately 14 kilometres (km) to the south (BoM 2022). The majority of rainfall occurs from May to September, as shown in Graph 1, with a long-term average annual rainfall of 760.9 millimetres (mm) (1944 to 2022). The annual average maximum temperature is 24.6 °C and the annual average minimum temperature is 12.2 °C, where January and February are typically the hottest months, and July is typically the coldest month.



Graph 1: Mean monthly rainfall statistics (Station No. 009021)

3.4 Topography

The elevation of the site ranges from approximately 42 metres Australian Height Datum (m AHD) in the north to approximately 39 m AHD in the south (Figure B). The site is generally flat, with an average grade of approximately 0.4%.

3.5 Geology

The Environmental Geology Series (Perth Sheet; (Gozzard 1986)) indicates that the site is comprised of thin Bassendean Sand over the Guildford Formation. The Guildford Formation generally consists of brown silty and slightly sandy clay (Davidson 1995). The geological unit occurring within the site is Sand (S10), described as very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin (Figure B). This geological unit is Quaternary in age (Gozzard 1986). The soil descriptions shown in the groundwater monitoring bore soil logs (Appendix B) are generally consistent with this description.

(Davidson 1995) indicates the Gnangara Sand is present beneath the superficial formations in the region. The Gnangara Sand is a pale grey, fine to coarse grained quartz sand with feldspar. The superficial formations at the site are underlain by the Poison Hill Greensand, Molecap Greensand, and the Mirrabooka Member of the Osborne Formation (Davidson 1995). These formations form part of the Mirrabooka aquifer. The Poison Hill Greensand typically consists of silty sand that is unconsolidated, pale yellowish green, fine to coarse grained, very poorly sorted, well rounded and glauconitic. The Molecap Greensand typically consists of sandstone that is yellowish-brown to greenish grey, fine to medium grained glauconitic and silty. The Mirrabooka Member of the Osborne Formation is a sandstone with thin interbeds of siltstone and shale that is dark greenish brown, fine to very coarse grained, very poorly sorted and richly glauconitic. Table 4 describes the geological formations and members from youngest to oldest age in the area.

Table 4: Geological formations, members and aquifers in the area

Formation	Member	Aquifer
Guildford Formation	NA	Superficial aquifer
Bassendean Sand	NA	
Gnangara Sand	NA	
Poison Hill Greensand	NA	Mirrabooka aquifer
Gingin Chalk	NA	
Molecap Greensand	NA	
Osborne Formation	Mirrabooka Member	
	Kardinya Shale	Confining unit
	Henley Sandstone	Leederville aquifer
Leederville Formation	Pinjar Member	
	Wanneroo Member	
	Mariginiup Member	
South Perth Shale	NA	Confining unit
Yarragadee Formation	NA	Yarragadee aquifer

3.6 Acid sulfate soils

The DWER's risk mapping for acid sulfate soils (ASS) for the Swan Coastal Plan identified that the site has a moderate to low risk of ASS occurring within three metres of the natural soil surface (Landgate 2022b) (Figure C).

3.7 Contaminated sites

A search of the Contaminated Sites Database (DWER 2022a) identified that the site is not registered as a contaminated site, indicating that it has not been formally classified under the *Contaminated Sites Act 2003*.

3.8 Heritage

A search of the Aboriginal Heritage Inquiry System (DPLH 2022b) identified no registered Aboriginal sites or other heritage places within or adjacent to the site.

A search of the inHerit database (Heritage Council 2022) identified no heritage places within the site. Adjacent to the site is the Whiteman Park heritage place (No. 25868).

3.9 Bush Forever sites

The site is adjacent to the 1,548 ha Bush Forever Site No. 304, Whiteman Park, located approximately 120 metres (m) to the west (Landgate 2022b) (Figure D).

3.10 Remnant vegetation

A reconnaissance spring flora and vegetation survey was completed for the site in November 2022 (RPS 2023a). A summary is provided below:

- Flora:
  - No Threatened or Priority flora were recorded
  - One declared pest recorded, arum lily
  - Forty-nine conservation significant flora identified in the desktop assessment, two were considered to have a high likelihood of occurrence within the survey area

  - A total of 24 flora species recorded including eight (33%) locally native species and 16 (67%) introduced or naturalised species
- Vegetation:
  - One vegetation type: CcArXpEc - Open Marri Woodland
  - Condition of the survey area was mainly Completely Degraded (58%) and included tracks and existing clearings. Remnant vegetation was mostly in Degraded-Good condition (35%)
  - Three Conservation Listed Wetlands within 2 km of the Survey Area. The Survey Area occurs on a Palusplain classified as Multiple Use.

3.11 Wetlands

The Department of Biodiversity, Conservation and Attractions (DBCA) mapping of Geomorphic Wetlands of the Swan Coastal Plain identified one Multiple Use (MU) wetland overlapping the site (Landgate 2022b) (Figure D). The MU wetland, UFI 13396, covers the majority of the site and is a palusplain wetland (seasonally waterlogged flats).

3.12 Groundwater

3.12.1 Public drinking water source areas

The site is located within the Gnangara Underground Water Pollution Control Area. Stage 1 is in a Priority 3* (P3*) public drinking water source area (PDWSA) while Stage 2 is in a Priority 2 (P2) area (Figure E). The WAPC is currently progressing an MRS amendment to rezone the 'Public purposes – special uses' area of the site to 'Urban' (Amendment 1410), which will support a reclassification of the P2 area to a P3* area. The PDWSA is further addressed in Section 4.

3.12.2 Aquifers

The site is situated within the Gnangara groundwater system, which comprises several hydrogeological units (aquifers), including the:

- Unconfined Perth Superficial Swan aquifer
- Semi-confined Mirrabooka aquifer
- Confined Leederville aquifer
- Confined Yarragadee North aquifer.

Table 4 in Section 3.5 provides a summary of the aquifers in the vicinity of the site.

A search of the Water Register (DWER 2022b) identified that the site is within the Whiteman Park management subarea of the Perth – Superficial Swan (unconfined) aquifer, which is fully allocated. There are no existing groundwater licences located within the site, although an application for 10,506 kL was submitted in February 2024.

3.12.3 Groundwater levels

A search of the DWER Water Information Reporting (WIR) database (DWER 2023) shows four monitoring bores with reliable long-term data dating back to 1970s within the site vicinity (GLW 7C, MM27, MM55B and MM59B).

Six monitoring bores (MW01 to MW06) were identified in the adjacent development to the east (Emerge Associates 2015). Monthly monitoring of these bores occurred for two years, between October 2015 and November 2017, with a single additional reading on 11 September 2018 (Appendix D).

RPS installed six monitoring bores (MB01–MB06) within the site (construction and lithological logs are located in Appendix B). One of these six bores (MB04) was found to be destroyed during the field survey on 20 December 2022. These on-site bores were monitored between November 2022 and February 2023; groundwater elevations are summarised in Table 5.

Table 5: Groundwater elevations and clearance (from natural surface)

Bore ID	MB01	MB02	MB03	MB05	MB06
Easting	401744	401417	401789	401648	401790
Northing	6481670	6481550	6481335	6480947	6480933
Ground level (mAHD)	41.74	40.68	39.72	39.14	38.95
Top of casing (mAHD)	42.358	41.393	40.35	39.825	39.678
Groundwater elevations (mAHD)					
10/11/2022	38.71	38.14	37.09	36.45	36.36
23/03/2023	38.67	Dry	36.74	36.49	36.03
10/05/2023	37.88	Dry	36.26	35.67	35.56
22/08/2023	38.93	38.98	37.92	37.29	37.19
13/11/2023	38.40	37.74	36.82	36.19	36.10
28/02/2024	37.84	37.29	36.23	35.66	35.51
Groundwater clearance (from natural surface)					
MGL (mAHD)	40.02	40.07	39.01	38.38	38.28
AAMGL (mAHD)	39.23	39.28	38.22	37.59	37.49
Depth to MGL (m)	1.72	0.61	0.71	0.76	0.67
Depth to AAMGL (m)	2.51	1.4	1.5	1.55	1.46

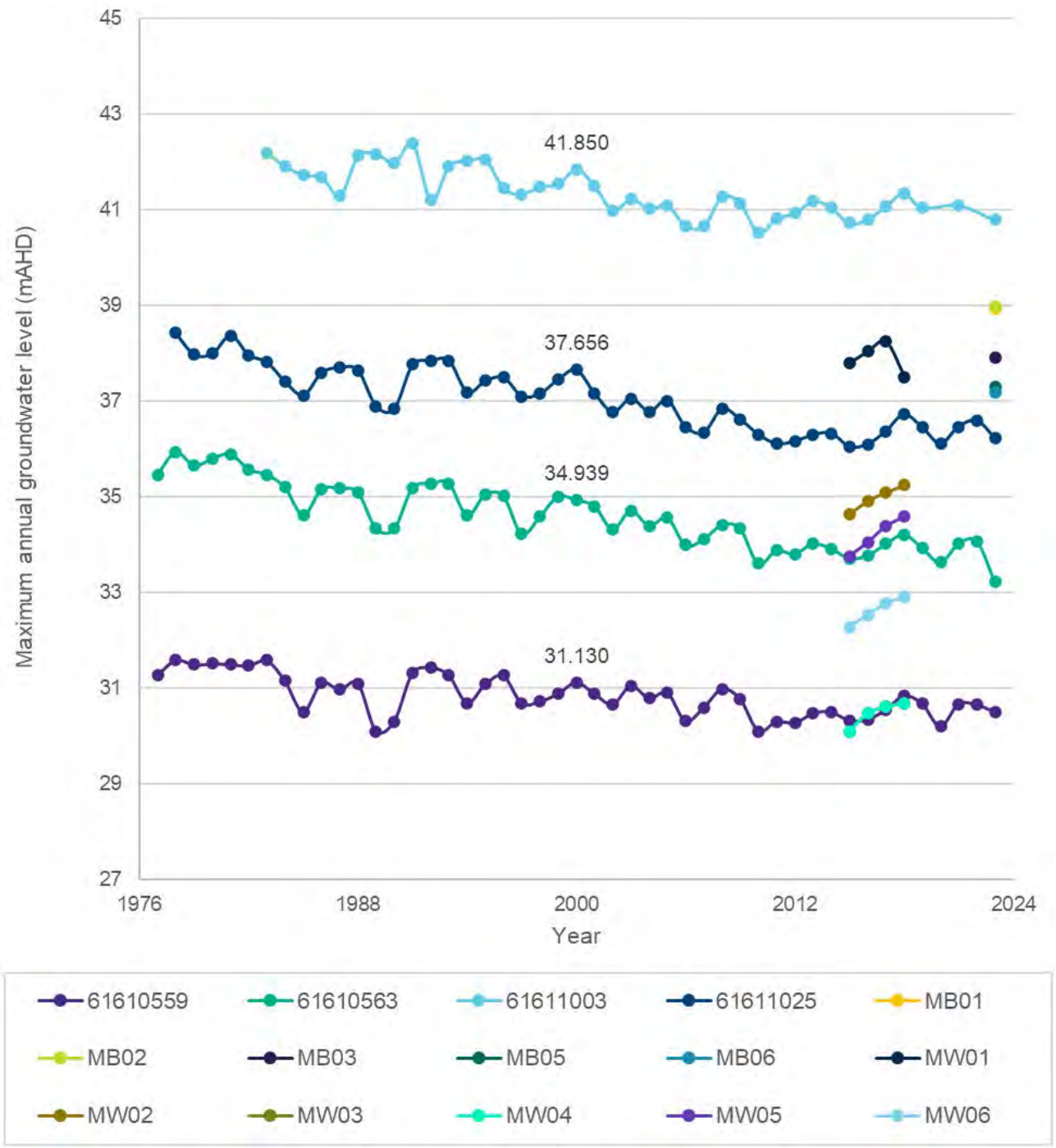
The time series of annual maximum groundwater levels for all bores is plotted in Graph 2, and shows that groundwater levels within the Gnangara PDWSA have been declining since the 1970s. To estimate the highest groundwater level for the Gnangara PDWSA, *Water quality protection note no. 15* (DWER 2022c) suggests the use of the highest groundwater levels from the year 2000, which approximates the analysis from the Perth Region Aquifer Modelling System (PRAMS) (Vogwill, et al. 2008). Average Annual Maximum Groundwater Level (AAMGL) and Maximum Groundwater Level (MGL) were therefore calculated for the DWER bores based on groundwater levels from 2000 onwards.

Post-2000 AAMGLs and MGLs have been estimated for the site by correcting water levels observed on the site to the long-term record from the DWER bores. The objective of calculating the AAMGL and MGL is to provide an understanding of the pre-development hydrology at the site, to ensure sufficient clearances to infrastructure, and to protect the health of receiving groundwater.

Post-2000 MGL contours across the site are presented in Figure F and are based on the calculated MGLs for the DWER bores, on-site bores (MB01 to MB06), and bores from the adjacent site to the east (MW01 to MW06), as presented in Table 6.

The MGL on the site ranges from 38.3 m to 40.1 m AHD, while the AAMGL ranges from 37.5 m to 39.3 m AHD. Groundwater flows in a south-south-easterly direction. The northern area of the site, where Service Commercial will be situated, had the highest clearance to MGL of 1.72 m, whereas the remainder of the site had clearance to MGL between 0.61 m and 0.76 m. Clearance to AAMGL was, again, largest at the Service Commercial site (2.51 m), and ranged between 1.40 m and 1.55 m at the remainder of the site, as documented in Table 5. The MGL was on average 0.8 m above the AAMGL.

Overall, the site-specific monitoring demonstrated a minimum of 0.6 m clearance to groundwater from the site's current surface.



Graph 2: **Time series of maximum annual groundwater levels (m AHD)**

Table 6: **Data from monitoring bores surrounding the site**

Bore ID	Easting	Northing	AAMGL (m AHD)	MGL (m AHD)
DWER bores				
MM55B (61610559)	401632	6479021	30.61	31.13
GLW 7C (61611003)	400633	6482209	41.10	41.85
MM27 (61610563)	401425	6479772	34.14	34.94
MM59B (61611025)	400956	6480761	36.54	37.66
Site bores				
MB01	401744	6481670	39.23	40.02
MB02	401417	6481550	39.28	40.07

Bore ID	Easting	Northing	AAMGL (m AHD)	MGL (m AHD)
MB03	401789	6481335	38.22	39.01
MB05	401648	6480947	37.59	38.38
MB06	401790	6480933	37.49	38.28
Off-site bores				
MW01	402235.2	6481723	38.35	39.15
MW02	402753.2	6480853	35.10	35.90
MW03	402503.2	6480231	34.21	35.01
MW04	403331.5	6480259	30.66	31.46
MW05	401903.7	6480014	34.31	35.11
MW06	402412.7	6479799	32.75	33.55

3.12.4 Groundwater quality

3.12.4.1 Regional water quality

Overall, since 1995 the salinity of the groundwater of the Gnangara groundwater area has remained relatively constant, with groundwater salinity typically increasing closer to the coast (DoW 2009). Salinity in the Superficial aquifer ranges from fresh (<250 mg/L TDS) to marginal (250–1000 mg/L TDS) (DoW 2009).

Elevated nutrient concentrations are common due to horticultural practices in the area, with nitrate concentrations frequently exceeding 20 mg/L and phosphorus concentrations frequently above 0.5 mg/L (DoW 2009).

3.12.4.2 Site water quality

On-site water quality baseline monitoring by RPS began in November 2022 and was completed in February 2024, with a total of six sampling events undertaken during this period. Laboratory reports can be found in Appendix C).

Quarterly sampling was undertaken for the following water quality parameters:

- Physico-chemistry: pH, electrical conductivity (EC), redox and dissolved oxygen (DO)
- Nutrients: Ammonia as N (NH_3), nitrate as N (NO_3), nitrite as N (NO_2), total nitrogen, nitrogen oxides, total Kjeldahl nitrogen (TKN), total phosphorus (TP) and filterable reactive phosphorus (FRP)
- Dissolved metals and metalloids: Aluminium, arsenic, cadmium, chromium, iron, lead, manganese, nickel, selenium, mercury and zinc
- Microbiology: heterotrophic plate count, faecal Enterococci, thermotolerant coliforms and E.coli.

Biannual sampling was undertaken for the following water quality parameters:

- Organochlorine and organophosphorus pesticides
- Volatile and semi-volatile TRH and BTEX.

Typically, two years of pre-development baseline monitoring (including two winters) is required to support subdivision. To date, 16 months of monitoring (November 2022 to February 2024) have been completed for the site. However, given that two years (2015–2017) of pre-development monitoring have already been completed for the adjacent development (Emerge Associates 2020), it is proposed to supplement Lot 96's monitoring with the adjacent development's monitoring data to establish a baseline. The groundwater quality data from this site is shown in Tables A and B (located at the rear of the report) and results from the adjacent site are included in Table C and Appendix D. The City of Swan and DWER have provided support for this reduced monitoring program (Appendix E).

To assess the suitability of using water quality data from the adjacent development, statistical significance testing was performed. Note that a nonparametric ANOVA (Independent-Samples Kruskal-Wallis one-way analysis of variance) was used for analysis as the assumption of normality was not met for most variables. Further note that for cases were concentrations were below the LOR, the LOR value was halved and used

for analysis. Since the majority of FRP concentrations were below the LOR, and the LOR between both groups (on-site/off-site bores) varied (LOR for on-site bores half of the LOR for off-site bores), an equal value of 0.005 mg/L (half LOR of off-site bores) was used for both groups to avoid positive skewing.

The Kruskal-Wallis test revealed that there was no statistically significant difference (p<0.05) between water quality parameters in groundwater of the two sites. As such, groundwater quality results from the adjacent development is also representative of the groundwater on the site and can be used to supplement the dataset.

Table 7 presents the summary statistics of the Kruskal-Wallis test, while the test output can be found in Appendix F.

Table 7: Summary statistics of Kruskal-Wallis test

Statistic	EC	pH	NH_3	NO_X	TKN	TN	TP	FRP
p	0.616	0.052	0.051	0.334	0.802	0.076	0.896	0.131
H	0.252	3.769	3.818	0.932	0.063	3.151	0.017	2.275
d.f.	1	1	1	1	1	1	1	1

Trigger levels for the interpretation of water quality data were sourced from the following guidelines:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ 2000)
- *Swan Canning Water Quality Improvement Plan* (Swan River Trust 2009)
- *Australian Drinking Water Guidelines Paper 6*, version 3.8 updated September 2022 (NHMRC 2011)

The guideline levels adopted for comparison against the groundwater reported in the following sections are:

- Freshwater Guidelines (FWG): Define assessment values for consideration of ecological risk in surface water bodies for wetlands in the south-west of Australia
- Swan River Trust (SRT) guidelines: Focus on reducing nitrogen and phosphorus inputs from catchments into the Swan Canning River system
- Australian Drinking Water Guidelines (ADWG): Intend to provide a framework for good management of drinking water supplies.

Table 8 provides summary statistics for key physico-chemical parameters and nutrients as well as a comparison of these parameters to relevant guideline values, for on-site and off-site bores. Note that tabulated raw data can be found in Tables A and C (located at the rear of the report). Results are summarised below:

- Both on-site and off-site groundwater was acidic, with an average pH of 4.34 and 4.72, respectively, which is below the guideline ranges of the FWG (7-8.5) and ADWG (6-8.5).
- Groundwater at most bores was also within freshwater ranges, with E.C. values often below the FWG (500-1500 µS/cm), except for MW06, where E.C. exceeded the guideline range throughout 2017.
- TP concentrations were generally below the LOR (0.01 mg/L), with some concentrations above the SRT (0.1 mg/L) observed.
- FRP concentrations were also mainly below the LOR (0.005 mg/L) and FWG (0.03 mg/L) exceedances were limited to off-site bores.
- Average TN concentrations were above the FWG (1.5 mg/L) and SRT (1 mg/L), with concentrations exceeding the guideline values in most samples.
- Similarly, average NH_3 and NO_x concentrations exceeded the respective guidelines.

Table 9 provides summary statistics for pathogens in groundwater. Tabulated raw data can be found in Table A and Table C.

Average Heterotrophic plate count at 35 °C, on-site, was 732 cfu/mL, with a minimum of 20 cfu/mL (MB06 in May 2023; MB03 in November 2023) and maximum of 5,900 cfu/mL (MB02 in November 2023). No guideline value has been set for Heterotrophic plate count.

While all on-site faecal enterococci and E.coli concentrations were below the LOR (<1 or <10 cfu/100 mL), concentrations of thermotolerant coliforms were detected at the LOR in one instance (10 cfu/100 mL at MB02, November 2022:). As the ADWG permit no thermotolerant coliforms or E.coli to be detected in water, this single measurement breached the guideline.

Off-site E.coli concentrations made up all of the faecal coliforms and exceeded the ADWG.

Note that summary statistics in Table 9 were determined by halving LORs (<1/<10), thus generating positive values, however it cannot be verified whether any pathogens were actually present.

Table 8: Groundwater quality

Location of bores	Guideline	pH	E.C.	Redox	D.O.	Total P	FRP	Total N	TKN	NH_3-N	Nitrate as NO_3	Nitrite as NO_2	NO_x-N
	Units	pH units	µS/cm	mV	ppm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	FWG	7-8.5	500-1500	-	-	0.06	0.03	1.5	-	0.04	-	0.15	0.1
	SRT	-	-	-	-	0.1	-	1.0	-	-	-	-	-
	ADWG	6-8.5[b]	-	-	-	-	-	-	-	0.5[b]	50[a]	3[a]	-
On-site	Average	4.36	392	118	0.56	0.09	0.004	1.70	1.29	0.12	1.68	0.02	0.42
	Median	4.15	381	110	0.40	0.03	0.003	1.50	1.20	0.12	0.31	0.01	0.07
	Standard deviation	0.52	70	148	0.54	0.29	0.004	0.84	0.65	0.08	2.44	0.03	0.55
Off-site	Average	4.72	529	32	1.38	0.20	0.142	2.97	1.31	0.34	---	---	1.66
	Median	4.76	324	-1	0.74	0.02	0.005	2.50	1.10	0.26	---	---	0.06
	Standard deviation	0.97	464	105	1.61	0.39	0.334	2.78	0.73	0.32	---	---	2.58

FWG - Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1 (ANZECC & ARMCANZ 2000)

SRT - Swan Canning Water Quality Improvement Plan. Swan River Trust (SRT 2009)

ADWG - Australian Drinking Water Guidelines 6 (NHMRC 2011), Version 3.8 Updated September 2022, (a) health threshold, (b) aesthetic threshold

- no guideline available, --- not tested

Table 9: Pathogens in groundwater

Location of bores	Guideline	Heterotrophic plate count 35 °C	Faecal enterococci	Faecal coliforms	Thermotolerant coliforms	E. coli
	Units	cfu/mL	cfu/100mL		cfu/100mL	cfu/100mL
	FWG	-	-	-	-	-
	SRT	-	-	-	-	-
	ADWG	-	0.0	-	0.0	0.0
On-site	Average	732	<1/<10	---	3.3*	<1/<10
	Median	250	<1/<10	---	5.0*	<1/<10
	Standard deviation	1,550	<1/<10	---	2.6*	<1/<10
Off-site	Average	---	---	4.58	---	4.58*
	Median	---	---	0.75	---	0.75*
	Standard deviation	---	---	9.04	---	9.04*

< all concentrations below LOR, - no guideline available, --- not tested, *values below LOR were halved to calculate statistic

Table B (located at the rear of the report) provides dissolved metal and metalloid concentrations, which is summarised below:

- Dissolved aluminium concentrations exceeded both the FWG (0.055 mg/L) as well as the ADWG aesthetic threshold (0.2 mg/L) in all samples.
- Dissolved chromium concentrations were also above the FWG (0.001 mg/L) and ADWG health threshold (0.05 mg/L) in all samples.
- Dissolved iron concentrations were mostly above the FWG and ADWG aesthetic threshold (both 0.3 mg/L).
- Dissolved lead concentrations were also mostly above the FWG (0.0034 mg/L) and ADWG health threshold (0.001 mg/L).
- Dissolved nickel and zinc concentrations were below the respective guidelines, except at MB06 in November 2022.
- Dissolved arsenic, cadmium, manganese, selenium and mercury concentrations were below the respective guidelines in all cases.

All volatile TRH and BTEX, semi-volatile TRH and pesticides concentrations were below the respective LOR.

3.13 Surface hydrology

The pre-development catchment slopes in SS-E direction, at a ~0.4% grade. There are no creeks or drainage lines visible within the site. Starflower Road (previously Lord Street) runs along the eastern site boundary in north to south direction, presenting a catchment eastern boundary. Road-side swales are present on its eastern side; however the site does not drain to it. Based on 1m LiDAR derived contours, it can be assumed that the site in pre-development condition receives negligible run-off from its northern boundary, and locally generated run-off would flow towards its south-eastern corner.

A bus station is located to the south, adjacent to the site. Aerial images indicate run-off from the bus station's access road is directed via rock pitching into an existing swale located within the site. This drainage area will be shared between the site and the bus station. Details of the bus station drainage are not available at this stage and contribution of this catchment has not been included in the assessment and analysis. However, it is anticipated that the run-off contribution from the bus station access road will be relatively small, compared to the site's run-off.

The LWMS (Emerge Associates 2020) prepared for the adjacent Henley Brook LSP to the east states that no flows cross Starflower Road to flow east. The adjacent development's catchments, modelling and subsequent drainage design has therefore not allowed for any inflows coming from the site. There is no piped drainage infrastructure within Starflower Road adjacent to the site.

4 PUBLIC DRINKING WATER SOURCE AREA

The site is within a Priority 2 (P2) and P3* public drinking water source area (PDWSA) in the Gnangara Underground Water Pollution Control Area (Figure E). P3* areas were previously P1 or P2 that have been changed as a result of strategic-level planning undertaken by the WAPC.

The current P3* area was identified for Urban Expansion in the North-East Subregional Planning Framework (DPLH 2018), which supports the Draft Perth and Peel @3.5 million strategic planning documents. Its PDWSA designation changed after the area was rezoned from 'Rural' to 'Urban' under the MRS Amendment 1329/57, which was approved by the Minister for Planning in October 2018 (DPLH 2021).

Additionally, the WAPC is currently progressing an MRS amendment to rezone the 'Public purposes – special uses' area of the site to 'Urban' (amendment 1410), which will support a reclassification of the current P2 area to a P3* area.

There may be additional requirements within P3* areas to protect drinking water quality and public health as compared to a P3 area. Guidance for development in P3* areas is provided in *Water quality protection note no. 38 – Priority 3* (P3*) areas* (DWER 2018).

4.1 Land use compatibility

Acceptable land uses within PDWSA are summarised in Table 10 (DWER 2021). Urban or residential land uses are considered incompatible with the P2 area and its associated water quality protection objectives.

Table 10: Acceptable land uses within PDWSAs

Zoning / land use	P2 areas	P3* areas
Rural residential/rural living (Lot size of 2 ha or greater)	Compatible (with conditions)	Compatible (with conditions)
Rural residential/rural living (Lot size of 1 ha to 2 ha)	Incompatible	Compatible (with conditions)
Urban/residential or urban deferred	Incompatible	Acceptable
Industrial and commercial	Incompatible	Compatible (with conditions)

The following land uses are considered appropriate in P3 areas, however DWER (2018) recommends they are avoided in P3* areas (unless under special circumstances) due to the risks posed to drinking water quality and public health:

- Airport
- Amusement park
- Aquatic centre (unless backwash is disposed to reticulated sewerage)
- Caravan and park home park, campground (unless connected to reticulated sewerage)
- Cemetery
- Hospital
- Education – tertiary and scientific research
- Golf course
- Landfill, waste transfer station, recycling depot
- Light, heavy and rural industry (including dry cleaner)
- Motor vehicle repair, wash, sales and racing
- Service station, fuel depot, works depot, underground fuel and chemical storage, bulk chemical storage/handling (e.g. warehouse)
- Wastewater treatment plant, ponds, irrigation and managed aquifer recharge (if not treated to drinking water standards).

4.2 Wellhead protection zones

A groundwater production bore associated with the PDWSA is located approximately 240 m to the east, and its wellhead protection zone (WHPZ) of 300 m radius partially overlaps the site's north-eastern extent (Figure E). Water Corporation (Gabe Pergamalis, pers. comm., 7 August 2023) has advised that the production bore is not currently in use, however the WHPZ must remain in place as the bore may still be used in the future.

The following conditions apply to WHPZs (DWER 2018 and 2021):

- On-site sewage disposal systems and sewage pump stations should be located outside of WHPZs.
- Building envelopes should be located outside WHPZs.
- Domestic animals should be prevented from entering WHPZs.
- Do not use recycled road base in WHPZs.
- End of conveyance stormwater infrastructure and subsoil drains should not outlet within WHPZs.
- Infiltration areas should be outside WHPZs where possible, but if unavoidable, biofiltration should be used.

4.3 Risk assessment

The proposed change in land use has the potential to impact water quality in the PDWSA. A risk assessment has been undertaken in accordance with *Australian drinking water guidelines* (NHMRC 2011).

The largest source of potential hazards for drinking water quality is human and animal waste, which can contribute high loads of enteric pathogens and nutrients (NHMRC, 2011). Enteric pathogens may be derived from urban stormwater run-off or sewer overflows, which can potentially escape impervious surfaces and enter groundwater. Both sources may also contribute nutrients and trace metals to the groundwater resource, while urban stormwater may also transport petrol and oil products from road surfaces.

Nutrients may also be derived from fertiliser application on POS and residential gardens, which can also enter the groundwater.

Excessive groundwater abstraction can adversely affect the local water table and may affect the sustainable use of the resource for all users.

To manage risks associated with on-site development to public drinking water sources, all potential hazards as well as their sources and respective levels of risk are listed below, with Table 11 outlining measures of likelihood, Table 12 presenting measures of impact, Table 13 providing a risk analysis matrix and Table 14 summarising the assessment of risks.

Table 14 shows that the potential risks to the PDWSA can be managed and be reduced from high/very high to moderate via control measures implemented as part of the site design and ongoing maintenance practices. Additional downstream controls as part of the water supply system as well as the production bore nearest to the site not being in use further reduces the risk of potential impact to the population.

Table 11: Measures of likelihood

Level	Descriptor	Description
A	Almost certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur at some time
D	Unlikely	Could occur at some time but is not likely to occur
E	Rare	May occur only in exceptional circumstances

Table 12: Measures of impact

Level	Descriptor	Description
1	Insignificant	Insignificant impacts on the sustainability of resource - no lasting effect
2	Minor	Short term impacts on the sustainability of resource - recovery may take around one week, minor impact for small population
3	Moderate	Moderate impacts on the sustainability of resource - recovery may take several weeks, minor impact for large population, increased monitoring
4	Major	Long-term impacts on the sustainability of resource - recovery may take several months or years, major impact for small population, high level of monitoring required
5	Catastrophic	Permanent impacts on the sustainability of resource - impacts are irreversible and/or permanent, major impact for large population

Table 13: Risk analysis matrix

Likelihood	Impact				
	1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)	5 (Catastrophic)
A (Almost certain)	Moderate	High	Very High	Very High	Very High
B (Likely)	Moderate	High	High	Very High	Very High
C (Possible)	Low	Moderate	High	Very High	Very High
D (Unlikely)	Low	Low	Moderate	High	Very High
E (Rare)	Low	Low	Moderate	High	High

Table 14: Risk assessment

Potential Source	Potential hazard	Likelihood	Consequence	Maximum risk	Control / preventive measures	Likelihood	Consequence	Residual risk
Groundwater abstraction from irrigation bore	Drawdown of local water table impacting other groundwater users	C (Possible)	4 (Major)	Very high	• Reduce irrigation demand where possible e.g. minimise turf and use local native species • Comply with annual allocation volumes in the groundwater licence issued by DWER. • Locate irrigation bore away from WHPZs to ensure drawdown cones do not significantly impact public water supply bores	D (Unlikely)	3 (Moderate)	Moderate
Urban stormwater run-off	Pathogens, nutrients, metals, pesticides, petrol/oil products entering groundwater	A (Almost certain)	4 (Major)	Very high	• Avoid incompatible land uses as per Section 4.1 • Capture and treat the small (15 mm) rainfall event which will mobilise most pollutants such as soluble materials, fine dusts and silts, oils, grease and non-volatile hydrocarbons from impervious areas (Section 7.3.1) • Site-responsive design to direct surface run-off away from drinking water extraction points such as via slopes and road cambers. • Only use clean fill that is suitable for protecting drinking water quality, i.e. does not introduce contaminants. • Include Public Drinking Water Source Area (PDWSA) awareness-raising strategies, for example: – Signage in public areas/POS educating the community that the site is in a PDWSA – Front yard landscape packages designed with low fertiliser requirements to be provided to lot purchasers	C (Possible)	2 (Minor)	Moderate
Sewer overflows	Pathogens, nutrients, metals entering groundwater	D (Unlikely)	4 (Major)	High	• Reticulated sewage to be provided, no on-site sewage disposal • Sewage pump stations to be located outside of WHPZs • Sewerage plans should be developed with a risk assessment process that considers PDWSAs, particularly, location of wellhead protection zones (WHPZs) and giving them the highest protection.	E (Rare)	3 (Moderate)	Moderate
POS maintenance	Nutrients and pesticides entering groundwater	B (Likely)	4 (Major)	Very high	• Retain areas of existing native vegetation within the POS • Limit areas of turf and comply with recommended fertiliser and pesticide application rates to avoid leaching into the groundwater • Low shrub and ground cover planting with low fertiliser requirements • Use appropriate herbicides (refer to *Use of herbicides in water catchment areas* (Department of Health 2007))	D (Unlikely)	3 (Moderate)	Moderate

5 WATER SOURCE PLANNING

5.1 Potable water supply

The site is situated within the Water Corporation's Ellenbrook Gravity water supply zone.

According to the development Engineering Servicing report (Cossill & Webley 2022) the upgrade of the current 250 mm water main to 500 mm main was due to be completed at the end of 2023. It will provide sufficient water for the potable water supply (Appendix G).

5.2 Non-potable water supply

Groundwater is proposed to be used for irrigation of the POS area. The size of the POS area is 1.71 ha, and it contains 0.91 ha of native trees to be retained that will not require irrigation. A total area of 1.56 ha is estimated to potentially require irrigation, which includes a turfed kickabout area, street trees, verges and entry areas.

The site is situated within the Perth – Superficial Swan aquifer, Mirrabooka groundwater area, Whiteman Park subarea. This groundwater subarea is currently fully allocated; however a large allocation is associated with a temporary licence for the construction of Drumpellier Drive adjacent to the site. Based on an irrigation rate of 6,750 kL/ha/year as per *North West corridor water supply strategy* (DoW 2014), a groundwater licence application (ref. 062426) for 10,506 kL was submitted in February 2024 and is currently being assessed by DWER.

5.3 Wastewater servicing

The site is within the current Water Corporation wastewater planning. Water corporation is proposing to construct 12.5 km pressured wastewater pipeline from the Barrambie Way Sewerage Pumping Station in Ellenbrook to the Gnangara Branch Sewer in Wangara (EPA 2021). According to figure section of the Barrambie Way Wastewater Pipeline EP Act Supporting Environmental Document (Jacobs 2021) the Sewerage Pumping station is in the neighbouring Lot 100 north-west of the site.

According to the servicing report (Cossill & Webley 2022) :

> The landholding grades to the south and will ultimately connect to the proposed gravity sewer in the Henley Brook area. There are several developments commenced and proposed in the Henley Brook area, and there are existing road reserves through the area east of Sunflower. It is expected that connection to the existing gravity sewer will be available to the landholding at the time of development.

The proponent is currently negotiating to upgrade the existing sewer line along Henley Street, and it is anticipated the development will connect into reticulated sewage via a connection pit in the south-east corner of the site. It should be noted that these strategies are dependent on the Water Corporation approvals and subject to change.

As per *Water quality protection note no. 38 – Priority 3* (P3*) areas* (DWER 2018), sewerage plans should be developed with a risk assessment process that considers PDWSAs, particularly, location of wellhead protection zones (WHPZs) and giving them the highest protection.

6 WATER CONSERVATION STRATEGIES

6.1 Targets

Water efficiency, reuse and recycling are integral components of total water cycle management (WAPC 2006). The State Water Plan (Government of Western Australia 2007) is a strategic policy and planning framework to meet the state's water demands to the year 2030. One of the key targets is to reduce scheme water consumption to 40–60 kL per person per year. More recently, the *Waterwise Perth Action Plan* (DWER 2022d) sets a target to reduce the average annual scheme water use to 91 kL/ person.

To meet this target, several water saving initiatives to reduce potable water use will be investigated and implemented within the development. The development will comply with the following objectives:

- Developments should aim to achieve a target of less than 91 kL per person per year of scheme water use.
- Irrigation of public spaces is to be sourced from groundwater or an alternate water supply scheme. The use of recycled water within a P3* PDWSA is generally not supported by DWER, subject to the level of treatment and the WQPN No. 25 Land use compatibility tables for public drinking water source areas (DWER 2021)
- No potable water should be used outside the homes and buildings where alternative water sources are available. Efficient use of scheme water should be achieved.
- Waterwise landscaping techniques should be employed in POS to reduce the irrigation requirement.

Methods that will be used to achieve these criteria include:

- Water efficient fixtures and fittings are to be installed in households.
- Irrigation of POS with groundwater or another alternative water supply. Landscaping design will incorporate Waterwise native plants, hydro-zoning and xeriscaping to reduce irrigation demand and turf will be limited to areas of active recreation.

6.2 Household water conservation

The Building Code of Australia sets minimum standards of efficiency for water-using fixtures and fittings in homes. These include:

- All tap fittings, except bath outlets, garden taps and toilets must be a minimum 4-star WELS rated.
- All showerheads must be a minimum of 3-star WELS rated.
- An outdoor private swimming pool or spa associated with a Class 1 building must be supplied with a cover or blanket.
- All internal hot water outlets (such as taps, showers and washing machine water supply fittings) must be connected to a hot water system or a recirculating hot water system with pipes installed and insulated in accordance with AS/NS 3500.
- Lot owners will be encouraged to install grey water systems for the irrigation of individual household landscaping.
- Lot owners will be encouraged to install rainwater tanks. Rainwater tanks can be connected to water using fixtures such as toilets, washing machines and external taps to reduce potable water demand as well as assisting in reducing stormwater run-off.

6.3 Waterwise landscaping

A landscape concept plan is included in Appendix H. Broad landscaping principles will be set to ensure waterwise features will be implemented in future designs. This will include but is not limited to:

- Retention of existing trees in the POS with non-irrigated revegetation planting
- Minimising areas of turf to kick about recreation areas

- Garden beds will be mulched
- Hydro zoning and xeriscaping principles will be implemented
- Planting will consist of predominantly endemic native species
- Efficient use of fertilisers and pesticides.

Water-use efficiency for irrigation of POS will be enhanced through:

- Prioritising irrigation areas
- Best practice turf maintenance
- Optimal irrigation design and management including adjusting irrigation rates in accordance with weather and site-specific requirements.

7 STORMWATER MANAGEMENT

7.1 Drainage principles and criteria

Integrated urban water management recognises that the urban water cycle should be managed as a single system and water supply, stormwater, wastewater, flooding, water quality and wetlands are interconnected (WAPC 2006). The aim of the stormwater management strategy, as per Water Sensitive Urban Design (WSUD) principles, is to:

- Protect natural systems.
- Integrate stormwater treatment into the landscape to maximise the visual and recreational amenity of the development.
- Protect water quality.
- Maintain peak flows to pre-development rates if discharging off site.
- Add value to the development.

The site will effectively manage stormwater quantity and quality generated from small, minor and major events, incorporating best practice WSUD principles. Table 15 summarises the drainage criteria for several objectives based on Stormwater management manual for Western Australia (DWER 2022) and Decision process for stormwater management in Western Australia (DWER 2017).

Table 15: Stormwater management design criteria

Objective	Criteria
Flood protection	• Convey flows exceeding the 20% AEP up to the 1% AEP via overland flow paths within road reserves. • Run-off from the 1% AEP event to be retained on site within POS and designated drainage areas. • Maintain a minimum 0.5 m clearance between building habitable floor levels and the 1% AEP flood level in local detention basins/swales and flood conveyancing structures.
Serviceability	• Design road drainage system so that roads will be passable in the 20% AEP event.
Ecological protection	• Manage and treat the 15 mm storm event on-site, as close to source as practicably possible, via soakwells and bioretention basins/swales. • Provide a minimum treatment area of 2% of the site's connected impervious areas. • Design the bioretention basins according to Vegetation guidelines for stormwater biofilters in the south-west of Western Australia (Monash University 2014) and Adoption Guidelines for Stormwater Biofiltration Systems (Payne et al. 2015).
Mosquito management	• Infiltrate retained stormwater within 96 hours to prevent mosquito breeding conditions and to reduce the risk from disease vector and nuisance insects.

7.2 Post-development catchments

The post-development catchments have been defined with consideration given to flow directions based on the earthworks plan (Appendix I) and discharge locations. Catchments and flow directions are shown in Figure G. An indicative breakdown of the different land use types within each catchment is presented in Table 16. These areas are indicative only for the purposes of the modelling described in Section 7.4 and may be subject to change at subdivision stage.

This analysis and modelling does not consider run-off from the bus station situated south of the site at this stage. However, it is anticipated that the run-off contribution from the bus station access road will be relatively small compared to the site's run-off.

Table 16: Post-development catchment and land use areas (ha)

Catchments	A	B1	B2	C	Service commercial	Neighbourhood centre	Total
Lot <300 m2	0.134	0.138	0.218	0.474	-	-	**0.964**
Lot ≥300 m2	2.552	1.412	1.193	2.232	-	-	**7.389**
Road verge	0.579	0.345	0.351	0.653	-	-	**1.928**
Road pavement	0.579	0.345	0.351	0.653	-	-	**1.928**
POS / drainage	-	-	1.714	0.513	-	-	**2.227**
Service commercial	-	-	-	-	0.442	-	**0.442**
Neighbourhood centre	-	-	-	-	-	1.803	**1.803**
Total	**3.844**	**2.24**	**3.827**	**4.525**	**0.442**	**1.803**	**16.68**

7.3 Stormwater management strategy

The stormwater management strategy includes a combination of structural (e.g. bioretention areas) and non-structural measures to manage surface water quality on site.

7.3.1 Small event (15 mm) drainage

Runoff generated by the first 15 mm of rainfall can mobilise pollutants such as soluble materials, fine dusts and silts, oils, grease and other non-volatile hydrocarbons from impervious areas (DWER 2017). In order to provide water quality treatment, the stormwater management strategy recommends that the first 15 mm of the run-off event is infiltrated as close as possible to the source. Run-off captured in this way infiltrates into the underlying soils and ultimately to groundwater. This strategy contributes to reduction of peak flow rates and discharge volumes in developed areas where impervious areas tend to produce additional discharge flows compared to pre-development catchments. Managing small rainfall events via close-to-source infiltration aids in mimicking the pre-development hydrological regime of the site.

7.3.1.1 Lot drainage

As per City of Swan guidelines (City of Swan 2013), residential lots greater than 300 m^2 are to provide soakwells sized for the first 15 mm of rainfall. Lots less than 300 m^2 may be connected directly to the City's drainage system as long as the downstream drainage infrastructure and stormwater treatment areas are designed accordingly.

Group housing and commercial lots are to provide interconnected soakwells.

Soakwells are to be located at the front of lots where possible and should be a minimum of 1.8 m from the building footings or property boundary.

The predominantly sandy in-situ soils and minimum 1.4 m clearance to the pre-development AAMGL allow soakwells to be effectively used.

7.3.1.2 Road reserve

The first 15 mm of rainfall from road reserves (as well as connected lots) will be managed in bioretention basins or swales located at various close-to-source locations throughout the development. They are designed to retain, treat and infiltrate small rainfall events.

Biofiltration areas will be sized to at least 2% of the equivalent connected impervious catchment area. Stormwater will be directed into the biofiltration areas via flush kerbing, kerb breaks and/or piped drainage etc. Biofiltration areas will be planted with reeds, sedges and other plant species that will be selected based on their ability to uptake nutrients. The plant species will be selected from Vegetation guidelines for stormwater biofilters in the south-west of Western Australia (Monash University 2014). The biofiltration areas will be designed in compliance with the Adoption Guidelines for Stormwater Biofiltration Systems (Payne, et al. 2015).

7.3.2 Minor event drainage

The road drainage network will be designed to convey up to the 20% AEP flows to retention basins located in POS via a traditional pit and pipe system. Roads adjacent to the POS may allow overland sheet flow into the POS via kerb breaks.

The stormwater management plan, including flow directions, is shown in Figure G.

7.3.3 Major event drainage

For all rainfall events up to and including the 1% AEP event, any run-off that does not infiltrate into the sandy soils will be conveyed via overland flow paths within the road carriageway to retention basins located in the POS or drainage areas. All run-off from events up to the 1% AEP will be retained on-site. The service commercial and neighbourhood centre lots will be required to manage up to the 1% AEP on-site, either via a retention basin or other suitable alternative. Retention basins within the central POS are to contain up to the 20% AEP events; larger events would spill over into the wider POS, which will infiltrate and contain events up to 1% AEP.

The strategy for each catchment is outlined in Table 18. The stormwater management plan, including flow directions, is presented in Figure G.

7.4 Post-development drainage modelling

The main objective of the stormwater management strategy is to maintain the predevelopment hydrological regime as much as possible after development. To inform and support the strategy, 1D stormwater modelling of the proposed post-development scenario has been undertaken using XPSWMM. Modelling assumptions and adopted parameters are summarised in Table 17.

Table 17: Adopted Infiltration and routing parameters for XPSWMM

Land use	Initial loss (mm)	Continuous loss (mm)	Manning's n
POS	36	4.7	0.10
Residential lots > 300 m^2	15	7	0.10
Residential lots < 300 m^2	7	2	0.03
Service commercial	5	1	0.025
Neighbourhood centre	5	1	0.025
Road verge	7	3	0.05
Road pavement	2	0	0.014

The stormwater management strategy proposes to retain up to the 1% AEP on-site within basins and the POS (Table 18). This is due to Starflower Road being elevated and creating a barrier to surface run-off spilling over to the catchments east of the road and being evacuated via future drainage east of Starflower Road to Saint Leonards Creek (Emerge Associates 2020). The adjacent Henley Brook LWMS (Emerge Associates 2020) catchments, modelling and subsequent drainage design has therefore not allowed for any discharge from the site.

Table 18: Stormwater management

Catchment	Management strategy
A	20% AEP retained in Basin A in central POS (NE), 1% AEP overtopping and retained within POS
B1	20% AEP retained in Basin B1 in central POS (SW), 1% AEP overtopping and retained within POS
B2	20% AEP retained in Basin B2 in central POS (SE), 1% AEP overtopping and retained within POS
C	1% AEP retained in Basin C in southern drainage area
Service commercial	1% AEP retained within the Service commercial lot
Neighbourhood centre	1% AEP retained within the Neighbourhood centre lot

As presented in Table 18, stormwater storages are proposed to collect and infiltrate run-off within 96 hours. Basins A, B1 and B2 are proposed within the POS area to retain up to the 20% AEP event, with larger events up to the 1% AEP overtopping into and infiltrating within the POS. Basin C in the southern drainage area is proposed to infiltrate up to 1% AEP events. The service commercial and neighbourhood centre lots are required to retain and infiltrate up to and including the 1% AEP events within basins or other suitable storages.

Modelled storage volumes for each storm event are presented in Table 19. Indicative basin volumes have been provided for the service commercial and neighbourhood centre lots, however the final drainage design for these lots may differ (e.g. storage could be provided underground instead). Indicative positions of the retention basins are presented in Figure G.

Table 19: Basin dimensions and modelled storage details

Basin	Indicative base area (m × m)	Base invert (mAHD)	15 mm			20% AEP			1% AEP		
			Max depth (m)	Area (m^2)	Volume (m^3)	Max depth (m)	Area (m^2)	Volume (m^3)	Max depth (m)	Area (m^2)	Volume (m^3)
A	11 × 16	39.7	0.3	273	60	0.7	468	215	Spills into POS		
B1	8 × 12	39.5	0.3	177	39	0.7	322	133			
B2	9 × 12	39.4	0.3	190	42	0.7	340	142			
POS	-	-	-	-	-	-	-	-	0.2[a]	3800	797[b]
C	7 × 100	38.1	0.04	747	27	0.2	941	151	0.8	1808	982
Commercial	5 × 8	TBC	0.3	102	21	0.6	184	62	1.0	333	161
Neighbourhood centre	15 × 20	TBC	0.2	378	59	0.6	578	240	1.2	1009	743

[a] Top water level approximately 40.3 mAHD

[b] Total volume in the POS including all basins

The southern half of the POS area will be briefly inundated during the 1% AEP event, up to a maximum water depth of 0.2 m. The top water level is approximately 40.3 mAHD. Roads levels surrounding the POS should be designed to ensure that the 1% AEP event is retained within the POS. Habitable floor levels will have a minimum 0.5 m clearance above the 1% AEP top water level in local stormwater retention basins to ensure adequate flood protection.

To prevent creation of mosquito habitat, infiltration storages are designed to dry out within 96 hours. As presented in Table 5, there is a minimum separation of 1.4 m from natural surface to the AAMGL across the site. Given basins will be 0.7 m to 0.8 m deep, there will be more than 0.5 m separation between the base of the basins to AAMGL to promote infiltration.

7.5 Water quality

A treatment train of structural and non-structural controls will be used to manage stormwater quality. Structural controls include the use of bioretention basins. Non-structural controls include land use management and establishing operational and maintenance practices. The site will use the following controls to improve stormwater quality and mitigate potential contamination:

- Use of high PRI (>10) soil media (minimum 300 mm depth) at the base of bioretention basins to provide phosphorus treatment.
- Bioretention basins will be planted with native vegetation to encourage biological nutrient uptake. Plant species selected will be consistent with the *Vegetation guidelines for stormwater biofilters in the south-west of Western Australia* (Monash University 2014).
- Local native plants to make up a minimum 50% of the planted areas and streetscape treatments. Any non-local species will be selected for drought tolerance and low fertiliser requirements.
- Regular street sweeping to remove potential pollutants before they are picked up by run-off. This will be coordinated by the developer during construction up to practical completion and by the City of Swan following handover.

- Front yard landscape packages designed with low fertiliser requirements to be provided to lot purchasers.
- Education materials to the public that raise awareness of protecting Public Drinking Water Source Area (PDWSA) (e.g. signage in public areas/POS).

8 GROUNDWATER MANAGEMENT

The principle behind the groundwater management strategy is to maintain the existing groundwater hydrology and to protect buildings and infrastructure.

Groundwater level controls (i.e. subsoil drainage) are not likely to be required given the depth to MGL across the site (greater than 0.6 m), however this will need to be confirmed following geotechnical investigations completed prior to the UWMP to confirm if any low permeability layer is present that may cause groundwater perching.

Groundwater quality management will be achieved via the stormwater quality management measures. As discussed in Section 7.5, the proposed stormwater management strategy includes a combination of structural (e.g. bioretention basins) and non-structural measures to manage surface water quality on site. Retention of the first 15 mm of rainfall will treat stormwater run-off as it infiltrates through the soil profile and ultimately, into groundwater. Non-structural measures that reduce pollutant loading into the drainage network will similarly reduce the potential for contaminants entering the groundwater.

9 MONITORING REQUIREMENTS

9.1 Pre-development monitoring

Typically, two years of pre-development baseline monitoring (including two winters) is required to support subdivision. Pre-development monitoring allows for baseline conditions to be established and site-specific trigger values to be set. To date, sixteen months of monitoring (November 2022 to February 2024) have been completed for the site. However, given that two years (2015–2017) of pre-development monitoring have already been completed for the adjacent development to the east (Emerge Associates 2020), it is proposed to supplement Lot 96's monitoring with the adjacent development's monitoring data to establish a baseline. The City of Swan and DWER have provided support for this reduced monitoring program (Appendix E).

Site-specific trigger values will be established in the UWMP as per the *Guidelines for fresh and marine water quality* (ANZG 2018) and *Swan Canning water quality improvement plan* (SRT 2009) targets, and will take into consideration the 2015 to 2024 monitoring data collected from both the Lot 96 site and neighbouring development.

9.2 Post-development monitoring

A post-development monitoring program is required to assess any potential impacts from the development and demonstrate compliance with objectives. Three years of post-development monitoring is recommended as described in Table 20.

Table 20: Post-development monitoring schedule

Monitoring location	Parameters	Frequency
Minimum of four groundwater bores at upstream and downstream locations	• Groundwater levels • Nutrients • Pathogens	Quarterly
	• Organochlorine and organophosphorus pesticides • Hydrocarbons	Biannually (coordinated with surface water sampling)
Minimum one surface water location (Basin B2)	• Nutrients • Organochlorine and organophosphorus pesticides • Hydrocarbons	Biannually (targeting after rainfall around May and August)

The UWMP will outline appropriate trigger values and adequate contingency planning in case of groundwater or surface water contamination. Annual monitoring reports will be submitted to DWER and the City of Swan.

10 FURTHER INVESTIGATIONS

This LWMS has been completed to address the objectives of BUWM (WAPC 2008) and demonstrate that the site can support future development in terms of water supply planning, flood mitigation, drainage management, groundwater management and water quality protection.

Urban Water Management Plans (UWMPs) will need to be prepared as part of the water management and land planning process to support each stage of development. Further investigations will be required at the subdivision (UWMP) stage including:

- Geotechnical investigations to confirm site-specific geology
- Confirmation of lot levels, drainage inverts, and clearances to flood levels and groundwater
- Confirmation of the potential runoff contribution from the bus station to the south to ensure the shared basin is adequately sized
- Development of trigger values for post-development groundwater quality
- Development of a contingency action plan in the event of exceedance of monitoring targets
- Identify responsibilities and funding for implementing the approved UWMP.

The UWMP should be prepared in accordance with *Urban water management plans, Guidelines for preparing plans and for complying with subdivision conditions* (DoW 2008b) and *Better urban water management* (WAPC 2008).

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Tables

Table A
On-Site Groundwater Quality - Physicochemistry, Nutrients and Microorganisms

Definitions:

FWG (Freshwater Guidelines) for slightly - moderately disturbed systems, SRT (Swan River Trust), ADWG (Australian Drinking Water Guidelines) health threshold (a) and aesthetic threshold (b),
LOR (Limit Of Reporting), - (No Guideline), --- (Not Tested), * (10x the Australian drinking water guidelines limit of reporting, as the samples were processed in the laboratory at a dilution due to high turbidity)

Notes:

Guideline values have been adopted from the following guidance documentation:

- FWG - Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1 (ANZECC & ARMCANZ 2000)
- SRT - Swan Canning Water Quality Improvement Plan. Swan River Trust (SRT 2009)
- ADWG - Australian Drinking Water Guidelines 6 (NHMRC 2011), Version 3.8 Updated September 2022

All results expressed as mg/L except for pH (pH units), EC (µS/cm), Redox (mV), DO (ppm), Heterotrophic Plate Count (cfu/mL) and other microorganism counts (cfu/100mL)

Bore ID	Trigger	Field Parameters				Nutrients								Microorganisms			
		pH	EC	Redox	DO	Total P	FRP	Total N	TKN	NH_3-N	Nitrate as NO_3	Nitrite as NO_2	NO_x-N	Heterotrophic Plate Count 35°C	Faecal Enterococci	Thermotolerant Coliforms	E.coli
	Units	pH units	µS/cm	mV	ppm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	cfu/mL	cfu/100mL	cfu/100mL	cfu/100mL
	FWG	7-8.5	500-1500	-	-	0.06	0.03	1.5	-	0.04	-	0.15	0.1	-	-	-	-
	SRT	-	-	-	-	0.1	-	1	-	-	-	-	-	-	-	-	-
	ADWG	6-8.5[b]	-	-	-	-	-	-	-	0.5[b]	50[a]	3[a]	-	-	0.0	0.0	0.0
	LOR	0.01	10	1	0.1	0.05	0.005	0.1	0.1	0.005	0.02	0.02	0.005	10	10*	10*	10*
10 Nov 2022																	
MB01		4.44	465	247	0.06	0.057	0.0089	1.5	1.1	0.054	1.8	<0.02	0.4	310	<10	<10	<10
MB02		5.08	324	185	---	<0.05	0.0062	3.2	1.2	0.005	8.7	0.022	2.0	4,900	<10	10	<10
MB03		4.77	438	100	0.16	<0.05	<0.005	1.9	1.4	0.120	2.4	<0.02	0.5	70	<10	<10	<10
MB04		4.04	410	196	0.11	<0.05	<0.005	2.8	1.4	0.400	6.4	<0.02	1.4	370	<10	<10	<10
MB05		4.13	367	228	0.80	<0.05	<0.005	2.0	0.8	0.130	5.4	<0.02	1.2	250	<10	<10	<10
MB06		4.15	384	121	---	<0.05	<0.005	1.1	1.1	0.170	<0.02	<0.02	<0.005	590	<10	<10	<10
23 Mar 2023																	
MB01		4.75	302	-122	0.38	1.6	<0.005	3.0	3	0.130	<0.02	<0.02	<0.005	---	---	<10	<10
MB02		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MB03		4.84	399	-130	0.28	<0.05	<0.005	2.4	2.4	0.096	<0.02	<0.02	<0.005	---	---	<10	<10
MB04		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MB05		3.83	447	8	2.18	0.12	<0.005	1.8	1.5	0.240	1.2	<0.02	0.27	---	---	<10	<10
MB06		3.77	380	-52	0.17	<0.05	<0.005	1.4	1.4	0.130	0.05	<0.02	0.012	---	---	<10	<10
10 May 2023																	
MB01		4.14	359	187	1.44	0.076	<0.005	0.65	0.64	0.078	<0.02	<0.02	<0.005	170	<10	<10	<10
MB02		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MB03		5.17	416	-117	0.94	<0.05	<0.005	2.1	2.2	0.120	<0.02	<0.02	<0.005	120	<10	<10	<10
MB04		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MB05		3.59	369	62	0.54	<0.05	<0.005	0.55	0.55	0.095	<0.02	<0.02	<0.005	80	<10	<10	<10
MB06		3.64	376	-11	0.5	<0.05	<0.005	0.64	0.56	0.160	0.31	<0.02	0.073	20	<10	<10	<10
22 Aug 2023																	
MB01		4.44	507	303	0.79	<0.05	<0.005	1.0	0.97	0.100	0.31	<0.02	0.07	540	<1	<1	<1
MB02		4.53	297	299	0.73	<0.05	0.0058	3.0	1.7	0.008	5.7	<0.02	1.3	1,300	<1	<1	<1
MB03		5.31	390	196	0.77	<0.05	0.0200	2.5	1.7	0.120	3.6	0.021	0.83	320	<1	<1	<1
MB04		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MB05		4.14	292	365	1.41	<0.05	<0.005	0.94	0.53	0.190	1.8	<0.02	0.41	350	<1	<1	<1
MB06		4.06	348	373	0.25	<0.05	<0.005	1.4	0.55	0.160	3.8	0.048	0.87	690	<1	<1	<1
13 Nov 2023																	
MB01		4.13	475	292	0.00	<0.05	<0.005	0.7	0.71	0.058	<0.0050	<0.02	<0.005	580	<1	<1	<1
MB02		4.46	325	57	1.16	<0.050	0.0050	2.7	2.1	0.014	0.56	<0.02	0.56	5,900	<1	<1	<1
MB03		5.21	327	26	0.10	<0.050	<0.0050	1.8	1.8	0.130	<0.050	<0.02	<0.005	20	<1	<1	<1
MB04		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MB05		3.8	329	181	0.06	<0.050	<0.0050	0.8	0.68	0.170	0.13	<0.02	0.13	60	<1	<1	<1
MB06		3.8	313	272	0.02	<0.050	<0.0050	1.5	0.68	0.120	0.83	0.011	0.84	70	<1	<1	<1
28 Feb 2024																	
MB01		4.36	562	110	0.40	0.072	<0.0050	1.2	1.2	0.071	<0.20	<0.20	<0.050	1100	<10	<10	<10
MB02		4.67	381	-59	0.90	<0.050	0.011	3	1.8	0.0083	5.3	<0.20	1.2	70	<10	<10	<10
MB03		5.27	385	-63	0.10	<0.050	<0.0050	2	2.1	0.18	<0.20	<0.20	<0.050	150	<10	<10	<10
MB04		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MB05		3.95	495	100	0.40	<0.050	<0.0050	0.89	0.87	0.21	0.098	<0.020	0.022	110	<10	<10	<10
MB06		3.95	500	64	0	<0.050	<0.0050	0.85	0.85	0.097	<0.020	<0.020	<0.0050	150	<10	<10	<10

Table B
On-Site Groundwater Quality - Dissolved Metals and Metalloids

Definitions:

FWG (Freshwater Guidelines) for slightly - moderately disturbed systems, SRT (Swan River Trust), ADWG (Australian Drinking Water Guidelines) health threshold ([a]) and aesthetic threshold ([b]), LOR (Limit Of Reporting), - (No Guideline), --- (Not Tested),

Notes:

Guideline values have been adopted from the following guidance documentation:

- FWG - Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1 (ANZECC & ARMCANZ 2000)
- SRT - Swan Canning Water Quality Improvement Plan. Swan River Trust (SRT 2009)
- ADWG *Australian Drinking Water Guidelines 6 2011, Version 3.8 Updated September 2022*

All results expressed as mg/L

Bore ID	Event	Trigger	Dissolved Metals and Metalloids										
			Aluminium	Arsenic	Cadmium	Chromium	Iron	Lead	Manganese	Nickel	Selenium	Mercury	Zinc
		Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		FWG	0.055	0.024	0.0002	0.001	0.3	0.0034	1.9	0.011	0.011	0.0006	0.008
		SRT	-	-	-	-	-	-	-	-	-	-	-
		ADWG	0.2[b]	0.01[a]	0.002[a]	0.05[a]	0.3[b]	0.001[a]	0.5[a]/0.1[b]	0.02[a]	0.01[a]	0.001[a]	3[b]
		LOR	0.01	0.001	0.0001	0.001	0.01	0.001	0.001	0.001	0.001	0.00005	0.001
10 Nov 2022													
MB01	Baseline		2.2	<0.0010	<0.00010	0.0047	0.57	0.0045	0.0068	0.0031	<0.0010	<0.000050	0.0054
MB02	Baseline		1.3	<0.0010	<0.00010	0.0035	0.99	0.0024	0.0097	0.0025	<0.0010	<0.000050	0.0034
MB03	Baseline		3.3	0.0011	<0.00010	0.0048	1.30	<0.001	0.0011	0.0051	<0.0010	<0.000050	0.0026
MB04	Baseline		6.2	0.0024	<0.00010	0.0099	0.54	0.0012	0.0045	0.0037	<0.0010	<0.000050	0.0013
MB05	Baseline		9.0	0.0011	<0.00010	0.0054	1.90	0.0028	0.0030	0.0060	<0.0010	<0.000050	0.0020
MB06	Baseline		6.3	0.0019	<0.00010	0.0034	6.60	<0.001	0.0420	0.0110	<0.0010	<0.000050	0.0089
10 May 2023													
MB01	Baseline		1.4	<0.0010	<0.00010	0.0013	0.20	0.0038	0.0031	---	<0.0010	<0.000050	0.0051
MB02	Baseline		---	---	---	---	---	---	---	---	---	---	---
MB03	Baseline		4.8	0.0016	<0.00010	0.0039	0.16	<0.001	0.0018	---	<0.0010	<0.000050	0.0036
MB04	Baseline		---	---	---	---	---	---	---	---	---	---	---
MB05	Baseline		8.6	0.0026	<0.00010	0.0020	4.00	<0.001	0.021	---	<0.0010	<0.000050	0.0018
MB06	Baseline		9.6	0.0014	<0.00010	0.0012	1.90	0.0023	0.0018	---	<0.0010	<0.000050	0.0028

Table C

Off-Site Groundwater Quality - Physicochemistry and Nutrients

Definitions:

FWG (Freshwater Guidelines) for slightly - moderately disturbed systems, SRT (Swan River Trust), ADWG (Australian Drinking Water Guidelines) health threshold (a) and aesthetic threshold (b),
LOR (Limit Of Reporting), - (No Guideline), --- (Not Tested), * (10x the Australian drinking water guidelines limit of reporting, as the samples were processed in the laboratory at a dilution due to high turbidity)

Notes:

Guideline values have been adopted from the following guidance documentation:

- FWG - Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1 (ANZECC & ARMCANZ 2000)
- SRT - Swan Canning Water Quality Improvement Plan. Swan River Trust (SRT 2009)
- ADWG - Australian Drinking Water Guidelines 6 (NHMRC 2011), Version 3.8 Updated September 2022

All results expressed as mg/L except for pH (pH units), EC (µS/cm), Redox (mV), DO (ppm), Heterotrophic Plate Count (cfu/mL) and other microorganism counts (cfu/100mL)

Sample ID	Trigger	Field Parameters				Nutrients						Microorganisms	
		pH	EC	Redox	DO	Total P	FRP	Total N	TKN	NH_3-N	NO_x-N	Faecal Coliforms	E.coli
	Units	pH units	µS/cm	mV	ppm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	cfu/100mL	cfu/100mL
	FWG	7-8.5	500-1500	-	-	0.06	0.03	1.5	-	0.04	0.1	-	-
	SRT	-	-	-	-	0.1	-	1	-	-	-	-	-
	ADWG	6-8.5[b]	-	-	-	-	-	-	-	0.5[b]	-	-	0.0
	LOR	0.01	10	1	0.1	0.01	0.01	0.1	0.1	0.01	0.01	1	1
8 Dec 2015													
MW01		4.00	202	-52	1.28	<0.01	<0.01	4.5	1.2	0.03	3.3	---	---
MW02		4.49	294	62	4.19	0.06	<0.01	3.9	0.6	0.03	3.3	---	---
MW03		4.31	682	-33	0.27	<0.01	<0.01	2.8	1.6	0.36	1.3	---	---
MW04		5.17	654	-165	0.25	1.02	0.89	2.8	2.8	0.85	0.01	---	---
MW05		3.42	222	-105	0.19	<0.01	<0.05	0.9	0.9	0.48	<0.01	---	---
MW06		3.33	1035	-77	0.26	<0.01	<0.01	1.4	1.4	0.72	0.01	---	---
15 Mar 2016													
MW01		5.68	224	-29	0.33	0.01	<0.01	0.7	0.6	0.05	0.06	---	---
MW02		6.28	306	91	4.55	<0.01	<0.01	6.4	0.9	<0.01	5.45	---	---
MW03		6.05	643	100	0.41	<0.01	0.01	10.7	2.3	0.22	8.35	---	---
MW04		6.10	536	-113	0.13	1.02	0.95	3	2.9	0.96	0.05	---	---
MW05		4.69	190	-48	0.14	<0.01	<0.01	0.8	0.8	0.54	<0.01	---	---
MW06		4.57	899	-52	0.82	<0.01	<0.01	1.4	1.4	0.95	<0.01	---	---
14 Jun 2016													
MW01		5.14	277	-34	0.92	0.01	<0.01	1.2	0.8	0.04	0.45	---	---
MW02		5.97	326	58	2.34	0.04	<0.01	2.5	0.7	0.01	1.78	---	---
MW03		5.38	624	-87	0.25	0.05	0.01	2.9	1.7	0.13	1.2	---	---
MW04		5.83	485	-107	0.33	0.77	0.76	5.2	2.7	0.69	2.49	---	---
MW05		4.12	268	-54	0.22	0.01	<0.01	0.9	0.9	0.41	<0.01	---	---
MW06		3.91	816	-1	0.32	0.02	<0.01	1.2	1.2	0.74	0.02	---	---
22 Sep 2016													
MW01		4.56	233	163	2.82	<0.01	<0.01	4.7	1.1	0.05	3.6	---	---
MW02		5.80	284	122	5.09	0.06	<0.01	5.1	1.4	0.05	3.7	---	---
MW03		5.62	755	-2	0.18	<0.01	<0.01	13	2.3	0.08	10.7	---	---
MW04		5.63	470	-140	0.14	1.01	1.06	2.5	2.5	0.68	<0.01	---	---
MW05		3.81	324	-24	0.27	<0.01	<0.01	0.8	0.8	0.29	0.02	---	---
MW06		3.39	1238	95	0.37	<0.01	<0.01	1	1	0.45	<0.01	---	---
8 Dec 2016													
MW01		4.76	206	163	2.07	0.02	<0.01	5.3	1	0.03	4.3	---	---
MW02		5.67	196	147	5.79	0.03	<0.01	3	0.5	0.02	2.5	---	---
MW03		5.28	591	102	0.13	0.02	<0.01	9.2	7.6	0.74	1.6	---	---
MW04		5.85	196	-21.3	0.28	1.19	1.2	2.7	2.7	1.01	<0.01	---	---
MW05		4.22	169	93	0.53	0.01	0.01	1.1	1.1	0.56	<0.01	---	---
MW06		3.95	797	114	0.23	<0.01	<0.01	0.8	0.8	0.46	<0.01	---	---
23 Mar 2017													
MW01		2.97	435	-22	2.57	<0.01	<0.01	1.2	0.5	0.01	0.7	---	---
MW02		5.38	178	-2	6.25	0.02	<0.01	5.1	0.7	<0.01	4.4	---	---
MW03		3.24	710	-49	1.18	0.04	0.02	1.2	1.2	0.16	0.01	---	---
MW04		4.96	366	-87.9	0.88	0.98	0.02	2.3	2.3	0.18	<0.01	---	---
MW05		2.68	237	-38	0.91	0.02	<0.01	0.6	0.6	0.40	<0.01	---	---
MW06		3.25	1630	-14	0.99	0.01	<0.01	1.1	1.1	0.62	<0.01	---	---
27 Jun 2017													
MW01		4.52	202	232	2.00	0.04	<0.01	0.5	0.4	0.07	0.06	---	---
MW02		4.80	252	276	2.15	0.05	<0.01	2.8	0.4	<0.01	2.4	---	---
MW03		4.93	634	180	1.91	0.16	0.03	11.5	1.9	0.08	9.6	---	---
MW04		5.62	260	23.5	0.26	1.2	1	2.5	2.2	0.99	0.27	---	---
MW05		4.31	263	82	0.37	0.02	<0.01	0.7	0.7	0.42	<0.01	---	---
MW06		3.64	1603	137	0.44	0.05	<0.01	1.3	1.3	0.36	<0.01	---	---
14 Sep 2017													
MW01		4.84	208	131	3.03	0.05	<0.01	3.2	1	0.02	2.2	<1	<1
MW02		5.86	267	113	3.88	0.05	<0.01	3.5	0.6	0.04	2.9	23	23
MW03		5.29	860	107	0.98	0.11	0.03	3.5	1.5	0.26	2.0	<1	<1
MW04		5.93	355	31.4	0.74	1.2	0.48	3.4	2.5	0.87	0.88	2	2
MW05		4.29	324	105	0.61	0.01	<0.01	0.8	0.8	0.45	<0.01	<1	<1
MW06		3.67	2550	222	0.92	0.03	<0.01	1.2	1.2	0.14	<0.01	1	1

Figures

Figure A

Site location

GDA 1994 MGA Zone 50

0 25 50 100 m

Job Number: WS7014.002
Doc Number: 001
Date: 16.01.23
Scale: Map 1:4,000 Overview 1:500,000 @ A4
Created by: QS
Source: Cadastre - 2022 Orthophoto - Landgate, 2022

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LEGEND

- 1 m Contour (mAHD) (DWER LiDAR derived)
- Site boundary (16.69 ha)
- Cadastre

Geology (DMIRS, 50K Mapsheets, Jul 2020)

- Mgs1, PEBBLY SILT - strong brown, silt with common fine to occasionally coarse grained, sub-rounded laterite quartz, heavily weathered granite pebbles, some fine to medium-grained quartz sand, of alluvial origin
- S10, SAND - as S8
- S8, SAND - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin

S8
S10
Mgs1
PONTE VECCHIO BVD
TARANTO WY
BELLINI AV
MARSALA WY
ROSSINI CIR
DRUMPELLIER DR
MILANO PDE
TRAPANI L
SIENA L
VERDI L
DANTE L
ST TROPEZ VSTA
MIMOSA L
JENOLAN L
KYEEMA WY
GNANGARA RD
BARRAMBIE WY
Great Northern Hwy
LORD ST
PETRANA PL
ANDREA DR
HENLEY ST WEST
BROOKLANDS DR

Figure B

Topography and surface geology

GDA 1994 MGA Zone 50
0 50 100 200 m

Job Number: WS7014.002
Doc Number: 002
Date: 16.01.23
Scale: 1:5,000 @ A3
Created by: QS
Source: Cadastre - 2022 Orthophoto - Landgate, 2022

Document Path: G:\Jobs\WS_Jobs\WS7014 Henley Brook DWMS\Figures WS7014_002\WS7014_002_G_FigB Topography and surface geology_A3P_230116.mxd

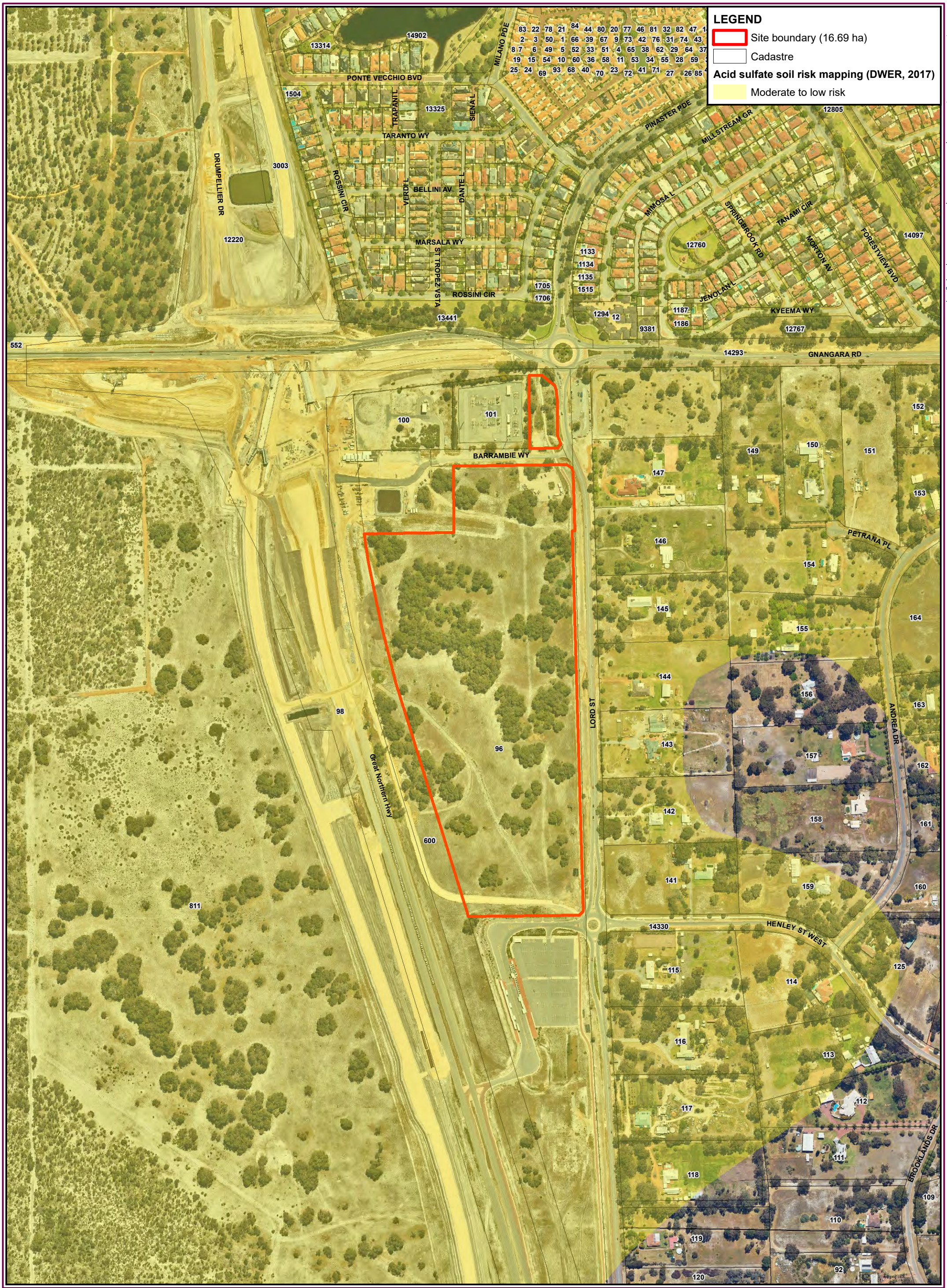

Figure C

Acid sulfate soils risk mapping

GDA 1994 MGA Zone 50

0 50 100 200 m

Job Number: WS7014.002
Doc Number: 003
Date: 16.01.23
Scale: 1:5,000 @ A3
Created by: QS
Source: Cadastre - 2022 Orthophoto - Landgate, 2022

Document Path: G:\Jobs\WS_Jobs\WS7014 Henley Brook DWMS\Figures WS7014_002\WS7014_002_G_FigC Acid Sulfate soils risk mapping _A3P_230116.mxd

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LEGEND

- Drains and watercourses
- Bush forever (DPLH, 2022)
- Site boundary (16.69 ha)
- Cadastre

Geomorphic wetlands - Swan Coastal Plain (DBCA, Oct 2021)

- Multiple Use

Figure D

Bush Forever and geomorphic wetlands

GDA 1994 MGA Zone 50

0 50 100 200 m

Job Number: WS7014.002
Doc Number: 004
Date: 16.01.23
Scale: 1:5,000 @ A3
Created by: QS

Source: Cadastre - 2022 Orthophoto - Landgate, 2022

Document Path: G:\Jobs\WS_Jobs\WS7014 Henley Brook DWMS\Figures WS7014_002\WS7014_002_G_FigD Bush Forever and geomorphic wetlands_A3P_230116.mxd

LEGEND

- Protection zones for public drinking water source areas (DWER, Nov 2021)
- Site boundary (16.69 ha)

Public drinking water source areas (DWER, May 2022)

- Protection Area-P1
- Protection Area-P2
- Protection Area-P3
- Protection Area-P3*

Figure E

Public Drinking Water Source Areas

GDA 1994 MGA Zone 50

0 50 100 200 m

Job Number: WS7014.002
Doc Number: 005
Date: 16.01.25
Scale: 1:5,000 @ A3
Created by: QS

Source: Cadastre - 2022 Orthophoto - Landgate, 2022

Document Path: \\rpsperfs02\Cartography\Jobs\WS_Jobs\WS7014 Henley Brook DWMS\Figures WS7014_002\WS7014_002_G_FigE Public Drinking Water Source Areas and historical minimum groundwater contours_A3P_2301120.mxd

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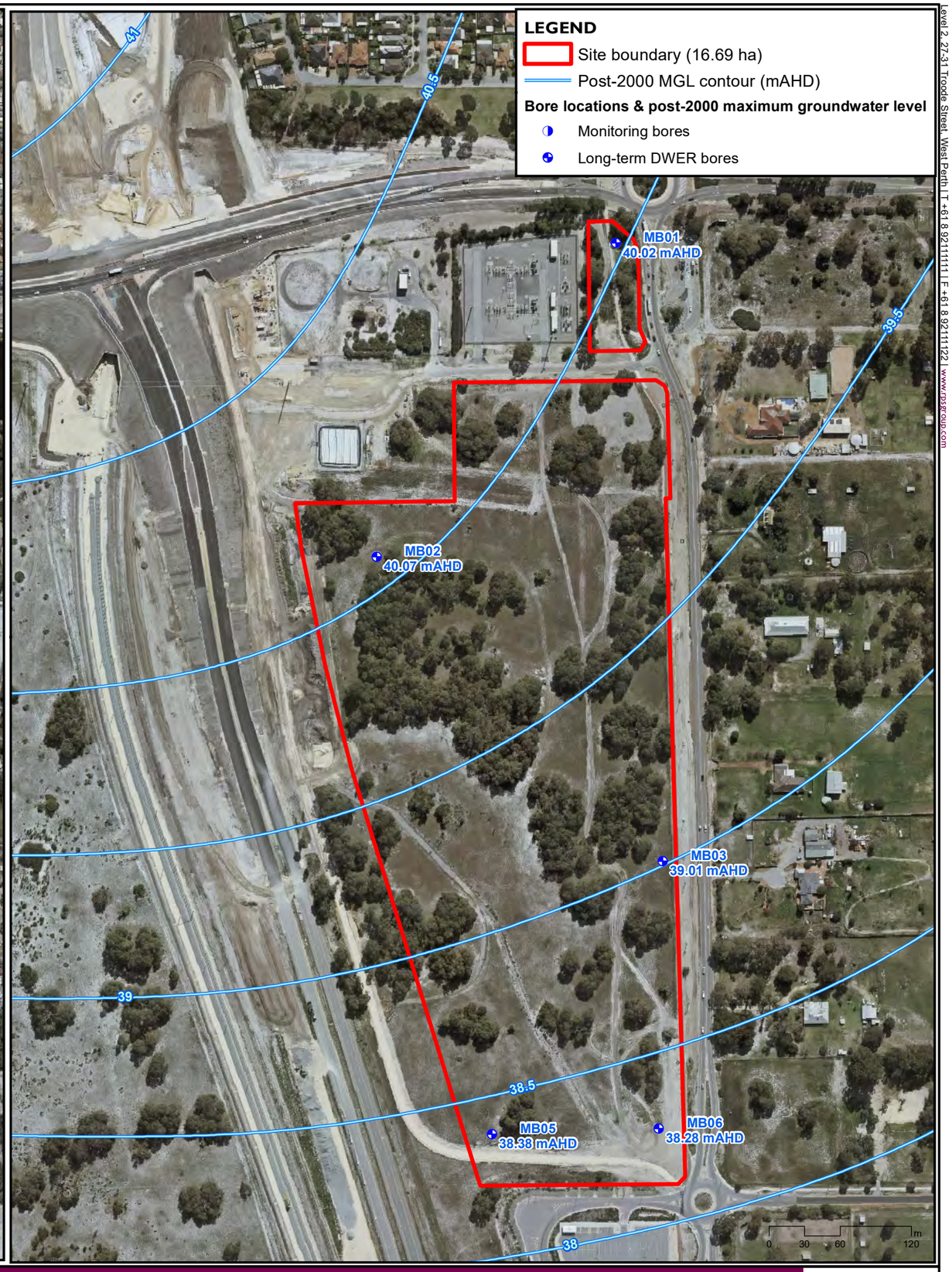

Figure F

Post-2000 maximum groundwater level

GDA 1994 MGA Zone 50

Job Number: AU213007014.003
Date: 13.03.24
Scale: 1:4,000 @ A3
Created by: JS
Source: Orthophoto - Landgate, Aug 2023

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Document Path: G:\Jobs\WS_Jobs\WS7014 Henley Brook DWMS\Figures WS7014_003\WS7014_002_G_FigF Maximum groundwater contours_A3L_240313.mxd

Basin	15 mm			20% AEP			1% AEP		
	Max depth (m)	Area (m^2)	Volume (m^3)	Max depth (m)	Area (m^2)	Volume (m^3)	Max depth (m)	Area (m^2)	Volume (m^3)
A	0.3	273	60	0.7	468	215	Spills into POS		
B1	0.3	177	39	0.7	322	133			
B2	0.3	190	42	0.7	340	142			
POS	-	-	-	-	-	-	0.2	3800	797
C	0.04	747	27	0.2	941	151	0.8	1808	982
Commercial	0.3	102	21	0.6	184	62	1.0	333	161
Neighbourhood Centre	0.2	378	59	0.6	578	240	1.2	1009	743

Figure G

Catchment and drainage plan

GDA 1994 MGA Zone 50

0 25 50 100 m

Job Number: WS7014.003
Doc Number: 007
Date: 14.03.24
Scale: 1:2,500 @ A3
Created by: JS

Source: Cadastre - 2022 Orthophoto - Landgate, Aug 2023

Document Path: G:\Jobs\WS_Jobs\WS7014 Henley Brook DWMS\Figures WS7014_003\WS7014_003_G_FigG Catchment and drainage plan_A3P_240314.mxd

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Appendix A
Local Structure Plan

N

GNANGARA ROAD

FUTURE SEWER PUMP STATION BUFFER
150m

SERVICE COMMERCIAL
4423m²

25.0 BARRAMBIE WAY

LOT 600

WWPS
LOT 96

NEIGHBOURHOOD CENTRE
1.8ha

STARFLOWER ROAD

16.0

14.0

ENTRY

POS / DRAINAGE
1.71ha
(0.91ha trees retained)

LOT 96

16.69ha
[incl commercial]

4m

4.0m ROAD WIDENING ALONG STARFLOWER ROAD TO ACCOMMODATE CONSTRUCTED PATH

ENTRY

POS/DRAINAGE
5138m²

HENLEY DRIVE

LOT 600

LOT 96

LEGEND

- SITE AREA
- NET SITE AREA
- PUBLIC OPEN SPACE / DRAINAGE
- PATHS
- RESIDENTIAL (R20-R40)
- COMMERCIAL

CADASTRAL INFORMATION
SOURCE: VERIS
YYMMDD: TO BE REVIEWED
DWG REF: TO BE REVIEWED
PROJECTION: PCG84
AERIAL PHOTOGRAPHY
SOURCE: NEARMAP
YYMMDD: 220415

HATCH

SIZE A3_1:2500

0 metres 25 50 75 100 125

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
G	REMOVE MRS AMEND 1410	240301	SB	TT
F	R-CODES LEGEND	240219	TG	TT
E	R-CODES	240215	TG	TT

LOCAL STRUCTURE PLAN

PT Lot 96 Starflower Road, Henley Brook

City of Swan

JOB CODE	DRAW NO.	REV.
LWP HBR RD1	**037**	**G**

Appendix B
Groundwater monitoring bore logs

BORE LITHOLOGICAL/CONSTRUCTION LOG

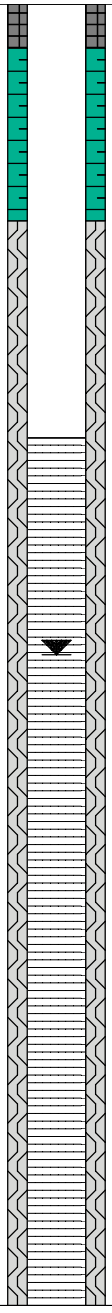
Bore:	**MB01**				
Client:	LWP	**Commenced:**	27/10/202	**Drilling method:**	P.P
Job No.:	AU213007014.001	**Completed:**	27/10/202	**Hole diameter:**	
Project:	Henley Brook	**Drilled by:**	DPP	**Casing diameter:**	50 mm
Area:		**Logged by:**	NM	**Depth to base:**	6.0 mbToC
Projection:	MGA Zone 50	**First water strike:**	3.0 mbgl	**Elevation:**	41.74 mAHD
Easting:	401752.400	**Static water level:**	38.74 mAHD	**Top of casing:**	42.35 mAHD
Northing:	6481700.544	**Date of SWL:**	27/10/202	**Casing stickup:**	0.618 m

Depth	Geology	Log	Lithological description	Hydro field data	Bore construction	
					Bore diagram	Construction notes
0	Sand		Sand: Dark grey, FMG, SA-SR, some organics at the top, dry			0.0 - 0.5 m: Concrete
			Sand: Light grey, FMG, moist			0.5 - 1.5 m: Bentonite Seal
1			Sand: Light brown, FMG, a layer of coffee rock, moist			0.0 - 2.0 m: 50 mm blank PVC
			Sand: Light grey, FMG, moist			1.5 - 6.0 m: Gravel
2			Sand: Orange, FMG, moist			
			Sand: Light grey, FMG, moist			
3			Sand: Brown, FMG, moist, hydrogen sulfide odour			
			Sand: Brown, FMG, wet			2.0 - 6.0 m: 50mm slotted PVC
4						
5			Sand: Pale yellow, FMG, wet			6.0 m: End of hole
6						

BORE LITHOLOGICAL/CONSTRUCTION LOG

Bore:	**MB02**				
Client:	LWP	**Commenced:**	28/10/202	**Drilling method:**	P.P
Job No.:	AU213007014.001	**Completed:**	28/10/202	**Hole diameter:**	
Project:	Henley Brook	**Drilled by:**	DPP	**Casing diameter:**	50 mm
Area:		**Logged by:**	NM	**Depth to base:**	6.0 mbToC
Projection:	MGA Zone 50	**First water strike:**	3.0 mbgl	**Elevation:**	40.68 mAHD
Easting:	401550.731	**Static water level:**	37.68 mAHD	**Top of casing:**	41.39 mAHD
Northing:	6481436.566	**Date of SWL:**	28/10/202	**Casing stickup:**	0.713 m

Depth	Geology	Log	Lithological description	Hydro field data	Bore construction	
					Bore diagram	Construction notes
0	Sand		Sand: Dark grey, FMG, some organics, dry			0.0 - 0.2 m: Concrete 0.2 - 1.0 m: Bentonite Seal
1						1.0 - 6.0 m: Gravel Pack
2			Sand: Dark brown (coffee rock), FMG, dry			0.0 - 2.0 m: 50 mm blank PVC
3			Sand: Brown, FMG, wet, odour			
4						2.0 - 6.0 m: 50mm slotted PVC
5			Sand: Pale brown, FMG, wet, odour,			
6						6.0 m: End of hole



BORE LITHOLOGICAL/CONSTRUCTION LOG

Bore:	**MB03**				
Client:	LWP	**Commenced:**	27/10/23	**Drilling method:**	P.P
Job No.:	AU213007014.001	**Completed:**	27/10/23	**Hole diameter:**	
Project:	Henley Brook	**Drilled by:**	DPP	**Casing diameter:**	50 mm
Area:		**Logged by:**	NM	**Depth to base:**	6.0 mbToC
Projection:	MGA Zone 50	**First water strike:**	3.0 mbgl	**Elevation:**	39.72 mAHD
Easting:	401791.887	**Static water level:**	36.72 mAHD	**Top of casing:**	39.825 mAHD
Northing:	6481179.605	**Date of SWL:**	27/10/23	**Casing stickup:**	0.63 m

Depth	Geology	Log	Lithological description	Hydro field data	Bore construction	
					Bore diagram	Construction notes
0	Sand		Sand: Dark grey, FMG, some organics, dry			0.0 - 0.3 m: Concrete 0.3 - 1.0 m: Bentonite Seal
1			Sand: Light grey, FMG, dry			1.0 - 6.0 m: Gravel Pack 0.0 - 2.0 m: 50 mm blank PVC
2			Sand: Darnk brown, FMG, dry			
3			Sand: Pale orange, FMG, wet			
4						2.0 - 6.0 m: 50mm slotted PVC
5			Sand: Pale brown, FMG, wet			
6						6.0 m: End of hole

BORE LITHOLOGICAL/CONSTRUCTION LOG

Bore:	**MB04**				
Client:	LWP	**Commenced:**	28/10/22	**Drilling method:**	P.P
Job No.:	AU213007014.001	**Completed:**	28/10/22	**Hole diameter:**	
Project:	Henley Brook	**Drilled by:**	DPP	**Casing diameter:**	50 mm
Area:		**Logged by:**	NM	**Depth to base:**	
Projection:		**First water strike:**	3.25 mbgl	**Elevation:**	
Easting:		**Static water level:**		**Top of casing:**	
Northing:		**Date of SWL:**	28/10/22	**Casing stickup:**	0

Depth	Geology	Log	Lithological description	Hydro field data	Bore construction	
					Bore diagram	Construction notes
0	Sand		Sand: Dark grey, FMG, some organics, dry			0.0 - 0.3 m: Concrete 0.3 - 1.0 m: Bentonite Seal
1						1.0 - 6.0 m: Gravel Pack
2			Sand: Dark brown, FMG, moist, some coffee rock			0.0 - 2.0 m: 50 mm blank PVC
3						
4			Sand: Pale brown, FMG, wet, some odour			2.0 - 6.0 m: 50mm slotted PVC
5						
6						6.0 m: End of hole

BORE LITHOLOGICAL/CONSTRUCTION LOG

Bore:	**MB05**				
Client:	LWP	**Commenced:**	27/10/23	**Drilling method:**	P.P
Job No.:	AU213007014.001	**Completed:**	27/10/23	**Hole diameter:**	
Project:	Henley Brook	**Drilled by:**	DPP	**Casing diameter:**	50 mm
Area:		**Logged by:**	NM	**Depth to base:**	6.0 mbToC
Projection:	MGA Zone 50	**First water strike:**	3.0 mbgl	**Elevation:**	39.14 mAHD
Easting:	401648.056	**Static water level:**	36.14 mAHD	**Top of casing:**	39.83 mAHD
Northing:	6480949.647	**Date of SWL:**	27/10/23	**Casing stickup:**	0.69 m

Depth	Geology	Log	Lithological description	Hydro field data	Bore construction	
					Bore diagram	Construction notes
0	Sand		Sand: Dark grey, FMG, some roots, SA-SR, dry			0.0 - 0.3 m: Concrete 0.3 - 1.0 m: Bentonite Seal
1						1.0 - 6.0 m: Gravel Pack
2			Sand: Dark brown, FMG, odour, wet			0.0 - 2.0 m: 50 mm blank PVC
3			Sand: Pale brown, FMG, wet, some orange mottling			
4						2.0 - 6.0 m: 50mm slotted PVC
5						
6						6.0 m: End of hole

BORE LITHOLOGICAL/CONSTRUCTION LOG

Bore:	**MB06**				
Client:	LWP	**Commenced:**	27/10/23	**Drilling method:**	P.P
Job No.:	AU213007014.001	**Completed:**	27/10/23	**Hole diameter:**	
Project:	Henley Brook	**Drilled by:**	DPP	**Casing diameter:**	50 mm
Area:		**Logged by:**	NM	**Depth to base:**	6.0 mbToC
Projection:	MGA Zone 50	**First water strike:**	3.0 mbgl	**Elevation:**	38.95 mAHD
Easting:	401788.559	**Static water level:**	35.95 mAHD	**Top of casing:**	39.68 mAHD
Northing:	6480954.53	**Date of SWL:**	27/10/23	**Casing stickup:**	0.73 m

Depth	Geology	Log	Lithological description	Hydro field data	Bore construction	
					Bore diagram	Construction notes
0	Sand		Sand: Dark grey, FMG, organics (rrots, leaves), dry			0.0 - 0.2 m: Concrete 0.2 - 1.2 m: Bentonite Seal
1			Sand: Light grey, FMG, some roots, dry			
			Sand: Dark brown, FMG, moist, with a layer of coffe rock			1.2 - 6.0 m: Gravel Pack 0.0 - 2.0 m: 50 mm blank PVC
2			Sand: Brown, coffee rock colour, odour			
3						
4						2.0 - 6.0 m: 50mm slotted PVC
5			Sand: Brown, FMG, wet			
6						6.0 m: End of hole

Appendix C
Envirolab Services Certificate of Analysis

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505 fax +61 8 9317 4163
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PDK0713

Client Details

Client	RPS AAP Consulting Pty Ltd
Contact	Kurt Blackman
Address	Level 2, 27-31 Troode St, West Perth, WA, 6005

Sample Details

Your Reference	AU213003894.001
Number of Samples	6 Water
Date Samples Received	11/11/2022
Date Samples Registered	11/11/2022

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	18/11/2022
Date of Issue	18/11/2022

Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Heram Halim, Operations Manager Jessica Miller, Microbiological Supervisor Lien Tang, Assistant Operations Manager Michael Mowle, Inorganics Supervisor Travis Carey, Organics Supervisor
Laboratory Manager	Michael Kubiak

Certificate of Analysis PDK0713

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PDK0713-01	MB01	Water	10/11/2022	11/11/2022
PDK0713-02	MB02	Water	10/11/2022	11/11/2022
PDK0713-03	MB03	Water	10/11/2022	11/11/2022
PDK0713-04	MB04	Water	10/11/2022	11/11/2022
PDK0713-05	MB05	Water	10/11/2022	11/11/2022
PDK0713-06	MB06	Water	10/11/2022	11/11/2022

Certificate of Analysis PDK0713

Volatile TRH and BTEX (Water)

Envirolab ID	Units	PQL	PDK0713-01	PDK0713-02	PDK0713-03	PDK0713-04	PDK0713-05
Your Reference			MB01	MB02	MB03	MB04	MB05
Date Sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022	10/11/2022
TRH C6-C9	µg/L	10	<20 [5]	<10	<20 [5]	<10	<10
TRH C6-C10	µg/L	10	<20 [5]	<10	<20 [5]	<10	<10
TRH C6-C10 less BTEX (F1)	µg/L	10	<20 [5]	<10	<20 [5]	<10	<10
Methyl tert butyl ether (MTBE)	µg/L	1.0	<2.0 [5]	<1.0	<2.0 [5]	<1.0	<1.0
Benzene	µg/L	1.0	<2.0 [5]	<1.0	<2.0 [5]	<1.0	<1.0
Toluene	µg/L	1.0	<2.0 [5]	<1.0	<2.0 [5]	<1.0	<1.0
Ethylbenzene	µg/L	1.0	<2.0 [5]	<1.0	<2.0 [5]	<1.0	<1.0
meta+para Xylene	µg/L	2.0	<4.0 [5]	<2.0	<4.0 [5]	<2.0	<2.0
ortho-Xylene	µg/L	1.0	<2.0 [5]	<1.0	<2.0 [5]	<1.0	<1.0
Total Xylene	µg/L	3.0	<6.0 [5]	<3.0	<6.0 [5]	<3.0	<3.0
Naphthalene (value used in F2 calc)	µg/L	1.0	<2.0 [5]	<1.0	<2.0 [5]	<1.0	<1.0
Surrogate Dibromofluoromethane	%		*85.7*	*84.8*	*91.8*	*86.1*	*88.0*
Surrogate Toluene-D8	%		*101*	*103*	*100*	*99.3*	*100*
Surrogate 4-Bromofluorobenzene	%		*99.6*	*102*	*99.8*	*98.6*	*102*

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
TRH C6-C9	µg/L	10	<10
TRH C6-C10	µg/L	10	<10
TRH C6-C10 less BTEX (F1)	µg/L	10	<10
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0
Benzene	µg/L	1.0	<1.0
Toluene	µg/L	1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0
ortho-Xylene	µg/L	1.0	<1.0
Total Xylene	µg/L	3.0	<3.0
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0
Surrogate Dibromofluoromethane	%		*94.2*
Surrogate Toluene-D8	%		*101*
Surrogate 4-Bromofluorobenzene	%		*98.7*

Semi-volatile TRH (Water)

Envirolab ID	Units	PQL	PDK0713-01	PDK0713-02	PDK0713-03	PDK0713-04	PDK0713-05
Your Reference			MB01	MB02	MB03	MB04	MB05
Date Sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022	10/11/2022
TRH C10-C14	µg/L	50	<50	<50	<50	<50	<50
TRH C15-C28	µg/L	100	<100	<100	<100	<100	<100
TRH C29-C36	µg/L	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	µg/L	50	<50	<50	<50	<50	<50
TRH >C10-C16	µg/L	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	µg/L	50	[NA]	<50	[NA]	<50	<50
TRH >C16-C34 (F3)	µg/L	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	µg/L	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	µg/L	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*88.6*	*88.2*	*86.1*	*94.7*	*88.6*

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
TRH C10-C14	µg/L	50	<50
TRH C15-C28	µg/L	100	<100
TRH C29-C36	µg/L	100	<100
Total +ve TRH C10-C36	µg/L	50	<50
TRH >C10-C16	µg/L	50	<50
TRH >C10-C16 less Naphthalene F2	µg/L	50	<50
TRH >C16-C34 (F3)	µg/L	100	<100
TRH >C34-C40 (F4)	µg/L	100	<100
Total +ve TRH >C10-C40	µg/L	50	<50
Surrogate o-Terphenyl	%		*93.4*

Organochlorine Pesticides (Water)

Envirolab ID	Units	PQL	PDK0713-01	PDK0713-02	PDK0713-03	PDK0713-04	PDK0713-05
Your Reference			MB01	MB02	MB03	MB04	MB05
Date Sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022	10/11/2022
alpha-BHC	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Hexachlorobenzene	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
beta-BHC	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
gamma-BHC	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
delta-BHC	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Heptachlor	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Aldrin	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Heptachlor epoxide	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
trans-Chlordane	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
cis-Chlordane	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan I	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4,4'-DDE	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Dieldrin	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4,4'-DDD	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan II	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin aldehyde	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4,4'-DDT	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan sulfate	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin ketone	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Methoxychlor	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Mirex	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total +ve OCP	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 2-Chlorophenol-D4	%		*60.5*	*63.0*	*64.4*	*68.9*	*66.4*

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
alpha-BHC	µg/L	0.20	<0.20
Hexachlorobenzene	µg/L	0.20	<0.20
beta-BHC	µg/L	0.20	<0.20
gamma-BHC	µg/L	0.20	<0.20
delta-BHC	µg/L	0.20	<0.20
Heptachlor	µg/L	0.20	<0.20
Aldrin	µg/L	0.20	<0.20
Heptachlor epoxide	µg/L	0.20	<0.20
trans-Chlordane	µg/L	0.20	<0.20
cis-Chlordane	µg/L	0.20	<0.20
Endosulfan I	µg/L	0.20	<0.20
4,4'-DDE	µg/L	0.20	<0.20
Dieldrin	µg/L	0.20	<0.20
Endrin	µg/L	0.20	<0.20
4,4'-DDD	µg/L	0.20	<0.20
Endosulfan II	µg/L	0.20	<0.20
Endrin aldehyde	µg/L	0.20	<0.20
4,4'-DDT	µg/L	0.20	<0.20
Endosulfan sulfate	µg/L	0.20	<0.20

Organochlorine Pesticides (Water)

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
Endrin ketone	µg/L	0.20	<0.20
Methoxychlor	µg/L	0.20	<0.20
Mirex	µg/L	0.20	<0.20
Total +ve OCP	µg/L	0.20	<0.20
Surrogate 2-Chlorophenol-D4	%		*70.2*

Organophosphorus Pesticides (Water)

Envirolab ID	Units	PQL	PDK0713-01	PDK0713-02	PDK0713-03	PDK0713-04	PDK0713-05
Your Reference			MB01	MB02	MB03	MB04	MB05
Date Sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022	10/11/2022
Dichlorvos	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Dimethoate	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Diazinon	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chlorpyrifos-methyl	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Ronnel	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fenitrothion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Malathion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chlorpyrifos	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Parathion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Bromophos-ethyl	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Ethion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Coumaphos	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Disulfoton	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fenamiphos	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fenthion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Methidathion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Mevinphos	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Parathion-methyl	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phorate	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phosalone	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Azinphos-methyl	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 2-Chlorophenol-D4	%		*60.5*	*63.0*	*64.4*	*68.9*	*66.4*

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
Dichlorvos	µg/L	0.20	<0.20
Dimethoate	µg/L	0.20	<0.20
Diazinon	µg/L	0.20	<0.20
Chlorpyrifos-methyl	µg/L	0.20	<0.20
Ronnel	µg/L	0.20	<0.20
Fenitrothion	µg/L	0.20	<0.20
Malathion	µg/L	0.20	<0.20
Chlorpyrifos	µg/L	0.20	<0.20
Parathion	µg/L	0.20	<0.20
Bromophos-ethyl	µg/L	0.20	<0.20
Ethion	µg/L	0.20	<0.20
Coumaphos	µg/L	0.20	<0.20
Disulfoton	µg/L	0.20	<0.20
Fenamiphos	µg/L	0.20	<0.20
Fenthion	µg/L	0.20	<0.20
Methidathion	µg/L	0.20	<0.20
Mevinphos	µg/L	0.20	<0.20
Parathion-methyl	µg/L	0.20	<0.20
Phorate	µg/L	0.20	<0.20
Phosalone	µg/L	0.20	<0.20
Azinphos-methyl	µg/L	0.20	<0.20

Organophosphorus Pesticides (Water)

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
Surrogate 2-Chlorophenol-D4	%		*70.2*

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Acid Extractable Metals (Water)

Envirolab ID	Units	PQL	PDK0713-01	PDK0713-02	PDK0713-03	PDK0713-04	PDK0713-05
Your Reference			MB01	MB02	MB03	MB04	MB05
Date Sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022	10/11/2022
Phosphorus	mg/L	0.050	0.057	<0.050	<0.050	<0.050	<0.050

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
Phosphorus	mg/L	0.050	<0.050

Dissolved Low Level Metals (Water)

Envirolab ID	Units	PQL	PDK0713-01	PDK0713-02	PDK0713-03	PDK0713-04	PDK0713-05
Your Reference			MB01	MB02	MB03	MB04	MB05
Date Sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022	10/11/2022
Aluminium	µg/L	10	2200	1300	3300	6200	9000
Arsenic	µg/L	1.0	<1.0	<1.0	1.1	2.4	1.1
Cadmium	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chromium	µg/L	1.0	4.7	3.5	4.8	9.9	5.4
Copper	µg/L	1.0	8.5	2.7	<1.0	3.6	1.9
Iron	µg/L	10	570	990	1300	540	1900
Mercury	µg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese	µg/L	1.0	6.8	9.7	11	4.5	3.0
Nickel	µg/L	1.0	3.1	2.5	5.1	3.7	6.0
Lead	µg/L	1.0	4.5	2.4	<1.0	1.2	2.8
Selenium	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	µg/L	1.0	5.4	3.4	2.6	1.3	2.0

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
Aluminium	µg/L	10	6300
Arsenic	µg/L	1.0	1.9
Cadmium	µg/L	0.10	<0.10
Chromium	µg/L	1.0	3.4
Copper	µg/L	1.0	<1.0
Iron	µg/L	10	6600
Mercury	µg/L	0.050	<0.050
Manganese	µg/L	1.0	42
Nickel	µg/L	1.0	11
Lead	µg/L	1.0	<1.0
Selenium	µg/L	1.0	<1.0
Zinc	µg/L	1.0	8.9

Certificate of Analysis PDK0713

Inorganics (Water)

Envirolab ID	Units	PQL	PDK0713-01	PDK0713-02	PDK0713-03	PDK0713-04	PDK0713-05
Your Reference			MB01	MB02	MB03	MB04	MB05
Date Sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022	10/11/2022
Ammonia as N	mg/L	0.0050	0.054	0.0052	0.12	0.40	0.13
Nitrate as N	mg/L	0.0050	0.40	2.0	0.54	1.4	1.2
Nitrite as N	mg/L	0.0050	<0.0050	0.0068	<0.0050	<0.0050	<0.0050
Total Nitrogen	mg/L	0.10	1.5	3.2	1.9	2.8	2.0
NOx as N	mg/L	0.0050	0.40	2.0	0.54	1.4	1.2
Phosphate as P	mg/L	0.0050	0.0089	0.0062	<0.0050	<0.0050	<0.0050
Organic Nitrogen by calc.	mg/L	0.10	1.0	1.2	1.3	0.98	0.68
TKN as N by calculation	mg/L	0.10	1.1	1.2	1.4	1.4	0.80
Nitrate as NO3 by calculation	mg/L	0.020	1.8	8.7	2.4	6.4	5.4
Nitrite as NO2 by calculation	mg/L	0.020	<0.020	0.022	<0.020	<0.020	<0.020

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
Ammonia as N	mg/L	0.0050	0.17
Nitrate as N	mg/L	0.0050	<0.0050
Nitrite as N	mg/L	0.0050	<0.0050
Total Nitrogen	mg/L	0.10	1.1
NOx as N	mg/L	0.0050	<0.0050
Phosphate as P	mg/L	0.0050	<0.0050
Organic Nitrogen by calc.	mg/L	0.10	0.92
TKN as N by calculation	mg/L	0.10	1.1
Nitrate as NO3 by calculation	mg/L	0.020	<0.020
Nitrite as NO2 by calculation	mg/L	0.020	<0.020

Heterotrophic Plate Count (Water)

Envirolab ID	Units	PQL	PDK0713-01	PDK0713-02	PDK0713-03	PDK0713-04	PDK0713-05
Your Reference			MB01	MB02	MB03	MB04	MB05
Date Sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022	10/11/2022
Heterotrophic Plate Count 35C	cfu/mL	10	310	4900 [1]	70	370	250

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
Heterotrophic Plate Count 35C	cfu/mL	10	590

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Microbiological Suite (Water)

Envirolab ID	Units	PQL	PDK0713-01	PDK0713-02	PDK0713-03	PDK0713-04	PDK0713-05
Your Reference			MB01	MB02	MB03	MB04	MB05
Date Sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022	10/11/2022
Thermotolerant Coliforms	cfu/100mL	1	<10	10	<10	<10	<10
Faecal Enterococci	cfu/100mL	1	<10	<10	<10	<10	<10
E.coli	cfu/100mL	1	<10	<10	<10	<10	<10

Envirolab ID	Units	PQL	PDK0713-06
Your Reference			MB06
Date Sampled			10/11/2022
Thermotolerant Coliforms	cfu/100mL	1	<10
Faecal Enterococci	cfu/100mL	1	<10
E.coli	cfu/100mL	1	<10

Result Comments

Identifier	Description
[1]	Heterotrophic plate count is an estimate.
[5]	PQL(s) has/have been raised as the sample(s) was/were foamy and therefore required dilution.

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-020	Determination of various metals by ICP-OES.
METALS-021	Determination of Mercury by Cold Vapour AAS.
METALS-022	Determination of various metals by ICP-MS.
MICRO-001B	E. coli/Thermotolerant coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.5-latest edition). Recommended maximums based on NHMRC Australian Drinking Water Guidelines. Please note that results for this test derived from counts outside of the range 10-100 are considered approximate as per AS4276.1.
MICRO-001D	Faecal Enterococci: Microbial Water Analysis - in accordance with MICRO-001 (ISO 7899-2:latest edition). Please note that results for this test derived from counts outside of the range 10-100 are considered approximate as per AS4276.1.
MICRO-001E	Heterotrophic Plate Count: Microbial Water Analysis - in accordance with MICRO-001 (APHA-9215D-latest edition). Recommended maximums based on NHMRC and ARMC Australian Drinking Water Guidelines.
ORG-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
ORG-022	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and soils using DCM/Acetone/Methanol.
ORG-023_F1_TOT	Determination of volatile organic compounds (VOCs) by P&T-GC-MS. Water samples are analysed directly by purge and trap GC-MS. Solids are extracted with Methanol, diluted and analysed by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PDK0713

Client Details

Client	RPS AAP Consulting Pty Ltd
Your Reference	AU213003894.001
Date Issued	18/11/2022

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	No	Duplicate Outliers Exist - See detailed list below
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	No	QC Frequency Outliers Exist - See detailed list below

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PDK0713

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
vTRH&MBTEXN | Water	1-6	10/11/2022	14/11/2022	15/11/2022	Yes
sTRH | Water	1-3	10/11/2022	14/11/2022	15/11/2022	Yes
	4-6	10/11/2022	14/11/2022	16/11/2022	Yes
OCP | Water	1-6	10/11/2022	14/11/2022	15/11/2022	Yes
OPP (21 list) | Water	1-6	10/11/2022	14/11/2022	15/11/2022	Yes
Total Phosphorus | Water	1-6	10/11/2022	14/11/2022	16/11/2022	Yes
Dissolved Metals (LL) | Water	1-6	10/11/2022	15/11/2022	15/11/2022	Yes
Dissolved Metals (LL)-Hg | Water	1-6	10/11/2022	15/11/2022	16/11/2022	Yes
Nitrogen - Ammonia | Water	1-6	10/11/2022	15/11/2022	15/11/2022	Yes
Nitrogen - Nitrate | Water	1-6	10/11/2022	15/11/2022	15/11/2022	Yes
Nitrogen - Nitrite | Water	1-6	10/11/2022	15/11/2022	15/11/2022	No
Nitrogen - NOx | Water	1-6	10/11/2022	15/11/2022	15/11/2022	Yes
Nitrogen - Total N | Water	1-6	10/11/2022	14/11/2022	15/11/2022	No
Phosphate as P | Water	1-6	10/11/2022	15/11/2022	15/11/2022	No
TKN as N calc | Water	1-6	10/11/2022	16/11/2022	16/11/2022	Yes
HPC-35C | Water	1-6	10/11/2022	11/11/2022	11/11/2022	Yes
E. coli & T.T.coli | Water	1-6	10/11/2022	11/11/2022	11/11/2022	Yes
Faecal Enterococci | Water	1-6	10/11/2022	11/11/2022	11/11/2022	Yes

Outliers: Duplicates

| ()| Batch

Sample ID	Duplicate ID	Analyte	% Limits	RPD

Data Quality Assessment Summary PDK0713

Outliers: Matrix Spike

INORG-055|Inorganics (Water)| Batch BDK1696

Sample ID	Analyte	% Limits	% Recovery
BDK1696-MS1#	Nitrate as N	70 - 130	##[2]
BDK1696-MS1#	NOx as N	70 - 130	##[2]

METALS-022|Dissolved Low Level Metals (Water)| Batch BDK1658

Sample ID	Analyte	% Limits	% Recovery
BDK1658-MS1#	Arsenic	70 - 130	##[3]
BDK1658-MS1#	Copper	70 - 130	##[2]
BDK1658-MS1#	Iron	70 - 130	##[2]
BDK1658-MS1#	Manganese	70 - 130	##[3]
BDK1658-MS1#	Nickel	70 - 130	##[2]
BDK1658-MS1#	Selenium	70 - 130	##[3]

ORG-022|Organochlorine Pesticides (Water)| Batch BDK1534

Sample ID	Analyte	% Limits	% Recovery
BDK1534-MS2#	2-Chlorophenol-D4	60 - 140	##[4]
BDK1534-MS2#	Aldrin	60 - 140	47.2[3]

ORG-022|Organophosphorus Pesticides (Water)| Batch BDK1534

Sample ID	Analyte	% Limits	% Recovery
BDK1534-MS2#	2-Chlorophenol-D4	60 - 140	##[4]
BDK1534-MS2#	Ethion	60 - 140	43.5[3]

Outliers: QC Frequency

ORG-023_F1_TOT|Volatile TRH and BTEX (Water)| Batch BDK1519

Analysis	QC Type	Expected	Reported
vTRH&MBTEXN	Duplicate	2	0
	Matrix Spike	1	0

Quality Control PDK0713

ORG-023_F1_TOT|Volatile TRH and BTEX (Water) | Batch BDK1519

Analyte	Units	PQL	Blank	LCS %
TRH C6-C9	µg/L	10	<10	88.7
TRH C6-C10	µg/L	10	<10	90.3
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	[NA]
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	[NA]
Benzene	µg/L	1.0	<1.0	87.9
Toluene	µg/L	1.0	<1.0	83.2
Ethylbenzene	µg/L	1.0	<1.0	83.6
meta+para Xylene	µg/L	2.0	<2.0	83.3
ortho-Xylene	µg/L	1.0	<1.0	85.1
Total Xylene	µg/L	3.0	<3.0	[NA]
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	[NA]
Surrogate Dibromofluoromethane	*%*		*94.4*	*99.6*
Surrogate Toluene-D8	*%*		*99.9*	*101*
Surrogate 4-Bromofluorobenzene	*%*		*98.3*	*101*

ORG-020|Semi-volatile TRH (Water) | Batch BDK1534

Analyte	Units	PQL	Blank	DUP1 BDK1534-DUP1# Samp | QC | RPD %	DUP2 BDK1534-DUP2# Samp | QC | RPD %	LCS %	Spike % BDK1534-MS1#
TRH C10-C14	µg/L	50	<50	153 | 110 | 32.5	538 | 627 | 15.2	[NA]	[NA]
TRH C15-C28	µg/L	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	[NA]	[NA]
TRH C29-C36	µg/L	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	[NA]	[NA]
TRH >C10-C16	µg/L	50	<50	153 | 111 | 32.5	500 | 579 | 14.7	[NA]	[NA]
TRH >C16-C34 (F3)	µg/L	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	[NA]	[NA]
TRH >C34-C40 (F4)	µg/L	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	[NA]	[NA]
Total TRH C10-C36	µg/L	250		<250 | <250 | [NA]	538 | 627 | 15.2	70.8	91.6
Total TRH >C10-C40	µg/L	250		<250 | <250 | [NA]	500 | 579 | 14.7	70.4	90.9
Surrogate o-Terphenyl	*%*		*86.6*	*85.2 | 81.4*	*75.8 | 82.6*	*79.7*	*104*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PDK0713

ORG-022|Organochlorine Pesticides (Water) | Batch BDK1534

Analyte	Units	PQL	Blank	DUP1 BDK1534-DUP1# Samp | QC | RPD %	DUP2 BDK1534-DUP2# Samp | QC | RPD %	LCS %	Spike % BDK1534-MS2#
alpha-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	90.0	84.2
Hexachlorobenzene	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
beta-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	89.8	84.5
gamma-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
delta-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Heptachlor	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	86.6	79.3
Aldrin	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	86.7	47.2[3]
Heptachlor epoxide	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	87.1	78.0
trans-Chlordane	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
cis-Chlordane	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Endosulfan I	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
4,4'-DDE	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	81.6	64.4
Dieldrin	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	87.3	77.7
Endrin	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	87.0	74.9
4,4'-DDD	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	98.1	82.2
Endosulfan II	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Endrin aldehyde	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
4,4'-DDT	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Endosulfan sulfate	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	94.4	81.7
Endrin ketone	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Methoxychlor	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Mirex	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Surrogate 2-Chlorophenol-D4	*%*		*66.6*	*##* | *##[NA] [4]*	*##* | *##[NA] [4]*	*60.1*	*##[4]*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-022|Organophosphorus Pesticides (Water) | Batch BDK1534

Analyte	Units	PQL	Blank	DUP1 BDK1534-DUP1# Samp | QC | RPD %	DUP2 BDK1534-DUP2# Samp | QC | RPD %	LCS %	Spike % BDK1534-MS2#
Dichlorvos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	101	93.8
Dimethoate	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Diazinon	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Chlorpyrifos-methyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	83.8	70.6
Ronnel	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	82.5	66.8
Fenitrothion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	90.4	75.5
Malathion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	75.6	63.2
Chlorpyrifos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	86.9	63.5
Parathion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	102	81.5
Bromophos-ethyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Ethion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	95.3	43.5[3]
Coumaphos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Disulfoton	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Fenamiphos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Fenthion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Methidathion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Mevinphos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Parathion-methyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Phorate	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Phosalone	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Azinphos-methyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Surrogate 2-Chlorophenol-D4	*%*		*66.6*	*##* | *##[NA] [4]*	*##* | *##[NA] [4]*	*60.1*	*##[4]*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PDK0713

METALS-020|Acid Extractable Metals (Water) | Batch BDK1569

Analyte	Units	PQL	Blank	DUP1 BDK1569-DUP1# Samp | QC | RPD %	DUP2 BDK1569-DUP2# Samp | QC | RPD %	LCS %	Spike % BDK1569-MS1#
Phosphorus	mg/L	0.050	<0.050	0.104 | 0.0920 | 12.5	<0.050 | <0.050 | [NA]	106	103

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-022|Dissolved Low Level Metals (Water) | Batch BDK1658

Analyte	Units	PQL	Blank	DUP1 BDK1658-DUP1# Samp | QC | RPD %	DUP2 PDK0713-01 Samp | QC | RPD %	LCS %	Spike % BDK1658-MS1#
Aluminium	µg/L	10	<10	<10 | <10 | [NA]	2230 | 2290 | 2.55	106	121
Arsenic	µg/L	1.0	<1.0	25.1 | 24.8 | 1.12	<1.0 | <1.0 | [NA]	100	##[3]
Cadmium	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	97.3	101
Chromium	µg/L	1.0	<1.0	5.09 | 5.24 | 2.90	4.70 | 4.80 | 2.19	105	119
Copper	µg/L	1.0	<1.0	6980 | 7140 | 2.19	8.54 | 8.68 | 1.54	103	##[2]
Iron	µg/L	10	<10	372 | 363 | 2.42	573 | 572 | 0.0709	106	##[2]
Lead	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	4.48 | 4.50 | 0.646	100	96.3
Manganese	µg/L	1.0	<1.0	83.7 | 85.7 | 2.37	6.77 | 7.01 | 3.37	101	##[3]
Nickel	µg/L	1.0	<1.0	8470 | 8690 | 2.59	3.09 | 3.18 | 2.87	102	##[2]
Selenium	µg/L	1.0	<1.0	29.6 | 29.2 | 1.12	<1.0 | <1.0 | [NA]	105	##[3]
Zinc	µg/L	1.0	<1.0	1.27 | 1.20 | 5.67	5.43 | 5.49 | 1.12	102	106

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-021|Dissolved Low Level Metals (Water) | Batch BDK1664

Analyte	Units	PQL	Blank	DUP1 BDK1664-DUP1# Samp | QC | RPD %	DUP2 PDK0713-04 Samp | QC | RPD %	LCS %	Spike % BDK1664-MS1#
Mercury	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	<0.050 | <0.050 | [NA]	95.6	94.8

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127|Inorganics (Water) | Batch BDK1460

Analyte	Units	PQL	Blank	DUP1 BDK1460-DUP1# Samp | QC | RPD %	DUP2 BDK1460-DUP2# Samp | QC | RPD %	LCS %	Spike % BDK1460-MS1#
Total Nitrogen	mg/L	0.10	<0.10	2.92 | 3.07 | 4.70	2.69 | 2.71 | 0.742	115	99.0

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-057|Inorganics (Water) | Batch BDK1696

Analyte	Units	PQL	Blank	DUP1 BDK1696-DUP1# Samp | QC | RPD %	DUP2 BDK1696-DUP2# Samp | QC | RPD %	LCS %	Spike % BDK1696-MS1#
Ammonia as N	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	0.182 | 0.188 | 3.27	115	94.7
Nitrate as N	mg/L	0.0050	<0.0050	5.74 | 5.79 | 0.886		118	##[2]
Nitrite as N	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]		101	101
NOx as N	mg/L	0.0050	<0.0050	5.75 | 5.80 | 0.885		118	##[2]
Phosphate as P	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	0.0164 | 0.0164 | 0.579	120	117
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PDK0713

MICRO-001E|Heterotrophic Plate Count (Water) | Batch BDK1378

Analyte	Units	PQL	Blank	DUP1 BDK1378-DUP1# Samp | QC | RPD %	DUP2 BDK1378-DUP2# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 35C	cfu/mL	10	<10	1470 | 1520 | 3.34 [1]	100 | 130 | 26.1	[NA]

Analyte	Units	PQL	Blank	DUP3 BDK1378-DUP3# Samp | QC | RPD %	DUP4 BDK1378-DUP4# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 35C	cfu/mL	10		<10 | <10 | [NA]	<10 | <10 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP5 BDK1378-DUP5# Samp | QC | RPD %	DUP6 BDK1378-DUP6# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 35C	cfu/mL	10		<10 | 10.0 | [NA]	<1.00 | <10 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001B|Microbiological Suite (Water) | Batch BDK1376

Analyte	Units	PQL	Blank	DUP1 BDK1376-DUP1# Samp | QC | RPD %	DUP2 BDK1376-DUP2# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP3 BDK1376-DUP3# Samp | QC | RPD %	DUP4 BDK1376-DUP4# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP5 BDK1376-DUP5# Samp | QC | RPD %	DUP6 BDK1376-DUP6# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001D|Microbiological Suite (Water) | Batch BDK1377

Analyte	Units	PQL	Blank	DUP1 BDK1377-DUP1# Samp | QC | RPD %	LCS %
Faecal Enterococci	cfu/100mL	1	<1	<1 | <1 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

QC Comments

Identifier	Description
[1]	Heterotrophic plate count is an estimate.
[2]	Spike recovery is not applicable due to the relatively high analyte background in the sample (>3* spike level). However, the LCS recovery is within acceptance criteria.
[3]	Spike recovery is outside routine acceptance criteria (60-140%), this may be due to suspected non-homogeneity and/or matrix interference effects. However, an acceptable recovery was achieved for the LCS.
[4]	Surrogate recovery was outside routine acceptance criteria (60-140%) due to sample matrix effects. This may be due to the presence of carbon and/or other artefacts. An acceptable recovery was achieved for the LCS surrogates.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505 fax +61 8 9317 4163
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PEC1706

Client Details

Client	RPS AAP Consulting Pty Ltd
Contact	Mohamed Fairooz
Address	Level 2, 27-31 Troode St, West Perth, WA, 6005

Sample Details

Your Reference	AU213007014.001 Henley Brook
Number of Samples	4 Groundwater
Date Samples Received	23/03/2023
Date Samples Registered	23/03/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	03/04/2023
Date of Issue	06/04/2023

Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Heram Halim, Operations Manager Jessica Miller, Microbiological Supervisor
Laboratory Manager	Michael Kubiak

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PEC1706-01	MB01	Groundwater	23/03/2023	23/03/2023
PEC1706-02	MB03	Groundwater	23/03/2023	23/03/2023
PEC1706-03	MB05	Groundwater	23/03/2023	23/03/2023
PEC1706-04	MB06	Groundwater	23/03/2023	23/03/2023

Certificate of Analysis PEC1706

Acid Extractable Metals (Groundwater)

Envirolab ID	Units	PQL	PEC1706-01	PEC1706-02	PEC1706-03	PEC1706-04
Your Reference			MB01	MB03	MB05	MB06
Date Sampled			23/03/2023	23/03/2023	23/03/2023	23/03/2023
Phosphorus	mg/L	0.050	1.6	<0.050	0.12	<0.050

Certificate of Analysis PEC1706

Inorganics - Nutrients (Groundwater)

Envirolab ID	Units	PQL	PEC1706-01	PEC1706-02	PEC1706-03	PEC1706-04
Your Reference			MB01	MB03	MB05	MB06
Date Sampled			23/03/2023	23/03/2023	23/03/2023	23/03/2023
Ammonia as N	mg/L	0.0050	0.13 [2]	0.096 [2]	0.24	0.13
Nitrate as N	mg/L	0.0050	<0.050 [2]	<0.050 [2]	0.27	0.011
Nitrate as NO3 by calculation	mg/L	0.020	<0.20 [2]	<0.20 [2]	1.2	0.049
Nitrite as N	mg/L	0.0050	<0.050 [2]	<0.050 [2]	<0.0050	<0.0050
Nitrite as NO2 by calculation	mg/L	0.020	<0.20 [2]	<0.20 [2]	<0.020	<0.020
NOx as N	mg/L	0.0050	<0.050 [2]	<0.050 [2]	0.27	0.012
TKN as N by calculation	mg/L	0.10	3.0	2.4	1.5	1.4
Organic Nitrogen by calc.	mg/L	0.10	2.8	2.3	1.3	1.3
Total Nitrogen	mg/L	0.10	3.0	2.4	1.8	1.4
Phosphate as P	mg/L	0.0050	<0.050 [2]	<0.050 [2]	<0.0050	<0.0050

Certificate of Analysis PEC1706

Microbiological Suite (Groundwater)

Envirolab ID	Units	PQL	PEC1706-01	PEC1706-02	PEC1706-03	PEC1706-04
Your Reference			MB01	MB03	MB05	MB06
Date Sampled			23/03/2023	23/03/2023	23/03/2023	23/03/2023
Thermotolerant Coliforms	cfu/100mL	1	<10 [1]	<10 [1]	<10 [1]	<10 [1]
E.coli	cfu/100mL	1	<10 [1]	<10 [1]	<10 [1]	<10 [1]

Result Comments

Identifier	Description
[1]	Microbiological testing PQL raised due to high sample turbidity and/or matrix interference.
[2]	Matrix interference - sample was highly coloured.

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-020	Determination of various metals by ICP-OES.
MICRO-001B	E. coli/Thermotolerant coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.5-latest edition). Recommended maximums based on NHMRC Australian Drinking Water Guidelines. Please note that results for this test derived from counts outside of the range 10-100 are considered approximate as per AS4276.1.

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PEC1706

Client Details

Client	RPS AAP Consulting Pty Ltd
Your Reference	AU213007014.001 Henley Brook
Date Issued	06/04/2023

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	Yes	No Outliers
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PEC1706

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
Total Phosphorus | Water	1-4	23/03/2023	24/03/2023	29/03/2023	Yes
Nitrogen - Ammonia | Water	1-4	23/03/2023	28/03/2023	29/03/2023	Yes
Nitrogen - Nitrate | Water	1-4	23/03/2023	28/03/2023	29/03/2023	Yes
Nitrogen - Nitrite | Water	1-4	23/03/2023	28/03/2023	29/03/2023	No
Nitrogen - NOx | Water	1-4	23/03/2023	28/03/2023	29/03/2023	Yes
Nitrogen - Total N | Water	1-4	23/03/2023	30/03/2023	06/04/2023	Yes
Phosphate as P | Water	1-4	23/03/2023	28/03/2023	29/03/2023	No
TKN as N calc | Water	1-4	23/03/2023	29/03/2023	06/04/2023	Yes
E. coli & T.T.coli | Water	1-4	23/03/2023	23/03/2023	23/03/2023	Yes

Quality Control PEC1706

METALS-020|Acid Extractable Metals (Water) | Batch BEC2690

Analyte	Units	PQL	Blank	DUP1 BEC2690-DUP1# Samp | QC | RPD %	DUP2 PEC1706-03 Samp | QC | RPD %	LCS %	Spike % BEC2690-MS1#
Phosphorus	mg/L	0.050	<0.050	16.6 | 16.3 | 1.47	0.116 | 0.107 | 7.77	98.7	91.2

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-057|Inorganics - Nutrients (Water) | Batch BEC3050

Analyte	Units	PQL	Blank	DUP1 PEC1706-03 Samp | QC | RPD %	DUP2 BEC3050-DUP2# Samp | QC | RPD %	LCS %	Spike % PEC1706-04
Ammonia as N	mg/L	0.0050	<0.0050	0.236 | 0.243 | 2.57	<0.0050 | <0.0050 | [NA]	104	106
Nitrate as N	mg/L	0.0050	<0.0050	0.272 | 0.261 | 4.25	<0.0050 | <0.0050 | [NA]	118	110
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as N	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	112	114
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
NOx as N	mg/L	0.0050	<0.0050	0.274 | 0.262 | 4.25	<0.0050 | <0.0050 | [NA]	118	110
Phosphate as P	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	114	114

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127|Inorganics - Nutrients (Water) | Batch BEC3285

Analyte	Units	PQL	Blank	DUP1 BEC3285-DUP1# Samp | QC | RPD %	DUP2 BEC3285-DUP2# Samp | QC | RPD %	LCS %	Spike % BEC3285-MS1#
Total Nitrogen	mg/L	0.10	<0.10	0.513 | 0.522 | 1.90	25.1 | 25.7 | 2.31	103	100

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001B|Microbiological Suite (Water) | Batch BEC2592

Analyte	Units	PQL	Blank	DUP1 BEC2592-DUP1# Samp | QC | RPD %	DUP2 BEC2592-DUP2# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP3 BEC2592-DUP3# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505 fax +61 8 9317 4163
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PEE0782

Client Details

Client	RPS AAP Consulting Pty Ltd
Contact	Mohamed Fairooz
Address	Level 2, 27-31 Troode St, West Perth, WA, 6005

Sample Details

Your Reference	AU213007014.001 - Henley Brook
Number of Samples	5 Water
Date Samples Received	11/05/2023
Date Samples Registered	10/05/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	18/05/2023
Date of Issue	18/05/2023

Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Heram Halim, Operations Manager Jessica Miller, Microbiological Supervisor Michael Hall, Inorganics & Metals Supervisor Michael Mowle, Inorganics Supervisor Travis Carey, Organics Supervisor
Laboratory Manager	Michael Kubiak

Certificate of Analysis PEE0782

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PEE0782-01	MB01	Water	10/05/2023	11/05/2023
PEE0782-02	MB03	Water	10/05/2023	11/05/2023
PEE0782-03	MB05	Water	10/05/2023	11/05/2023
PEE0782-04	MB06	Water	10/05/2023	11/05/2023
PEE0782-05	MB-ZZ	Water	10/05/2023	11/05/2023

Volatile TRH and BTEX (Water)

Envirolab ID	Units	PQL	PEE0782-01	PEE0782-02	PEE0782-03	PEE0782-04	PEE0782-05
Your Reference			MB01	MB03	MB05	MB06	MB-ZZ
Date Sampled			10/05/2023	10/05/2023	10/05/2023	10/05/2023	10/05/2023
TRH C6-C9	µg/L	10	<10	<50 [5]	<10	<10	<50 [5]
TRH C6-C10	µg/L	10	<10	<50 [5]	<10	<10	<50 [5]
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	<50 [5]	<10	<10	<50 [5]
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	<5.0 [5]	<1.0	<1.0	<5.0 [5]
Benzene	µg/L	1.0	<1.0	<5.0 [5]	<1.0	<1.0	<5.0 [5]
Toluene	µg/L	1.0	<1.0	<5.0 [5]	<1.0	<1.0	<5.0 [5]
Ethylbenzene	µg/L	1.0	<1.0	<5.0 [5]	<1.0	<1.0	<5.0 [5]
meta+para Xylene	µg/L	2.0	<2.0	<10 [5]	<2.0	<2.0	<10 [5]
ortho-Xylene	µg/L	1.0	<1.0	<5.0 [5]	<1.0	<1.0	<5.0 [5]
Total Xylene	µg/L	3.0	<3.0	<15 [5]	<3.0	<3.0	<15 [5]
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	<5.0 [5]	<1.0	<1.0	<5.0 [5]
Surrogate Dibromofluoromethane	%		*104*	*106*	*105*	*108*	*107*
Surrogate Toluene-D8	%		*101*	*104*	*104*	*102*	*99.9*
Surrogate 4-Bromofluorobenzene	%		*93.9*	*96.7*	*95.8*	*95.0*	*91.8*

Semi-volatile TRH (Water)

Envirolab ID	Units	PQL	PEE0782-01	PEE0782-02	PEE0782-03	PEE0782-04	PEE0782-05
Your Reference			MB01	MB03	MB05	MB06	MB-ZZ
Date Sampled			10/05/2023	10/05/2023	10/05/2023	10/05/2023	10/05/2023
TRH C10-C14	µg/L	50	<50	<50	<50	<50	<50
TRH C15-C28	µg/L	100	<100	<100	<100	<100	<100
TRH C29-C36	µg/L	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	µg/L	50	<50	<50	<50	<50	<50
TRH >C10-C16	µg/L	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	µg/L	50	<50	<50	<50	<50	<50
TRH >C16-C34 (F3)	µg/L	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	µg/L	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	µg/L	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*62.7*	*## [4]*	*66.6*	*85.9*	*65.5*

Organochlorine Pesticides (Water)

Envirolab ID	Units	PQL	PEE0782-01	PEE0782-02	PEE0782-03	PEE0782-04	PEE0782-05
Your Reference			MB01	MB03	MB05	MB06	MB-ZZ
Date Sampled			10/05/2023	10/05/2023	10/05/2023	10/05/2023	10/05/2023
alpha-BHC	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Hexachlorobenzene	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
beta-BHC	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
gamma-BHC	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
delta-BHC	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Heptachlor	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Aldrin	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Heptachlor epoxide	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
trans-Chlordane	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
cis-Chlordane	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan I	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4,4'-DDE	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Dieldrin	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4,4'-DDD	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan II	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin aldehyde	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4,4'-DDT	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan sulfate	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin ketone	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Methoxychlor	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Mirex	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total +ve OCP	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 2-Chlorophenol-D4	%		*79.5*	*77.3*	*92.8*	*87.3*	*65.8*

Organophosphorus Pesticides (Water)

Envirolab ID	Units	PQL	PEE0782-01	PEE0782-02	PEE0782-03	PEE0782-04	PEE0782-05
Your Reference			MB01	MB03	MB05	MB06	MB-ZZ
Date Sampled			10/05/2023	10/05/2023	10/05/2023	10/05/2023	10/05/2023
Dichlorvos	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Dimethoate	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Diazinon	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chlorpyrifos-methyl	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Ronnel	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fenitrothion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Malathion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chlorpyrifos	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Parathion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Bromophos-ethyl	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Ethion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Coumaphos	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Disulfoton	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fenamiphos	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fenthion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Methidathion	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Mevinphos	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Parathion-methyl	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phorate	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phosalone	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Azinphos-methyl	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 2-Chlorophenol-D4	%		*79.5*	*77.3*	*92.8*	*87.3*	*65.8*

Acid Extractable Metals (Water)

Envirolab ID	Units	PQL	PEE0782-01	PEE0782-02	PEE0782-03	PEE0782-04	PEE0782-05
Your Reference			MB01	MB03	MB05	MB06	MB-ZZ
Date Sampled			10/05/2023	10/05/2023	10/05/2023	10/05/2023	10/05/2023
Phosphorus	mg/L	0.050	0.076	<0.050	<0.050	<0.050	<0.050

Dissolved Metals (Water)

Envirolab ID	Units	PQL	PEE0782-01	PEE0782-02	PEE0782-03	PEE0782-04	PEE0782-05
Your Reference			MB01	MB03	MB05	MB06	MB-ZZ
Date Sampled			10/05/2023	10/05/2023	10/05/2023	10/05/2023	10/05/2023
Silicon	mg/L	0.10	2.9	3.2	6.7	6.6	3.2

Dissolved Low Level Metals (Water)

Envirolab ID	Units	PQL	PEE0782-01	PEE0782-02	PEE0782-03	PEE0782-04	PEE0782-05
Your Reference			MB01	MB03	MB05	MB06	MB-ZZ
Date Sampled			10/05/2023	10/05/2023	10/05/2023	10/05/2023	10/05/2023
Aluminium	mg/L	0.010	1.4	4.8	8.6	9.6	4.8
Arsenic	mg/L	0.0010	<0.0010	0.0016	0.0026	0.0014	0.0015
Cadmium	mg/L	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Chromium	mg/L	0.0010	0.0013	0.0039	0.0020	0.0012	0.0040
Copper	mg/L	0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010
Iron	mg/L	0.010	0.20	0.16	4.0	1.9	0.19
Mercury	mg/L	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Manganese	mg/L	0.0010	0.0031	0.0018	0.021	0.0018	0.0027
Lead	mg/L	0.0010	0.0038	<0.0010	<0.0010	0.0023	<0.0010
Selenium	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc	mg/L	0.0010	0.0051	0.0036	0.0018	0.0028	0.0027

Inorganics - Nutrients (Water)

Envirolab ID	Units	PQL	PEE0782-01	PEE0782-02	PEE0782-03	PEE0782-04	PEE0782-05
Your Reference			MB01	MB03	MB05	MB06	MB-ZZ
Date Sampled			10/05/2023	10/05/2023	10/05/2023	10/05/2023	10/05/2023
Ammonia as N	mg/L	0.0050	0.078 [2]	0.12 [2]	0.095	0.16	<0.10 [2]
Nitrate as N	mg/L	0.0050	<0.050 [2]	<0.10 [2]	<0.0050	0.071	<0.10 [2]
Nitrate as NO3 by calculation	mg/L	0.020	<0.20 [2]	<0.40 [2]	<0.020	0.31	<0.40 [2]
Nitrite as N	mg/L	0.0050	<0.050 [2]	<0.10 [2]	<0.0050	<0.0050	<0.10 [2]
Nitrite as NO2 by calculation	mg/L	0.020	<0.20 [2]	<0.40 [2]	<0.020	<0.020	<0.40 [2]
NOx as N	mg/L	0.0050	<0.050 [2]	<0.10 [2]	<0.0050	0.073	<0.10 [2]
TKN as N by calculation	mg/L	0.10	0.64	2.2	0.55	0.56	2.0
Organic Nitrogen by calc.	mg/L	0.10	0.56	2.0	0.46	0.40	1.9
Total Nitrogen	mg/L	0.10	0.65	2.1	0.55	0.64	2.0
Phosphate as P	mg/L	0.0050	<0.050 [2]	<0.10 [2]	<0.0050	<0.0050	<0.10 [2]

Heterotrophic Plate Count (Water)

Envirolab ID	Units	PQL	PEE0782-01	PEE0782-02	PEE0782-03	PEE0782-04	PEE0782-05
Your Reference			MB01	MB03	MB05	MB06	MB-ZZ
Date Sampled			10/05/2023	10/05/2023	10/05/2023	10/05/2023	10/05/2023
Heterotrophic Plate Count 36C	cfu/mL	10	170	120	80	20	20

Microbiological Suite (Water)

Envirolab ID	Units	PQL	PEE0782-01	PEE0782-02	PEE0782-03	PEE0782-04	PEE0782-05
Your Reference			MB01	MB03	MB05	MB06	MB-ZZ
Date Sampled			10/05/2023	10/05/2023	10/05/2023	10/05/2023	10/05/2023
Thermotolerant Coliforms	cfu/100mL	1	<10 [1]	<10 [1]	<10 [1]	<10 [1]	<10 [1]
Faecal Enterococci	cfu/100mL	1	<10 [1]	<10 [1]	<10 [1]	<10 [1]	<10 [1]
E.coli	cfu/100mL	1	<10 [1]	<10 [1]	<10 [1]	<10 [1]	<10 [1]

Result Comments

Identifier	Description
[1]	Microbiological testing PQL raised due to high sample turbidity and/or matrix interference.
[2]	Matrix interference - sample was highly coloured.
[4]	Surrogate recovery is outside routine acceptance criteria (60-140%) as a result of the high concentration of analyte(s) in the sample.
[5]	PQL(s) has/have been raised as the sample(s) was/were foamy and therefore required dilution.

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-020	Determination of various metals by ICP-OES.
METALS-021	Determination of Mercury by Cold Vapour AAS.
METALS-022	Determination of various metals by ICP-MS.
MICRO-001B	E. coli/Thermotolerant coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.5-latest edition). Recommended maximums based on NHMRC Australian Drinking Water Guidelines. Please note that results for this test derived from counts outside of the range 10-100 are considered approximate as per AS4276.1.
MICRO-001D	Faecal Enterococci: Microbial Water Analysis - in accordance with MICRO-001 (ISO 7899-2:latest edition). Please note that results for this test derived from counts outside of the range 10-100 are considered approximate as per AS4276.1.
MICRO-001E	Heterotrophic Plate Count: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.3-latest edition).
ORG-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
ORG-022	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and soils using DCM/Acetone/Methanol.
ORG-022_OC	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and soils using DCM/Acetone/Methanol.
ORG-023_F1_TOT	Determination of volatile organic compounds (VOCs) by P&T-GC-MS. Water samples are analysed directly by purge and trap GC-MS. Solids are extracted with Methanol, diluted and analysed by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PEE0782

Client Details

Client	RPS AAP Consulting Pty Ltd
Your Reference	AU213007014.001 - Henley Brook
Date Issued	18/05/2023

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	No	Surrogates / Extracted ISTD Outliers Exist - See detailed list below
QC Frequency	No	QC Frequency Outliers Exist - See detailed list below

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PEE0782

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
vTRH&MBTEXN | Water	1-5	10/05/2023	11/05/2023	11/05/2023	Yes
sTRH | Water	1-5	10/05/2023	15/05/2023	18/05/2023	Yes
OCP | Water	1-5	10/05/2023	15/05/2023	18/05/2023	Yes
OPP (21 list) | Water	1-5	10/05/2023	15/05/2023	18/05/2023	Yes
Total Phosphorus | Water	1-5	10/05/2023	12/05/2023	15/05/2023	Yes
Dissolved Metals | Water	1-5	10/05/2023	12/05/2023	17/05/2023	Yes
Dissolved Metals (LL) | Water	1-5	10/05/2023	12/05/2023	16/05/2023	Yes
Dissolved Metals (LL)-Hg | Water	1-5	10/05/2023	12/05/2023	17/05/2023	Yes
Nitrogen - Ammonia | Water	1-5	10/05/2023	15/05/2023	15/05/2023	Yes
Nitrogen - Nitrate | Water	1-5	10/05/2023	15/05/2023	15/05/2023	Yes
Nitrogen - Nitrite | Water	1-5	10/05/2023	15/05/2023	15/05/2023	No
Nitrogen - NOx | Water	1-5	10/05/2023	15/05/2023	15/05/2023	Yes
Nitrogen - Total N | Water	1-5	10/05/2023	15/05/2023	16/05/2023	Yes
Phosphate as P | Water	1-5	10/05/2023	15/05/2023	15/05/2023	No
TKN as N calc | Water	1-5	10/05/2023	12/05/2023	17/05/2023	Yes
HPC-36C | Water	1-5	10/05/2023	11/05/2023	11/05/2023	Yes
E. coli & T.T.coli | Water	1-5	10/05/2023	11/05/2023	11/05/2023	Yes
Faecal Enterococci | Water	1-5	10/05/2023	11/05/2023	11/05/2023	Yes

Outliers: Matrix Spike

METALS-022|Dissolved Low Level Metals (Water)| Batch BEE1498

Sample ID	Analyte	% Limits	% Recovery
PEE0782-02	Aluminium	70 - 130	##[3]

ORG-020|Semi-volatile TRH (Water)| Batch BEE1575

Sample ID	Analyte	% Limits	% Recovery
PEE0782-02	o-Terphenyl	60 - 140	##[4]

Data Quality Assessment Summary PEE0782

Outliers: Surrogate / Extracted Internal Standards

ORG-020|Semi-volatile TRH (Matrix)| Batch BEE1575

Sample ID	Analyte	% Limits	% Recovery
PEE0782-02	o-Terphenyl	60 - 140	## [4]

Outliers: QC Frequency

ORG-023_F1_TOT|Volatile TRH and BTEX (Water)| Batch BEE1276

Analysis	QC Type	Expected	Reported
vTRH&MBTEXN	Duplicate	2	1
	Matrix Spike	1	0

Quality Control PEE0782

ORG-023_F1_TOT|Volatile TRH and BTEX (Water) | Batch BEE1276

Analyte	Units	PQL	Blank	DUP1 BEE1276-DUP1# Samp | QC | RPD %	LCS %
TRH C6-C9	µg/L	10	<10	<10 | <10 | [NA]	103
TRH C6-C10	µg/L	10	<10	<10 | <10 | [NA]	104
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	<10 | <10 | [NA]	[NA]
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0		[NA]
Benzene	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	111
Toluene	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	109
Ethylbenzene	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	110
meta+para Xylene	µg/L	2.0	<2.0	<2.0 | <2.0 | [NA]	103
ortho-Xylene	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	107
Total Xylene	µg/L	3.0	<3.0	<3.0 | <3.0 | [NA]	[NA]
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	[NA]
Surrogate Dibromofluoromethane	*%*		*99.5*	*98.6 | 103*	*102*
Surrogate Toluene-D8	*%*		*104*	*100 | 102*	*102*
Surrogate 4-Bromofluorobenzene	*%*		*95.9*	*92.2 | 95.0*	*94.7*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-020|Semi-volatile TRH (Water) | Batch BEE1575

Analyte	Units	PQL	Blank	DUP1 PEE0782-01 Samp | QC | RPD %	DUP2 BEE1575-DUP2# Samp | QC | RPD %	LCS %	Spike % PEE0782-02
TRH C10-C14	µg/L	50	<50	<50 | <50 | [NA]	<50 | <50 | [NA]	90.8	73.2
TRH C15-C28	µg/L	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	101	82.3
TRH C29-C36	µg/L	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	87.6	65.8
TRH >C10-C16	µg/L	50	<50	<50 | <50 | [NA]	<50 | <50 | [NA]	97.3	79.4
TRH >C16-C34 (F3)	µg/L	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	87.9	71.0
TRH >C34-C40 (F4)	µg/L	100	<100	<100 | <100 | [NA] [6]	<100 | <100 | [NA]	104	85.8
Surrogate o-Terphenyl	*%*		*84.1*	*62.7 | 65.4*	*65.6 | 64.8*	*78.6*	*##[4]*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PEE0782

ORG-022_OC|Organochlorine Pesticides (Water) | Batch BEE1575

Analyte	Units	PQL	Blank	DUP1 PEE0782-01 Samp | QC | RPD %	DUP2 BEE1575-DUP2# Samp | QC | RPD %	LCS %	Spike % PEE0782-03
alpha-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	108	105
Hexachlorobenzene	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
beta-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	96.1	106
gamma-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
delta-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Heptachlor	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	97.1	98.6
Aldrin	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	97.2	100
Heptachlor epoxide	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	94.9	98.5
trans-Chlordane	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
cis-Chlordane	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Endosulfan I	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
4,4'-DDE	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	93.3	95.9
Dieldrin	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	98.6	105
Endrin	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	98.7	103
4,4'-DDD	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	95.6	97.0
Endosulfan II	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Endrin aldehyde	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
4,4'-DDT	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Endosulfan sulfate	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	99.0	106
Endrin ketone	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Methoxychlor	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Mirex	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Surrogate 2-Chlorophenol-D4	*%*		*93.6*	*79.5 | 85.6*	*85.0 | 87.7*	*88.8*	*89.6*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-022|Organophosphorus Pesticides (Water) | Batch BEE1575

Analyte	Units	PQL	Blank	DUP1 PEE0782-01 Samp | QC | RPD %	DUP2 BEE1575-DUP2# Samp | QC | RPD %	LCS %	Spike % PEE0782-03
Dichlorvos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	98.8	106
Dimethoate	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Diazinon	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Chlorpyrifos-methyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	86.0	92.4
Ronnel	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	79.8	84.2
Fenitrothion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	93.2	96.5
Malathion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	73.7	79.1
Chlorpyrifos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	96.7	98.1
Parathion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	108	114
Bromophos-ethyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Ethion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	104	108
Coumaphos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Disulfoton	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Fenamiphos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Fenthion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Methidathion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Mevinphos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Parathion-methyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Phorate	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Phosalone	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Azinphos-methyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Surrogate 2-Chlorophenol-D4	*%*		*93.6*	*79.5 | 85.6*	*85.0 | 87.7*	*88.8*	*89.6*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PEE0782

METALS-020|Acid Extractable Metals (Water) | Batch BEE1452

Analyte	Units	PQL	Blank	DUP1 BEE1452-DUP1# Samp | QC | RPD %	DUP2 BEE1452-DUP2# Samp | QC | RPD %	LCS %	Spike % BEE1452-MS1#
Phosphorus	mg/L	0.050	<0.050	12.4 | 11.7 | 5.69	<0.050 | <0.050 | [NA]	109	91.2

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-020|Dissolved Metals (Water) | Batch BEE1502

Analyte	Units	PQL	Blank	DUP1 PEE0782-01 Samp | QC | RPD %	DUP2 BEE1502-DUP2# Samp | QC | RPD %	LCS %	Spike % PEE0782-02
Silicon	mg/L	0.10	<0.10	2.95 | 2.99 | 1.49	<0.10 | <0.10 | [NA]	118	127

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-022|Dissolved Low Level Metals (Water) | Batch BEE1498

Analyte	Units	PQL	Blank	DUP1 PEE0782-01 Samp | QC | RPD %	DUP2 BEE1498-DUP2# Samp | QC | RPD %	LCS %	Spike % PEE0782-02
Aluminium	µg/L	0.010	<0.010	1.44 | 1.44 | 0.334	<0.010 | <0.010 | [NA]	102	##[3]
Arsenic	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	<0.0010 | <0.0010 | [NA]	106	108
Cadmium	µg/L	0.00010	<0.00010	<0.00010 | <0.00010 | [NA]	<0.00010 | <0.00010 | [NA]	107	107
Chromium	µg/L	0.0010	<0.0010	0.00133 | 0.00138 | 3.33	<0.0010 | <0.0010 | [NA]	102	105
Copper	µg/L	0.0010	<0.0010	0.00127 | 0.00135 | 5.80	<0.0010 | <0.0010 | [NA]	101	104
Iron	µg/L	0.010	<0.010	0.203 | 0.204 | 0.450	<0.010 | <0.010 | [NA]	106	112
Lead	µg/L	0.0010	<0.0010	0.00376 | 0.00374 | 0.560	<0.0010 | <0.0010 | [NA]	106	104
Manganese	µg/L	0.0010	<0.0010	0.00311 | 0.00309 | 0.644	<0.0010 | <0.0010 | [NA]	105	107
Selenium	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	<0.0010 | <0.0010 | [NA]	101	98.3
Zinc	µg/L	0.0010	<0.0010	0.00505 | 0.00487 | 3.75	<0.0010 | <0.0010 | [NA]	102	106

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-021|Dissolved Low Level Metals (Water) | Batch BEE1506

Analyte	Units	PQL	Blank	DUP1 PEE0782-01 Samp | QC | RPD %	DUP2 BEE1506-DUP2# Samp | QC | RPD %	LCS %	Spike % PEE0782-02
Mercury	µg/L	0.000050	<0.000050	<0.000050 | <0.000050 | [NA]	<0.000050 | <0.000050 | [NA]	104	94.8

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127|Inorganics - Nutrients (Water) | Batch BEE1604

Analyte	Units	PQL	Blank	DUP1 BEE1604-DUP1# Samp | QC | RPD %	DUP2 BEE1604-DUP2# Samp | QC | RPD %	LCS %	Spike % BEE1604-MS1#
Total Nitrogen	mg/L	0.10	<0.10	0.525 | 0.518 | 1.41	0.498 | 0.543 | 8.74	92.1	93.6

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-057|Inorganics - Nutrients (Water) | Batch BEE1621

Analyte	Units	PQL	Blank	DUP1 PEE0782-01 Samp | QC | RPD %	DUP2 BEE1621-DUP2# Samp | QC | RPD %	LCS %	Spike % BEE1621-MS1#
Ammonia as N	mg/L	0.0050	<0.0050	0.0777 | 0.0858 | 9.91 [2]	<0.0050 | <0.0050 | [NA]	90.0	92.5
Nitrate as N	mg/L	0.0050	<0.0050	<0.050 | <0.050 | [NA] [2]	1.08 | 1.06 | 1.91	87.5	76.2
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as N	mg/L	0.0050	<0.0050	<0.050 | <0.050 | [NA] [2]	0.0230 | 0.0230 | 0.152	111	114
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
NOx as N	mg/L	0.0050	<0.0050	<0.050 | <0.050 | [NA] [2]	1.10 | 1.08 | 1.87	87.5	74.9
Phosphate as P	mg/L	0.0050	<0.0050	<0.050 | <0.050 | [NA] [2]	0.00668 | 0.00616 | 8.17	114	107

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PEE0782

MICRO-001E|Heterotrophic Plate Count (Water) | Batch BEE1364

Analyte	Units	PQL	Blank	DUP1 BEE1364-DUP1# Samp | QC | RPD %	DUP2 BEE1364-DUP2# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10	<10	<10 | <10 | [NA]	<10 | <10 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001B|Microbiological Suite (Water) | Batch BEE1360

Analyte	Units	PQL	Blank	DUP1 BEE1360-DUP1# Samp | QC | RPD %	DUP2 BEE1360-DUP2# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP3 BEE1360-DUP3# Samp | QC | RPD %	DUP4 BEE1360-DUP4# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP5 BEE1360-DUP5# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001D|Microbiological Suite (Water) | Batch BEE1362

Analyte	Units	PQL	Blank	LCS %
Faecal Enterococci	cfu/100mL	1	<1	[NA]

QC Comments

Identifier	Description
[2]	Matrix interference - sample was highly coloured.
[3]	Spike recovery is not applicable due to the relatively high analyte background in the sample (>3* spike level). However, the LCS recovery is within acceptance criteria.
[4]	Surrogate recovery is outside routine acceptance criteria (60-140%) as a result of the high concentration of analyte(s) in the sample.
[6]	Duplicate %RPD may be flagged as an outlier to routine laboratory acceptance, however, where one or both results are <10*PQL, the RPD acceptance criteria increases exponentially.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505 fax +61 8 9317 4163
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PEH1416

Client Details

Client	RPS AAP Consulting Pty Ltd
Contact	Reen Bubb
Address	Level 3, 500 Hay St, SUBIACO, WA, 6008

Sample Details

Your Reference	AU213007014.001 - Henley Brook
Number of Samples	6 Water
Date Samples Received	22/08/2023
Date Samples Registered	22/08/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	30/08/2023
Date of Issue	29/08/2023

Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Heram Halim, Operations Manager Lien Tang, Assistant Operations Manager Sally Rogers, Senior Microbiological Analyst
Laboratory Manager	Michael Kubiak

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PEH1416-01	MB01	Water	22/08/2023	22/08/2023
PEH1416-02	MB02	Water	22/08/2023	22/08/2023
PEH1416-03	MB03	Water	22/08/2023	22/08/2023
PEH1416-04	MB05	Water	22/08/2023	22/08/2023
PEH1416-05	MB06	Water	22/08/2023	22/08/2023
PEH1416-06	MBWZ1	Water	22/08/2023	22/08/2023

Certificate of Analysis PEH1416

Acid Extractable Metals (Water)

Envirolab ID	Units	PQL	PEH1416-01	PEH1416-02	PEH1416-03	PEH1416-04	PEH1416-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			22/08/2023	22/08/2023	22/08/2023	22/08/2023	22/08/2023
Phosphorus	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050

Envirolab ID	Units	PQL	PEH1416-06
Your Reference			MBWZ1
Date Sampled			22/08/2023
Phosphorus	mg/L	0.050	<0.050

Inorganics - Nutrients (Water)

Envirolab ID	Units	PQL	PEH1416-01	PEH1416-02	PEH1416-03	PEH1416-04	PEH1416-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			22/08/2023	22/08/2023	22/08/2023	22/08/2023	22/08/2023
Ammonia as N	mg/L	0.0050	0.10	0.0078	0.12	0.19	0.16
Nitrate as N	mg/L	0.0050	0.070	1.3	0.82	0.41	0.86
Nitrate as NO3 by calculation	mg/L	0.020	0.31	5.7	3.6	1.8	3.8
Nitrite as N	mg/L	0.0050	<0.0050	<0.0050	0.0065	<0.0050	0.015
Nitrite as NO2 by calculation	mg/L	0.020	<0.020	<0.020	0.021	<0.020	0.048
NOx as N	mg/L	0.0050	0.070	1.3	0.83	0.41	0.87
TKN as N by calculation	mg/L	0.10	0.97	1.7	1.7	0.53	0.55
Organic Nitrogen by calc.	mg/L	0.10	0.87	1.7	1.6	0.34	0.39
Total Nitrogen	mg/L	0.10	1.0	3.0	2.5	0.94	1.4
Phosphate as P	mg/L	0.0050	<0.0050	0.0058	0.020	<0.0050	<0.0050

Envirolab ID	Units	PQL	PEH1416-06
Your Reference			MBWZ1
Date Sampled			22/08/2023
Ammonia as N	mg/L	0.0050	0.16
Nitrate as N	mg/L	0.0050	0.67
Nitrate as NO3 by calculation	mg/L	0.020	3.0
Nitrite as N	mg/L	0.0050	0.011
Nitrite as NO2 by calculation	mg/L	0.020	0.036
NOx as N	mg/L	0.0050	0.68
TKN as N by calculation	mg/L	0.10	0.61
Organic Nitrogen by calc.	mg/L	0.10	0.45
Total Nitrogen	mg/L	0.10	1.3
Phosphate as P	mg/L	0.0050	<0.0050

Heterotrophic Plate Count (Water)

Envirolab ID	Units	PQL	PEH1416-01	PEH1416-02	PEH1416-03	PEH1416-04	PEH1416-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			22/08/2023	22/08/2023	22/08/2023	22/08/2023	22/08/2023
Heterotrophic Plate Count 36C	cfu/mL	10	540	1300	320	350	690

Envirolab ID	Units	PQL	PEH1416-06
Your Reference			MBWZ1
Date Sampled			22/08/2023
Heterotrophic Plate Count 36C	cfu/mL	10	500

Certificate of Analysis PEH1416

Microbiological Suite (Water)

Envirolab ID	Units	PQL	PEH1416-01	PEH1416-02	PEH1416-03	PEH1416-04	PEH1416-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			22/08/2023	22/08/2023	22/08/2023	22/08/2023	22/08/2023
Thermotolerant Coliforms	cfu/100mL	1	<1	<1	<1	<1	<10 [1]
Faecal Enterococci	cfu/100mL	1	<1	<1	<1	<1	<10 [1]
E.coli	cfu/100mL	1	<1	<1	<1	<1	<10 [1]

Envirolab ID	Units	PQL	PEH1416-06
Your Reference			MBWZ1
Date Sampled			22/08/2023
Thermotolerant Coliforms	cfu/100mL	1	<10 [1]
Faecal Enterococci	cfu/100mL	1	<10 [1]
E.coli	cfu/100mL	1	<10 [1]

Result Comments

Identifier	Description
[1]	Microbiological testing PQL raised due to high sample turbidity and/or matrix interference.

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-020	Determination of various metals by ICP-OES.
MICRO-001B	E. coli/Thermotolerant coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.5-latest edition). Recommended maximums based on NHMRC Australian Drinking Water Guidelines. Please note that results for this test derived from counts outside of the range 10-100 are considered approximate as per AS4276.1.
MICRO-001D	Faecal Enterococci: Microbial Water Analysis - in accordance with MICRO-001 (ISO 7899-2:latest edition). Please note that results for this test derived from counts outside of the range 10-100 are considered approximate as per AS4276.1.
MICRO-001E	Heterotrophic Plate Count: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.3-latest edition).

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PEH1416

Client Details

Client	RPS AAP Consulting Pty Ltd
Your Reference	AU213007014.001 - Henley Brook
Date Issued	29/08/2023

Recommended Holding Time Compliance

No recommended holding time exceedances

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PEH1416

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
Total Phosphorus | Water	1-6	22/08/2023	23/08/2023	25/08/2023	Yes
Nitrogen - Ammonia | Water	1-6	22/08/2023	23/08/2023	23/08/2023	Yes
Nitrogen - Nitrate | Water	1-6	22/08/2023	23/08/2023	23/08/2023	Yes
Nitrogen - Nitrite | Water	1-6	22/08/2023	23/08/2023	23/08/2023	Yes
Nitrogen - NOx | Water	1-6	22/08/2023	23/08/2023	23/08/2023	Yes
Nitrogen - Total N | Water	1-2	22/08/2023	24/08/2023	28/08/2023	Yes
	3-6	22/08/2023	24/08/2023	29/08/2023	Yes
Phosphate as P | Water	1-6	22/08/2023	23/08/2023	23/08/2023	Yes
TKN as N calc | Water	1-6	22/08/2023	24/08/2023	29/08/2023	Yes
HPC-36C | Water	1-6	22/08/2023	22/08/2023	22/08/2023	Yes
E. coli & T.T.coli | Water	1-6	22/08/2023	22/08/2023	22/08/2023	Yes
Faecal Enterococci | Water	1-6	22/08/2023	22/08/2023	22/08/2023	Yes

Outliers: Matrix Spike

INORG-055|Inorganics - Nutrients (Water)| Batch BEH2479

Sample ID	Analyte	% Limits	% Recovery
BEH2479-MS2#	Nitrate as N	70 - 130	##[2]
BEH2479-MS1#	NOx as N	70 - 130	##[2]

Quality Control PEH1416

METALS-020|Acid Extractable Metals (Water) | Batch BEH2602

Analyte	Units	PQL	Blank	DUP1 BEH2602-DUP1# Samp | QC | RPD %	DUP2 BEH2602-DUP2# Samp | QC | RPD %	LCS %	Spike % BEH2602-MS1#
Phosphorus	mg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	0.107 | 0.105 | 1.93	109	106

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-020|Acid Extractable Metals (Water) | Batch BEH2603

Analyte	Units	PQL	Blank	DUP1 PEH1416-06 Samp | QC | RPD %	LCS %	Spike % BEH2603-MS1#
Phosphorus	mg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	107	103

INORG-057|Inorganics - Nutrients (Water) | Batch BEH2479

Analyte	Units	PQL	Blank	DUP1 BEH2479-DUP1# Samp | QC | RPD %	DUP2 BEH2479-DUP2# Samp | QC | RPD %	LCS %	Spike % BEH2479-MS1#
Ammonia as N	mg/L	0.0050	<0.0050	0.0157 | 0.0157 | 0.00	0.0123 | 0.0130 | 5.85	95.8	103
Nitrate as N	mg/L	0.0050	<0.0050	5.94 | 5.94 | 0.0840	6.30 | 6.33 | 0.407	98.0	##[2]
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as N	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	93.1	102
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
NOx as N	mg/L	0.0050	<0.0050	5.94 | 5.95 | 0.0858	6.30 | 6.33 | 0.409	98.0	##[2]
Phosphate as P	mg/L	0.0050	<0.0050	0.0129 | 0.0118 | 9.68	<0.0050 | <0.0050 | [NA]	112	122

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127|Inorganics - Nutrients (Water) | Batch BEH2721

Analyte	Units	PQL	Blank	DUP1 PEH1416-01 Samp | QC | RPD %	DUP2 BEH2721-DUP2# Samp | QC | RPD %	LCS %	Spike % PEH1416-02
Total Nitrogen	mg/L	0.10	<0.10	1.04 | 0.996 | 4.33	13.9 | 14.1 | 2.08	104	80.8

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001E|Heterotrophic Plate Count (Water) | Batch BEH2527

Analyte	Units	PQL	Blank	DUP1 BEH2527-DUP1# Samp | QC | RPD %	DUP2 BEH2527-DUP2# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10	<10	<10 | <10 | [NA]	<10 | <10 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP3 BEH2527-DUP3# Samp | QC | RPD %	DUP4 BEH2527-DUP4# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10		<10 | <10 | [NA]	<10 | <10 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP5 BEH2527-DUP5# Samp | QC | RPD %	DUP6 BEH2527-DUP6# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10		<10 | <10 | [NA]	<10 | <10 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PEH1416

MICRO-001B | Microbiological Suite (Water) | Batch BEH2525

Analyte	Units	PQL	Blank	DUP1 BEH2525-DUP1# Samp | QC | RPD %	DUP2 BEH2525-DUP2# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP3 BEH2525-DUP3# Samp | QC | RPD %	DUP4 BEH2525-DUP4# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP5 BEH2525-DUP5# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001D | Microbiological Suite (Water) | Batch BEH2526

Analyte	Units	PQL	Blank	LCS %
Faecal Enterococci	cfu/100mL	1	<1	[NA]

QC Comments

Identifier	Description
[2]	Spike recovery is not applicable due to the relatively high analyte background in the sample (>3* spike level). However, the LCS recovery is within acceptance criteria.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505 fax +61 8 9317 4163
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PEK0817

Client Details

Client	RPS AAP Consulting Pty Ltd
Contact	Kurt Blackman
Address	Level 3, 500 Hay St, SUBIACO, WA, 6008

Sample Details

Your Reference	AU213007014.001 - Henley Brook
Number of Samples	7 Groundwater
Date Samples Received	13/11/2023
Date Instructions Received	13/11/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	20/11/2023
Date of Issue	17/11/2023

Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Heram Halim, Operations Manager Jessica Miller, Microbiological Supervisor Lien Tang, Assistant Operations Manager
Laboratory Manager	Michael Kubiak

Certificate of Analysis PEK0817

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PEK0817-01	MB01	Groundwater	13/11/2023	13/11/2023
PEK0817-02	MB02	Groundwater	13/11/2023	13/11/2023
PEK0817-03	MB03	Groundwater	13/11/2023	13/11/2023
PEK0817-04	MB05	Groundwater	13/11/2023	13/11/2023
PEK0817-05	MB06	Groundwater	13/11/2023	13/11/2023
PEK0817-06	FB	Groundwater	13/11/2023	13/11/2023
PEK0817-07	RS	Groundwater	13/11/2023	13/11/2023

Certificate of Analysis PEK0817

Acid Extractable Metals (Groundwater)

Envirolab ID	Units	PQL	PEK0817-01	PEK0817-02	PEK0817-03	PEK0817-04	PEK0817-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			13/11/2023	13/11/2023	13/11/2023	13/11/2023	13/11/2023
Phosphorus	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050

Envirolab ID	Units	PQL	PEK0817-06	PEK0817-07
Your Reference			FB	RS
Date Sampled			13/11/2023	13/11/2023
Phosphorus	mg/L	0.050	<0.050	<0.050

Inorganics - Nutrients (Groundwater)

Envirolab ID	Units	PQL	PEK0817-01	PEK0817-02	PEK0817-03	PEK0817-04	PEK0817-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			13/11/2023	13/11/2023	13/11/2023	13/11/2023	13/11/2023
Ammonia as N	mg/L	0.0050	0.058	0.014	0.13	0.17	0.12
Nitrate as N	mg/L	0.0050	<0.0050	0.56	<0.050 [2]	0.13	0.83
Nitrate as NO3 by calculation	mg/L	0.020	<0.020	2.5	<0.20 [2]	0.56	3.7
Nitrite as N	mg/L	0.0050	<0.0050	<0.0050	<0.050 [2]	<0.0050	0.011
Nitrite as NO2 by calculation	mg/L	0.020	<0.020	<0.020	<0.20 [2]	<0.020	0.038
NOx as N	mg/L	0.0050	<0.0050	0.56	<0.050 [2]	0.13	0.84
TKN as N by calculation	mg/L	0.10	0.71	2.1	1.8	0.68	0.68
Organic Nitrogen by calc.	mg/L	0.10	0.65	2.1	1.6	0.51	0.56
Total Nitrogen	mg/L	0.10	0.71	2.7	1.8	0.80	1.5
Phosphate as P	mg/L	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050

Envirolab ID	Units	PQL	PEK0817-06	PEK0817-07
Your Reference			FB	RS
Date Sampled			13/11/2023	13/11/2023
Ammonia as N	mg/L	0.0050	<0.0050	<0.0050
Nitrate as N	mg/L	0.0050	<0.0050	<0.0050
Nitrate as NO3 by calculation	mg/L	0.020	<0.020	<0.020
Nitrite as N	mg/L	0.0050	<0.0050	<0.0050
Nitrite as NO2 by calculation	mg/L	0.020	<0.020	<0.020
NOx as N	mg/L	0.0050	<0.0050	<0.0050
TKN as N by calculation	mg/L	0.10	<0.10	<0.10
Organic Nitrogen by calc.	mg/L	0.10	<0.10	<0.10
Total Nitrogen	mg/L	0.10	<0.10	<0.10
Phosphate as P	mg/L	0.0050	<0.0050	<0.0050

Heterotrophic Plate Count (Groundwater)

Envirolab ID	Units	PQL	PEK0817-01	PEK0817-02	PEK0817-03	PEK0817-04	PEK0817-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			13/11/2023	13/11/2023	13/11/2023	13/11/2023	13/11/2023
Heterotrophic Plate Count 36C	cfu/mL	10	580	5900 [1]	20	60	70

Envirolab ID	Units	PQL	PEK0817-06	PEK0817-07
Your Reference			FB	RS
Date Sampled			13/11/2023	13/11/2023
Heterotrophic Plate Count 36C	cfu/mL	10	40	70

Certificate of Analysis PEK0817

Microbiological Suite (Groundwater)

Envirolab ID	Units	PQL	PEK0817-01	PEK0817-02	PEK0817-03	PEK0817-04	PEK0817-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			13/11/2023	13/11/2023	13/11/2023	13/11/2023	13/11/2023
Thermotolerant Coliforms	cfu/100mL	1	<1	<1	<1	<1	<1
Enterococci	cfu/100mL	1	<1	<1	<1	<1	<1
E.coli	cfu/100mL	1	<1	<1	<1	<1	<1

Envirolab ID	Units	PQL	PEK0817-06	PEK0817-07
Your Reference			FB	RS
Date Sampled			13/11/2023	13/11/2023
Thermotolerant Coliforms	cfu/100mL	1	<1	<1
Enterococci	cfu/100mL	1	<1	<1
E.coli	cfu/100mL	1	<1	<1

Result Comments

Identifier	Description
[1]	Heterotrophic plate count is an estimate.
[2]	PQL has been raised due to matrix requiring dilution

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-020	Determination of various metals by ICP-OES.
MICRO-001B	E. coli/Thermotolerant coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.5-latest edition). Recommended maximums based on NHMRC Australian Drinking Water Guidelines. Please note that results for this test derived from counts outside of the range 10-100 are considered approximate as per AS4276.1.
MICRO-001DE	Enterococci: Microbial Water Analysis - in accordance with MICRO-001 (AS 4276.9: latest edition). Please note that results for this test derived from counts outside of the range 10-100 are concidered approximate as per AS 4276.1.
MICRO-001E	Heterotrophic Plate Count: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.3-latest edition).

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PEK0817

Client Details

Client	RPS AAP Consulting Pty Ltd
Your Reference	AU213007014.001 - Henley Brook
Date Issued	17/11/2023

Recommended Holding Time Compliance

No recommended holding time exceedances

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	Yes	No Outliers
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PEK0817

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
Total Phosphorus | Water	1-7	13/11/2023	15/11/2023	16/11/2023	Yes
Nitrogen - Ammonia | Water	1-7	13/11/2023	15/11/2023	15/11/2023	Yes
Nitrogen - Nitrate | Water	1-2, 4-7	13/11/2023	15/11/2023	15/11/2023	Yes
	3	13/11/2023	15/11/2023	16/11/2023	Yes
Nitrogen - Nitrite | Water	1-2, 4-7	13/11/2023	15/11/2023	15/11/2023	Yes
	3	13/11/2023	15/11/2023	16/11/2023	Yes
Nitrogen - NOx | Water	1-2, 4-7	13/11/2023	15/11/2023	15/11/2023	Yes
	3	13/11/2023	15/11/2023	16/11/2023	Yes
Nitrogen - Total N | Water	1-7	13/11/2023	15/11/2023	15/11/2023	Yes
Phosphate as P | Water	1-7	13/11/2023	15/11/2023	15/11/2023	Yes
TKN as N calc | Water	1-7	13/11/2023	16/11/2023	17/11/2023	Yes
HPC-36C | Water	1-7	13/11/2023	13/11/2023	13/11/2023	Yes
E. coli & T.T.coli | Water	1-7	13/11/2023	13/11/2023	13/11/2023	Yes
Enterococci | Water	1-7	13/11/2023	13/11/2023	13/11/2023	Yes

Quality Control PEK0817

METALS-020|Acid Extractable Metals (Water) | Batch BEK1728

Analyte	Units	PQL	Blank	DUP1 BEK1728-DUP1# Samp | QC | RPD %	DUP2 PEK0817-06 Samp | QC | RPD %	LCS %	Spike % BEK1728-MS1#
Phosphorus	mg/L	0.050	<0.050	3.80 | 3.73 | 1.78	<0.050 | <0.050 | [NA]	106	106

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127|Inorganics - Nutrients (Water) | Batch BEK1600

Analyte	Units	PQL	Blank	DUP1 PEK0817-01 Samp | QC | RPD %	DUP2 BEK1600-DUP2# Samp | QC | RPD %	LCS %	Spike % PEK0817-02
Total Nitrogen	mg/L	0.10	<0.10	0.708 | 0.676 | 4.62	53.1 | 54.0 | 1.52	104	89.4

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-057|Inorganics - Nutrients (Water) | Batch BEK1606

Analyte	Units	PQL	Blank	DUP1 BEK1606-DUP1# Samp | QC | RPD %	DUP2 BEK1606-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK1606-MS1#
Ammonia as N	mg/L	0.0050	<0.0050	0.742 | 0.710 | 4.42	0.00572 | 0.00652 | 12.9	99.6	93.7
Nitrate as N	mg/L	0.0050	<0.0050	7.42 | 7.38 | 0.517	13.6 | 13.6 | 0.287	103	105
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as N	mg/L	0.0050	<0.0050	0.00766 | 0.00772 | 0.845	0.0165 | 0.0163 | 1.25	[NA]	[NA]
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
NOx as N	mg/L	0.0050	<0.0050	7.42 | 7.39 | 0.516	13.6 | 13.6 | 0.285	103	105
Phosphate as P	mg/L	0.0050	<0.0050	2.68 | 2.71 | 1.20	0.0133 | 0.0134 | 0.112	115	90.7

Analyte	Units	PQL	Blank	LCS %	Spike % BEK1606-MS2#
Nitrite as N	mg/L	0.005		102	122

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001E|Heterotrophic Plate Count (Water) | Batch BEK1493

Analyte	Units	PQL	Blank	DUP1 BEK1493-DUP1# Samp | QC | RPD %	DUP2 BEK1493-DUP2# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10	<10	<10 | 10 | 200	4800 | 4200 | 13.3 [1]	[NA]

Analyte	Units	PQL	Blank	DUP3 BEK1493-DUP3# Samp | QC | RPD %	DUP4 BEK1493-DUP4# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10		10 | 20 | 66.7	5400 | 5400 | 0.00 [1]	[NA]

Analyte	Units	PQL	Blank	DUP5 BEK1493-DUP5# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10		<10 | <10 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PEK0817

MICRO-001B | Microbiological Suite (Water) | Batch BEK1490

Analyte	Units	PQL	Blank	DUP1 BEK1490-DUP1# Samp | QC | RPD %	DUP2 BEK1490-DUP2# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1	<1	<1 | <1 | [NA]	1.00 | 1.00 | 0.00	[NA]
E.coli	cfu/100mL	1	<1	<1 | <1 | [NA]	1.00 | 1.00 | 0.00	[NA]

Analyte	Units	PQL	Blank	DUP3 BEK1490-DUP3# Samp | QC | RPD %	DUP4 BEK1490-DUP4# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP5 BEK1490-DUP5# Samp | QC | RPD %	DUP6 BEK1490-DUP6# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP7 BEK1490-DUP7# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001DE | Microbiological Suite (Water) | Batch BEK1491

Analyte	Units	PQL	Blank	DUP1 BEK1491-DUP1# Samp | QC | RPD %	DUP2 BEK1491-DUP2# Samp | QC | RPD %	LCS %
Enterococci	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

QC Comments

Identifier	Description
[1]	Heterotrophic plate count is an estimate.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PFB1771

Client Details

Client	RPS AAP Consulting Pty Ltd
Contact	Mohamed Fairooz
Address	Level 3, 500 Hay St, SUBIACO, WA, 6008

Sample Details

Your Reference	AU213007014.001 - Henley Brook
Number of Samples	8 Water
Date Samples Received	28/02/2024
Date Instructions Received	28/02/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	08/03/2024
Date of Issue	07/03/2024

Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Heram Halim, Operations Manager Sally Rogers, Senior Microbiological Analyst
Laboratory Manager	Michael Kubiak

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PFB1771-01	MB01	Water	28/02/2024	28/02/2024
PFB1771-02	MB02	Water	28/02/2024	28/02/2024
PFB1771-03	MB03	Water	28/02/2024	28/02/2024
PFB1771-04	MB05	Water	28/02/2024	28/02/2024
PFB1771-05	MB06	Water	28/02/2024	28/02/2024
PFB1771-06	MB-Z	Water	28/02/2024	28/02/2024
PFB1771-07	FB	Water	28/02/2024	28/02/2024
PFB1771-08	RS	Water	28/02/2024	28/02/2024

Certificate of Analysis PFB1771

Acid Extractable Metals (Water)

Envirolab ID	Units	PQL	PFB1771-01	PFB1771-02	PFB1771-03	PFB1771-04	PFB1771-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			28/02/2024	28/02/2024	28/02/2024	28/02/2024	28/02/2024
Phosphorus	mg/L	0.050	0.072	<0.050	<0.050	<0.050	<0.050

Envirolab ID	Units	PQL	PFB1771-06	PFB1771-07	PFB1771-08
Your Reference			MB-Z	FB	RS
Date Sampled			28/02/2024	28/02/2024	28/02/2024
Phosphorus	mg/L	0.050	0.082	<0.050	<0.050

Inorganics - Nutrients (Water)

Envirolab ID	Units	PQL	PFB1771-01	PFB1771-02	PFB1771-03	PFB1771-04	PFB1771-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			28/02/2024	28/02/2024	28/02/2024	28/02/2024	28/02/2024
Ammonia as N	mg/L	0.0050	0.071	0.0083	0.18	0.21	0.097
Nitrate as N	mg/L	0.0050	<0.050	1.2	<0.050 [3]	0.022	<0.0050
Nitrate as NO3 by calculation	mg/L	0.020	<0.20 [3]	5.3	<0.20 [3]	0.098	<0.020
Nitrite as N	mg/L	0.0050	<0.050 [3]	<0.050 [3]	<0.050 [3]	<0.0050	<0.0050
Nitrite as NO2 by calculation	mg/L	0.020	<0.20 [3]	<0.20 [3]	<0.20 [3]	<0.020	<0.020
NOx as N	mg/L	0.0050	<0.050 [3]	1.2	<0.050 [3]	0.022	<0.0050
TKN as N by calculation	mg/L	0.10	1.2	1.8	2.1	0.87	0.85
Organic Nitrogen by calc.	mg/L	0.10	1.1	1.7	1.9	0.66	0.76
Total Nitrogen	mg/L	0.10	1.2	3.0	2.0	0.89	0.85
Phosphate as P	mg/L	0.0050	<0.0050	0.011	<0.0050	<0.0050	<0.0050

Envirolab ID	Units	PQL	PFB1771-06	PFB1771-07	PFB1771-08
Your Reference			MB-Z	FB	RS
Date Sampled			28/02/2024	28/02/2024	28/02/2024
Ammonia as N	mg/L	0.0050	0.067	<0.0050	<0.0050
Nitrate as N	mg/L	0.0050	<0.0050	<0.0050	<0.0050
Nitrate as NO3 by calculation	mg/L	0.020	<0.020	<0.020	<0.020
Nitrite as N	mg/L	0.0050	<0.0050	<0.0050	<0.0050
Nitrite as NO2 by calculation	mg/L	0.020	<0.020	<0.020	<0.020
NOx as N	mg/L	0.0050	<0.0050	<0.0050	<0.0050
TKN as N by calculation	mg/L	0.10	1.1	0.14	0.14
Organic Nitrogen by calc.	mg/L	0.10	1.1	0.15	0.15
Total Nitrogen	mg/L	0.10	1.1	0.13	0.14
Phosphate as P	mg/L	0.0050	<0.0050	<0.0050	<0.0050

Certificate of Analysis PFB1771

Heterotrophic Plate Count (Water)

Envirolab ID	Units	PQL	PFB1771-01	PFB1771-02	PFB1771-03	PFB1771-04	PFB1771-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			28/02/2024	28/02/2024	28/02/2024	28/02/2024	28/02/2024
Heterotrophic Plate Count 36C	cfu/mL	10	1100	70	150	110	150

Envirolab ID	Units	PQL	PFB1771-06	PFB1771-07	PFB1771-08
Your Reference			MB-Z	FB	RS
Date Sampled			28/02/2024	28/02/2024	28/02/2024
Heterotrophic Plate Count 36C	cfu/mL	10	980	20	10

Certificate of Analysis PFB1771

Microbiological Suite (Water)

Envirolab ID	Units	PQL	PFB1771-01	PFB1771-02	PFB1771-03	PFB1771-04	PFB1771-05
Your Reference			MB01	MB02	MB03	MB05	MB06
Date Sampled			28/02/2024	28/02/2024	28/02/2024	28/02/2024	28/02/2024
Thermotolerant Coliforms	cfu/100mL	1	<10 [1]	<10 [1]	<10 [1]	<10 [1]	<10 [1]
Enterococci	cfu/100mL	1	<10 [1]	<10 [1]	<10 [1]	<10 [1]	<10 [1]
E.coli	cfu/100mL	1	<10 [1]	<10 [1]	<10 [1]	<10 [1]	<10 [1]

Envirolab ID	Units	PQL	PFB1771-06	PFB1771-07	PFB1771-08
Your Reference			MB-Z	FB	RS
Date Sampled			28/02/2024	28/02/2024	28/02/2024
Thermotolerant Coliforms	cfu/100mL	1	<10 [1]	<1	<1
Enterococci	cfu/100mL	1	<10 [1]	<1	<1
E.coli	cfu/100mL	1	<10 [1]	<1	<1

Result Comments

Identifier	Description
[1]	Microbiological testing PQL raised due to high sample turbidity and/or matrix interference.
[3]	PQL(s) has/have been raised due to matrix interference.

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-020	Determination of various metals by ICP-OES.
MICRO-001B	E. coli/Thermotolerant coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.5-latest edition). Recommended maximums based on NHMRC Australian Drinking Water Guidelines. Please note that results for this test derived from counts outside of the range 10-100 are considered approximate as per AS4276.1.
MICRO-001DE	Enterococci: Microbial Water Analysis - in accordance with MICRO-001 (AS 4276.9: latest edition). Please note that results for this test derived from counts outside of the range 10-100 are concidered approximate as per AS 4276.1.
MICRO-001E	Heterotrophic Plate Count: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.3-latest edition).

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PFB1771

Client Details

Client	RPS AAP Consulting Pty Ltd
Your Reference	AU213007014.001 - Henley Brook
Date Issued	07/03/2024

Recommended Holding Time Compliance

No recommended holding time exceedances

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PFB1771

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
Total Phosphorus | Water	7-8	28/02/2024	05/03/2024	06/03/2024	Yes
	1-6	28/02/2024	29/02/2024	05/03/2024	Yes
Nitrogen - Ammonia | Water	1-8	28/02/2024	01/03/2024	05/03/2024	Yes
Nitrogen - Nitrate | Water	4-8	28/02/2024	01/03/2024	05/03/2024	Yes
	1-3	28/02/2024	01/03/2024	06/03/2024	Yes
Nitrogen - Nitrite | Water	4-8	28/02/2024	01/03/2024	05/03/2024	Yes
	1-3	28/02/2024	01/03/2024	06/03/2024	Yes
Nitrogen - NOx | Water	4-8	28/02/2024	01/03/2024	05/03/2024	Yes
	1-3	28/02/2024	01/03/2024	06/03/2024	Yes
Nitrogen - Total N | Water	1-8	28/02/2024	05/03/2024	05/03/2024	Yes
Phosphate as P | Water	1-8	28/02/2024	01/03/2024	05/03/2024	Yes
TKN as N calc | Water	1-8	28/02/2024	29/02/2024	07/03/2024	Yes
HPC-36C | Water	1-8	28/02/2024	29/02/2024	29/02/2024	Yes
E. coli & T.T.coli | Water	1-8	28/02/2024	29/02/2024	29/02/2024	Yes
Enterococci | Water	1-8	28/02/2024	29/02/2024	29/02/2024	Yes

Outliers: Matrix Spike

INORG-055|Inorganics - Nutrients (Water)| Batch BFC0006

Sample ID	Analyte	% Limits	% Recovery
BFC0006-MS1#	Nitrate as N	70 - 130	##[2]
BFC0006-MS1#	NOx as N	70 - 130	##[2]

Quality Control PFB1771

METALS-020|Acid Extractable Metals (Water) | Batch BFB3283

Analyte	Units	PQL	Blank	DUP1 BFB3283-DUP1# Samp | QC | RPD %	DUP2 BFB3283-DUP2# Samp | QC | RPD %	LCS %	Spike % BFB3283-MS1#
Phosphorus	mg/L	0.050	<0.050	4.96 | 4.90 | 1.15	5.44 | 5.71 | 4.93	96.7	97.8

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-020|Acid Extractable Metals (Water) | Batch BFC0378

Analyte	Units	PQL	Blank	DUP1 BFC0378-DUP1# Samp | QC | RPD %	DUP2 BFC0378-DUP2# Samp | QC | RPD %	LCS %	Spike % BFC0378-MS1#
Phosphorus	mg/L	0.050	<0.050	16.8 | 17.3 | 2.72	0.458 | 0.444 | 3.17	92.3	81.8

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-057|Inorganics - Nutrients (Water) | Batch BFC0006

Analyte	Units	PQL	Blank	DUP1 BFC0006-DUP1# Samp | QC | RPD %	DUP2 BFC0006-DUP2# Samp | QC | RPD %	LCS %	Spike % BFC0006-MS1#
Ammonia as N	mg/L	0.0050	<0.0050	0.369 | 0.360 | 2.54	1.32 | 1.36 | 3.26	93.0	105
Nitrate as N	mg/L	0.0050	<0.0050	0.117 | 0.119 | 1.98	<0.0050 | <0.0050 | [NA]	104	##[2]
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as N	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	[NA]	[NA]
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
NOx as N	mg/L	0.0050	<0.0050	0.118 | 0.120 | 1.93	<0.0050 | <0.0050 | [NA]	104	##[2]
Phosphate as P	mg/L	0.0050	<0.0050	0.172 | 0.171 | 0.350	0.0135 | 0.0138 | 2.26	98.2	98.2

Analyte	Units	PQL	Blank	LCS %	Spike % BFC0006-MS2#
Nitrite as N	mg/L	0.005		80.8	102

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127|Inorganics - Nutrients (Water) | Batch BFC0249

Analyte	Units	PQL	Blank	DUP1 PFB1771-01 Samp | QC | RPD %	DUP2 BFC0249-DUP2# Samp | QC | RPD %	LCS %	Spike % PFB1771-02
Total Nitrogen	mg/L	0.10	<0.10	1.21 | 1.14 | 5.97	7.93 | 7.58 | 4.55	102	93.7

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001E|Heterotrophic Plate Count (Water) | Batch BFC0071

Analyte	Units	PQL	Blank	DUP1 BFC0071-DUP1# Samp | QC | RPD %	DUP2 BFC0071-DUP2# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10	<10	10 | 10 | 0.00	680 | 710 | 4.32	[NA]

Analyte	Units	PQL	Blank	DUP3 BFC0071-DUP3# Samp | QC | RPD %	DUP4 BFC0071-DUP4# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10		60 | 70 | 15.4	440 | 390 | 12.0	[NA]

Analyte	Units	PQL	Blank	DUP5 BFC0071-DUP5# Samp | QC | RPD %	DUP6 BFC0071-DUP6# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10		810 | 790 | 2.50	1510 | 1480 | 2.01	[NA]

Analyte	Units	PQL	Blank	DUP7 BFC0071-DUP7# Samp | QC | RPD %	LCS %
Heterotrophic Plate Count 36C	cfu/mL	10		20 | <10 | 200	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFB1771

MICRO-001B | Microbiological Suite (Water) | Batch BFC0067

Analyte	Units	PQL	Blank	DUP1 BFC0067-DUP1# Samp | QC | RPD %	DUP2 BFC0067-DUP2# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1	<1	<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP3 BFC0067-DUP3# Samp | QC | RPD %	DUP4 BFC0067-DUP4# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP5 BFC0067-DUP5# Samp | QC | RPD %	DUP6 BFC0067-DUP6# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	<1 | <1 | [NA]	[NA]

Analyte	Units	PQL	Blank	DUP7 BFC0067-DUP7# Samp | QC | RPD %	LCS %
Thermotolerant Coliforms	cfu/100mL	1		<1 | <1 | [NA]	[NA]
E.coli	cfu/100mL	1		<1 | <1 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

MICRO-001DE | Microbiological Suite (Water) | Batch BFC0069

Analyte	Units	PQL	Blank	LCS %
Enterococci	cfu/100mL	1	<1	[NA]

QC Comments

Identifier	Description
[2]	Spike recovery is not applicable due to the relatively high analyte background in the sample (>3* spike level). However, the LCS recovery is within acceptance criteria.

Appendix D
Emerge (2020) groundwater monitoring data

Table E. 1 Groundwater levels (m AHD and m BGL)

Date	MW01		MW02		MW03		MW04		MW05		MW06		MW07	
14/10/15	37.79	2.94	34.64	4.21	33.71	2.23	30.11	0.86	33.76	2.46	32.29	1.43	29.79	2.23
18/11/15	37.63	3.1	34.45	4.4	33.55	2.39	29.98	0.99	33.63	2.59	32.13	1.59	29.6	2.42
8/12/15	37.57	3.17	34.37	4.48	33.48	2.47	29.9	1.07	33.57	2.65	32.03	1.69	29.48	2.54
13/01/16	37.34	3.39	33.87	4.98	33.24	2.71	29.73	1.24	33.37	2.85	31.82	1.9	29.18	2.85
29/02/16	37.12	3.61	33.48	5.38	33.01	2.94	29.59	1.39	33.2	3.02	31.65	2.07	Dry	
15/03/16	36.99	3.74	33.38	5.47	32.95	2.99	29.53	1.45	33.15	3.08	31.6	2.12	Dry	
13/04/16	37.01	3.72	33.5	5.35	32.97	2.98	29.46	1.51	No access		31.61	2.11	Dry	
18/05/16	37.09	3.65	33.81	5.04	33.14	2.8	29.58	1.4	33.16	3.06	31.75	1.98	29.3	2.72
14/06/16	37.3	3.43	34.09	4.76	33.38	2.56	29.91	1.06	33.38	2.84	32.04	1.69	29.43	2.59
22/07/16	37.58	3.16	34.45	4.4	33.66	2.28	30.2	0.77	33.63	2.59	32.31	1.41	29.74	2.28
10/08/16	37.72	3.01	34.61	4.24	33.77	2.17	30.29	0.68	33.74	2.48	32.38	1.34	29.86	2.16
22/09/16	38.04	2.69	34.92	3.93	34.02	1.92	30.48	0.49	34.05	2.17	32.54	1.18	30.14	1.88
28/10/16	37.98	2.75	34.8	4.05	33.83	2.11	30.29	0.68	33.92	2.3	32.43	1.29	30.02	2
23/11/16	37.8	2.93	34.61	4.24	33.66	2.28	30.14	0.83	33.74	2.48	32.25	1.47	30.48	1.54
8/12/16	37.73	3	34.44	4.41	33.56	2.38	30.06	0.91	33.68	2.54	32.16	1.56	30.35	1.67
23/03/17	37.49	3.24	33.82	5.03	33.34	2.6	30.01	0.96	33.55	2.67	32.05	1.67	30.29	1.73
27/06/17	37.42	3.31	34.24	4.61	33.45	2.49	29.95	1.02	33.46	2.77	32.03	1.69	30.08	1.94
14/07/17	37.57	3.16	34.39	4.46	-	-	30.15	0.82	33.66	2.56	32.26	1.46	Blocked	
24/08/17	38.24	2.49	35.1	3.75	34.28	1.66	30.62	0.35	34.4	1.82	32.79	0.93	Blocked	
14/09/17	38.25	2.48	35.06	3.8	34.17	1.77	30.52	0.45	34.27	1.95	32.68	1.04	Blocked	
20/10/17	38.23	2.51	34.98	3.87	34.09	1.85	30.54	0.43	34.19	2.04	32.63	1.1	Blocked	
16/11/17	38.05	2.68	34.79	4.06	33.88	2.06	30.29	0.68	34.03	2.19	32.46	1.26	Blocked	
11/09/18	37.51	3.22	35.25	3.6	34.44	1.5	30.7	0.27	34.59	1.63	32.91	0.81	Blocked	

Table E. 2 Groundwater quality - MW01

Analyte	Average	Standard deviation	08/12/15	15/03/16	14/06/16	22/09/16	8/12/16	23/03/17	27/06/17	14/09/17
Temperature (°C)	20.54	3.40	22.09	24.54	20.78	17.6	21.4	24	20.6	13.3
EC (mS/cm)	0.248	0.074	0.202	0.224	0.277	0.233	0.206	0.435	0.202	0.208
DO (mg/L)	1.88	0.90	1.28	0.33	0.92	2.82	2.07	2.57	2	3.03
DO (% sat)	20.85	9.63	14.7	3.9	10.3	29.3	23.4	30.7	22.3	32.2
pH (pH units)	4.56	0.75	4	5.68	5.14	4.56	4.76	2.97	4.52	4.84
Redox (mV)	69	107	-52	-29	-34	163	162.6	-22	231.6	130.7
Ammonia as N (mg/L)	0.04	0.02	0.03	0.05	0.04	0.05	0.03	0.01	0.07	0.02
Nitrites and Nitrates as N (NOx, mg/L)	1.83	1.61	3.29	0.06	0.45	3.59	4.26	0.71	0.06	2.24
Total Kjeldahl Nitrogen as N (mg/L)	0.83	0.28	1.2	0.6	0.8	1.1	1	0.5	0.4	1
Total Nitrogen as N (mg/L)	2.66	1.86	4.5	0.7	1.2	4.7	5.3	1.2	0.5	3.2
Total Phosphorous as P (mg/L)	0.02	0.01	<0.01	0.01	0.01	<0.02	0.02	<0.01	0.04	0.05
Reactive Phosphorous as P (mg/L)	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Suspended Solids (mg/L)	52.86	104.75	<5	<5	<5	37	<5	308	<5	-

Table E. 3 Groundwater quality - MW02

Analyte	Average	Standard deviation	08/12/15	15/03/16	14/06/16	22/09/16	8/12/16	23/03/17	27/06/17	14/09/17
Temperature (°C)	21.00	2.02	21.78	24.59	21.15	17.41	20.5	22.2	21.5	18.9
EC (mS/cm)	0.263	0.049	0.294	0.306	0.326	0.284	0.196	0.178	0.252	0.267
DO (mg/L)	4.28	1.39	4.19	4.55	2.34	5.09	5.79	6.25	2.15	3.88
DO (% sat)	47.93	15.64	47.8	54.5	26.3	52.7	64.3	71.7	24.5	41.6
pH (pH units)	5.53	0.57	4.49	6.28	5.97	5.8	5.67	5.38	4.8	5.86
Redox (mV)	108	76	62	91	58	122	147	-2	276	113
Ammonia as N (mg/L)	0.02	0.01	0.03	<0.01	0.01	0.05	0.02	<0.01	<0.01	0.04
Nitrites and Nitrates as N (NOx, mg/L)	3.29	1.12	3.29	5.45	1.78	3.73	2.48	4.36	2.37	2.87
Total Kjeldahl Nitrogen as N (mg/L)	0.73	0.29	0.6	0.9	0.7	1.4	0.5	0.7	0.4	0.6
Total Nitrogen as N (mg/L)	4.04	1.28	3.9	6.4	2.5	5.1	3	5.1	2.8	3.5
Total Phosphorous as P (mg/L)	0.05	0.01	0.06	<0.05	0.04	0.06	0.03	0.02	0.05	0.05
Reactive Phosphorous as P (mg/L)	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Suspended Solids (mg/L)	161.57	130.50	426	69	148	186	54	237	11	-

Table E. 4 Groundwater quality - MW03

Analyte	Average	Standard deviation	08/12/15	15/03/16	14/06/16	22/09/16	8/12/16	23/03/17	27/06/17	14/09/17
Temperature (°C)	20.88	1.47	21.55	23	20.53	17.83	20.2	22.4	21	20.5
EC (mS/cm)	0.687	0.081	0.682	0.643	0.624	0.755	0.591	0.710	0.634	0.860
DO (mg/L)	0.66	0.59	0.27	0.41	0.25	0.18	0.13	1.18	1.91	0.98
DO (% sat)	7.60	6.77	3	5.3	2.8	1.9	1.4	13.8	21.6	11
pH (pH units)	5.01	0.82	4.31	6.05	5.38	5.62	5.28	3.24	4.93	5.29
Redox (mV)	40	89	-33	100	-87	-2	102	-49	180	107
Ammonia as N (mg/L)	0.25	0.20	0.36	0.22	0.13	0.08	0.74	0.16	0.08	0.26
Nitrites and Nitrates as N (NOx, mg/L)	4.34	4.12	1.25	8.35	1.2	10.7	1.58	0.01	9.63	2.01
Total Kjeldahl Nitrogen as N (mg/L)	2.51	1.96	1.6	2.3	1.7	2.3	7.6	1.2	1.9	1.5
Total Nitrogen as N (mg/L)	6.85	4.40	2.8	10.7	2.9	13	9.2	1.2	11.5	3.5
Total Phosphorous as P (mg/L)	0.06	0.05	<0.05	<0.05	0.05	<0.01	0.02	0.04	0.16	0.11
Reactive Phosphorous as P (mg/L)	0.02	0.01	<0.01	0.01	0.01	<0.01	<0.01	0.02	0.03	0.03
Total Suspended Solids (mg/L)	104.00	162.17	68	98	30	8	7	494	23	-

Table E. 5 Groundwater quality - MW04

Analyte	Average	Standard deviation	08/12/15	15/03/16	14/06/16	22/09/16	8/12/16	23/03/17	27/06/17	14/09/17
Temperature (°C)	22.73	3.11	24.31	26.46	21.67	17.5	26	25.4	21.3	19.2
EC (mS/cm)	0.415	0.140	0.654	0.536	0.485	0.470	0.196	0.366	0.260	0.355
DO (mg/L)	0.38	0.26	0.25	0.13	0.33	0.14	0.28	0.88	0.26	0.74
DO (% sat)	4.38	3.07	2.9	1.6	3.8	1.4	3.5	10.7	3	8.1
pH (pH units)	5.64	0.36	5.17	6.1	5.83	5.63	5.85	4.96	5.62	5.93
Redox (mV)	-72	70	-165	-113	-107	-140	-21.3	-87.9	23.5	31.4
Ammonia as N (mg/L)	0.78	0.26	0.85	0.96	0.69	0.68	1.01	0.18	0.99	0.87
Nitrites and Nitrates as N (NOx, mg/L)	0.47	0.81	0.01	0.05	2.49	<0.01	<0.01	<0.01	0.27	0.88
Total Kjeldahl Nitrogen as N (mg/L)	2.58	0.23	2.8	2.9	2.7	2.5	2.7	2.3	2.2	2.5
Total Nitrogen as N (mg/L)	3.05	0.87	2.8	3	5.2	2.5	2.7	2.3	2.5	3.4
Total Phosphorous as P (mg/L)	1.05	0.14	1.02	1.02	0.77	1.01	1.19	0.98	1.2	1.2
Reactive Phosphorous as P (mg/L)	0.80	0.36	0.89	0.95	0.76	1.06	1.2	0.02	1	0.48
Total Suspended Solids (mg/L)	55.29	106.83	33	6	<5	<5	14	316	8	-

Table E. 6 Groundwater quality - MW05

Analyte	Average	Standard deviation	08/12/15	15/03/16	14/06/16	22/09/16	8/12/16	23/03/17	27/06/17	14/09/17
Temperature (°C)	22.60	1.50	22.86	24.5	22.66	19.11	23.3	22.8	21.9	23.7
EC (mS/cm)	0.250	0.053	0.222	0.19	0.268	0.324	0.169	0.237	0.263	0.324
DO (mg/L)	0.41	0.25	0.19	0.14	0.22	0.27	0.53	0.91	0.37	0.61
DO (% sat)	4.65	2.84	2.2	1.7	2.5	2.9	6.2	10.5	4.2	7
pH (pH units)	3.94	0.59	3.42	4.69	4.12	3.81	4.22	2.68	4.31	4.29
Redox (mV)	1	75	-105	-48	-54	-24	92.5	-38.3	82.2	105.3
Ammonia as N (mg/L)	0.44	0.08	0.48	0.54	0.41	0.29	0.56	0.4	0.42	0.45
Nitrites and Nitrates as N (NOx, mg/L)	0.01	0.00	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl Nitrogen as N (mg/L)	0.83	0.14	0.9	0.8	0.9	0.8	1.1	0.6	0.7	0.8
Total Nitrogen as N (mg/L)	0.83	0.14	0.9	0.8	0.9	0.8	1.1	0.6	0.7	0.8
Total Phosphorous as P (mg/L)	0.02	0.01	<0.05	<0.01	0.01	<0.01	0.01	0.02	0.02	0.01
Reactive Phosphorous as P (mg/L)	0.02	0.01	<0.05	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Total Suspended Solids (mg/L)	54.29	61.37	86	50	<5	<5	41	188	<5	-

Table E. 7 Groundwater quality - MW06

Analyte	Average	Standard deviation	08/12/15	15/03/16	14/06/16	22/09/16	8/12/16	23/03/17	27/06/17	14/09/17
Temperature (°C)	20.00	1.46	20.29	22.25	20.67	17.31	19.70	21.50	19.60	18.70
EC (mS/cm)	1.321	0.557	1.035	0.899	0.816	1.238	0.797	1.630	1.603	2.550
DO (mg/L)	0.54	0.29	0.26	0.82	0.32	0.37	0.23	0.99	0.44	0.92
DO (% sat)	5.98	3.27	2.90	9.30	3.50	3.80	2.60	11.20	4.80	9.70
pH (pH units)	3.71	0.40	3.33	4.57	3.91	3.39	3.95	3.25	3.64	3.67
Redox (mV)	53	98	-77	-52	-1	95	114	-14	137	222
Ammonia as N (mg/L)	0.56	0.24	0.72	0.95	0.74	0.45	0.46	0.62	0.36	0.14
Nitrites and Nitrates as N (NOx, mg/L)	0.01	0.00	0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl Nitrogen as N (mg/L)	1.18	0.19	1.4	1.4	1.2	1	0.8	1.1	1.3	1.2
Total Nitrogen as N (mg/L)	1.18	0.19	1.4	1.4	1.2	1.0	0.8	1.1	1.3	1.2
Total Phosphorous as P (mg/L)	0.02	0.02	<0.05	<0.01	0.02	<0.01	<0.01	0.01	0.05	0.03
Reactive Phosphorous as P (mg/L)	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Suspended Solids (mg/L)	220.57	426.75	72	144	17	8	<5.	1260	38	-

Table E. 8 Groundwater quality - MW07

Analyte	Average	Standard deviation	08/12/15	15/03/16	14/06/16	22/09/16	8/12/16	23/03/17	27/06/17	14/09/17
Temperature (°C)	19.64	1.69	20.63		21.03	17.27				
EC (mS/cm)	0.979	0.177	1.226		0.820	0.892				
DO (mg/L)	0.82	0.25	0.47		1.00	0.99				
DO (% sat)	9.27	2.99	5.20		12.30	10.30				
pH (pH units)	4.92	0.79	5.46		5.49	3.80				
Redox (mV)	-136	74	-221		-147	-41				
Ammonia as N (mg/L)	0.13	0.11	0.28		0.06	0.04				
Nitrites and Nitrates as N (NOx, mg/L)	0.01	0.00	0.01		0.02	<0.01				
Total Kjeldahl Nitrogen as N (mg/L)	2.50	0.50	3.2	Dry	2.1	2.2	Blocked			
Total Nitrogen as N (mg/L)	2.50	0.50	3.2		2.1	2.2				
Total Phosphorous as P (mg/L)	0.50	0.07	0.45		0.60	0.44				
Reactive Phosphorous as P (mg/L)	0.41	0.04	0.35		0.44	0.44				
Total Suspended Solids (mg/L)	118.33	158.87	343		7	<5.				

Table E. 9 Faecal Coliforms and E.coli (colony forming unit /100 mL)

Analyte	MW01	MW02	MW03	MW04	MW05	MW06	MW07
Faecal Coliforms	<1	23	<1	~2	<1	~1	Blocked
Escherichia coli	<1	23	<1	~2	<1	~1	

Appendix E
Agreement for reduced monitoring

From: Yoon-Kah Wong
To: Joycelyn Siew
Cc: Jonas Polifka; Diorra Indira
Subject: RE: Lot 96 Starflower Road Henley Brook - Pre-Development Monitoring Reduction
Date: Tuesday, 27 February 2024 2:11:22 PM
Attachments: image001.png
image002.png

Hi Joycelyn,

If DWER has no issue with the reduced requirements the City has no issue but please do mention this reduced period in the LWMS so that future UWMP can be processed without any issues.

Happy Regards & Take Care :-)

Yoon Kah Wong Urban Development Team
Asset Management

city of swan
One City, diverse people, cultures and places

PO Box 196
Midland WA 6056
t 08 9267 9186
m 0408 820 089
www.swan.wa.gov.au

From: Joycelyn Siew <Joycelyn.Siew@rpsgroup.com.au>
Sent: Tuesday, February 27, 2024 1:33 PM
To: Yoon-Kah Wong <yoon-kah.wong@swan.wa.gov.au>
Cc: Jonas Polifka <Jonas.Polifka@rpsgroup.com.au>
Subject: Lot 96 Starflower Road Henley Brook - Pre-Development Monitoring Reduction

Hi Yoon-Kah,

Please see the below email trail with DWER. In short, RPS was seeking approval from DWER that in lieu of the typical 2 years monitoring, the 5 monitoring events over 13 months completed for Lot 96 supplemented by historical data from the adjacent site will be sufficient to support development of Lot 96 up to subdivision stage and no further pre-development monitoring is required.

DWER has provided their support for this approach for the LWMS, but has deferred the decision for the UWMP to City as the approving authority. Could you please review the below request and advise?

Regards,

Joycelyn Siew
Senior Hydrologist
RPS | Australia Asia Pacific
D +61 8 9211 1138
E joycelyn.siew@rpsgroup.com.au

Please address mail to: PO Box 170, West Perth WA 6870

From: Jim Mackintosh <jim.mackintosh@dwer.wa.gov.au>
Sent: Tuesday, February 27, 2024 12:37 PM
To: Joycelyn Siew <Joycelyn.Siew@rpsgroup.com.au>
Cc: Jonas Polifka <Jonas.Polifka@rpsgroup.com.au>
Subject: RE: Proposed MRS Amendment - Pt Lot 96 Starflower Road Henley Brook - Request for preliminary comments (RLS/1090)

OFFICIAL

OFFICIAL

Hi Joycelyn,

Apologies for the confusion. I was confusing this with the MRS Amendment stage as that was the title of the email. Yes, DWER did not consider a DWMS was not necessary after further discussion with DPLH.

I can therefore confirm that the monitoring undertaken is sufficient to support a Local Structure Plan and the supporting Local Water Management Strategy (LWMS). In regards to the requirements for the Urban Water Management Plan (UWMP) you should confirm this with the Local Government as the Department is not involved in the review and approval of UWMP's.

Regards

Jim Mackintosh

Department of Water and Environmental Regulation
Program Manager
Swan Avon Region
Planning Advice Section
T 08 6250 8043 |
E jim.mackintosh@dwer.wa.gov.au
Visit our website www.dwer.wa.gov.au

From: Joycelyn Siew <Joycelyn.Siew@rpsgroup.com.au>
Sent: Friday, February 23, 2024 3:22 PM
To: Jim Mackintosh <jim.mackintosh@dwer.wa.gov.au>
Cc: Jonas Polifka <Jonas.Polifka@rpsgroup.com.au>
Subject: RE: Proposed MRS Amendment - Pt Lot 96 Starflower Road Henley Brook - Request for preliminary comments (RLS/1090)

OFFICIAL

Hi Jim,

Apologies for not being clear.

I was seeking advice for the water planning process as a whole, as the full 2 years of monitoring is not typically required for the DWMS. Referring to the *Interim: developing a local water management strategy*, it states that the pre-development monitoring is for "up to the time of subdivision" and that "any proposed reduction to the standard monitoring requirement should be discussed and approved by DWER before the LWMS has been finalised", hence my reaching out now to get agreement on the requirements for subdivision.

To give you an update, the proponent is aiming to lodge the LSP in mid-March, concurrent with the ongoing MRS amendment. We are currently preparing the LWMS to support that. DPLH had initially advised that a DWMS was not required for the MRS amendment (supposedly based on DWER advice in February 2023 that any water issues can be addressed at LSP stage). However, we prepared the DWMS anyway so that we could receive preliminary feedback. The current LWMS in preparation is essentially a revision of the DWMS with more detail and addresses the deficiencies previously identified in the DWMS. This document will therefore be suitable for both the MRS amendment and LSP.

Hope that clears things up.

Regards,

Joycelyn Siew
Senior Hydrologist
RPS | Australia Asia Pacific
D +61 8 9211 1138
E joycelyn.siew@rpsgroup.com.au

Please address mail to: PO Box 170, West Perth WA 6870

From: Jim Mackintosh <jim.mackintosh@dwer.wa.gov.au>
Sent: Friday, February 23, 2024 12:00 PM
To: Joycelyn Siew <Joycelyn.Siew@rpsgroup.com.au>
Cc: Jonas Polifka <Jonas.Polifka@rpsgroup.com.au>
Subject: RE: Proposed MRS Amendment - Pt Lot 96 Starflower Road Henley Brook - Request for preliminary comments (RLS/1090)

OFFICIAL

OFFICIAL

I was not aware that this was in regards to a LSP (was not mentioned in previous emails and I have only been dealing with the MRS Amendment). I would have to consider the LWMS (for LSP) requirements once we have reviewed the DWMS.

Regards

Jim Mackintosh
_____
Department of Water and Environmental Regulation
Program Manager
Swan Avon Region
Planning Advice Section
T 08 6250 8043 |
E jim.mackintosh@dwer.wa.gov.au
Visit our website www.dwer.wa.gov.au

From: Joycelyn Siew <Joycelyn.Siew@rpsgroup.com.au>
Sent: Friday, February 23, 2024 11:51 AM
To: Jim Mackintosh <jim.mackintosh@dwer.wa.gov.au>
Cc: Jonas Polifka <Jonas.Polifka@rpsgroup.com.au>
Subject: RE: Proposed MRS Amendment - Pt Lot 96 Starflower Road Henley Brook - Request for preliminary comments (RLS/1090)

OFFICIAL

Thanks Jim,

Can you please confirm if "this stage of the development" only refers to the LSP stage, or if this will be sufficient monitoring to support the UWMPs and subdivision application as well? We would like to ensure all required monitoring is completed ahead of UWMP preparation to avoid any delays to approvals.

Regards,

Joycelyn Siew
Senior Hydrologist
RPS | Australia Asia Pacific
D +61 8 9211 1138
E joycelyn.siew@rpsgroup.com.au

Please address mail to: PO Box 170, West Perth WA 6870

From: Jim Mackintosh <jim.mackintosh@dwer.wa.gov.au>
Sent: Friday, February 23, 2024 11:44 AM
To: Joycelyn Siew <Joycelyn.Siew@rpsgroup.com.au>
Cc: Jonas Polifka <Jonas.Polifka@rpsgroup.com.au>
Subject: RE: Proposed MRS Amendment - Pt Lot 96 Starflower Road Henley Brook - Request for preliminary comments (RLS/1090)

OFFICIAL

OFFICIAL

Thanks Joycelyn,

I can now confirm that the DWER do not require any further groundwater monitoring, at this stage of the development.

Regards

Jim Mackintosh
_____
Department of Water and Environmental Regulation
Program Manager
Swan Avon Region
Planning Advice Section
T 08 6250 8043 |
E jim.mackintosh@dwer.wa.gov.au
Visit our website www.dwer.wa.gov.au

From: Joycelyn Siew <Joycelyn.Siew@rpsgroup.com.au>
Sent: Tuesday, February 20, 2024 1:05 PM
To: Jim Mackintosh <jim.mackintosh@dwer.wa.gov.au>
Cc: Jonas Polifka <Jonas.Polifka@rpsgroup.com.au>
Subject: RE: Proposed MRS Amendment - Pt Lot 96 Starflower Road Henley Brook - Request for preliminary comments (RLS/1090)

OFFICIAL

Hi Jim,

Yes, confirming that sampling for pathogens was undertaken for all 5 monitoring events.

This included thermotolerant coliforms, faecal enterococci, *E. coli* and heterotrophic plate count.

Regards,

Joycelyn Siew
Senior Hydrologist
RPS | Australia Asia Pacific
D +61 8 9211 1138
E joycelyn.siew@rpsgroup.com.au

Please address mail to: PO Box 170, West Perth WA 6870

From: Jim Mackintosh <jim.mackintosh@dwer.wa.gov.au>
Sent: Tuesday, February 20, 2024 12:53 PM
To: Joycelyn Siew <Joycelyn.Siew@rpsgroup.com.au>
Cc: Jonas Polifka <Jonas.Polifka@rpsgroup.com.au>
Subject: RE: Proposed MRS Amendment - Pt Lot 96 Starflower Road Henley Brook - Request for preliminary comments (RLS/1090)

OFFICIAL

OFFICIAL

Dear Joycelyn,

Thank you for this information. The Department will consider your request in due course. However, in the interim can you please advise if pathogen monitoring has also been undertaken, as previously recommended by the Department?

"The DWER would recommend that at least one further sampling event is undertaken to inform this proposal, focusing on pathogens and nutrients."

Regards

Jim Mackintosh
_____
Department of Water and Environmental Regulation
Program Manager
Swan Avon Region

Planning Advice Section
T 08 6250 8043 |
E jim.mackintosh@dwer.wa.gov.au
Visit our website www.dwer.wa.gov.au

From: Joycelyn Siew <Joycelyn.Siew@rpsgroup.com.au>
Sent: Monday, February 19, 2024 3:41 PM
To: Jim Mackintosh <jim.mackintosh@dwer.wa.gov.au>
Cc: Jonas Polifka <Jonas.Polifka@rpsgroup.com.au>
Subject: RE: Proposed MRS Amendment - Pt Lot 96 Starflower Road Henley Brook - Request for preliminary comments (RLS/1090)

Hi Jim,

Following on from your advice re Groundwater Quality Monitoring last year, a total of 5 monitoring events (November 2022 – November 2023) have been completed for the site, including nutrients and pathogens.

Typically, two years of pre-development monitoring is recommended. To date, thirteen months of monitoring have been completed for Lot 96 Starflower Road, however more than two years of groundwater level and quality monitoring have already been done for the immediate surrounding areas (ie. DWER bores and adjacent Henley Brook LSP area [2015-2017]). RPS is proposing to supplement Lot 96's monitoring with the existing monitoring from the broader area to establish baseline conditions.

A comparison of the groundwater quality results is shown below. To assess the suitability of water quality from the adjacent site to supplement Lot 96's data, statistical significance testing was performed. The Kruskal-Wallis test revealed that there was no statistically significant difference ($p<0.05$) between water quality parameters in the groundwater of the two sites.

Location of bores	Guideline	pH	E.C.	Redox	D.O.	Total P	FRP	Total N	TKN	NH_3-N	Nitrate as NO_3	Nitrite as NO_2	NO_x-N
	Units	pH units	µS/cm	mV	ppm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	FWG	**7-8.5**	**500-1500**	**-**	**-**	**0.06**	**0.03**	**1.5**	**-**	**0.04**	**-**	**0.15**	**0.1**
	SRT	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**
	ADWG	**6-8.5[b]**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.5[b]**	**50[a]**	**3[a]**	**-**
On-site	Average	4.34	376	136	0.58	0.10	0.004	1.72	1.28	0.12	1.79	0.013	0.46
	Median	4.15	372	183	0.44	0.03	0.003	1.65	1.15	0.12	0.44	0.010	0.20
	Standard deviation	0.52	59	153	0.57	0.32	0.004	0.84	0.67	0.08	2.50	0.008	0.56
Off-site	Average	4.72	529	32	1.38	0.20	0.142	2.97	1.31	0.34	---	---	1.66
	Median	4.76	324	-1	0.74	0.02	0.005	2.50	1.10	0.26	---	---	0.06
	Standard deviation	0.97	464	105	1.61	0.39	0.334	2.78	0.73	0.32	---	---	2.58

RPS is therefore seeking support from DWER that 5 monitoring events over 13 months, supplemented by data from the adjacent site, will be sufficient to support development of Lot 96 and no further pre-development monitoring is required.

Regards,

Joycelyn Siew
Senior Hydrologist
RPS | Australia Asia Pacific
D +61 8 9211 1138
E joycelyn.siew@rpsgroup.com.au

Please address mail to: PO Box 170, West Perth WA 6870

Appendix F
Statistical test results

Nonparametric Tests

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of Electrical conductivity is the same across categories of Location of bores.	Independent-Samples Kruskal-Wallis Test	.616	Retain the null hypothesis.
2	The distribution of pH is the same across categories of Location of bores.	Independent-Samples Kruskal-Wallis Test	.052	Retain the null hypothesis.
3	The distribution of Ammonia is the same across categories of Location of bores.	Independent-Samples Kruskal-Wallis Test	.051	Retain the null hypothesis.
4	The distribution of Nitrogen oxides is the same across categories of Location of bores.	Independent-Samples Kruskal-Wallis Test	.334	Retain the null hypothesis.
5	The distribution of Total nitrogen is the same across categories of Location of bores.	Independent-Samples Kruskal-Wallis Test	.076	Retain the null hypothesis.
6	The distribution of Total kjeldahl nitrogen is the same across categories of Location of bores.	Independent-Samples Kruskal-Wallis Test	.802	Retain the null hypothesis.
7	The distribution of Total phosphorus is the same across categories of Location of bores.	Independent-Samples Kruskal-Wallis Test	.896	Retain the null hypothesis.
8	The distribution of Filterable reactive phosphorus is the same across categories of Location of bores.	Independent-Samples Kruskal-Wallis Test	.131	Retain the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

Independent-Samples Kruskal-Wallis Test

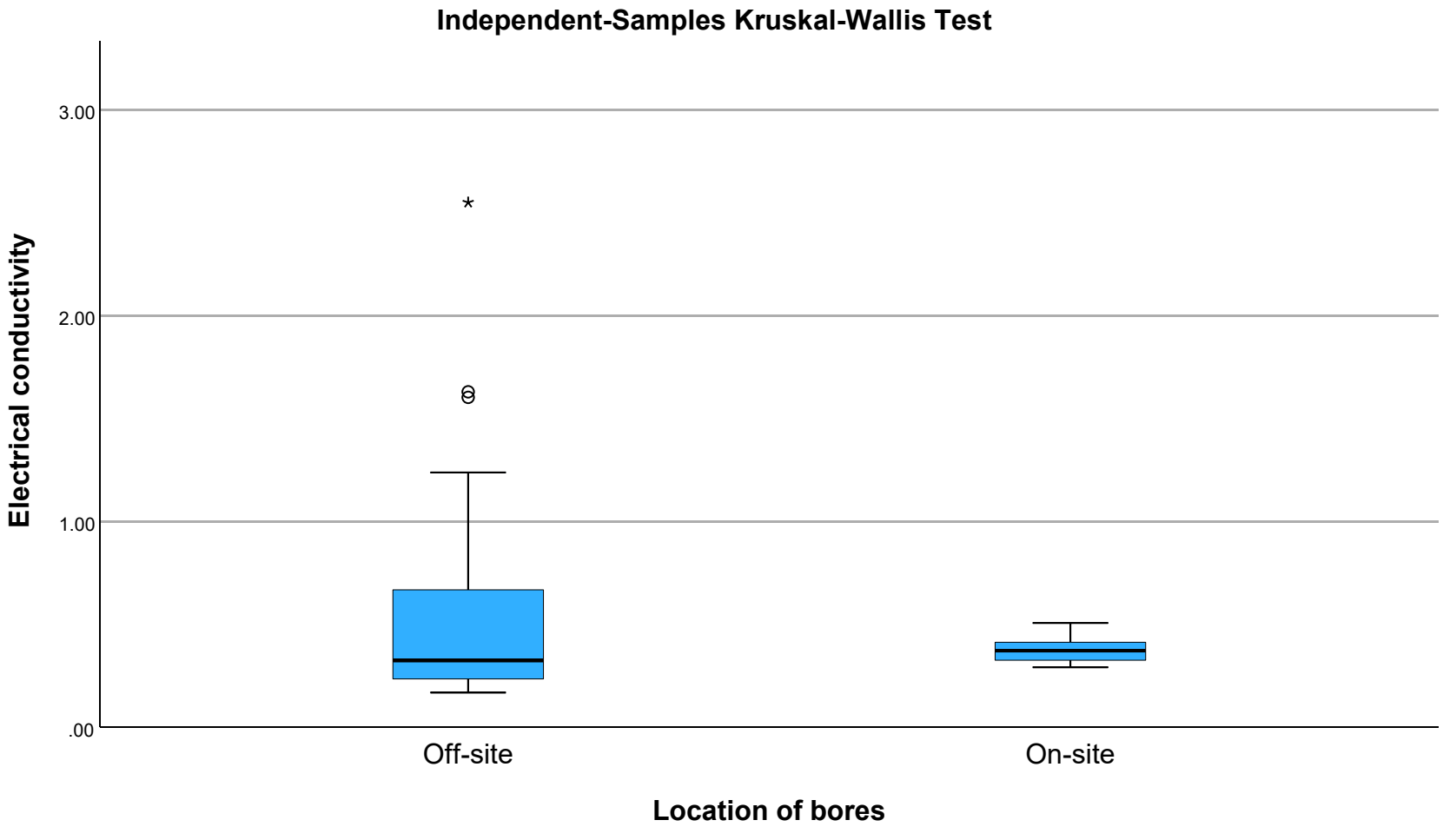
Electrical conductivity across Location of bores

Independent-Samples Kruskal-Wallis Test Summary

Total N	72
Test Statistic	.252[a,b]
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	.616

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because there are less than three test fields.



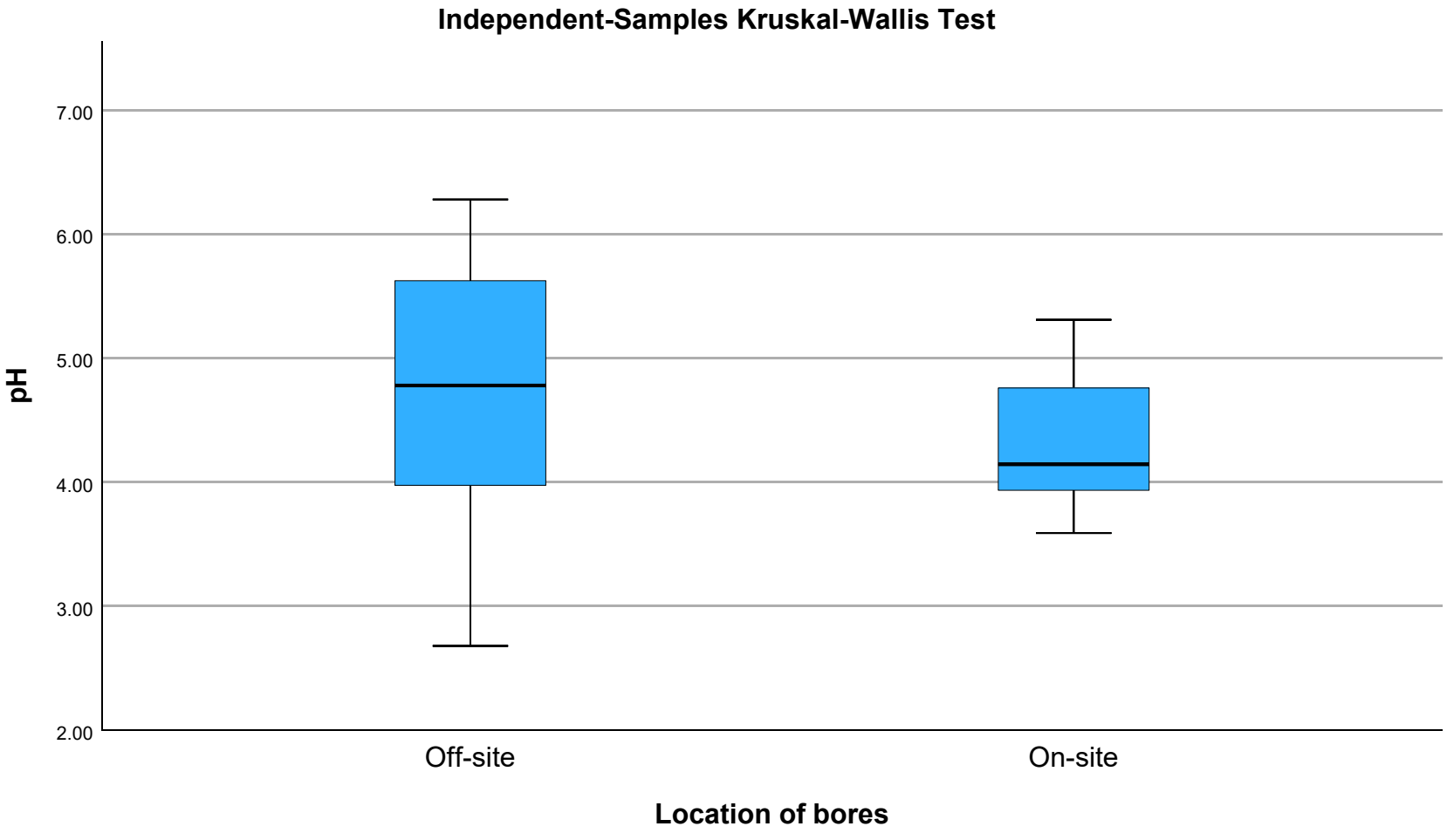
pH across Location of bores

Independent-Samples Kruskal-Wallis Test Summary

Total N	72
Test Statistic	3.769[a,b]
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	.052

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because there are less than three test fields.



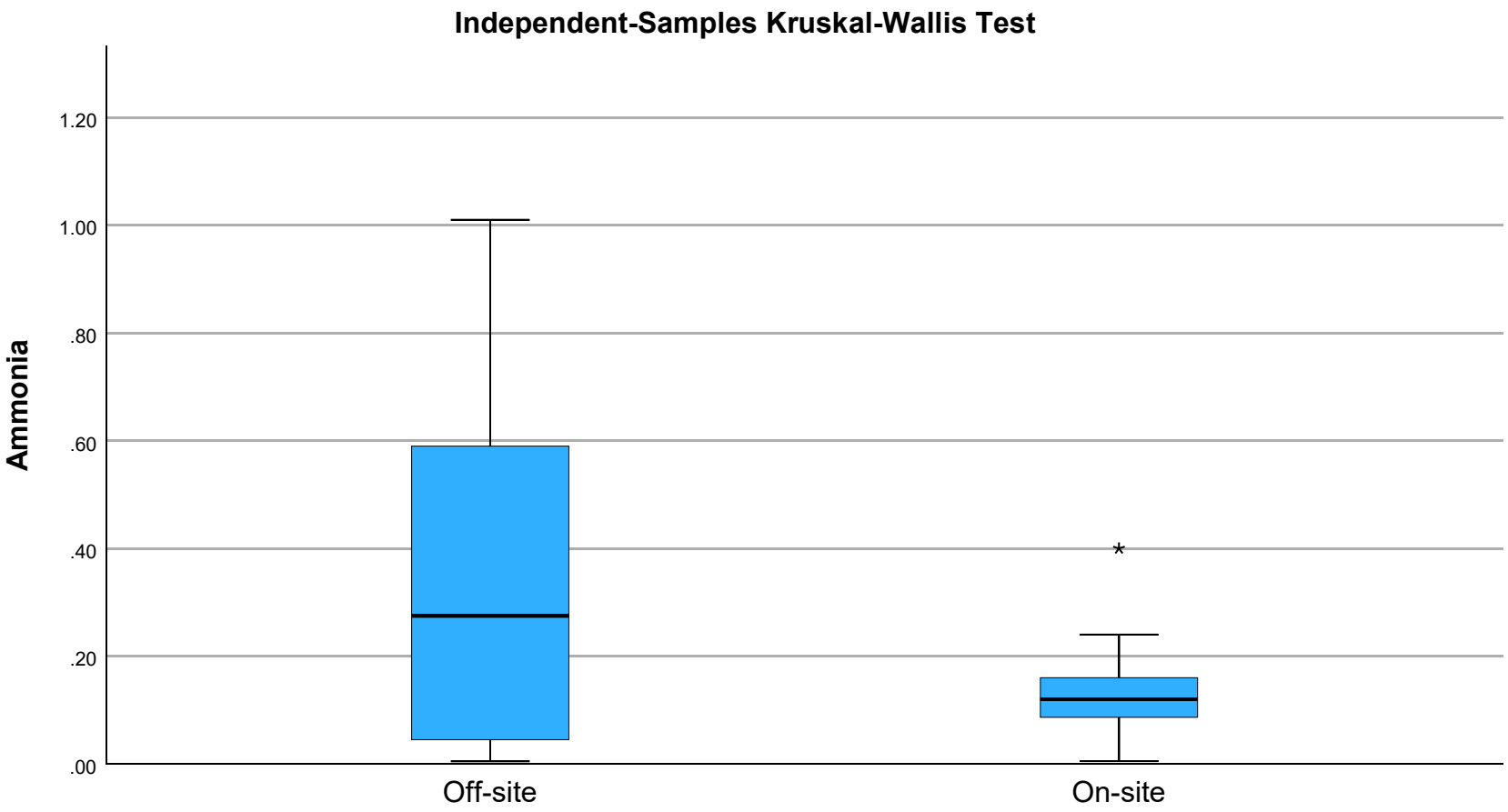
Ammonia across Location of bores

Independent-Samples Kruskal-Wallis Test Summary

Total N	72
Test Statistic	3.818[a,b]
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	.051

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because there are less than three test fields.



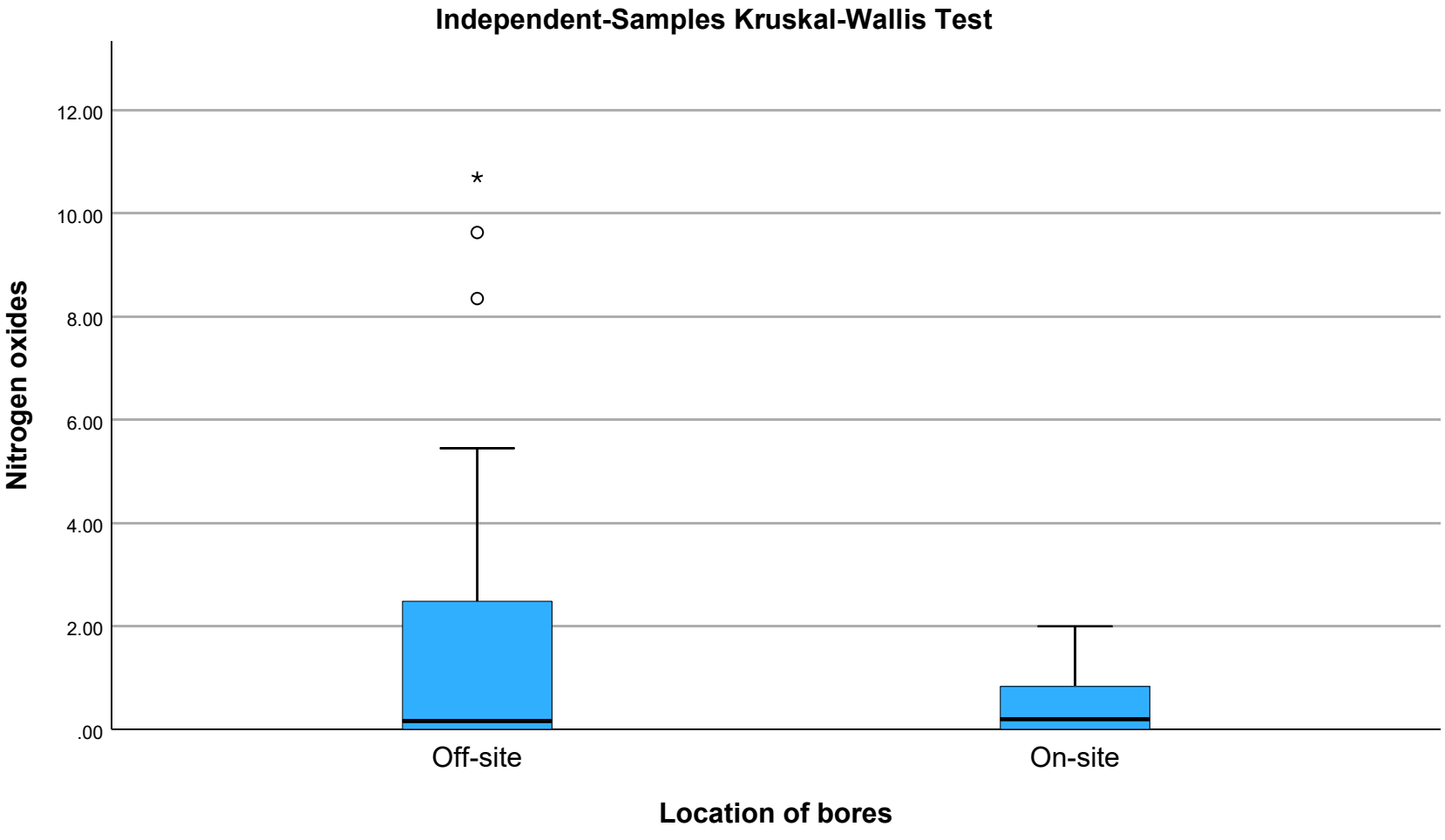
Nitrogen oxides across Location of bores

Independent-Samples Kruskal-Wallis Test Summary

Total N	72
Test Statistic	.932[a,b]
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	.334

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because there are less than three test fields.



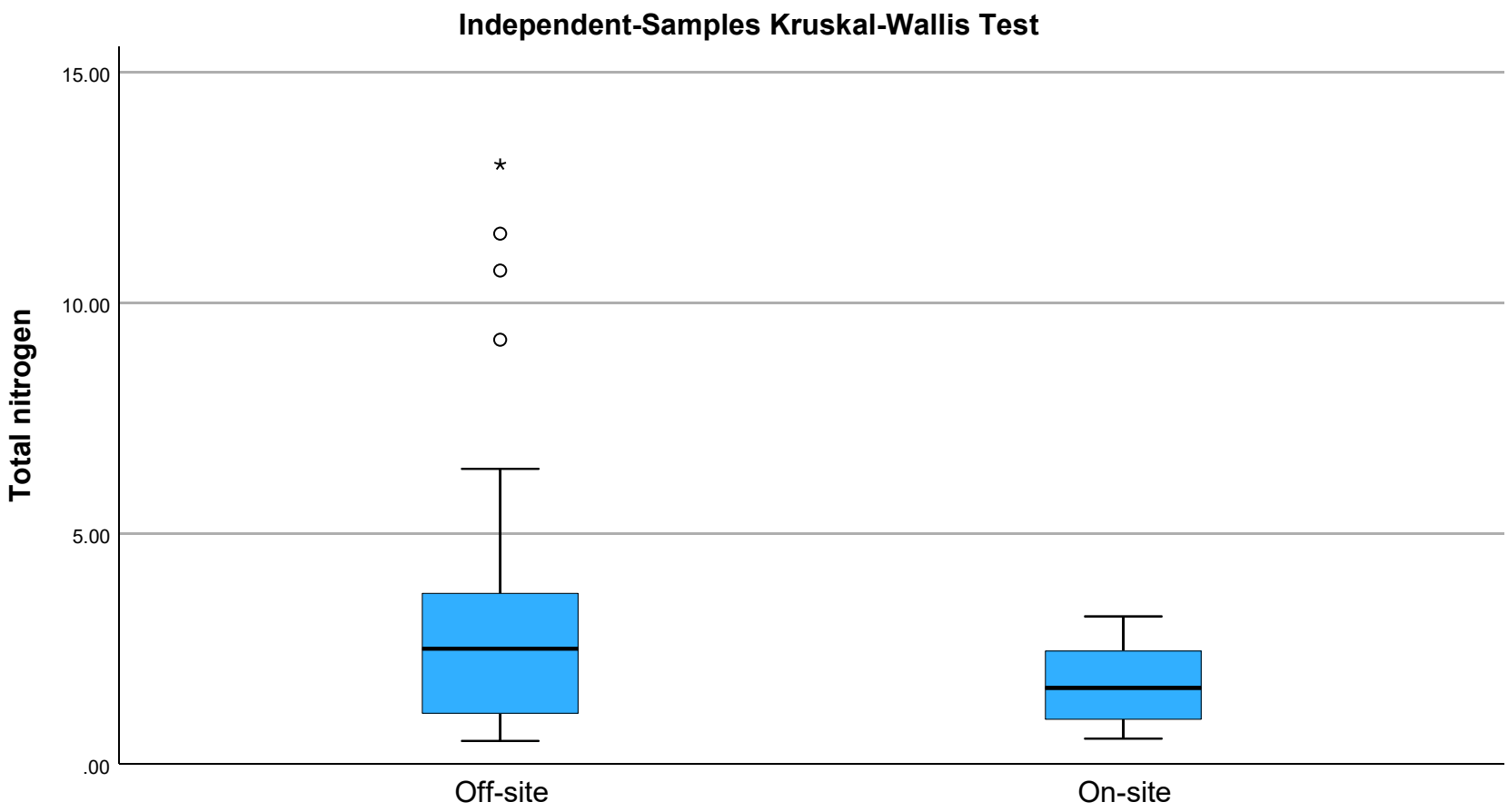
Total nitrogen across Location of bores

Independent-Samples Kruskal-Wallis Test Summary

Total N	72
Test Statistic	3.151[a,b]
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	.076

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because there are less than three test fields.



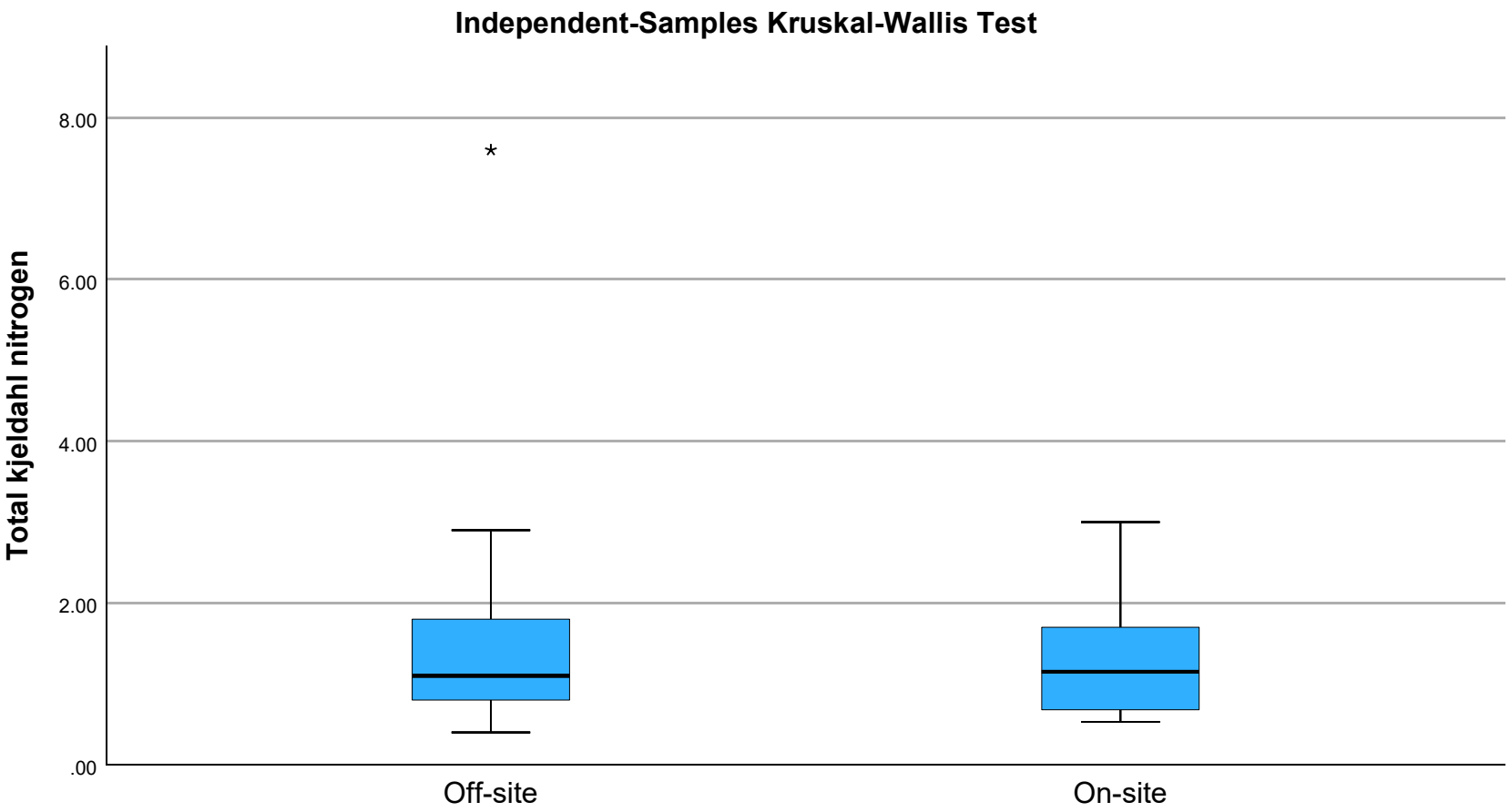
Total kjeldahl nitrogen across Location of bores

Independent-Samples Kruskal-Wallis Test Summary

Total N	72
Test Statistic	.063[a,b]
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	.802

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because there are less than three test fields.



Total phosphorus across Location of bores

Independent-Samples Kruskal-Wallis Test Summary

Total N	72
Test Statistic	.017[a,b]
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	.896

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because there are less than three test fields.

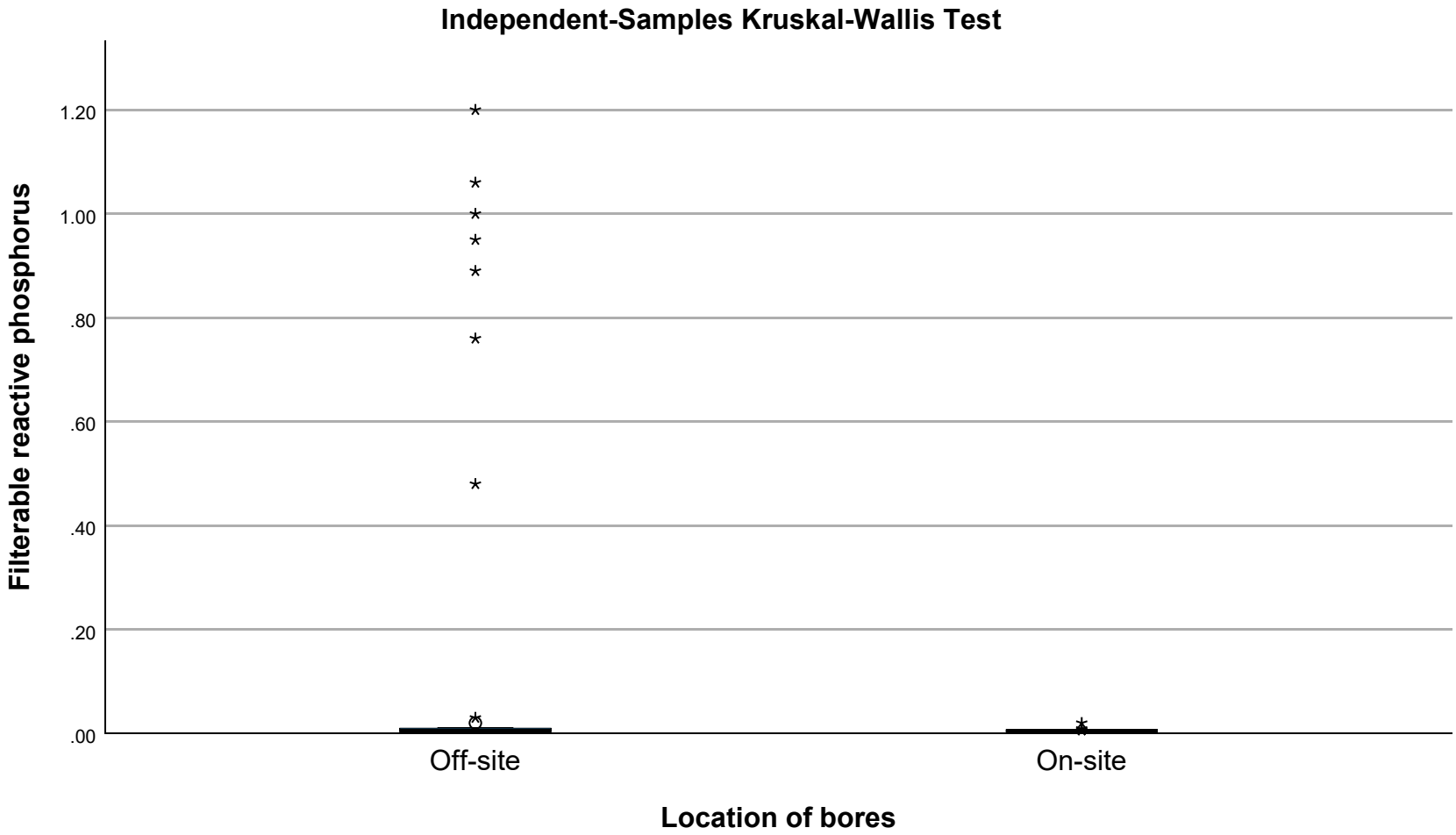
Filterable reactive phosphorus across Location of bores

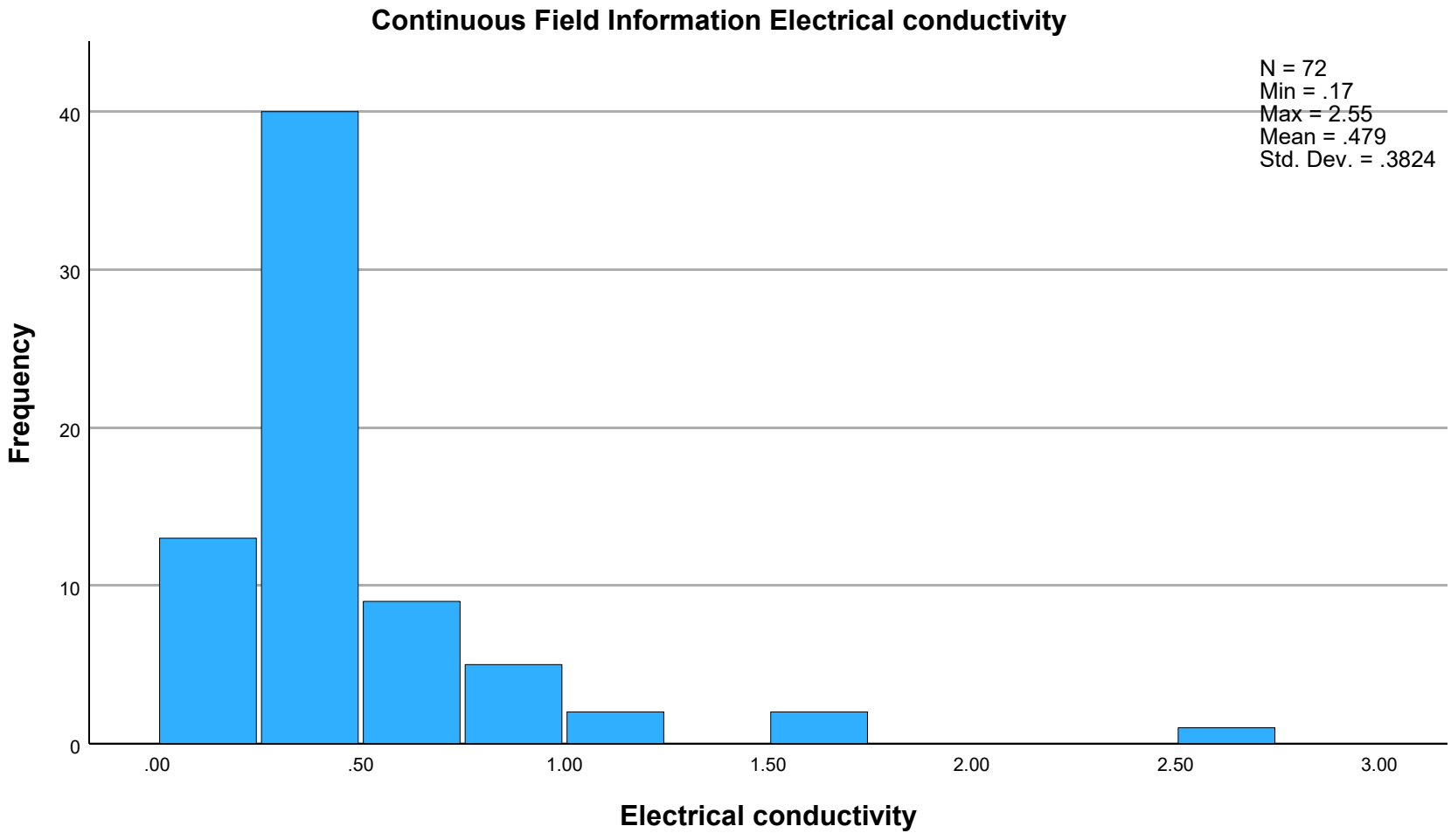
Independent-Samples Kruskal-Wallis Test Summary

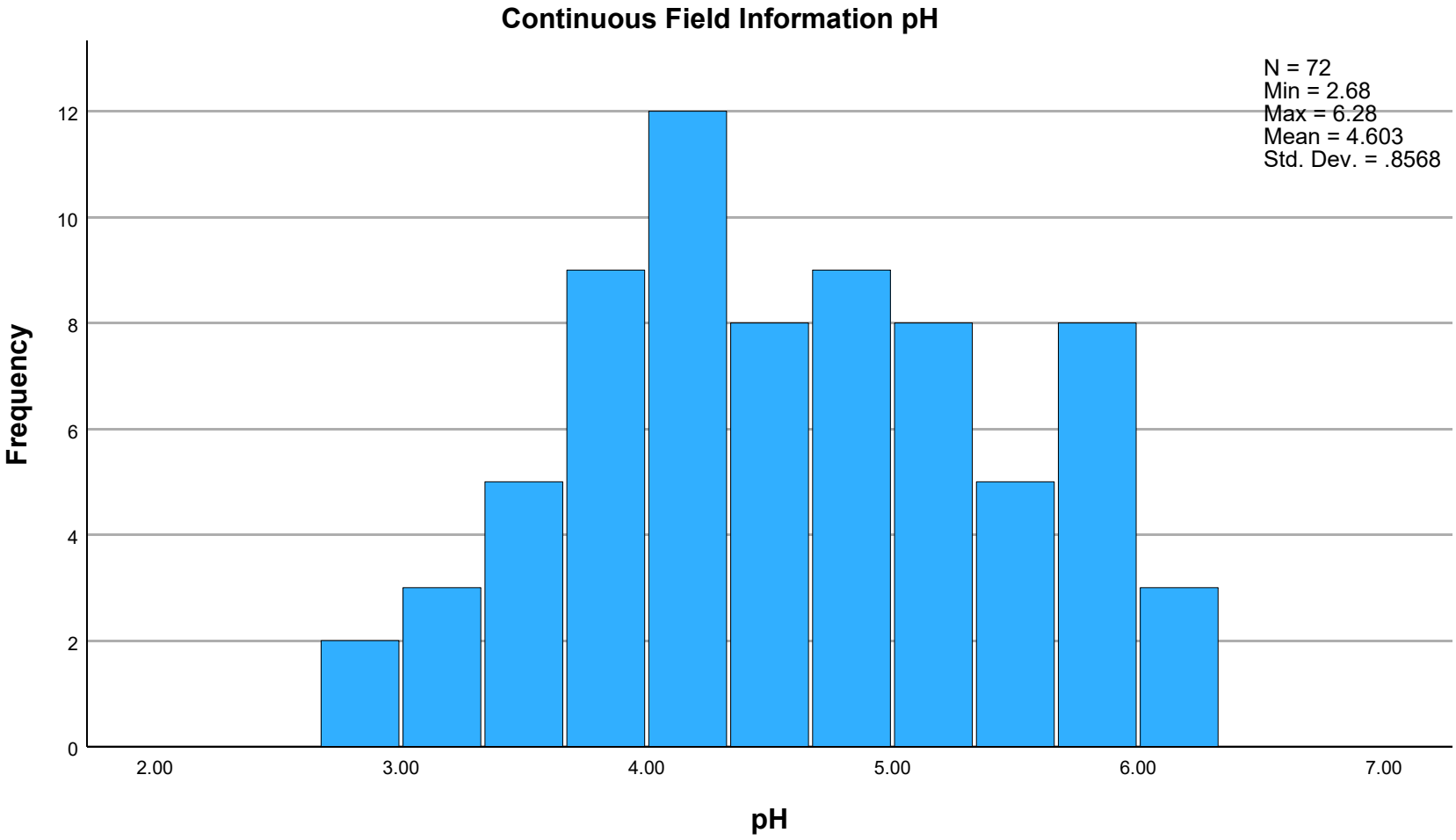
Total N	72
Test Statistic	2.275[a,b]
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	.131

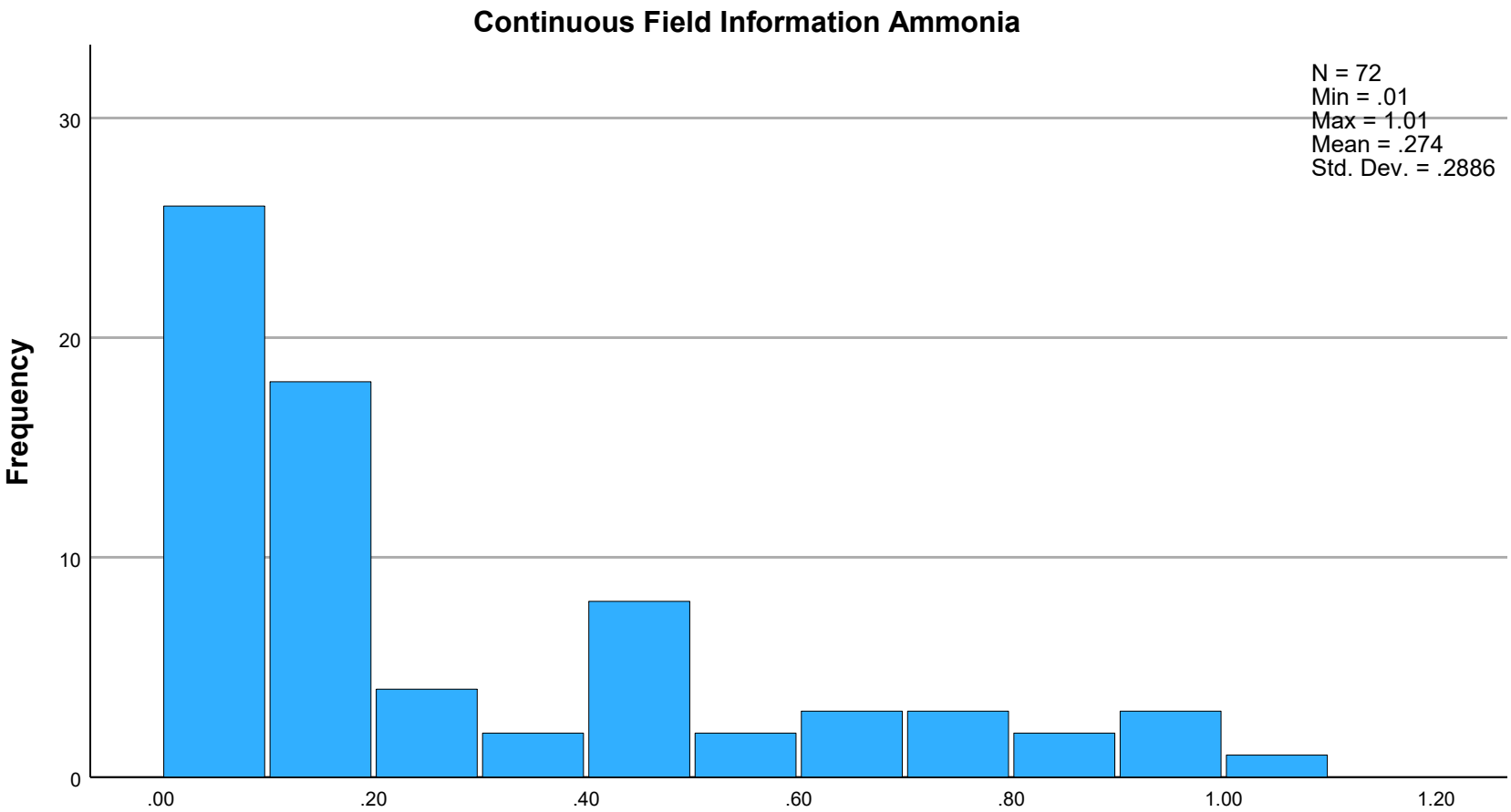
a. The test statistic is adjusted for ties.

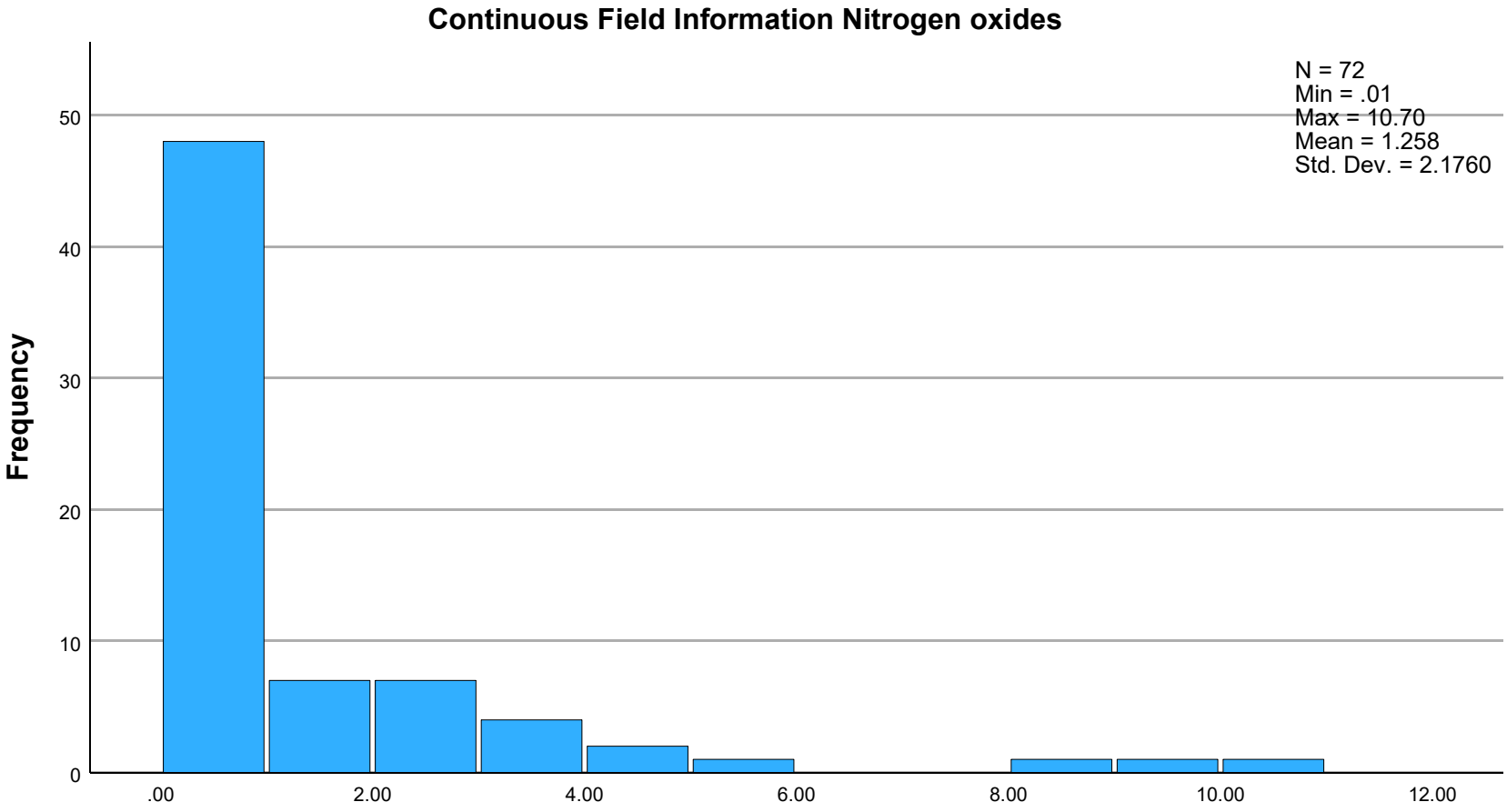
b. Multiple comparisons are not performed because there are less than three test fields.

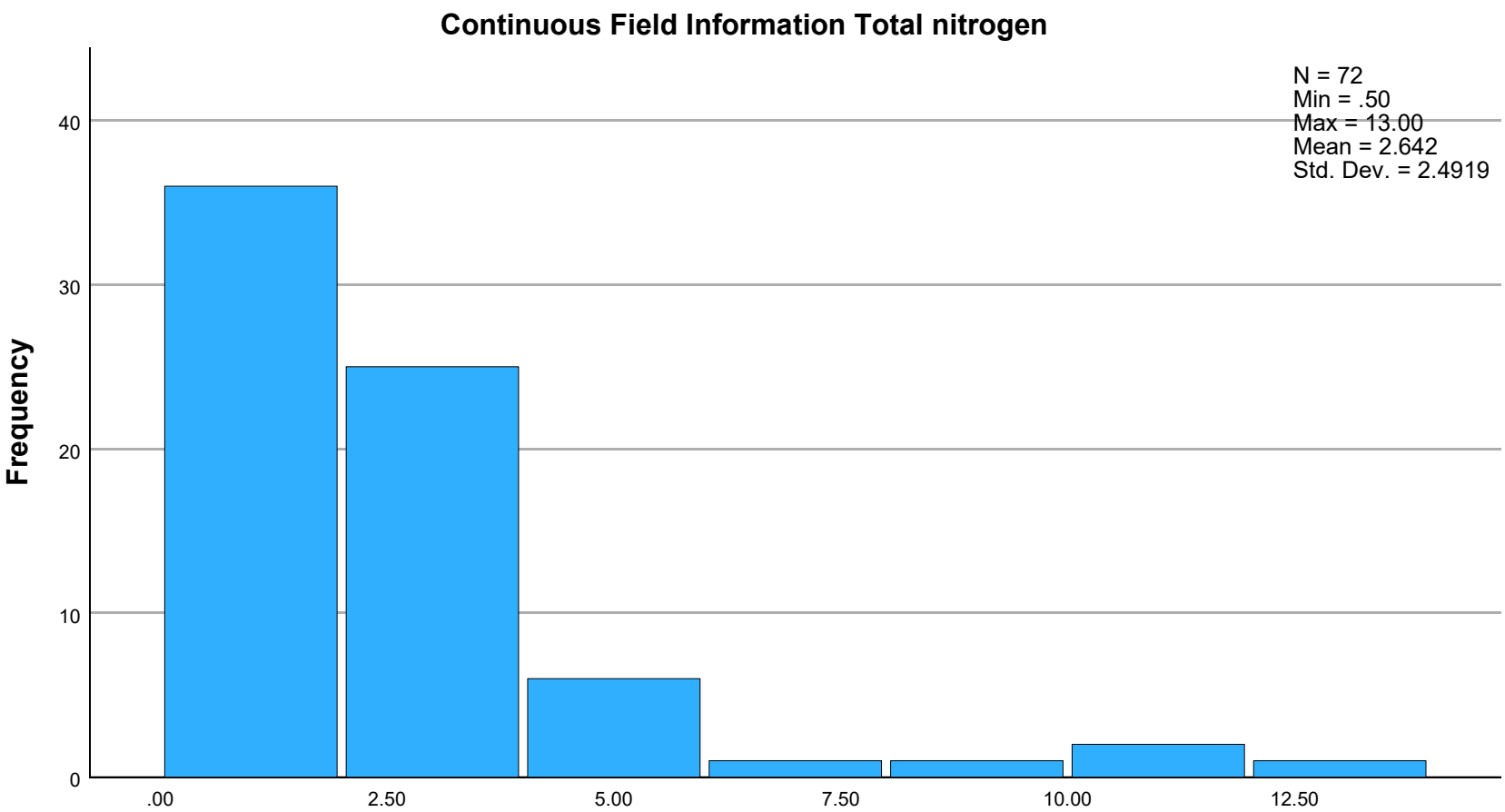


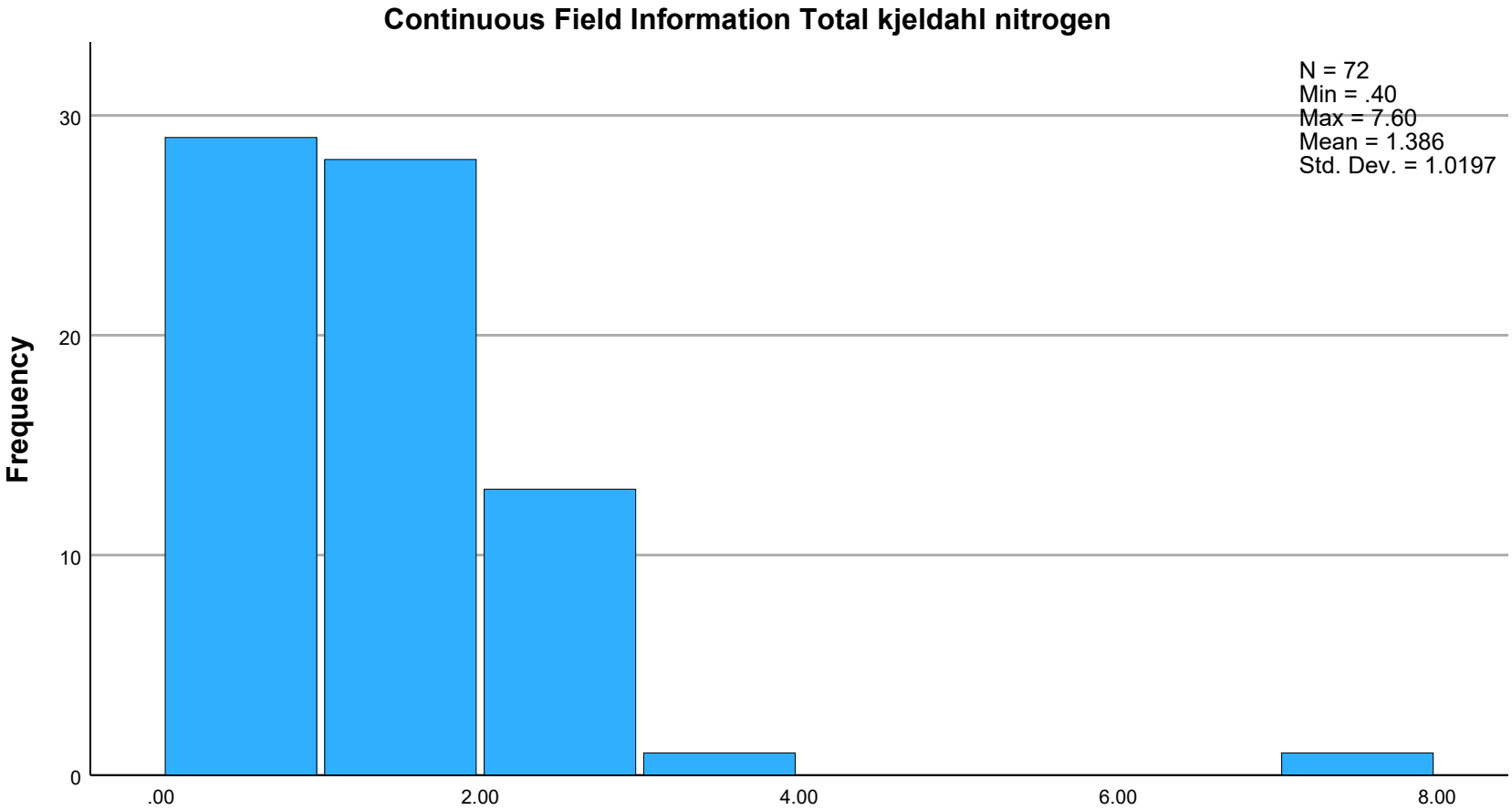


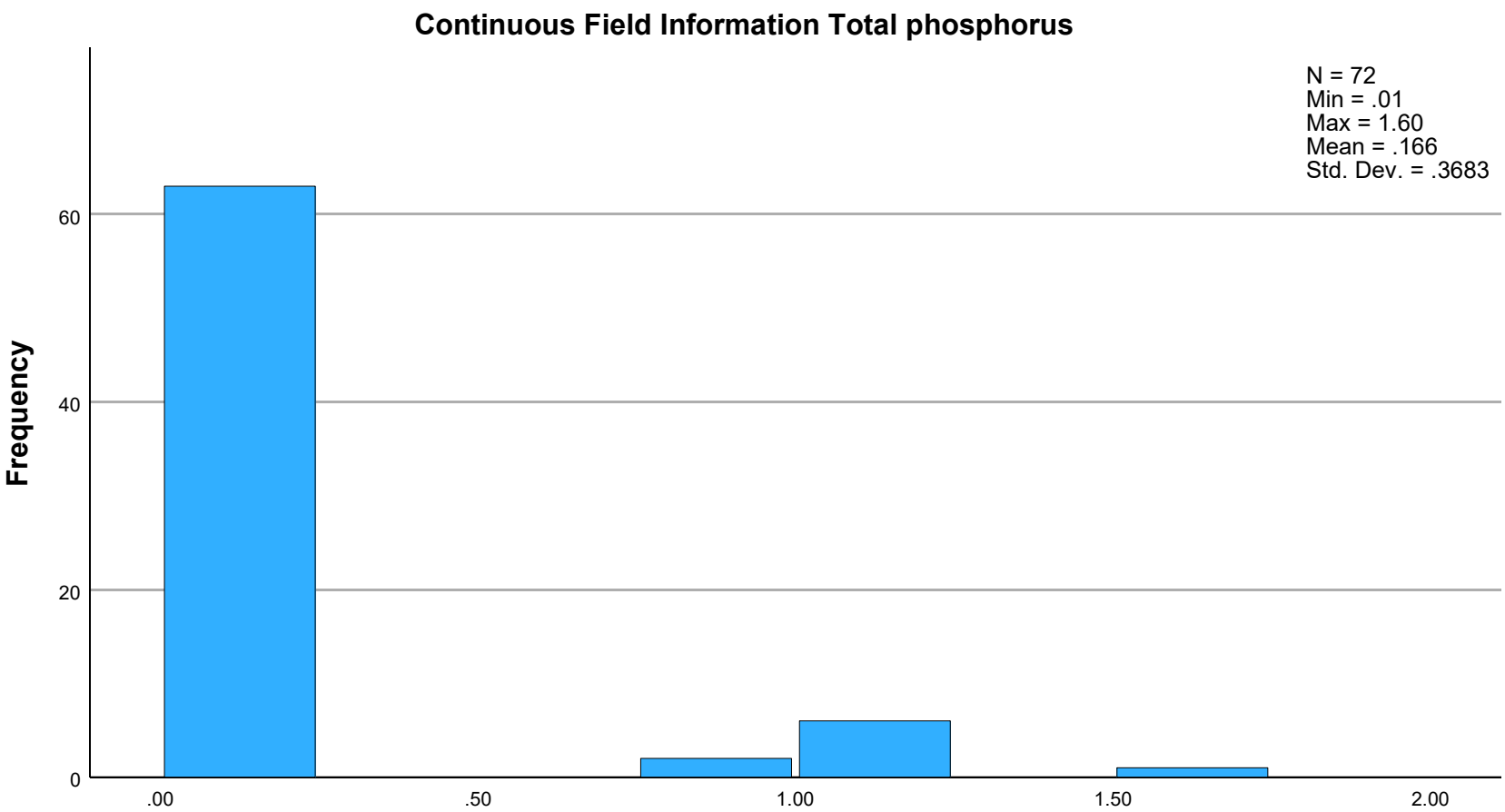

Continuous Field Information pH
N = 72
Min = 2.68
Max = 6.28
Mean = 4.603
Std. Dev. = .8568
Frequency
0
2
4
6
8
10
12
2.00
3.00
4.00
5.00
6.00
7.00
pH

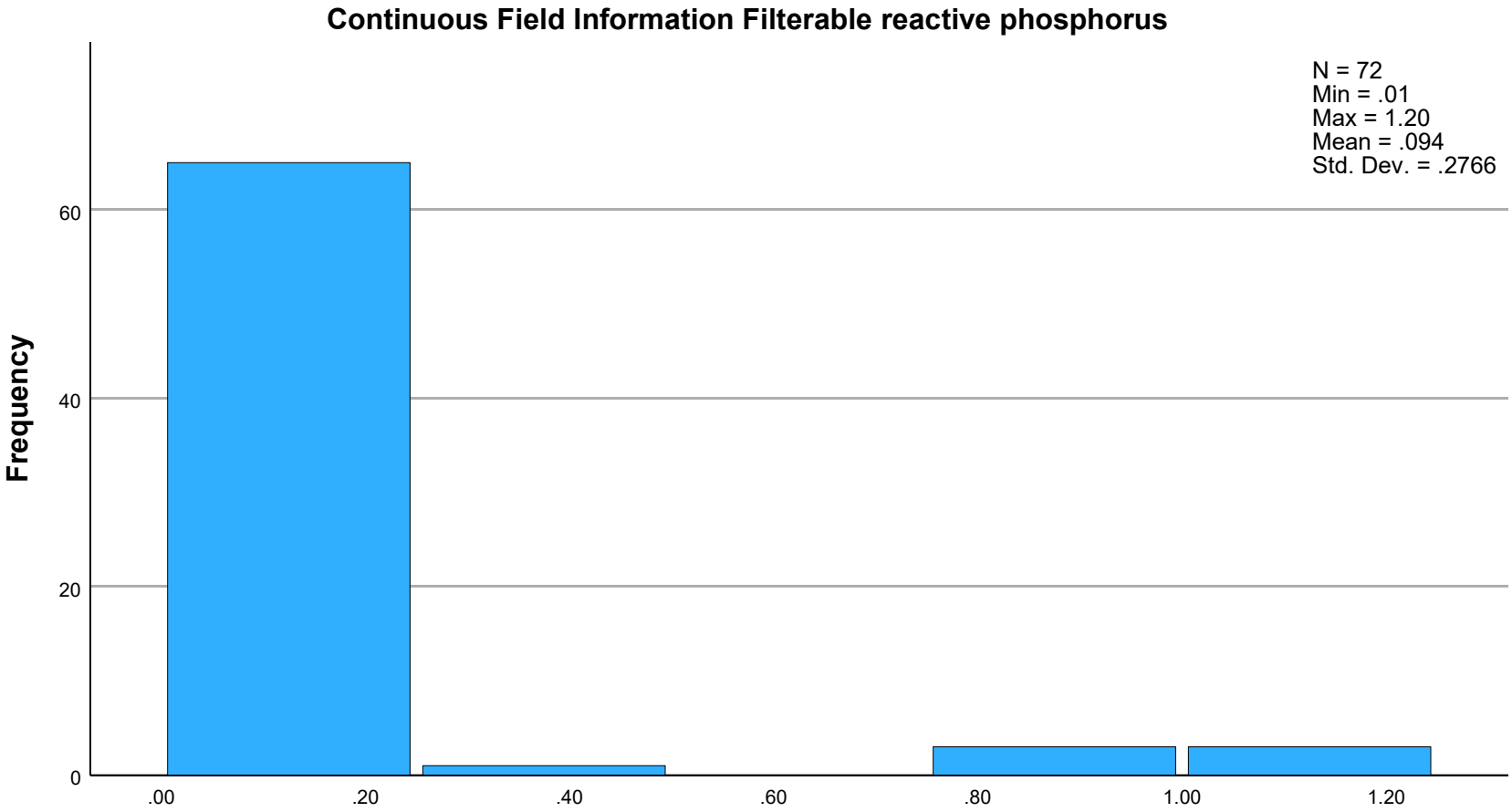

Continuous Field Information Ammonia
N = 72
Min = .01
Max = 1.01
Mean = .274
Std. Dev. = .2886
Frequency
0
10
20
30
.00
.20
.40
.60
.80
1.00
1.20
Ammonia


Continuous Field Information Nitrogen oxides
N = 72
Min = .01
Max = 10.70
Mean = 1.258
Std. Dev. = 2.1760
Frequency
50
40
30
20
10
0
.00
2.00
4.00
6.00
8.00
10.00
12.00
Nitrogen oxides


Continuous Field Information Total nitrogen
N = 72
Min = .50
Max = 13.00
Mean = 2.642
Std. Dev. = 2.4919
Frequency
40
30
20
10
0
.00
2.50
5.00
7.50
10.00
12.50
Total nitrogen


Continuous Field Information Total kjeldahl nitrogen
N = 72
Min = .40
Max = 7.60
Mean = 1.386
Std. Dev. = 1.0197
Frequency
30
20
10
0
.00
2.00
4.00
6.00
8.00
Total kjeldahl nitrogen


Continuous Field Information Total phosphorus
N = 72
Min = .01
Max = 1.60
Mean = .166
Std. Dev. = .3683
Frequency
60
40
20
0
.00
.50
1.00
1.50
2.00
Total phosphorus


Continuous Field Information Filterable reactive phosphorus
N = 72
Min = .01
Max = 1.20
Mean = .094
Std. Dev. = .2766
Frequency
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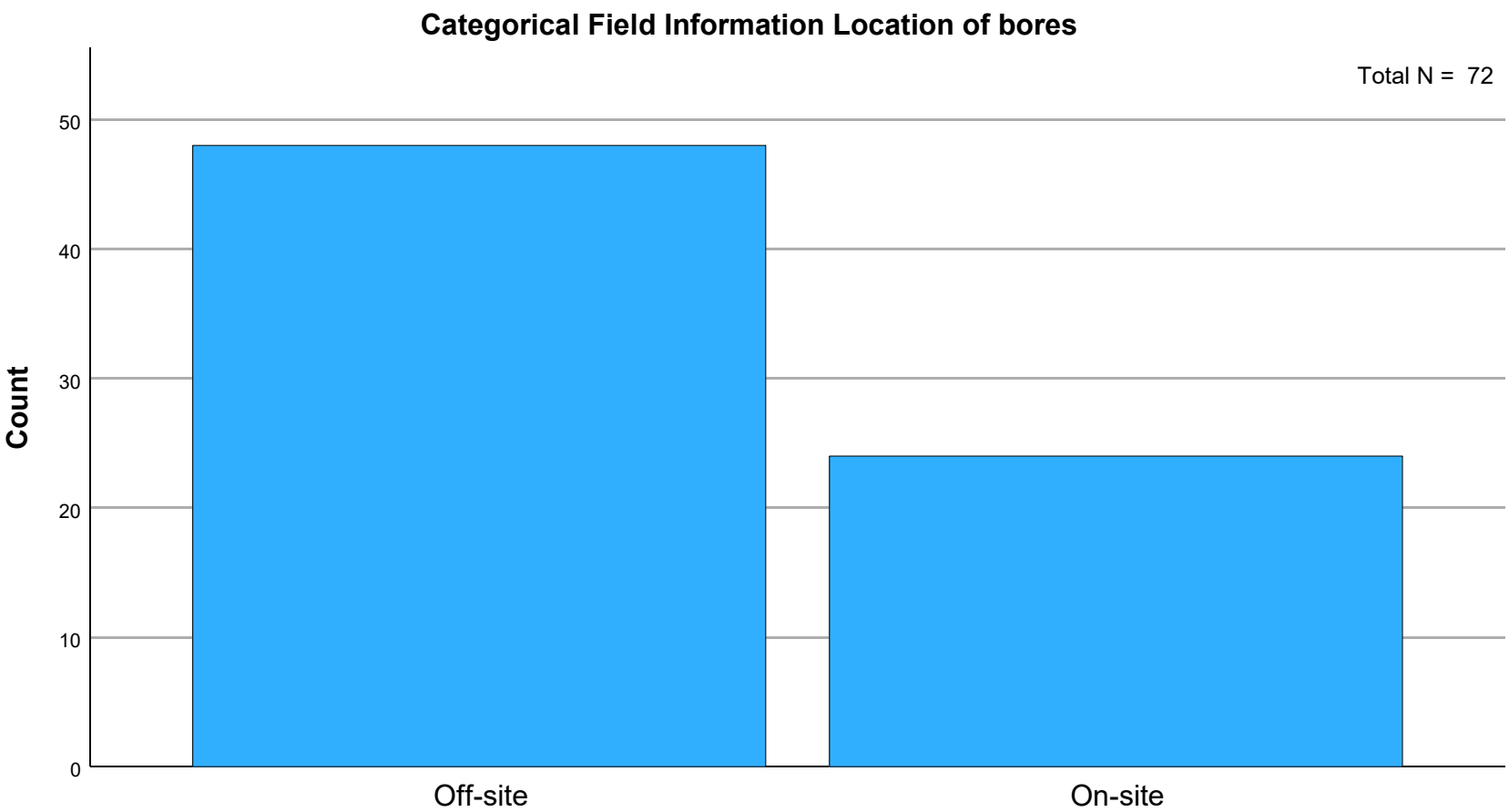
40
20
0
.00
.20
.40
.60
.80
1.00
1.20
Filterable reactive phosphorus


Categorical Field Information Location of bores
Total N = 72
Count
50
40
30
20
10
0
Off-site
On-site
Location of bores

Appendix G
Engineering service report

Cossill & Webley
CONSULTING ENGINEERS

Lot 96 – Starflower Road

Engineering Servicing Report

Henley Brook

11 April 2023

Level 2, 431 Roberts Road,
Subiaco WA 6008.
PO Box 680 Subiaco, WA 6904

T (08) 9422 5800
E admin@cosweb.com.au
W cosweb.com.au

Lot 96 Starflower Road
Henley Brook

11 April 2023

Contents

List of Appendices

1. INTRODUCTION

This is a desktop study of all Engineering related issues pertaining to Lot 96 Starflower Road, Henley Brook. This is provided in response to a request from LWP. The layout of the proposed development is in Appendix A.

Cossill & Webley Pty Ltd (CW) is a Western Australian firm established to provide civil engineering services to the civil infrastructure and urban development industry. CW's resources comprise a team of engineers, designers and draftspersons who are all highly experienced in civil infrastructure and urban development projects and are all based locally in Western Australia.

2. WATER & WASTEWATER

Water Corporation has confirmed that the existing 250mm water main running along Starflower Road is currently at capacity. The upgrade of this water main, to a 500mm main, is in planning (shown in Red in Appendix B) and will be completed at the end of 2023. This new main will provide sufficient water for the development of the development as per Appendix A. The 500mm water main will need to be installed in the Starflower Road reserve and avoid the lot at the corner of Gnangara and Starflower as currently planned otherwise the developability of the southern section of the land may be compromised.

The landholding is within the current Water Corporation wastewater planning, as shown in Appendix B. The landholding grades to the south and will ultimately connect to the proposed gravity sewer in the Henley Brook area. There are several developments commenced and proposed in the Henley Brook area, and there are existing road reserves through the area east of Starflower. It is expected that connection to the existing gravity sewer will be available to the landholding at the time of development.

The sewer pressure mains shown within Lot 600, Appendix B, are not located within that lot. One has been constructed, and is within Starflower Road, the other has not been constructed, and is unlikely to ever be required. These locations are shown indicatively only, however should the remaining sewer ultimately be constructed in its proposed location, it will compromise the developability of Lot 600.

The Water Corporation have established that the Barrambie Wastewater Pump Station will be upgraded. The ultimate size of the Pump Station and associated buffer is shown in Appendix B. This will have some impact to the land at the northern extents by way of a buffer.

3. WESTERN POWER

The current Western Power mapping shows there is a limited capacity within the existing network. The landholding is adjacent to the Henley Brook Substation, and hence feeders to the site are not a significant cost. Western Power may need to carry out a load transfer between the Henley Brook substation and the Beechboro Substation to free up some capacity. The load transfer may also free up an existing HV feeder.

If there is significant increase in demand in the area, say 2 to 3 MVA as one job, then WP will do the upgrade works required to supply that power and charge the Developer full cost for the upgrade.

If adjacent land (east of Starflower) is carried out prior to the development of the landholding, then these upgrade works may be carried out by another party. Western Power will upgrade the Henley Brook Substation as a last resort, and at their own cost.

4. TRAFFIC AND ACCESS

The landholding is bound on the west by Perth-Darwin Highway. This road will not allow access and will require a 5m noise wall to be constructed along the boundary if the landholding is to be used for residential purposes.

The land is bound to the east by Starflower Road. The ultimate traffic volumes of Starflower are approx. 11,800 vehicles per day (vpd) at the northern end and dropping below 5,000vpd at the southern end. In the Local Structure Plan this road is defined as a Neighbourhood Connector A.

Access onto the Neighbourhood Connector A is possible with road connections. The development proposes two T intersection entries from Starflower Road. No direct lot access will be allowed from Starflower Road. Refer to Appendix A for location. For information on the proposed intersections of the development east of Starflower Rd please refer to Appendix D.

There is an existing 3m wide asphalt path in the site at the corner of Gnangara and Starflower that is installed within the site. Refer to the extent of the path shown in Appendix A. The path will need to be removed and reinstalled within the Starflower Road reserve adjacent the proposed Neighbourhood Centre and Commercial lot. The development includes a proposed 4m widening of Starflower Road south of the neighbourhood centre which allows this path to remain on its current location where the road is widened.

5. GEOTECHNICAL

The Geo-mapping identifies the site as Bassendean Sands, overlaying Guilford Clay formation. The depth of the Bassendean sands will be varying and can only be determined with further geotechnical investigation. It is expected that some imported clean fill will be required to facilitate residential development.

The wetlands mapping, as shown in Appendix E, identifies the land as Multiple Use Geomorphic Wetlands. This mapping is not a constraint to development; however, it indicates groundwater close to the surface.

The site does not have any free-flowing outlet for stormwater drainage, and hence the 1%AEP stormwater event will need to be stored on site, through the creation of a drainage swale. Given the existing groundwater is close to the surface, this swale will need to be shallow, and wide, and will result in imported fill requirements beneath the development to lift the levels above the flood tailwater and HGL. Imported fill levels of between 1m to 1.8m may be required at various areas over the landholding.

6. GAS AND COMMUNICATIONS

Gas and Communications are in the surrounding developments around the Landholding, and are not expected to be an impediment to development.

There is an existing High Pressure Gas Main running along Starflower Road, and this will require care during construction. It does not have any restriction to the land uses adjacent to the gas main.

7. CONCLUSION

The landholding is suitable for development, subject to planning over the land, and detailed Engineering design. All services are readily available, and access to the site is good.

There is likely imported fill required, depending on the land use, to develop the site.

Please call Cossill & Webley (Mark Wallis 0438 927 710) with any queries.

Appendix A

Development Plan

N

GNANGARA ROAD

FUTURE SEWER PUMP STATION BUFFER
150m

SERVICE COMMERCIAL
4423m²

25.0 BARRAMBIE WAY

LOT 600

WWPS
LOT 96

NEIGHBOURHOOD CENTRE
1.8ha

STARFLOWER ROAD

16.0

ENTRY

POS / DRAINAGE
1.71ha
(0.91ha trees retained)

LOT 96

14.0

4m

LOT 600

4.0m ROAD WIDENING ALONG STARFLOWER ROAD TO ACCOMMODATE CONSTRUCTED PATH

ENTRY

DRAINAGE
5138m²

HENLEY DRIVE

LOT 96

LEGEND

- SITE AREA
- NET SITE AREA
- PUBLIC OPEN SPACE / DRAINAGE
- PATHS
- RESIDENTIAL
- COMMERCIAL

CADASTRAL INFORMATION
SOURCE: VERIS
YYMMDD: TO BE REVIEWED
DWG REF: TO BE REVIEWED
PROJECTION: PCG84
AERIAL PHOTOGRAPHY
SOURCE: NEARMAP
YYMMDD: 220415

SIZE A3_1:2500

0 metres 25 50 75 100 125

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
A	BASE RD1 035E	230320	TG	TT

CONCEPT DESIGN

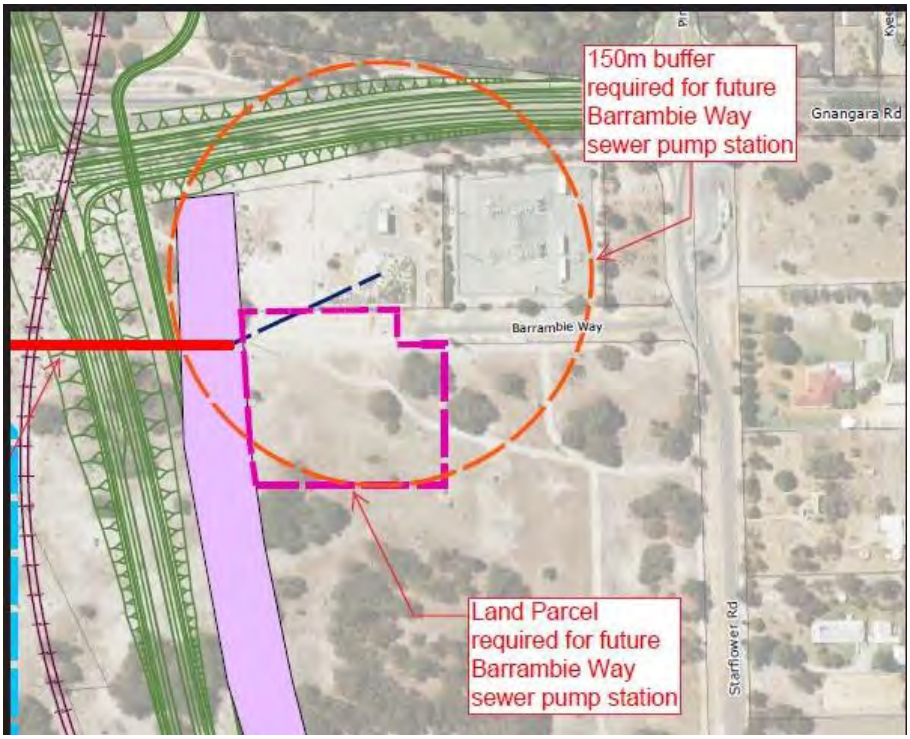
PT Lot 96 Starflower Road, Henley Brook

City of Swan

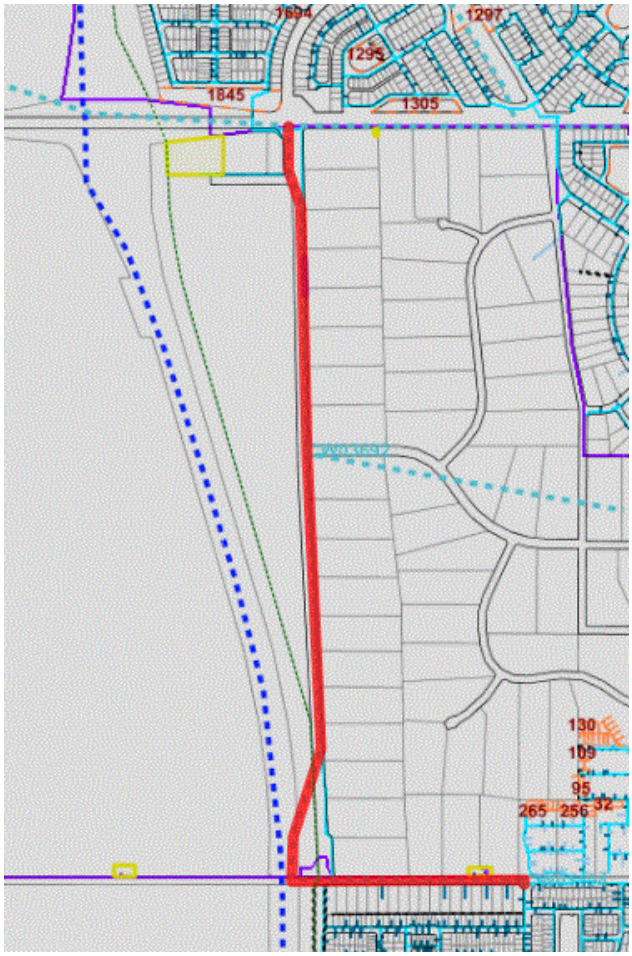
JOB CODE	DRAW NO.	REV.
EJV ELL	**RD1 037**	**A**

Appendix B

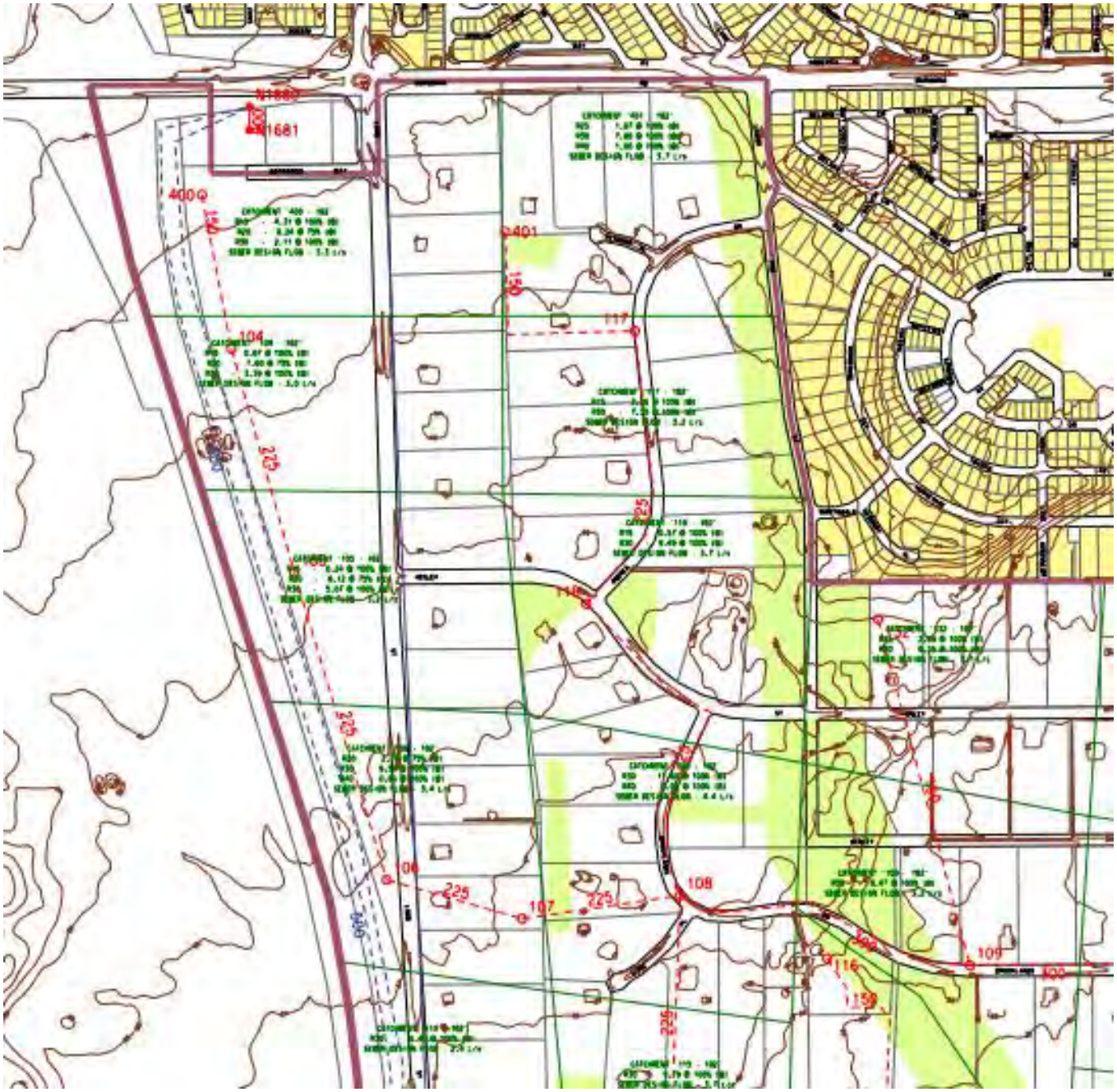
Water Corporation Figures



Pump Station Upgrade



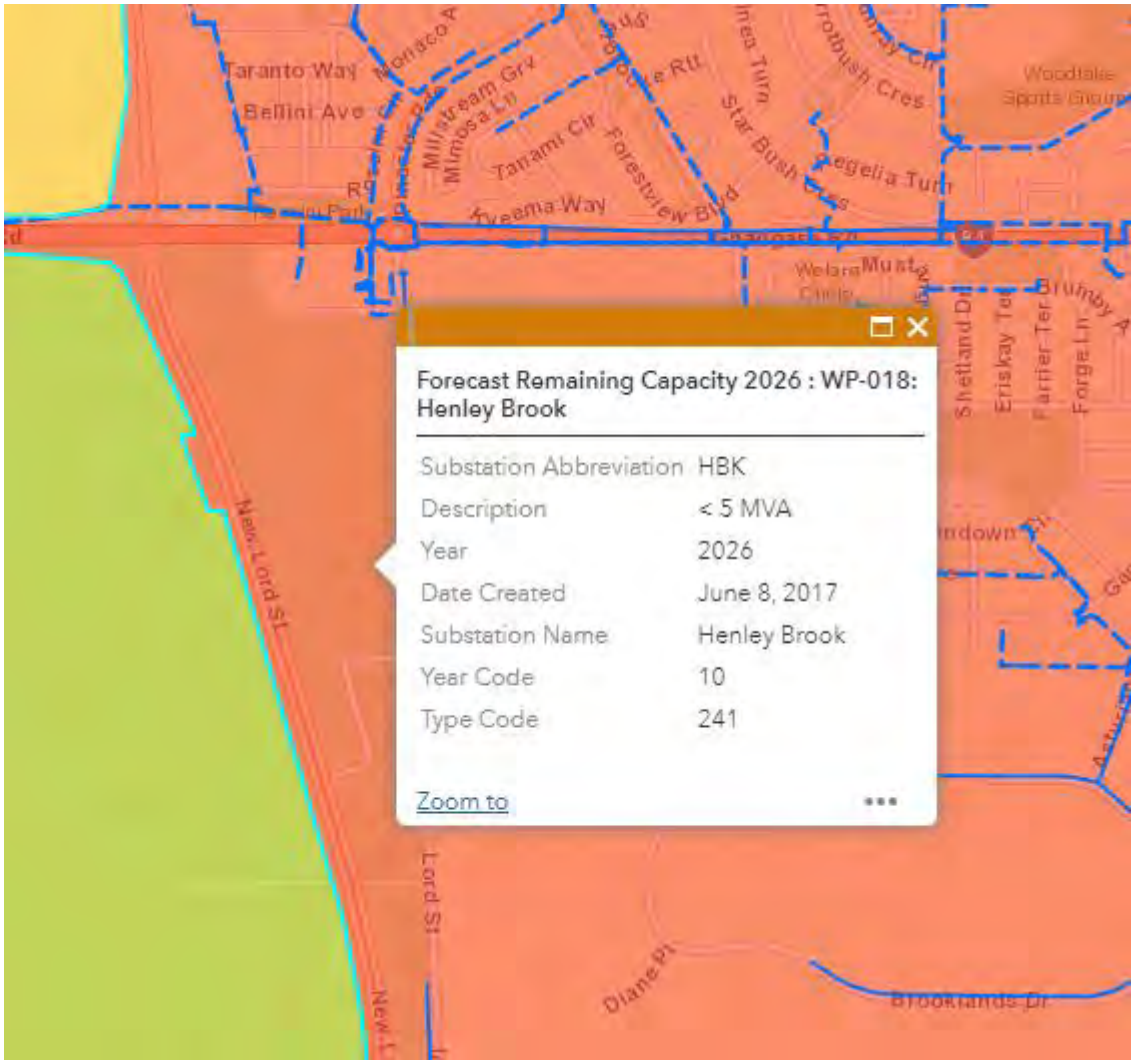
Water Main Upgrade



Wastewater Strategy

Appendix C

Western Power Mapping



Western Power Mapping Tool

Appendix D

Traffic Figures

Affected by SPP5.4 Road & Rail Noise

- Land along northern and western edges (Lots 2, 141-147 & 149-153) located within Other Significant Freight/Traffic Route Trigger Distances (Gnagarra Road & Lord Street)

  Other significant freight/traffic route

  Other significant freight/traffic route trigger

  (NB. Sourced from PlanWA)

- 2019 Transportation Noise Assessment undertaken by Lloyd George Acoustics
- No mitigation requirements identified along Gnagara Road or along New Lord Street alignment within proximity of this land

(NB. Sourced from Emerge Associates – Environmental Assessment & Management Strategy – July 2019)

Traffic Numbers – Ultimate Scenario (HBLSP)

Henley Brook LSP

Purple – signed Left in Left out
Green – signed T intersection
Blue – roundabout

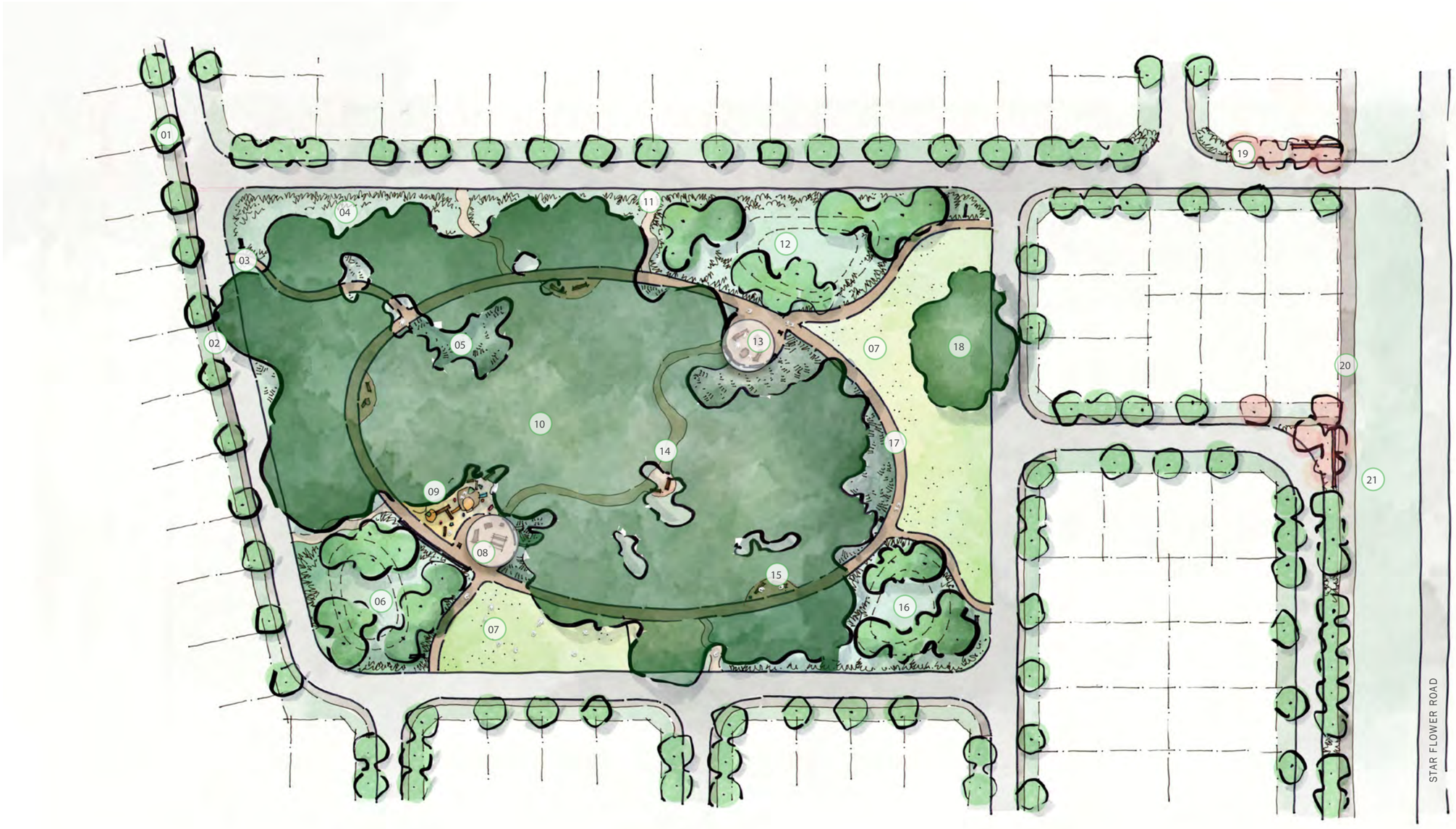
Appendix E

Geotechnical and Levels

Geomorphic Wetland

Appendix H
Landscape plan

01 | CENTRAL PARK SKETCH MASTER PLAN



LEGEND

01 STREET TREE PLANTING (1 PER LOT)

02 1.8m WIDE FOOTPATH AT BACK OF KERB

03 PATH CONNECTION WITH SIGN AT ENTRY TO PARK

04 LOW SHRUB AND GROUND COVER PLANTING TO ROAD EDGE

05 NON IRRIGATED REVEGETATION PLANTING TO EXISTING RETAINED TREES

06 DRAINAGE BASIN B1, FULLY PLANTED WITH REEDS AND SEDGES, LOW SHRUBS & TREES

07 IRRIGATED TURF

08 CIRCULAR SHELTER WITH TABLE & INFORMAL SEATING ELEMENTS

09 SMALL PLAYGROUND WITH EXPLORATORY PLAY ELEMENTS

10 RETAINED EXISTING TREES/WOODLAND

11 INFORMAL PATH ACCESS

12 DRAINAGE BASIN A, FULLY PLANTED WITH REEDS AND SEDGES, LOW SHRUBS & TREES

13 CIRCULAR SHELTER TO GATHERING AREA WITH INFORMAL SEATING ELEMENTS

14 INFORMAL PATH CONNECTION WITH SEATING NODE

15 INFORMAL SEATING NODE WITH NATURAL SEATING ELEMENTS

16 DRAINAGE BASIN B2, FULLY PLANTED WITH REEDS AND SEDGES, LOW SHRUBS & TREES

17 2.4m WIDE PATH

18 RETAINED EXISTING TREES WITH MULCH UNDER

19 PLANTED ENTRY WITH TREE, LOW SHRUB /GROUND COVER PLANTING AND ENTRY WALL

20 EXISTING DUAL USE PATH

21 PLANTED VERGE WITH TREE, LOW SHRUB /GROUND COVER PLANTING AND WALL

PLAN E

LANDSCAPE ARCHITECTS

LEVEL 1 278 RAILWAY PDE WEST LEEDERVILLE WA 6007
T: (08) 9388 9566 E: mail@plane.com.au

MASTER PLAN

LWP PROPERTY GROUP
OCTOBER 2023

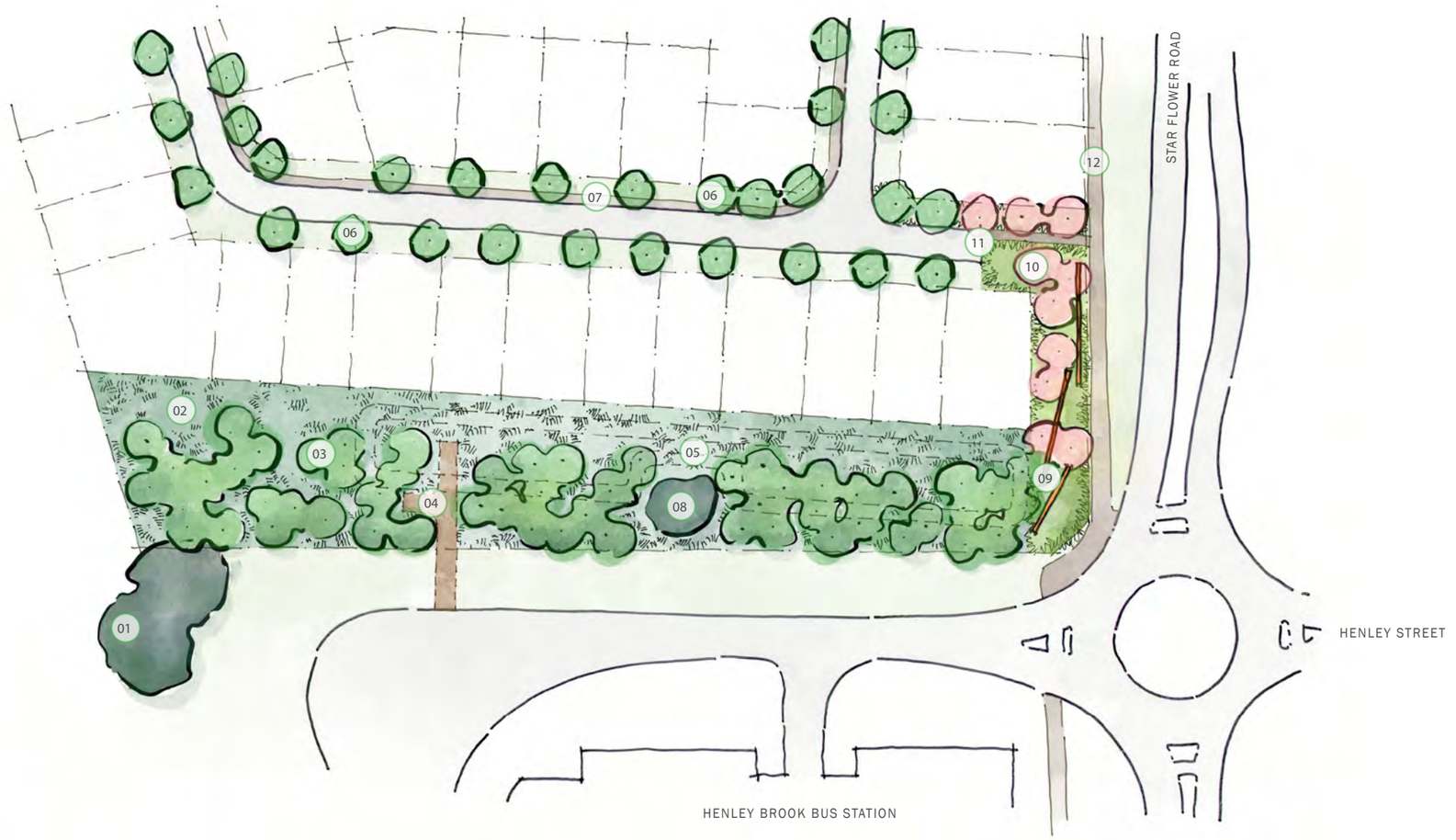
M1.101

REV B
SCALE: 1:1000 @ A3

0 10 20 30 50m

22168 LOT 96 HENLEY BROOK

02 | SOUTH PARK SKETCH MASTER PLAN



LEGEND

01 EXISTING TREES TO BE RETAINED & PROTECTED

02 NON IRRIGATED REVEGETATION PLANTING

03 NON IRRIGATED TREE PLANTING

04 DRAINAGE BASIN MAINTENANCE ACCESS (LOCATION SUBJECT TO COUNCIL & PTA APPROVAL)

05 DRAINAGE BASIN C, FULLY PLANTED WITH REEDS AND SEDGES, LOW SHRUBS & TREES

06 STREET TREE PLANTING (1 PER LOT)

07 1.8m WIDE FOOTPATH AT BACK OF KERB

08 EXISTING TREE TO BE RETAINED & PROTECTED

09 FEATURE ENTRY WALLS WITH ESTATE SIGN

10 FULLY IRRIGATED TREE, LOW SHRUB / GROUND COVER PLANTING

11 PATH CONNECTION

12 EXISTING DUAL USE PATH

PLAN E

LANDSCAPE ARCHITECTS

LEVEL 1 278 RAILWAY PDE WEST LEEDERVILLE WA 6007
T: (08) 9388 9566 E: mail@plane.com.au

MASTER PLAN

LWP PROPERTY GROUP
OCTOBER 2023

M1.102

REV B
SCALE: 1:1000 @ A3

0 10 20 30 50m

22168 LOT 96 HENLEY BROOK

Appendix I
Engineering plans

STARFLOWER ROAD

DRUMPELLIER DRIVE

BARRAMBIE WAY

SERVICE COMMERCIAL

NEIGHBOURHOOD CENTRE

POS

POS

TYPICAL CUT SECTION FOR LOTS IN LIMESTONE AREAS

SCALE: N.T.S

TYPICAL FILL SECTION FOR LOTS IN SAND AREAS

SCALE: N.T.S

LEGEND

DESCRIPTION	SYMBOL
LIMIT OF WORKS BOUNDARY	
FINISHED SURFACE CONTOUR MAJOR	25.0
FINISHED SURFACE CONTOUR MINOR	25.1
EXISTING SURFACE CONTOUR MAJOR	25.0
EXISTING SURFACE CONTOUR MINOR	25.1
FUTURE SURFACE CONTOUR MAJOR	25.0
FUTURE SURFACE CONTOUR MINOR	25.1
FINISHED LOT PAD LEVEL	25.00
FINISHED LOT SPOT LEVEL	+25.00
PROPOSED RETAINING WALL	
EXISTING RETAINING WALL	
FUTURE RETAINING WALL	
BUILDING SETBACK LINE	

NOTES

1. ALL LEVELS IN METRES TO AHD. SURVEY BY VERIS.
2. BATTERS TO EXISTING SURFACE AT 1:4 (CUT) 1:4 (FILL) UNLESS NOTED OTHERWISE.
3. BATTER POSITION FOR FUTURE WALLS TO ENSURE CUT TO FILL EARTHWORKS BALANCE.
4. ALL UNSUITABLE MATERIAL TO BE REMOVED BY THE CONTRACTOR TO APPROVED TIPPING SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION. ALL FEES TO BE PAID BY CONTRACTOR.
5. EXTENT OF CLEARING AND EARTHWORKS TO BE LIMITED TO THE STAGE CLEARING BOUNDARY UNLESS AGREED WITH THE SUPERINTENDENT.
6. ALL CLEARED MATERIAL TO BE MULCHED AND STOCKPILED ON SITE AS DIRECTED BY THE SUPERINTENDENT.
7. CONTRACTOR TO LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS ON SITE.
8. CONTRACTOR TO GRADE EVENLY BETWEEN DESIGN CONTOURS AND MATCH INTO EXISTING SURFACE AT LIMIT OF EARTHWORKS BOUNDARY WHERE APPROPRIATE.
9. EXCESS CUT FROM EARTHWORKS SHALL BE PLACED ON SITE AS DIRECTED BY THE SUPERINTENDENT.
10. WHERE LIMESTONE IS WITHIN 600mm OF THE FINAL SURFACE LEVEL THE CONTRACTOR SHALL TREAT THE SITE IN ACCORDANCE WITH THE SPECIFICATION.
11. DESIGN LEVELS SHOWN SHALL BE ON THE FINISHED SURFACE INCLUDING TOPSOIL WHERE SPECIFIED.
12. THE CONTRACTOR SHALL LIMIT THE MOVEMENT OF EQUIPMENT AND MANPOWER TO THE MINIMUM AREA NECESSARY AND PROTECT ALL VEGETATION AND EXISTING SERVICES ON SITE.
13. ADJACENT RESIDENTS TO BE NOTIFIED OF THE WORKS AT LEAST TWO WEEKS IN ADVANCE. CONTRACTOR TO PROVIDE MOBILE NUMBER FOR SUPERVISOR AS PART OF NOTIFICATION.

REV	DATE	DRN	CKD	APP	AMENDMENT
A	01.09.23	XXX	MH		ISSUED FOR APPROVAL

N

BEFORE YOU DIG www.byda.com.au

1:1000 0m 20 40 60

Cossill & Webley CONSULTING ENGINEERS

Mailing Address
PO Box 680
Subiaco WA 6904

Street Address
B12 (Level 2) 431 Roberts Road
Subiaco WA 6008

T (08) 9422 5800 F (08) 9422 5801 E admin@cosweb.com.au

CLIENT: ELLENBROOK MAMNAGEMENT PTY. LTD.

APPROVED

DESIGNED: HVD

SCALE: 1:1000

PROJECT: HENLEY BROOK - LOT 96 - STAGE 00

TITLE: EARTHWORKS PLAN SHEET 1 OF 1

WAPC No. ...

DRAWING No. 6488-00-200

REVISION A

ORIGINAL SIZE A1

P:\6488 Henley Brook\6488-00\Acad\6488-00-200.dwg, 1/09/2023 11:27:03 AM, hamv, Digital Signing PDF pc3, 1:1, - CW Reference