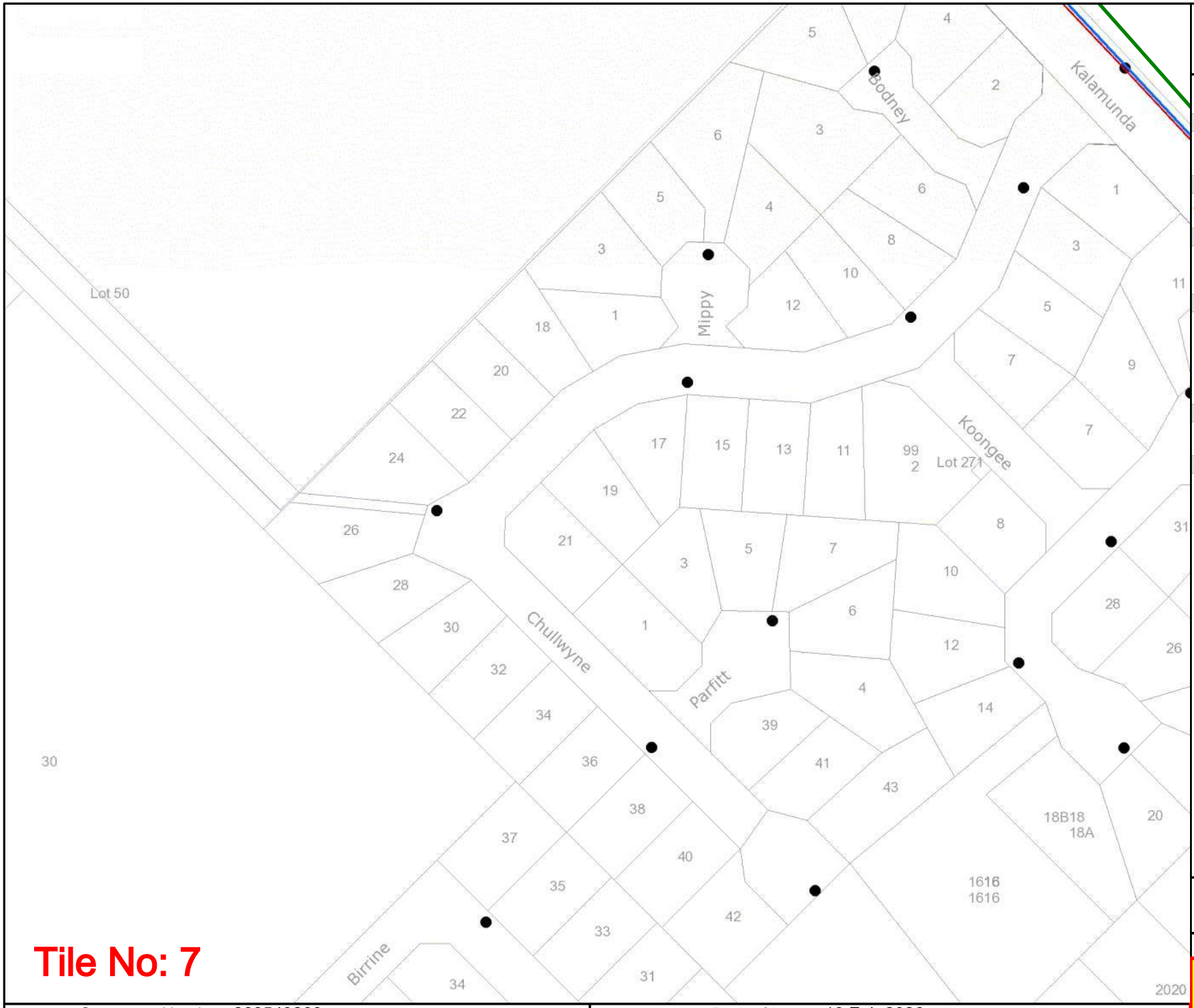
This report only relates to the advertising of the Hatch Court Light Industrial Area, all references contained in this report to the Stirling Crescent Precinct should therefore be disregarded.



Tile No: 7

westernpower

OVERHEAD LEGEND

Structures

- Power Pole
- Transmission Poles

Transmission Overhead Powerline

- Transmission (33kV - 330kV)

Distribution Overhead Powerline

- High Voltage (1kV - 33kV)
- Low Voltage (< 1kV)

Proposed Construction Assets

- Design Area *
- High Voltage Overhead Powerline
- Low Voltage Overhead Powerline
- Power Pole

Communications Assets

- Overhead Pilot Cable

Feature

- Area of Interest

*** Please refer to coversheet**

Privately owned cables NOT SHOWN (including house services)

This map is INDICATIVE ONLY. Check that you have enough clearance from the DANGER ZONES near overhead powerlines.

Telephone Support: 1300 769 345
Mon to Fri - 08:00 to 16:30

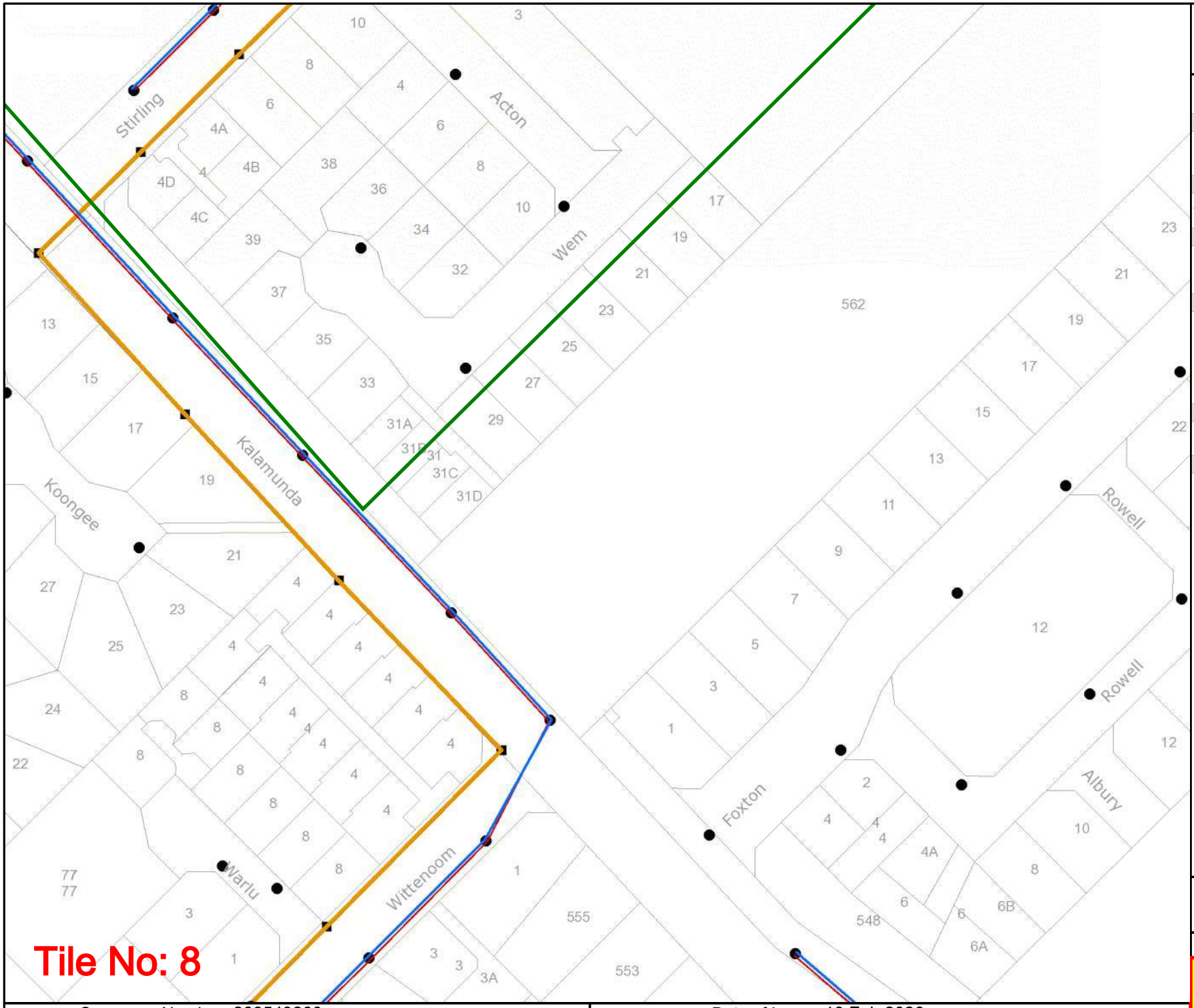
Information valid for 30 days from date of issue

A4	Scale : 1:1500

WARNING! Look out for overhead power lines

Sequence Number: 268549260

Date of Issue: 19 Feb 2026



westernpower

OVERHEAD LEGEND

Structures

- Power Pole
- Transmission Poles

Transmission Overhead Powerline

- Transmission (33kV - 330kV)

Distribution Overhead Powerline

- High Voltage (1kV - 33kV)
- Low Voltage (< 1kV)

Proposed Construction Assets

- Design Area *
- High Voltage Overhead Powerline
- Low Voltage Overhead Powerline
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Communications Assets

- Overhead Pilot Cable

Feature

- Area of Interest

*** Please refer to coversheet**

Privately owned cables NOT SHOWN (including house services)

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Mon to Fri - 08:00 to 16:30

Information valid for 30 days from date of issue

A4	Scale : 1:1500

WARNING! Look out for overhead power lines

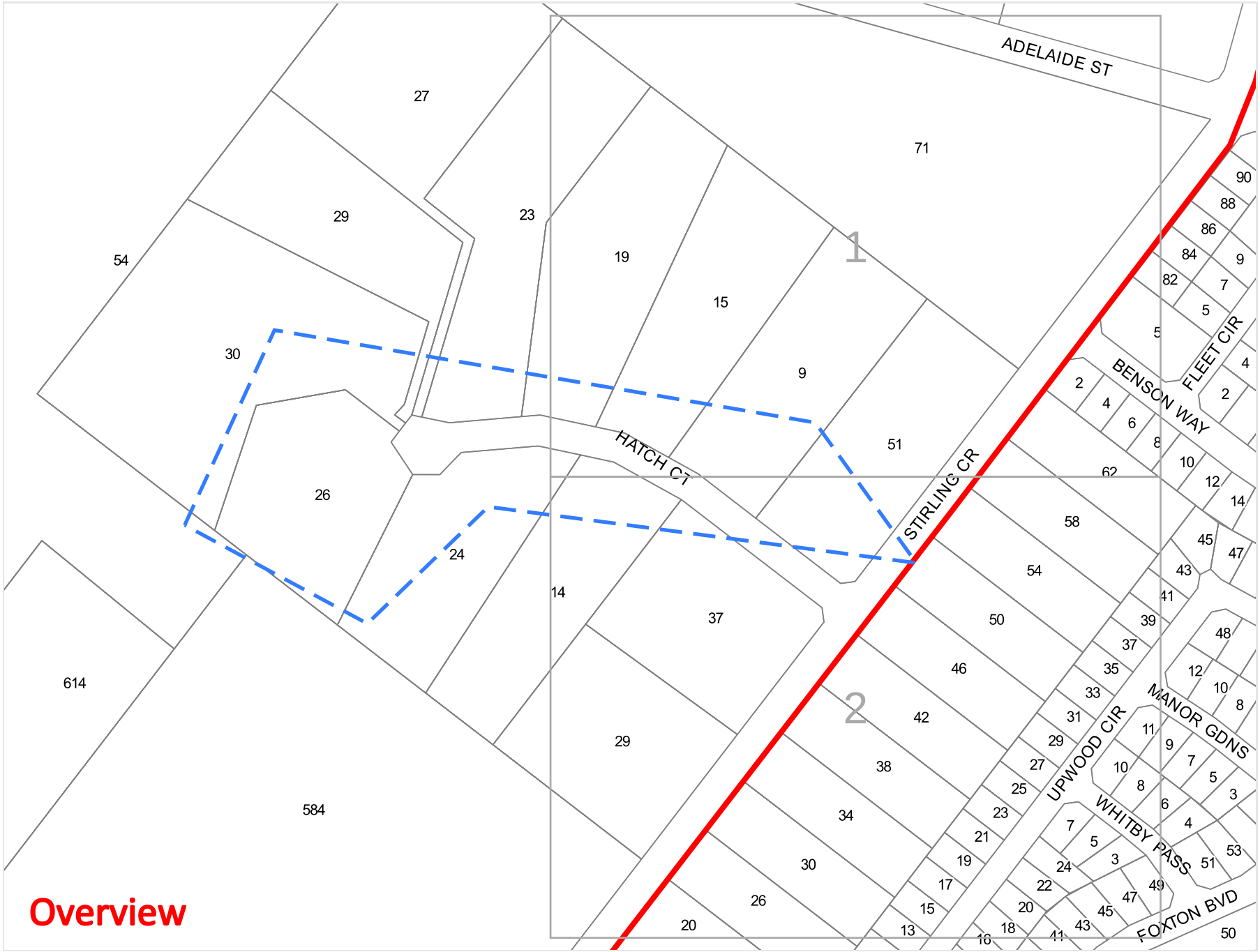
Sequence Number: 268549260

Date of Issue: 19 Feb 2026

aarnet
Australia's Academic and Research Network

Sequence No: 268596027
Job No: 52433030
Location: 24 Hatch Court, High Wycombe, WA 6057

BEFORE YOU DIG www.byda.com.au



Overview

Legend

- Enquiry Area
- AARNet Fibre Optic Assets
- AARNet Power Assets
- Cadastre

N

Scale: 1:3075
Expires: 20 Mar 2026

DISCLAIMER: While reasonable measures have been taken to ensure the accuracy of the information contained in this plan response, neither AARNet nor PelicanCorp shall have any liability whatsoever in relation to any loss, damage, cost or expense arising from the use of this plan response or the information contained in it or the completeness or accuracy of such information. Use of such information is subject to and constitutes acceptance of these terms.

aarnet
Australia's Academic and Research Network

Sequence No: 268596027
Job No: 52433030
Location: 24 Hatch Court, High Wycombe, WA 6057

BEFORE YOU DIG www.byda.com.au



Legend

- Enquiry Area
- AARNet Fibre Optic Assets
- AARNet Power Assets
- Cadastre

N

Scale: 1:1500
Expires: 20 Mar 2026

DISCLAIMER: While reasonable measures have been taken to ensure the accuracy of the information contained in this plan response, neither AARNet nor PelicanCorp shall have any liability whatsoever in relation to any loss, damage, cost or expense arising from the use of this plan response or the information contained in it or the completeness or accuracy of such information. Use of such information is subject to and constitutes acceptance of these terms.

aarnet
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Sequence No: 268596027
Job No: 52433030
Location: 24 Hatch Court, High Wycombe, WA 6057

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Legend

- Enquiry Area
- AARNet Fibre Optic Assets
- AARNet Power Assets
- Cadastre

N

Scale: 1:1500
Expires: 20 Mar 2026

DISCLAIMER: While reasonable measures have been taken to ensure the accuracy of the information contained in this plan response, neither AARNet nor PelicanCorp shall have any liability whatsoever in relation to any loss, damage, cost or expense arising from the use of this plan response or the information contained in it or the completeness or accuracy of such information. Use of such information is subject to and constitutes acceptance of these terms.

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BEFORE YOU DIG www.byda.com.au

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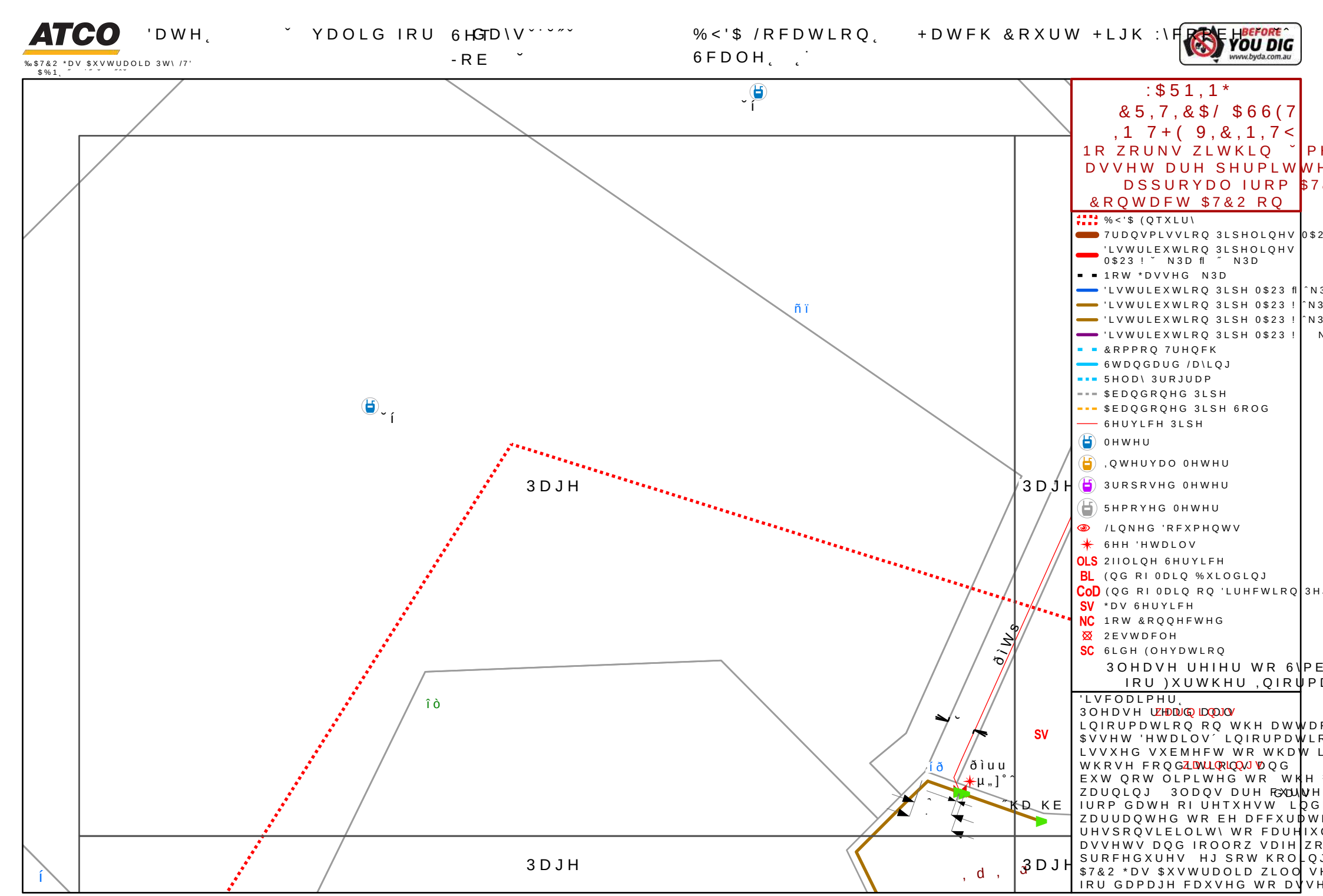
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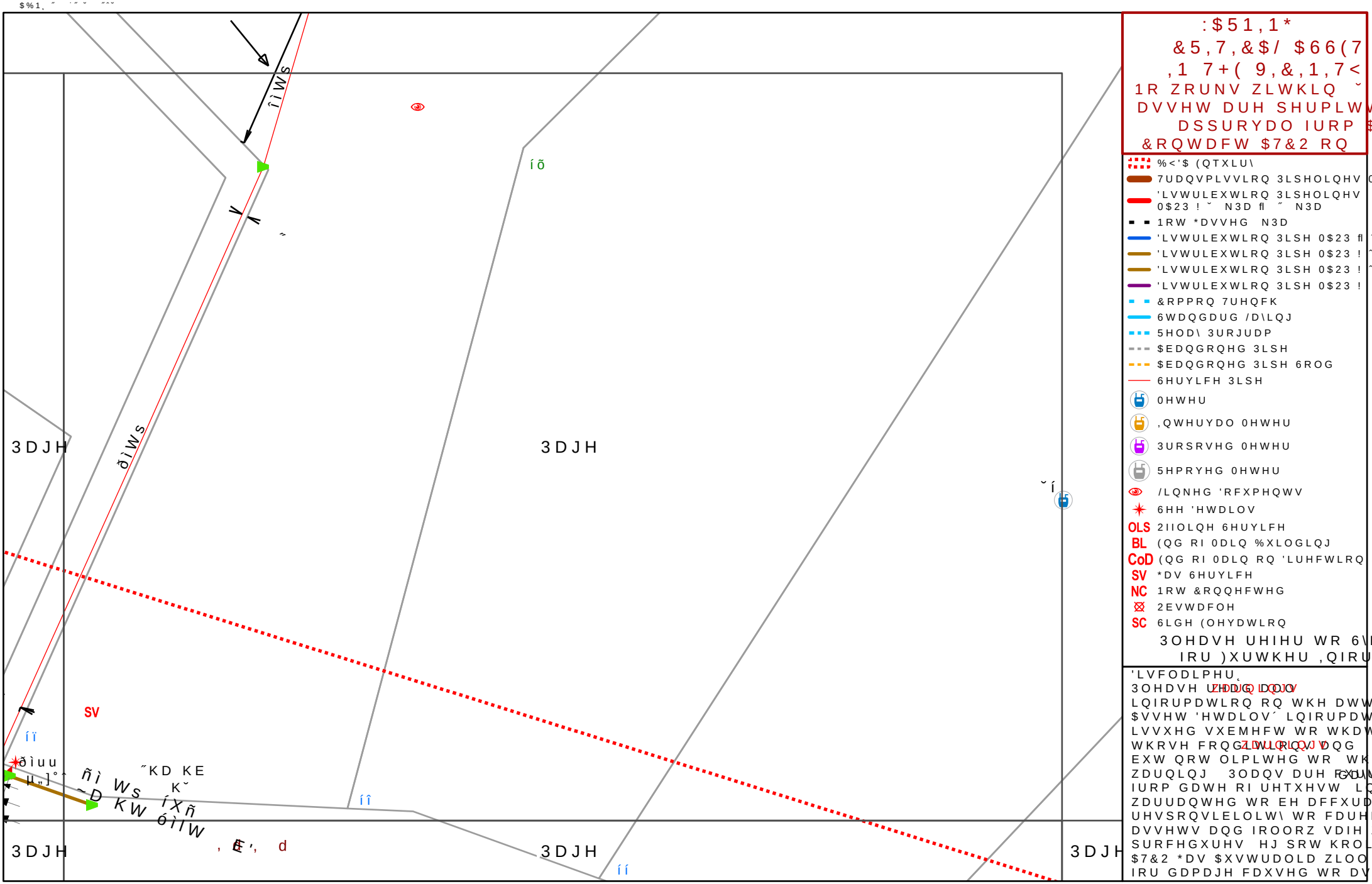
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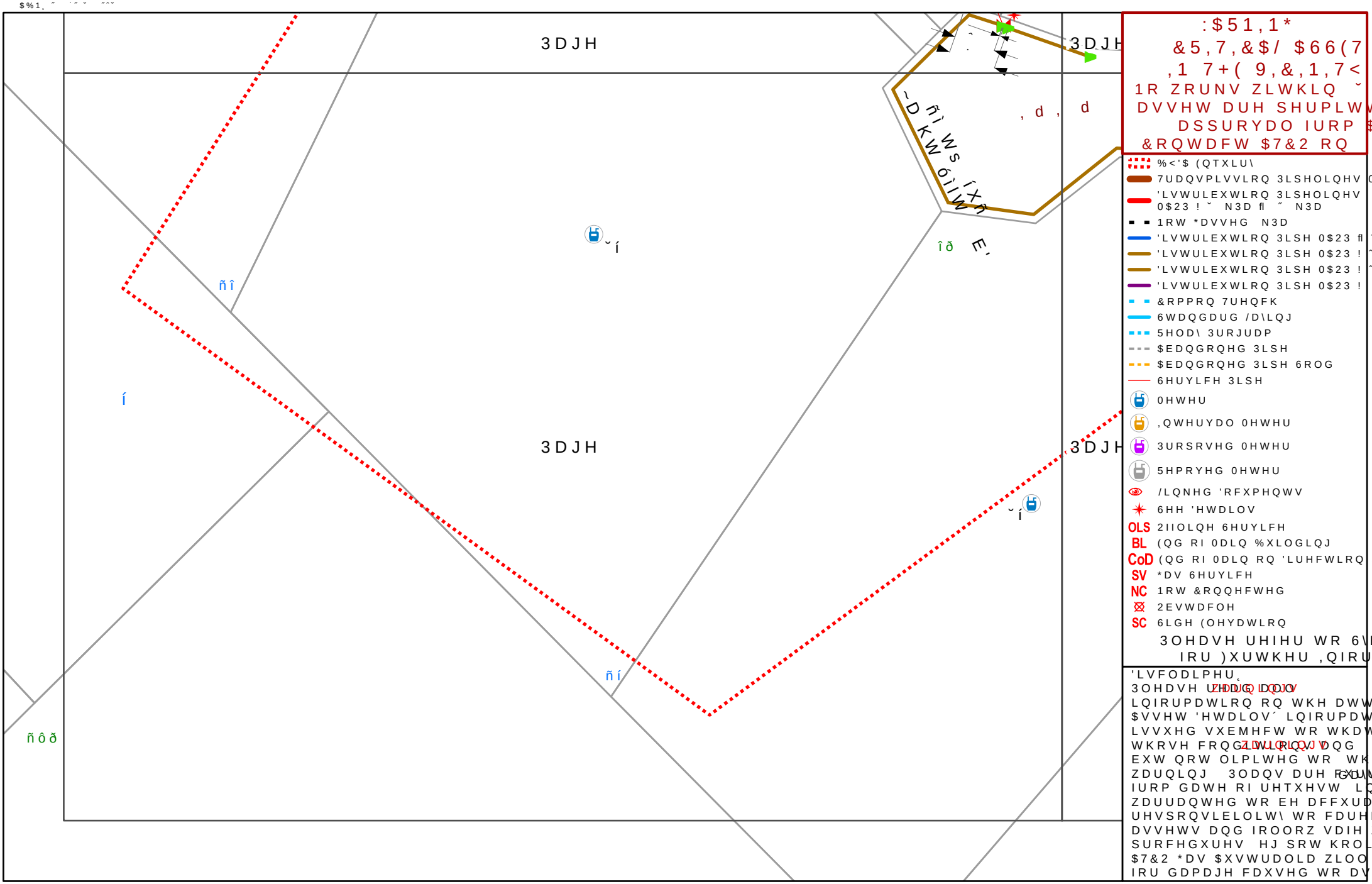
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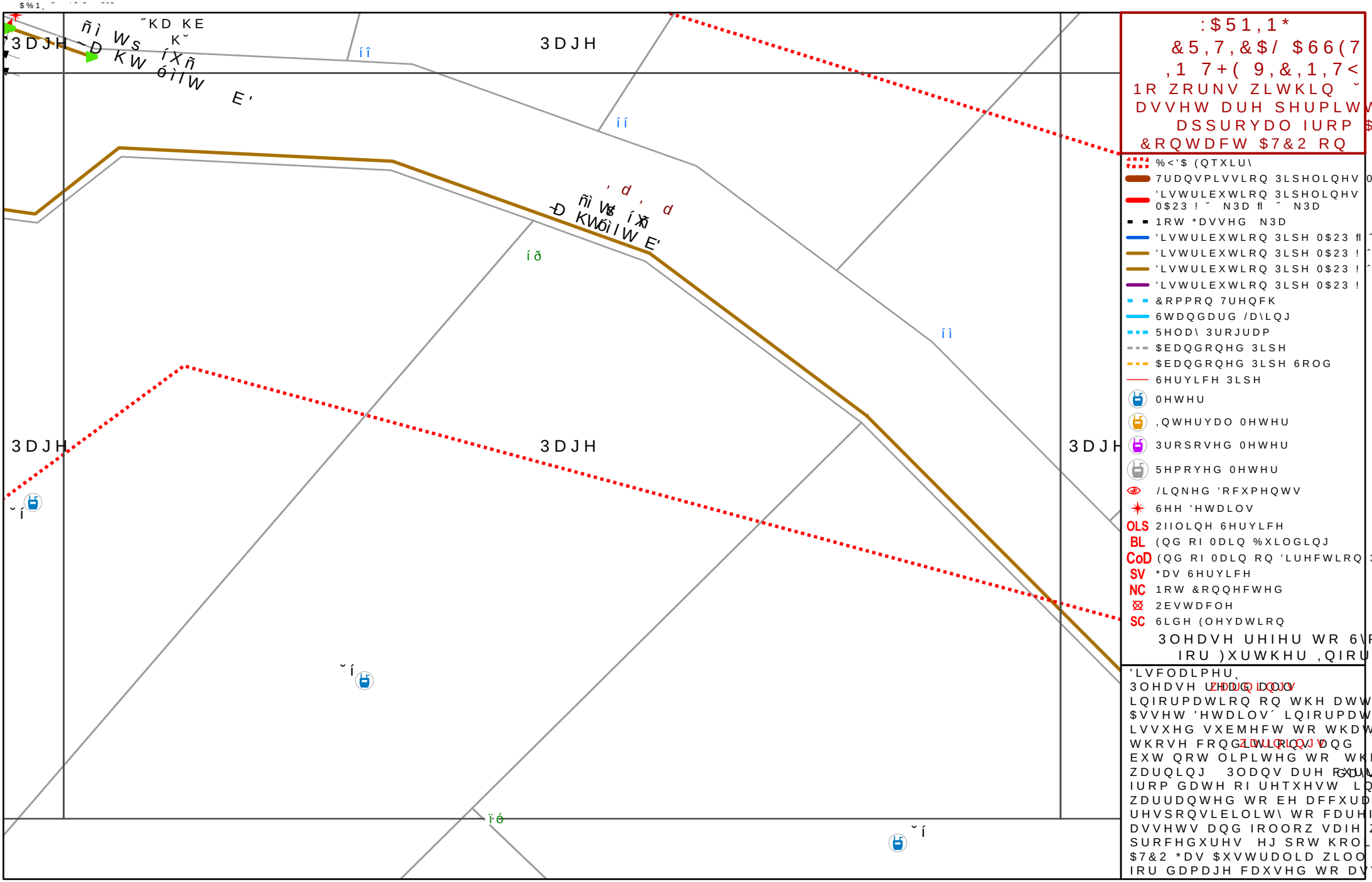
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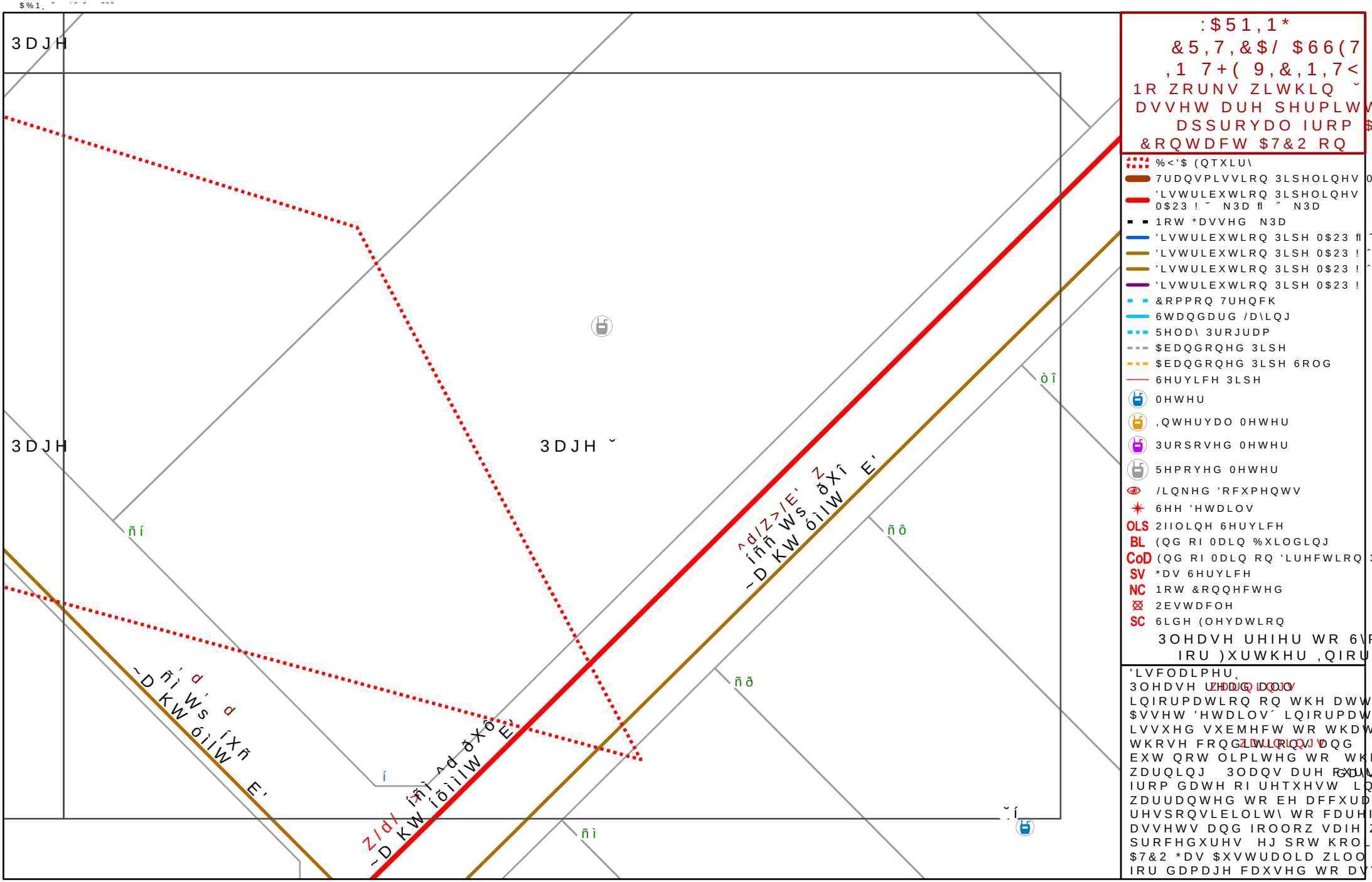
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To:	Dinura Ranatunga
Phone:	Not Supplied
Fax:	Not Supplied
Email:	dranatunga@peritas.au

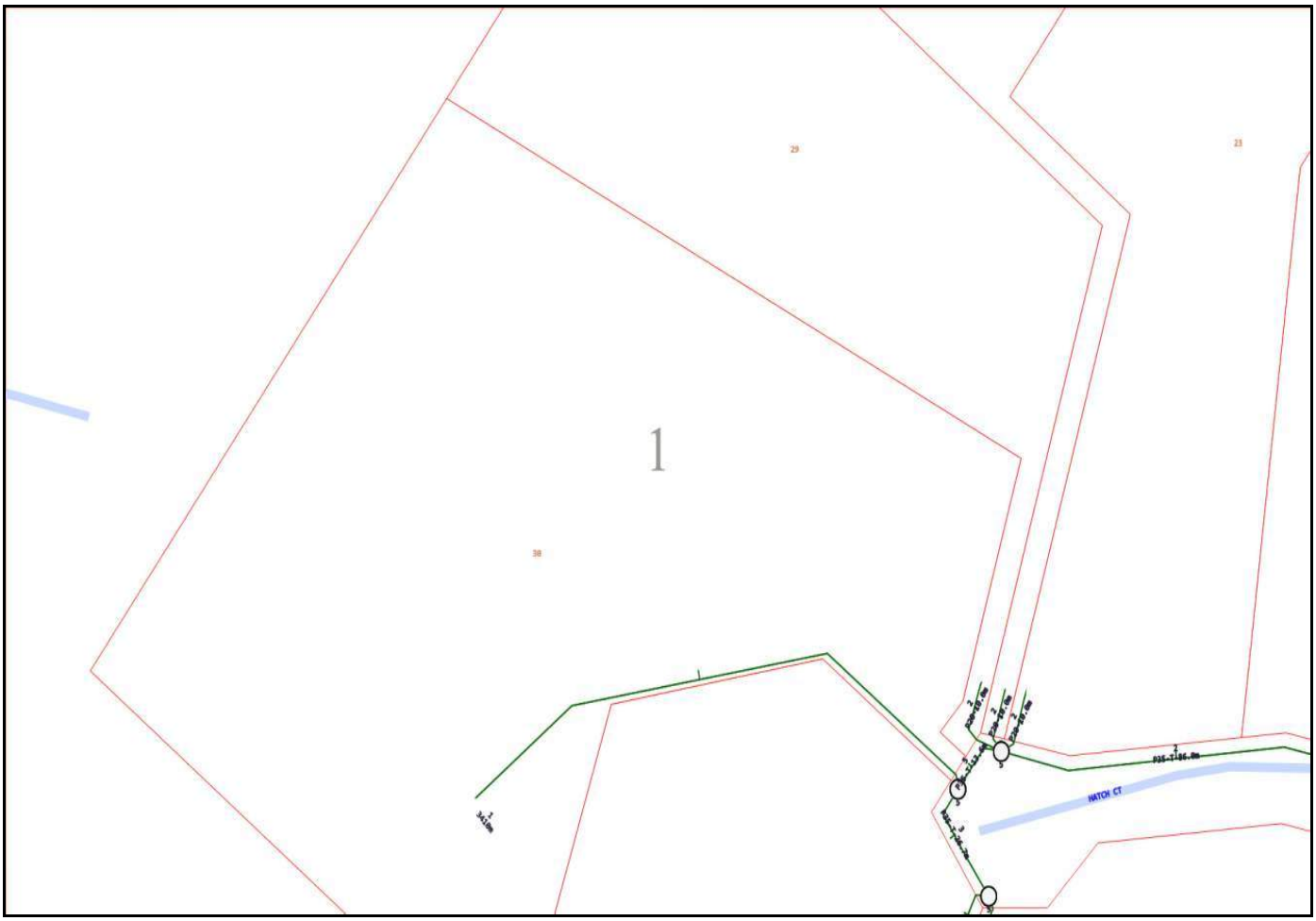
Dial before you dig Job #:	52433030
Sequence #	268596021
Issue Date:	20/02/2026
Location:	24 Hatch Court , High Wycombe , WA , 6057

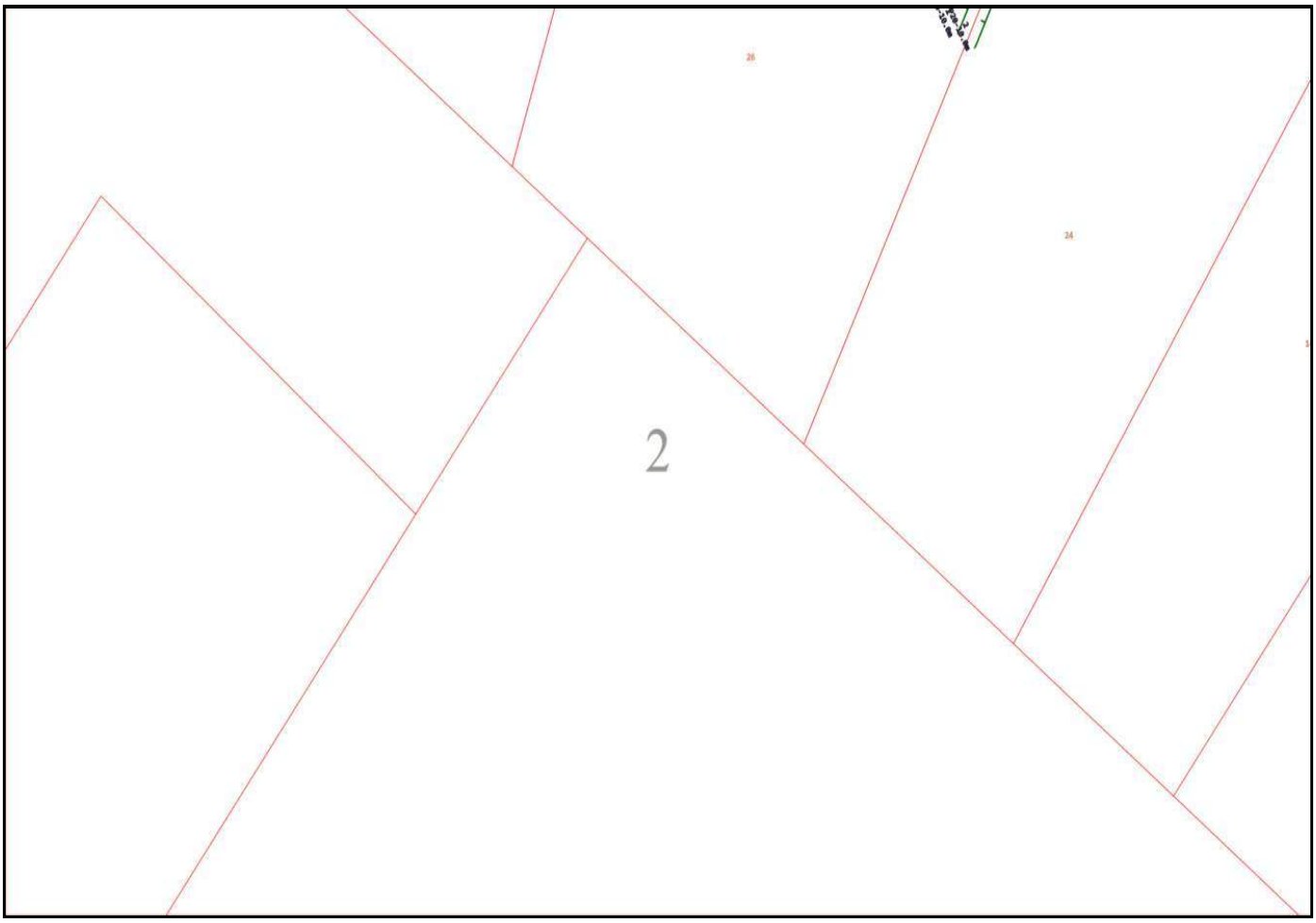
Indicative Plans are tiled below to demonstrate how to layout and read nbn asset plans

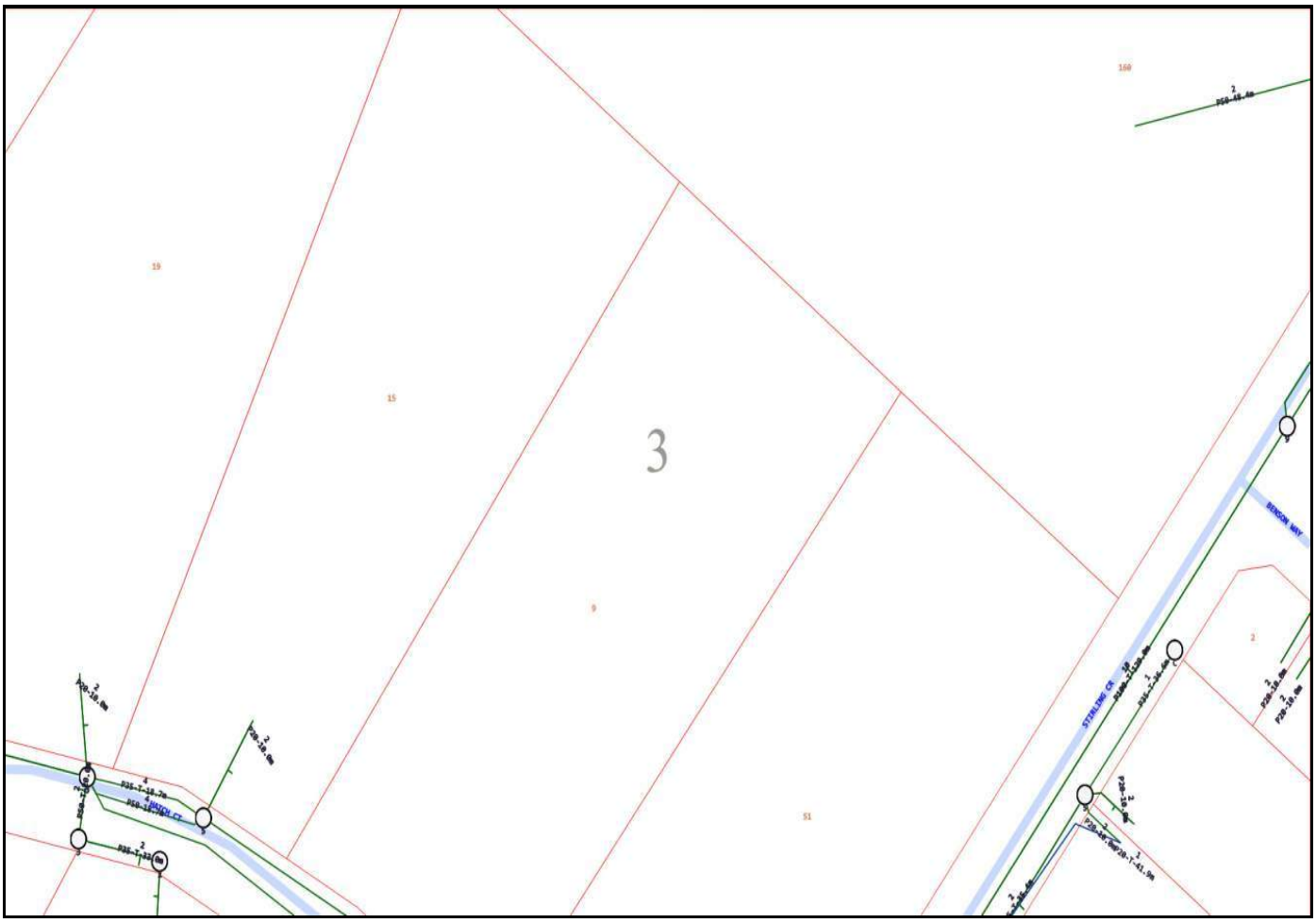
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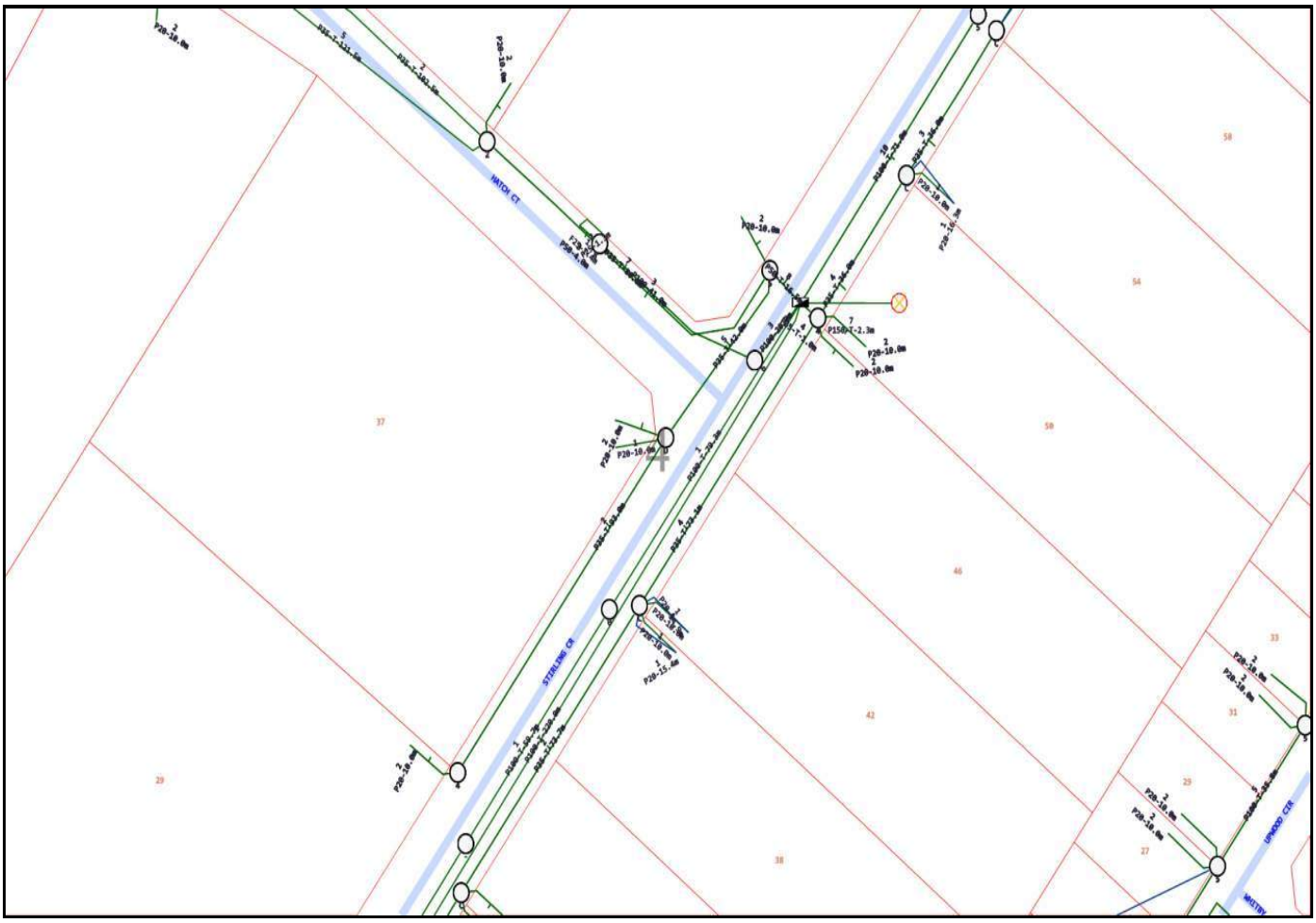
LEGEND

34	Parcel and the location
5	Pit with size "5"
2E	Power Pit with size "2E". Valid PIT Size: e.g. 2E, 5E, 6E, 8E, 9E, E, null.
	Manhole
	Pillar
2 PO – T- 25.0m P40 – 20.0m 5 9	Cable count of trench is 2. One "Other size" PVC conduit (PO) owned by Telstra (-T-), between pits of sizes, "5" and "9" are 25.0m apart. One 40mm PVC conduit (P40) owned by NBN, between pits of sizes, "5" and "9" are 20.0m apart.
2 10.0m 5 9	2 Direct buried cables between pits of sizes ,"5" and "9" are 10.0m apart.
5 9	Trench containing any INSERVICE/CONSTRUCTED (Copper/RF/Fibre) cables.
5 9	Trench containing only DESIGNED/PLANNED (Copper/RF/Fibre/Power) cables.
5 9	Trench containing any INSERVICE/CONSTRUCTED (Power) cables.
BROADWAY ST	Road and the street name "Broadway ST"
Scale	0 20 40 60 Meters 1:2000 1 cm equals 20 m


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HATCH CT

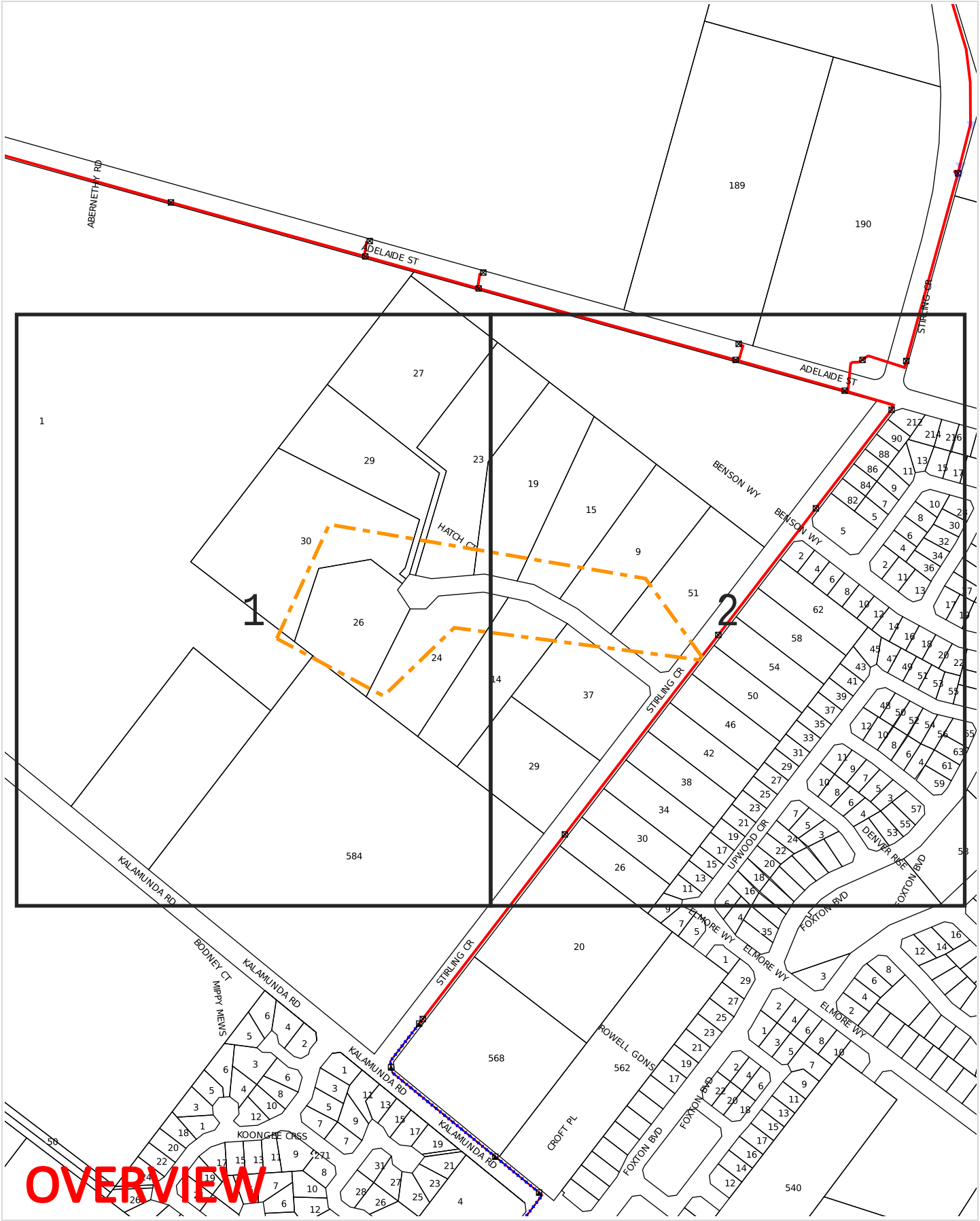

2


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19
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STERLING CR
BENSON WAY



Emergency Contacts

You must immediately report any damage to the **nbn™** network that you are/become aware of. Notification may be by telephone - 1800 626 329.



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Sequence Number: 268596020

Date Generated: 20 Feb 2026

For all Optus DBYD plan enquiries –
Email: Fibre.Locations@optus.net.au
For urgent onsite assistance contact 1800 505 777
Optus Limited ACN 052 833 208

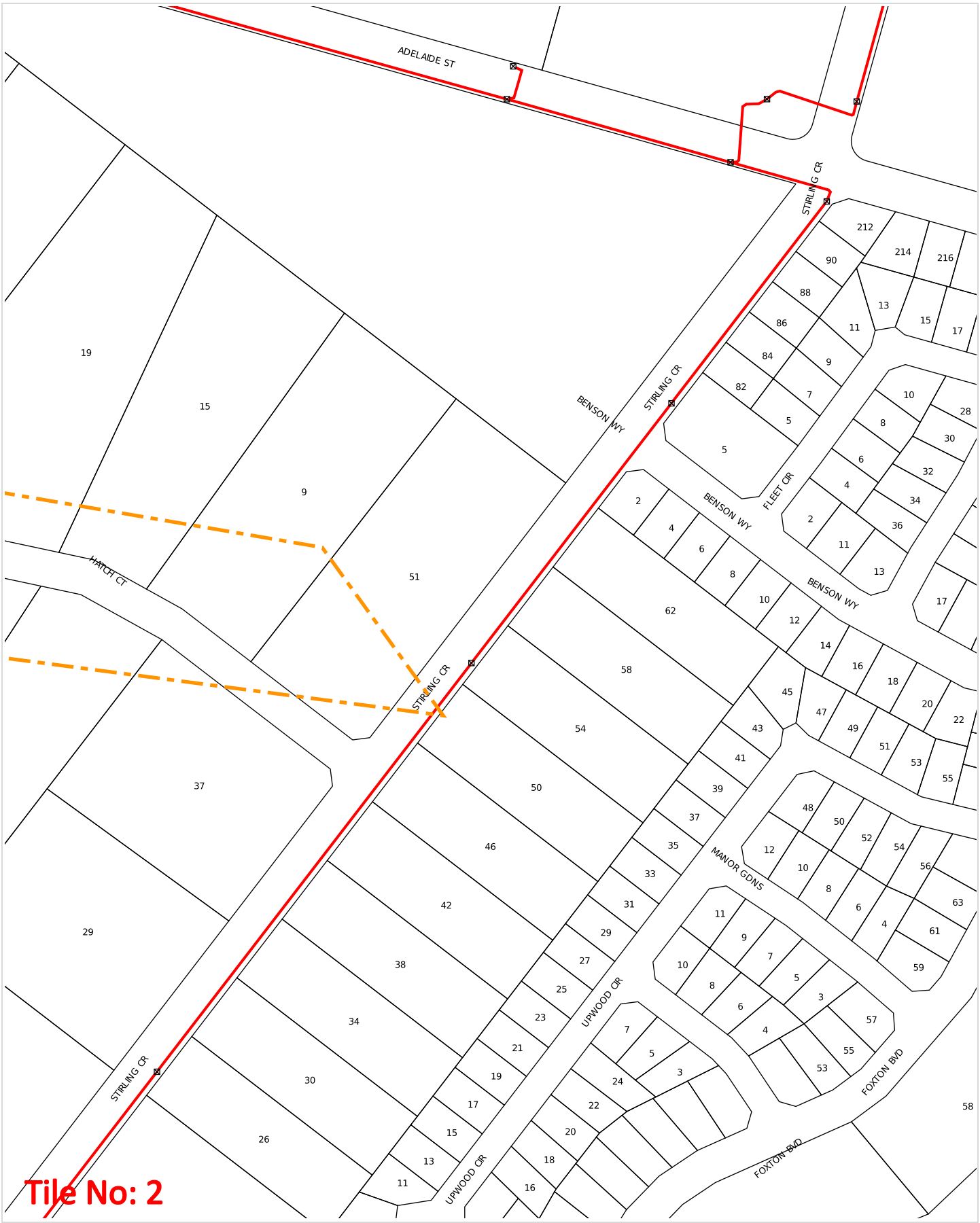


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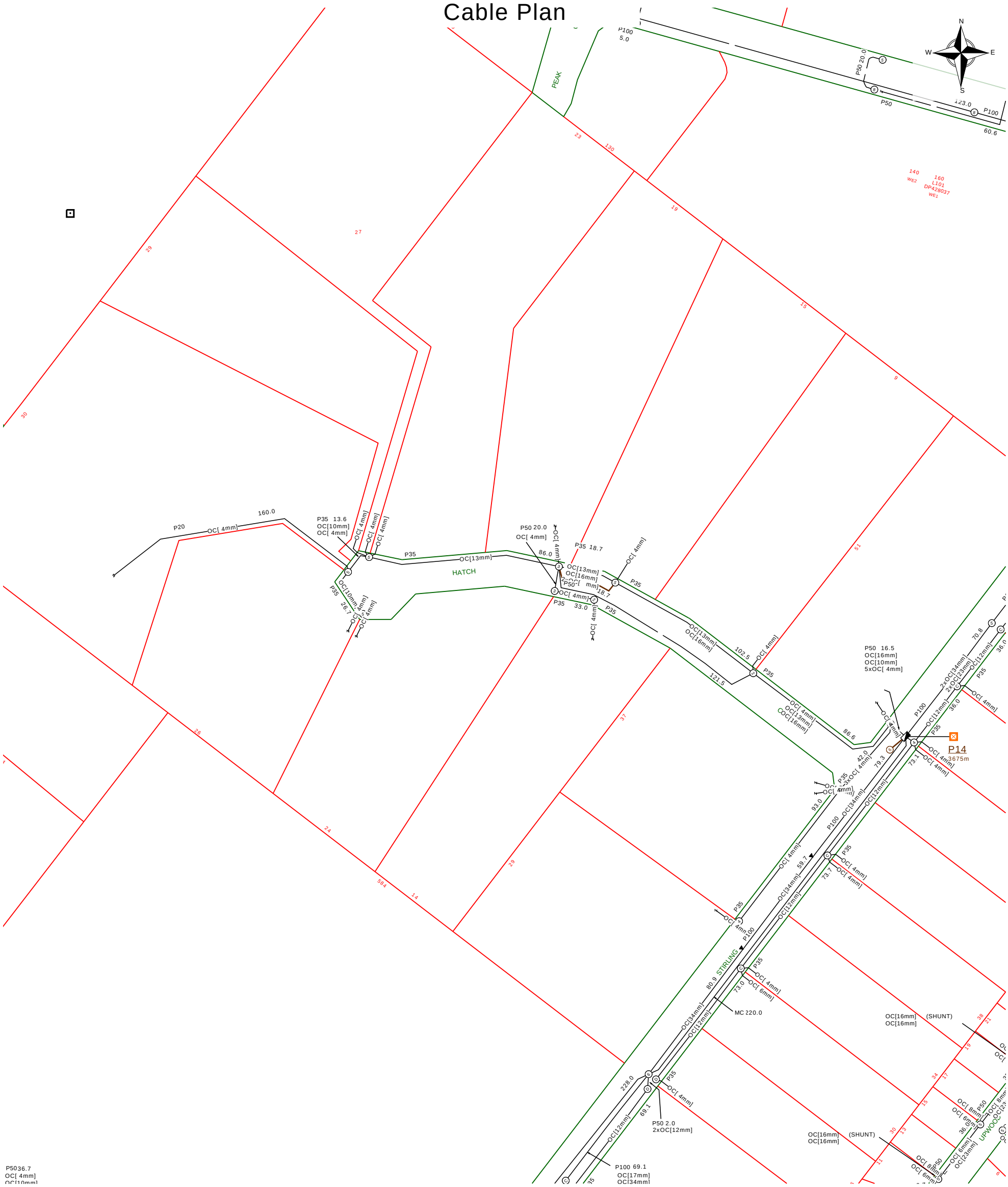
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Optus Limited ACN 052 833 208

Cable Plan



Report Damage:https://service.telstra.com.au/customer/general/forms/report-damage-to-telstra-(
Ph - 13 22 03
Email - Telstra.Plans@team.telstra.com
Planned Services - ph 1800 653 935 (AEST bus hrs only) General Enquiries

TELSTRA LIMITED A.C.N. 086 174 781

Generated On 20/02/2026 13:48:44

Sequence Number: 268596029

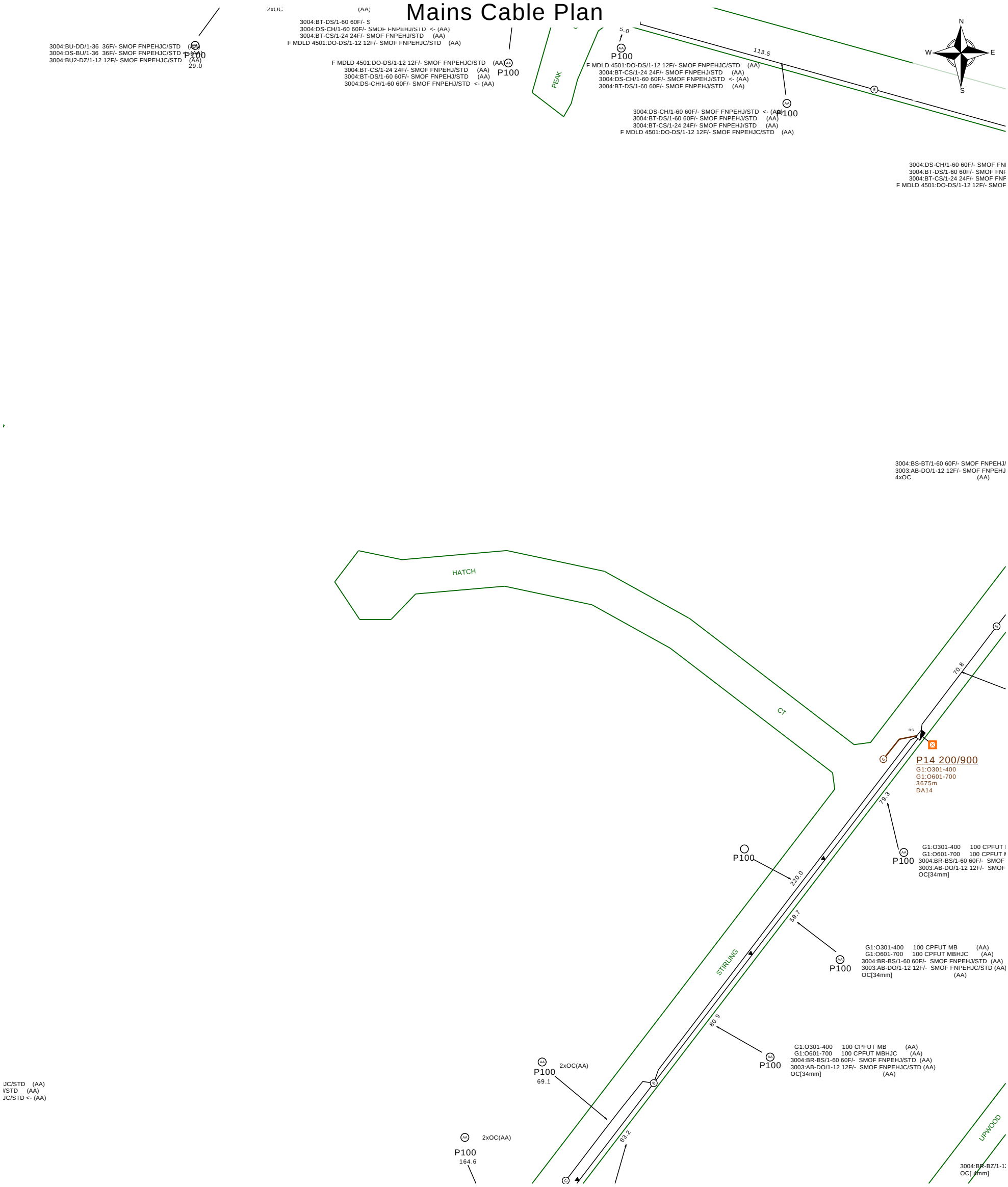
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See the Steps- Telstra Duty of Care that was provided in the email response.

Mains Cable Plan



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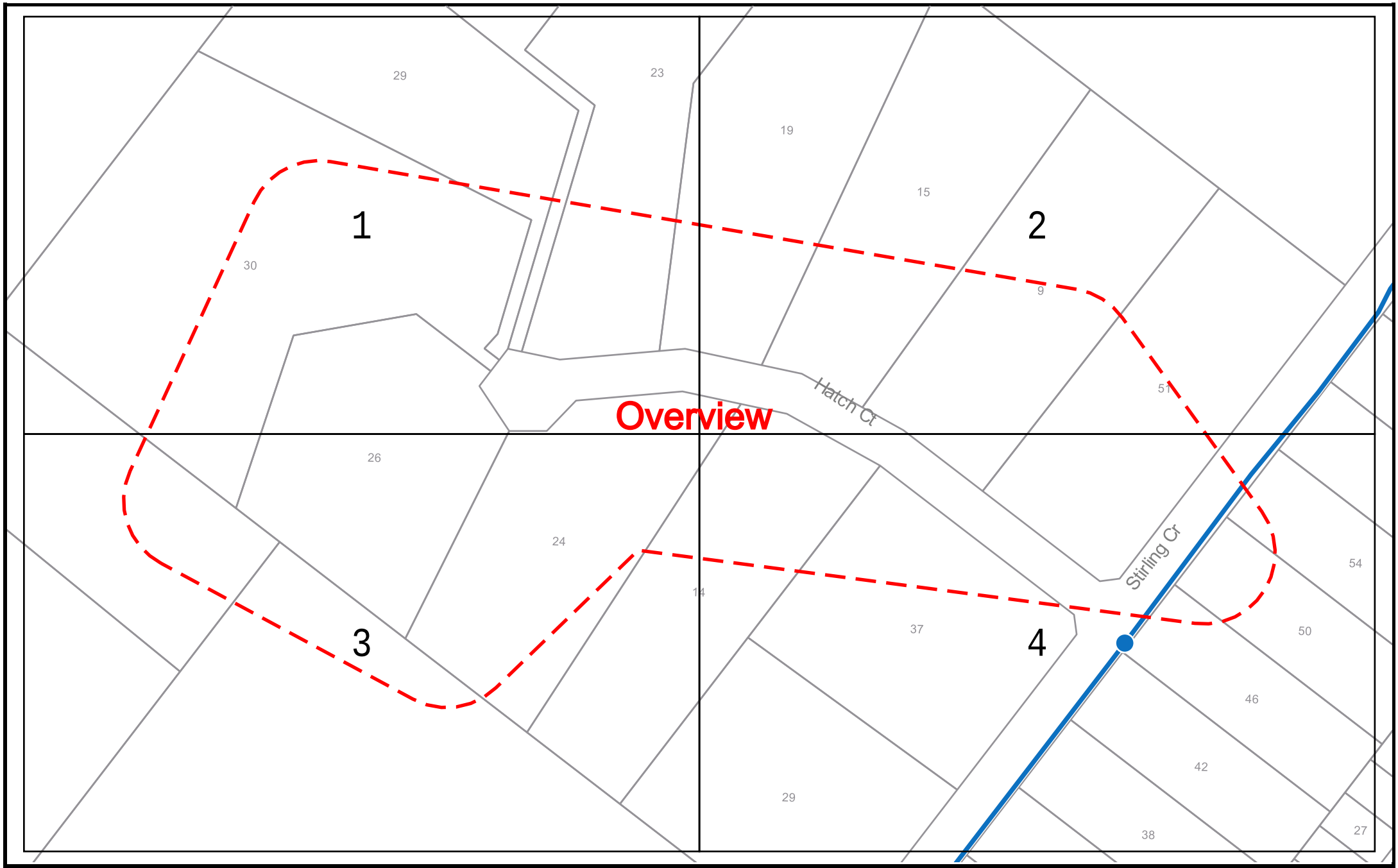
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Further on site investigation is required to validate the exact location of Telstra plant prior to commencing construction work.
A Certified Locating Organisation is an essential part of the process to validate the exact location of Telstra assets and to ensure the asset is protected during construction works.

See the Steps- Telstra Duty of Care that was provided in the email response.



SEQUENCE NUMBER: 268596028
JOB NUMBER: 52433030
ADDRESS: 24 Hatch Court, High Wycombe, WA 6057

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Vocus Group Conduit

SCALE: 1:2050

The Vocus Group includes related bodies corporate of Vocus Communications Limited ACN 084 115 499.

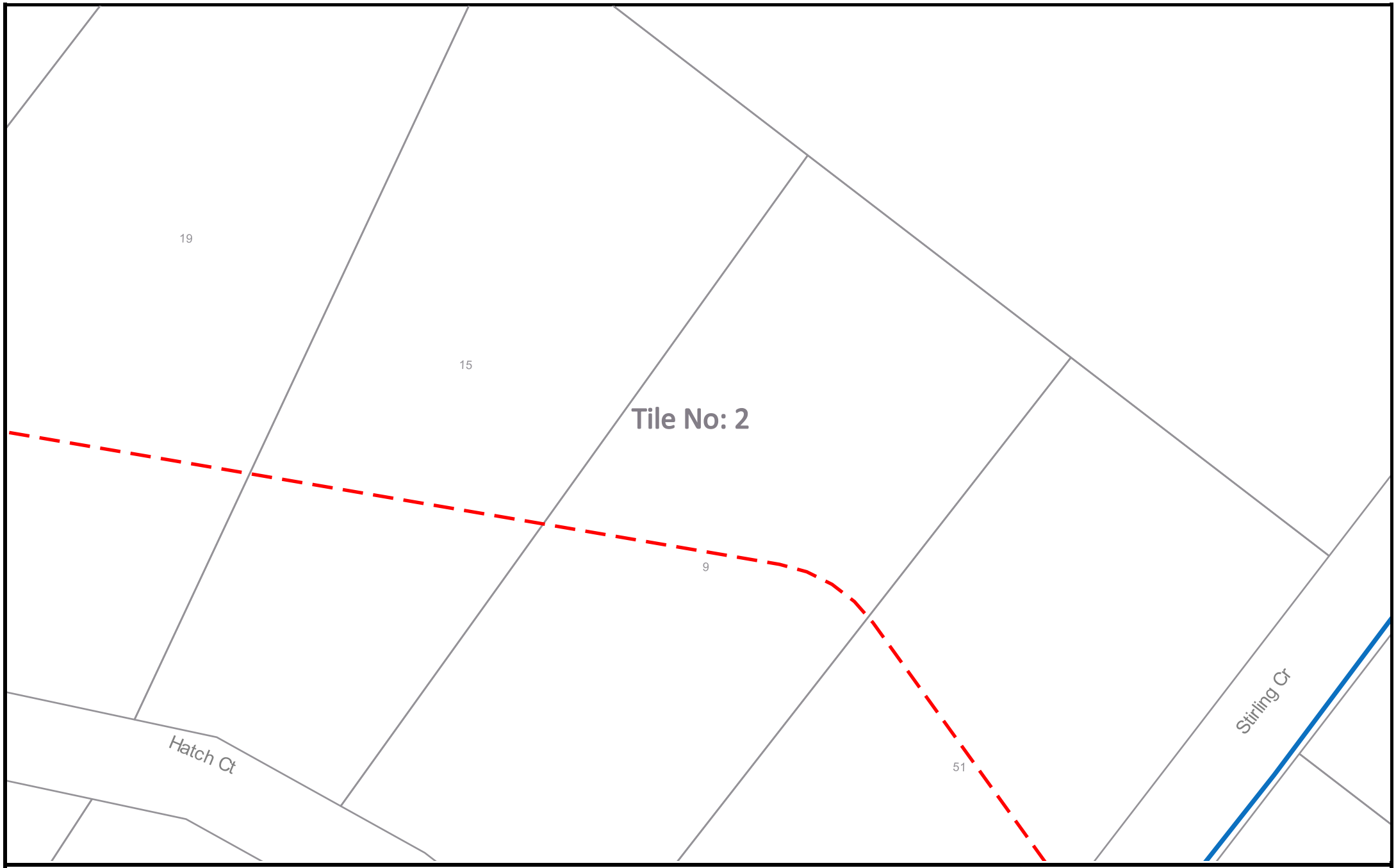


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LEGEND
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Vocus Group Conduit

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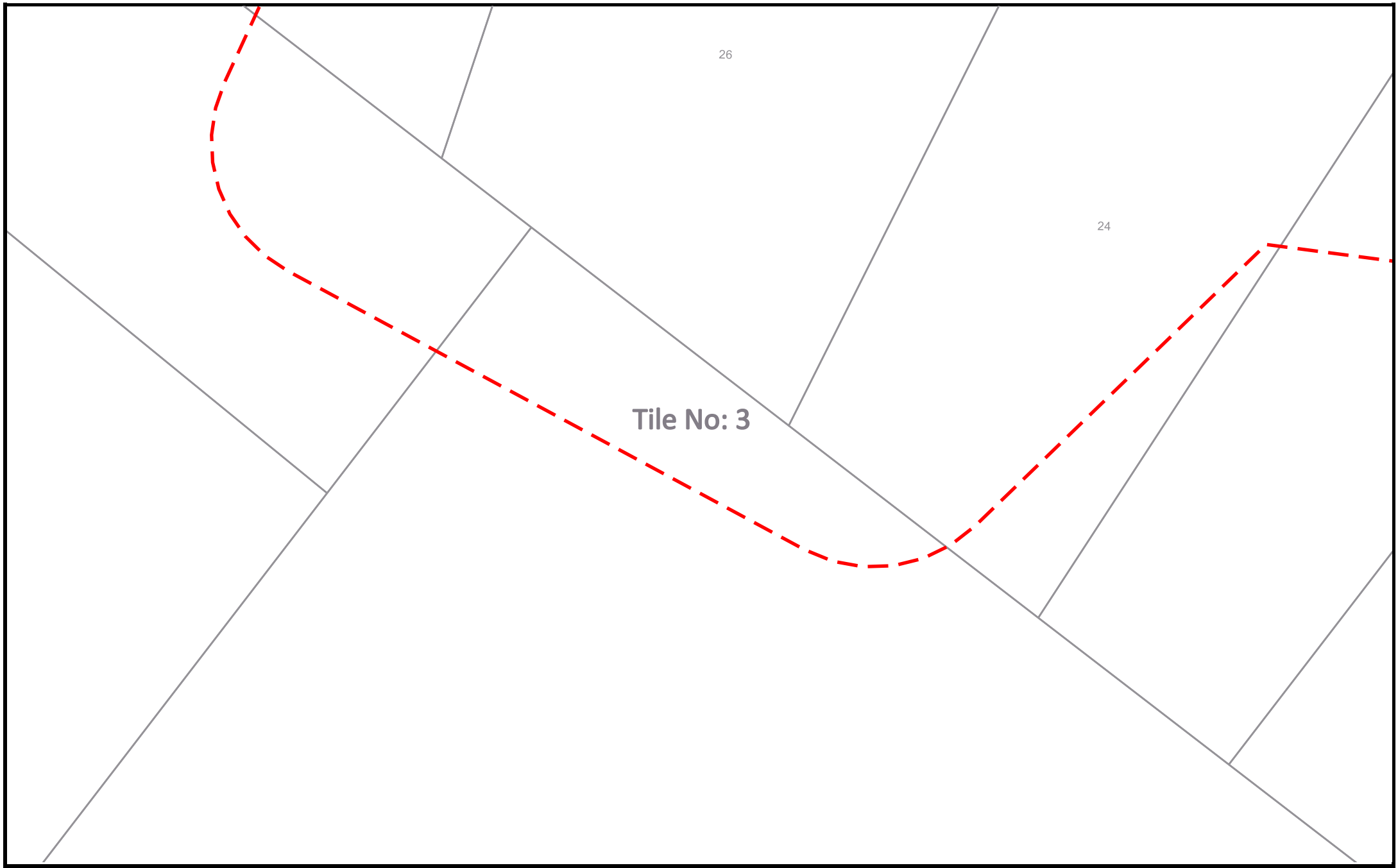
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SEQUENCE NUMBER: 268596028
JOB NUMBER: 52433030
ADDRESS: 24 Hatch Court, High Wycombe, WA 6057

LEGEND
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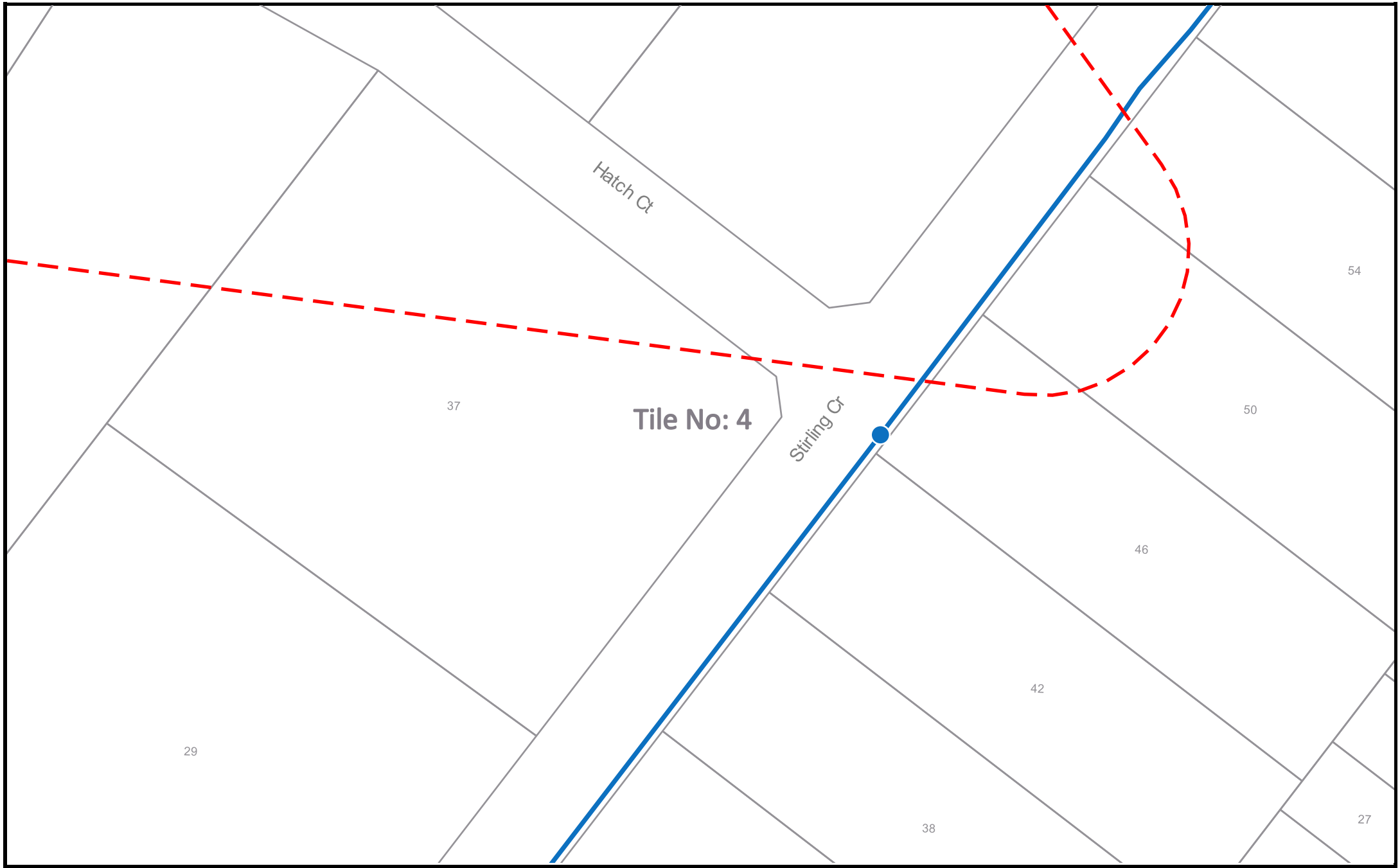


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JOB NUMBER: 52433030
ADDRESS: 24 Hatch Court, High Wycombe, WA 6057

LEGEND
Vocus Group Pit
Vocus Group Conduit

SCALE: 1:1000

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N W E S

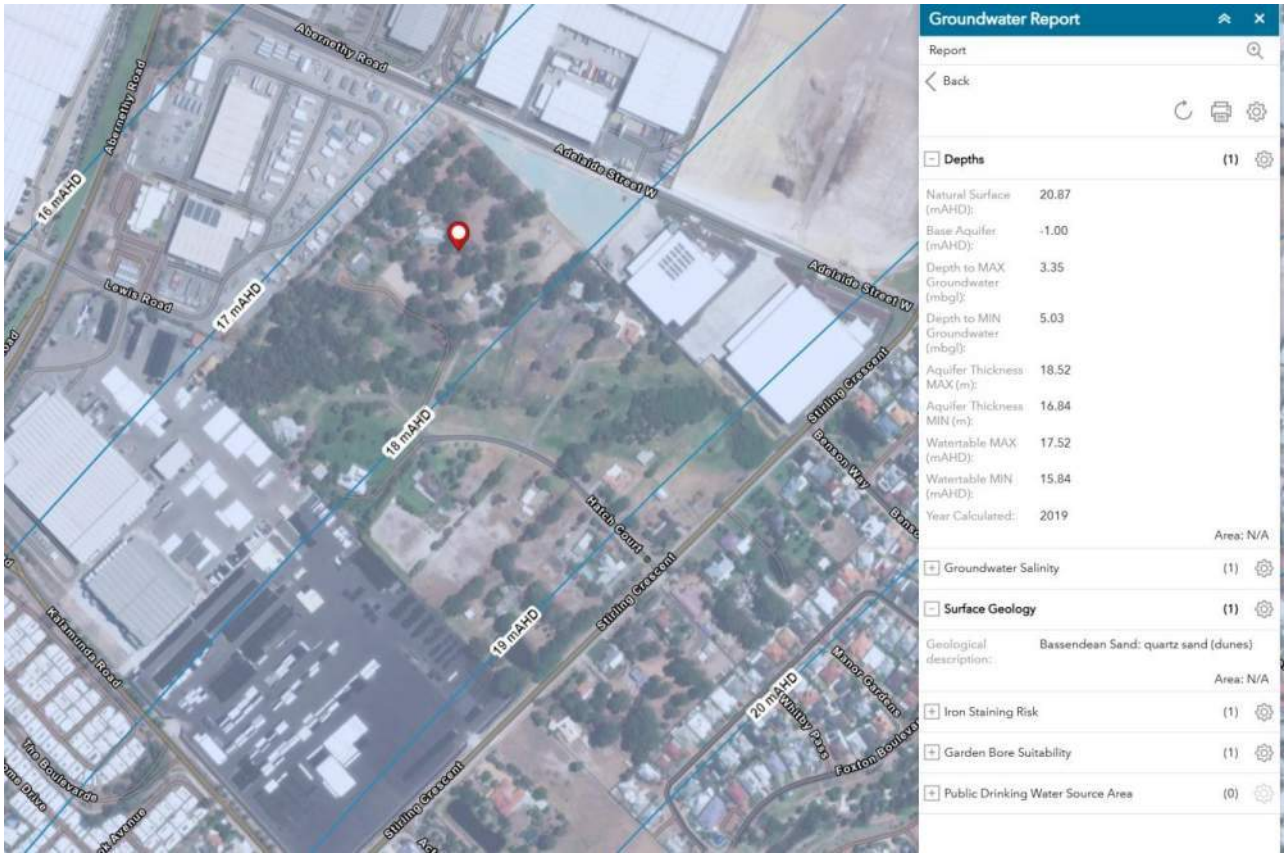
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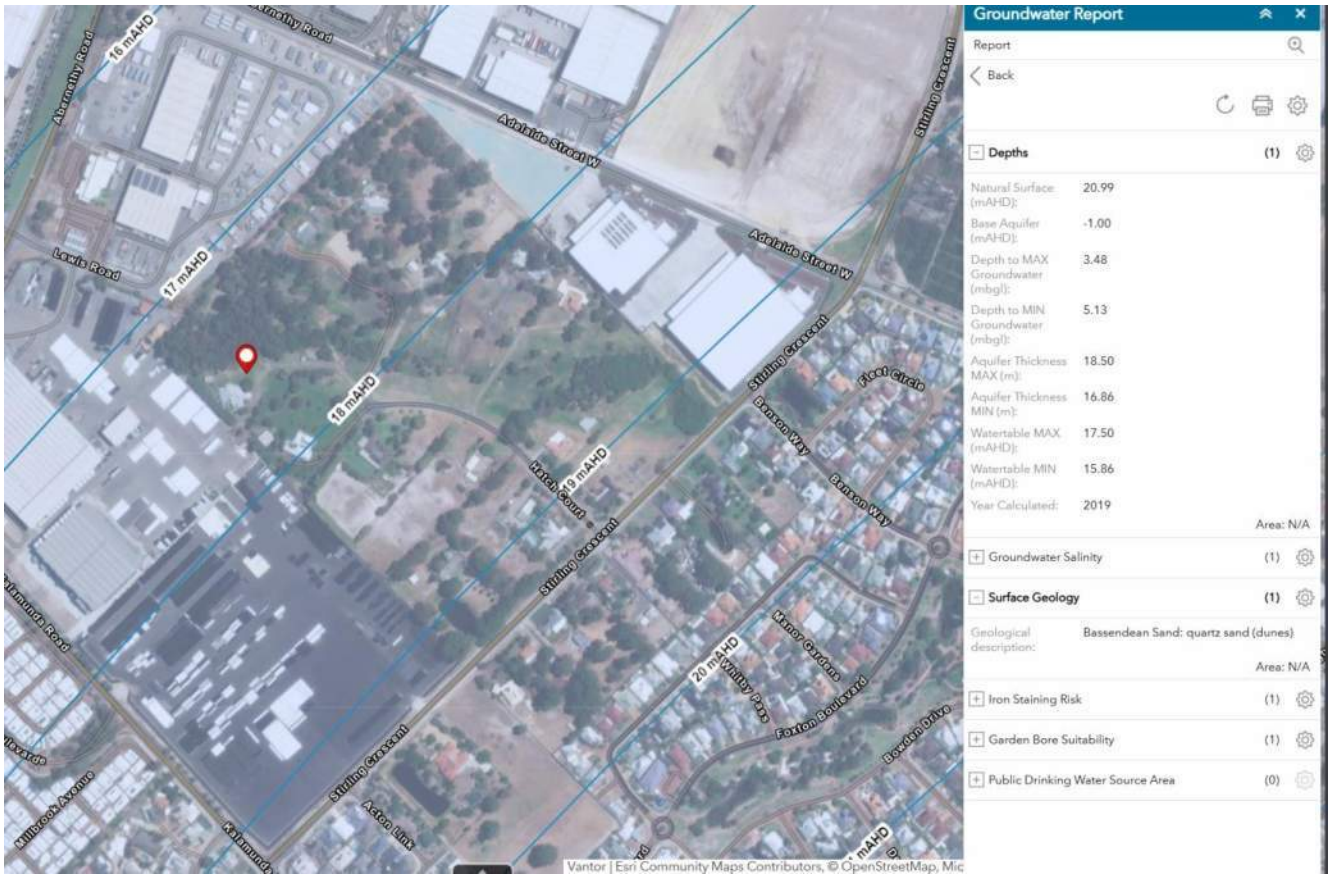
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Vocus Group Conduit

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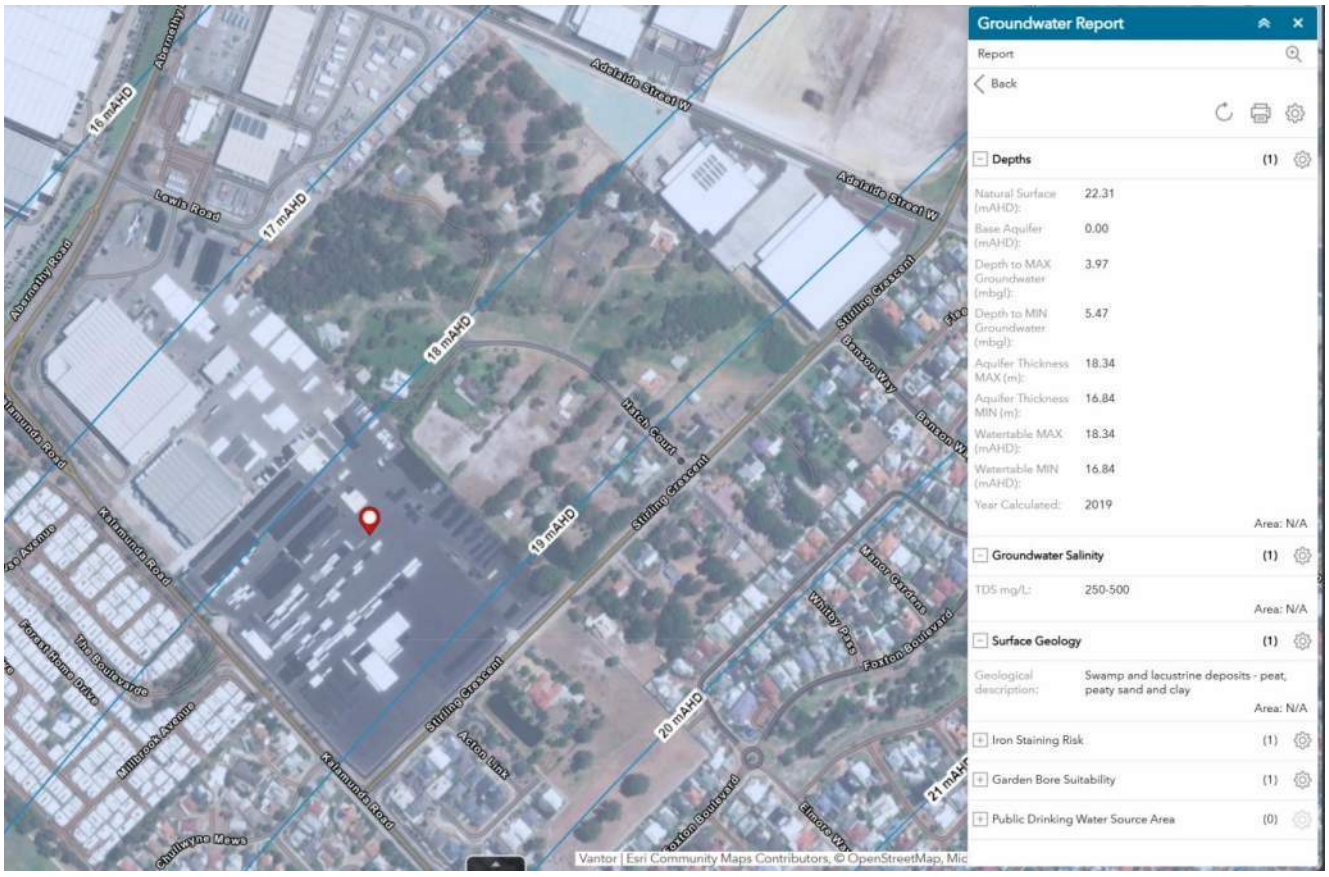
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APPENDIX D – GROUNDWATER MAPPING

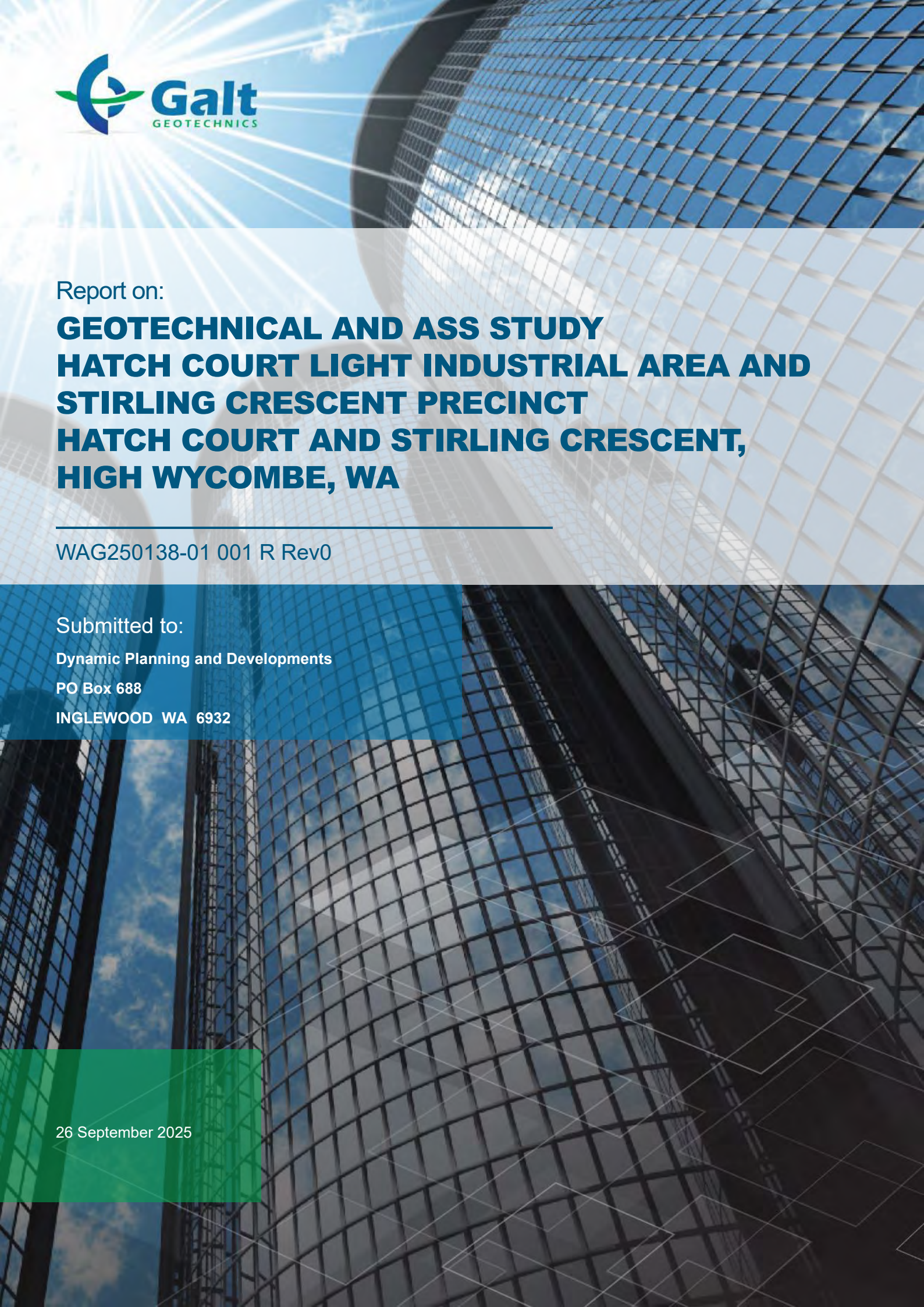

Groundwater Report
Report
Back
Depths (1)
Natural Surface (mAHD): 20.87
Base Aquifer (mAHD): -1.00
Depth to MAX Groundwater (mbgl): 3.35
Depth to MIN Groundwater (mbgl): 5.03
Aquifer Thickness MAX (m): 18.52
Aquifer Thickness MIN (m): 16.84
Watertable MAX (mAHD): 17.52
Watertable MIN (mAHD): 15.84
Year Calculated: 2019
Area: N/A
Groundwater Salinity (1)
Surface Geology (1)
Geological description: Bassendean Sand: quartz sand (dunes)
Area: N/A
Iron Staining Risk (1)
Garden Bore Suitability (1)
Public Drinking Water Source Area (0)
Abernethy Road
Adelaide Street W
Lewis Road
Stirling Crescent
Benson Way
Hatch Court
Manor Gardens
Foxton Boulevard
16 mAHD
17 mAHD
18 mAHD
19 mAHD
20 mAHD


Groundwater Report
Report
Back
Depths (1)
Natural Surface (mAHD): 20.99
Base Aquifer (mAHD): -1.00
Depth to MAX Groundwater (mbgl): 3.48
Depth to MIN Groundwater (mbgl): 5.13
Aquifer Thickness MAX (m): 18.50
Aquifer Thickness MIN (m): 16.86
Watertable MAX (mAHD): 17.50
Watertable MIN (mAHD): 15.86
Year Calculated: 2019
Area: N/A
Groundwater Salinity (1)
Surface Geology (1)
Geological description: Bassendean Sand: quartz sand (dunes)
Area: N/A
Iron Staining Risk (1)
Garden Bore Suitability (1)
Public Drinking Water Source Area (0)
Abernethy Road
Adelaide Street W
Lewis Road
Stirling Crescent
Benson Way
Hatch Court
Manor Gardens
Foxton Boulevard
Whitby Pass
Bordyn Drive
Hillcrest Avenue
Action Link
16 mAHD
17 mAHD
18 mAHD
19 mAHD
20 mAHD
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Groundwater Report
Report
Back
Depths (1)
Natural Surface (mAHD): 23.98
Base Aquifer (mAHD): 0.00
Depth to MAX Groundwater (mbgl): 4.59
Depth to MIN Groundwater (mbgl): 5.98
Aquifer Thickness MAX (m): 19.39
Aquifer Thickness MIN (m): 18.00
Watertable MAX (mAHD): 19.39
Watertable MIN (mAHD): 18.00
Year Calculated: 2019
Area: N/A
Groundwater Salinity (1)
TDS mg/L: 250-500
Area: N/A
Surface Geology (1)
Geological description: Swamp and lacustrine deposits - peat, peaty sand and clay
Area: N/A
Iron Staining Risk (1)
Garden Bore Suitability (1)
Public Drinking Water Source Area (0)
Adelaide Street W
17 mAHD
18 mAHD
19 mAHD
20 mAHD
21 mAHD
Stirling Crescent
Benson Way
Manor Gardens
Whitby Pass
Forton Boulevard
Bordon Drive
Oldham Pass
Elmore Way
Aston Link
Kalmunda Road
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Groundwater Report
Report
Back
Depths (1)
Natural Surface (mAHD): 22.31
Base Aquifer (mAHD): 0.00
Depth to MAX Groundwater (mbgl): 3.97
Depth to MIN Groundwater (mbgl): 5.47
Aquifer Thickness MAX (m): 18.34
Aquifer Thickness MIN (m): 16.84
Watertable MAX (mAHD): 18.34
Watertable MIN (mAHD): 16.84
Year Calculated: 2019
Area: N/A
Groundwater Salinity (1)
TDS mg/L: 250-500
Area: N/A
Surface Geology (1)
Geological description: Swamp and lacustrine deposits - peat, peaty sand and clay
Area: N/A
Iron Staining Risk (1)
Garden Bore Suitability (1)
Public Drinking Water Source Area (0)
Adelaide Street W
16 mAHD
17 mAHD
18 mAHD
19 mAHD
20 mAHD
21 mAHD
Lowis Road
Abernethy Road
Stirling Crescent
Benson Way
Manor Gardens
Whitby Pass
Forton Boulevard
Aston Link
Kalmunda Road
Millbrook Avenue
Forest Home Drive
The Boulevarde
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Appendix B GEOTECHNICAL REPORTS



Report on:

GEOTECHNICAL AND ASS STUDY HATCH COURT LIGHT INDUSTRIAL AREA AND STIRLING CRESCENT PRECINCT HATCH COURT AND STIRLING CRESCENT, HIGH WYCOMBE, WA

WAG250138-01 001 R Rev0

Submitted to:

Dynamic Planning and Developments

PO Box 688

INGLEWOOD WA 6932

26 September 2025

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Appendix H: Groundwater Field Parameters
Appendix I: Tabulated Groundwater Results

Standard Geotechnical Definitions, Recommendations, Requirements and Limitations

1. INTRODUCTION

This report presents the outcomes of Galt Geotechnics' (Galt's) geotechnical and acid sulfate soils (ASS) study for the proposed Hatch Court Light Industrial Area (HCLIA) and Stirling Crescent Precinct (SCP), at Hatch Court and Stirling Crescent, High Wycombe ("the site").

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

2. KEY FINDINGS

Over most of both sites, **we encountered SAND, extending to depths of 2.0 m to over 6.2 m, overlying Guildford Formation** (interbedded stiff to hard cohesive soils and medium dense granular soils) at some locations extending beyond investigated depths. In addition to the above:

- The surficial **sand is interbedded with Cemented sand / 'Coffee Rock' layers** (about 0.3 m to 1.0 m thick) below about 2.0 m to 3.4 m depth. Associated uncemented zones of discoloured brown / black sand with a higher fines content were also encountered in some locations.
- **Peat / organic soils were encountered** within / adjacent the drainage line in the northern part of the HCLIA site, and within the wetland area near Lewis Road (refer Figure 1). Similar zones of organic soils could be present in lakes at the site (refer Figure 1).
- **Surficial uncontrolled fill about 1.1 m thick was encountered** in the northern corner of site at 27 Hatch Court within the HCLIA (refer Galt report referenced: WAG250256-01 001 R Rev1).

The locations of encountered coffee rock, Guildford Formation and organic soils are summarised in Attached Tables 3 to 7.

Groundwater was encountered at depths ranging from the ground surface to over 3 m. Groundwater was also observed in lakes in southern part of each site, and along drainage line in northern part of HCLIA site.

The sites are considered broadly geotechnically suitable for the proposed development (LSP amendment to industrial use). Standard site preparation measures for sand sites will apply for most of the site area. However, geotechnical challenges relevant to the proposed development are summarised as follows:

- **Peat / organic soils must be removed** if these areas are to be developed. Removal of these soils is likely to require dewatering. Management / treatment of organic / acid sulfate generating soils and acidic groundwater could also possibly be required (refer Section 12);
- **Cemented sand / 'Coffee Rock' layers could have a low permeability**, which could impact the performance of soakwells. Coffee rock also has the potential to be acid generating (if removed) and would require treatment (refer Section 12);
- **Areas of shallow groundwater have been identified** in lower lying areas. Shallow groundwater will impact temporary excavations, and compaction during construction. Dewatering is likely to be required, particularly if construction is undertaken during winter. The potential requirement for and ASSDMP is discussed in Section 12. Shallow groundwater will affect the performance of soakwells and effluent disposal. Control of groundwater levels at the site must be assessed by a suitably qualified civil engineer / hydrogeologist. Subsoil drainage could possibly be required;
- **Surficial uncontrolled fill in the northern corner of the site must be removed**, assessed by a suitably qualified engineer and environmental scientist (refer Section 12), and either removed from site, or (if suitable) reused as approved fill; and
- **Environmental considerations are** discussed in Section 12.

We do not consider that the sites are geotechnically unusual in the context of the nearby area and similar industrial developments. We do not consider that there are any major contamination encumbrances to a proposed rezoning.

3. SITE DESCRIPTION

Table 1: Summary of Site

Item	Comment
Site Extent	Refer to In-line Image 1.
Site Area	Hatch Court Light Industrial Area (HCLIA): ~30 ha (16 lots). Stirling Crescent Precinct (SCP): ~6 ha (11 lots).
Current Site Surface Elevation[1]	Around RL 20 m AHD at the north to RL 24 m AHD at the south.
Vegetation	Vegetation present in landscaped areas surrounding houses and associated infrastructure. Vegetation includes grassed areas, some mature trees and some bushes (refer Figure 1). Dense vegetation along drainage line in northern part of HCLIA site.
Current Land Use	Mostly rural-residential developments and associated infrastructure. South west part of site (Lots 614 and 584) is a hardstand area (refer Figure 1).
Site drainage	Drainage line traverses from west to east in northern part of HCLIA site. Wetland area present in western corner of HCLIA site near Lewis Road. Several damp lands are apparent from historical aerial photos (refer In-line Image 2). Localised lakes are present in southern part of both the HCLIA and SCP sites, which are judged to be expressions of groundwater.
Site History[2]	**Prior to 1979**: Site mostly pastoral / agricultural land. Three residences developed on site. **1979 to 1983**: Development of residential buildings in SCP. **1983 to 1995**: Development of Hatch Court. And associated residential lots / developments. **1995 to 2018**: Site relatively unchanged. Some additional residential buildings and associated infrastructure constructed progressively during this time. **2018**: to Construction of hardstand in western corner of site. **2018 to 2024**: progressive construction of hardstand in western part of site (Lots 614 and 584).

NOTES: ***1.*** *Site elevation based on publicly available data (Landgate).*

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



In-line Image 1: Approximate extent of subject area



In-line Image 2: Aerial photo of site in 1961. HCLA marked in red/yellow.

4. PROPOSED DEVELOPMENT

Table 2: Summary of Proposed Development

Item	Comment
Proposed Development	LSP amendment to facilitate subdivision of industrial lots with associated infrastructure
Cut/Fill	Assumed typically up to about ± 1 m. Fill is generally anticipated to be required in low lying areas to achieve adequate clearance to groundwater.
Assumed Retaining Walls	Gravity walls up to about 2 m high
Assumed Stormwater Disposal	Possibly on site via soakwells with overflow to regional drainage.
Assumed Sewage Disposal	On site via leach drains

5. PROJECT OBJECTIVES

The objective of the geotechnical study is to assess the geotechnical suitability of the site for the proposed development. Our scope is limited to undeveloped portion of the HCLIA (i.e. excludes Lots 614 and 584)) and entirety of the SCP.

The objectives of the environmental assessment are to investigate the risk of acid sulfate soils (ASS) across the site through soil and groundwater analysis and provided recommendation for the treatment of ASS of groundwater (if required). No specific infrastructure is proposed at this stage, therefore the assessment is high level for the general assessment of ASS.

Comment is also required on the potential contamination risk within the HCLIA and SCP.

6. PREVIOUS STUDIES

Galt has previously undertaken a number of geotechnical studies for individual lots within and adjacent the site as summarised below:

- **Located within site:**
  - 27 Hatch Court in May 2025 (report reference: WAG250256-01 001 R Rev1);
  - Lots 8 and 16 Stirling Crescent in November 2024 (report reference: WAG240438-01 001 R Rev2);
- ***Located north of site / not within site:***
  - 71 Stirling Crescent in March 2023 (report reference: WAG230133-01 001 R Rev1); and
  - Part of Lot 1499 Stirling Crescent in September 2023 (report reference: WAG230463-01 002 R Rev1).

Test locations from the above reports are shown on Figure 1. Relevant information from the above studies are incorporated into this report.

7. FIELDWORK

7.1. General

Fieldwork was carried out on 25 August and 05 September 2025 and is summarised below.

Table 3: Summary of Fieldwork

Type	Results Appendix	Summary	GDR Clause	Equipment Used	No. Tests	Depth Range (m)
Site Plan	Figure 1	-	-	Hand held GPS[1]	-	-
Photographs	A	-	-	-	-	-
Cone Penetration Tests (CPTs)	B	Section 9.4	GDR3.2	Pagani TG 73-200	16	2.34 to 5.20
Boreholes (BH)	C	Section 9.4	GDR3.3	EVH Scout on utility / 7822DT / Hand Auger	14	1.30 to 3.00
Monitoring Wells (MW)	C	Section 7.3	-	7822DT	3[2]	3.00
Constant Head Permeameter Tests (G)	D	Section 7.2	GDR3.8	Guelph Permeameter	7	0.38 to 0.57

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

2. *One groundwater monitoring well location was unavailable for sampling after installation.*

7.2. Permeability Test Results

Table 4: Permeability Test Results (Constant Head)

Test Location	Soil Description	Depth (m)	Minimum Saturated Hydraulic Conductivity, k_{sat} (m/day)	Soil Category[2]
G01/BH01	SAND (SP)	0.38	25.01	1
G02/BH02	SAND (SP-SM)	0.42	*0.94*[3]	*3*[3]
G03/BH03	SAND (SP)	0.57	9.05	1
G05/BH05	SAND (SP)	0.44	*0.44*[3]	*4*[3]
G07/BH15	SAND (SP)	0.53	9.82	1
G09/BH09	SAND (SP)	0.52	3.94	1
G10/BH10	SAND (SP)	0.47	3.53	1
27 Hatch Court in May 2025 (WAG250256-01 001 R Rev1)				
G01	SAND (SP)	0.33	3.56	1
G02	SAND (SP)	0.41	2.82	2
G03	SAND (SP)	0.40	3.31	1
71 Stirling Crescent in March 2023 (WAG230133-01 001 R Rev1, *located north of site / not within site)*				
IT01	SAND (SP)	0.50	1.6	2
IT02	SAND (SP)	0.50	2.1	2
IT03	SAND (SP)	0.55	3.3	1
IT04	SAND (SP)	0.60	2.8	2
Lots 8 and 16 Stirling Crescent in November 2024 (WAG240438-01 001 R Rev2)				
G01	SAND (SP)	0.44	5.11	1
G02	SAND (SP)	0.50	3.17	1
G03	SAND (SP)	0.39	3.26	1
G04	SAND (SP)	0.40	10.95	1
Part of Lot 1499 Stirling Crescent in September 2023 (WAG230463-01 002 R Rev1, *located north of site / not within site)*				
G01	SAND (SP)	1.00	3.9	1
G01A	SAND (SP)	0.80	2.3	2
G01B	SAND (SP)	0.53	> 15	1
G02	SAND (SP-SM)	0.90	*0.07*[4]	-[4]
G02A	SAND (SP)	0.70	1.74	2
G02B	SAND (SP)	0.70	1.67	2
G02C	SAND (SP)	0.50	>15	1

NOTES:

1. *Constant head Guelph Permeameter tests were carried out in hand-auger boreholes in accordance with Appendix G of AS1547 (2012) "On-site domestic wastewater management".*
2. *Soil type is as per Table 5.2 of AS1547-2012.*
3. *Test results likely to have been influenced by shallow groundwater*
4. *Result considered spurious.*

Table 5: Permeability Test Results (Falling Head)

Test Location	Soil Description	Depth (m)	Minimum Saturated Hydraulic Conductivity, k_{sat} (m/day)	Soil Category[2]
27 Hatch Court in May 2025 (WAG250256-01 001 R Rev1)				
BH02 / IT01	SAND (SP)	0.84	3.9	1
BH07 / IT02	SAND (SP)	0.90	3.8	1
BH08 / IT03	SAND (SP)	0.84	31.3	1
BH05 / IT04	SAND (SP)	0.84	4.7	1
Lots 8 and 16 Stirling Crescent in November 2024 (WAG240438-01 001 R Rev2)				
BH07 / IT01	SAND (SP)	0.88	> 15	1
BH08 / IT02	SAND (SP)	0.86	6.3	1
BH10 / IT03	SAND (SP)	0.82	3.9	1
BH16 / IT04	SAND (SP)	0.77	7.1	1
BH06 / IT06	SAND (SP)	0.77	> 15	1
Part of Lot 1499 Stirling Crescent in September 2023 (WAG230463-01 002 R Rev1, *located north of site / not within site*)				
IT01	SAND (SP)	0.95	10.6	1
IT02	SAND (SP)	1.00	9.4	1

NOTES: ***1.*** *Soil type is as per Table 5.2 of AS1547-2012*

2. *Test method described in GDR3.7.*

3. *Test results likely to have been influenced by shallow groundwater*

7.3. Soil Sampling

Soil samples for the ASS study were collected from selected boreholes in accordance with the following guidelines:

- Department of Environmental Regulation (DER) (2015) *Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes and;*
- Department of Agriculture and Water Resources (DAWR) (2018) National Acid Sulfate Soils Guidance.

Samples collected for acid sulfate soils testing were collected at 0.25 m intervals using dedicated nitrile gloves and placed in laboratory-supplied sample bags. The samples were then placed in an ice chilled cooler in the field, and then transferred to a freezer until field testing was undertaken. All samples scheduled for analysis were transported to the laboratory with sufficient packaging and ice to ensure preservation of sample integrity. The lateral borehole distribution is considered appropriate for the project and in accordance with the aforementioned regulatory guidelines.

7.4. Acid Sulfate Soil Field Testing

A small portion of each soil sample was tested for pH before (pH_F) and after (pH_{FOX}) rapid oxidation with hydrogen peroxide (H_2O_2). The samples were then placed in an ice chilled cooler until submission to the laboratory for chromium reducible sulfur (CRS) analysis.

Samples with field pH values (pH_F) of <3 to 4 indicate the presence of ASS, thus indicating acids in the soil profile have oxidised.

The presence of unoxidized acids or potential acid sulfate soil (PASS) is indicated if:

- a strong reaction with hydrogen peroxide is observed;
- the pH_{FOX} is at least 1 pH unit below pH_F; or
- the pH_{FOX} is <3 to 4 and one or both of the above conditions apply.

The texture based net acidity action criteria presented in the DER (2015) *Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes* guideline document specifies a value of 0.03 %S based on the anticipated volume of soil to be disturbed being greater than 1,000 tonnes. This value has been adopted for the assessment of net acidity in soils across the site.

7.5. Groundwater Monitoring Wells

Groundwater monitoring wells were installed in boreholes drilled Geoprobe 6620 DT drill rig supplied and operated by Direct Push Probing.

Wells were constructed using 50 mm, class 18 flush-threaded PVC with a 2.5 m screened interval was installed at the base of each well and finished with approximate 0.6 to 0.7 m solid section extending to the surface. Refer to Appendix C for more information on construction details for each well.

A submersible pump was used to remove fine sediments and filter sand from the well. Groundwater levels were measured more than 7 days after installation and development to allow the water in the well to reach hydrostatic levels (refer Attached Table 3).

7.6. Groundwater Sampling

The groundwater wells were sampled in accordance with the following Australian Standards:

- AS/NZS 5667.1:1998 Water Quality Sampling. Part I – Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples; and
- AS/NZS 5667.11:1998 Water Quality Sampling. Part II – Guidance on the Sampling of Groundwater. Groundwater samples were recovered using low-flow methods.

The pump was set at the centre of the screened interval and drawdown measured concurrently whilst pumping to ensure the pump flow rates were less than the recharge capacity of the well. An initial flow rate in the order of 0.5-1.0 L/min was used and adjusted as appropriate to ensure minimal drawdown (<0.1m) during purging. New nitrile disposable gloves were used at each monitoring well location.

Representative samples for laboratory analysis were collected after stabilisation of groundwater physio-chemical parameters was achieved. Measurements of these parameters including temperature, pH, electrical conductivity, redox potential and dissolved oxygen, were taken every 60 seconds using appropriately calibrated equipment.

Stabilisation of groundwater parameters is considered to be achieved when there is less than 10% variation in physiochemical parameters between three successive readings. The groundwater physio-chemical parameters were recorded which included physical observations such as colour and turbidity of the purged water, any indications of the presence of contamination, including odour, sheen, the presence of any foreign material or objects, any quality assurance/quality control (QA/QC) sampling and the unique sample identifier.

Groundwater samples were collected directly from the low-flow pump into appropriately preserved and labelled, laboratory supplied bottles and filled to zero headspace. Samples that required field filtering were collected using an in-line, single-use, 0.45 µm filter.

All samples were stored in an ice chilled cooler during fieldwork and submitted to the laboratory at the conclusion of the field work, with adequate packing to ensure that they arrived intact and at the appropriate temperature to ensure sample preservation.

8. LABORATORY TESTING

8.1. Geotechnical

Geotechnical and chemical laboratory testing of soil samples was undertaken by Western Geotechnical and Laboratory Services (WGLS) and Envirolab Services (WA) at their NATA accredited laboratory. Laboratory test results along with the test methods followed are presented in Appendix E and summarised in Attached Tables 1 and 2.

Chemical test results from previous studies are also included in Attached Table 2.

8.2. Environmental

Environmental laboratory testing was conducted by Eurofins laboratory using the chromium reducible sulfur (CRS) method which provides acid base accounting and quantification of potential acid generation. The selection of samples for laboratory analysis was based on soil type and the results of field testing. Groundwater samples were also analysed by Eurofins laboratory for the Department of Water – Groundwater Quality Suite. All laboratory analysis was undertaken using NATA-accredited methods of analysis.

Laboratory certificate of analysis are presented in Appendix F.

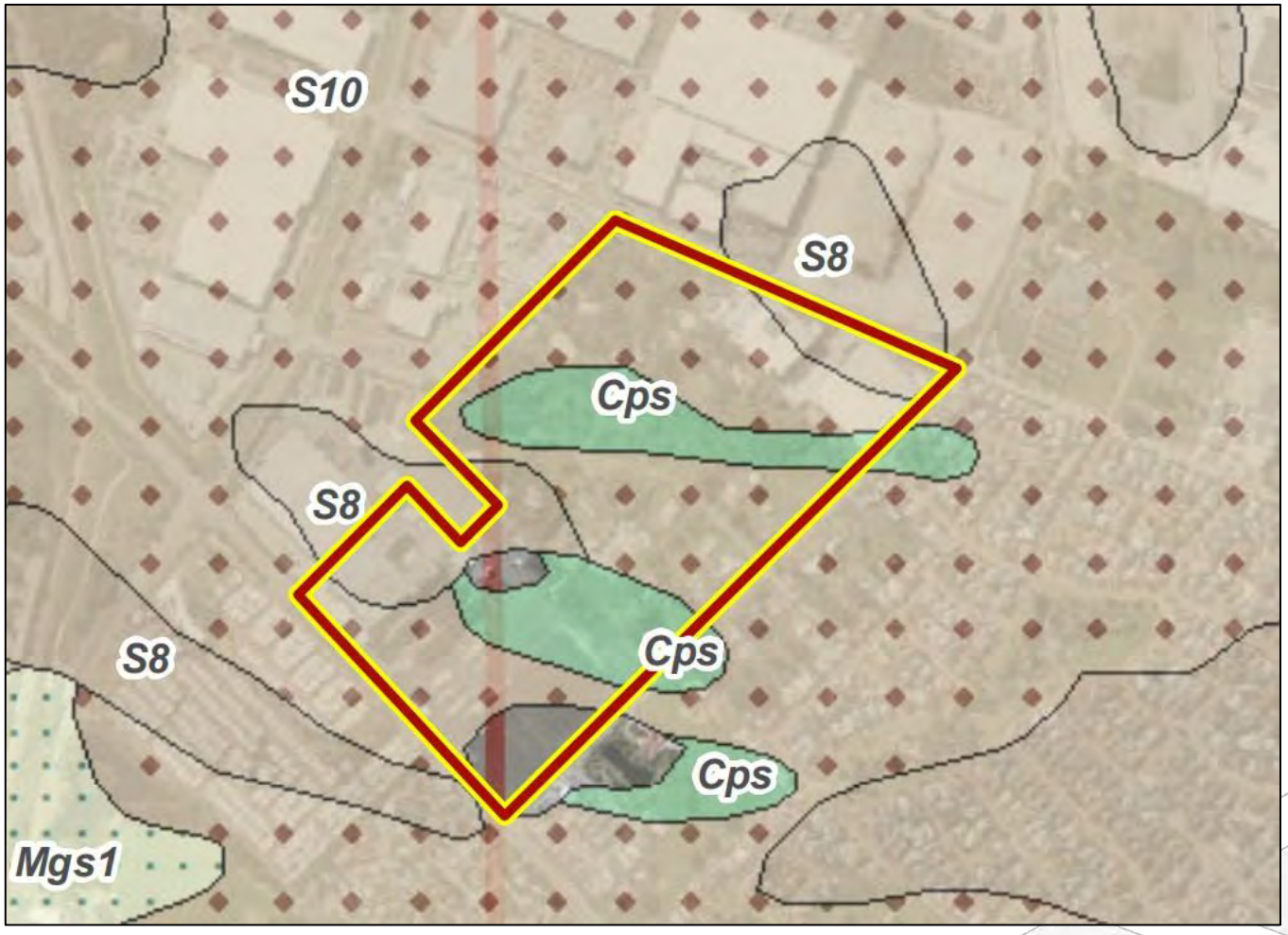
9. SITE CONDITIONS

9.1. Geology

Table 6: Summary of Geology Mapping

Map Sheet	Map Scale	Mapped Soils
Perth	1:50,000	Refer In-Line Image 3 for distribution of following units: **- Cps**: Peaty CLAY: "*dark grey and black with variable sand content of lacustrine origin [Swamp Deposits (Qhw)]*" **- S8**: Bassendean SAND: "*very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin*" **- S10**: "*Thin Bassendean Sand over Guildford formation*"

***NOTE**: Encountered subsurface profile discussed in Section 9.4.*



In-line Image 3: Excerpt from Perth 1:50,000 scale environmental geology map. HCLIA marked in red/yellow.

9.2. Groundwater

Table 7: Summary of Groundwater Levels

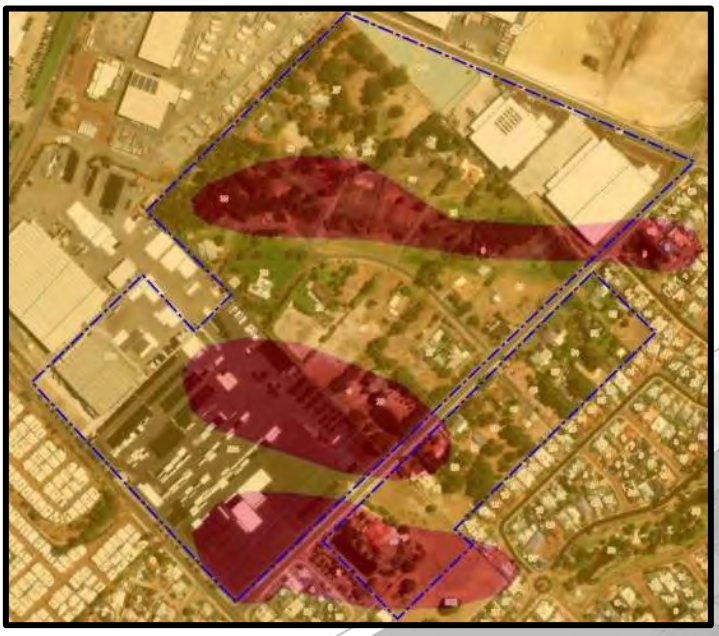
Item	Date	Depth Range (m)	Elevation Range (m AHD)	Comment
Perth Groundwater Atlas	2004	-	North: 13 South: 15	Inferred from levels measured in monitoring wells near the end of summer in 2004 only.
	2019		North west: 15.0 to 17.0 South east: 18.5 to 19.5	Inferred from maximum and minimum levels measured in monitoring wells in 2019 only.
DBCA Mapping	-	-	-	Most of the site are mapped as "Sumpland/Dampland", defined as a seasonally inundated/waterlogged area.
Site observations	Aug/Sept 2025	-	Surface to > 3 (Refer Attached Tables 3 to 7)	Groundwater also observed in lakes in southern part of site, and along drainage line in northern part of site. Groundwater could perch on underlying clay / clayey soils at the site.
Recommended Design	-	-	-	Design groundwater levels for the site must be assessed by a suitably qualified civil engineer and / or hydrologist. Subsoil drains and / or table drains could possibly be required.

NOTES: ***1.*** *Perth Groundwater Atlas observations based on monitoring wells which are not located at the site.*

2. *Elevation range for site observations is based on depth and site levels during fieldwork*

9.3. Acid Sulfate Soils

According to the DWER online ASS risk database, the HCLIA and SCP sites are is generally mapped as being within an area of 'moderate to low' ASS risk (highlighted in yellow in In-line Image 4 below) , with part of the site identified as having 'high to moderate' risk (highlighted in red in In-line Image 4 below) within the upper 3 m of the soil profile. High risk areas are judged to be associated with potential organic soils mapped in these areas (refer Section 9.1).



In-line Image 4: ASS Risk Mapping (DWER Database)

9.4. Contamination

The DWER contaminated sites database indicates that the site is not registered as a contaminated site. We note that the public database only shows sites classified as 'Remediated for restricted use', 'Contaminated – restricted use', 'Contaminated – remediation required'.

We understand that the site is likely to be redeveloped for commercial/light industrial purposes and as such, the site is unlikely to be changing to a more sensitive land use.

During fieldwork there were no visual or olfactory indicators of potential contamination. We note that some uncontrolled fill is present in the northern corner of the site. This may require investigation if anthropogenic waste is encountered within the material and/or it is proposed to be reused onsite.

10. GROUND MODEL

The encountered subsurface conditions are summarised in Attached Tables 3 to 7, ad can be generalised as follows:

Most of HCLIA and SCP Sites:

- Surficial Topsoil / Hardstand / Sand Fill Layers; over
- **SAND (SP / SP-SM)**: fine to medium grained, sub angular to sub rounded, typically grey, typically trace fines, typically loose to depths of about 0.5 m to 2.5 m and then becomes typically medium dense, extending to depths of 2.0m to over 6.2 m; with
  - **Interbedded layers of cemented sand / 'Coffee Rock'**: encountered at some locations as cemented layer of sand typically with a higher fines content (i.e. Silty SAND in some zones) about 0.3 m to 1.0 m thick (where penetrated) and below about 2.0 m to 3.4 m depth (refer Attached Tables 3 to 7 for locations encountered). Coffee rock inferred from CPT refusal at some locations. Associated uncemented zones of discoloured brown / black sand with a higher fines content were also encountered in some locations. Layer underlain by sand; over
- **Guildford Formation interbedded CLAY / Clayey SAND / Sandy CLAY / SAND Layers (SP/SC/CL-CH)**: typically stiff to hard cohesive layers and medium dense sand layers, locations of encountered Guildford Formation summarised in Attached Tables 3 to 7.

HCLIA - within / adjacent drainage line and wetland area[1]:

Variable organic soils were encountered as follows:

- **CPT01**: Possible inferred organic soil layer from 0.9 m to 1.2 m depth;
- **BH02**: Trace organics in Clayey SAND from 0.9 m to 2.0 m depth;
- **BH04**: Organic Clayey SAND from 0.7 m to 1.4 m depth
- **BH12/MW01**: PEAT from 0.0 m to 0.6 m depth, and then Organic SAND from 0.6 m to 1.4 m depth.

Notes:

- [1] Drainage line traverses from west to east in northern part of site (refer Figure 1). Wetland area present in western corner of site near Lewis Road. Similar zones of organic soils could be present in lakes at the site (Refer Table 1).
- [2] An area of surficial uncontrolled fill about 1.1 m thick was encountered in the northern corner of site at 27 Hatch Court (refer Galt report referenced: WAG250256-01 001 R Rev1);

11. GEOTECHNICAL ASSESSMENT

The HCLIA and SCP sites are considered geotechnically suitable for redevelopment as industrial land, provided appropriate site preparation is done. Standard site preparation measures for sand sites will apply for most of the site. Geotechnical challenges relevant to the proposed development are summarised as follows:

- **Peat / organic soils** were encountered within / adjacent the drainage line in the northern part of the HCLIA site, and within the wetland area near Lewis Road (refer Figure 1). Similar zones of organic soils could be present in lakes at the site (refer Figure 1 – could also extend to lake in south of SCP). If these areas are to be developed, organic soils will need to be removed from the site. We note that organic soils are likely to be acid sulfate generating, and therefore would require treatments (refer Section 12). Dewatering is also likely to be required to enable remediation of these areas;
- **Cemented sand / 'Coffee Rock'** layers (about 0.3 m to 1.0 m thick) interbedded within the sand were encountered below about 2.0 m to 3.4 m depth (refer Attached Tables 3 to 7). Associated uncemented zones of discoloured brown / black sand with a higher fines content were also encountered in some locations. These materials could have a low permeability, which could impact the performance of soakwells. Coffee rock also has the potential to be acid generating (if removed) and would require treatment (refer Section 12);
- **Areas of shallow groundwater** have been identified in lower lying areas (refer Table 7 and Attached Table 3). Shallow groundwater will impact temporary excavations, and compaction during construction. Dewatering is likely to be required, particularly if construction is undertaken during winter. The potential requirement for and ASSDMP is discussed in Section 12. Shallow groundwater will affect the performance of soakwells and effluent disposal. Control of groundwater levels at the site must be assessed by a suitably qualified civil engineer / hydrogeologist. Subsoil drainage could possibly be required;
- **Surficial uncontrolled fill** about 1.1 m thick was encountered in the northern corner of site at 27 Hatch Court (refer Galt report referenced: WAG250256-01 001 R Rev1). Uncontrolled fill must be removed, assessed by a suitably qualified engineer and environmental scientist (refer Section 12), and either removed from site, or (if suitable) reused as approved fill; and
- **Environmental considerations** are discussed in Section 12.

Geotechnical recommendations for the site are summarised in the Table 8.

Table 8: Summary of Geotechnical Assessment

Type	Clause	Parameter	Comment
Site Suitability	-	-	We consider both sites to be geotechnically suitable for the proposed development with appropriate site preparation measures. Standard site preparation measures will apply for most of the site (refer further comments above table).
Site Classification (AS2870)	GDR5	A / P	Class A for most of each site. Class P in drainage lines, wetland areas and lakes (refer Table 1). The site classification in these areas could be improved if organics soils are removed and replaced.
Site Subsoil Class (AS1170.4)	-	Ce	-
Site Preparation	GDR6	-	**For most of the site**: preparation will comprise **GDR6.2.1 Common Measures** followed by **GDR6.2.2 Sand Sites.** Surficial uncontrolled fill in the northern part of the site must be remediated (refer Galt report referenced: WAG250256-01 001 R Rev1). We anticipate raising of the site above shallow groundwater levels by importation and compaction of sand fill (**Permeable Sand**), however this is subject to civil design. **In drainage lines, wetland areas and lakes (refer Table 1):** If these areas are to be developed, organic soils present in these areas (refer Section 9.4) will need to be removed and replaced with approved fill. Dewatering and treatment of water / soil for acid sulfates will also be required (refer Section 12).

Type	Clause	Parameter	Comment
Footing Preparation and Testing	GDR6.4	-	We expect the base of footings at this site to be entirely within sand. We refer you to GDR6.4.1. A PSP may be used to verify compaction in footing excavations as discussed below.
Topsoil Strip	GDR6.2.1	Thickness = 100 mm	Expected thickness of topsoil strip (average).
Compaction Control	GDR7	-	Requirements for "Sand" as per GDR7 Compaction control at this site may be done using a Perth sand penetrometer (PSP). The target blow counts for "Bassendean Sand" are applicable as per **GDR7.4 Perth Sand Penetrometer.**
Approved Fill	GDR8	Permeable Sand or General Sand	Approved fill at this site is to comprise **Permeable Sand** (where stormwater disposal is required) or **General Sand** (where stormwater disposal is not required) as per **GDR8 Approved Fill and Conformance Testing.** The insitu sand is suitable for reuse as **General Sand**, and as likely to have an unsaturated hydraulic conductivity of approximately 3 m/day when compacted. **Further permeability testing of recompacted insitu sand is required to derive a design hydraulic conductivity value.**
Excavations, batters and slopes	GDR12	1V:2H (temporary) 1V:3H (permanent)	Excavations in sand should be readily achievable to 2 m with 15 ton excavator or similar. The batter angles given are for slopes up to 2 m high and above groundwater. Refer to **GDR12 Excavations, Batters and Slopes** for more information. **Dewatering will be required for excavations in lower lying areas of shallow groundwater.**
Unsaturated Hydraulic Conductivity	GDR13	k_{unsat} = 3 m/day for isolated soakwells, and k_{unsat} = 5 m/day for interconnected soakwells.	k_{unsat} values apply where disposing into natural grey sand, minimum 0.5 m above the groundwater table, coffee rock layers (or overlying perched water) or black / brown sand layers near the groundwater table as per GDR13.4.
Pavement Subgrades	GDR16	CBR = 10%	For subgrades of granular pavements comprising compacted approved fill / insitu sand.
Acid Sulfate Soils	-	Refer Section 12	Management of acid sulfate soils is likely to be required during construction.

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

12. PRELIMINARY ENVIRONMENTAL ASSESSMENT

12.1. Soil

The field-testing results are summarised in Table 9 below and presented in Appendix G. Laboratory certificates of analysis are presented in Appendix H

Table 9: Summary of Soil Field Results

Field pHf range	Field pHfox range	pH change	Laboratory pH range	Maximum Net Acidity (%S)
4.7 – 8.5	2.6 – 6.5	1.0 – 5.8	4.0 – 9.5	<0.02 – 0.14

Laboratory analytical results indicate that the net acidity in all samples, except BH16/3.0 (0.14%S) were below the laboratory limit of reporting (LOR) and/or below the maximum net acidity of 0.03%S.

Tabulated results are presented in Appendix G.

12.2. Groundwater

Groundwater at the site was encountered at depths ranging from 0.28 to 1.15 m below ground level with a pH ranging from 6.18 – 7.16. Mildly elevated inherent acidity along with high to very high alkalinity concentrations were noted at

both monitoring locations indicating that groundwater will likely have sufficient self-buffering capacity to maintain an acceptable pH in the event of ASS generation.

Elevated concentrations of aluminium and iron indicate that historical oxidation of ASS may have occurred at the site. Concentrations of chloride were found to exceed non-potable use of groundwater guidelines in MW01 (330 mg/L).

Groundwater field parameters are presented in Appendix H and tabulated groundwater results are presented in Appendix I.

12.3. Summary

Based on the findings of the study and previous experience with ASS identification, coffee rock and organic soils at the site are considered to be ASS.

13. RECOMMENDATIONS

We recommend a more detailed investigation of ASS is conducted in the event that deep disturbances and/or dewatering are required as part of future development at the site. The need for this will mainly depend on the filling regime and disturbances in the drainage lines and lakes present at the site.

14. CLOSURE

GALT GEOTECHNICS





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https://galtgeo.sharepoint.com/sites/wag250138/shared documents/01 dpd si/03 correspondence/wag250138-01 001 r rev0.docx

Attached Table 1: Summary of Geotechnical Index Test Results

Test Name	Sample Depth (m)	Soil Class (AS1726 2017)	Gravel (%)	Sand (%)	Fines (%)	LL (%)	PI (%)	LS (%)	Org %	MMDD (t/m^3)	OMC (%)	CBR (%)	CBR Swell (%)
BH02	1.0 to 1.5	Clayey SAND (SC)	4	71	25	28	5	2.5	-	-	-	-	-
BH03	1.5 to 1.8	SAND (SP)	-	98	2	-	-	-	-	-	-	-	-
BH04	1.0 to 1.4	Organic Clayey SAND (SC)	2	66	32	46	6	3.0	10.7	-	-	-	-
BH06	0.6 to 1.0	SAND (SP-SC)	2	92	6	-	-	-	1.2	-	-	-	-
BH10	1.0 to 1.5	SAND (SP)	-	99	1	-	-	-	-	-	-	-	-
G07	0.5 to 0.6	SAND (SP)	-	97	3	-	-	-	0.4	-	-	-	-
G10	0.4 to 0.5	SAND (SP)	1	94	5	-	-	-	1.1	-	-	-	-
27 Hatch Court in May 2025 (WAG250256-01 001 R Rev1)													
BH04	0.3 to 0.5	SAND (SP)	0	95	5	-	-	-	1.7	-	-	-	-
BH06	1.0 to 1.4	SAND (SP)	0	96	4	-	-	-	0.5	-	-	-	-
BH07	0.3 to 0.7	SAND (SP)	6	92	2	-	-	-	2.7	-	-	-	-
Lots 8 and 16 Stirling Crescent in November 2024 (WAG240438-01 001 R Rev2)													
G01	0.1 to 0.5	(SP) SAND	0	96	4	-	-	-	-	-	-	-	-
BH16	0.1 to 0.5	(SP) SAND	0	96	4	-	-	-	-	-	-	-	-
Part of Lot 1499 Stirling Crescent in September 2023 (WAG230463-01 002 R Rev1). ***Located north of site (not within site).***													
BH01	0.1 to 0.5	SAND (SP)	1	96	3	-	-	-	-	1.76	12.5	20	0.0
BH03	0.6 to 1.2	SAND (SP)	-	95	5	-	-	-	-	-	-	-	-
BH04	0.1 to 0.4	SAND (SP)	-	96	4	NO	NP	0.0	-	-	-	-	-
BH06	0.5 to 1.2	SAND (SP)	-	97	3	NO	NP	0.0	-	-	-	-	-
BH07	0.0 to 0.4	SAND (SP)	1	96	3	-	-	-	-	1.73	14.5	19	0.0
G02	0.2 to 0.6	SAND (SP-SM)	5	89	6	-	-	-	-	-	-	-	-

Notes

1. *Particle size distribution (by mass)*
   - *Gravel: 2.36 mm – 63 mm*
   - *Sand: 0.075 mm – 2.36 mm*
   - *Fines: <0.075 mm*
2. *Atterberg Limits*
   - *LL: Liquid limit*
   - *PI: Plasticity index*
   - *LS: Linear shrinkage*
   - *NO: Not obtainable*
   - *NP: Non-plastic*
3. *Org: Organic content (by mass)*
4. *Modified compaction*
   - *MMDD: Modified maximum dry density*
   - *OMC: Optimum moisture content*
6. *CBR: California bearing ratio*
   - *Remoulding dry density ratio: 95% MMDD*
   - *Surcharge: 6.75 kg*
   - *Soaking: 4-day soaked*

Attached Table 2: Summary of Chemical Test Results

Test Name	Sample Depth (m)	Soil Class (AS1726 2017)	Electric Conductivity (us/cm)	pH	Phosphorus Retention Index	Exchangeable Sodium Percentage (%)
BH02	1.0 to 1.5	Clayey SAND (SC)	300	8.4	21	-
BH04	1.0 to 1.4	Organic Clayey SAND (SC)	1000	4.8	200	-
BH06	0.5 to 1.0	SAND (SP-SC)	110	7.3	4.0	-
G07	0.5 to 0.6	SAND (SP)	14	7.8	0.5	-
G10	0.4 to 0.5	SAND (SP)	73	7.7	1.5	-
27 Hatch Court in May 2025 (WAG250256-01 001 R Rev1)						
G01	0.3	SAND (SP)	66	6.6	-0.14	-
G03	0.4	SAND (SP)	60	6.6	-0.48	-
Lots 8 and 16 Stirling Crescent in November 2024 (WAG240438-01 001 R Rev2)						
G01	0.1 to 0.5	SAND (SP)	32	5.8	-0.11	Not Reportable
BH16	0.1 to 0.5	SAND (SP)	36	6.2	-0.25	Not Reportable
Part of Lot 1499 Stirling Crescent in September 2023 (WAG230463-01 002 R Rev1). ***Located north of site (not within site).***						
BH04	0.1 to 0.4	SAND (SP)	-	-	0.62	-
G02	0.2 to 0.6	SAND (SP-SM)	-	-	1.2	-

Attached Table 3: Summary of encountered conditions (August / September 2025)

Test Location	Hole Depth (m)	Depth to Groundwater (m BGL[1])	Depth to top of clay / clayey or cemented[4] soil (m BGL[1])	Organic Soil layers (m BGL[1])
CPT01	5.1	0.60	0.9 to 1.2 and from 4.0	possibly from 0.9 to 1.2
CPT02	5.1	0.40	3.0	-
CPT03	5.1	1.70	2.2	-
CPT04	5.1	Collapsed[2]	***3.5***[4]	-
CPT05	2.3	0.60	-	-
CPT06	5.1	0.80	***2.0***[4]	-
CPT08	5.1	0.20	-	-
CPT09	5.1	1.40	***3.4***[4]	-
CPT10	5.1	0.20	-	-
CPT12	5.1	0.60	-	-
CPT13	5.1	0.00	4.2	-
CPT14	5.1	0.80	4.1	-
CPT15	5.1	0.80	***3.2***[4]	-
CPT16	3.0	1.10	***2.8***[4]	-
CPT19	5.1	0.80	-	-
CPT20	5.1	0.80	***2.2***[4]	-
BH01	3.0	2.10	-	-
BH02	3.0	0.80	0.9	0.9 to 2.0 - trace organics in clayey sand
BH03	3.0	1.60	***2.6***[4]	-
BH04	3.0	0.10	0.7	0.7 to 1.4 Organic clayey sand
BH05	1.3	0.60	-	-
BH06	3.0	0.40	2.6	-
BH09	3.0	1.30	-	-
BH10	3.0	1.60	-	-
BH11	3.0	1.00	-	-
BH12 / MW01	3.0	1.00	0.0 to 1.4 and 2.6	Peat from 0.0 to 0.6, Organic sand from 0.6 to 1.4
BH13	3.0	0.90	-	-
BH14 / MW03	3.0	0.28	2.0	-
BH15	3.0	1.10	-	-
BH16 / MW02	3.0	1.15	***2.0***[4]	-

NOTES:

1. *'BGL' – below current ground level*
2. *CPT probe hole collapsed before groundwater could be measured.*
3. *CPT probes may not have had sufficient time to recharge to hydrostatic levels.*
4. *Coffee rock layer, typically about 0.3 m to 1.0 m thick, and underlain by sand. Coffee rock inferred from CPT refusal at some locations.*
5. *Investigation typically encountered thin surficial fill / topsoil sand over clay / clayey or cemented soil layers as stated in table above. Thicker surficial organic layers encountered near / within drainage line in northern part of site as summarised above. Refer to appendices for further details.*

Attached Table 4: Summary of encountered conditions at 27 Hatch Court (May 2025)

Test Location	Hole Depth (m)	Depth to Groundwater (m BGL[1])	Depth to top of clay / clayey soil (m BGL[1])
BH01	3	1.7	-
BH02	3	-	-
BH03	3	-	-
BH04	3	1.9	2.8
BH05	3	2.8	-
BH06	3	-	-
BH07	3	2.7	-
BH08	3	-	-
CPT01	6.5	collapsed	6.2
CPT02	5.8	collapsed	2.2
CPT03	6.3	collapsed	6.1
CPT04	6.4	collapsed	3.5
CPT05	6.4	collapsed	6.2
CPT06	6.4	collapsed	2.2

NOTES:

1. *'BGL' – below current ground level*
2. *CPT probe hole collapsed before groundwater could be measured.*
3. *CPT probes may not have had sufficient time to recharge to hydrostatic levels.*
4. *Investigation typically encountered thin surficial fill / topsoil sand over clay / clayey or cemented soil layers as stated in table above. Refer Report WAG250256-01 001 R Rev1 for further details.*

Attached Table 5: Summary of groundwater depths during fieldwork at 71 Stirling Crescent (March 2023)

Test Location	Hole Depth (m)	Depth to Groundwater (m BGL[1])	Depth to top of cemented[4] soil (m BGL[1])
BH01	1.7	-	***1.7[4]***
BH02	2.0	-	-
BH03	2.0	-	-
BH04	1.0	-	***1.0[4]***

NOTES:

1. *'BGL' – below current ground level*
2. *CPT probe hole collapsed before groundwater could be measured.*
3. *CPT probes may not have had sufficient time to recharge to hydrostatic levels.*
4. *Coffee rock layer, inferred from borehole refusal.*
5. *Investigation typically encountered thin surficial fill / topsoil sand over clay / clayey or cemented soil layers as stated in table above. Refer Report WAG230133-01 001 R Rev 1 for further details.* ***Investigation located north of site (not within site).***

Attached Table 6: Summary of groundwater depths during fieldwork at Lots 8 & 16 Stirling Crescent (November 2024)

Test Location	Hole Depth (m)	Depth to Groundwater (m BGL[1])	Depth to top of clay / clayey or cemented[4] soil (m BGL[1])
BH01	3.00	-	-
BH02	3.00	-	-
BH03	3.00	-	-
BH04	3.00	-	-
BH05	2.70	1.2	-
BH06	3.00	-	-
BH07	3.00	-	-
BH08	2.00	-	***2.0***[4]
BH09	3.00	-	-
BH10	3.00	-	-
BH11	3.00	-	-
BH12	3.00	-	-
BH13	3.00	-	-
BH14	2.88	-	***2.5***[4]
BH15	2.30	-	***2.2***[4]
BH16	3.00	-	-
CPT01	6.90	-	6.5
CPT02	2.70	collapsed	***1.8***[4]
CPT03	6.20	collapsed	6.0
CPT04	6.20	collapsed	-
CPT05	6.20	collapsed	-
CPT06	6.20	collapsed	***3.0***[4]
CPT07	2.83	collapsed	***2.8***[4]
CPT08	2.86	collapsed	***2.8***[4]
CPT09	2.91	collapsed	***2.9***[4]
CPT10	2.51	collapsed	***2.5***[4]

NOTES:

1. *'BGL' – below current ground level*
2. *CPT probe hole collapsed before groundwater could be measured.*
3. *CPT probes may not have had sufficient time to recharge to hydrostatic levels.*
4. *Coffee rock layer, typically about 0.3 m to 1.0 m thick, and underlain by sand. Coffee rock inferred from CPT refusal at some locations.*
5. *Investigation typically encountered thin surficial fill / topsoil sand over clay / clayey or cemented soil layers as stated in table above. Refer Report WAG240438-01 001 R Rev2 for further details.*

Attached Table 7: Summary of groundwater depths during fieldwork at part of Lot 1499 Stirling Crescent (September 2023)

Test Location	Hole Depth (m)	Depth to Groundwater (m BGL[1])	Depth to top of clay / clayey or cemented[4] soil (m BGL[1])
BH01	2.0	-	-
BH02	2.0	1.7	-
BH03	2.0	1.1	-
BH04	2.0	1.9	-
BH05	2.0	1.9	-
BH06	2.0	-	-
CPT01	3.2	collapsed	***3.0[4]***
CPT02	8.4	2.5	***2.5 to 3.5[4]***, and from 8.0
CPT03	3.0	collapsed	***2.8[4]***
CPT04	8.2	1.9	-
CPT05	8.2	collapsed	***3.4 to 4.0[4]*** and 5.6
CPT06	2.7	collapsed	***2.6[4]***
CPT07	8.2	1.7	4.0

NOTES:

1. *'BGL' – below current ground level*
2. *CPT probe hole collapsed before groundwater could be measured.*
3. *CPT probes may not have had sufficient time to recharge to hydrostatic levels.*
4. *Coffee rock layer, typically about 0.3 m to 1.0 m thick, and underlain by sand. Coffee rock inferred from CPT refusal at some locations.*
5. *Investigation typically encountered thin surficial fill / topsoil sand over clay / clayey or cemented soil layers as stated in table above. Refer Report WAG230463-01 002 R Rev1 for further details.* ***Investigation located north of site (not within site).***

Figures





Legend

- Site Boundary
- Borehole
- Machine Auger Borehole
- Cone Penetration Test
- Direct Push Borehole / Groundwater Monitoring Well
- Machine Auger Borehole / Guelph Permeameter
- Guelph Permeameter

N

0 50 100 150 200 250
Meters

NOTES
Aerial Imagery and Cadastre sourced from Landgate/SLIP



SCALE	1:3,250	(A3)
DRAWN	CED	
DATE DRAWN	11/9/2025	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

Galt Geotechnics Pty Ltd
ACN : 138 490 865
Tel : +61 (0)8 6272-0200
Address : 50 Edward Street
Osborne Park WA 6017

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CLIENT	**DYNAMIC PLANNING AND DEVELOPMENTS**
PROJECT	LSP AMENDMENT
LOCATION	51 STIRLING CRESCENT HIGH WYCOMBE
TITLE	SITE & LOCATION PLAN

Job No	Fig No	Rev
WAG250138-01	FIGURE 1	**A**





Legend

- Site Boundary
- Borehole
- Machine Auger Borehole
- Cone Penetration Test
- Direct Push Borehole / Groundwater Monitoring Well
- Machine Auger Borehole / Guelph Permeameter
- Guelph Permeameter

WAG250256-01-TLF

- Borehole
- Borehole / Infiltration Test
- Cone Penetration Test
- Guelph Permeameter

WAG240438-01-TLF

- Borehole
- Borehole / Standpipe
- Cone Penetration Test
- Guelph Permeameter
- Guelph Permeameter / Standpipe
- Infiltration Test

WAG230463-01-TLF

- Borehole
- Borehole / Infiltration Test
- Cone Penetration Test
- Permeability Test
- Sediment Sample

WAG230133-01-FTL

- Borehole
- Borehole / Infiltration Test
- Infiltration Test

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP



SCALE	1:3,250	(A3)
DRAWN	CED	
DATE DRAWN	11/9/2025	
CHECKED	_	
DATE CHECKED	_	
PROJECTION	GDA 1994 MGA Zone 50	

Galt Geotechnics Pty Ltd
ACN : 138 490 865
Tel : +61 (0)8 6272-0200
Address : 50 Edward Street
Osborne Park WA 6017

Job No	Fig No	Rev
WAG250138-01	FIGURE 1	A

Appendices

Appendix A: Site Photographs

Photograph 1: Site photo near BH13. Water ponded at ground surface



Photograph 2: Near BH02 facing west. Wetland area near Lewis Road.



Photograph 3: Near BH01 facing south east



Photograph 4: Near CPT01 facing north. Wetland area near Lewis Road / drainage line in northern part of site.



Photograph 5: Near BH04 facing north



Photograph 6: Near CPT08 facing west. Drainage line adjacent borehole.



Photograph 7: Near BH10 facing east



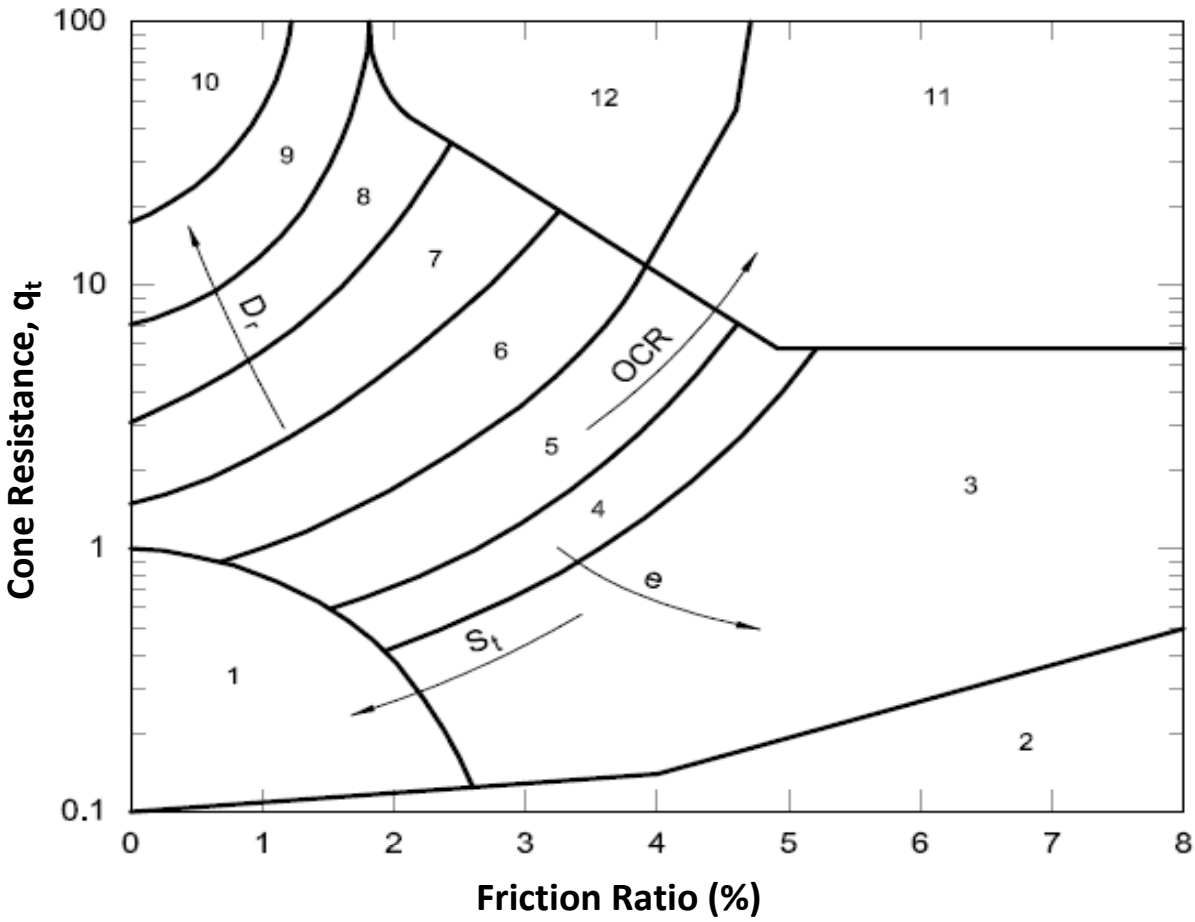
Photograph 8: Near BH15 facing south east



Photograph 9: Near BH06 facing south west



Appendix B: CPT Test Results



DEFINITIONS

q_t : Cone tip resistance corrected for pore water pressure
S_t : Sensitivity
e : Void ratio
D_r : Relative density
OCR : Overconsolidation ratio
OC : Overconsolidated

SOIL BEHAVIOUR TYPE ZONES

1. Sensitive fine grained
2. Organic material
3. Clay
4. Silty clay to clay
5. Clayey silt to silty clay
6. Sandy silt to clayey silt
7. Silty sand to sandy silt
8. Sand to silty sand
9. Sand
10. Gravelly sand to sand
11. Very stiff fine grained material (OC/cemented)
12. Sand to clayey sand (OC/cemented)

NOTES

A. Some overlap in type zones is expected
B. Local correlations are preferred and may indicate soil type boundaries that are different from those shown above

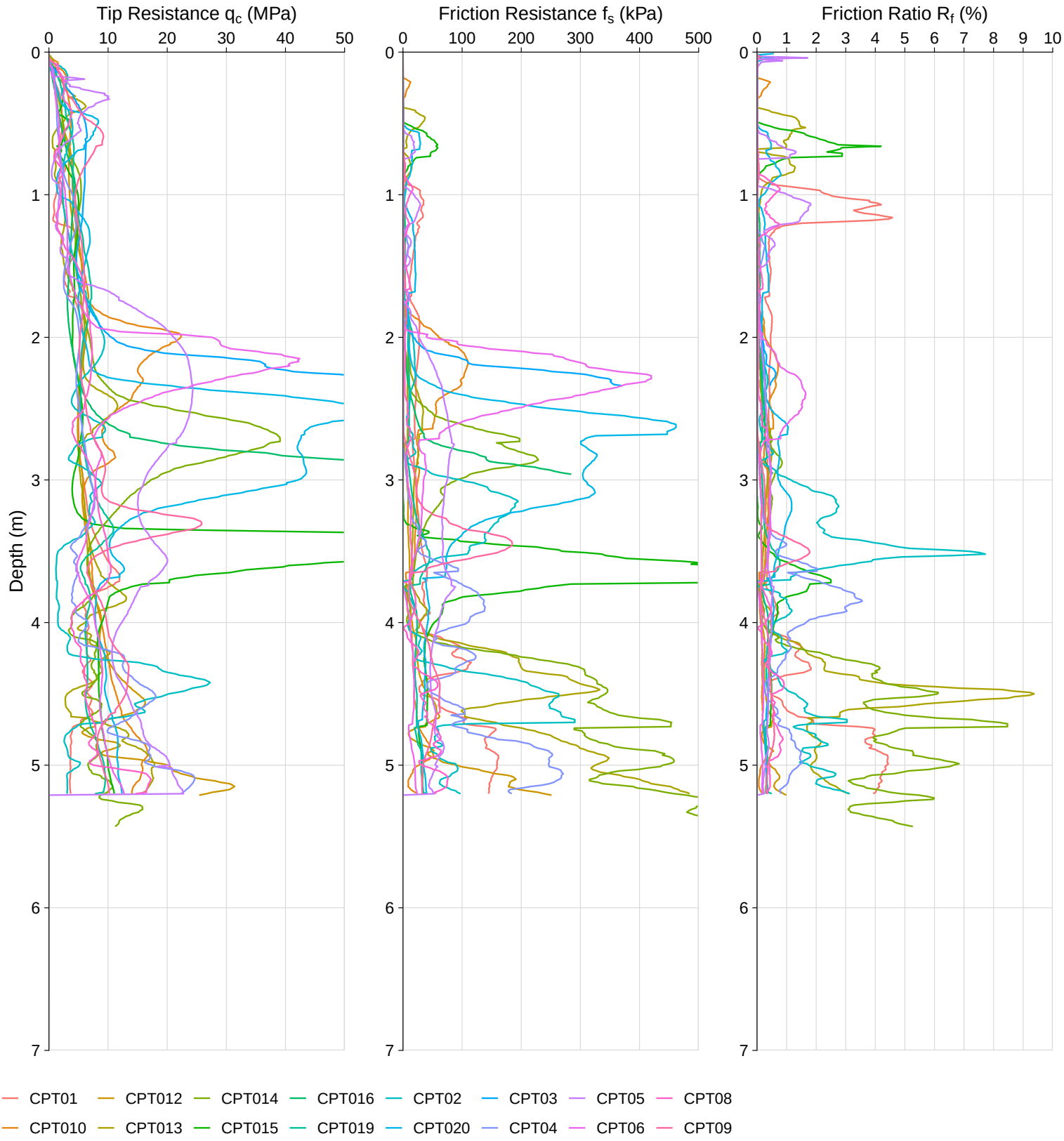
Reference: Robertson, P.K., Campanella, R.G., Gillespie, D. and Grieg, J. (1986) "Use of Piezometer Cone Data". Proceedings of the ASCE Speciality Conference In Situ '86: Use of In Situ Tests in Geotechnical Engineering, Blacksburg, pp 1263-80, American Society of Civil Engineers (ASCE)

Galt GEOTECHNICS

CONE PENETRATION TESTING (CPT) SOIL TYPE INTERPRETATION

CONE PENETRATION TEST

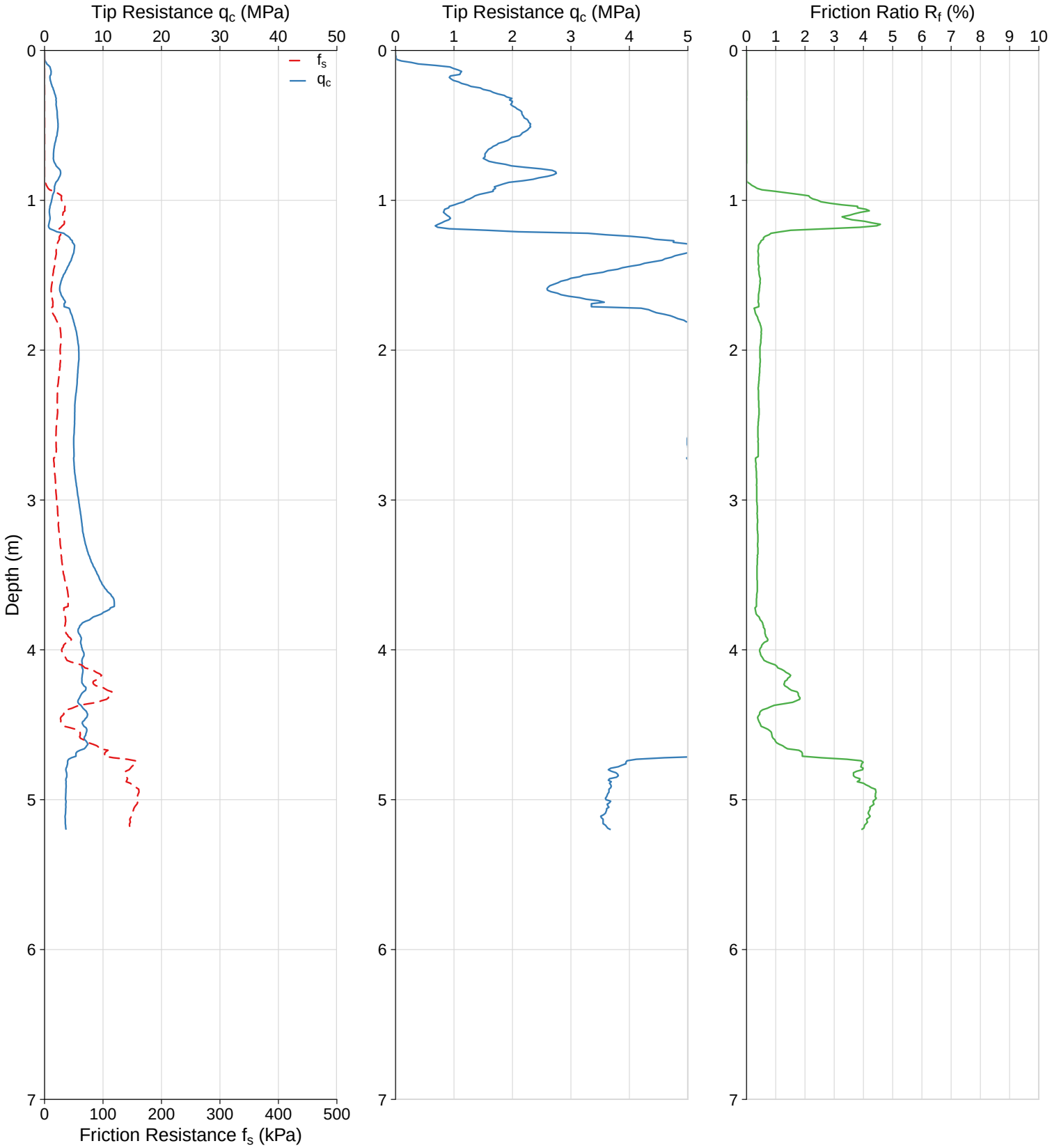
ALL TESTS		**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



RIG: Pagani TG 73-200 200kN

CONE PENETRATION TEST

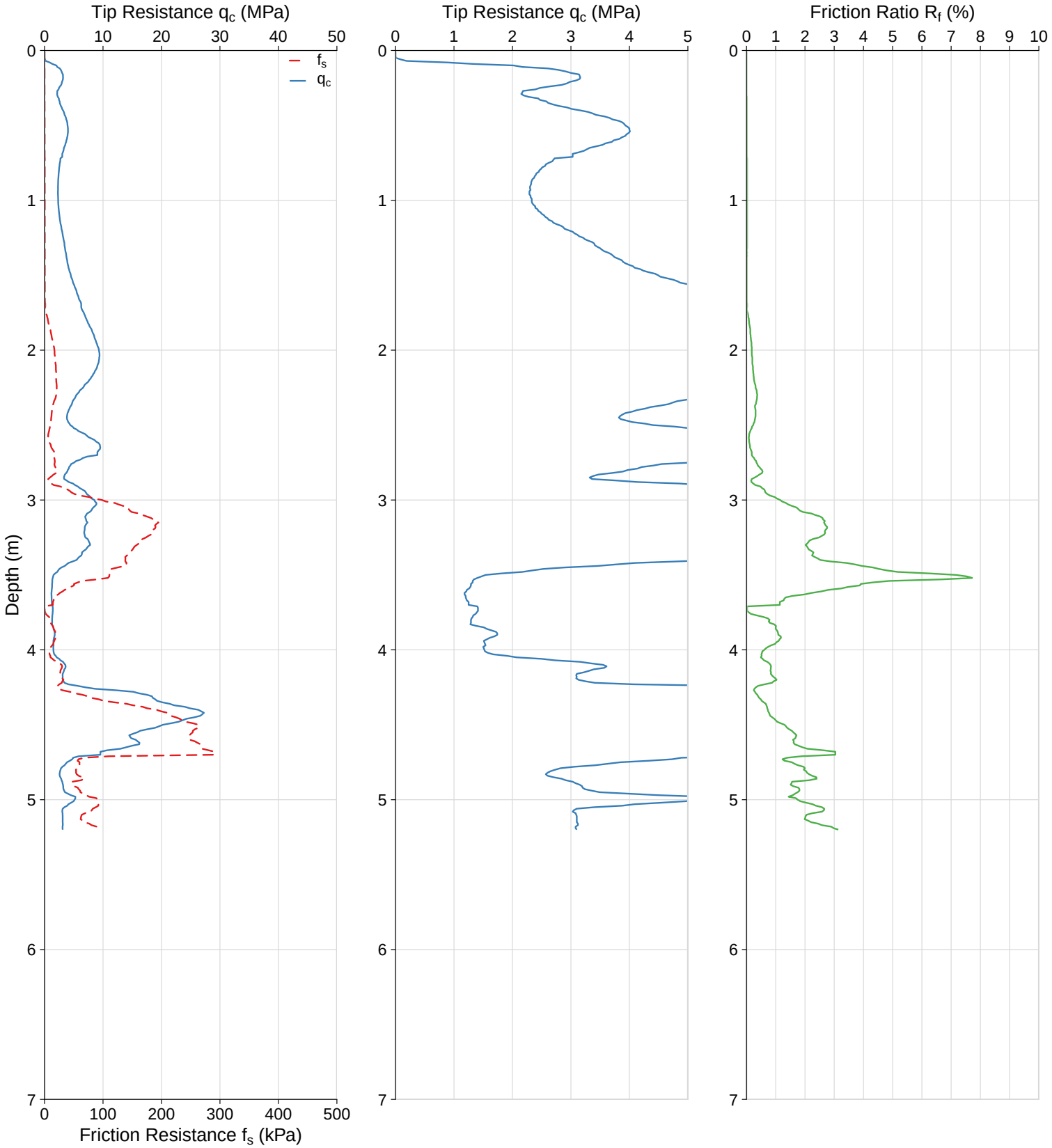
CPT ID:	CPT01	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.6m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

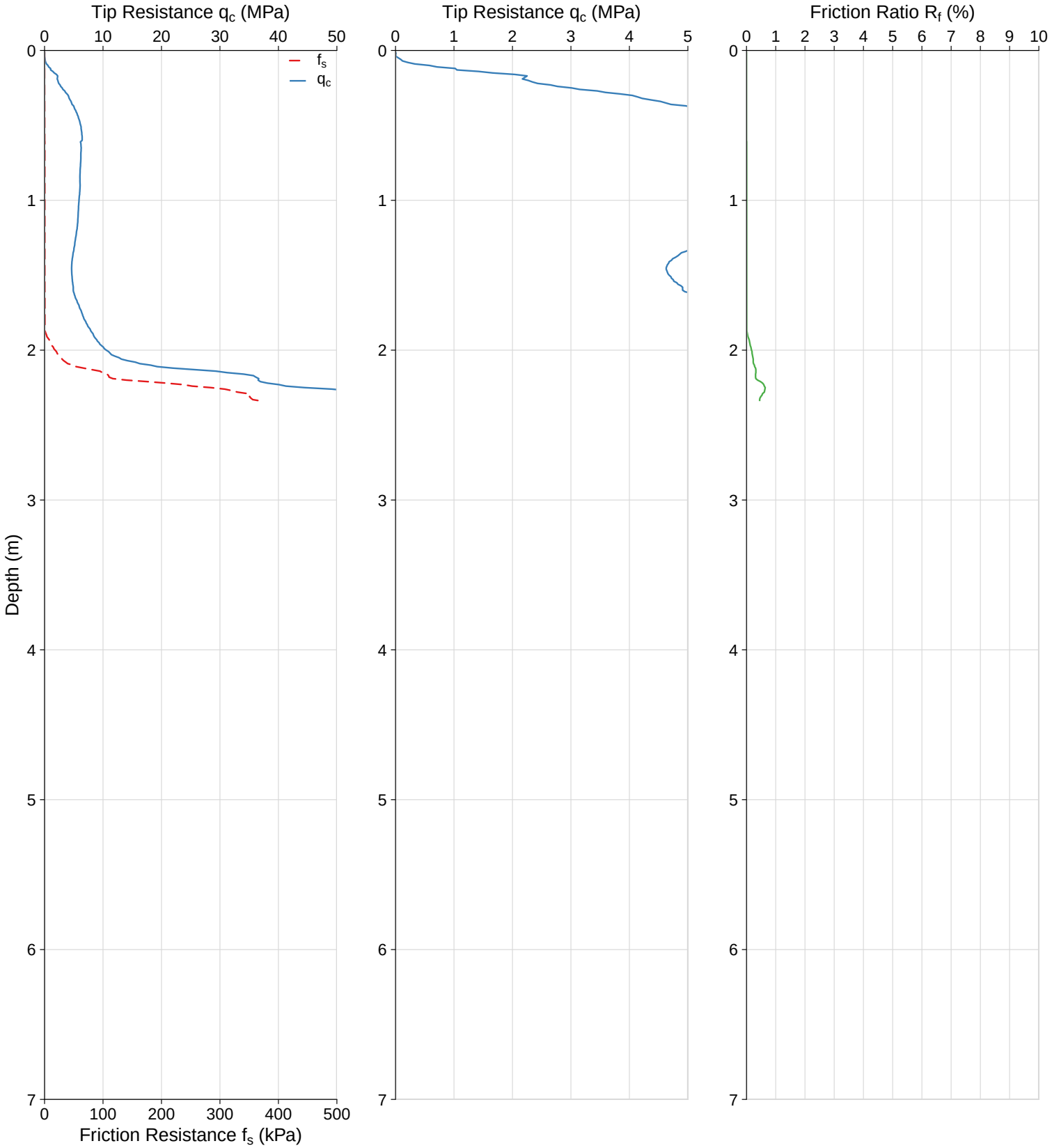
CPT ID:	CPT02	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.4m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

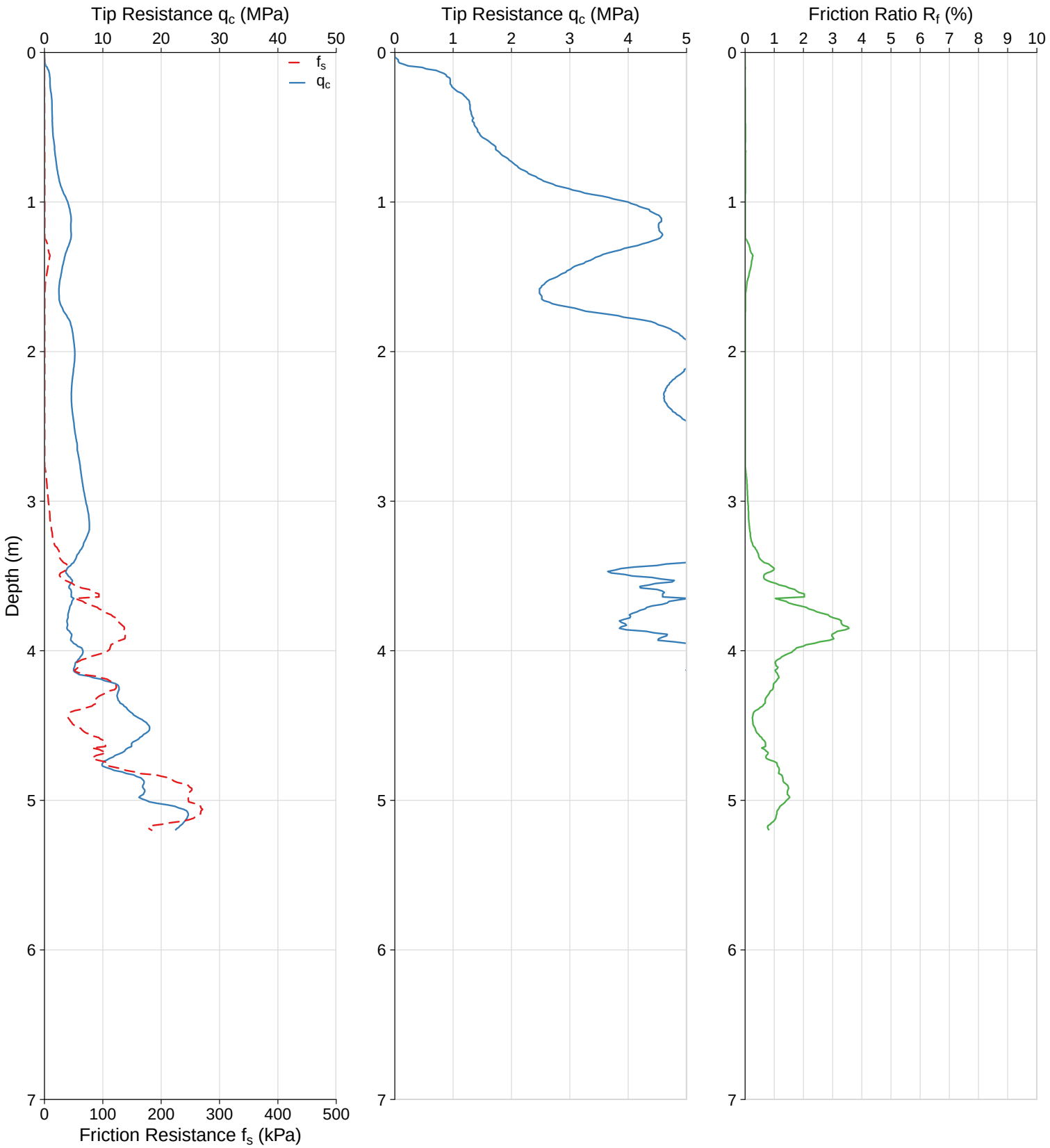
CPT ID:	CPT03	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 1.7m	**CO-ORDS:**	
TERMINATION:	Refused, 2.34m	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

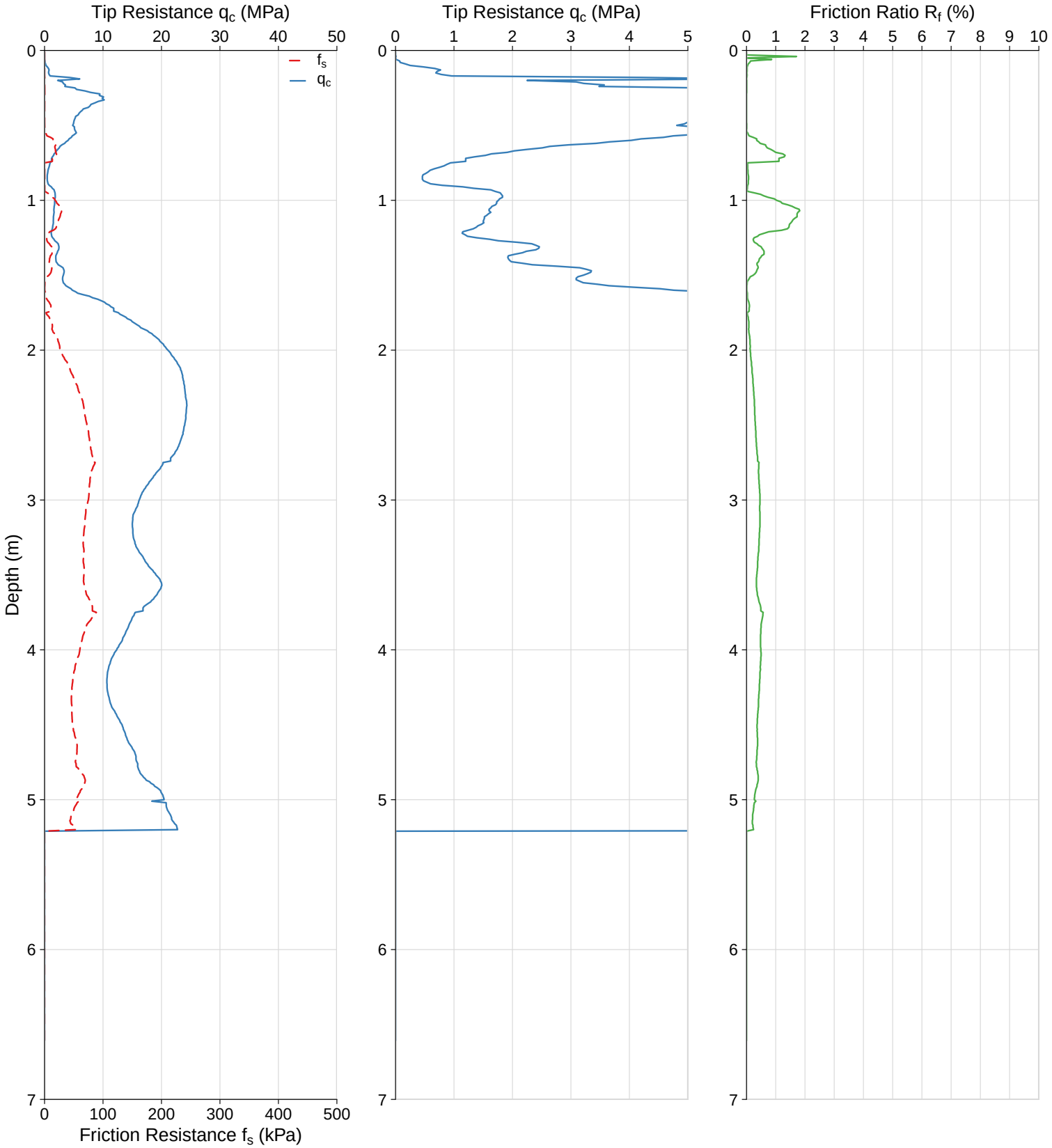
CPT ID:	CPT04	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

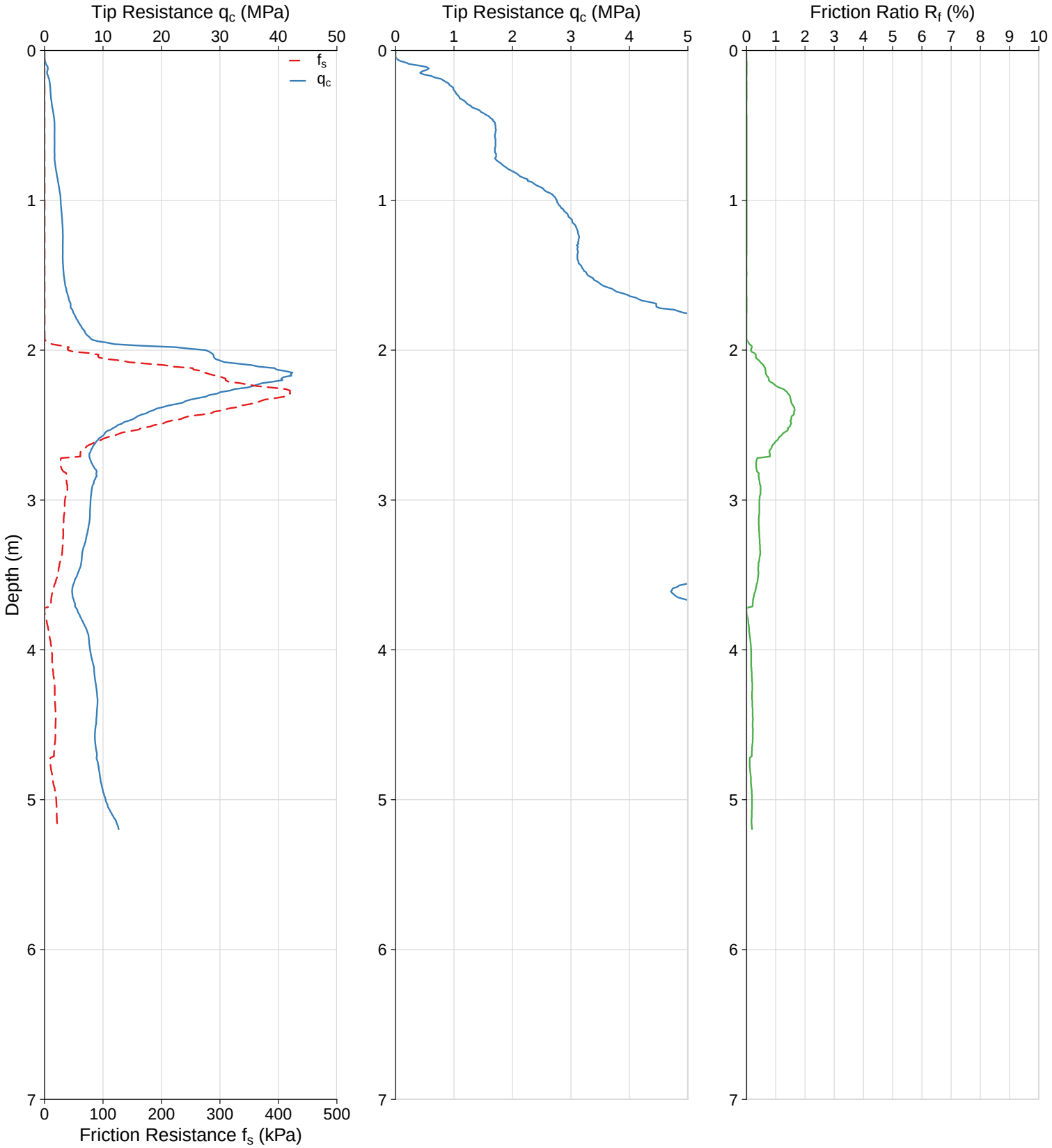
CPT ID:	CPT05	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.6m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

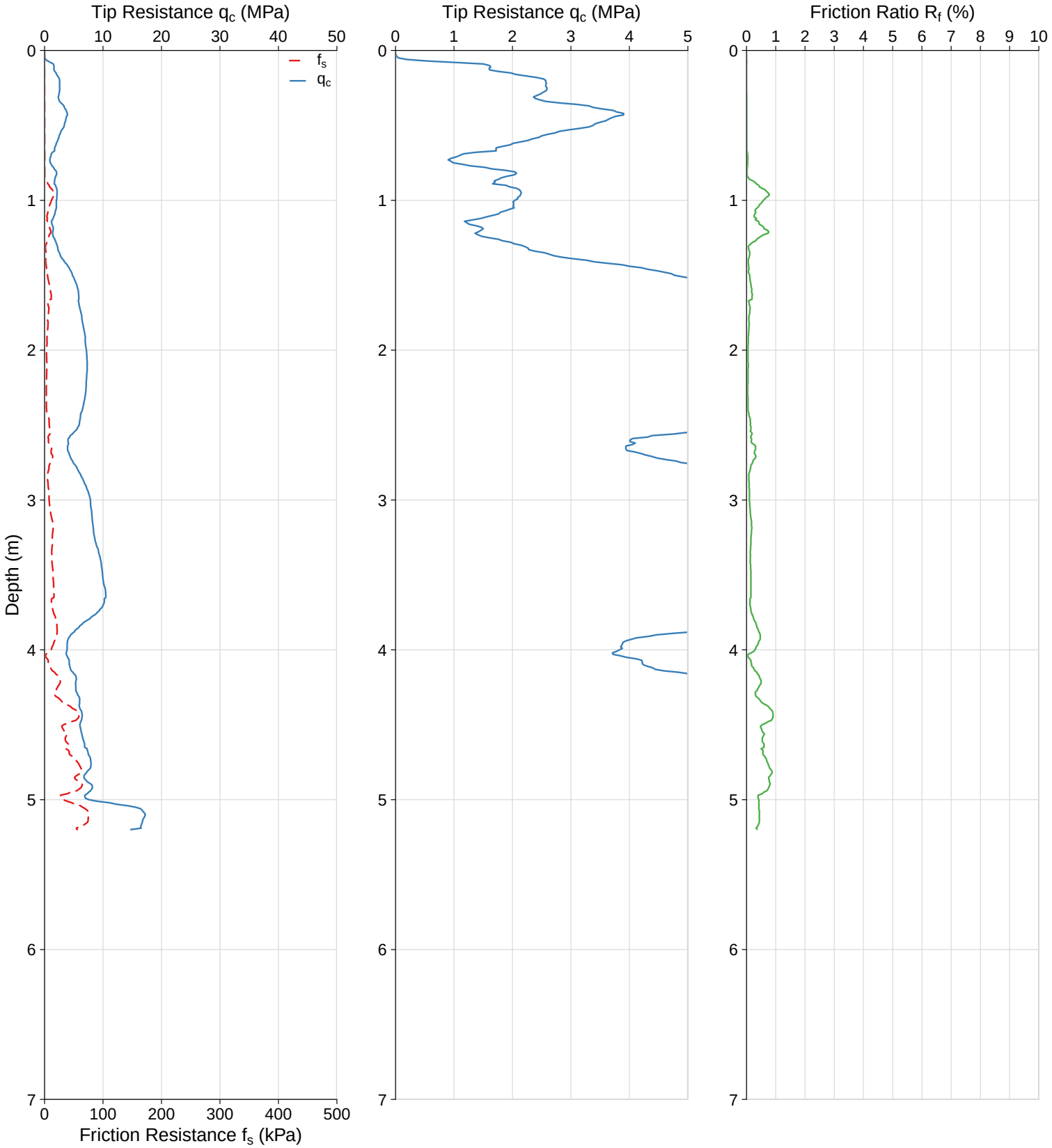
CPT ID:	CPT06	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 0.8m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

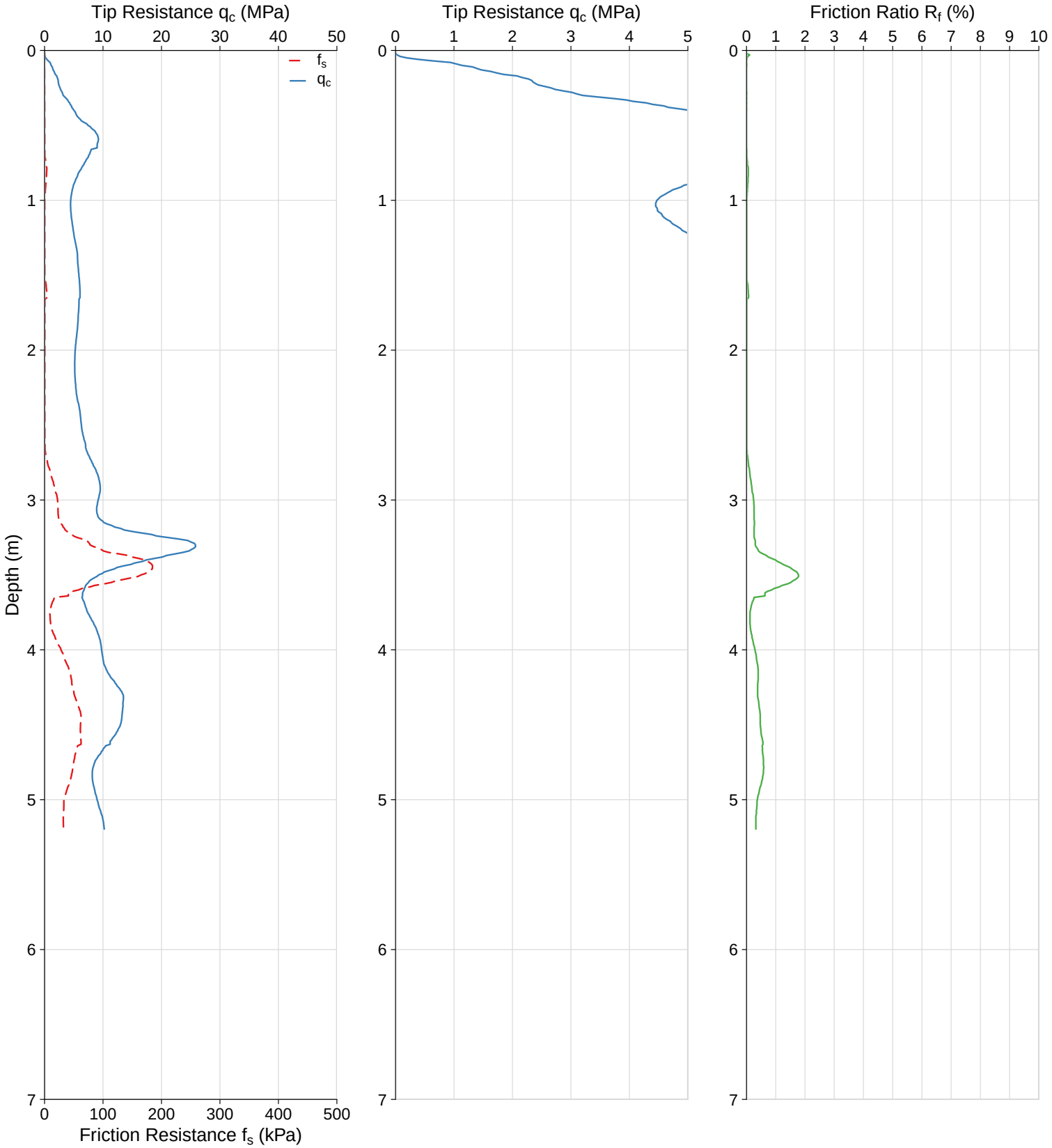
CPT ID:	CPT08	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.2m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

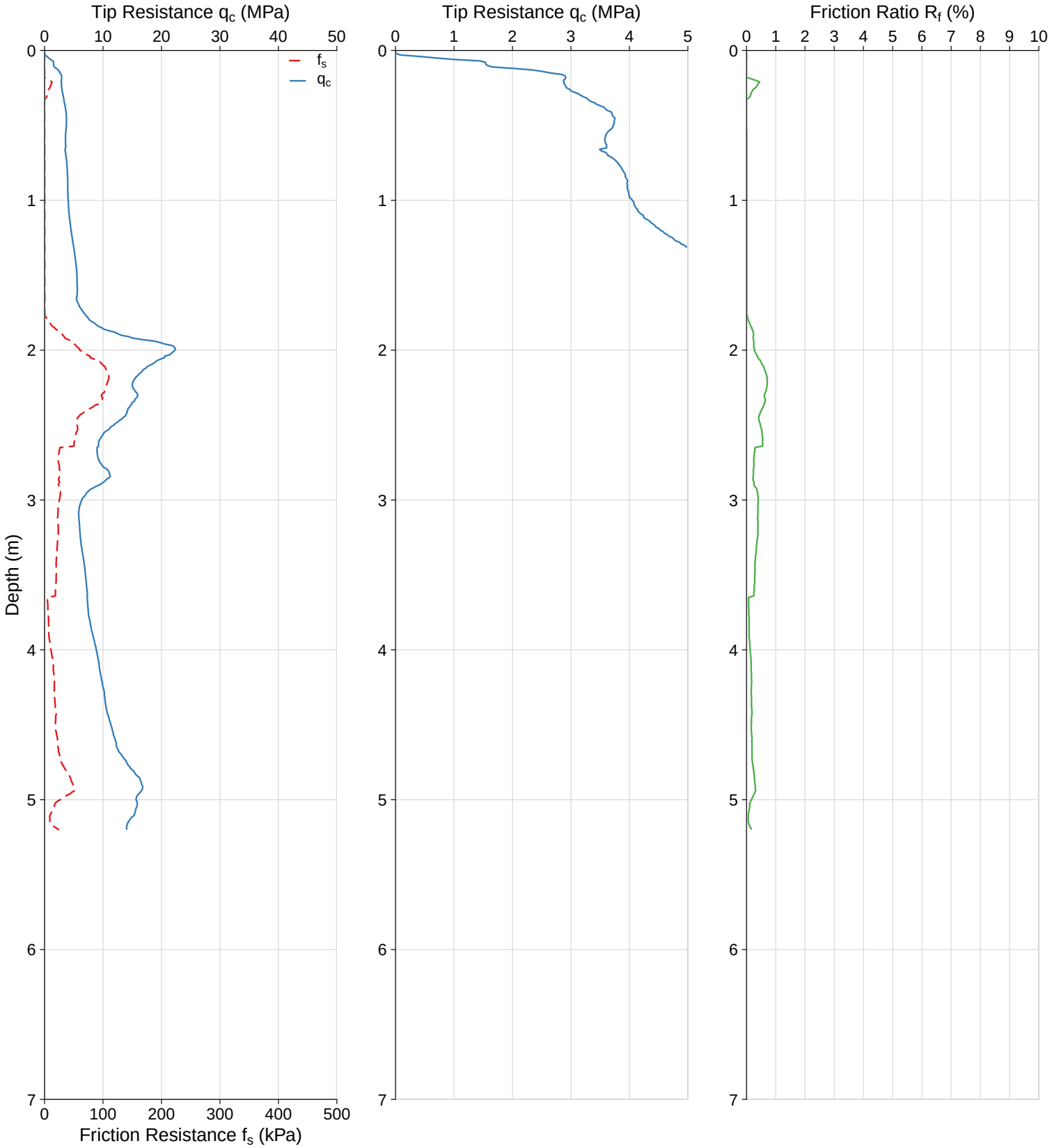
CPT ID:	CPT09	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 1.4m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

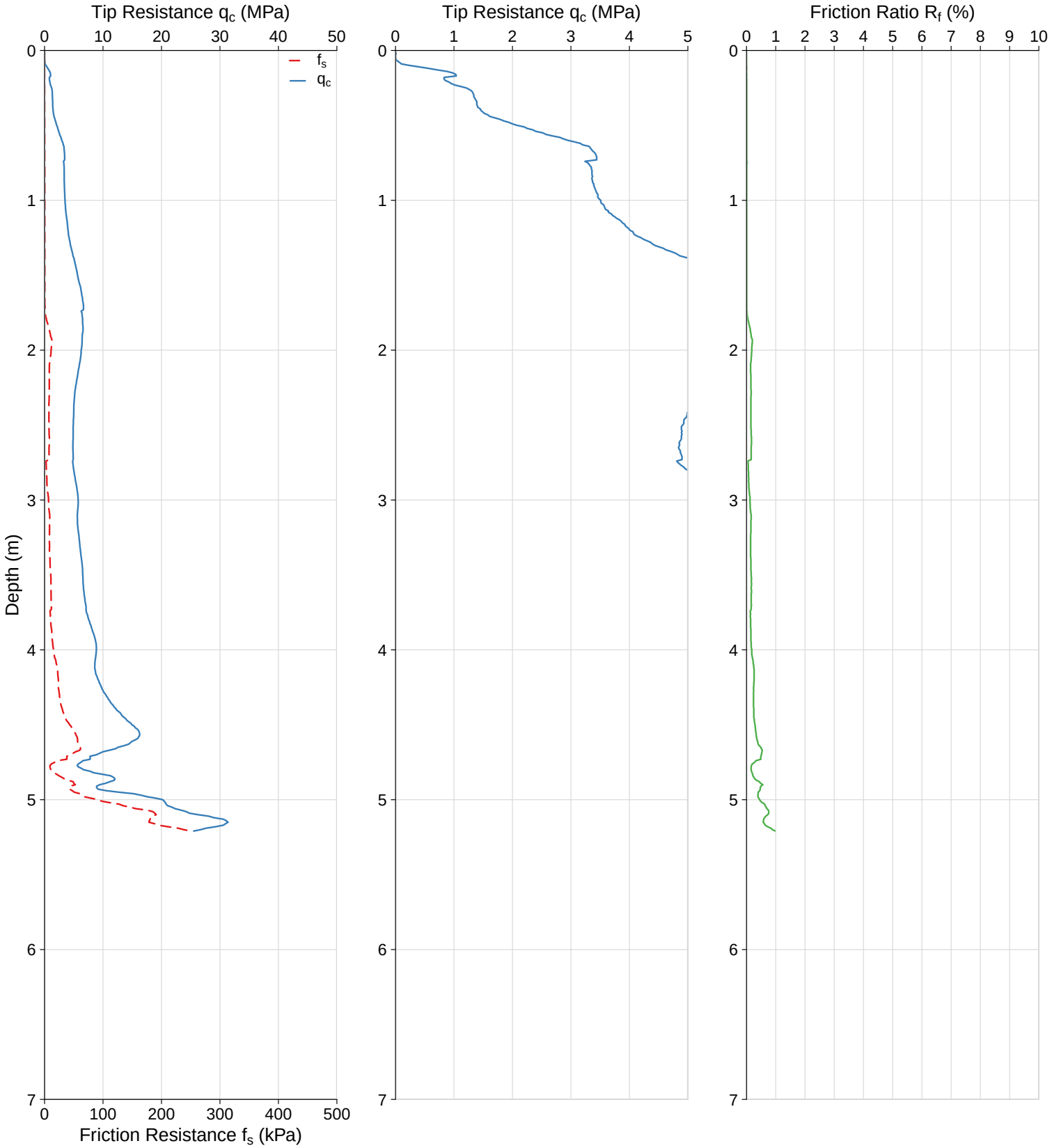
CPT ID:	CPT010	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.2m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

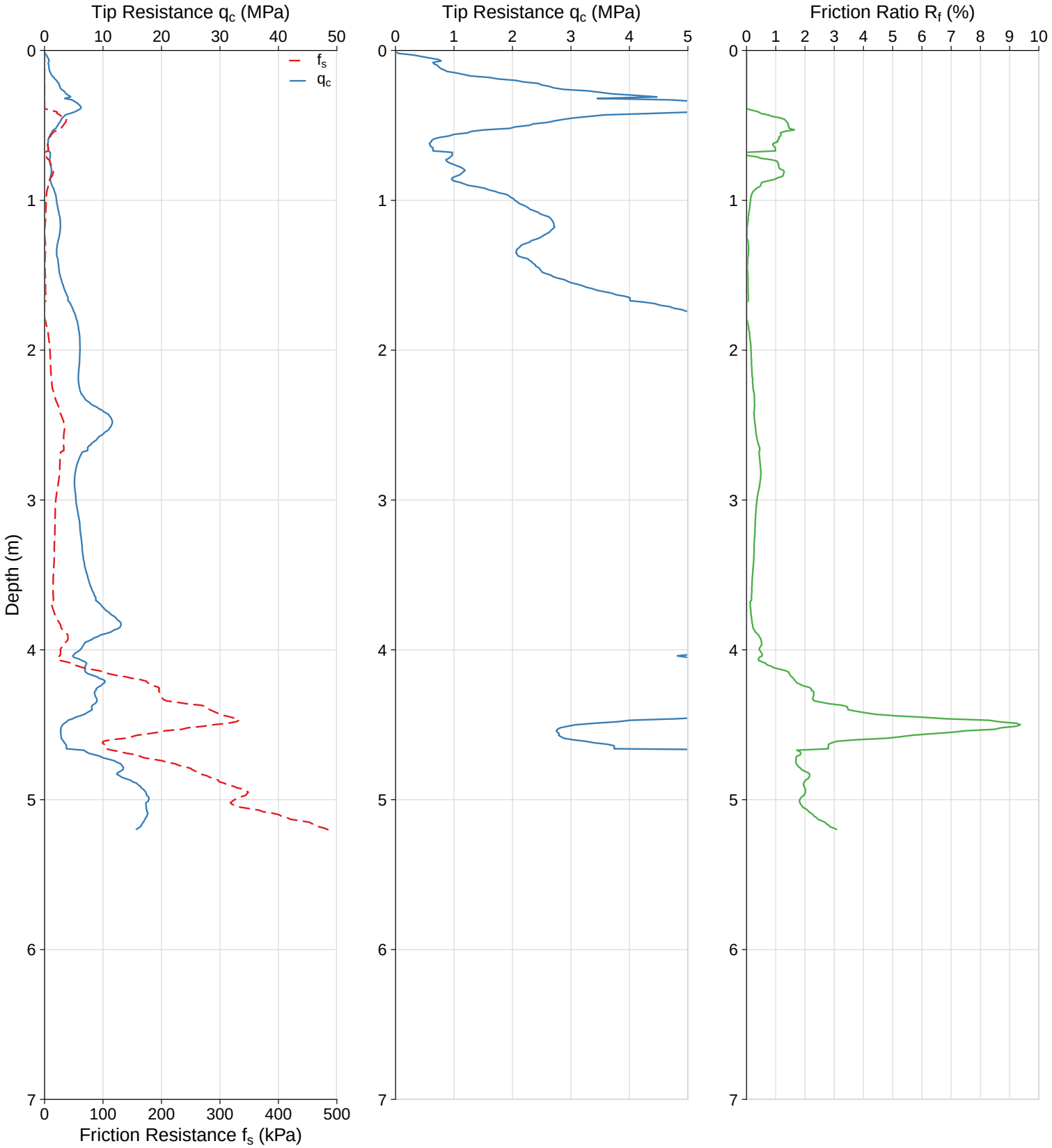
CPT ID:	CPT012	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.6m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

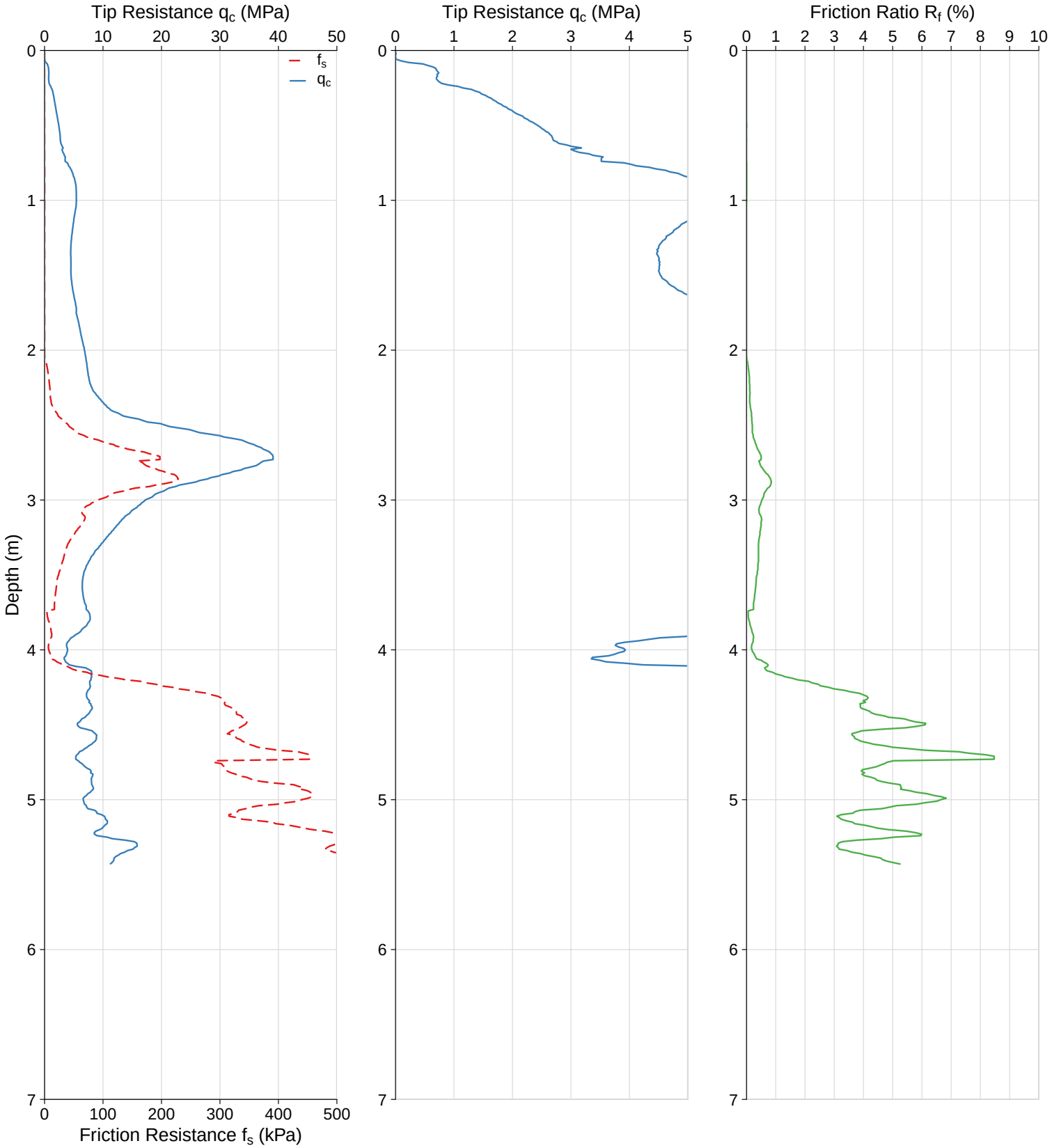
CPT ID:	CPT013	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Wet surface	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

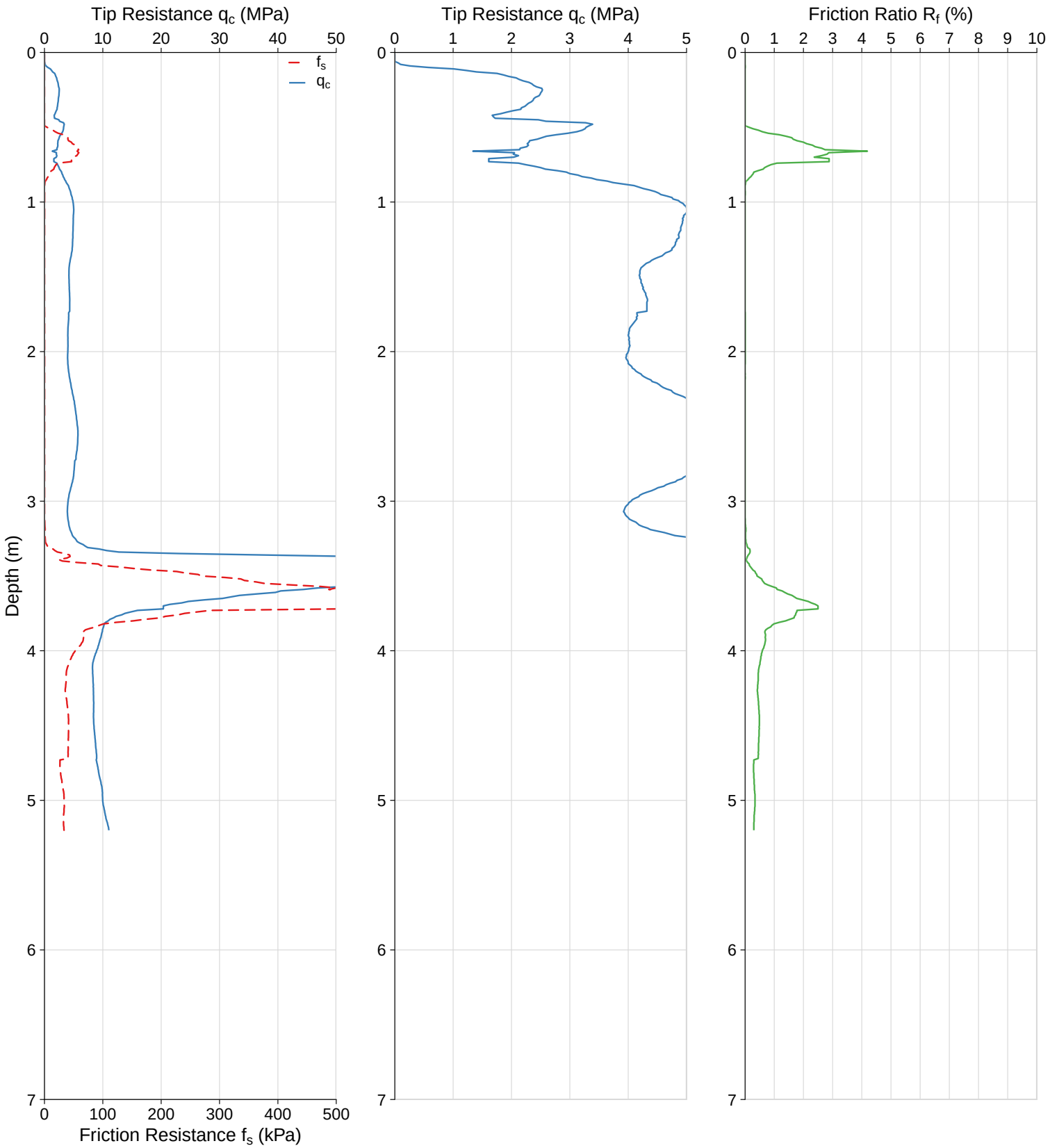
CPT ID:	CPT014	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 0.8m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

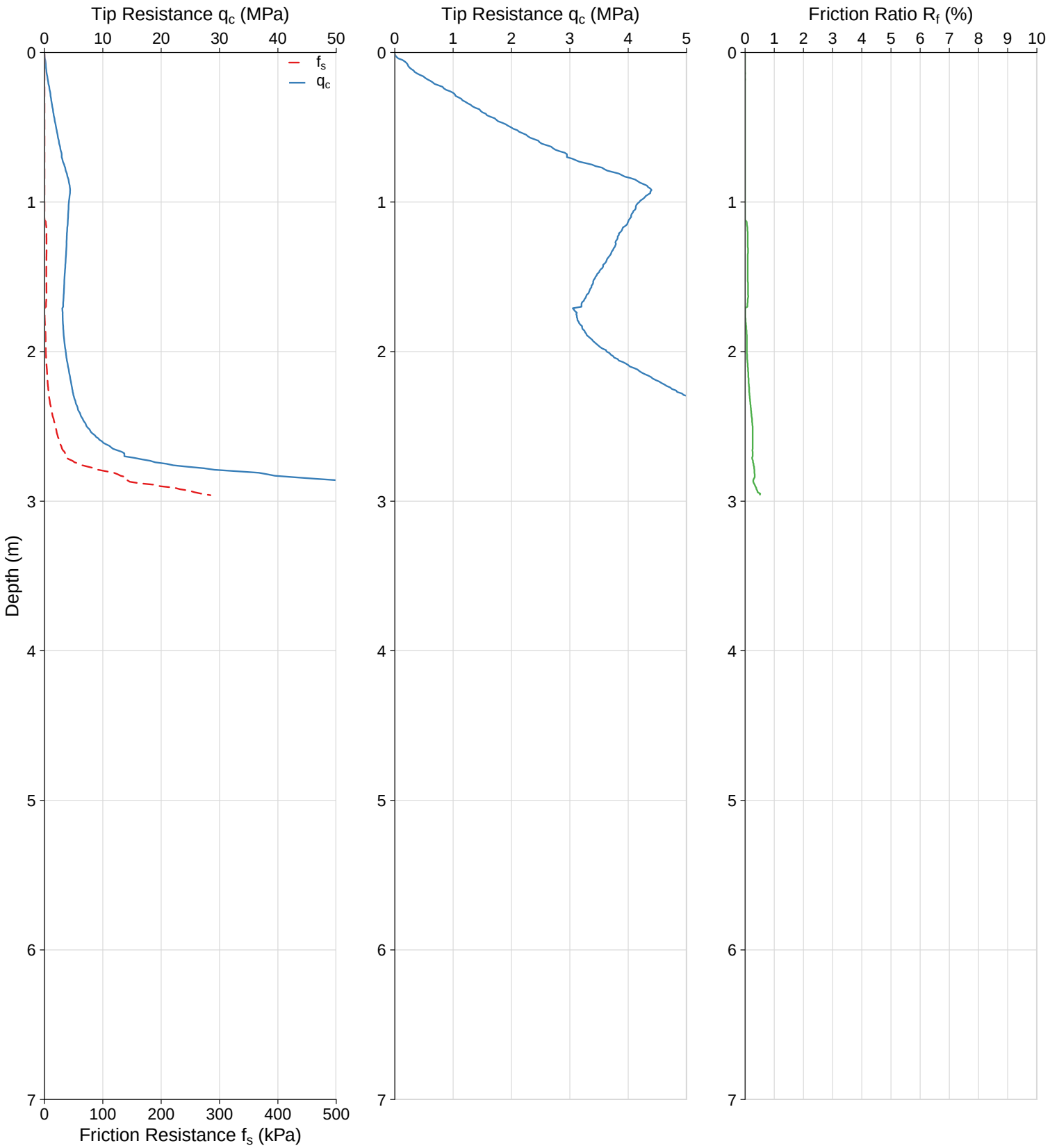
CPT ID:	CPT015	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 0.8m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

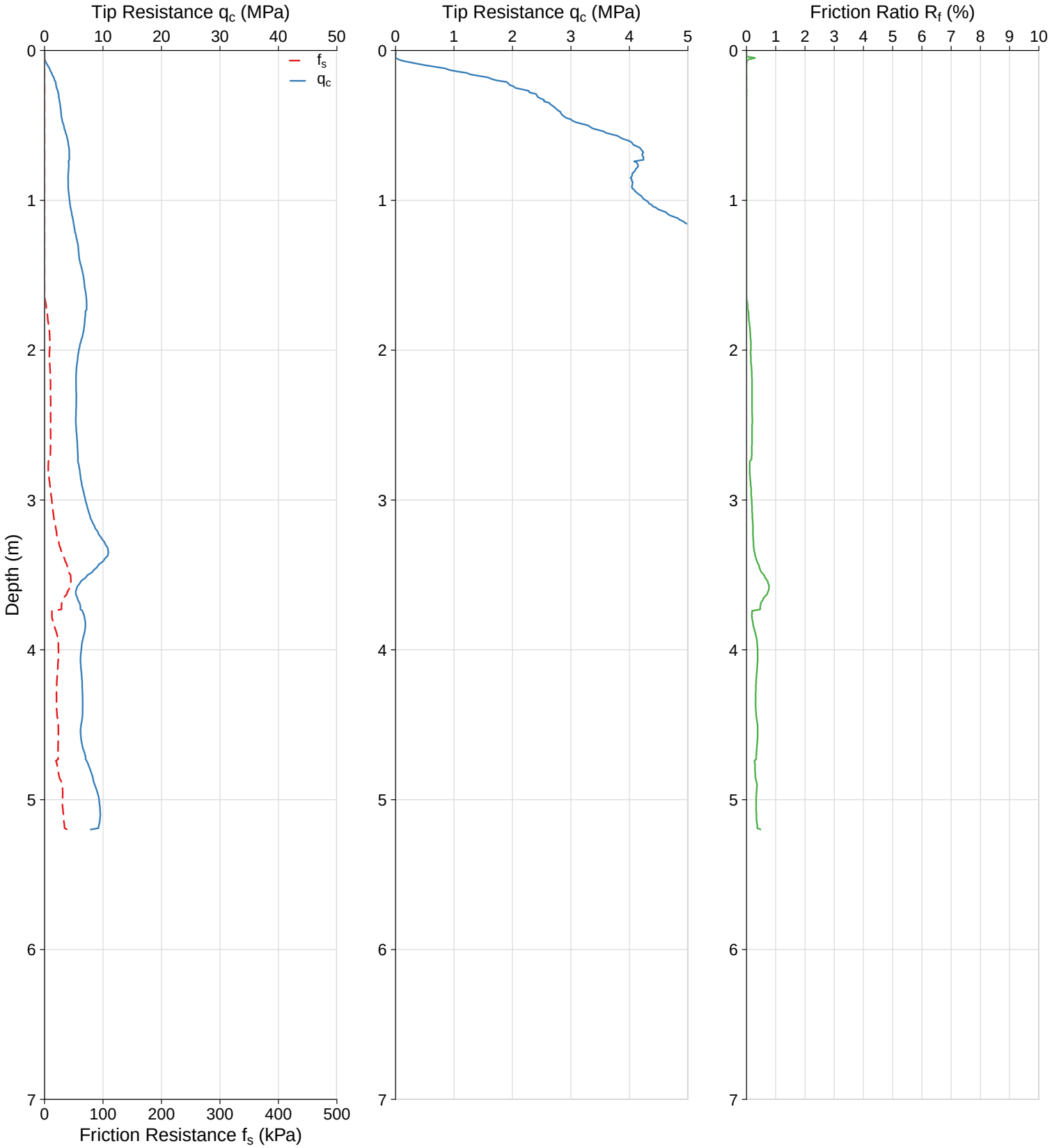
CPT ID:	CPT016	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 1.1m	**CO-ORDS:**	
TERMINATION:	Refused	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

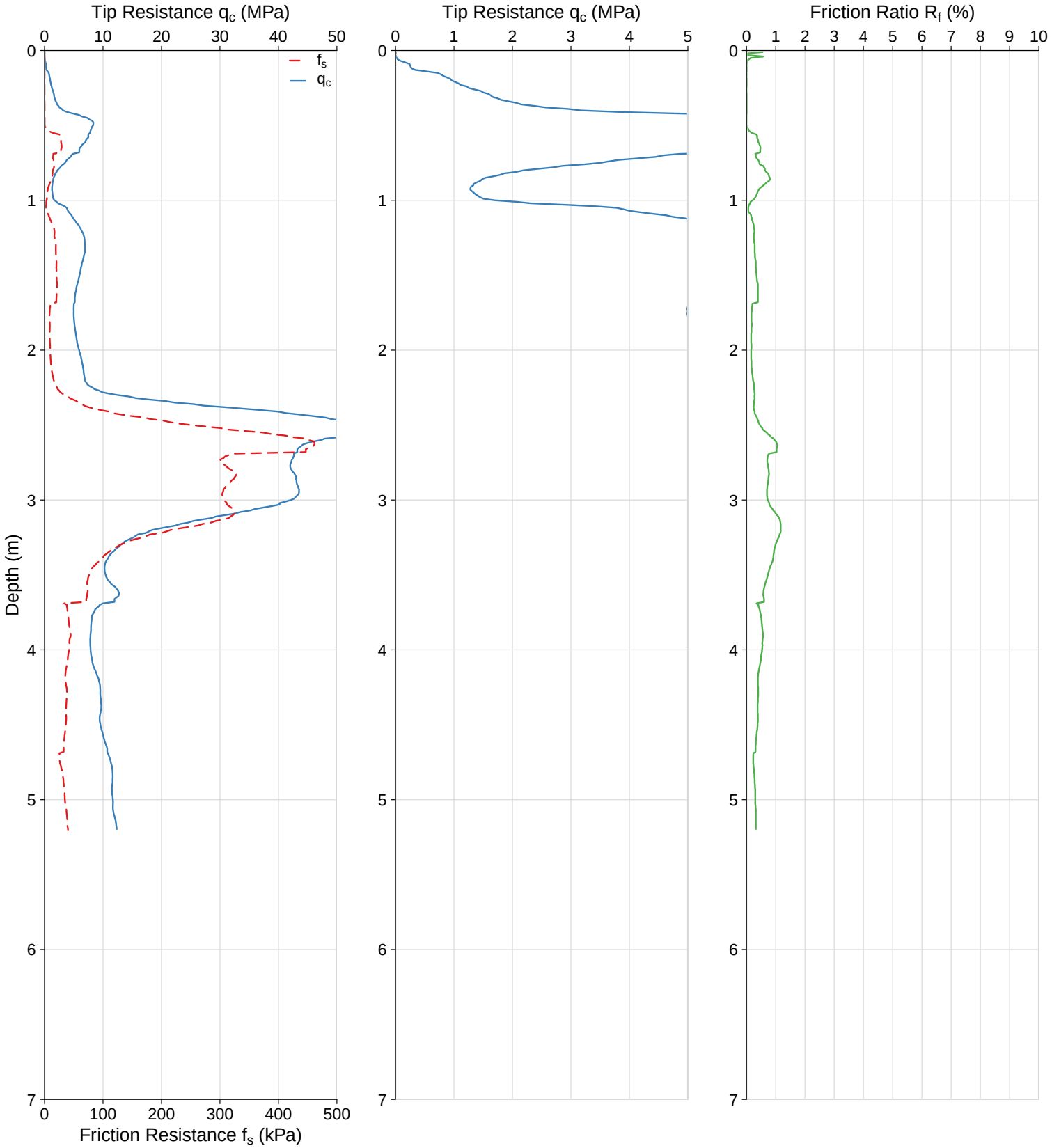
CPT ID:	CPT019	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 0.8m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

CPT ID:	CPT020	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 0.8m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

Appendix C: Borehole Logs

METHOD OF SOIL DESCRIPTION
BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG & SOIL CLASSIFICATION SYMBOLS

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

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

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

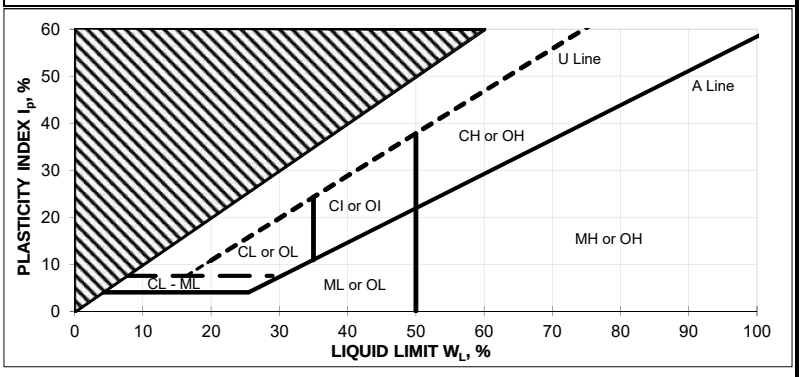
SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

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

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

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

PLASTICITY - MODIFIED CASAGRANDE CHART - AS1726-2017



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

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

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

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

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

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

EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS

METHOD OF DRILLING OR EXCAVATION

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

SUPPORT

T	Timbering

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

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

WATER

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

SAMPLING AND TESTING

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

ROCK CORE RECOVERY

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

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

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

BOREHOLE: BH01

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 28/08/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼				SP	TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics (0.1)	M		0	
								SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey, trace fines				
0.5											0.5	
1									M		1	
1.5							SP				1.5	
2											2	
2.5									W		2.5	
3								(3.0)			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 2.1 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH01
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH02

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 28/08/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼				SP	TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, brown, trace to with gravel, trace fines, trace organics			0	
								0.3				
0.5							SP/SM	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, with fines, trace to with organics	M		0.5	
								0.9				
1				Bulk	BH02-01		SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, low plasticity clay, trace gravel, trace organics	W		1	
1.5											1.5	
2							SC	pale grey mottled dark grey			2	
								2.3				
2.5							SC/CL	Sandy CLAY/Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey, low to medium plasticity clay			2.5	
3								3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 0.8 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH02
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH03

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼	Bulk	BH03-01		SP	TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace fines, trace organics	M		0	
								0.1 SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey-white, trace fines				
0.5											0.5	
									M			
1							SP				1	
1.5											1.5	
2								2.0 grey			2	
2.5							SP		W		2.5	
								2.6 trace coffee rock gravel				
3							SP	3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 1.6 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH03
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH04

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 28/08/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼	Bulk	BH04-01		SP/SM	TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey mottled brown, trace to with fines, with organics	M		0	No Guelph testing due to high ground water
								0.2				
							SP/SM	SAND: fine to medium grained, sub-angular to sub-rounded, dark grey/brown, trace to with fines, trace organics	W			
0.5											0.5	
								0.7				
							SC	Organic Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, dark brown, medium plasticity clay	W			
1											1	
								1.4				
1.5							SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, brown/grey, low plasticity clay	W		1.5	
								2.0				
2							SP-SC	Fine to coarse grained, sub-angular to sub-rounded, dark grey/white, with fines			2	
2.5											2.5	
3								3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 0.1 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH04
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH05

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 28/08/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼				SP	TOPSOIL: SAND: fine to medium grained, sub-angular to sub-rounded, dark grey/brown, trace fines, trace organics	M		0	
								0.3				
0.5							SP	SAND: fine to medium grained, sub-angular to sub-rounded, dark grey, trace fines	W		0.5	
1								1.3			1	

Borehole terminated at 1.3 m, due to collapse
Groundwater encountered at 0.6 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH05
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH06

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

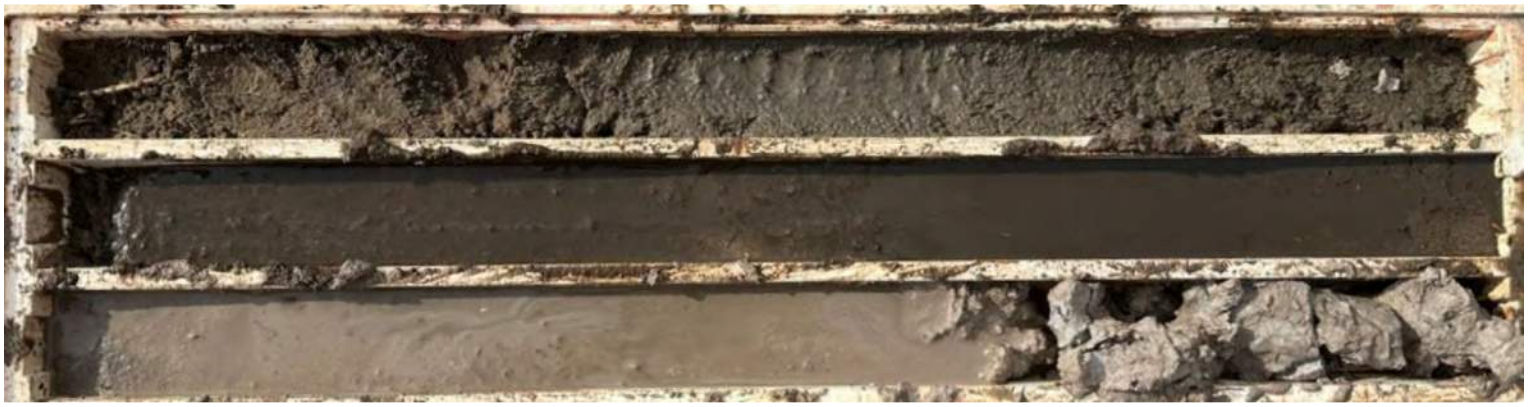
Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼	Bulk	BH06-01		SP	TOPSOIL: SAND: fine to medium grained, sub-angular to sub-rounded, brown-grey, trace fines, trace organics	M		0	
								0.3				
							SP/SC	SAND: fine to coarse grained, sub-angular to sub-rounded, brown-grey, with fines, trace organics				
0.5											0.5	
1									W		1	
1.5											1.5	
2								2.0			2	
							SP/SC	grey	W			
2.5								2.6			2.5	
							SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, grey, low plasticity clay	W			
3								3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 0.4 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH06
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH09

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

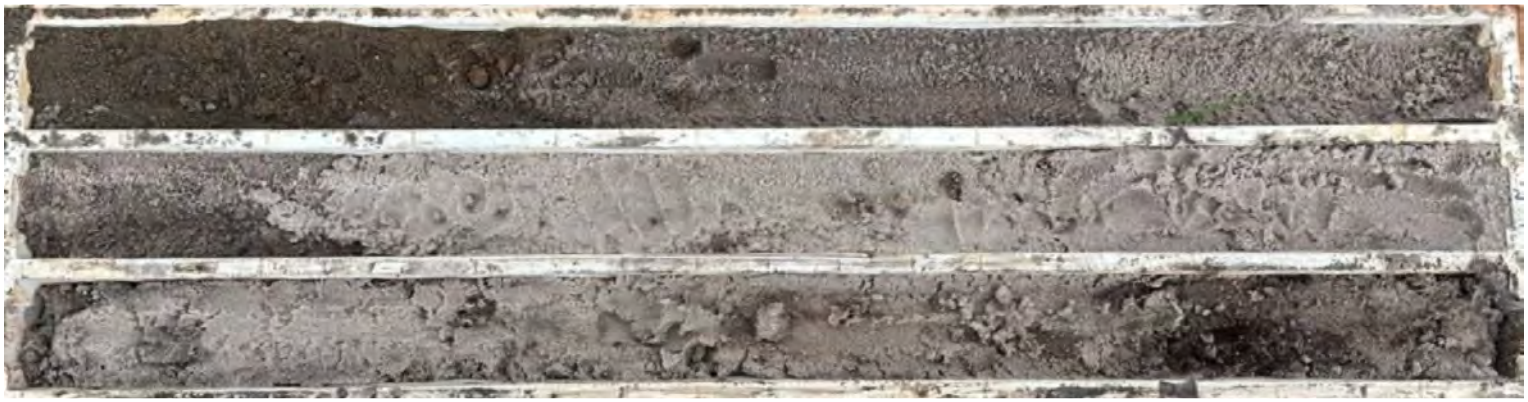
Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼				SP	FILL: TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, trace lateritic gravel, trace/with organics	M		0	
								0.3				
							SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace fines	M			
0.5											0.5	
1								1.3			1	
							SP	pale grey	M			
1.5											1.5	
								2.0				
2							SP	pale grey mottled dark grey	W		2	
2.5											2.5	
3								3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 1.8 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

Galt GEOTECHNICS

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH09
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH10

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼				SP	TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace fines, trace organics	M		0	
								0.3				
0.5								SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey/white, trace fines			0.5	
1				Bulk	BH10-01				M		1	
1.5							SP				1.5	
2									W		2	
2.5											2.5	
3								3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 1.6 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH10
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH11

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: DPP
Drill Rig: 7822DT
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Additional Remarks
				ASS	BH11/0.00			Grass 0.1			
				ASS	BH11/0.25		SP	SAND: fine to medium grained, sub-angular to sub-rounded, dark brown/grey, trace organics, with fine to coarse grained gravel (up to 0.6 m) trace fines			
0.5				ASS	BH11/0.50			0.6	M	0.5	
				ASS	BH11/0.75		SP	becomes dark grey			
1			▼	ASS	BH11/1.00			1.1		1	
				ASS	BH11/1.25		SP	becomes fine to coarse grained, pale grey			
1.5	AD/V	E		ASS	BH11/1.50					1.5	
				ASS	BH11/1.75						
2				ASS	BH11/2.00				W	2	
				ASS	BH11/2.25						
2.5				ASS	BH11/2.50					2.5	
				ASS	BH11/2.75						
3				ASS	BH11/3.00			3.0		3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 1.0 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH11
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE/MONITORING WELL: BH12/MW01

Project Name: WAG250138-01
Client Name: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres,

Contractor: DPP
Drill Rig: 7822DT
Hole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Checked By: TM
Date Checked: 22/09/2025

Drill Method	Depth (m)	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Well	Additional Remarks
AD/V	0	E	▼	ASS	BH12/MW01/0.00		PT	PEAT: Fiberous, spongy, organic odour, dark brown, with sand	M	0	SUP; Concrete; Bentonite Solid	SUP: +0.68 Solid: 0-0.5 Screen: 0.5-3.0 Concrete:0-0.1 Bentonite: 0.1-0.4 Gravel: 0.4-3.0
				ASS	BH12/MW01/0.25							
	0.5			ASS	BH12/MW01/0.50			0.6		0.5		
				ASS	BH12/MW01/0.75		SP	Organic SAND: fine to medium grained, sub-angular to sub-rounded, dark brown/grey				
	1			ASS	BH12/MW01/1.00					1		
				ASS	BH12/MW01/1.25			1.4				
	1.5			ASS	BH12/MW01/1.50		SP	SAND: fine to medium grained, sub-angular to sub-rounded, pale brown/grey, trace fines	W	1.5	Gravel; Screen	
				ASS	BH12/MW01/1.75							
	2			ASS	BH12/MW01/2.00					2		
				ASS	BH12/MW01/2.25							
	2.5			ASS	BH12/MW01/2.50			2.6		2.5		
				ASS	BH12/MW01/2.75		SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, blue grey, low plasticity clay				
	3			ASS	BH12/MW01/3.00			3.0		3		

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 1.0 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH12/MW01
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH13

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: DPP
Drill Rig: 7822DT
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Additional Remarks
0	AD/V	E	▼	ASS	BH13/0.00			Grass (0.1)	M	0	
				ASS	BH13/0.25		SP	SAND: fine to medium grained, sub-angular to sub-rounded, dark brown/grey, trace organics, trace fines			
0.5				ASS	BH13/0.50					0.5	
				ASS	BH13/0.75						
1				ASS	BH13/1.00				W	1	
				ASS	BH13/1.25						
1.5				ASS	BH13/1.50					1.5	
				ASS	BH13/1.75		SP	becomes fine to coarse grained (1.7)			
2				ASS	BH13/2.00			becomes pale brown/grey (2.0)		2	
				ASS	BH13/2.25						
2.5				ASS	BH13/2.50		SP			2.5	
				ASS	BH13/2.75						
3				ASS	BH13/3.00			(3.0)		3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 0.9 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH13
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE/MONITORING WELL: BH14/MW03

Project Name: WAG250138-01
Client Name: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres,

Contractor: DPP
Drill Rig: 7822DT
Hole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Checked By: TM
Date Checked: 22/09/2025

Drill Method	Depth (m)	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Well	Additional Remarks
AD/V	0	E	▼	ASS	BH14/MW03/0.00		SP	Gravelly SAND: sub-angular to sub-rounded, fine to medium grained sand, brown, rounded to sub-rounded, fine to medium grained gravel, trace fines	M	0	SUP Concrete	SUP: +0.65 Solid: 0-0.5 Screen: 0.5-3.0 Concrete:0-0.1 Bentonite: 0.1-0.5 Gravel: 0.5-3.0
				ASS	BH14/MW03/0.25						Solid Bentonite	
	0.5			ASS	BH14/MW03/0.50					0.5		
				ASS	BH14/MW03/0.75			0.9				
	1			ASS	BH14/MW03/1.00		SP	SAND: fine to medium grained, sub-angular to sub-rounded, dark grey, trace gravel (up to 1.5 m), trace fines		1		
				ASS	BH14/MW03/1.25							
	1.5	E		ASS	BH14/MW03/1.50			1.5		1.5		
				ASS	BH14/MW03/1.75		SP	becomes brown	W		Gravel Screen	
	2			ASS	BH14/MW03/2.00			2.0		2		
				ASS	BH14/MW03/2.25		CL	Sandy CLAY: low plasticity, blue grey, sub-angular to sub-rounded, fine to coarse grained sand				
	2.5			ASS	BH14/MW03/2.50					2.5		
				ASS	BH14/MW03/2.75							
	3			ASS	BH14/MW03/3.00			3.0		3		

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 0.28 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH14/MW03
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH15

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: DPP
Drill Rig: 7822DT
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Additional Remarks
0	AD/V	E	▼	ASS	BH15/0.00		SP	SAND: fine to medium grained, sub-angular to sub-rounded, brown, trace organics, trace fines	M	0.5	
				ASS	BH15/0.25						
				ASS	BH15/0.50						
								0.7			
				ASS	BH15/0.75		SP	becomes grey			
1				ASS	BH15/1.00					1	
				ASS	BH15/1.25						
1.5				ASS	BH15/1.50					1.5	
				ASS	BH15/1.75						
								1.8			
								becomes fine to coarse grained	W		
2				ASS	BH15/2.00					2	
				ASS	BH15/2.25		SP				
2.5				ASS	BH15/2.50					2.5	
				ASS	BH15/2.75						
3				ASS	BH15/3.00			3.0		3	
								Borehole terminated at 3.0 m, target depth Groundwater encountered at 1.1 m depth			

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH15
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE/MONITORING WELL: BH16/MW02

Project Name: WAG250138-01
Client Name: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres,

Contractor: DPP
Drill Rig: 7822DT
Hole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Checked By: TM
Date Checked: 22/09/2025

Drill Method	Depth (m)	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Well	Additional Remarks
AD/V	0	E	▼	ASS	BH16/MW02/0.00		SP	SAND: fine to medium grained, sub-angular to sub-rounded, brown, trace rootlets (up to 0.3 m), trace fines	M	0	SUP, Concrete	SUP: +0.62 Solid: 0-0.5 Screen: 0.5-3.0 Concrete:0-0.1 Bentonite: 0.1-0.5 Gravel: 0.5-3.0
				ASS	BH16/MW02/0.25						Solid, Bentonite	
	0.3							becomes grey				
	0.5			ASS	BH16/MW02/0.50		SP			0.5		
	0.7							becomes fine to coarse grained				
				ASS	BH16/MW02/0.75							
	1			ASS	BH16/MW02/1.00					1		
				ASS	BH16/MW02/1.25		SP					
	1.5			ASS	BH16/MW02/1.50					1.5		
				ASS	BH16/MW02/1.75				W		Gravel Screen	
	2			ASS	BH16/MW02/2.00					2		
	2.0							Gravelly SAND: sub-angular to sub-rounded, fine to medium grained, dark brown, angular to subangular, fine to coarse grained gravel, with coffee rock, trace/with fines				
				ASS	BH16/MW02/2.25							
	2.5			ASS	BH16/MW02/2.50		SP-SM			2.5		
				ASS	BH16/MW02/2.75							
	3			ASS	BH16/MW02/3.00					3		
	3.0							Borehole terminated at 3.0 m, target depth Groundwater encountered at 1.15 m depth				

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH16/MW02
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

Appendix D: Guelph Permeameter Test Results

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH01/G01

$$K = \frac{4.4Q\left[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}\right]}{2\,\pi H^2}$$

Spreadsheet Legend

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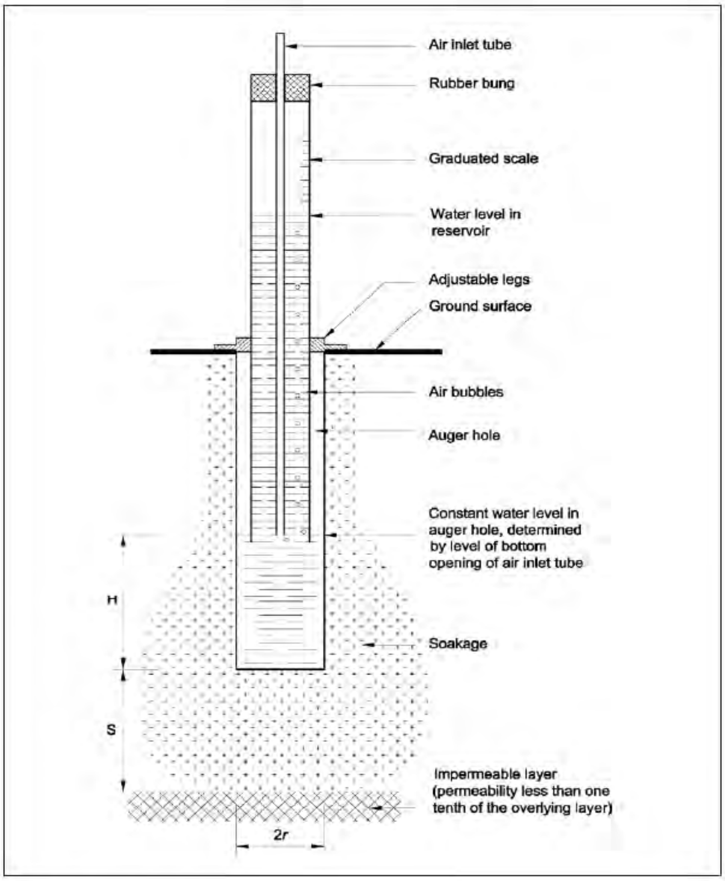
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	38	cm
H	Head of water above base	8	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	52		
0.5	40	12.00	24.00
1	30	10.00	20.00
1.5	20.5	9.50	19.00
2	10	10.50	21.00
2.5	0	10.00	20.00
AVERAGE - LAST 5 READINGS			20.80

Calculation

Steady State Flow	20.80	cm/min
Flow from reservoir (Q)	755.04	cm^3/min
K_{sat}	1.737	cm/min
K_{sat}	2.894E-04	m/s
K_{sat}	**25.01**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH02/G02

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

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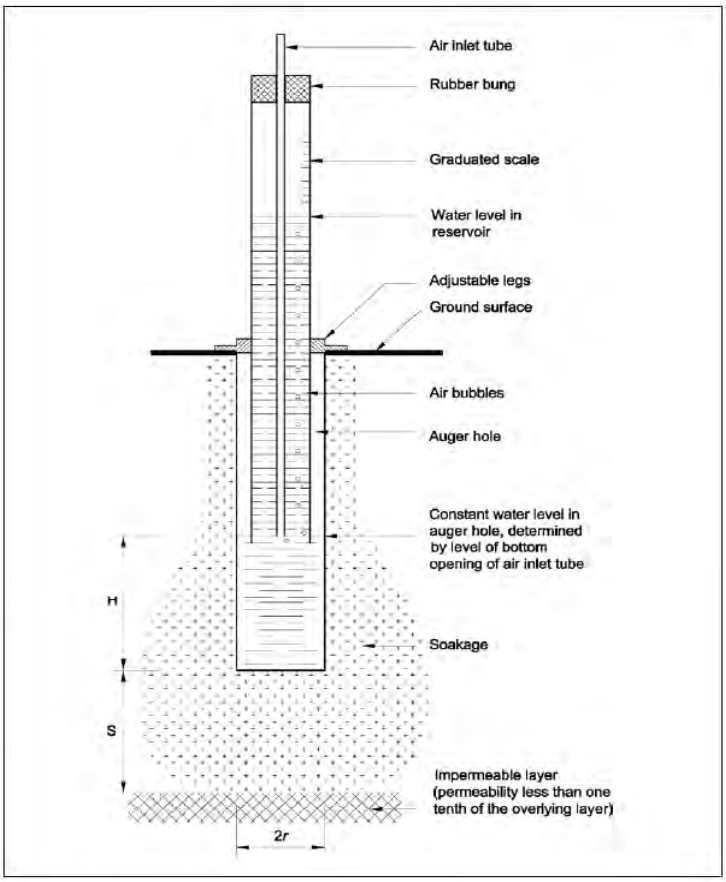
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	42	cm
H	Head of water above base	11	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	46.5		
2	45.5	1.00	0.50
4	42.5	3.00	1.50
6	41	1.50	0.75
8	39.5	1.50	0.75
10	36	3.50	1.75
12	34	2.00	1.00
14	32	2.00	1.00
16	29.8	2.20	1.10
AVERAGE - LAST 5 READINGS			1.12

Calculation

Steady State Flow	1.12	cm/min
Flow from reservoir (Q)	40.66	cm^3/min
K_{sat}	0.065	cm/min
K_{sat}	1.091E-05	m/s
K_{sat}	**0.94**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH03/G03

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

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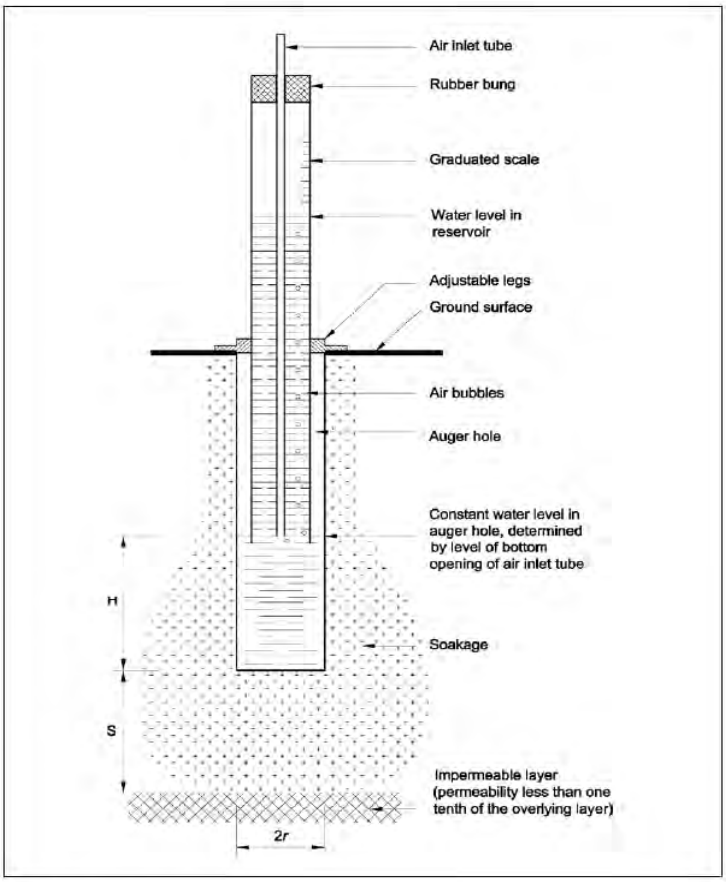
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	57	cm
H	Head of water above base	23	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	71		
0.33	66	5.00	15.15
0.66	59	7.00	21.21
1.33	45	14.00	20.90
1.66	38	7.00	21.21
1.99	28	10.00	30.30
2.33	21	7.00	20.59
2.66	11	10.00	30.30
2.99	1	10.00	30.30
		AVERAGE - LAST 5 READINGS	26.54

Calculation

Steady State Flow	26.54	cm/min
Flow from reservoir (Q)	963.47	cm^3/min
K_{sat}	0.628	cm/min
K_{sat}	1.047E-04	m/s
K_{sat}	**9.05**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH05/G05

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

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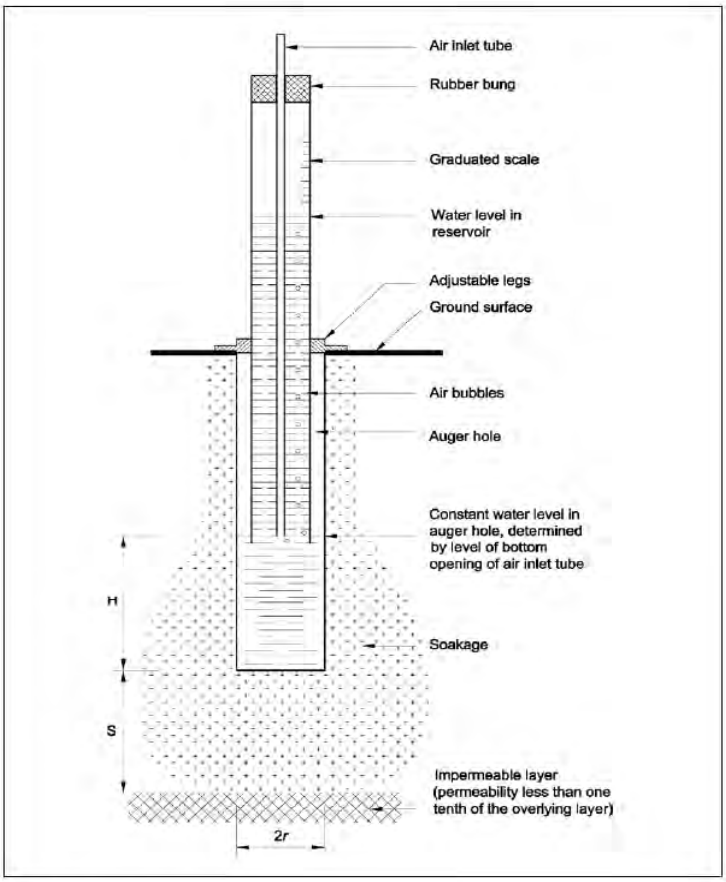
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	44	cm
H	Head of water above base	14	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	53.5		
5	49	4.50	0.90
10	45	4.00	0.80
15	41	4.00	0.80
20	38	3.00	0.60
25	35	3.00	0.60
30	31.5	3.50	0.70
AVERAGE - LAST 5 READINGS			0.70

Calculation

Steady State Flow	0.70	cm/min
Flow from reservoir (Q)	25.41	cm^3/min
K_{sat}	0.031	cm/min
K_{sat}	5.139E-06	m/s
K_{sat}	**0.44**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH09/G09

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

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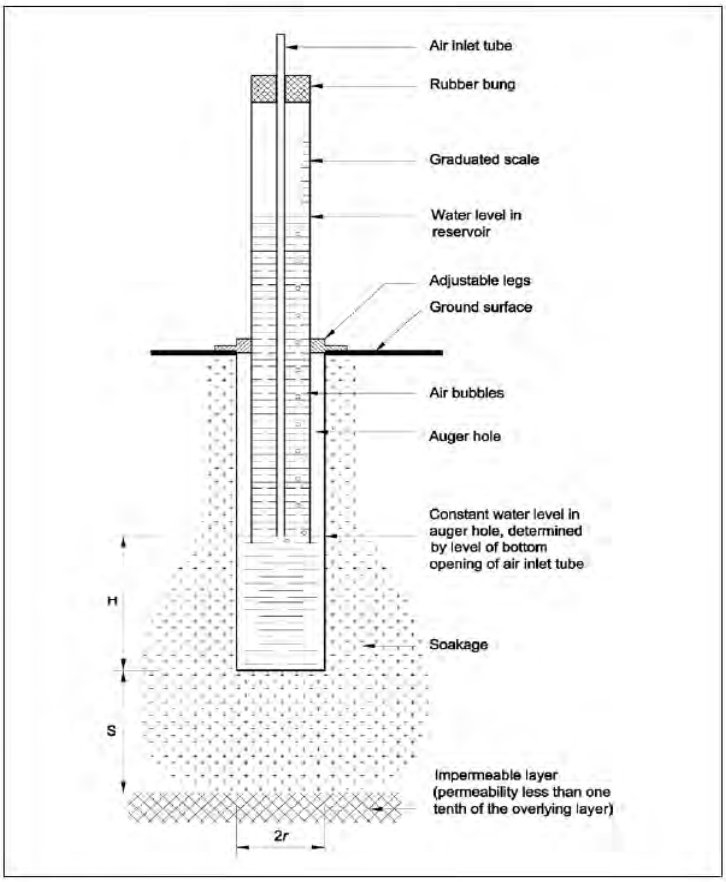
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	52	cm
H	Head of water above base	16	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	72.5		
1	62	10.50	10.50
2	52.5	9.50	9.50
3	46	6.50	6.50
4	38	8.00	8.00
5	28.5	9.50	9.50
6	23.6	4.90	4.90
7	14.5	9.10	9.10
8	8	6.50	6.50
9	1.5	6.50	6.50
AVERAGE - LAST 5 READINGS			7.30

Calculation

Steady State Flow	7.30	cm/min
Flow from reservoir (Q)	264.99	cm^3/min
K_{sat}	0.274	cm/min
K_{sat}	4.559E-05	m/s
K_{sat}	**3.94**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH10/G10

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

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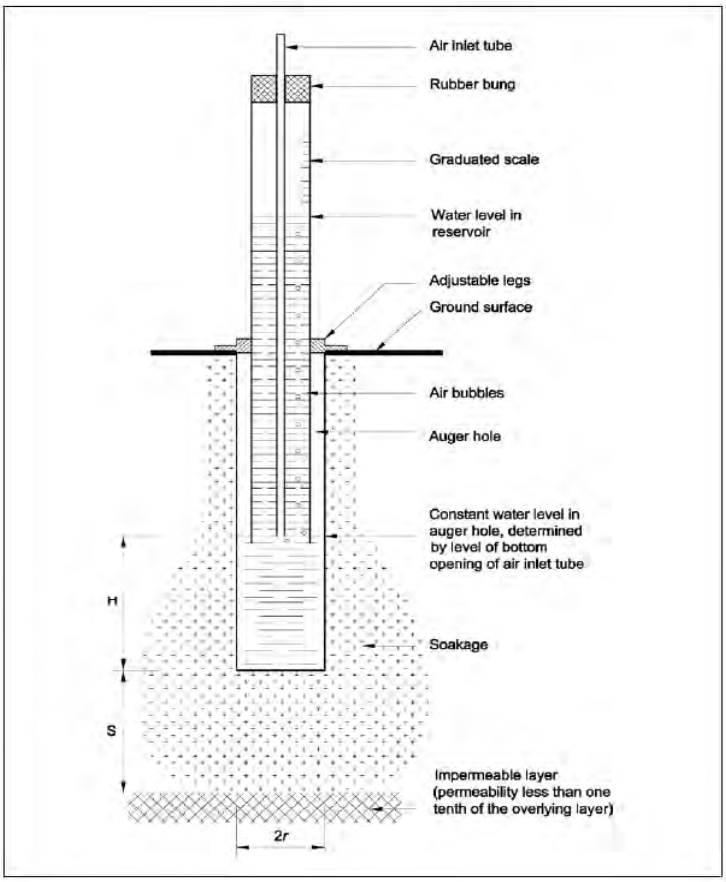
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	47	cm
H	Head of water above base	11	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	58		
1	53	5.00	5.00
2	50	3.00	3.00
3	44	6.00	6.00
4	40	4.00	4.00
5	36	4.00	4.00
6	32	4.00	4.00
AVERAGE - LAST 5 READINGS			4.20

Calculation

Steady State Flow	4.20	cm/min
Flow from reservoir (Q)	152.46	cm^3/min
K_{sat}	0.245	cm/min
K_{sat}	4.090E-05	m/s
K_{sat}	**3.53**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH15/G07

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

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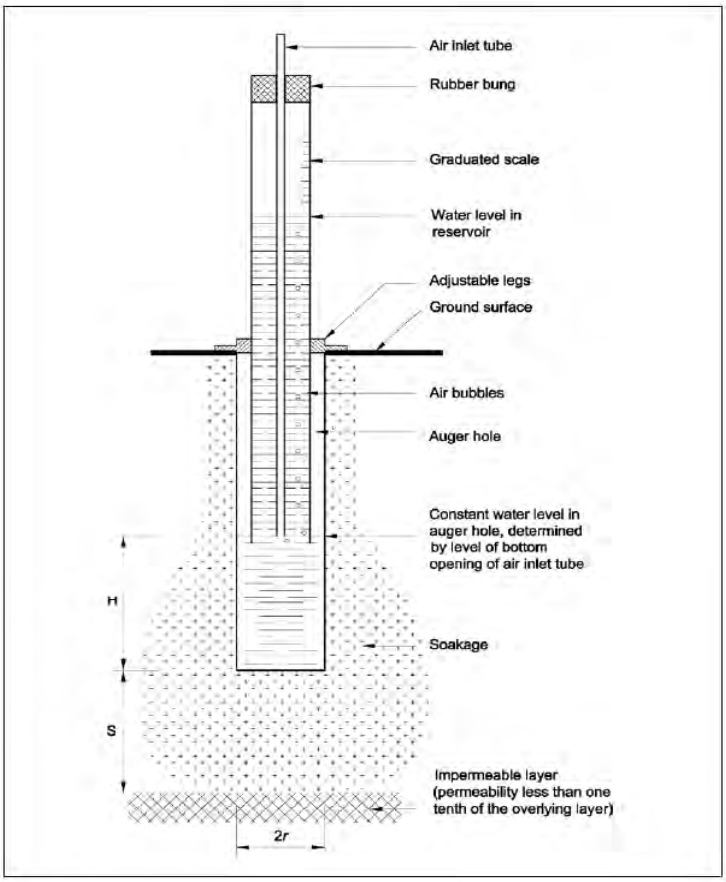
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	53	cm
H	Head of water above base	16	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	60		
0.5	48	12.00	24.00
1	38	10.00	20.00
1.5	31	7.00	14.00
2	20	11.00	22.00
2.5	12	8.00	16.00
3	2.5	9.50	19.00
AVERAGE - LAST 5 READINGS			18.20

Calculation

Steady State Flow	18.20	cm/min
Flow from reservoir (Q)	660.66	cm^3/min
K_{sat}	0.682	cm/min
K_{sat}	1.137E-04	m/s
K_{sat}	**9.82**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Appendix E: Geotechnical Laboratory Test Results

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15432_1_PI
Project:	Proposed HCLIA	*Sample No.*	WG25.15432
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH02 (1 - 1.5m)	*Date Tested:*	16/09/2025

TEST RESULTS - Consistency Limits (Casagrande)

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

AS 1289.3.1.1	**Liquid Limit (%)**	**28**
AS 1289.3.2.1	**Plastic Limit (%)**	**23**
AS 1289.3.3.1	**Plasticity Index (%)**	**5**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**2.5**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:



Name: Connor Budimir

Date: 17/September/2025

NATA WORLD RECOGNISED ACCREDITATION

Accreditation No. 20599

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

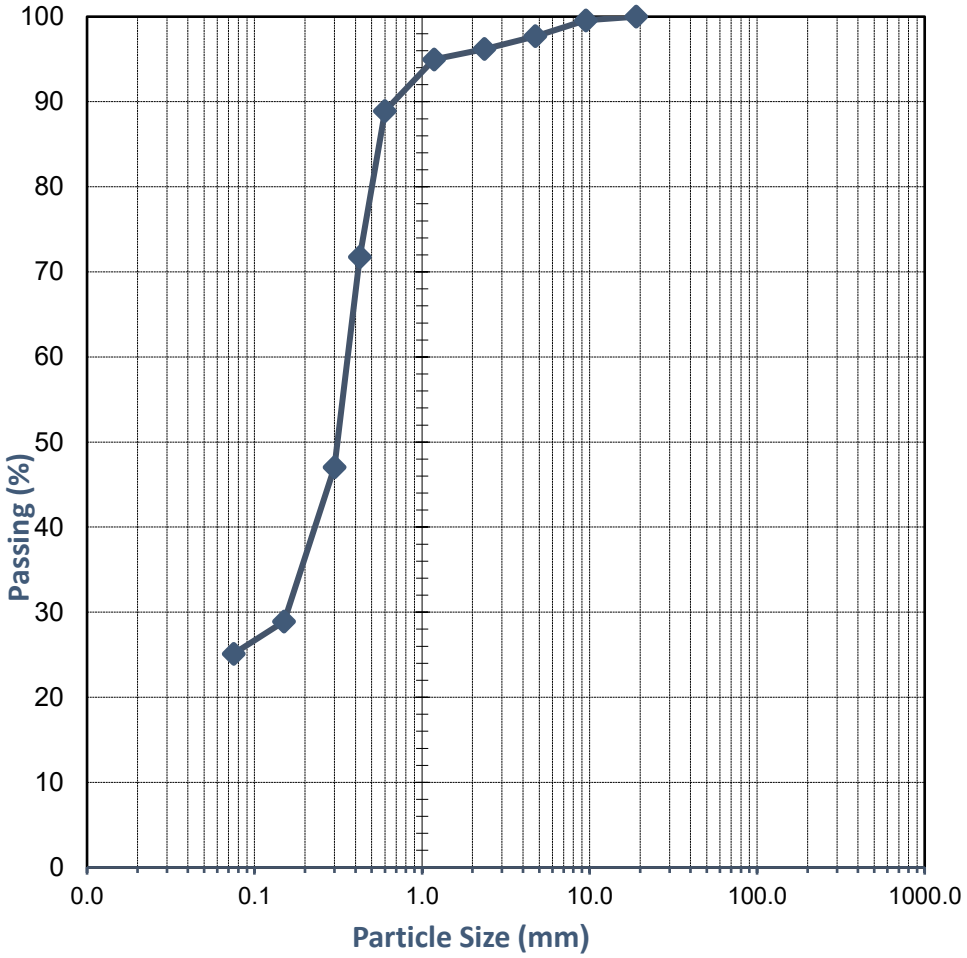
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15432_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15432
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH02 (1 - 1.5m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	98
2.36	96
1.18	95
0.600	89
0.425	72
0.300	47
0.150	29
0.075	25



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

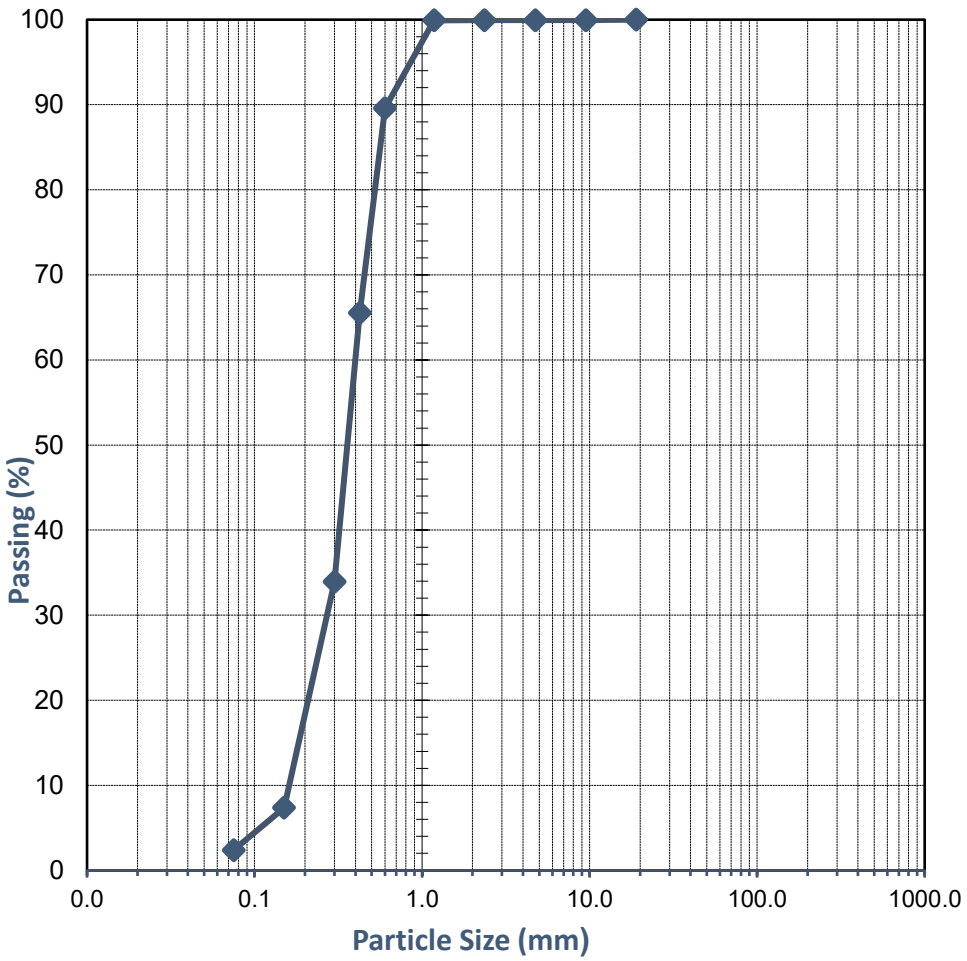
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15433_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15433
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH03 (1.5 - 1.8m)	*Date Tested:*	15/09 - 17/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	100
2.36	100
1.18	100
0.600	90
0.425	66
0.300	34
0.150	7
0.075	2



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

NATA **Accreditation No. 20599**
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.2, 3.2.1, 3.3.1 & 3.4.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15434_1_PI
Project:	Proposed HCLIA	*Sample No.*	WG25.15434
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH04 (1 - 1.4m)	*Date Tested:*	16/09/2025

TEST RESULTS - Consistency Limits (Casagrande)

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

AS 1289.3.1.2	**Liquid Limit (%)**	**46**
AS 1289.3.2.1	**Plastic Limit (%)**	**40**
AS 1289.3.3.1	**Plasticity Index (%)**	**6**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**3.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen**	**-**

Approved Signatory:

Name: Danielle Reynolds

Date: 18/September/2025

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

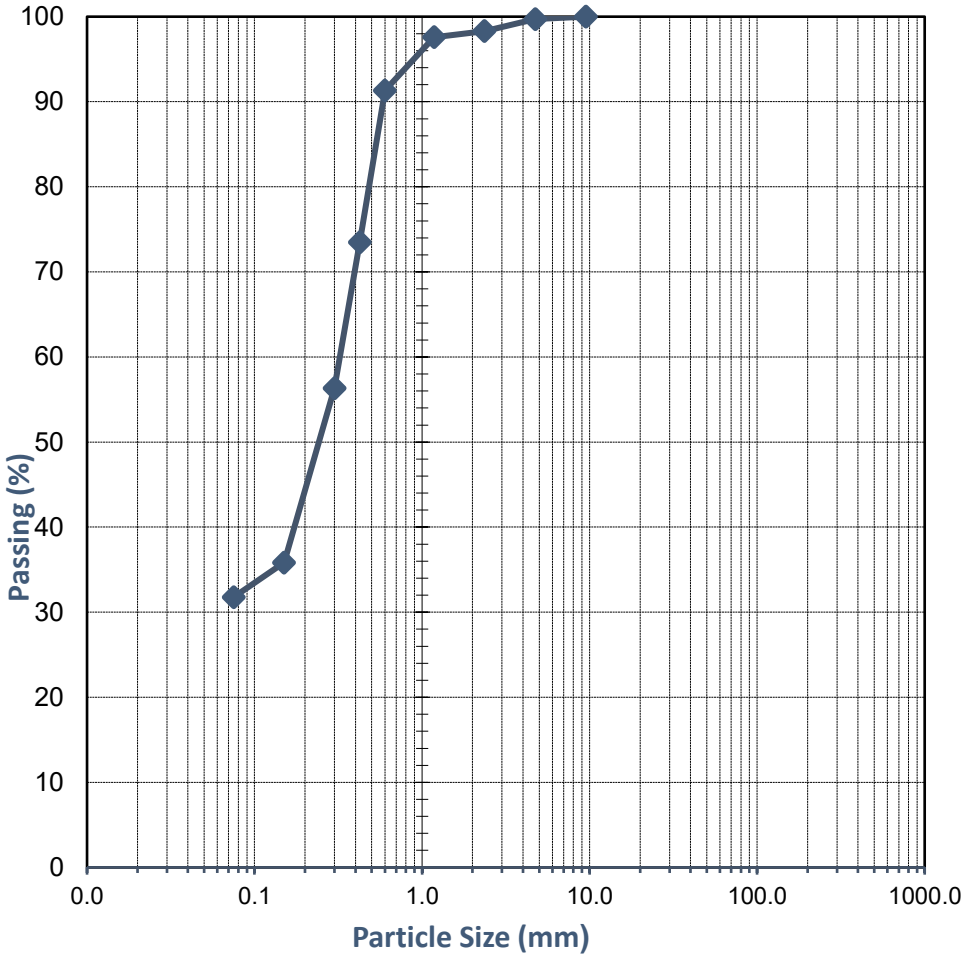
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15434_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15434
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH04 (1 - 1.4m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	98
1.18	98
0.600	91
0.425	73
0.300	56
0.150	36
0.075	32



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

NATA **Accreditation No. 20599**
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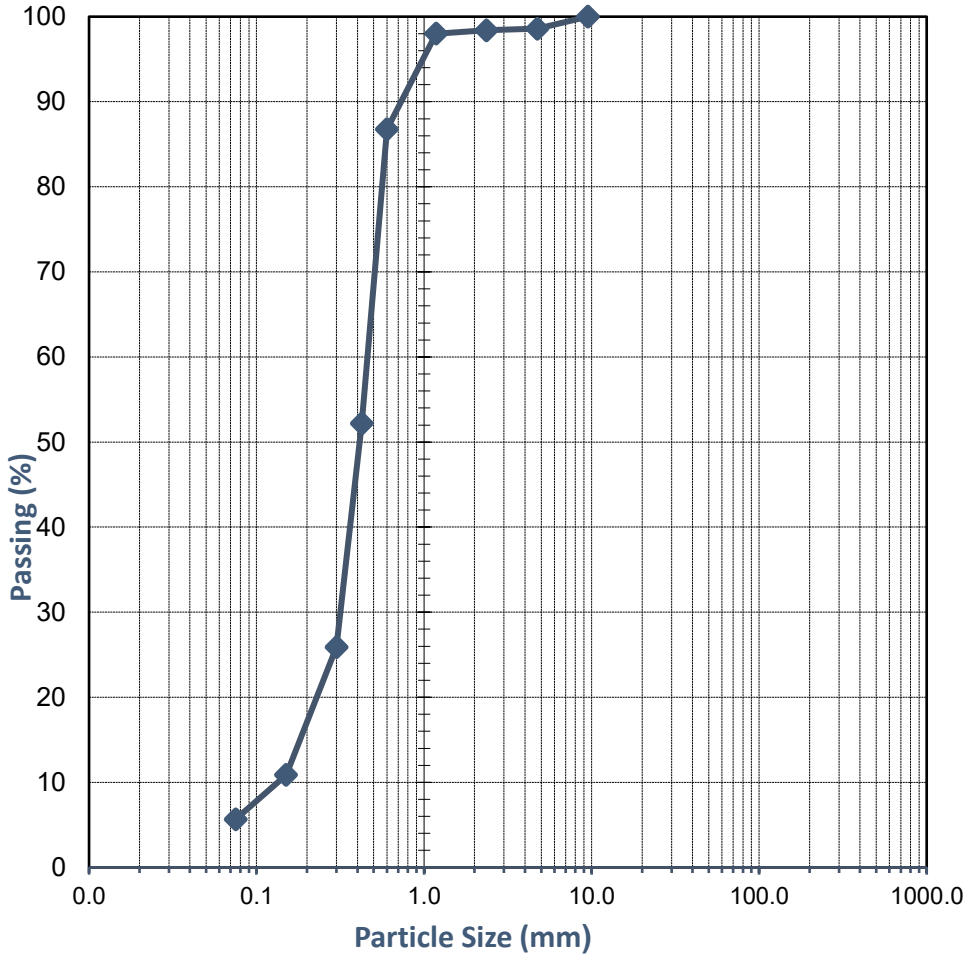
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15435_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15435
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH06 (0.6 - 1.0m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	99
2.36	98
1.18	98
0.600	87
0.425	52
0.300	26
0.150	11
0.075	6



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

NATA **Accreditation No. 20599**
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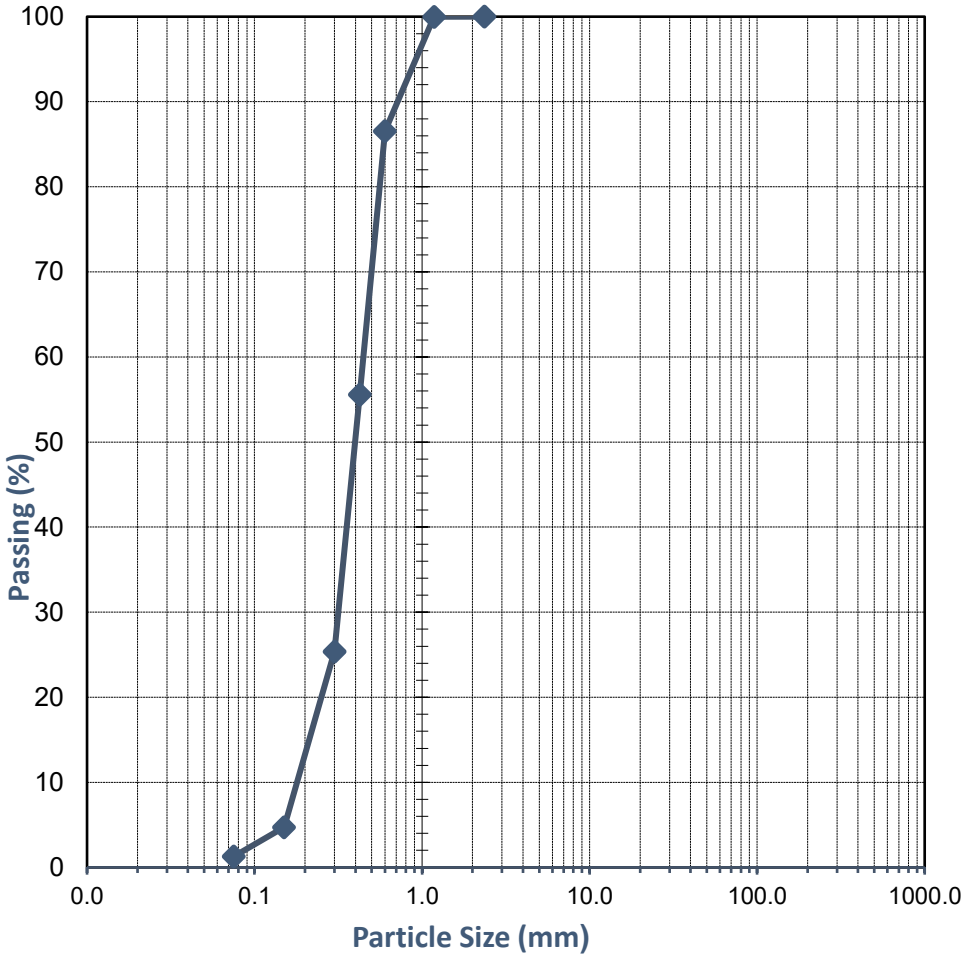
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15436_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15436
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH10 (1 - 1.5m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	87
0.425	56
0.300	25
0.150	5
0.075	1



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

NATA Accreditation No. 20599
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SOIL | AGGREGATE | CONCRETE | CRUSHING

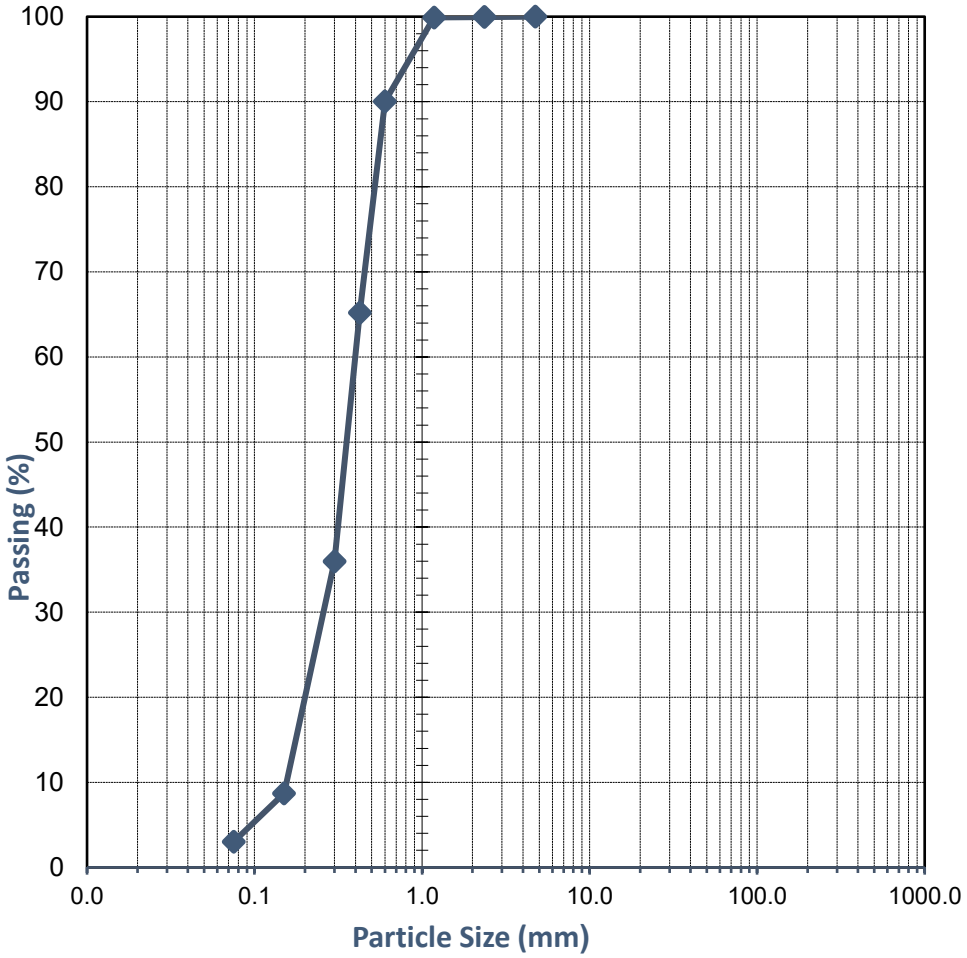
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15437_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15437
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	G07 (0.5 - 0.6m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	100
2.36	100
1.18	100
0.600	90
0.425	65
0.300	36
0.150	9
0.075	3



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

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SOIL | AGGREGATE | CONCRETE | CRUSHING

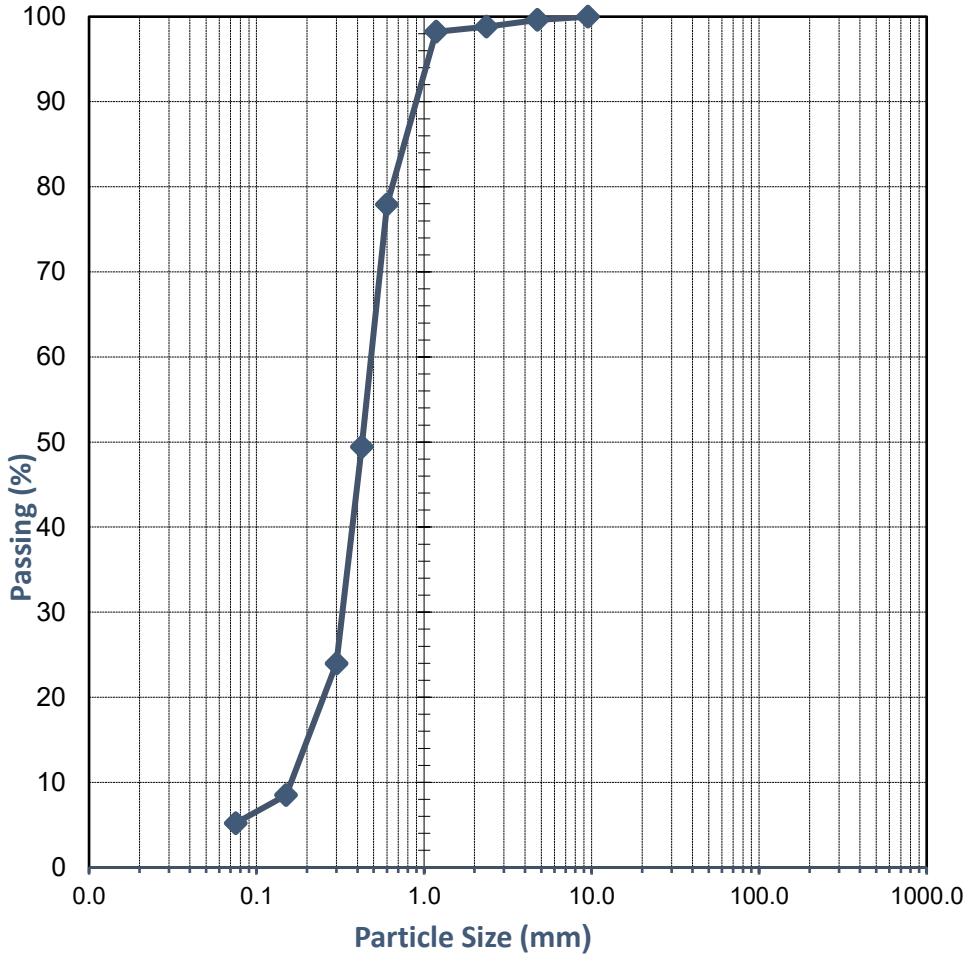
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15438_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15438
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	G10 (0.4 - 0.5m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	99
1.18	98
0.600	78
0.425	49
0.300	24
0.150	8
0.075	5



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.4.1.1

Client:	Dynamic Planning and Developments	*Ticket No.*	C597
Client Address:	-	*Report No.*	WC25.779-782_1_OMC
Project:	Proposed HCLIA	*Sample No.*	WC25.779-782
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	Not Specified
Sample Identification:	Various - see below	*Date Tested:*	16/09/2025 - 17/09/2025

TEST RESULTS - Organic Matter Content of Soil - Normal Method

Sampling Method: **Sampled by Client, Tested as Received**

Sample Number	Sample Identification	Material Description	Organic Matter (%)
WC25.779	BH04 (1 - 1.4m)	Sandy Silt	10.7
WC25.780	BH06 (0.6 - 1.0m)	Sand	1.2
WC25.781	G07 (0.5 - 0.6m)	Sand	0.4
WC25.782	G10 (0.4 - 0.5m)	Sand	1.1

Comments:

Approved Signatory:

Name: Courtney Watt

Date: 18/September/2025

NATA WORLD RECOGNISED ACCREDITATION

Accreditation No. 20599
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Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
7-11 Catalano Road Canning Vale WA 6155
ph +61 8 9317 2505
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PGI0989

Client Details

Client	Western Geotechnical & Laboratory Services
Contact	Laboratory
Address	235 Bank Street, WELSHPOOL, WA, 6101

Sample Details

Your Reference	S18630 / Proposed HCLIA
Number of Samples	5 Soil
Date Samples Received	12/09/2025
Date Instructions Received	12/09/2025

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 soils and on an as received basis for other matrices.

Report Details

Date Final Results Expected	23/09/2025
Date of Issue	19/09/2025

NATA Accreditation Number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Lien Tang, Assistant Operations Manager Lucas Yii, Inorganics Team Leader Varsha Ho Wing, Inorganics and Metals Supervisor
Laboratory Manager	Michael Kubiak

Certificate of Analysis PGI0989

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PGI0989-01	WG25.15432 / BH02 (1-1.5m)	Soil	12/09/2025	12/09/2025
PGI0989-02	WG25.15434 / BH04 (1-1.4m)	Soil	12/09/2025	12/09/2025
PGI0989-03	WG25.15435 / BH06 (0.6-1.0m)	Soil	12/09/2025	12/09/2025
PGI0989-04	WG25.15437 / G07 (0.5-0.6m)	Soil	12/09/2025	12/09/2025
PGI0989-05	WG25.15438 / G10 (0.4-0.5m)	Soil	12/09/2025	12/09/2025

Certificate of Analysis PGI0989

Inorganics - General Physical Parameters (Soil)

Envirolab ID	Units	PQL	PGI0989-01	PGI0989-02	PGI0989-03	PGI0989-04	PGI0989-05
Your Reference			WG25.15432 / BH02 (1-1.5m)	WG25.15434 / BH04 (1-1.4m)	WG25.15435 / BH06 (0.6-1.0m)	WG25.15437 / G07 (0.5-0.6m)	WG25.15438 / G10 (0.4-0.5m)
Date Sampled			12/09/2025	12/09/2025	12/09/2025	12/09/2025	12/09/2025
pH	pH units		8.4	4.8	7.3	7.8	7.7
Electrical Conductivity	µS/cm	2.0	300	1000	110	14	73

Certificate of Analysis PGI0989

PBI/PRI (Soil)

Envirolab ID	Units	PQL	PGI0989-01	PGI0989-02	PGI0989-03	PGI0989-04	PGI0989-05
Your Reference			WG25.15432 / BH02 (1-1.5m)	WG25.15434 / BH04 (1-1.4m)	WG25.15435 / BH06 (0.6-1.0m)	WG25.15437 / G07 (0.5-0.6m)	WG25.15438 / G10 (0.4-0.5m)
Date Sampled			12/09/2025	12/09/2025	12/09/2025	12/09/2025	12/09/2025
Phosphorus Retention Index	-		21	200	4.0	0.50	1.5

Method Summary

Method ID	Methodology Summary
AGRI-003_PRI	Phosphorous Retention index (PRI) is the ratio of adsorbed phosphorus to the equilibrium concentration. Phosphorus is extracted using KCl and determined colourimetrically. Result value is used to calculate PRI as per Allen and Jefferey.
INORG-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis can be completed outside of the recommended holding times. Solids are reported from a 1:5 water extract unless otherwise specified. Alternatively, pH is determined in a 1:5 extract using 0.01M calcium chloride or a solid is extracted at a ratio of 1:2.5 (AS1289.4.3.1), pH is measured in the extract.
INORG-002	Conductivity and Salinity - measured using a conductivity cell at 25°C. Soil results reported from a 1:5 Soil:Water extract unless otherwise specified. Please note Resistivity is estimated by calculation and may not correlate with results otherwise obtained using the Resistivity current method (based on AS 1289.4.4.1), depending on the nature of the soil being analysed. Blanks may yield EC readings >1µS/cm, this is likely due to adsorption of Carbon Dioxide while the blank sample is sat on the instrument autosampler prior to analysis. The values are generally insignificant (<5µS/cm) compared to most actual sample conductivities.

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 volumes are typically provided by customers (often as flow rate(s) and sampling time(s) and/or simply volume(s) sampled or exposure times (determines 'volume' passive badges are exposed to)). Hence in such circumstances the volume measurement is inevitably not covered by Envirolab's NATA accreditation. An exception may occur where Envirolab Newcastle does the sampling where accreditation exists for certain types of sampling and hence volume determination(s). Note air volumes are often used to determine concentrations for dust and/or analyses on filters, sorbents and in impingers. For canister sampling, the air volume is covered by Envirolab's NATA accreditation.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from the latest "Australian Drinking Water Guidelines", published by NHMRC. No guideline values have been set for Total Coliforms in drinking water. Increased concentrations should be investigated. Total Coliforms are not considered useful as indicators of the presence of faecal contamination.

Where we have provided guideline values eg. ADWG Health Value, it is the responsiblity of the reader to decide if the water is fit for consumption. Please note that the tests we have conducted are just a selection of common tests to give you a general idea of drinking water quality. There are many other tests included in the ADWG that we have not tested for.

Data Quality Assessment Summary PGI0989

Client Details

Client	Western Geotechnical & Laboratory Services
Your Reference	S18630 / Proposed HCLIA
Date Issued	19/09/2025

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 PGI0989

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
EC | Soil	1-5	15/09/2025	15/09/2025	16/09/2025	Yes
pH | Soil	1-5	15/09/2025	15/09/2025	16/09/2025	Yes
PRI | Soil	1-5	12/09/2025	16/09/2025	18/09/2025	Yes

Quality Control PGI0989

INORG-001|Inorganics - General Physical Parameters (Soil) | Batch BGI2590

Analyte	Units	PQL	Blank	DUP1 PGI0989-03 Samp | QC | RPD %	LCS %
pH	pH units		5.9	7.3 | 7.5 | 2.43	102
Electrical Conductivity	µS/cm	2.0	<2.0	108 | 108 | 0.00	98.4

AGRI-003_PRI|PBI/PRI (Soil) | Batch BGI2709

Analyte	Units	PQL	Blank	DUP1 PGI0989-01 Samp | QC | RPD %	LCS %
Phosphorus Retention Index	-		0.00	20.5 | 20.3 | 1.08	75.6

Appendix F: Environmental Laboratory Certificates of Analysis

Galt Environment P/L
50 Edward Street
Osborne Park
WA 6017

NATA Accredited
Accreditation Number 1261
Site Number 20794 & 2780

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NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **- ALL SRA/Results**

Report **1265933-S**
Project name HATCH CT HIGH WYCOMBE
Project ID WAG25018-01
Received Date Sep 09, 2025

Client Sample ID			**BH11/0.25**	**BH11/1.0**	**BH11/2.25**	**BH12/0.75**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**L25-Se0027209**	**L25-Se0027210**	**L25-Se0027211**	**L25-Se0027212**
Date Sampled			**Sep 05, 2025**	**Sep 05, 2025**	**Sep 05, 2025**	**Sep 05, 2025**
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	77	170	94	190
>2mm Fraction	0.005	g	53	< 0.005	< 0.005	< 0.005
Analysed Material	0.1	%	59	100	100	100
Extraneous Material	0.1	%	41	< 0.1	< 0.1	< 0.1
Chromium Suite - NASSG (Excluding ANC)						
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	< 1	< 1	1.2
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	< 10	< 10	15
s-CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	0.02
pH-KCL (NLM-3.1)	0.1	pH Units	8.7	6.9	6.6	5.1
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2	< 2	< 2	12
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	< 0.003	< 0.003	0.020
Chromium Reducible Sulfur (s-SCR) (NLM-2.1)[S04]	0.005	% S	< 0.005	0.013	0.005	0.006
Chromium Reducible Sulfur (a-SCR) (NLM-2.1)	3	mol H+/t	< 3	8.4	3.2	3.6
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A	N/A	N/A	N/A
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	2.7	0.29	0.17	N/A
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	530	58	35	N/A
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	0.85	0.09	0.06	N/A
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
s-CRS Suite - Net Acidity - NASSG (including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10	15
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	1.2
% Moisture	1	%	19	21	17	23

Client Sample ID			BH12/2.0	BH12/3.0	BH13/0.5	BH13/1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L25-Se0027213	L25-Se0027214	L25-Se0027215	L25-Se0027216
Date Sampled			Sep 05, 2025	Sep 05, 2025	Sep 05, 2025	Sep 05, 2025
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	100	100	130	94
>2mm Fraction	0.005	g	< 0.005	< 0.005	< 0.005	< 0.005
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
Chromium Suite - NASSG (Excluding ANC)						
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	< 1	< 1	< 1
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	< 10	11	< 10
s-CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	< 0.02	0.02	< 0.02
pH-KCL (NLM-3.1)	0.1	pH Units	5.9	5.6	6.2	6.6
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	2.0	4.0	3.0	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	0.010	< 0.003	< 0.003
Chromium Reducible Sulfur (s-SCR) (NLM-2.1)[S04]	0.005	% S	< 0.005	< 0.005	0.012	0.006
Chromium Reducible Sulfur (a-SCR) (NLM-2.1)	3	mol H+/t	< 3	< 3	7.5	3.6
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A	N/A	N/A	N/A
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A	N/A	N/A	0.88
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A	N/A	N/A	180
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	N/A	N/A	N/A	0.28
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
s-CRS Suite - Net Acidity - NASSG (including ANC)	0.02	% S	< 0.02	< 0.02	0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	11	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	< 1
% Moisture	1	%	16	15	28	19

Client Sample ID			BH13/2.50	BH14/0.25	BH14/1.75	BH14/2.75
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L25-Se0027217	L25-Se0027218	L25-Se0027219	L25-Se0027220
Date Sampled			Sep 05, 2025	Sep 05, 2025	Sep 05, 2025	Sep 05, 2025
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	140	160	200	69
>2mm Fraction	0.005	g	< 0.005	100	< 0.005	< 0.005
Analysed Material	0.1	%	100	60	100	100
Extraneous Material	0.1	%	< 0.1	40	< 0.1	< 0.1
Chromium Suite - NASSG (Excluding ANC)						
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	< 1	< 1	< 1
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	< 10	< 10	13
s-CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	0.02
pH-KCL (NLM-3.1)	0.1	pH Units	6.2	9.5	8.0	5.4
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2	< 2	< 2	9.0
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	< 0.003	< 0.003	0.010
Chromium Reducible Sulfur (s-SCR) (NLM-2.1)[S04]	0.005	% S	< 0.005	< 0.005	0.005	0.006
Chromium Reducible Sulfur (a-SCR) (NLM-2.1)	3	mol H+/t	< 3	< 3	3.2	3.8

Client Sample ID			BH13/2.50	BH14/0.25	BH14/1.75	BH14/2.75
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L25-Se0027217	L25-Se0027218	L25-Se0027219	L25-Se0027220
Date Sampled			Sep 05, 2025	Sep 05, 2025	Sep 05, 2025	Sep 05, 2025
Test/Reference	LOR	Unit				
Chromium Suite - NASSG (Excluding ANC)						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A	N/A	N/A	N/A
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A	4.1	0.21	N/A
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A	830	43	N/A
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	N/A	1.3	0.07	N/A
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
s-CRS Suite - Net Acidity - NASSG (including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10	13
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	< 1
% Moisture	1	%	15	14	14	18

Client Sample ID			BH15/0.75	BH15/1.25	BH15/2.5	BH16/0.50
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L25-Se0027221	L25-Se0027222	L25-Se0027223	L25-Se0027224
Date Sampled			Sep 05, 2025	Sep 05, 2025	Sep 05, 2025	Sep 05, 2025
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	140	120	140	170
>2mm Fraction	0.005	g	< 0.005	< 0.005	< 0.005	< 0.005
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
Chromium Suite - NASSG (Excluding ANC)						
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	< 1	< 1	< 1
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
s-CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
pH-KCL (NLM-3.1)	0.1	pH Units	7.1	6.9	6.4	7.0
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2	< 2	< 2	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	< 0.003	< 0.003	< 0.003
Chromium Reducible Sulfur (s-SCR) (NLM-2.1)[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCR) (NLM-2.1)	3	mol H+/t	< 3	< 3	< 3	< 3
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A	N/A	N/A	N/A
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	0.29	0.21	N/A	0.43
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	58	41	N/A	85
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	0.09	0.07	N/A	0.14
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
s-CRS Suite - Net Acidity - NASSG (including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	< 1

Client Sample ID			BH15/0.75	BH15/1.25	BH15/2.5	BH16/0.50
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L25-Se0027221	L25-Se0027222	L25-Se0027223	L25-Se0027224
Date Sampled			Sep 05, 2025	Sep 05, 2025	Sep 05, 2025	Sep 05, 2025
Test/Reference	LOR	Unit				
% Moisture	1	%	4.8	7.4	14	8.0

Client Sample ID			BH16/1.50	BH16/3.0	QC101
Sample Matrix			Soil	Soil	Soil
Eurofins Sample No.			L25-Se0027225	L25-Se0027226	L25-Se0027227
Date Sampled			Sep 05, 2025	Sep 05, 2025	Sep 05, 2025
Test/Reference	LOR	Unit			
Extraneous Material					
<2mm Fraction	0.005	g	240	190	120
>2mm Fraction	0.005	g	< 0.005	22	160
Analysed Material	0.1	%	100	90	43
Extraneous Material	0.1	%	< 0.1	10	57
Chromium Suite - NASSG (Excluding ANC)					
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	6.6	< 1
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	88	< 10
s-CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	0.14	< 0.02
pH-KCL (NLM-3.1)	0.1	pH Units	8.9	4.9	9.2
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2	48	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	0.080	< 0.003
Chromium Reducible Sulfur (s-SCR) (NLM-2.1)[S04]	0.005	% S	< 0.005	0.064	0.005
Chromium Reducible Sulfur (a-SCR) (NLM-2.1)	3	mol H+/t	< 3	40	3.4
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A	N/A	N/A
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	0.50	N/A	4.3
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	99	N/A	850
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	0.16	N/A	1.4
ANC Fineness Factor		factor	1.5	1.5	1.5
s-CRS Suite - Net Acidity - NASSG (including ANC)	0.02	% S	< 0.02	0.14	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	88	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	6.6	< 1
% Moisture	1	%	14	13	14

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Extraneous Material	Brisbane	Sep 10, 2025	6 Week
- Method: LTM-GEN-7050/7070			
Chromium Suite - NASSG (Excluding ANC)	Brisbane	Sep 10, 2025	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
% Moisture	Brisbane	Sep 09, 2025	14 Days
- Method: LTM-GEN-7080 Moisture			

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Project Name: HATCH CT HIGH WYCOMBE
Project ID: WAG25018-01

Order No.: WAG25018-01
Report #: 1265933
Phone: 08 6272 0200
Fax: 08 9285 8444

Received: Sep 9, 2025 11:55 AM
Due: Sep 16, 2025
Priority: 5 Day
Contact Name: - ALL SRA/Results

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Moisture Set	Chromium Suite - NASSG (Excluding ANC)
Brisbane Laboratory - NATA # 1261 Site # 20794 & 2780						X	X
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	BH11/0.25	Sep 05, 2025		Soil	L25-Se0027209	X	X
2	BH11/1.0	Sep 05, 2025		Soil	L25-Se0027210	X	X
3	BH11/2.25	Sep 05, 2025		Soil	L25-Se0027211	X	X
4	BH12/0.75	Sep 05, 2025		Soil	L25-Se0027212	X	X
5	BH12/2.0	Sep 05, 2025		Soil	L25-Se0027213	X	X
6	BH12/3.0	Sep 05, 2025		Soil	L25-Se0027214	X	X
7	BH13/0.5	Sep 05, 2025		Soil	L25-Se0027215	X	X
8	BH13/1.25	Sep 05, 2025		Soil	L25-Se0027216	X	X
9	BH13/2.50	Sep 05, 2025		Soil	L25-Se0027217	X	X
10	BH14/0.25	Sep 05, 2025		Soil	L25-Se0027218	X	X
11	BH14/1.75	Sep 05, 2025		Soil	L25-Se0027219	X	X
12	BH14/2.75	Sep 05, 2025		Soil	L25-Se0027220	X	X
13	BH15/0.75	Sep 05, 2025		Soil	L25-Se0027221	X	X
14	BH15/1.25	Sep 05, 2025		Soil	L25-Se0027222	X	X

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Received: Sep 9, 2025 11:55 AM
Due: Sep 16, 2025
Priority: 5 Day
Contact Name: - ALL SRA/Results

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Moisture Set	Chromium Suite - NASSG (Excluding ANC)
Brisbane Laboratory - NATA # 1261 Site # 20794 & 2780						X	X
15	BH15/2.5	Sep 05, 2025		Soil	L25-Se0027223	X	X
16	BH16/0.50	Sep 05, 2025		Soil	L25-Se0027224	X	X
17	BH16/1.50	Sep 05, 2025		Soil	L25-Se0027225	X	X
18	BH16/3.0	Sep 05, 2025		Soil	L25-Se0027226	X	X
19	QC101	Sep 05, 2025		Soil	L25-Se0027227	X	X
Test Counts						19	19

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ppm:** parts per million
µg/L: micrograms per litre	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	**Colour:** Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery									
Chromium Suite - NASSG (Excluding ANC)									
pH-KCL (NLM-3.1)			%	98			80-120	Pass	
Titratable Actual Acidity (NLM-3.2)			%	111			80-120	Pass	
Chromium Reducible Sulfur (s-SCR) (NLM-2.1)			%	102			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Chromium Suite - NASSG (Excluding ANC)				Result 1	Result 2	RPD			
CRS Suite - Liming Rate - NASSG (Excluding ANC)	L25-Se0027209	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Excluding ANC)	L25-Se0027209	CP	mol H+/t	< 10	< 10	<1	20%	Pass	
s-CRS Suite - Net Acidity - NASSG (Excluding ANC)	L25-Se0027209	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
pH-KCL (NLM-3.1)	L25-Se0027209	CP	pH Units	8.7	8.8	2.0	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	L25-Se0027209	CP	mol H+/t	< 2	< 2	<1	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	L25-Se0027209	CP	% pyrite S	< 0.003	< 0.003	<1	30%	Pass	
Chromium Reducible Sulfur (s-SCR) (NLM-2.1)	L25-Se0027209	CP	% S	< 0.005	< 0.005	<1	20%	Pass	
Chromium Reducible Sulfur (a-SCR) (NLM-2.1)	L25-Se0027209	CP	mol H+/t	< 3	< 3	<1	20%	Pass	
Sulfur - KCl Extractable	L25-Se0027209	CP	% S	N/A	N/A	N/A	30%	Pass	
HCl Extractable Sulfur	L25-Se0027209	CP	% S	N/A	N/A	N/A	20%	Pass	
Net Acid soluble sulfur (SNAS) NLM-4.1	L25-Se0027209	CP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (a-SNAS) NLM-4.1	L25-Se0027209	CP	mol H+/t	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	L25-Se0027209	CP	% S	N/A	N/A	N/A	30%	Pass	
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	L25-Se0027209	CP	% CaCO3	2.7	2.4	11	20%	Pass	
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)	L25-Se0027209	CP	% S	0.85	0.77	11	30%	Pass	
ANC Fineness Factor	L25-Se0027209	CP	factor	1.5	1.5	<1	30%	Pass	
s-CRS Suite - Net Acidity - NASSG (including ANC)	L25-Se0027209	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Including ANC)	L25-Se0027209	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Including ANC)	L25-Se0027209	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	L25-Se0027217	CP	%	15	19	23	30%	Pass	
Duplicate									
Chromium Suite - NASSG (Excluding ANC)				Result 1	Result 2	RPD			
CRS Suite - Liming Rate - NASSG (Excluding ANC)	L25-Se0027219	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Excluding ANC)	L25-Se0027219	CP	mol H+/t	< 10	< 10	<1	20%	Pass	
s-CRS Suite - Net Acidity - NASSG (Excluding ANC)	L25-Se0027219	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
pH-KCL (NLM-3.1)	L25-Se0027219	CP	pH Units	8.0	8.0	1.0	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	L25-Se0027219	CP	mol H+/t	< 2	< 2	<1	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	L25-Se0027219	CP	% pyrite S	< 0.003	< 0.003	<1	30%	Pass	
Chromium Reducible Sulfur (s-SCR) (NLM-2.1)	L25-Se0027219	CP	% S	0.005	0.005	<1	20%	Pass	

Duplicate									
Chromium Suite - NASSG (Excluding ANC)				Result 1	Result 2	RPD			
Chromium Reducible Sulfur (a-SCR) (NLM-2.1)	L25-Se0027219	CP	mol H+/t	3.2	3.2	<1	20%	Pass	
Sulfur - KCl Extractable	L25-Se0027219	CP	% S	N/A	N/A	N/A	30%	Pass	
HCl Extractable Sulfur	L25-Se0027219	CP	% S	N/A	N/A	N/A	20%	Pass	
Net Acid soluble sulfur (SNAS) NLM-4.1	L25-Se0027219	CP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (a-SNAS) NLM-4.1	L25-Se0027219	CP	mol H+/t	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	L25-Se0027219	CP	% S	N/A	N/A	N/A	30%	Pass	
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	L25-Se0027219	CP	% CaCO3	0.21	0.21	2.0	20%	Pass	
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)	L25-Se0027219	CP	% S	0.07	0.07	2.0	30%	Pass	
ANC Fineness Factor	L25-Se0027219	CP	factor	1.5	1.5	<1	30%	Pass	
s-CRS Suite - Net Acidity - NASSG (including ANC)	L25-Se0027219	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Including ANC)	L25-Se0027219	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Including ANC)	L25-Se0027219	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	L25-Se0027227	CP	%	14	14	3.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

Authorised by:

Natalie Hill	Analytical Services Manager
Jonathon Angell	Senior Analyst-Sample Properties
Jonathon Angell	Senior Analyst-SPOCAS



Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Galt Environment P/L
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Osborne Park
WA 6017

NATA Accredited
Accreditation Number 2377
Site Number 2370 & 2554

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **- ALL SRA/Results**

Report **1268461-W**
Project name HATCH CT HIGH WYCOMBE
Project ID WAG25018-01
Received Date Sep 15, 2025

Client Sample ID			**MW01**	**MW02**	**QC102**
Sample Matrix			**Water**	**Water**	**Water**
Eurofins Sample No.			**L25-Se0046302**	**L25-Se0046303**	**L25-Se0046304**
Date Sampled			**Sep 12, 2025**	**Sep 12, 2025**	**Sep 12, 2025**
Test/Reference	LOR	Unit			
Acidity (as CaCO3)	10	mg/L	36	12	11
Ammonia (as N)	0.02	mg/L	0.49	< 0.02	0.05
Chloride	5	mg/L	330	16	16
Conductivity (at 25 °C)	10	uS/cm	1400	430	430
Filterable Reactive Phosphorus	0.01	mg/L	< 0.01	0.05	0.12
NOx (as N)	0.01	mg/L	< 0.01	9.9	9.8
pH (at 25 °C)	0.1	pH Units	6.8	7.7	7.7
Salinity (at 25 °C)	10	mg/L	690	200	200
Sulfate (as SO4)	1	mg/L	35	< 1	13
Total Dissolved Solids Dried at 180 °C ± 2 °C	5	mg/L	810	360	350
Total Kjeldahl Nitrogen	0.2	mg/L	4.9	< 0.2	< 0.2
Total Nitrogen	0.2	mg/L	4.9	9.9	9.9
Total Phosphorus	0.01	mg/L	0.18	0.17	0.16
Alkalinity (speciated)					
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	210	150	150
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5
Hydroxide Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5
Total Alkalinity (as CaCO3)	5	mg/L	210	150	150
Heavy Metals					
Aluminium	0.05	mg/L	0.80	2.5	2.5
Iron	0.01	mg/L	4.3	3.1	2.9
Alkali Metals					
Sodium	0.5	mg/L	120	15	12
Acid Sulphate Metals : Metals M9 filtered					
Aluminium (filtered)	0.05	mg/L	0.70	0.46	0.23
Arsenic (filtered)	0.001	mg/L	0.002	0.006	0.005
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001
Chromium (filtered)	0.001	mg/L	0.002	0.001	0.001
Iron (filtered)	0.01	mg/L	4.3	0.40	0.26
Manganese (filtered)	0.005	mg/L	0.35	0.055	0.036
Nickel (filtered)	0.001	mg/L	0.002	0.003	0.003
Selenium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001
Zinc (filtered)	0.005	mg/L	< 0.005	0.065	0.10

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Acidity (as CaCO3)	Welshpool	Sep 15, 2025	14 Days
- Method: LTM-INO-4210 Acidity			
Ammonia (as N)	Welshpool	Sep 15, 2025	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Chloride	Welshpool	Sep 15, 2025	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Conductivity (at 25 °C)	Welshpool	Sep 15, 2025	28 Days
- Method: LTM-INO-4030 Conductivity			
Filterable Reactive Phosphorus	Welshpool	Sep 15, 2025	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
NOx (as N)	Welshpool	Sep 15, 2025	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
pH (at 25 °C)	Welshpool	Sep 15, 2025	6 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Salinity (at 25 °C)	Welshpool	Sep 15, 2025	28 Days
- Method: ARL019 - Conductivity and Salinity in Water			
Sulfate (as SO4)	Welshpool	Sep 15, 2025	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Total Dissolved Solids Dried at 180 °C ± 2 °C	Welshpool	Sep 15, 2025	7 Days
- Method: ARL No. 017 - Total Dissolved Solids			
Total Kjeldahl Nitrogen	Welshpool	Sep 15, 2025	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Sep 15, 2025	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Sep 15, 2025	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Alkalinity (speciated)	Welshpool	Sep 15, 2025	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Heavy Metals	Welshpool	Sep 15, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Alkali Metals	Welshpool	Sep 15, 2025	6 Months
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Acid Sulphate Metals : Metals M9 filtered	Welshpool	Sep 15, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			

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Address: 50 Edward Street
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WA 6017

Project Name: HATCH CT HIGH WYCOMBE
Project ID: WAG25018-01

Order No.: WAG25018-01
Report #: 1268461
Phone: 08 6272 0200
Fax: 08 9285 8444

Received: Sep 15, 2025 3:15 PM
Due: Sep 22, 2025
Priority: 5 Day
Contact Name: - ALL SRA/Results

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						ASS Groundwater Quality Suite - WA Department of Environment and
Perth Laboratory - NATA # 2377 Site # 2370 & 2554						X
External Laboratory						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
1	MW01	Sep 12, 2025		Water	L25-Se0046302	X
2	MW02	Sep 12, 2025		Water	L25-Se0046303	X
3	QC102	Sep 12, 2025		Water	L25-Se0046304	X
Test Counts						3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ppm:** parts per million
µg/L: micrograms per litre	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	**Colour:** Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Ammonia (as N)	mg/L	< 0.02			0.02	Pass	
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
NOx (as N)	mg/L	< 0.01			0.01	Pass	
Salinity (at 25 °C)	mg/L	< 10			10	Pass	
Sulfate (as SO4)	mg/L	< 1			1	Pass	
Total Dissolved Solids Dried at 180 °C ± 2 °C	mg/L	< 5			5	Pass	
Method Blank							
Alkalinity (speciated)							
Bicarbonate Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Hydroxide Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/L	< 0.05			0.05	Pass	
Iron	mg/L	< 0.01			0.01	Pass	
Method Blank							
Alkali Metals							
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Acid Sulphate Metals : Metals M9 filtered							
Aluminium (filtered)	mg/L	-0.00012585			0.05	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0001			0.0001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Iron (filtered)	mg/L	< 0.01			0.01	Pass	
Manganese (filtered)	mg/L	< 0.005			0.005	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Selenium (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Acid Sulphate Metals : Metals M9 filtered							
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0001			0.0001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Iron (filtered)	mg/L	< 0.01			0.01	Pass	
Manganese (filtered)	mg/L	< 0.005			0.005	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Selenium (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Chloride	mg/L	< 5			5	Pass	
Method Blank							
Acid Sulphate Metals : Metals M9 filtered							
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Iron (filtered)	mg/L	< 0.01			0.01	Pass	
Manganese (filtered)	mg/L	< 0.005			0.005	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Selenium (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Heavy Metals							
Aluminium	%	90			80-120	Pass	
Iron	%	98			80-120	Pass	
LCS - % Recovery							
Alkali Metals							
Sodium	%	85			80-120	Pass	
LCS - % Recovery							
Acid Sulphate Metals : Metals M9 filtered							
Aluminium (filtered)	%	96			80-120	Pass	
Arsenic (filtered)	%	107			80-120	Pass	
Cadmium (filtered)	%	92			80-120	Pass	
Chromium (filtered)	%	103			80-120	Pass	
Iron (filtered)	%	100			80-120	Pass	
Manganese (filtered)	%	102			80-120	Pass	
Nickel (filtered)	%	97			80-120	Pass	
Selenium (filtered)	%	97			80-120	Pass	
Zinc (filtered)	%	101			80-120	Pass	
LCS - % Recovery							
Acid Sulphate Metals : Metals M9 filtered							
Arsenic (filtered)	%	110			80-120	Pass	
Cadmium (filtered)	%	92			80-120	Pass	
Chromium (filtered)	%	100			80-120	Pass	
Iron (filtered)	%	96			80-120	Pass	
Manganese (filtered)	%	98			80-120	Pass	
Nickel (filtered)	%	92			80-120	Pass	
Selenium (filtered)	%	95			80-120	Pass	
Zinc (filtered)	%	97			80-120	Pass	
LCS - % Recovery							
Acid Sulphate Metals : Metals M9 filtered							
Arsenic (filtered)	%	106			80-120	Pass	
Chromium (filtered)	%	101			80-120	Pass	
Iron (filtered)	%	98			80-120	Pass	
Manganese (filtered)	%	99			80-120	Pass	
Nickel (filtered)	%	94			80-120	Pass	
Selenium (filtered)	%	96			80-120	Pass	
Zinc (filtered)	%	98			80-120	Pass	
CRM - % Recovery							
Sulfate (as SO4)	%	112			80-120	Pass	
CRM - % Recovery							
Acid Sulphate Metals : Metals M9 filtered							
Arsenic (filtered)	%	91			90-110	Pass	
Cadmium (filtered)	%	98			90-110	Pass	
Chromium (filtered)	%	105			90-110	Pass	
Manganese (filtered)	%	108			90-110	Pass	
Nickel (filtered)	%	100			90-110	Pass	
Selenium (filtered)	%	91			90-110	Pass	
Zinc (filtered)	%	97			90-110	Pass	
CRM - % Recovery							
Chloride	%	109			80-120	Pass	
CRM - % Recovery							
Acid Sulphate Metals : Metals M9 filtered							
Aluminium (filtered)	%	93			90-110	Pass	
Arsenic (filtered)	%	104			90-110	Pass	
Cadmium (filtered)	%	92			90-110	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Chromium (filtered)			%	110			90-110	Pass	
Iron (filtered)			%	110			90-110	Pass	
Manganese (filtered)			%	110			90-110	Pass	
Nickel (filtered)			%	108			90-110	Pass	
Selenium (filtered)			%	103			90-110	Pass	
CRM - % Recovery									
Chloride			%	115			80-120	Pass	
CRM - % Recovery									
Acid Sulphate Metals : Metals M9 filtered									
Arsenic (filtered)			%	99			90-110	Pass	
Cadmium (filtered)			%	107			90-110	Pass	
Chromium (filtered)			%	91			90-110	Pass	
Iron (filtered)			%	91			90-110	Pass	
Manganese (filtered)			%	107			90-110	Pass	
Nickel (filtered)			%	106			90-110	Pass	
Selenium (filtered)			%	100			90-110	Pass	
Zinc (filtered)			%	107			90-110	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Ammonia (as N)	L25-Se0046303	CP	%	104			80-120	Pass	
Chloride	L25-Se0046303	CP	%	106			70-130	Pass	
Filterable Reactive Phosphorus	L25-Se0046303	CP	%	107			80-120	Pass	
NOx (as N)	L25-Se0046303	CP	%	111			80-120	Pass	
Sulfate (as SO4)	L25-Se0046303	CP	%	110			70-130	Pass	
Spike - % Recovery									
Acid Sulphate Metals : Metals M9 filtered				Result 1					
Arsenic (filtered)	L25-Se0046303	CP	%	111			75-125	Pass	
Cadmium (filtered)	L25-Se0046303	CP	%	88			75-125	Pass	
Chromium (filtered)	L25-Se0046303	CP	%	100			75-125	Pass	
Iron (filtered)	L25-Se0046303	CP	%	95			75-125	Pass	
Manganese (filtered)	L25-Se0046303	CP	%	92			75-125	Pass	
Nickel (filtered)	L25-Se0046303	CP	%	91			75-125	Pass	
Selenium (filtered)	L25-Se0046303	CP	%	96			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	L25-Se0046302	CP	mg/L	0.49	0.46	8.0	20%	Pass	
Chloride	L25-Se0046302	CP	mg/L	330	340	2.0	30%	Pass	
Conductivity (at 25 °C)	L25-Se0043840	NCP	uS/cm	41000	41000	<1	30%	Pass	
Filterable Reactive Phosphorus	L25-Se0046302	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
NOx (as N)	L25-Se0046302	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
pH (at 25 °C)	L25-Se0043840	NCP	pH Units	7.7	7.7	1.0	30%	Pass	
Salinity (at 25 °C)	L25-Se0046302	CP	mg/L	690	670	2.0	20%	Pass	
Sulfate (as SO4)	L25-Se0046302	CP	mg/L	35	38	8.0	30%	Pass	
Total Dissolved Solids Dried at 180 °C ± 2 °C	L25-Se0046302	CP	mg/L	810	810	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium	L25-Se0046302	CP	mg/L	0.80	0.79	1.0	30%	Pass	
Iron	L25-Se0046302	CP	mg/L	4.3	4.4	2.0	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Sodium	L25-Se0046302	CP	mg/L	120	120	1.0	30%	Pass	

Duplicate									
Acid Sulphate Metals : Metals M9 filtered				Result 1	Result 2	RPD			
Arsenic (filtered)	L25-Se0046302	CP	mg/L	0.002	0.002	4.0	30%	Pass	
Cadmium (filtered)	L25-Se0046302	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Chromium (filtered)	L25-Se0046302	CP	mg/L	0.002	0.002	13	30%	Pass	
Iron (filtered)	L25-Se0046302	CP	mg/L	4.3	4.7	1.0	30%	Pass	
Manganese (filtered)	L25-Se0046302	CP	mg/L	0.35	0.34	3.0	30%	Pass	
Nickel (filtered)	L25-Se0046302	CP	mg/L	0.002	0.002	3.0	30%	Pass	
Selenium (filtered)	L25-Se0046302	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Zinc (filtered)	L25-Se0046302	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Sam Becker	Senior Analyst-Inorganic



Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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Appendix G: Acid Sulfate Soil Testing Results

Acid Sulfate Soil Field Testing

Field Observations						Lab pH	Chromium Reducible Sulfur Suite				Acid Sulfate Soil Classification
Sample ID		pH_f	pH_{fox}	$pH_f - pH_{fox}$	Reaction Rate	pH_{KCl}	Titratable Actual Acidity	Chromium Reducible Sulfur	Acid Neutralising Capacity	Net Acidity	
Location	Depth (m)	pH units	pH units	pH units	LMHXV	pH units	%S	%S	%S	%S	
		4	4	1	NV	NV	0.03	0.03	NV	0.03	NV
BH11	0.00	7.6	5.2	2.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.25	7.6	5.2	2.4	L	8.7	< 0.003	<0.005	0.85	< 0.02	NASS
	0.50	7.6	5.3	2.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.75	7.6	5.3	2.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00	8.3	6.0	2.3	L	6.8	< 0.003	0.013	0.09	< 0.02	NASS
	1.25	8.3	6.1	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50	8.5	6.0	2.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75	8.4	5.5	2.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00	8.3	5.3	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25	8.3	5.0	3.3	L	6.6	< 0.003	0.005	0.06	< 0.02	NASS
	2.50	8.3	5.0	3.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.75	7.4	4.8	2.6	L	. . .	. . .	. . .	. . .	. . .	. . .
	3.00	7.5	4.3	3.2	L	. . .	. . .	. . .	. . .	. . .	. . .
BH12	0.00	5.2	3.9	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.25	5.2	3.6	1.6	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	4.7	3.3	1.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.75	5.1	3.7	1.4	L	5.1	0.02	0.006	N/A	0.02	NASS
	1.00	5.6	4.3	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25	5.9	4.9	1.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50	6.4	5.1	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75	6.7	5.2	1.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00	6.8	4.9	1.9	L	5.9	< 0.003	< 0.005	N/A	< 0.02	NASS
	2.25	6.7	4.6	2.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50	6.5	4.2	2.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.75	6.8	4.1	2.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	3.00	6.9	4.1	2.8	L	4.0	0.01	< 0.005	N/A	< 0.02	NASS
BH13	0.00	7.3	5.1	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.25	7.3	5.1	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	7.2	5.0	2.2	L	6.2	< 0.003	0.012	N/A	0.02	NASS
	0.75	7.2	5.1	2.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00	7.3	5.6	1.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25	7.3	5.6	1.7	L	6.6	< 0.003	0.006	0.28	< 0.02	NASS
	1.50	7.4	5.6	1.8	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75	7.4	5.3	2.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00	7.5	5.9	1.6	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25	7.8	6.0	1.8	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50	8.0	5.8	2.2	L	6.2	< 0.003	< 0.005	N/A	< 0.02	NASS
	2.75	8.1	5.9	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	3.00	8.1	5.8	2.3	L	. . .	. . .	. . .	. . .	. . .	. . .

Acid Sulfate Soil Field Testing

Field Observations						Lab pH	Chromium Reducible Sulfur Suite				Acid Sulfate Soil Classification
Sample ID		pH_f	pH_{fox}	$pH_f - pH_{fox}$	Reaction Rate	pH_{KCl}	Titratable Actual Acidity	Chromium Reducible Sulfur	Acid Neutralising Capacity	Net Acidity	
Location	Depth (m)	pH units	pH units	pH units	LMHXV	pH units	%S	%S	%S	%S	
		4	4	1	NV	NV	0.03	0.03	NV	0.03	NV
BH14	0.00	8.2	5.8	2.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.25	8.2	5.8	2.4	L	9.5	< 0.003	< 0.005	1.3	< 0.02	NASS
	0.50	8.3	6.5	1.8	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.75	8.3	6.4	1.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00	8.4	6.3	2.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25	8.3	6.2	2.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50	8.2	6.1	2.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75	8.2	5.8	2.4	L	8.0	< 0.003	0.005	0.07	< 0.02	NASS
	2.00	8.2	4.4	3.8	M	. . .	. . .	. . .	. . .	. . .	. . .
	2.25	8.3	3.9	4.4	M	. . .	. . .	. . .	. . .	. . .	. . .
	2.50	8.5	2.9	5.6	H	. . .	. . .	. . .	. . .	. . .	. . .
	2.75	8.4	2.6	5.8	M	5.4	0.01	0.006	N/A	0.02	NASS
	3.00	8.3	2.6	5.7	M	. . .	. . .	. . .	. . .	. . .	. . .
BH15	0.00	7.8	6.5	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.25	7.6	6.4	1.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	8.0	6.3	1.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.75	8.1	6.2	1.9	L	7.1	< 0.003	< 0.005	0.09	< 0.02	NASS
	1.00	8.2	6.2	2.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25	8.3	5.9	2.4	L	6.9	< 0.003	< 0.005	0.07	< 0.02	NASS
	1.50	8.2	5.9	2.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75	8.3	5.9	2.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00	8.3	6.3	2.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25	8.5	6.1	2.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50	8.5	6.0	2.5	L	6.4	< 0.003	< 0.005	N/A	< 0.02	NASS
	2.75	8.5	5.8	2.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	3.00	8.3	6.4	1.9	L	. . .	. . .	. . .	. . .	. . .	. . .
BH16	0.00	8.3	6.3	2.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.25	8.3	6.1	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	8.2	6.1	2.1	L	7.0	< 0.003	< 0.005	0.14	< 0.02	NASS
	0.75	8.2	6.0	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00	8.2	5.9	2.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25	8.1	5.9	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50	8.0	5.7	2.3	L	5.9	< 0.003	< 0.005	0.16	< 0.02	NASS
	1.75	7.8	6.1	1.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00	7.8	6.1	1.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25	6.0	4.9	1.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50	6.1	4.8	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.75	6.0	4.6	1.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	3.00	6.0	4.6	1.4	L	4.9	0.08	0.064	N/A	0.14	ASS

Appendix H: Groundwater Field Parameters

GROUNDWATER FIELD PARAMETERS

Date:	12/09/2025	Monitoring Well:	MW02	Purge Method:	LF
Job Number:	WAG250183	Depth to Water (mTOC)	1.77	Purge volume (L)	2.5
Site:	Hatch Ct High Wycombe	Depth of Well (mTOC)	3.32	Flow rate (L/min)	0.5
Field Rep:	SB	Stick-up (m):	0.62	Flow cell used:	Y
		Dipper correction	Y		

Observations	Volume (L)	Time	Temp(C)	DO(%L)	DO(mg/L)	SPC(uS/cm)	pH	Redox(mV)
Pale brown colour, mild turbidity, mild organic odour.	0.5	1	17.28	72.5	6.33	405.0	7.18	65
	1.0	2	17.28	70.1	6.21	405.0	7.17	58
	1.5	3	17.28	65.5	6.08	403.0	7.17	54
	2.0	4	17.27	62.3	5.98	400.0	7.16	54
	2.5	5	17.27	62.5	5.96	401.0	7.16	58

GROUNDWATER FIELD PARAMETERS

Date:	12/09/2025	Monitoring Well:	MW03	Purge Method:	LF
Job Number:	WAG250183	Depth to Water (mTOC)	0.93	Purge volume (L)	2.5
Site:	Hatch Ct High Wycombe	Depth of Well (mTOC)	3.54	Flow rate (L/min)	0.5
Field Rep:	SB	Stick-up (m):	0.65	Flow cell used:	Y
		Dipper correction	Y		

Observations	Volume (L)	Time	Temp(C)	DO(%L)	DO(mg/L)	SPC(uS/cm)	pH	Redox(mV)
Grey/ brown, high turbidity, strong organic odour.	0.5	1	16.6	34.0	2.59	1270.0	6.16	51.6
	1.0	2	16.6	33.1	2.59	1268.0	6.19	49.9
	1.5	3	16.5	30.2	2.56	1258.0	6.19	47.5
	2.0	4	16.05	29.4	2.45	1250.0	6.18	48.5
	2.5	5	16.05	27.0	2.45	1247.0	6.18	40.9

Appendix I: Tabulated Groundwater Results

Laboratory Analytical Results - Groundwater

			Field ID	MW01	MW02
			Date	12 Sep 2025	12 Sep 2025
			Sample Type	Normal	Normal
			Lab Report Number	1268461	1268461
	Unit	EQL	WA DWER Non-potable groundwater use guideline (NPUG) (2021)		
Other					
Acidity (as CaCO3)	**mg/L**	10		36	12
Inorganics					
Reactive Phosphorus (Orthophosphate)	**mg/L**	0.01		<0.01	0.12*
Nitrite + Nitrate as N	**mg/L**	0.01		<0.01	9.9
Alkalinity (Bicarbonate as CaCO3)	**mg/L**	5		210	150
Alkalinity (Carbonate as CaCO3)	**mg/L**	5		<5	<5
Alkalinity (Hydroxide) as CaCO3	**mg/L**	5		<5	<5
Alkalinity (total) as CaCO3	**mg/L**	5		210	150
Ammonia as N	**mg/L**	0.02		0.49	<0.02
Chloride (filtered)	**mg/L**	5	250	330	16
Electrical Conductivity (Lab)	**µS/cm**	10		1,400	430
Kjeldahl Nitrogen Total	**mg/L**	0.2		4.9	<0.2
Nitrogen (Total)	**mg/L**	0.2		4.9	9.9
pH (Lab)	**-**	0.1		6.8	7.7
Total Phosphorus (Organic Phosphate)	**mg/L**	0.01		0.18	0.17
Salinity	**mg/L**	10		690	200
Sodium	**mg/L**	0.5		120	15
Sulphate (filtered)	**mg/L**	1	1,000	35	13*
Total Dissolved Solids (Lab)	**mg/L**	5		810	360
Metals					
Aluminium	**mg/L**	0.05	0.2	0.80	2.5
Aluminium (filtered)	**mg/L**	0.05	0.2	0.70	0.46
Selenium (filtered)	**ug/L**	1	100	<1	<1
Arsenic (filtered)	**mg/L**	0.001	0.1	0.002	0.006
Cadmium (filtered)	**mg/L**	0.0001	0.02	<0.0001	<0.0001
Chromium (III+VI) (filtered)	**mg/L**	0.001		0.002	0.001
Iron	**mg/L**	0.01	0.3	4.3	3.1
Iron (filtered)	**mg/L**	0.01	0.3	4.3	0.40
Manganese (filtered)	**mg/L**	0.005	5	0.35	0.055
Nickel (filtered)	**mg/L**	0.001	0.2	0.002	0.003
Zinc (filtered)	**mg/L**	0.005	3	<0.005	0.065

* The highest value has been adopted from QA/QC samples

Environmental Standards

WA DWER, November 2021, WA DWER Non-potable groundwater use guideline (NPUG) (2021)



Standard Geotechnical Definitions, Recommendations, Requirements and Limitations

GDR1 ABOUT THIS APPENDIX

These technical notes are to be read with the attached report. These notes contain important information regarding the study in the attached report, and the report cannot be considered in isolation without full reading of these notes.

Where there are conflicts between this appendix and the report text, the report text takes precedence.

Unless noted otherwise, geotechnical investigations are conducted in accordance with AS1726-2017, “Geotechnical site investigations”.

Unless noted otherwise, the report does not include any assessment (or implied assessment) of karst risk.

GDR2 DEFINITIONS

The following definitions apply:

- **Approved Fill** – fill that has been assessed and approved by the geotechnical engineer or civil designer for a particular purpose.
- **Bedding** – A controlled fill layer placed beneath buried elements such as pipes, cables or other infrastructure to provide uniform support and distribute loading.
- **Bulk Fill** – Controlled fill intended to support future infrastructure, but potentially lacking some engineering properties required for upper fill layers or adjacent to structures, where fill with specific properties may be required. Contrast with Select Fill.
- **Civil Design** – the engineering design of the earthworks including surface water and erosion control and subsurface drainage control (where required) to achieve an earthworked, drained site which is capable of supporting the proposed development (including target site classification to AS2870, where relevant). This design is separate to this geotechnical investigation and is a required element of a site development.
- **Clay** – A component of a soil with particles smaller than 0.002 mm in size.
- **Cohesionless (Non-cohesive) Soil** – A soil mass that has does not hold together at low applied stress levels. The strength of the soil depends solely on friction between particles.
- **Cohesive Soil** – A soil mass that has holds together and can adhere to itself.
- **Collapsible Soil** – a soil with high void ratio that is typically strong when dry but loses strength and consolidates under constant stress when wetted, usually due to loss of soil matric suction or dissolving of a chemical cementing agent.
- **Compaction –** The process of increasing the soil density, typically be mechanical means.
- **Competent Person** – A person who has, through a combination of training, education and experience, acquired knowledge and skills enabling that person to correctly perform a specified task.
- **Consistency** – The stiffness of a cohesive soil, at specific moisture contents, to resist mechanical stress or manipulation (remoulding).
- **Controlled (or engineered) Fill** – Any fill for which engineering properties are controlled during placement. Also referred to as structural fill.
- **Dense –** with respect to sandy soils, at a relatively high density index or dry density ratio, exhibiting better engineering parameters with respect to strength and stiffness than the same material at a lower density index.
- **Density** – A measure of the mass of material per unit volume.
- **Eccentric Load** – a load incorporating either a varying vertical load and/or a horizontal load such that the peak vertical stress exceeds the average vertical stress.
- **Embedment Fill** – A controlled fill material placed around and above buried infrastructure (such as pipes, cables or conduits) to provide protection and support.
- **Fill** – Any material that has been placed by anthropogenic processes.
- **Fines** – A component of a soil with particles smaller than 0.075 mm in size.
- **Groundwater** – Water located beneath the earth’s surface in pore spaces, fractures and voids in soil or rock.

- **Gravel** – A component of a soil with particles between 2.36 mm and 63 mm in size.
- **Heavily Loaded** – in reference to mobile plant, particularly intended for equipment where ground bearing pressures exceed 50 kPa and/or equipment has a high centre of gravity and could be prone to toppling. In reference to buildings/structures, where footing pressures exceed 100 kPa and/or footing dimensions exceed 1 m wide.
- **Hydraulic Conductivity** – ratio of volume flux to hydraulic gradient – a quantitative measure of soil's ability to transmit water when subjected to a hydraulic gradient. k_{sat} – saturated hydraulic conductivity, intended for dewatering assessment, subsoil drainage design and other engineering assessments where saturated soils are relevant. k_{unsat} – unsaturated hydraulic conductivity, intended for design of stormwater disposal elements such as soakwells and infiltration basins, where the base of disposal elements is above the groundwater level.
- **In situ** – In the place and condition in which it exists naturally. May also refer to fill that is present at any site prior to an investigation taking place.
- **Limestone** – A sedimentary carbonate rock. The use of the term does not infer a specific strength, carbonate content or grain size. Refer to GDR4.1 for further detail.
- **Loose** – with respect to sand soils, at a relatively low density index or dry density ratio, typically indicating poorer engineering parameters with respect to strength and stiffness than the same material at a higher density index.
- **Material** – Matter that meets the definitions of 'soil', 'rock', other engineered matter (i.e., concrete, bricks etc.) or non-engineered matter (organics, contaminated refuse, deleterious material).
- **May** – Indicates that the statement is an option.
- **Must** – Indicates that the statement is mandatory.
- **Natural** – In the context of soil or rock, material which is present as a result of natural geological processes and has not been subject to anthropogenic engineering processes (such as filling, excavation, replacement, etc).
- **Organic** – In the context of soil, material derived from living matter, primarily plants.
- **Overconsolidated** – a soil that has been subjected to a greater vertical stress than its current state.
- **Permeable Soil** – soil that meets the civil design permeability requirements to allow relatively rapid flow of water through the soil matrix.
- **Rock** – Any aggregate of minerals and/or materials that cannot be disaggregated by hand in air or water without prior soaking.
- **Sand** – a component of soil with particle size between 0.075 mm and 2.36 mm.
- **Select Fill** – a controlled fill which has been chosen for particular engineering characteristics (such as strength, CBR, grading, permeability, etc), commonly for use as a higher-grade capping layer or adjacent to structures. Contrast with Bulk Fill.
- **Shall** – Indicates that the statement is mandatory.
- **Should** – Indicates that the statement is a recommendation.
- **Silt** – A component of a soil with particles between 0.075 mm and 0.002 mm in size.
- **Soil** – Particulate materials that occur in the ground and can be disaggregated or remoulded by hand in air or water without prior soaking.
- **Sand** – A component of a soil with particle between 0.075 mm and 2.36 mm in size.
- **Uncontrolled Fill** – Any material that has been deposited by anthropogenic process, which does not meet the definition of 'controlled fill'.

GDR3 GEOTECHNICAL TEST METHODS AND INTERPRETATION

GDR3.1 Test Pit Excavation

Test pit excavations are formed using mechanical excavation equipment (typically an excavator) or hand dug, with the objective of inspecting (or profiling) the soil exposed in the excavation.

Typical limitations on test pit excavations are:

- Limited depth of excavation – typically governed by reach of the excavator arm.
- Cannot be excavated below groundwater in cohesionless soils, due to collapse and water ingress.
- Cannot be excavated through very stiff / very dense soils (i.e., desiccated clays or cemented soils) or most rock.
- Cannot typically obtain rock samples that are suitable for strength testing.

Test pits are usually mechanically excavated with a toothed bucket (intended for excavation in clay or weak rock) or a flat-edged bucket (typically for sands).

When hand-dug test pits are excavated, it is usually for recovery of near-surface soils or inspection of shallow in-ground elements.

We note that where test pits are excavated on a site, they are only ever loosely backfilled during our studies. They must always be located during site preparation works, over-excavated to their full depth and plan extents and re-filled with approved fill in compacted layers.

GDR3.2 Cone Penetration Tests (CPTs)

Cone penetration testing (CPT) is done by Galt or specialist contractors and typically to AS1289.6.5.1. The test involves pushing an instrumented cone into the soil with a hydraulically operated pushing frame. The test measures tip resistance and sleeve friction on the cone, which are then plotted with depth.

We interpret soil types and associated geotechnical soil parameters from CPT data using the following:

Technical Interpretations and International Guides

- Robertson P.K., Campanella R.G., Gillespie D. and Grieg J. (1986). “Use of piezometer cone data”. Proceedings of the ASCE Speciality Conference In Situ ’86: Use of In Situ Tests in Geotechnical Engineering, Blacksburg, pp 1263-80, American Society of Civil Engineers (ASCE).
- Robertson, P.K., Cabal K.L. (2016) “Guide to Cone Penetration Testing for Geotechnical Engineering 6th Edition 2015”. Gregg Drilling & Testing, Inc., California.
- Baldi G., Bellotti R., Ghionna V.H., Jamiolkowski M., Lo Presti D. C. (1989) “Modulus of sands from CPTs and DMTs”. Proc. 12th Int. Conf. on SMFE, Rio de Janeiro, Vol 1, p165-170, Balkema, Rotterdam.

Local (Perth and Western Australia) Research, Interpretation and Guides

- Fahey, M., Lehane, B., Stewart, D. (2003) “Soil stiffness for shallow foundation design in the Perth CBD”. Australian Geomechanics Vol. 8 No. 3.
- Main Roads Western Australia (MRWA) (2009) “Structures Engineering Design Manual”. Document 3912/03, Perth.
- Lehane B. (2017). “CPT-Based Design of Foundations”, E.H. Davis Memorial Lecture, Australian Geomechanics, Vol 54. No. 4’ and
- Galt’s in-house correlations between CPT data and other geotechnical testing.

GDR3.3 Borehole Drilling

Boreholes are drilled for sampling of the soil and rock, with a small disturbance footprint. Typical techniques are:

- Auger drilling (hand auger or machine auger) – for recovery of soil at relatively shallow depths only. Cannot penetrate cemented soils or rock.
- Push probe drilling – for recovery of soil at relatively shallow depths and below groundwater. Cannot penetrate cemented soils or rock.

- Air core drilling – for recovery of soil, cemented soil and rock (typically up to high strength rock). Not suited to drilling of very high strength rock.
- Diamond coring (or rotary coring) – for recovery of cemented soil, rock and some soil types (typically not sand). Suited to all strengths of rock.

If used, standard penetration tests (SPTs) are done in accordance with AS1289.6.3.1. Correlations for consistency and density are based on:

- Standards Australia (2016), "HB160-2006, Soils Testing".

GDR3.4 Dynamic Cone Penetrometer (DCP)

The DCP is a hand-held tool for assessing penetration resistance of a soil. This comprises a 16 mm rod equipped with a 20 mm cone, hammered into the ground using a falling 9 kg weight on a 510 mm slide hammer on the top of the rod. This is done in accordance with AS1289.6.3.2 and the blow counts to hammer in the rod are measured in 100 mm penetration increments. Where provided, correlations for consistency and density are based on:

- Standards Australia (2016), "HB160-2006, Soils Testing".

GDR3.5 Perth Sand Penetrometer (PSP)

The PSP is a variation on a DCP and uses a 9 kg weight on a 600 mm slide hammer to hammer in a 16 mm rod with a blunt (square-faced) end. Testing is done in accordance with AS1289.6.3.3, with the following typical variations:

- Testing is often done to a greater depth than the 450 mm covered in the standard.
- Blow counts are sometimes recorded in 150 mm intervals (compared to 300 mm intervals used in the standard) to provide better resolution on the tests.

Where provided, correlations for density are based on:

- Standards Australia (2016), "HB160-2006, Soils Testing".

GDR3.6 Dynamic Probing Super Heavy (DPSH)

The DPSH test involves driving a solid cone (20 cm^2) into the ground using a 63.5 kg hammer falling 760 mm. Testing is done in accordance with EN ISO 22476-2 – Geotechnical engineering – Field testing – Part 2: Dynamic probing – DPSH-B.

Results may be presented as either:

- N10 (No. of blows required for every 100 mm penetration);
- N30 (No. of blows required for every 300 mm penetration); or
- q_d (dynamic tip resistance, analogous to CPT q_c).

GDR3.7 Inverse Auger Hole Infiltration Test (Falling Head, Unsaturated Soil)

Infiltration tests are carried out using the 'inverse auger hole' method described by:

- Cocks, G (2007), "Disposal of Stormwater Runoff by Soakage in Perth Western Australia", Journal and News of the Australian Geomechanics Society, Volume 42 No. 3, pp 101-114

This test is an unsaturated falling head test, in that it is carried out above the groundwater table and is intended to mimic the behaviour of soak wells and similar drainage elements (i.e. soakage basins), which discharge stormwater into an unsaturated medium.

The hole is wetted only for a short period prior to the testing.

The test is usually repeated three times, with the intention that the second and third tests provide similar results (within about 10%-20%). Tests are done over a short duration, typically 2 minutes to 10 minutes. The focus of the testing is generally when the head is low (200 mm or lower), such that the relevant lateral zone is as saturated as the zone directly below the borehole.

The hydraulic conductivity derived from this test is not to be used for applications where saturated hydraulic conductivity is relevant, e.g.:

- Subsoil drainage design; and

- Dewatering estimations.

Based on Galt's in-house research, this method does not completely saturate the soil in any reasonable test length, and thus may not be suitable for assessment of soils at sites where the critical drainage condition is a fully saturated soil (i.e., in areas with high groundwater tables). Our research on sand sites indicates that the test does correlate well with actual soak well performance, in unsaturated sand zones without impermeable zones.

GDR3.8 Guelph Permeameter Test (Constant Head, Quasi-Saturated Soil)

The Guelph permeameter test, conducted in accordance with the constant head test method outlined in Appendix G of AS1547, is a constant-head test in nominally "saturated" soil (in that the test is conducted until a "steady state" is reached). However, we note that this test can only be done above the groundwater table and as such, is in an unsaturated zone. Therefore, the hydraulic conductivity derived from this test should be used with caution and evaluated against other test methods (such as saturated, constant-head permeability testing from laboratory samples, or in situ saturated hydraulic conductivity testing below the groundwater table).

GDR4 GEOLOGICAL UNITS

GDR4.1 Limestone

The term 'Limestone' is used to describe a carbonate rock. Tamala Limestone is the common limestone in Western Australia, and typically comprises cemented quartz and shell fragments cemented together by calcium carbonate.

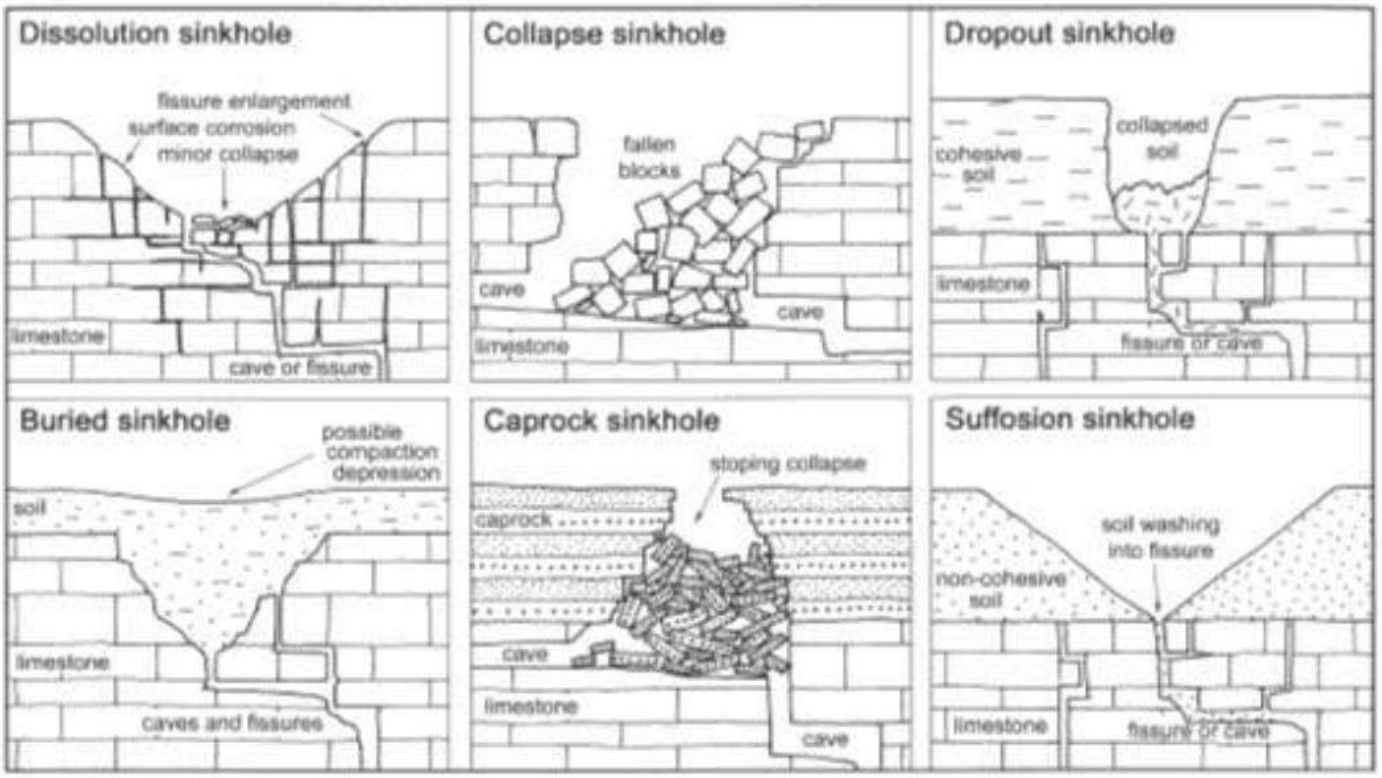
Limestone can vary significantly across short distances in composition, strength and cementation. Tamala limestones in Western Australia also have known possible geological features including:

- Caprock/calcrete – The formation of a very hard duricrust, usually due to sun exposure. Caprock may be up to 3 m thick, but typically around 1.5 m thick. Caprock is very difficult to excavate and may require the use of hydraulic rock breakers or rock saws to excavate.
- Solution features/tubes – Often initially formed due to the presence of Eucalypt and Jarrah roots during limestone formation, and often increasing in depth and size due to ongoing weathering. May be up to 500 mm in diameter. These are typically filled with very loose, unconsolidated sand.
- Pinnacles – Pinnacles are usually the limestone that is left around surrounding solution features. Often can comprise very hard limestone/caprock that can be substantially higher than surrounding areas. Pinnacles may have also been formed by surrounding erosion (i.e., wind/water).
- Karst/caves – Karst is caused by the dissolution of limestone, typically where there is interaction in low-lying areas with water and limestone. Karst manifests itself as loose near-surface sand with cavities (caves) in the underlying limestone. This can lead to sinkholes and collapse of overlying structures.

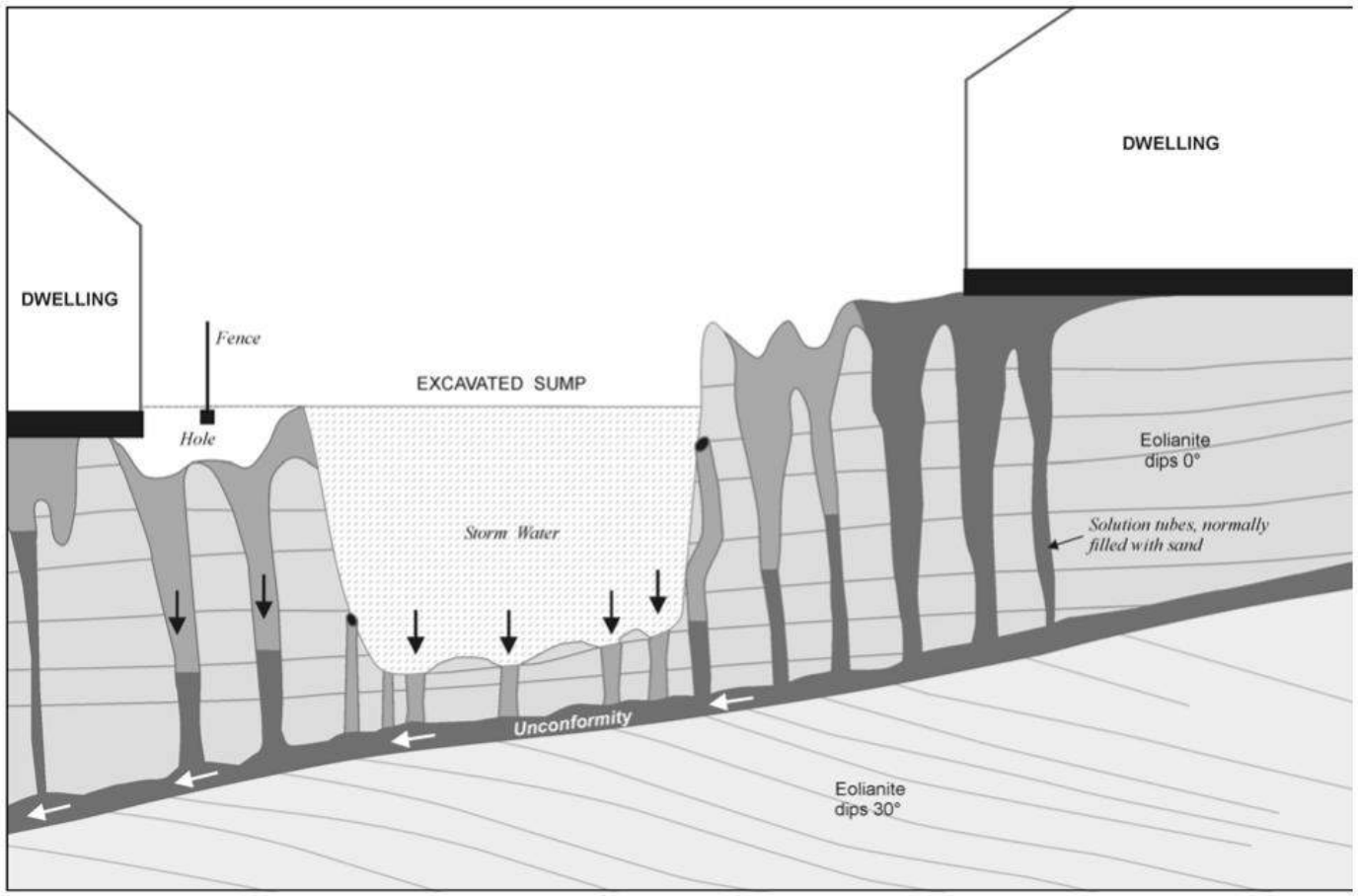
Inline images showing typical pinnacle/solution features and Karstic features follow. These are taken from:

- Gordon, R. (2003). "Coastal Limestones". Australian Geomechanics Vol.38 No. 4, The Engineering Geology of Perth.
- Waltham, A. & Fookes, P. (2003). "Engineering Classification of Karst Ground Conditions: Quarterly Journal of Engineering Geology and Hydrogeology, Vol 36.

Inline Image GDR 1 - Karstic Sinkhole Features from Waltham and Fookes (2003)



Inline Image GDR 2: Pinnacle/Solution Features from Gordon (2003)



GDR4.2 Pindan Sands and Collapsible Soils

In the Western Australian context, Pindan sands are sandy soils present predominantly across the Pilbara and Kimberley regions. Pindan sands are typically:

- Red brown in colour.
- Between 10% and 40% fines.
- Of aeolian origin, usually resulting in unconsolidated in situ conditions (nuclear density gauge testing often indicates these soils have in situ density ratios of 80%-85% of modified maximum dry density).
- Very strong when dry due to high soil suctions in the fine fraction, which create strong bonds between the sand particles.

As the grains are usually held in place by the dry fine fraction, this can lead to:

- very high settlements (i.e., “collapse”) as the grain-to-grain bonds are weakened as matric suction decreases on soaking; and
- loss of vertical and horizontal strength/stiffness as the grain-to-grain bonds weaken.

The risks associate with Pindan sands are usually quantified in terms of the collapse potential/magnitude of possible collapse events.

Other similar soils are present in Western Australia that may exhibit similar collapse potential and may not strictly be Pindan sands (i.e., have other grain-to-grain bonding mechanisms).

GDR5 SITE CLASSIFICATION

Site classification refers to the assessment of a site in reference to AS2870-2011, “Residential slabs and footings”. The method for assessing the site class is outlined in Section 2 of AS2870-2011, which indicates that this may be done by:

- assessing the characteristic surface movement, due to seasonal moisture changes in the soil profile;
- assessing the performance of existing foundations; or
- assessment of the soil profile (where there are deleterious inclusions, landfill, putrescible waste etc.).

The site classifications based on the expected characteristic surface movement are summarised in Table GDR 1.

Table GDR 1: Summary of Site Classifications (AS2870-2011)

Class	Description	Characteristic Surface Movement (y_s)
A	Most sand and rock site with little or no ground movement from moisture change	Not Defined (typically <5 mm)
S	Slightly reactive clay sites with only slight ground movement from moisture changes	0 – 20 mm
M	Moderately reactive clay sites, which may experience moderate ground movements from moisture change	20 – 40 mm
H1	Highly reactive sites, which may experience high ground movements from moisture change	40 – 60 mm
H2	Highly reactive sites, which may experience very high ground movements from moisture change	60 – 75 mm
E	Extremely reactive sites, which may experience extreme ground movements from moisture change	>75 mm
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise	Not Defined

The calculated characteristic surface movement is predominantly based on:

- the reactivity (i.e., the shrink-swell potential) of the soil (and any proposed fill);
- the design depth of soil suction change, which is the maximum expected depth of soil suction change due to seasonal soil moisture changes; and
- the depth to any bedrock and groundwater table.

The design depth of soil suction change for Western Australia has been refined using the Thornthwaite Moisture Index (TMI). We have carried out assessment using the depths as detailed in:

- Hu Y, Saraceni P, Cocks G, Zhou M (2016). "TMI assessment and climate zones in Western Australia". Australian Geomechanics Journal, Vol.51 No.3.
- Hu Y, Raj A, Cocks G, Verheyde F (2019). "Re-assessment of TMI based climate zones in metropolitan Perth, WA". ANZ Geomechanics Conference 2019, Perth Australia.

The design depth of soil suction change for Northern Territory is based on the research presented in:

- Jackson, S (2022), "Thornthwaite moisture index and climate zones in the Northern Territory", Australian Geomechanics Journal, Vol. 57 No. 3.

We highlight that AS2870-2011 does not make any reference to the fines content of a soil when assessing the site classification.

Where a site classification is provided in our reports, it is always predicated on the requirement that the recommended site preparation procedures are carried out.

We also highlight that the footing performance and shrink-swell movements of a site can be impacted by the planting or removal of trees. This should be considered where appropriate, and we refer to the CSIRO BTF 18-2011 "Foundation Maintenance and Footing Performance: A Homeowner's Guide" for further information.

AS 2870 is limited to single and double storey residential buildings with normal shallow footings with a maximum bearing pressure of 100 kPa and is not applicable where development types other than this are proposed.

GDR6 SITE PREPARATION

GDR6.1 General

The intent of the site preparation guidelines provided in the above report are to ensure that the earthworks can be constructed to meet specific requirements, i.e., minimum compaction, fill requirements, removal of unsuitable material etc. The site preparation guidelines are not exhaustive, and on-site conditions may dictate that other preparation measures may be required to meet geotechnical requirements.

GDR6.2 Site Preparation

Site preparation measures outlined in this section relate to bulk earthworks at the site in preparation for the construction of buildings, pavements and other structures.

The preparation of a site in accordance with outlined measures below or those presented in the report text does not imply that the site is suitable for heavily loaded plant or eccentric loads. This is especially applicable for working platforms for mobile plant including cranes, crawlers or the like. The site surface may still not be trafficable for mobile plant. Individual working platform assessments must be done if heavily loaded mobile plant are proposed.

GDR6.2.1 Common Measures

The common measures outlined below are to prepare standard sites in advance of proof compaction, bulk excavation and filling. These measures are applicable to most sites, however the applicability of these measures is stated in the main report.

Table GDR 2: Common Measures

Measure	Commentary
Demolish and remove structures and pavements	Demolish existing structures and pavements, including removal of all buried services and footings and dispose off-site.
Remove demolition debris and other deleterious material	Remove any demolition debris and other deleterious material from site including old footings, slabs, soak wells, buried services, paving and building rubble.
Strip uncontrolled fill (where present)	Strip any uncontrolled fill from the site (where encountered) and, if suitable, stockpile it for potential re-use as non-structural fill. If contaminated, dispose off-site. Refer to the report text for discussions on the presence of detected uncontrolled fill and its composition. It is important to realise that undetected uncontrolled fill may be present between test locations and the absence of its identification in our report does not preclude its presence. If uncontrolled fill is detected during site works, please contact us for inspection and to provide recommendations.
Remove trees	All tree roots must be removed, this may result in significant excavation in places. Where tree roots and stumps are removed, the disturbed soil must be over-excavated and replaced with controlled, compacted fill. Backfilling of over-excavations is discussed in the following sections .
Strip and stockpile topsoil.	Strip and stockpile topsoil from unpaved areas of the site for potential re-use in non-structural applications. The topsoil strip is only necessary to remove roots and we recommend a topsoil strip as necessary to remove all roots from the soil.
Carry out bulk excavation	Excavate to the required level. Stockpile suitable excavated material for potential re-use as fill (the re-use of spoil as fill , if appropriate, is discussed in the report text) and remove unsuitable or excess material off-site.
Batter edges of excavation	Excavations should be battered to a temporary slope as given in the report text where applicable and not in close proximity to adjacent structures etc. If required, construct temporary/permanent retaining walls where batters cannot be accommodated.

By following these measures, the site should have been prepared to a point where topsoil and vegetation has been removed to expose either natural soil or controlled fill. Over-excavation to the required levels may then be required for some projects. Once complete, the site is now ready for proof compaction and filling.

GDR6.2.2 Sand Sites

The preparation measures outlined below are provided for sand sites meeting the following criteria:

- Site underlain by sand.
- No collapsible soils present.
- No deep loose sand.
- Compaction of a loose upper horizon to maximum 1 m depth.
- No shallow groundwater (<1 m deep).
- No limestone or other rock present at shallow depth.
- “Common Measures” outlined in Section GDR6.2.1 have been completed (as required).

The applicability of these measures is stated in the main report. These measures must be carried out for all areas where structures, footings, pavements and any other settlement-sensitive infrastructure is proposed.

Unless specified otherwise in the report, the **Approved Fill** to be used is outlined in Section GDR8 (**Permeable Sand** where permeable fill is required, else **General Sand**). The specific selection is subject to the requirements of the civil designer.

Table GDR 3: Sand Site Measures

Measure	Commentary
Moisture condition and proof compact.	Moisture condition and compact the exposed sandy ground to achieve the density specified in Section GDR7.1 ("sand") to a depth of at least 900 mm.
Test proof compaction	Check that the density specified in Section GDR7.1 ("sand") has been achieved to a depth of at least 900 mm. We note that the applicability of the use of the PSP for compaction control is discussed in the report. Unless specifically approved for use on the subject site, the contractor must **not** assume that the use of the PSP is appropriate.
Treat areas of loose or unsuitable material	Any areas of loose sand or unsuitable material (including over-excavated areas of former trees and root balls) must be removed and replaced with **Approved Fill** as outlined in the report or as noted above. The report will explain the suitability of site-derived materials for re-use as approved fill.
Carry out bulk filling	Where fill is required to build up levels, use **Approved Fill**, placed and compacted in layers of no greater than 300 mm loose thickness. Test compaction to achieve the density specified in Section GDR7.1.

In following this method, shallow/surficial loose sand will be compacted, and the site will be filled (where required) in preparation for supporting footings, ground slabs, pavements and the like.

GDR6.2.3 Deep Loose Sand Sites

The preparation measures outlined below are provided for sand sites meeting the following criteria:

- Site underlain by sand.
- Collapsible soils or deep loose sand present (if applicable, this is discussed in the report).
- Over-excavation, compaction and replacement of loose sand required.
- No shallow groundwater (<1 m deep).
- No limestone or other rock present at shallow depth.
- "Common Measures" outlined in Section GDR6.2.1 have been completed.

The greatest depth of compaction that can be achieved with standard compaction equipment (vibrating roller, etc) is around 1 m (for sands). As such, it is necessary to cut down the site level to a point where this compaction can be done to the lowest level needed to be improved.

The applicability of these measures is stated in the main report. These measures must be carried out for all areas where structures, footings and any other settlement-sensitive infrastructure are proposed. Not typically required for pavement subgrades, however, this is discussed in the report if required.

Unless specified otherwise in the report, the **Approved Fill** to be used is outlined in Section GDR8 (**Permeable Sand** where permeable fill is required, else **General Sand**). The specific selection is subject to the requirements of the civil designer.

Table GDR 4: Deep Loose Sand Site Measures

Measure	Commentary
Over-excavate to the required depth.	Over-excavate sand soil to the depth stated in the report and, if appropriate (discussed in report) retain it for re-use as fill. Over-excavation is likely to be done in stages depending on the site area available for earthworks. Excavations must be battered to a temporary slope as given in the report text where applicable and not in close proximity to adjacent structures etc. If required, construct temporary/permanent retaining walls where batters cannot be accommodated.
Moisture condition and proof compact.	Moisture condition and compact the exposed sandy ground to achieve the density specified in Section GDR7.1 ("sand") to a depth of at least 900 mm.
Test proof compaction	Check that the density specified in Section GDR7.1 ("sand") has been achieved to a depth of at least 900 mm. We note that the applicability of the use of the PSP for compaction control is discussed in the report. Unless specifically approved for use on the subject site, the contractor must **not** assume that the use of the PSP is appropriate.
Treat areas of loose or unsuitable material	Any areas of loose sand or unsuitable material (including over-excavated areas of former trees and root balls) must be removed and replaced with compacted **Approved Fill** as outlined in the report or as noted above. The report will explain the suitability of site-derived materials for re-use as approved fill.

Measure	Commentary
Carry out bulk filling	Where fill is required to build up levels (including restoration of the site surface level to the original level), use **Approved Fill**, placed and compacted in layers of no greater than 300 mm loose thickness. Test compaction as specified in Section GDR7.1.

In following this method, deep, loose sand will be compacted to a sufficient depth to reduce settlement impacts and the site will be filled (where required) in preparation for supporting footings, ground slabs, pavements and the like.

GDR6.2.4 Clayey Sites

The preparation measures outlined below are provided for sand sites meeting the following criteria:

- Site underlain by cohesive soils (typically >12% fines, i.e., clayey enough for the fines proportion of the soil to dominate behaviour).
- No collapsible soils present.
- No deep soft soils or organic soils.
- Over consolidated clayey soils present which will not be subject to significant primary or secondary consolidation (settlements expected to be within the limit of typical seasonal movements occasioned by moisture content changes, which would be captured in assignment of an AS2870 site classification).
- No shallow groundwater (<1 m deep)
- No rock present at shallow depth.
- "Common Measures" outlined in Section GDR6.2.1 have been completed.

The applicability of these measures is stated in the main report. These measures must be carried out for all areas where structures, footings, pavement subgrades and any other settlement-sensitive infrastructure is proposed.

Unless specified otherwise in the report, the **Approved Fill** to be used is **Clay** as outlined in Section GDR8.

Table GDR 5: Clay Site Measures

Measure	Commentary
Moisture condition and proof compact.	Moisture condition and compact the exposed clayey ground to achieve the density specified in Section GDR7.1 ("fine grained soils") to a depth of at least 300 mm.
Test proof compaction	Check that the density specified in Section GDR7.1 ("fine grained soils") has been achieved to a depth of at least 300 mm. The use of a penetrometer for compaction control of cohesive soils is not an appropriate substitute for in situ NDG testing.
Treat areas of loose or unsuitable material	Any areas of soft clayey soils or unsuitable material (including over-excavated areas of former trees and root balls) must be removed and replaced with compacted **Approved Fill**. The report will explain the suitability of site-derived materials for re-use as approved fill.
Carry out bulk filling	Where excavations are done into clayey soils (e.g. to treat soft zones, remove root balls and the like), they must not be backfilled filled with sand fill (even where a sand topping layer is proposed). Where fill is required (including backfilling of excavations to remove trees), only use **Approved Fill**, moisture conditioned, placed and compacted in layers of no greater than 300 mm loose thickness. Test moisture and compaction as specified in Section GDR7.1.
Grade completed clayey surface	Surface water control is essential for clayey sites. This also applies to control of infiltrated water into sand topping layers or the like. The surface of clayey ground must be graded at a minimum of 1% crossfall to drain. This is a general recommendation, and an appropriate civil design must be done to account for surface and subsoil drainage.
Install sand topping layer	Where a sand topping layer is proposed, this should be done as outlined in Section GDR6.2.5.

These measures do not take into account the objectives of the civil design for the site, particularly with regard to surface water drainage and groundwater control (including clay grading, subsoil drainage, thickness and composition of a sand topping layer and the like). This must be taken into account by the civil designer. General commentary on drainage control measures is presented in Section GDR14.

GDR6.2.5 Sand Topping Layer

Where a sand topping layer is required:

Unless specified otherwise in the report, the **Approved Fill** to be used is outlined in Section GDR8 (**Permeable Sand** where permeable fill is required, else **General Sand**). The specific selection is subject to the requirements of the civil designer.

Table GDR 6: Sand Topping Layer Measures

Measure	Commentary
Prepare Substrate	Prepare the clayey or other substrate as separately outlined prior to installing the topping layer.
Build up sand topping layer	Build up level to the required level with **Approved Fill**, placed and compacted in layers of no greater than 300 mm loose thickness to achieve the density specified in Section GDR7.1.

For the purposes of achieving the allowable bearing pressures and site classification discussed in the report, it is not necessary to have the bases of slabs and footings in the sand topping layer, i.e. if required, they may extend through the sand topping layer into clayey soil below.

GDR6.2.6 Limestone Sites

The preparation measures outlined below are provided for sites underlain by limestone (refer to Section GDR4.1), meeting the following criteria:

- Site underlain by sand overlying limestone.
- Compaction of a loose upper horizon to maximum 1 m depth, with localised deeper treatments between pinnacles if required.
- No shallow groundwater (<1 m deep)
- “Common Measures” outlined in Section GDR6.2.1 have been completed.

The site preparation measures outlined below are aimed at improvement of the site in preparation for construction of the structures including on-ground slabs, shallow footings, retaining walls and pavements.

Unless specified otherwise in the report, the **Approved Fill** may comprise one of the following as specified in Section GDR8 (the specific selection is subject to the requirements of the civil designer):

- **Permeable Sand** where permeable fill is required
- **General Sand** where permeable fill is not required
- **Mixed Sand/Limestone Fill** where permeable fill is not required

The re-use of any limestone for fill is subject to the requirements of the civil design and discussions in the report text. The use of **Mixed Sand/Limestone Fill** is discussed in Section GDR6.2.7. The preparation measures outlined in Table GDR 7 assume sand fill.

Table GDR 7: Standard Limestone Site Measures (Bulk Earthworks)

Measure	Commentary
Treat zones of loose sand	Where deep loose sand is present (particularly, but not exclusively, between limestone pinnacles), over-excavate to the depth as noted in the report . Sand should be retained for re-use as fill if recommended in the report. Limestone debris and pinnacles should be separated and only re-used if recommended in the report.
Moisture condition and proof compact.	Moisture condition and compact the exposed sandy ground to achieve the density specified in Section GDR7.1 ("sand") to a depth of at least 900 mm. Proof compaction of intact limestone is not required.
Test proof compaction	Check that the density specified in Section GDR7.1 ("sand") has been achieved to a depth of at least 900 mm. We note that the applicability of the use of the PSP for compaction control is discussed in the report. Unless specifically approved for use on the subject site, the contractor must not assume that the use of the PSP is appropriate. If refusal to the test method is encountered within the target test depth on limestone and the results to the refusal depth are acceptable, it is not necessary to repeat compaction testing at that location. Compaction control of intact limestone is not required.
Treat areas of loose or unsuitable material	Any areas of loose sand or unsuitable material (including over-excavated areas of former trees and root balls) must be removed and replaced with compacted **Approved Fill** as outlined in the report or as noted above. The report will explain the suitability of site-derived materials for re-use as approved fill.
Carry out bulk filling	Where fill is required to build up levels, use **Approved Fill**, placed and compacted in layers of no greater than 300 mm loose thickness. Test compaction to achieve the density specified in Section GDR7.1.

These measures do not take into account the specifics of the civil design, including the requirement (if any) for excavatable and/or free draining layers to achieve construction and drainage objectives. The civil design must take precedence and is not specifically considered in this advice.

Soakwells can perform poorly in limestone and specific advice may apply to the installation of soakwells in limestone areas. If not discussed in our report, please contact us for further advice.

Without further consultation with the structural designer, footings for any one structure must not be founded on a mixture of sand and intact limestone. This is due to potential differential settlements between limestone zones (relatively stiff) and soil zones (relatively soft). Where this is the case, the measures outlined in Table GDR 8 must be followed, only with guidance from the structural designer and Galt.

Table GDR 8: Standard Limestone Site Measures (Footing and Slab Preparation)

Measure	Commentary
Excavate and compact for slabs, subgrades, pad or strip footings	Excavate for pad and strip footings. Where a mix of soil and limestone is present below any one structure, one of the following must be done (to be agreed with structural designer and us): ▪ **Over-excavate limestone and replace with compacted soil:** Typically where the foundation largely comprises soil and a relatively small amount of limestone is present. Where footings and slabs are founded partly on soil and partly on limestone, over-excavate the limestone by at least 300 mm below the base of footing or slab and replace the excavated material with compacted **Approved Fill**. ▪ **Remove soil from over limestone and replace with concrete**: Typically where the foundation largely comprises limestone and a relatively small amount of soil is present. Localised zones of sand and mixed sand/limestone rubble must be removed and replaced with lean-mix concrete, e.g. 10 MPa blinding concrete. ▪ **Design the structure to accommodate differential foundation movements:** For example, include construction joints or use a more heavily reinforced footing (subject to the structural designer's requirements).
Test compaction of footing bases, slabs or subgrades.	Compact the exposed bases to achieve the density specified in Section GDR7.1 ("sand"), to a depth of at least 900 mm, or to the depth where limestone is intersected. If refusal to the test method is encountered within the target test depth on limestone and the results to the refusal depth are acceptable, it is not necessary to repeat compaction testing at that location. Compaction control of intact limestone is not required. Remove, replace and compact as required with approved fill any zone not achieving the density specified in Section GDR7.1 ("sand")

GDR6.2.7 Mixed Sand/Limestone Filling

On sites where deemed appropriate by the Civil Design, **Approved Fill** may comprise limestone rubble fill (**Mixed Sand/Limestone**, as specified in Section GDR8).

The preparation measures outlined below are provided for sites meeting the following criteria:

- No shallow groundwater (<1 m deep)
- "Common Measures" outlined in Section GDR6.2.1 have been completed.
- Substrate preparation for the relevant site type has been done in preparation for further filling (as relevant for sand, limestone or clayey sites discussed in the preceding sections).

The site preparation measures outlined below are required prior to construction of structures including on-ground slabs, shallow footings, retaining walls and pavements.

Table GDR 9: Mixed Sand/Limestone Fill Measures

Measure	Commentary
Develop a method specification for the filling	A performance specification is not appropriate for compaction control in **Mixed Sand/Limestone** fill, due to oversize limestone particles and the limitations of test methods. Therefore, a method specification is required. Development of a method specification is discussed in Section GDR7.5. A tentative method specification for **Mixed Sand/Limestone** Fill preparation is also provided.
Carry out bulk filling	Where fill is required to build up levels, use **Approved Fill**, placed and compacted in accordance with the developed method specification.
Maintain Construction Records	As performance testing cannot be done, quality assurance records are limited. Therefore, the parameters mentioned in Section GDR7.5.1 must be kept in a comprehensive record of the earthworks done to the developed method specification. The use of the PSP is possible only to check for loose sand zones between limestone particles. High PSP blow counts, where limestone particles are intersected, are meaningless in terms of assessing density of the prepared fill. The primary means of validation of the earthworks is conformance with the developed method specification.
Install sand topping layer	Where a sand topping layer is proposed, this should be done as outlined in Section GDR6.2.5.

These measures do not take into account the specifics of the civil design, including the requirement (if any) for excavatable and/or free draining layers to achieve construction and drainage objectives. The civil design must take precedence and is not specifically considered in this advice.

Soakwells can perform poorly in limestone fill and specific advice may apply to the installation of soakwells in limestone fill areas. If not discussed in our report, please contact us for further advice.

GDR6.2.8 Rock Sites

The preparation measures outlined below are provided for sites underlain by rock, meeting the following criteria:

- Site underlain by shallow soil overlying rock, or outcropping rock.
- No shallow groundwater or surface water (>1 m deep).
- Common site preparation measures outlined in GDR6.2.1 have been completed. In addition to these measures, any surface cobbles/boulders will need to be removed from the site.

The site preparation measures outlined below are aimed at improvement of the site for construction of structures including on-ground slabs, shallow footings, retaining walls and pavements.

Approved Fill will be as specified in this report. The re-use of any rock for fill is subject to the civil design requirements and any other requirements noted in the report text. The preparation measures outlined below assume **Approved Fill**.

Table GDR 10: Standard Rock Site Measures (Bulk Earthworks)

Measure	Commentary
Moisture condition and proof compact.	Moisture condition and compact the exposed ground (soil above rock) to achieve the density specified in Section GDR7.1 to a depth of at least 300 mm. Proof compaction of rock is not required.
Test proof compaction	Check that the density specified in Section GDR7.1 has been achieved to a depth of at least 300 mm. in situ NDG testing is suitable to assess compaction. Compaction control of intact rock is not required.
Treat areas of loose or unsuitable material	Any areas of loose / soft or unsuitable material (including over-excavated areas of former trees and root balls) must be removed and replaced with compacted **Approved Fill** as outlined in the report or as noted above. The report will explain the suitability of site-derived materials for re-use as **Approved Fill.**
Carry out bulk filling	Where fill is required to build up levels, use **Approved Fill**, placed and compacted in layers of no greater than 300 mm loose thickness. Test compaction to achieve the density specified in Section GDR7.1.
Grade surface	Surface water control may be required for lower permeability soils/rock, or at an interface where high permeability fill is placed over relatively impermeable soils/ rock. The surface of any impermeable ground / rock must be graded at a minimum of 1% crossfall to drain. This is a general recommendation, and an appropriate civil design must be done to account for surface and subsoil drainage.

These measures do not take into account the specifics of the civil design, including the requirement (if any) for excavatable and/or free draining layers to achieve construction and drainage objectives. The civil design must take precedence and is not specifically considered in this advice.

Soakwells can perform poorly in rock and specific advice may apply to the installation of soakwells in these areas. If not discussed in our report, please contact us for further advice.

Without further consultation with the structural designer, footings for any one structure must not be founded on a mixture of sand and rock. This is due to potential differential settlements between rock zones (relatively hard) and soil zones (relatively soft). Where this is the case, the measures outlined below must be followed, only with guidance from the structural designer and Galt.

Table GDR 11: Standard Rock Site Measures (Footing and Slab Preparation)

Measure	Commentary
Excavate and compact for slabs, subgrades, pad or strip footings	Excavate for pad and strip footings. Where a mix of soil and rock is present below any one structure, one of the following must be done (to be agreed with structural designer and us): ▪ **Over-excavate rock and replace with compacted soil:** Typically where the foundation largely comprises soil and a relatively small amount of rock is present. Where footings and slabs are founded partly on soil and partly on rock, over-excavate the rock by at least 300 mm below the base of footing or slab and replace the excavated material with compacted **Approved Fill**. ▪ **Remove soil from over rock and replace with concrete**: Typically where the foundation largely comprises rock and a relatively small amount of soil is present. Localised zones of sand and mixed sand/rock rubble must be removed and replaced with lean-mix concrete (e.g. 10 MPa blinding concrete) or cement stabilised sand (minimum UCS=2 MPa at 7 days). ▪ **Design the structure to accommodate differential foundation movements:** For example, include construction joints or use a more heavily reinforced footing (subject to the structural designer's requirements).

Measure	Commentary
Test compaction of footing bases, slabs or subgrades.	Compact the exposed bases to achieve the density specified in Section GDR7.1, to a depth of at least 300 mm, or to the depth where rock is intersected. If refusal to the test method is encountered within the target test depth on rock and the results to the refusal depth are acceptable, it is not necessary to repeat compaction testing at that location. Compaction control of intact rock is not required. Remove, replace and compact as required with **Approved Fill** any zone not achieving the density specified in Section GDR7.1.

GDR6.3 Guidance on Sites with Cohesive Soils

Cohesive soils (most commonly, "clayey" soils) require careful moisture conditioning to facilitate compaction. We recommend that the moisture content of the material is between optimum moisture content (OMC) and 2% wet of OMC at the time of placement and compaction. We note that compaction to the densities specified in Section GDR7.1 can be difficult to achieve for clayey material when not appropriately moisture conditioned.

Vibratory padfoot rollers are preferred for compacting cohesive fill to promote proper kneading and interlocking of subsequent layers.

Clayey soils will drain poorly when inundated following rain events and result in saturated conditions that may inhibit compaction of the soil. In general, it is preferable to avoid trying to re-work clayey sites within several days of any substantial rainfall.

We recommend that the surfaces of clayey sites are sealed by compaction (i.e., final compaction should be with a smooth drum roller) and graded to drain (to avoid low spots where water can pond and cause softening) prior to any rain events. Stripping back of softened materials to expose competent natural or compacted clayey soil is required before continuing earthworks.

If difficulties are experienced during compaction due to water, further advice should be sought from a geotechnical engineer.

GDR6.4 Preparation and Testing of Shallow Footings

GDR6.4.1 General

It is preferable to dig all footing excavations carefully with a flat-edged bucket to minimise the disturbance of underlying foundation soil.

Where the footing base is disturbed, or compaction is required, this must be done using appropriate compaction equipment particular to the task (as evaluated by the contractor) – typically a 'jumping jack', self-propelled plate compactor or an excavator-mounted plate compactor.

All footing bases must be tested to achieve the density requirements of Section GDR7.1 unless otherwise specified. PSP testing of sand foundations is only applicable where the use of the PSP is specifically approved in the report, otherwise all testing is to be done using the NDG.

Sand Topping Layer – Where a sand topping layer is present over a different soil (i.e., clay, limestone etc.), testing of the density of the sand topping layer is only necessary within the thickness of the sand topping layer. Testing does not need to extend into the underlying compacted substrate, which is separately subjected to compaction control.

Mixed Sand/Limestone Fill – Where mixed sand/limestone fill has been installed to a method specification, no compaction control testing is required, however re-compaction of the base must be done as noted above.

In situ limestone – where in situ limestone (weakly or more cemented limestone, with no sand zones or voids) is present at a footing base and no over-excavation has been done (refer to Section GDR6.2.6 regarding over-excavation of footing bases in limestone), then no compaction control testing is required.

Where loose or soft material is encountered, one of the following actions must be taken:

- Over-excavate the loose / soft layer to expose a suitable layer that does meet the required density (Section GDR7.1) and either:
- Place and compact Approved Fill (relevant to the appropriate preparation measures outlined in Section GDR6.2) to achieve the required density (Section GDR7.1); or

- Pouring blinding concrete (f'c>15 MPa at 28 days) from the competent layer up to the underside of the footing.

All foundations must be assessed by a competent person prior to blinding.

GDR6.4.2 Footings in Clay

Where footings are excavated into natural clay and not subject to filling, density testing (e.g., NDG testing) is not required at the base of the footings. This will be highlighted in the report text if this is relevant to the site conditions. Footing bases must be dug with a flat-edged excavator bucket and the underlying soil not disturbed by trafficking or over-excavation.

In these instances, only testing with a DCP is required in accordance with AS1289.6.3.2 at the footing base to achieve the required blow counts indicated in the report text, to a minimum depth of 0.6 m below the base of the footing, or other depth as indicated in the report text. Where the minimum blow count specified cannot be met, the following options are possible to prepare the footing base:

- Scarify, moisture condition and re-compact all zones not achieving the minimum blow counts. Re-test with a DCP to confirm that any soft zones are remediated; or
- Over-excavate and replace all zones not achieving the minimum blow counts with a suitable compacted low permeability fill (e.g., crushed limestone, clayey fill or other approved fill). This fill must be compacted to the appropriate level as specified in GDR7; or
- Over-excavate and replace all zones not achieving the minimum blow counts with blinding concrete (min. 10 MPa at 28 days) or cement-stabilised sand (min. 2 MPa at 7 days). This is typically appropriate where only the upper zones below the footing base are soft.

Measures must be taken to minimise moisture changes in clayey foundation soils at the base of footing excavations. Concrete footings are to be poured soon after excavation to minimise the potential for excessive moisture change. The use of a concrete blinding layer following foundation preparation should be considered.

GDR7 COMPACTION AND MOISTURE CONDITIONING

GDR7.1 Requirements

Any soil within the significant founding zone of structures (buildings, slabs, pavements, etc.) must be suitably moisture conditioned and compacted. These soils must be compacted to the requirements as outlined below.

Table GDR 12: Compaction and Moisture Requirements

Soil Description	Soil Particle Limits	Moisture Requirement	Density Requirement (DDR)	Possible QA/QC Test Methods
Sand	<5% fines <5% gravel *Maximum particle size 9.5 mm*	MOMC ±2%	95% MMDD	PSP NDG
Gravel	<5% fines >50% gravel *Maximum particle size 19.0 mm*	MOMC ±2%	95% MMDD	NDG
Clayey/Silty Gravel	5-35% fines >50% gravel *Maximum particle size 19.0 mm*	MOMC ±2%	95% MMDD	NDG
Sand with fines or gravel	5-35% fines; and/or 5-50% gravel *Maximum particle size 19.0 mm*	MOMC ±2%	95% MMDD	NDG Method Specification
Fine grained soils (Clayey or Silty)	>35% fines *Maximum particle size 19.0 mm*	MOMC ±2%; or SOMC ±2%[2]	92% MMDD; or 95% SMDD	NDG Method Specification
Oversize/rubbly soil	Any soils with particles >19.0 mm	MOMC ±2%	95% MMDD (Or equivalent to)	Method Specification Detailed Assessment Based on Specific Material

NOTES: ***1.*** *DDR – Dry Density Ratio*

MMDD – Modified maximum dry density (AS1289.5.2.1)
MOMC – Modified optimum moisture content (AS1289.5.2.1)
SMDD – Standard maximum dry density (AS1289.5.1.1)
SOMC – Standard optimum moisture content (AS1289.5.1.1)
PSP – Perth Sand Penetrometer
NDG – Nuclear Density Gauge

2. *Preferably OMC to OMC +2%, for ease of compaction and producing a homogenous fill*
3. *Test frequencies are specified in Section GDR7.6.*

The soil groups and definitions outlined above are generally based on AS1726-2017. Test methods are discussed in subsequent sections.

GDR7.2 Construction Recommendations

Over-excavation and replacement of loose material must be done where the minimum DDR cannot be achieved.

Fill must be placed in horizontal layers of not greater than 300 mm loose thickness. Each layer must be compacted by suitable compaction equipment, and carefully controlled to ensure even compaction over the full area and depth of each layer.

Care will need to be taken if compacting in the vicinity of existing structures, such as the adjacent properties. This is particularly important if vibratory compaction is being carried out.

- Tynan (1973), "Ground Vibration and Damage Effects on Buildings", Australia Road Research Board, Special Report No. 11.

Tynan (1973) provides guidance on the selection of compaction equipment for use adjacent to structures. The distance of influence (i.e., the definition of "vicinity") will vary depending on the size of compaction plant proposed for use. Where there is concern regarding the impact on nearby structures, a dilapidation study should be done.

Care must be taken when compaction is undertaken when the site surface is within 1 m of the groundwater level, as compaction (particularly with vibration) can draw the water up to the surface. In this instance, consideration should be given to:

- Static rolling only;
- Using a pioneering layer (if possible); or
- Dewatering to keep the water at least 1 m below the surface being compacted.

GDR7.3 Nuclear Density Gauge

Where applicable, a nuclear density gauge (NDG) must be used in accordance with AS1289.5.8.1. NDG tests must be done to a depth of 300 mm or as otherwise indicated in the text of the attached report.

GDR7.4 Perth Sand Penetrometer

Where clean sand is used (<5% fines and <5% gravel), a Perth sand penetrometer (PSP) may be used for compaction control in accordance with AS1289.6.3.3. Refer to the report for recommended blow counts correlating to the specified density.

Where the fines or gravel contents of a sand soil exceed the maximum contents noted above, a PSP must not be used exclusively for compaction control. As a minimum, ongoing confirmation testing with an NDG is required. If not specified in our report, please contact us for further advice regarding test frequencies.

If difficulties are experienced recording the required blow counts, a site-specific PSP correlation should be carried out to determine the PSP blow count correlating to a DDR of 95% MMDD. In addition, a particle size distribution (PSD) test should be carried out to verify that the use of a PSP is suitable for the sands being tested. A site-specific PSP correlation must:

- be done on site;
- use the nuclear density gauge (NDG) to determine density at a minimum of 5 points with varying density to a depth of 300 mm below surface;
- include at least 1 point where the dry density ratio is in excess of 95% MMDD;
- use a calibrated PSP to determine the PSP blow count from 150 mm to 450 mm at each NDG test point; and
- be plotted on a chart of PSP blow count vs DDR.

Only where specifically stated as applicable in the report and where the use of the PSP is relevant as noted above, the following values may be taken as deemed to conform to a dry density ratio of 95% MMDD for the relevant sand type.

Table GDR 13: Deemed-to-comply Values for PSP Results in Perth Sands

Depth Interval (mm)	Bassendean	Tamala	Calcareous
0-150	SET	SET	SET
150-450	7	8	12
450-750	9	10	14
750-1050	11	12	16

NOTES:
1. *Blows per 300 mm interval*
2. *Bassendean Sand is typically a white - grey, low-fines quartz sand found on the eastern part of the Perth coastal plain*
3. *Tamala / Spearwood sand is typically yellow or orange, low-fines quartz sand found on the western part of the Perth coastal plain*
4. *Calcareous sands are typically white or yellow, calcareous sand found in low-lying areas on the western fringe of the Perth coastal plain*
5. *Values derived from Galt experience on PSP correlations done on sites across Perth for the 150-450 mm interval.*

GDR7.5 Method Specifications

GDR7.5.1 General

Where proposed, a method specification should be developed by a geotechnical engineer or similarly qualified person and ratified by us (including a site visit by us). The method specification should be confirmed by the construction of a trial pad or trial area and the compaction methodology should be checked against either:

- density, as assessed using a nuclear density gauge; or
- settlement, as assessed using a dGPS.

Specific advice should be requested for the development of a method specification, taking into consideration the material being compacted.

Method specification compliance should be maintained for all areas on a minimum 20 m grid, with the compliance to include:

- Roller used (weight, style, vibration);
- Water application rate (per lift);
- Layer thickness placed; and
- Number of passes with roller.

GDR7.5.2 Indicative Method Specification – Sand/Limestone Rubble Mix

Where mixed sand/limestone is used as structural fill, a performance specification is not appropriate due to the inaccuracies of standard test methods (NDG/PSP etc.) in this type of material. A method specification can be used instead. The following indicative method specification is provided for evaluation and trial but must be trialled and ratified by us prior to widespread employment on site. The following would be typically adopted:

- Maximum particle size: 250 mm
- Maximum loose layer thickness: 350 mm
- Minimum watering rate: 10 L/m^2/100 mm thickness of loose material (e.g. 35 L/m^2 for a 350 mm thick layer)
- Minimum 8 passes with a vibrating padfoot roller, minimum static weight 10 tonnes.
- The compacted fill must comprise closely packed particles without any significant voids between the larger particles.

GDR7.6 Testing Frequency

After compaction, verify that the required density has been achieved by testing at the base of excavation and through the full depth of any fill, and to a minimum depth of:

- 900 mm where a PSP is used; or
- 300 mm where a NDG is used.

The frequency of testing (when a method specification is not used) should be as follows:

Table GDR 14: Compaction Testing Frequency Requirements

Area	Minimum Testing Frequency	Minimum Tests Per Lot
Proof Compacted Area	1 test per 1,000 m^2 (30 m grid)	2
Structural Fill Outside of Building and Pavement Footprints	1 test per 500 m^3 2 tests per layer *Whichever is greater*	2
Structural Fill Within Building and Pavement Footprints	1 test per 500 m^3 4 tests per layer *Whichever is greater*	4
Spread/Pad Footings	1 test per 9 m^2 per footing	1
Strip Footings/Retaining Wall Foundations	Minimum 2 tests At 5 m centres *Whichever is greater*	2
On-ground slabs, pavements and rafts	Minimum 2 tests At 10 m centres 1 test per 100 m^2 *Whichever is greater*	2

NOTES: ***1.*** *A 'lot' is defined in the context of this section as a section of earthworks that is undertaken in one operation where the equipment, personnel, materials and methodology are consistent throughout the entire process. This would typically be limited to operations done in one day, but this is not mandatory.*

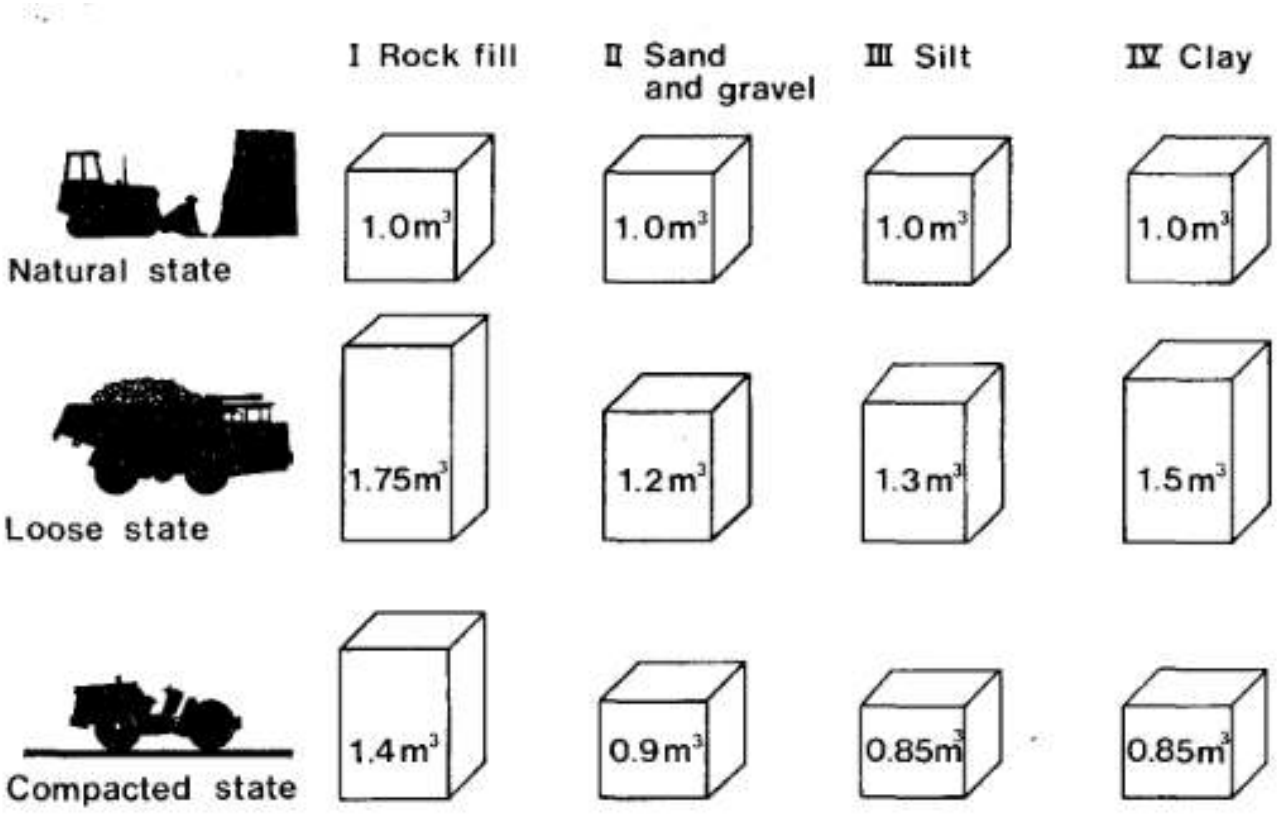
2. *There will frequently be multiple 'lots' in an earthworks process, therefore the number of tests must be adjusted according to the minimum number per lot in this table (where this is more than the frequency specified in 'testing requirements').*

GDR7.7 Bulking and Compaction Factors

All soils will "bulk" when excavated to stockpile, and "compact" when placed from stockpile to earthworks layers. Published bulk and compaction factors are presented below for conventional materials, taken from:

- Forssblad, L (1981), "Vibratory Soil and Rock Fill Compaction", Dynapac Maskin AB

Inline Image GDR 3: Volumes of Different Types of Fill Materials in Natural, Loose and Compacted State



These values are indicative only and will vary according to site specific conditions. The values provided here must not be used for commercial volume estimates or settling disputes regarding volumes.

GDR8 APPROVED FILL AND CONFORMANCE TESTING

Imported fill must comply with the material requirements as stated in AS 3798-2007, “Guidelines on Earthworks for Commercial and Residential Developments”.

Where doubt exists, a geotechnical engineer must be engaged to inspect and approve the use of potential fill materials.

The following table presents recommended material parameters for standard fill types. This does not take account of availability of materials either on site or in the local area. Refer to the report text for specific advice on fill at the subject site.

Table GDR 15: Standard Fill Recommendations

Soil Description	Application	Soil Particle Limits (%)[3]				k_{min}[1] (m/d)	OC[2] (%)	Atterberg Limits		CBR[6] (%)	Test Method[4]
		Fines	Sand	Gravel	Max.			LL (%)	PI (%)		
Permeable Sand	Permeable bulk fill Retaining wall backfill Permeable select fill	≤5	≥90	≤5	9.5	5	≤2	NP	NP	≥12	PSP NDG
General Sand	Bulk fill Select fill (permeability not required)	≤5	≥90	≤5	9.5	N/A	≤2	NP	NP	≥12	PSP NDG
Silty Sand	Bulk fill Select fill	≤35	≥55	≤10	9.5	N/A	≤2	<35	<11	≥12	NDG
Clayey Sand	Bulk fill Select fill	≤35	≥55	≤10	9.5	N/A	≤2	<40	N/A	≥12	NDG
Granular Fill	Bulk Fill	≤30[10]	Varies[10]	Varies[10]	37.5	N/A	≤2	<40	N/A	N/A	NDG
Mixed Sand/Limestone	Bulk fill (permeability not required)	≤5	≥20	≤80	250	N/A	≤2	NP	NP	N/A	NDG Method
Blue Metal Gravel[8]	Retaining wall backfill Drainage trench backfill	≤3	≤5	≥90	37.5	5	≤1	NP	NP	N/A	NDG
Clay[7]	Reinstatement of localised excavations in clay Bulk fill	≥12	Varies	≤30	19	N/A	≤2	Varies			NDG

NOTES:

1. *k_{min} – minimum saturated hydraulic conductivity (AS1289.6.7.1, remoulded to minimum DDR 100% MMDD).*
2. *OC – organic content (Walkley-Black method recommended, AS1289.4.1.1 – not loss on ignition methods)*
3. *% by mass.*
4. *Test method indicates possible compaction control methods for this material.*
   PSP – Perth sand penetrometer (AS1289.6.3.3). Where a PSP is used, a site-specific correlation must be done unless otherwise noted in the report.
   NDG – Nuclear density gauge (AS1289.5.8.1)
   Method – method specification
5. *Atterberg Limits: LL – liquid limit PI – plasticity index NP – non-plastic*
6. *CBR: California bearing ratio (for sand - remoulded to DDR 95% MMDD @ OMC, 4.5 kg surcharge). CBR values may be changed depending on the design pavement requirements.*
7. *"Clay" fill type is included for broad reference only and to illustrate preferred applications, particle size limits and recommended test method. Specific discussion on the use of clayey fills is included in the report text if applicable. Atterberg limit and CBR testing of clayey fills may be required and advice must be sought from us if not stated in the report.*
8. *"Blue metal" gravel refers to single sized, crushed, washed igneous rock gravel used for drainage purposes.*
9. *In the absence of specific test frequencies by the civil designer, the testing shown in Table GDR 16 must be done (highlights in Table GDR 15 show where the test is required).*
10. *Sand and gravel must be reasonably graded to control the risk of soil ingress from surrounding layers. Where the fines content is high (e.g. above ~15%), the gravel content should proportionally increase to meet the requirements for "granular fill". We recommend a minimum gravel content of 30% where the fines content is above 15%.*

Table GDR 16: Conformance Testing Frequency Requirements

Parameter	Frequency (m^3)	Minimum Tests per Source	AS1289 Reference
Particle size distribution	5,000	1	3.6.1
Hydraulic conductivity (permeability)	10,000	2	6.7.1
Organic content	5,000	1	4.1.1
Atterberg limits	5,000	1	3.1.1, 3.2.1, 3.3.1
CBR	10,000	2	6.1.1

NOTES: *1. Frequency is for the nominal number of cubic metres of compacted fill.*
2. Unless stated otherwise in the report text, the conformance testing must also be carried out on site-derived materials to confirm suitability.

GDR9 SHALLOW FOUNDATIONS

GDR9.1 Design

Footings and slabs may be designed in accordance with the assigned site classification in accordance with AS2870-2011. We note that AS2870-2011 is limited to single and double storey residential and commercial developments and may not be strictly applicable.

Where the report provides tables for shallow footing design, custom footings may be designed by the structural engineer using the data provided therein.

GDR9.2 Interpretation of Provided Values

BEARING PRESSURES

All settlement and bearing pressures estimates are provided on the assumption that the site preparation requirements outlined in the report are completed below all structures plus a minimum distance of 1 m beyond the outside edge of any footing or slab. It is essential that the soil below all foundations is appropriately prepared as outlined and meets the relevant compaction requirements.

Allowable bearing pressures for footings of intermediate plan dimensions (to any tabulated) can be interpolated. Footings that have a plan dimension either smaller or larger than those presented in the report will need to be considered individually along with other embedment depths.

Allowable bearing pressures, where provided, are considered to be the upper limit for shallow footings to limit total and differential settlements. Footings carrying eccentric loading, such as below retaining walls, must be assessed separately.

SETTLEMENTS

The reporting of settlements to any precision level is not intended to imply a high accuracy of settlement prediction. Settlements as reported should be considered ‘order of magnitude’.

Estimated settlements represent vertical downwards movement due to loading and do not take into account potential additional movement associated with the characteristic surface movement of the soil (which must be taken in addition to these settlements from loading, refer Section GDR5). The site classification is discussed in the report.

The actual settlement of any proposed structure will depend upon a number of factors including the applied pressures, footing size and base preparation. The estimated settlement(s) provided in this report are for the working bearing pressures as indicated. Differential settlements are likely between footings of similar sizes, loads and elevations (as stated in the report text). A proportion of the settlement is expected to occur during construction (i.e., during initial loading.

The provided settlement estimates (unless otherwise stated) do not include interaction effects from footings founded near other footings (i.e., groups of footings). Interaction effects will need to be considered if the spacing between adjacent footings is smaller than the dimension of the footings (i.e., the centre-to-centre spacing between footings is less than twice the width of the footing). This could act to double provided settlements, dependent on the footing configuration. Where an assessment of footing groups is required, a more detailed numerical or finite-element modelling analysis would need to be undertaken.

CREEP AND CONSOLIDATION

Creep settlement is an irreversible component of long-term soil settlement caused by sustained vertical stress. Consolidation is a time-dependent irreversible compression in a soil layer caused by a reduction in pore pressure between soil particles. Both creep and consolidation can occur in natural materials as a result of earthworks or the placement of loads on to soil layers. The settlements as presented for short-term loading do not include consideration for creep and consolidation settlements unless specifically stated.

GDR9.3 Raft Foundations

Where moduli of subgrade reactions are provided for the design of raft foundations, we highlight that these are an estimate of the elastic reaction of the soil. The values are provided based on an expected load and loaded area size. Soils are typically non-linear in their response and will have different stiffnesses at different levels of strain and load repetitions. This is due to the physical interaction of soil particles under different levels of stress.

The possibility of a non-linear response must be considered by the designer of any raft foundation.

GDR10 PILED FOUNDATIONS

Piles must be designed and tested in accordance with AS2159-2009, “Piling – Design and Installation”. We use the following interpretation/design methods to provide pile design parameters:

- Franki Africa Pty Ltd (2008) “A Guide to Practical Geotechnical Engineering in South Africa”. 4th ed.
- AFNOR (2012) “NF P 94-262 – Justification des ouvrages géo-techniques, Normes d’application nationale de l’Eurocode 7”, Afnor, Paris, July 2012.
- Lehane, B. (2017) “CPT-Based Design of Foundations”. E.H Davis Memorial Lecture, Australian Geomechanics Vol 54. No. 4.
- Lehane, B. et al. (2020) “A New ‘Unified’ CPT-Based Axial Pile Capacity Design for Drivel Piles in Sand”. Proceedings of the Fourth International Symposium on Frontiers of Offshore Geotechnics.
- Doan., Lehane, B. (2021) “CPT-Based Design Method for Axial Capacities of Drilled Shafts and Cast-in-place Piles.” American Society of Civil Engineers (ASCE), Journal of Geotechnical and Geoenvironmental Engineering.

The pile designer must:

- consider the possible variation in subsurface conditions at each pile location;
- consider any pile group effects based on the final piling configuration;
- assume that the unit shaft resistance in tension is less than 80% of the unit shaft resistance in compression to account for Poisson’s effect in sand;
- ignore pile resistance in the surficial 0.5 m or 1 x pile diameter (whichever is greater), if relevant;
- consider the impact of weak layers underlying stiffer layers (or vice versa) on end bearing capacity; and
- reduce the pile capacity in tension to no greater than 0.8 of the pile capacity in compression.

The piling contractor must:

- make their own assessment on the suitability of their equipment to install any piles at the subject site; and
- carry out or appoint a suitably experienced contractor to test the piles in accordance with AS2159.

Where dynamic or static testing of the piles does not occur, we consider that a design geotechnical reduction factor (ϕg) of 0.4 is applicable for the pile design. If testing of the piles is proposed by the piling contractor, a higher ϕg could be adopted.

Unless otherwise stated, providing pile design parameters does not specifically indicate the driveability of any piles into soil units.

A separate driveability study may be required and must be considered by the pile designer and installer. The given pile design parameters must not be used for driveability assessments as these parameters are likely to be un-conservative.

GDR11 EARTH RETAINING STRUCTURES

GDR11.1 General

Retaining structures may be designed in accordance with AS4678 (2002) "Earth Retaining Structures". Unless otherwise specifically stated, we recommend that all retaining walls are backfilled with free-draining soil (Permeable Sand or Blue Metal Gravel as defined in Section GDR8).

Where the cohesive soil is used as retaining wall backfill, a suitable, permanent drainage system must be placed behind the wall such that a build-up of pore pressure is prevented. A separator geotextile (Bidim A24, or similar, or heavier) must be used between the interface of any granular backfill and the cohesive soil.

Where drainage is not provided, the retaining wall must be designed to accommodate water pressure behind the wall (10 kPa per metre height).

GDR11.2 Earth Pressure Coefficients and Strength Parameters

Where earth pressure coefficients are provided for retaining walls, the wall designer must make an independent assessment of the parameters appropriate to the construction method to be used, including alternative values of wall friction. Unless otherwise stated, we have assumed a horizontal ground surface behind and in front of the retaining wall for provided parameters.

GDR11.2.1 Cohesionless Soils

Where cross-referenced for suitability in the report, the following parameters may be adopted for design of earth retaining structures in cohesionless soils (sand and gravel).

Table GDR 17: Retaining Wall Geotechnical Parameters (Cohesionless Soils)

Density	γ (kN/m^3)	ϕ' (^{o})	k_0	Wall Friction=0		Wall Friction=0.5ϕ		Wall Friction=0.67ϕ	
				k_a	k_p	k_a	k_p	k_a	k_p
Very Loose	17	30	0.44	0.33	3.00	0.29	4.81	0.28	5.74
Loose	17	32	0.42	0.31	3.25	0.27	5.55	0.26	6.83
Medium Dense	18	34	0.39	0.28	3.54	0.25	6.47	0.23	8.26
Dense	19	36	0.36	0.26	3.85	0.22	7.63	0.21	10.18
Very Dense (1)	19	38	0.34	0.24	4.20	0.21	9.11	0.20	12.85
Very Dense (2)	19	40	0.31	0.22	4.60	0.19	11.06	0.18	16.73

NOTES:

1. *Earth pressure coefficients are provided in this table for conditions of zero friction between the wall and the soil and with wall friction of 0.5Φ' or 0.67Φ'.*
2. *A horizontal ground surface behind and in front of the wall has been assumed.*
3. *The retaining wall designer should make an independent assessment of the parameters appropriate to the construction method to be used, including alternative values of wall friction.*
4. *γ – bulk unit weight*
   ϕ' – effective friction angle
   k_a – coefficient of active earth pressure (Coulomb – AS4678-2002, Appendix E)
   k_p – coefficient of passive earth pressure (Coulomb – AS4678-2002, Appendix E)
   k_0 – coefficient of at-rest earth pressure (Jaky)
5. *Maximum fines content 12% for applicability of this table for design purposes.*
6. *Unit weights based on Table D1 of AS4678-2002, for moist bulk weight.*
7. *Friction angle based on Equation D1 and Table D2 of AS4678-2002, based on rounded, moderately graded siliceous sand.*

GDR11.2.2 Cohesive Soils

Where cohesive soils (i.e. clayey or silty soils) are proposed for backfill, geotechnical design parameters may be provided in the form of effective strength and undrained strength parameters. We note that:

- Undrained strength parameters should be used for analysis of short-term stability, or stability under sudden loading of cohesive soils.
- The effective strength parameters should be used for analysis of free-draining soils and the long-term stability of cohesive soils.

Table GDR 18: Retaining Wall Geotechnical Design Parameters (Cohesive Soils – Undrained)

Consistency	γ_b (kN/m^3)	c_u (kPa)

Soft	17	12
Firm	18	25
Stiff	19	50
Very Stiff	20	100
Hard	20	200

NOTES:
1. γ_b – bulk unit weight
   c_u – undrained cohesion
   $\phi_u = 0^o$ (undrained friction angle)
2. *Unit weights based on Table D1 of AS4678-2002*
3. *Undrained cohesion based on lower end of shear strengths as define in AS1726-2017, Table 11*

Table GDR 19: Retaining Wall Geotechnical Design Parameters (Cohesive Soils – Drained)

Fines Content	PI (%)	γ_b (kN/m^3)	ϕ' (°)	c' (kPa)[5]
12-35%	All	19	32	0
>35%	10	20	30	0 – 5
>35%	20	20	26	0 – 5
>35%	30	20	23	0 – 5
>35%	40	20	21	0 – 5

NOTES:
1. γ_b – bulk unit weight
   c' – drained cohesion
   ϕ' – effective friction angle
   PI – plasticity index
2. *Unit weights based on Table D1 of AS4678-2002, assuming generally stiff to hard overconsolidated soils.*
3. *For fines contents <35% (silty sand and clayey sand), strength parameters based on:*
   - *Lehane, B. et al (2007) "A Laboratory Investigation of the Upper Horizons of the Perth/Guildford Formation in Perth CBD", Australian Geomechanics Vol 42. No. 3.*
4. *For fines content >35% (sandy clay), strength parameters based on:*
   - *CIVL5503 course notes (2004), "Underground Construction", University of Western Australia*
5. *c' = 0 recommended for long-term design. Table D4 of AS4678 suggests c' up to 5 kPa for 'poor' fine grained soils and 10 kPa for 'average' fine-grained soils. The use of c' for design is subject to the designer's judgement but recommended by us only for temporary works.*

Per AS4678-2002 Appendix E, horizontal earth pressures for frictional-cohesive soils may be calculated in accordance with the Rankine-Bell design model (illustrated in Figure E2 of AS4678). The earth pressures are as follows (Z = depth, all other terms have the meanings given in the above tables):

- Active: $p_a = \gamma\ Z\ tan^2\left(45 - \frac{\emptyset}{2}\right) - 2\ c\ tan\left(45 - \frac{\emptyset}{2}\right)$
- Passive: $p_p = \gamma\ Z\ tan^2\left(45 + \frac{\emptyset}{2}\right) + 2\ c\ tan\left(45 + \frac{\emptyset}{2}\right)$

GDR11.3 Design and Construction Considerations

Compaction plant can augment the lateral earth pressure acting on retaining walls. Hand operated compaction equipment is recommended within 2 m of any retaining walls to minimise compaction pressures.

Retaining walls can move and rotate under imposed soil loading resulting in settlement behind the wall. This must be considered in the design and during construction of the retaining walls in order that adjacent infrastructure is not adversely affected.

It is important to note that some ground movement will occur behind any soil retaining system, including gravity retaining walls.

GDR12 EXCAVATIONS, BATTERS AND SLOPES

GDR12.1 Excavatability

Our assessment of the excavatability of rock is based on a combination of:

- Our experience on earthworks and construction projects across Australia; and

- Figure 10 of the revised graphical method of assessing excavatability of rock by:
- Pettifer, G.S. & Fookes, P.G., "A revision of the graphical method for assessing the excavatability of rock", Quarterly Journal of Engineering Geology, 27, pp145-164, 1994.

GDR12.2 Safety

All excavations must be carried out in accordance with:

- Commission for Occupational Safety and Health (2022). "Excavation: Code of Practice", Department of Mines, Industry Regulation and Safety, 89pp, Perth.

Excavations in cohesionless soils are particularly prone to instability unless support is provided. Care must be exercised in such excavations and appropriate safety measures adopted where necessary, particularly in the vicinity of existing buildings, structures and infrastructure.

The toe of any batter must be at least 500 mm above groundwater (including perched groundwater).

Unless a specific slope stability assessment or retention design has been done, the toe of any excavation should not encroach within a line of 1V:3H to any nearby footings, pavements or other settlement-sensitive structures.

Surcharges (such as structures, plant and soil stockpiles) must not be placed at or close to the crest of unsupported excavations, without a specific slope stability assessment.

A geotechnical engineer must be consulted where there is any doubt regarding the stability or safety of unsupported excavations.

GDR12.3 Batters

Temporary batter slopes provided in the report are subject to the following conditions, unless otherwise stated:

- The maximum slope height is 2 m without specific advice and slope stability analysis.
- The groundwater level for the duration of the excavation must be at least 500 mm below the toe of the slope.
- No surcharges are present in the vicinity of the slope (i.e. must be outside a line of 1V:3H from the toe of the slope).

Unless noted specifically in the report, the following batters may be adopted (maximum height: 2 m):

Table GDR 20: Default Batter Angles

Situation	Material	Batter
Temporary	Cohesionless Soils (Sand/Gravel)	1V:2H
Temporary	Cohesive Soils – Soft	1V:2H
Temporary	Cohesive Soils – Firm, Stiff, Very Stiff or Hard	1V:1H
Temporary	Limestone – Variably Cemented	1V:1H
Temporary	Limestone – Well Cemented	1V:0.5H
Permanent	All Soils	1V:3H
Permanent	Limestone – Variably Cemented	1V:2H
Permanent	Limestone – Well Cemented	1V:1H

Where specified batters cannot be accommodated in the vicinity of existing footings, roads and services, temporary or permanent lateral support will be required.

Specific advice is required for batters higher than 2 m.

Erosion control must be considered for permanent slopes.

Rock slopes must be inspected, and all loose cobbles / boulders removed. Permanent rock slopes may require dentition works or possibly rock catch drains.

GDR12.4 Grouting

Permeation or jet grouting involves injecting a microfine cement into soil to form a grouted soil block (soilcrete) to support excavation and structures. Grouting is typically only effective where the soil has the capacity to "take" the grout and form a uniformly cemented soil mass. Permeation grouting is generally limited to relatively permeable, coarse-grained cohesionless soils (sands and gravels with <5% fines).

If grouting is proposed, we recommend the following:

- Grouting must be carried out by a suitably experienced contractor.
- Only microfine cement grout should be used (not GP or coarse cement blends) to ensure adequate penetration into the soil matrix.
- Grouting should be done on a grid of not greater than 300 m.
- Application rates must be discussed with the contractor.
- The grouted soil mass must have intimate contact with any structures it is intended to support.
- The contractor must satisfy themselves that the proposed grouting can be installed with their equipment and into the subsurface conditions encountered at the site, considering possible obstructions, groundwater, cemented layers, loose sands etc.
- Testing of the grouted soil mass must be done to ensure that the grout has adequately permeated through the soil matrix. This can be done by drilling into the soil mass to ensure the cementation is continuous.

Grouting is most effective on permeable, relatively loose natural sand. Where historical filling or other ground disturbances have occurred, the grouting process can be less effective due to the tendency of grout (or other liquids) to follow more permeable paths / zones through the disturbed soil.

GDR13 STORMWATER DISPOSAL AND DRAINAGE DESIGN

GDR13.1 Groundwater Separation – Controlled Groundwater

These recommendations ONLY apply to where regional controls on groundwater (primarily: subsoil drainage, but also surficial 'main drains') exist, i.e. only to areas where groundwater is actively controlled.

The following reference:

- IPWEA (2016), "Specification: Separation Distances for Groundwater Controlled Urban Development", Institute of Public Works Engineering Australasia

recommends the following separation distances from drainage infrastructure to groundwater:

- Underground infiltration systems: 0 mm from the 50% AEP (annual exceedance probability) phreatic surface.
- Surface infiltration systems (vegetated): 300 mm from the 50% AEP phreatic surface.

The above IPWEA reference also states that performance measures for underground infiltration systems are to have a: demonstration of acceptable volumetric capacity when groundwater is elevated above base of system and that the groundwater recedes below the invert of the system during mosquito breeding seasons (grated or partially open systems).

GDR13.2 Groundwater Separation – Uncontrolled Groundwater

These recommendations apply where regional controls on groundwater levels are not present. For infiltration into soakwells and soakage basins to be the full theoretical value, an adequate separation to groundwater must be achieved, because otherwise performance is hindered by inadequate separation to groundwater or partial submergence of the infiltrative element.

We recommend a minimum separation of 500 mm from the underside of infiltrative elements to maximum groundwater level.

- To average annual maximum groundwater level (AAMGL), where this has been defined for the site; or
- To historical maximum groundwater level, where this has been defined to the site.

GDR13.3 Design Hydraulic Conductivity Values

Where provided, the values of hydraulic conductivity (k) should be considered the maximum/upper limit design values. As discussed in Section GDR3.7, the inverse auger hole test is an unsaturated field test carried out above the groundwater table and, as such, presents the best-case conditions for drainage.

For soak wells in sand, we provide the design value taking into consideration the variability in materials and reduced permeability as a result of:

- Densification of sand during site preparation works; and
- Natural variation in sands.

Design k_{unsat} values provided for soak wells are only appropriate for the design of unsaturated soils where the base of disposal area is at least 500 mm above groundwater and 500 mm above any impermeable layer.

Where design values of k_{unsat} have been provided, clogging of the base of the soakwell / drainage basin has not been considered. Clogging will need to be controlled with maintenance over the life of the soakwell / drainage basin.

For the design of subsoil drains or modelling of saturated soil performance, a k_{sat} value must be given (in the report text) or assessed by laboratory testing (or a combination of field and laboratory testing). Unless specifically stated, k_{unsat} values presented in our report are for unsaturated conditions and intended for design of stormwater disposal elements above groundwater. If no k_{sat} value has been provided, do not use the provided k_{unsat} value for saturated drainage design. Please contact us for further advice.

For saturated or semi-saturated sands, the hydraulic conductivity must be assessed by testing of representative soil samples at a NATA accredited laboratory to determine:

- The modified maximum dry density (MMDD); and
- The constant-head permeability (AS1289.6.7.1) on a sample remoulded to at least 5% greater than the proposed specification density (i.e., sample should be remoulded to 100% MMDD if the earthworks specification requires a density ratio of 95% MMDD).

For saturated or semi-saturated clayey or silty soils, the hydraulic conductivity must be assessed by testing of representative soil samples at a NATA accredited laboratory to determine:

- The standard maximum dry density (SMDD); and
- The falling-head permeability (AS1289.6.7.2) on a sample remoulded to at least 3% greater than the proposed specification density (i.e., sample should be remoulded to 101% SMDD if the earthworks specification requires a density ratio of 98% SMDD).

GDR13.4 Soakwells

In uncontrolled groundwater environments, the base of any soakwell must be the higher of:

- At least 500 mm above the average annual maximum groundwater level (AAMGL).
- At least 500 mm above any low permeability/impermeable layers (clay, rock or otherwise).

In controlled groundwater environments (refer to Section GDR13.1), the base of any soakwell may be 0 mm above the controlled groundwater level at the location of the soakwell (as determined by the civil engineer).

Soak wells must be placed outside a line of 1V:2H extending below the edge of the nearest footing, subject to local council regulations. Discharge from soak wells has been known to promote densification of loose sandy soils, leading to settlements of footings and slabs. Soak wells should be carefully wrapped with geotextile to prevent migration of sand and fines into the soak well.

Where soak wells are proposed to dispose of water within a line of 1V:2H from any basement walls or similar, the walls must be waterproofed to prevent seepage or damp within the basement wall.

In potentially karstic terrain or areas of potentially collapsible soils, soakwells should typically be located 10 m from the nearest footing, slab or pavement.

GDR13.5 Design Groundwater Elevation

Where applicable, a recommended design groundwater elevation will be provided in the report and will be identified as such.

In the absence of a specific statement on design groundwater elevation, do not assume that:

- Absence of comments about groundwater indicates an absence of groundwater (in particular, sites that are dry in the dry season to the investigated depth may well become waterlogged in the rainy season).
- Where groundwater depths/levels are noted, that these are fixed (groundwater fluctuations occur over the course of the year and between wetter and drier years).

Where groundwater elevations are likely to be critical for a development (particularly where large-scale subdivision or large developments are proposed with substantial channelling of stormwater into on-site disposal by infiltration), a site-specific hydrology study is likely to be required to confirm design groundwater elevations.

GDR14 DRAINAGE CONTROL

In addition to the site preparation measures outlined for cohesive soils (refer Section GDR6.2.4), careful control of surface water and stormwater is essential to minimise the likelihood of cohesive soils decreasing in strength and affecting the installed infrastructure. These measures include:

- The ground surface of clayey soils should be graded to drain any seepage away from structures and prevent standing water over the cohesive soils. A grade of at least 1% is recommended.
- Pavements should be sealed to minimise water ingress.
- Stormwater disposal swales should be located at least 10 m away from buildings, retaining walls and pavements.
- Runoff from hardstandings and pavements must either be collected and discharged via pipes into discrete locations (via swales or soakage basins) at least 10 m away from structures and pavements or, alternatively, discharged over a wide area, but not allowed to collect and discharge into concentrated areas, particularly near structures and pavements.
- Spoon drains should be used to collect water at the crest of slopes to capture surface runoff and direct it away from running directly down slopes or seeping into the ground behind slopes.

These measures are general in nature only and do not take into account the civil design objectives, which must be addressed separately by the civil designer.

GDR15 DEWATERING

Dewatering may be required for excavations and construction below groundwater or perched groundwater tables. Common dewatering methods are summarised below:

Table GDR 21: Dewatering Recommendations

Material	Recommended Methods
Sandy Soils	Spears Deep Well Point
Impermeable Clay	Sump Pumping

Dewatering spears are typically suitable for small scale excavations below groundwater, with a typical recommendation for spears to be installed at 1 m below the base of any excavation. Dewatering spears may not be suitable where there are impermeable/cemented/strong transition layers, i.e., it may not be possible to extract water near an impermeable layer (rock/clay), or the spear may not be readily driven through a hard clay/cemented layer (i.e., coffee rock).

Sump pumping can be done by grading a clayey excavation to drain (i.e., by using spoon drains), and excavating a sump in the excavation. A sump can typically be backfilled with a blue metal gravel, with a pump wrapped in a geofabric (i.e., Bidim A14 or similar), with disposal of water away from the excavation.

Deep well point dewatering is typically suitable for larger excavations, where there are transitional layers or where the aquifer is confined. It may not be suitable where there are impermeable layers within the profile. It involves the installation of a deep filtered well to a depth required to draw down the groundwater level at the entire site. A deep well dewatering system must be designed by a suitable designer to provide design flow rates, draw down depths etc.

GDR16 PAVEMENT SUBGRADES

Unless otherwise specified, the provided subgrade California bearing ratio (CBR) is not a pavement design, but an assessment of the subgrade as an input into any required pavement designs.

Provided design values are based on the assumption that the relevant site preparation measures are completed for all pavement subgrades, including the use of appropriate approved fill and adequate compaction. We highlight that specific requirements such as those outlined by Main Roads WA (MRWA) or the local council in their construction specifications may have different requirements.

The provided design value is based on laboratory testing (where done), local experience, and the advice as outlined in:

- Main Roads Western Australia (2013). “Engineering Road Note 9 – Procedure for the Design of Road Pavements”. Western Australia Supplement to the Austroads Guide to Pavement Technology Part 2: Pavement Structural Design, East Perth.

Where the subgrade differs from that described in the text, the subgrade CBR must be confirmed.

The performance of any pavement is highly dependent on the surface and subsurface drainage provided (also considering factors like capillary rise from seasonally high groundwater tables). Adequate drainage must be provided to any pavements, and capillary rise must be considered by the designer.

GDR17 SOIL CORROSIVITY AND AGGRESSIVITY

The relevant exposure classifications for concrete and steel piles in soils based on the exposure conditions are presented in Table GDR 22 and Table GDR 23 respectively.

The relevant exposure classifications for concrete in sulfate soils based on the exposure conditions are presented in Table GDR 24.

Table GDR 22: Exposure Classification for Concrete Piles in Soil

Exposure Conditions				Exposure Classification	
Sulfates (expressed as SO_4)[1]					
In Soil (ppm)	In Groundwater (ppm)	pH	Chlorides in Groundwater (ppm)	Soil Conditions A[2]	Soil Conditions B[3]
< 5,000	< 1,000	> 5.5	<6000	Mild	Non-aggressive
5,000 – 10,000	1,000 – 3,000	4.5 – 5.5	6,000-12,000	Moderate	Mild
10, 000 – 20,000	3,000 – 10,000	4 – 4.5	12,000-30,000	Severe	Moderate
> 20,000	> 10,000	< 4	>30,000	Very Severe	Severe

NOTES:
1. *Approximately 100 ppm SO_4 = 80 ppm SO_3*
2. *Soil Conditions A – high permeability soils (e.g. sands and gravels) which are in groundwater*
3. *Soil Conditions B – low permeability soils (e.g. silts and clays) or all soils above groundwater*
4. *Table reproduced from Table 6.4.2(C) of AS2159-2009*

Table GDR 23: Exposure Classification for Steel Piles in Soil

pH	Chlorides		Resistivity (ohm.cm)	Exposure Classification	
	In Soil (ppm)	In Water (ppm)		Soil Conditions A[2]	Soil Conditions B[3]
> 5	< 5,000	< 1,000	> 5,000	Non-aggressive	Non-aggressive
4–5	5,000-20,000	1,000–10,000	2,000 – 5,000	Mildly aggressive	Non-aggressive
3–4	20,000-50,000	10,000–20,000	1,000 – 2,000	Moderately aggressive	Mildly aggressive
< 3	> 50,000	> 20,000	< 1,000	Severely aggressive	Moderately aggressive

NOTES:
1. *1 ppm (parts per million) is equivalent to 1 mg/kg*
2. *Soil Conditions A – high permeability soils (e.g. sands and gravels) which are in groundwater*
3. *Soil Conditions B – low permeability soils (e.g. silts and clays) or all soils above groundwater*
4. *Table reproduced from Table 6.5.2(C) of AS2159-2009*

Table GDR 24: Exposure Classification for Concrete in Sulfate Soils

Exposure Conditions			Exposure Classification	
Sulfates (expressed as SO_4)[1]				
In Soil (ppm)	In Groundwater (ppm)	pH	Soil Conditions A[2]	Soil Conditions B[3]
< 5,000	< 1,000	> 5.5	Mild	Non-aggressive
5,000 – 10,000	1,000 – 3,000	4.5 – 5.5	Moderate	Mild
10, 000 – 20,000	3,000 – 10,000	4 – 4.5	Severe	Moderate
> 20,000	> 10,000	< 4	Very Severe	Severe

NOTES:
1. *Approximately 100 ppm SO_4 = 80 ppm SO_3*
2. *Soil Conditions A – high permeability soils (e.g. sands and gravels) which are in groundwater*
3. *Soil Conditions B – low permeability soils (e.g. silts and clays) or all soils above groundwater*
4. *For disturbed soils, the assumption of soil A conditions where accelerated corrosion is possible should be considered.*
5. *Table reproduced from Table 4.8.1 of AS3600-2018*

GDR18 LIQUEFACTION

Soil liquefaction can occur when loose, granular, Holocene age material below the groundwater table is subjected to a seismic event (typically within 15 m of the ground surface). This can cause a loss of strength and result in vertical and lateral movements of the site surface.

Where a liquefaction analysis is carried out and outlined in the report, this has been done in accordance with consideration to the design earthquake details as presented in AS1170.4-2007:

- The hazard factor is taken from Figure 3.2 (C) and Table 3.2. The Hazard Factor (Z) for Western Australia represents the 1 in 500-year annual probability of exceedance of ground motions measured in gravity (g).
- The probability factor (k_p) is taken from Table 3.1.

Unless otherwise stated, an earthquake magnitude of 7.5 for the south-west of WA is based on research by:

- Dhu T., Sinadinovski C., Edwards M., Robinson D., Jones T., Jones A. (2004) “Earthquake Risk Assessment for Perth, Western Australia”. 13th World Conference on Earthquake Engineering, Vancouver, B.C., Canada. Paper No. 2748.

GDR19 EXPECTATIONS OF THE REPORT

The following sections have been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

GDR20 THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- the project objectives as we understood them and as described in this report;
- the specific site mentioned in this report; and
- the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- the report was not written for you;
- the report was not written for the site specific to your development;
- the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

GDR21 DATA PROVIDED BY THIRD PARTIES

Where data is provided by third parties, it will be identified as such in our reports. We necessarily rely on the completeness and accuracy of data provided by third parties in order to draw conclusions presented in our reports. We are not responsible for omissions, incomplete or inaccurate data associated with third party data, including where we have been requested to provide advice in relation to field investigation data provided by third parties.

GDR22 SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques prepared by Galt. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

GDR23 THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

GDR24 CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

GDR25 SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

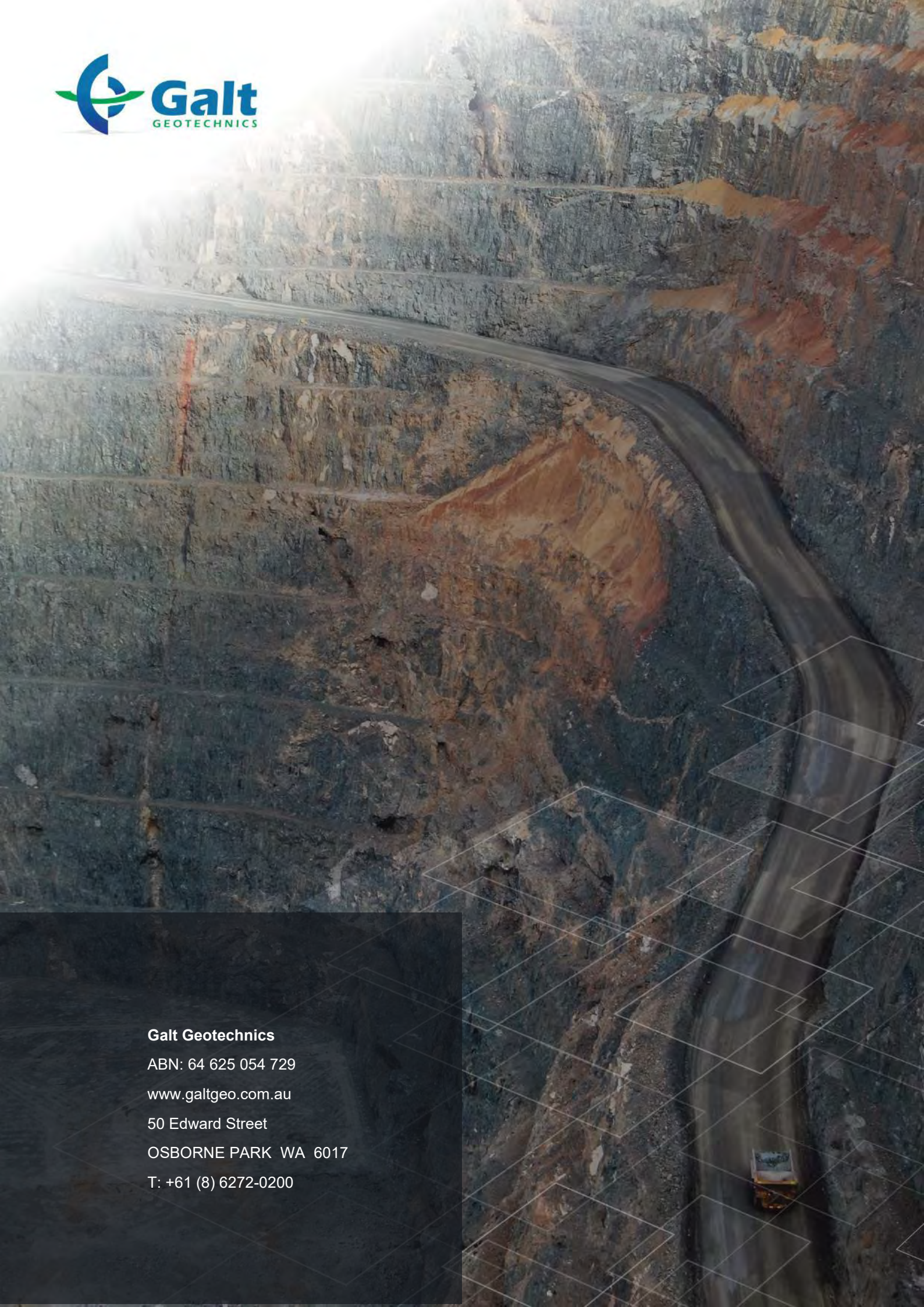
The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

GDR26 ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

Geotechnical advice presented in a Galt Environmental report has been provided by Galt Geotechnics under a sub-contract agreement. Similarly, environmental advice presented in a Galt Geotechnics report has been provided by Galt Environmental under a sub-contract agreement.

Unless specifically noted otherwise, no parties shall draw any inferences about the applicability of the Western Australian state government landfill levy from the contents of this document.



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Report on:

GENERAL SITE AND SOIL EVALUATION HATCH COURT LIGHT INDUSTRIAL AREA AND STIRLING CRESCENT PRECINCT HATCH COURT AND STIRLING CRESCENT, HIGH WYCOMBE, WA

WAG250138-01 001 R Rev0

Submitted to:

Dynamic Planning Developments
PO Box 688
INGLEWOOD WA 6932

26 September 2025

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Understanding your Report

1. INTRODUCTION

This report presents the outcomes of Galt Geotechnics' (Galt's) general site and soil evaluation (SSE) for the proposed Hatch Court Light Industrial Area (HCLIA) and Stirling Crescent Precinct (SCP), at Hatch Court and Stirling Crescent, High Wycombe ("the site").

This report is to be read in conjunction with the appended "Requirements and Limitations" found at the back of this report.

2. DEFINITIONS

Site and Soil Evaluation (SSE): an assessment of all relevant constraints and the risks to public health and the environment in accordance with AS1547-2012 "On-site domestic wastewater management". This SSE is a general assessment SSE, with the purpose being to undertake a site suitability assessment for onsite wastewater management and to recommend the type of onsite wastewater system for the proposed development.

A specific assessment is required to support an "application to install" an onsite wastewater system. This is for when a particular type of system/model is proposed, and a detailed design, including management recommendations and operation requirements. This document is not a specific assessment.

Land Application Area (LAA): The unencumbered plan area to which treated sewage from an on-site sewage system is distributed for further in-soil treatment and absorption or evaporation. This area is restricted to the distribution of treated sewage and may not be developed for other purposes.

Land Application System (LAS): The system used to apply effluent from a wastewater treatment unit into or onto the soil for further in-soil treatment and absorption or evaporation.

Effluent: The liquid discharged from a wastewater treatment unit.

Primary Treatment: The separation of suspended material from sewage in septic tanks, primary settling chambers or other structures before discharge to either a LAS or secondary treatment process.

Secondary Treatment: Microbiological digestions and physical settling and filtering processes and decomposition of sewage constituents following primary treatment.

Sewage: Any kind of sewage, faecal matter or urine, and any waste composed wholly or in part of liquid.

Infiltrative Area: Is the area within an LAA that has treated effluent directly discharged onto, and does not include setback areas. I.e., the base of leach drains, evapotranspiration beds etc.

3. GOVERNING STANDARDS, REGULATIONS AND POLICIES

SSEs are governed by various National and State Standards, Regulations and Policies, including:

- AS/NZS 1547:2012, On-site domestic wastewater management.
- Western Australia Government Sewerage Policy (2019)
- Western Australia Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations (1974)
- Western Australia State Planning Policy 2.9, Water Resources (2005)

Other regulatory requirements may become relevant depending on the outcomes of any SSE.

SSEs can be rejected on the basis of not meeting the regulatory requirements of the above. This report is intended to address all these various requirements.

4. SITE DESCRIPTION

Table 1: Summary of Site

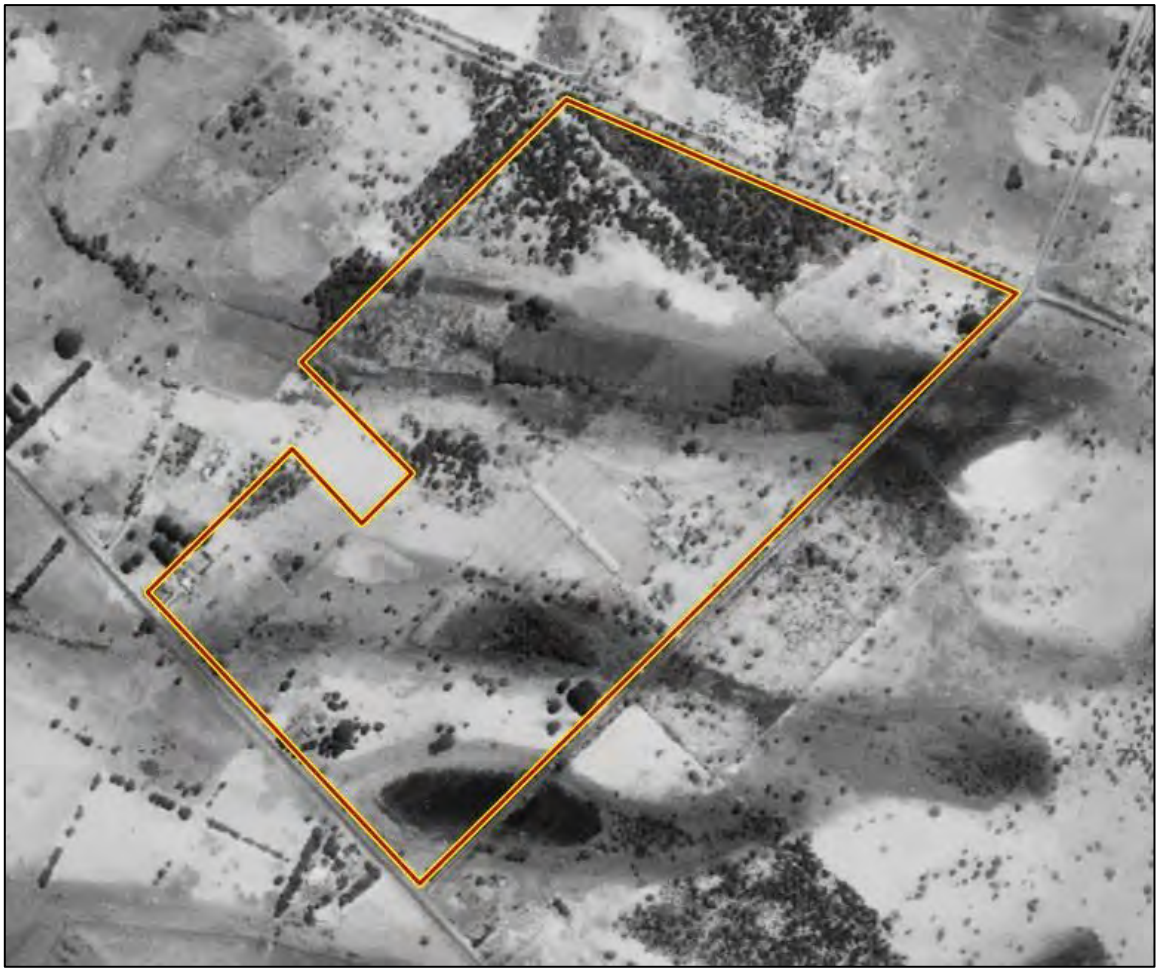
Item	Comment
Site Extent	Refer to In-line Image 1.
Site Area	Hatch Court Light Industrial Area (HCLIA): ~30 ha (16 lots). Stirling Crescent Precinct (SCP): ~6 ha (11 lots).
Current Site Surface Elevation[1]	Around RL 20 m AHD at the north to RL 24 m AHD at the south.
Vegetation	Vegetation present in landscaped areas surrounding houses and associated infrastructure. Vegetation includes grassed areas, some mature trees and some bushes (refer Figure 1). Dense vegetation along drainage line in northern part of site.
Current Land Use	Mostly Residential developments and associated infrastructure. South west part of site (Lots 614 and 584) is a hardstand area (refer Figure 1).
Site drainage	Drainage line traverses from west to east in northern part of site. Wetland area present in western corner of site near Lewis Road. Several damp lands are apparent from historical aerial photos (refer In-line Image 2). Localised lakes are present in southern part of site, which are judged to be expressions of groundwater.
Site History[2]	**Prior to 1979**: Site mostly pastoral / agricultural land. Three residences developed on site. **1979 to 1983**: Development of residential buildings in SCP. **1983 to 1995**: Development of Hatch Court. And associated residential lots / developments. **1995 to 2018**: Site relatively unchanged. Some additional residential buildings and associated infrastructure constructed progressively during this time. **2018**: to Construction of hardstand in western corner of site. **2018 to 2024**: progressive construction of hardstand in western part of site (Lots 614 and 584).

NOTES: ***1.*** *Site levels based on survey information provided.*

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



In-line Image 1: Approximate extent of subject area



In-line Image 2: Aerial photo of site in 1961. HCLA marked in red/yellow.

5. PROPOSED DEVELOPMENT

Table 2: Summary of Proposed Development

Item	Comment
Proposed Development	Subdivision of industrial lots with associated infrastructure
Cut/Fill	Assumed typically up to about ± 1 m. Fill is generally anticipated to be required in low lying areas to achieve adequate clearance to groundwater.
Assumed Retaining Walls	Gravity walls up to about 2 m high
Assumed Stormwater Disposal	Possibly On site via soakwells.
Assumed Sewage Disposal	On site via leach drains within individual lots of proposed subdivision.

6. PRELIMINARY HYDRAULIC LOADING

No preliminary hydraulic loading is available at this stage. We have assumed a preliminary hydraulic loading of 5,000 L/day per lot. The LAA within each lot will need to be resized based on the actual hydraulic loading.

Hydraulic loading must be calculated in accordance with “Supplement to Regulation 29 – Wastewater system loading rates”. The proposed LAA must also be adequately sized to meet the zero effluent storage and Government Sewerage Policy (2019) design requirements. We have assumed that any industrial liquid waste is to be disposed off site (and not into the LAA).

7. PREVIOUS STUDIES

Galt has previously undertaken a number of geotechnical studies for individual lots within and adjacent the sites as summarised below:

- **Located within site:**
  - 27 Hatch Court in May 2025 (report reference: WAG250256-01 001 R Rev1);
  - Lots 8 and 16 Stirling Crescent in November 2024 (report reference: WAG240438-01 001 R Rev2);
- ***located north of site / not within site:***
  - 71 Stirling Crescent in March 2023 (report reference: WAG230133-01 001 R Rev1); and
  - Part of Lot 1499 Stirling Crescent in September 2023 (report reference: WAG230463-01 002 R Rev1).

Test locations from the above reports are shown on Figure 1. Relevant information from the above studies are incorporated into this report.

8. FIELDWORK

8.1. Summary

Fieldwork was carried out in the presence of a representative from Galt on 25 August and 5 September 2025 as summarised below.

Table 3: Summary of Field Data

Type	Results Appendix	Summary	Equipment Used	No. Tests	Depth Range (m)
Site Plan	Figure 1	-	Hand held GPS[1]	-	-
Photographs	A	-	-	-	-
Cone Penetration Tests (CPTs)	B	Section 11	Pagani TG 73-200	16	2.34 to 5.20
Boreholes (BH)	C	Section 11	EVH Scout on utility / 7822DT / Hand Auger	14	1.30 to 3.00
Monitoring Wells (MW)	C	Section 8.3	7822DT	3[2]	3.00
Constant Head Permeameter Tests (G)	D	Section 8.2	Guelph Permeameter	7	0.38 to 0.57

NOTES:

1. *Hand held GPS is accurate to ±5 m.*
2. *Constant head Guelph Permeameter tests were carried out in hand-auger boreholes in accordance with Appendix G of AS 1547 (2012) "On-site domestic wastewater management".*
3. *One groundwater monitoring well location was unavailable for sampling after installation.*

8.2. Permeability Test Results

Table 4: Guelph Permeameter Test Results

Test Location	Soil Description	Depth (m)	Minimum Saturated Hydraulic Conductivity, k_{sat} (m/day)	Soil Category[2]
G01/BH01	SAND (SP)	0.38	25.01	1
G02/BH02	SAND (SP-SM)	0.42	*0.94*[3]	*3*[3]
G03/BH03	SAND (SP)	0.57	9.05	1
G05/BH05	SAND (SP)	0.44	*0.44*[3]	*4*[3]
G07/BH15	SAND (SP)	0.53	9.82	1
G09/BH09	SAND (SP)	0.52	3.94	1
G10/BH10	SAND (SP)	0.47	3.53	1
27 Hatch Court in May 2025 (WAG250256-01 001 R Rev1)				
G01	SAND (SP)	0.33	3.56	1
G02	SAND (SP)	0.41	2.82	2
G03	SAND (SP)	0.40	3.31	1
71 Stirling Crescent in March 2023 (WAG230133-01 001 R Rev1, l*ocated north of site / not within site)*				
IT01	*SAND (SP)*	*0.50*	*1.6*	*2*
IT02	*SAND (SP)*	*0.50*	*2.1*	*2*
IT03	*SAND (SP)*	*0.55*	*3.3*	*1*
IT04	*SAND (SP)*	*0.60*	*2.8*	*2*
Lots 8 and 16 Stirling Crescent in November 2024 (WAG240438-01 001 R Rev2)				
G01	SAND (SP)	0.44	5.11	1
G02	SAND (SP)	0.50	3.17	1
G03	SAND (SP)	0.39	3.26	1
G04	SAND (SP)	0.40	10.95	1
Part of Lot 1499 Stirling Crescent in September 2023 (WAG230463-01 002 R Rev1, l*ocated north of site / not within site)*				
G01	*SAND (SP)*	*1.00*	*3.9*	*1*
G01A	*SAND (SP)*	*0.80*	*2.3*	*2*
G01B	*SAND (SP)*	*0.53*	*> 15*	*1*
G02	*SAND (SP-SM)*	*0.90*	*0.07*[4]	*-*[4]
G02A	*SAND (SP)*	*0.70*	*1.74*	*2*
G02B	*SAND (SP)*	*0.70*	*1.67*	*2*
G02C	*SAND (SP)*	*0.50*	*>15*	*1*

NOTES:

1. *Constant head Guelph Permeameter tests were carried out in hand-auger boreholes in accordance with Appendix G of AS1547 (2012) "On-site domestic wastewater management".*
2. *Soil type is as per Table 5.2 of AS1547-2012.*
3. *Test results likely to have been influenced by shallow groundwater*
4. *Result considered spurious, and also not from within the site.*
5. *Results in italics not from within the site.*

Table 5: Permeability Test Results (Falling Head)

Test Location	Soil Description	Depth (m)	Minimum Saturated Hydraulic Conductivity, k_{sat} (m/day)	Soil Category[2]
27 Hatch Court in May 2025 (WAG250256-01 001 R Rev1)				
BH02 / IT01	SAND (SP)	0.84	3.9	1
BH07 / IT02	SAND (SP)	0.90	3.8	1
BH08 / IT03	SAND (SP)	0.84	31.3	1
BH05 / IT04	SAND (SP)	0.84	4.7	1
Lots 8 and 16 Stirling Crescent in November 2024 (WAG240438-01 001 R Rev2)				
BH07 / IT01	SAND (SP)	0.88	> 15	1
BH08 / IT02	SAND (SP)	0.86	6.3	1
BH10 / IT03	SAND (SP)	0.82	3.9	1
BH16 / IT04	SAND (SP)	0.77	7.1	1
BH06 / IT06	SAND (SP)	0.77	> 15	1
Part of Lot 1499 Stirling Crescent in September 2023 (WAG230463-01 002 R Rev1, *located north of site / not within site)*				
IT01	*SAND (SP)*	*0.95*	*10.6*	*1*
IT02	*SAND (SP)*	*1.00*	*9.4*	*1*

8.3. Groundwater Monitoring Wells

Groundwater monitoring wells were installed in boreholes drilled Geoprobe 6620 DT drill rig supplied and operated by Direct Push Probing.

Wells were constructed using 50 mm, class 18 flush-threaded PVC with a 2.5 m screened interval was installed at the base of each well and finished with approximate 0.6 to 0.7 m solid section extending to the surface. Refer to Appendix C for more information on construction details for each well.

A submersible pump was used to remove fine sediments and filter sand from the well. Groundwater levels were measured more than 7 days after installation and development to allow the water in the well to reach hydrostatic levels.

9. LABORATORY TESTING

Geotechnical and chemical laboratory testing of soil samples was undertaken by Western Geotechnical and Laboratory Services (WGLS) and Envirolab Services (WA) at their NATA accredited laboratories. Laboratory test results along with the test methods followed are presented in Appendix F and summarised in Attached Tables 1 and 2.

Chemical test results from previous studies are also included in Attached Table 2.

10. SITE CONDITIONS

10.1. Geology

Table 6: Summary of Geology Mapping

Map Sheet	Map Scale	Mapped Soils
Perth	1:50,000	Refer In-Line Image 3 for distribution of following units: - **Cps**: Peaty CLAY: "*dark grey and black with variable sand content of lacustrine origin [Swamp Deposits (Qhw)]*" - **S8**: Bassendean SAND: "*very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin*" - **S10**: "*Thin Bassendean Sand over Guildford formation*"

***NOTE**: Encountered subsurface profile discussed in Section 11.*



Inline Image 1: Excerpt from Perth 1:50,000 scale environmental geology map. HCLA marked in red/yellow

10.2. Groundwater and Surface Water

Table 7: Summary of Groundwater and Surface Water Levels

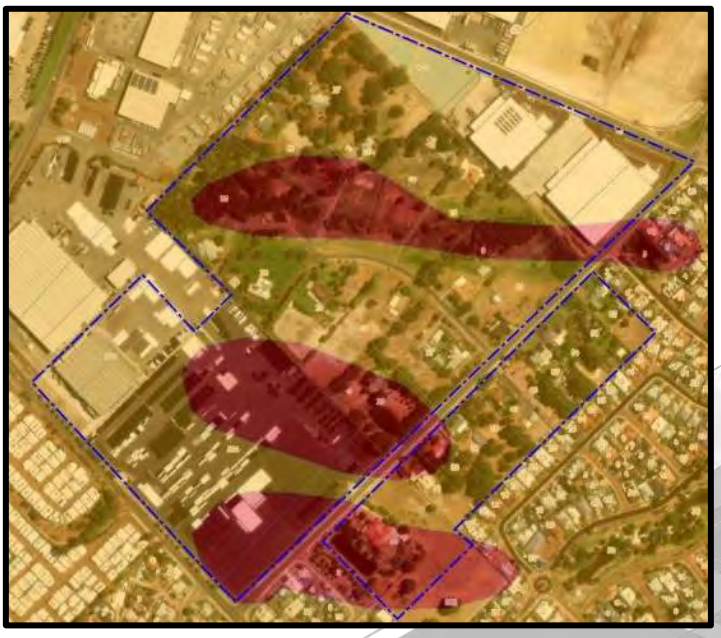
Item	Date	Depth Range (m)	Elevation Range (m AHD)	Comment
Perth Groundwater Atlas	2004	-	North: 13 South: 15	Inferred from levels measured in monitoring wells near the end of summer in 2004 only.
	2019		North west: 15.0 to 17.0 South east: 18.5 to 19.5	Inferred from maximum and minimum levels measured in monitoring wells in 2019 only.
DBCA Mapping	-	-	-	Most of the site are mapped as "Sumpland/Dampland", defined as a seasonally inundated/waterlogged area.
Site observations	Aug/Sept 2025	-	Surface to > 3 (Refer Attached Tables 3 to 7)	Groundwater also observed in lakes in southern part of site, and along drainage line in northern part of site. Groundwater could perch on underlying clay / clayey soils at the site.
Recommended Design	-	-	-	Design groundwater levels for the site must be assessed by a suitably qualified civil engineer and / or hydrologist. Filling of the site to gain separation to groundwater levels will be needed. Possibly, subsoil drains drains may be required.

NOTES: ***1.*** *Perth Groundwater Atlas observations based on monitoring wells which are not located at the site.*

2. *Elevation range for site observations is based on depth and site levels during fieldwork*

10.3. Acid Sulfate Soils

According to the DWER online ASS risk database, the proposed site is generally mapped as being within an area of 'moderate to low' ASS risk (highlighted in yellow in In-line Image 3 below) , with part of the site identified as having 'high to moderate' risk (highlighted in red in In-line Image 3 below) within the upper 3 m of the soil profile. High risk areas are judged to be associated with potential organic soils mapped in these areas (refer Section 10.1).



In-line Image 3: ASS Risk Mapping (DWER Database)

11. GROUND MODEL

The encountered subsurface conditions are summarised in Attached Tables 3 to 7, ad can be generalised as follows:

Most of Site (HCLIA and SCP):

- Surficial Topsoil / Hardstand / Sand Fill Layers; over
- **SAND (SP / SP-SM)**: fine to medium grained, sub angular to sub rounded, typically grey, typically trace fines, typically loose to depths of about 0.5 m to 2.5 m and then becomes typically medium dense, extending to depths of 2.0m to over 6.2 m; with
  - **Interbedded layers of cemented sand / 'Coffee Rock'**: encountered at some locations as cemented layer of sand typically with a higher fines content (i.e. Silty SAND in some zones) about 0.3 m to 1.0 m thick (where penetrated) and below about 2.0 m to 3.4 m depth (refer Attached Tables 3 to 7 for locations encountered). Coffee rock inferred from CPT refusal at some locations. Associated uncemented zones of discoloured brown / black sand with a higher fines content were also encountered in some locations. Layer underlain by sand; over
- **Guildford Formation interbedded CLAY / Clayey SAND / Sandy CLAY / SAND Layers (SP/SC/CL-CH)**: typically stiff to hard cohesive layers and medium dense sand layers, locations of encountered Guildford Formation summarised in Attached Tables 3 to 7.

HCLIA only: within / adjacent drainage line and wetland area[1]:

Variable organic soils were encountered as follows:

- **CPT01**: Possible inferred organic soil layer from 0.9 m to 1.2 m depth;
- **BH02**: Trace organics in Clayey SAND from 0.9 m to 2.0 m depth;
- **BH04**: Organic Clayey SAND from 0.7 m to 1.4 m depth
- **BH13/MW01**: PEAT from 0.0 m to 0.6 m depth, and then Organic SAND from 0.6 m to 1.4 m depth.

Notes:

- [1] Drainage line traverses from west to east in northern part of HCLIA site (refer Figure 1). Wetland area present in western corner of site near Lewis Road. Similar zones of organic soils could be present in lakes at the site (Refer Table 1).
- [2] An area of surficial uncontrolled fill about 1.1 m thick was encountered in the northern corner of the HCLIA site at 27 Hatch Court (refer Galt report referenced: WAG250256-01 001 R Rev1);

12. SITE ASSESSMENT

12.1. General

The results of our site assessment are presented in Attached Table 3.

12.2. Horizontal Setbacks

Table 8: Required Horizontal Setback Distances (AS1547)

Feature	Sub-Type	Horizontal Setback Distances (m)
Treatment tanks to buildings, property boundaries, driveways, paths and other tanks	-	1.2
Trenches, beds and soak wells to boundary, building, tanks and other land application systems	-	1.8
Trenches, beds and soak wells to trafficable areas	-	1.2
Any land application system to wells, streams, private bores or underground source of water intended for human consumption	-	30.0
Trenches, beds and soak wells to subsoil drains or open drainage channels	-	6.0
Spray irrigation	Boundaries, buildings, driveways etc.	1.8
	Subsoil and open drains	6.0
	Swimming pools	3.0
	Treatment tanks	1.2
Subsurface Drippers	Boundaries, buildings, driveways etc.	0.5
	Subsoil and open drains	3.0
	Swimming pools	2.0
	Garden bore	10.0
On-site waste system to water resources (river, stream etc.)	-	100.0

12.3. Land Application Areas

12.3.1. Government Sewerage Policy (GSP, 2019)

The minimum LAA size in accordance with the GSP (2019) has been calculated and is shown below. The LAA may need to be resized if the hydraulic loading changes.

Table 9: GSP LAA Calculation

Soil Category (AS1547)	Conversion Factor (Table 2 of GSP)	Hydraulic Loading (L/day, Section 6)	Minimum LAA (m^2)
1 to 2	0.2	5,000	1,000

12.3.2. Water Balance

Water balance calculations are presented in Appendix E.

As well as the GSP minimum, the LAA must have a minimum size to meet the water balance area requirements (in accordance with the WA Health Regulations Method), calculated as 108 m^2 per 5,000 L/day of hydraulic loading.

12.3.3. Summary

The GSP sizing will govern with a minimum 1,000 m^2 total LAA per 5,000 L/day of hydraulic loading. This may need to be resized based on the actual hydraulic loading within each proposed lot.

A detailed plan will be required with the application to install that shows that the required setbacks are met, in particular to the drainage line through the HCLIA (lot configuration will need to be done to allow LAAs to achieve the required setbacks). Provided lot configurations are suitable, there 100 m setback to drainage courses should be achievable.

13. SOIL ASSESSMENT

Details of our soil assessment are presented in Attached Table 4.

14. SITE SUITABILITY AND RECOMMENDATIONS

Based on our assessment, the site is suitable for disposal of wastewater. Wastewater must have secondary treatment (i.e., an ATU).

LAA Location and Setbacks

The exact location of the LAA has not been finalised, however, we judge that setback requirements can be met. A setback of 6 m is required from the open drainage channels, wetland areas, and lakes at the site (refer Table 8). A 100 m setback will be required from the creek line

Any proposed LAA will need to satisfy the setback requirements, including meeting the appropriate distances from site boundaries, buildings, trafficable areas and driveways etc.

Disposal Method

We considered the use of leach drains to dispose of treated effluent is appropriate. Flatbed leach drains or concrete leach drains are likely to be acceptable.

Separation to Groundwater and LAA Surface Level

A minimum 1.5 m clearance to groundwater below leach drains must be achieved.

Groundwater was encountered between 0 m below ground (in low lying areas) and over 3 m below ground (in elevated areas). Surface water (judged to be an expression of the groundwater table) was observed in the table drain, wetland areas and lakes in Section 4.

Design groundwater levels for the site must be assessed by a suitably qualified civil engineer and / or hydrologist. Filling, subsoil drains and / or table drains could possibly be required to control groundwater. Levels for leach drain invert levels can be assessed once design groundwater levels are derived for the development.

We recommend that filling requirements be assessed based on proposed lot configurations and design groundwater levels as established by a hydrologist.

Treatment Units

The wastewater may be treated using an ATU (secondary treatment), also known as aerated wastewater treatment systems (AWTS). ATU's use the processes of aeration followed by clarification to achieve biological treatment of wastewater.

ATU's (or any other proposed system) must be certified to AS1546.3 (2008) and require approval by the Chief Health Officer. A list of approved ATU's is presented in Table 2 on the Department of Health website.

Soil improvement in areas of proposed fill

Any fill at the site below leach drains must have a phosphorous retention index (PRI) of at least 20, and monitored 3-yearly, in accordance with Department of Health requirements. This can be done with a product like 'gypsum', or by using high-PRI soil. High PRI soil must be present to a minimum depth of 200 mm below the base of all infiltration zones and at least 0.5 m in plan outside the leach drain footprint area.

There is no requirement for other fill above leach drains to have a minimum PRI.

15. CLOSURE

GALT GEOTECHNICS



Owen Woodland CPEng
Geotechnical Engineer



Tyrone Mardesic CPEng
Geotechnical Engineer

https://galtgeo.sharepoint.com/sites/wag250138/shared documents/01 dpd si/03 correspondence/wag250138-01 002 r rev0 sse.docx

Attached Table 1: Summary of Geotechnical Index Test Results

Test Name	Sample Depth (m)	Soil Class (AS1726 2017)	Gravel (%)	Sand (%)	Fines (%)	LL (%)	PI (%)	LS (%)	Org %	MMDD (t/m^3)	OMC (%)	CBR (%)	CBR Swell (%)
BH02	1.0 to 1.5	Clayey SAND (SC)	4	71	25	28	5	2.5	-	-	-	-	-
BH03	1.5 to 1.8	SAND (SP)	-	98	2	-	-	-	-	-	-	-	-
BH04	1.0 to 1.4	Organic Clayey SAND (SC)	2	66	32	46	6	3.0	10.7	-	-	-	-
BH06	0.6 to 1.0	SAND (SP-SC)	2	92	6	-	-	-	1.2	-	-	-	-
BH10	1.0 to 1.5	SAND (SP)	-	99	1	-	-	-	-	-	-	-	-
G07	0.5 to 0.6	SAND (SP)	-	97	3	-	-	-	0.4	-	-	-	-
G10	0.4 to 0.5	SAND (SP)	1	94	5	-	-	-	1.1	-	-	-	-
27 Hatch Court in May 2025 (WAG250256-01 001 R Rev1)													
BH04	0.3 to 0.5	SAND (SP)	0	95	5	-	-	-	1.7	-	-	-	-
BH06	1.0 to 1.4	SAND (SP)	0	96	4	-	-	-	0.5	-	-	-	-
BH07	0.3 to 0.7	SAND (SP)	6	92	2	-	-	-	2.7	-	-	-	-
Lots 8 and 16 Stirling Crescent in November 2024 (WAG240438-01 001 R Rev2)													
G01	0.1 to 0.5	(SP) SAND	0	96	4	-	-	-	-	-	-	-	-
BH16	0.1 to 0.5	(SP) SAND	0	96	4	-	-	-	-	-	-	-	-
Part of Lot 1499 Stirling Crescent in September 2023 (WAG230463-01 002 R Rev1). ***Located north of site (not within site).***													
BH01	0.1 to 0.5	SAND (SP)	1	96	3	-	-	-	-	1.76	12.5	20	0.0
BH03	0.6 to 1.2	SAND (SP)	-	95	5	-	-	-	-	-	-	-	-
BH04	0.1 to 0.4	SAND (SP)	-	96	4	NO	NP	0.0	-	-	-	-	-
BH06	0.5 to 1.2	SAND (SP)	-	97	3	NO	NP	0.0	-	-	-	-	-
BH07	0.0 to 0.4	SAND (SP)	1	96	3	-	-	-	-	1.73	14.5	19	0.0
G02	0.2 to 0.6	SAND (SP-SM)	5	89	6	-	-	-	-	-	-	-	-

Notes

1. *Particle size distribution (by mass)*
   - *Gravel: 2.36 mm – 63 mm*
   - *Sand: 0.075 mm – 2.36 mm*
   - *Fines: <0.075 mm*
2. *Atterberg Limits*
   - *LL: Liquid limit*
   - *PI: Plasticity index*
   - *LS: Linear shrinkage*
   - *NO: Not obtainable*
   - *NP: Non-plastic*
3. *Org: Organic content (by mass)*
4. *Modified compaction*
   - *MMDD: Modified maximum dry density*
   - *OMC: Optimum moisture content*
6. *CBR: California bearing ratio*
   - *Remoulding dry density ratio: 95% MMDD*
   - *Surcharge: 6.75 kg*
   - *Soaking: 4-day soaked*

Attached Table 2: Summary of Chemical Test Results

Test Name	Sample Depth (m)	Soil Class (AS1726 2017)	Electric Conductivity (us/cm)	pH	Phosphorus Retention Index	Exchangeable Sodium Percentage (%)
BH02	1.0 to 1.5	Clayey SAND (SC)	300	8.4	21	-
BH04	1.0 to 1.4	Organic Clayey SAND (SC)	1000	4.8	200	-
BH06	0.5 to 1.0	SAND (SP-SC)	110	7.3	4.0	-
G07	0.5 to 0.6	SAND (SP)	14	7.8	0.5	-
G10	0.4 to 0.5	SAND (SP)	73	7.7	1.5	-
27 Hatch Court in May 2025 (WAG250256-01 001 R Rev1)						
G01	0.3	SAND (SP)	66	6.6	-0.14	-
G03	0.4	SAND (SP)	60	6.6	-0.48	-
Lots 8 and 16 Stirling Crescent in November 2024 (WAG240438-01 001 R Rev2)						
G01	0.1 to 0.5	SAND (SP)	32	5.8	-0.11	Not Reportable
BH16	0.1 to 0.5	SAND (SP)	36	6.2	-0.25	Not Reportable
Part of Lot 1499 Stirling Crescent in September 2023 (WAG230463-01 002 R Rev1). ***Located north of site (not within site).***						
BH04	0.1 to 0.4	SAND (SP)	-	-	0.62	-
G02	0.2 to 0.6	SAND (SP-SM)	-	-	1.2	-

Attached Table 3: Summary of encountered conditions (August / September 2025)

Test Location	Hole Depth (m)	Depth to Groundwater (m BGL[1])	Depth to top of clay / clayey or cemented[4] soil (m BGL[1])	Organic Soil layers (m BGL[1])
CPT01	5.1	0.60	0.9 to 1.2 and from 4.0	possibly from 0.9 to 1.2
CPT02	5.1	0.40	3.0	-
CPT03	5.1	1.70	2.2	-
CPT04	5.1	Collapsed[2]	***3.5***[4]	-
CPT05	2.3	0.60	-	-
CPT06	5.1	0.80	***2.0***[4]	-
CPT08	5.1	0.20	-	-
CPT09	5.1	1.40	***3.4***[4]	-
CPT10	5.1	0.20	-	-
CPT12	5.1	0.60	-	-
CPT13	5.1	0.00	4.2	-
CPT14	5.1	0.80	4.1	-
CPT15	5.1	0.80	***3.2***[4]	-
CPT16	3.0	1.10	***2.8***[4]	-
CPT19	5.1	0.80	-	-
CPT20	5.1	0.80	***2.2***[4]	-
BH01	3.0	2.10	-	-
BH02	3.0	0.80	0.9	0.9 to 2.0 - trace organics in clayey sand
BH03	3.0	1.60	***2.6***[4]	-
BH04	3.0	0.10	0.7	0.7 to 1.4 Organic clayey sand
BH05	1.3	0.60	-	-
BH06	3.0	0.40	2.6	-
BH09	3.0	1.30	-	-
BH10	3.0	1.60	-	-
BH11	3.0	1.00	-	-
BH12 / MW01	3.0	1.00	0.0 to 1.4 and 2.6	Peat from 0.0 to 0.6, Organic sand from 0.6 to 1.4
BH13	3.0	0.90	-	-
BH14 / MW03	3.0	0.28	2.0	-
BH15	3.0	1.10	-	-
BH16 / MW02	3.0	1.15	***2.0***[4]	-

NOTES:

1. *'BGL' – below current ground level*
2. *CPT probe hole collapsed before groundwater could be measured.*
3. *CPT probes may not have had sufficient time to recharge to hydrostatic levels.*
4. *Coffee rock layer, typically about 0.3 m to 1.0 m thick, and underlain by sand. Coffee rock inferred from CPT refusal at some locations.*
5. *Investigation typically encountered thin surficial fill / topsoil sand over clay / clayey or cemented soil layers as stated in table above. Thicker surficial organic layers encountered near / within drainage line in northern part of site as summarised above. Refer to appendices for further details.*

Attached Table 4: Summary of encountered conditions at 27 Hatch Court (May 2025)

Test Location	Hole Depth (m)	Depth to Groundwater (m BGL[1])	Depth to top of clay / clayey soil (m BGL[1])
BH01	3	1.7	-
BH02	3	-	-
BH03	3	-	-
BH04	3	1.9	2.8
BH05	3	2.8	-
BH06	3	-	-
BH07	3	2.7	-
BH08	3	-	-
CPT01	6.5	collapsed	6.2
CPT02	5.8	collapsed	2.2
CPT03	6.3	collapsed	6.1
CPT04	6.4	collapsed	3.5
CPT05	6.4	collapsed	6.2
CPT06	6.4	collapsed	2.2

NOTES:
1. *'BGL' – below current ground level*
2. *CPT probe hole collapsed before groundwater could be measured.*
3. *CPT probes may not have had sufficient time to recharge to hydrostatic levels.*
4. *Investigation typically encountered thin surficial fill / topsoil sand over clay / clayey or cemented soil layers as stated in table above. Refer Report WAG250256-01 001 R Rev1 for further details.*

Attached Table 5: Summary of groundwater depths during fieldwork at 71 Stirling Crescent (March 2023)

Test Location	Hole Depth (m)	Depth to Groundwater (m BGL[1])	Depth to top of cemented[4] soil (m BGL[1])
BH01	1.7	-	***1.7[4]***
BH02	2.0	-	-
BH03	2.0	-	-
BH04	1.0	-	***1.0[4]***

NOTES:
1. *'BGL' – below current ground level*
2. *CPT probe hole collapsed before groundwater could be measured.*
3. *CPT probes may not have had sufficient time to recharge to hydrostatic levels.*
4. *Coffee rock layer, inferred from borehole refusal.*
5. *Investigation typically encountered thin surficial fill / topsoil sand over clay / clayey or cemented soil layers as stated in table above. Refer Report WAG230133-01 001 R Rev 1 for further details.* ***Investigation located north of site (not within site).***

Attached Table 6: Summary of groundwater depths during fieldwork at Lots 8 & 16 Stirling Crescent (November 2024)

Test Location	Hole Depth (m)	Depth to Groundwater (m BGL[1])	Depth to top of clay / clayey or cemented[4] soil (m BGL[1])
BH01	3.00	-	-
BH02	3.00	-	-
BH03	3.00	-	-
BH04	3.00	-	-
BH05	2.70	1.2	-
BH06	3.00	-	-
BH07	3.00	-	-
BH08	2.00	-	***2.0[4]***
BH09	3.00	-	-
BH10	3.00	-	-
BH11	3.00	-	-
BH12	3.00	-	-
BH13	3.00	-	-
BH14	2.88	-	***2.5[4]***
BH15	2.30	-	***2.2[4]***
BH16	3.00	-	-
CPT01	6.90	-	6.5
CPT02	2.70	collapsed	***1.8[4]***
CPT03	6.20	collapsed	6.0
CPT04	6.20	collapsed	-
CPT05	6.20	collapsed	-
CPT06	6.20	collapsed	***3.0[4]***
CPT07	2.83	collapsed	***2.8[4]***
CPT08	2.86	collapsed	***2.8[4]***
CPT09	2.91	collapsed	***2.9[4]***
CPT10	2.51	collapsed	***2.5[4]***

NOTES:

1. *'BGL' – below current ground level*
2. *CPT probe hole collapsed before groundwater could be measured.*
3. *CPT probes may not have had sufficient time to recharge to hydrostatic levels.*
4. *Coffee rock layer, typically about 0.3 m to 1.0 m thick, and underlain by sand. Coffee rock inferred from CPT refusal at some locations.*
5. *Investigation typically encountered thin surficial fill / topsoil sand over clay / clayey or cemented soil layers as stated in table above. Refer Report WAG240438-01 001 R Rev2 for further details.*

Attached Table 7: Summary of groundwater depths during fieldwork at part of Lot 1499 Stirling Crescent (September 2023)

Test Location	Hole Depth (m)	Depth to Groundwater (m BGL[1])	Depth to top of clay / clayey or cemented[4] soil (m BGL[1])
BH01	2.0	-	-
BH02	2.0	1.7	-
BH03	2.0	1.1	-
BH04	2.0	1.9	-
BH05	2.0	1.9	-
BH06	2.0	-	-
CPT01	3.2	collapsed	***3.0[4]***
CPT02	8.4	2.5	***2.5 to 3.5[4]***, and from 8.0
CPT03	3.0	collapsed	***2.8[4]***
CPT04	8.2	1.9	-
CPT05	8.2	collapsed	***3.4 to 4.0[4]*** and 5.6
CPT06	2.7	collapsed	***2.6[4]***
CPT07	8.2	1.7	4.0

NOTES:

1. *'BGL' – below current ground level*
2. *CPT probe hole collapsed before groundwater could be measured.*
3. *CPT probes may not have had sufficient time to recharge to hydrostatic levels.*
4. *Coffee rock layer, typically about 0.3 m to 1.0 m thick, and underlain by sand. Coffee rock inferred from CPT refusal at some locations.*
5. *Investigation typically encountered thin surficial fill / topsoil sand over clay / clayey or cemented soil layers as stated in table above. Refer Report WAG230463-01 002 R Rev1 for further details.* ***Investigation located north of site (not within site).***

Attached Table 8: Site Assessment

Consideration	Assessment / Discussion	Reference	Level of Constraint	Mitigation Measures
Geology	Refer Section 10.1. Mapped as Bassendean sand of variable thickness, with swamp deposits mapped in low lying areas (refer Inline Image 1). LAA are only to be located in areas of deep sand, at least 2 m above any clay or coffee rock layers.	Perth Sheet of the 1:50,000 Environmental Geology Series Map	Nil	-
Climate	To satisfy zero storage requirements, minimum LAA's to be sized as required for hydraulic loading.	Appendix E, Water Balance Calculation	Low	LAA to be greater than area required to meet zero storage requirement.
Exposure	Site will be cleared and broadly levelled - minimal/no tree cover or significant site aspect.	-	Low	-
Vegetation	Assumed area cleared, with minimal vegetation (i.e. limited to grass and / or shrubs)	-	Low	-
Landform and Drainage	The site generally undulates, but slopes down towards the drainage line traversing from west to east in the northern part of the site. Site drainage is controlled by this drainage line. Localised lakes are present in southern part of site, which are judged to be expressions of groundwater.	-	Moderate	Civil design to minimise rainfall run-on and run-off (using bunds/curbs etc.)
Slope	The proposed development area will be relatively flat after earthworks.	-	Low	Slope is <10% grade.
Fill (Imported)	Filling is anticipated to achieve adequate clearance to groundwater. Fill could be site derived or imported and must have similar properties as that encountered (i.e. All fill must be Soil Category 1 to 2).	-	Low	Any imported fill must have minimum hydraulic conductivity of 1.4 m/day (i.e. All fill must be Soil Category 1 to 2).
PDWSAs	The site is **not** mapped as being within a public drinking water source area.	Department of water (DoW) mapping service	-	-
SSAs	The site is mapped as a Sewage Sensitive Area, being within 1 km of a significant wetland and within the catchment of the Swan Coastal Plan.	Department of lands and heritage (DPLH) mapping service.	Moderate	The underside of any disposal area must be at least 1.5 m above the design groundwater level, provided a secondary treatment system is used.

Attached Table 8: Site Assessment CONTINUED (Page 2 of 2)

Consideration	Assessment / Discussion	Reference	Level of Constraint	Mitigation Measures
Surface gravel and rock outcrops	We did not note any significant surficial gravel and rock outcrops.	Section 11	Low	-
Groundwater Level	Groundwater currently between 0 m below ground (in low lying areas) and over 3 m below ground (in elevated areas). Surface water (judged to be an expression of the groundwater table) was observed in the table drain, wetland areas and lakes discussed above and in Section 4. Design groundwater levels for the site must be assessed by a suitably qualified civil engineer and / or hydrologist. Filling, subsoil drains and / or table drains could possibly be required.	Table 7	Moderate	The underside of any disposal area must be at least 1.5 m above the design groundwater level, provided a secondary treatment system is used.
Groundwater Separation	A minimum groundwater separation of 0.6 m is required for treated effluent at the site.	Government Sewerage Policy (2019)	Moderate	Refer comment above.
Rainfall Run-on/Seepage	Site slopes and levels will be changed significantly by bulk earthworks. Some rainfall run-on and run-off may occur.	-	Moderate	Incident rainfall must be diverted away from LAA's using curbs or diversion bunds. Similarly, any run-off must be prevented by either having a level LAA, or by using retention bunds.
Surface Water/Water Resources	As discussed in Section 4, Surface water (judged to be an expression of the groundwater table) was observed in - the table drain traversing west to east through the northern part of the site - the wetland area in the western part of the site near Lewis Road; and - lakes in the southern part of the site. It is possible some of these features will be removed as part of earthworks.	-	Moderate	LAA to be positioned so the required minimum setbacks to water resources are met. Particularly a 6 m offset from open drainage channels (refer Table 8) and 100 m offset from the creek in the HCLIA.
Flood Potential	The site is **not** mapped as a Floodplain Development Control Area	DWER floodplain mapping	-	-
Setbacks	All setbacks to be met.	Section 12.2	High	LAA to meet setback requirements.
LAA	The minimum total LAA area by the GSP 2019 method is 1,000 m^2 per 5,000 L/day of hydraulic loading. This will need to be resized as required for the actual hydraulic loading within each proposed lot.	Section 12.3.3	Low	LAA to be sized to meet the minimum required infiltrative area and setbacks.

Attached Table 9: Soil Assessment

Consideration	Assessment / Discussion				Reference	Level of Constraint	Mitigation Measures
Subsurface Soil Conditions	In proposed LAA areas, soil conditions to comprise SAND with a minimum permeability of 1.4 m/day (i.e. Soil Category 1 or 2). To a depth of no less than 2 m. This is achievable for most of the site.				Section 11	Moderate	-
Acid Sulfate Soils	Organic soils near drainage lines, wetland areas and possibly within existing lakes could have a high acid sulfate soil risk. LAA's are to be located away from these features in sand above the groundwater, and therefore no significant ASS risk is present.				Department of Environmental Regulation (DER) mapping	Low	-
Soil Category	In situ soil in proposed LAA areas is Category 1 to 2				AS1547-2012	Moderate	Any imported fill must have minimum hydraulic conductivity of 1.4 m/day to meet these assumptions (i.e. All fill must be Soil Category 1 to 2). LAA areas not to be near drainage lines or wetland areas where surficial organic clayey soils could be present.
Design Loading Rates	50 mm/day				Table L1, AS1547-2012	-	Secondary treated effluent
Laboratory Testing in SAND	**Level of Constraint**						-
	Result	**Low**	**Medium**	**High**			
Coarse Fragments[1]	Up to 6%	<10%	10-40%	>40%	-	Low	Erosion risk is relatively low and can be controlled around perimeter using geotextile / vegetation / etc.. as per civil design requirements. No reduction in permeability necessary to account for gravel.
Phosphorous Retention Index (PRI)[2]	-0.5 to 4.0	>20	5-20	<5		High	The upper 0.2 m of soil below leach drains must comprise high PRI (PRI>20) soil to ensure nutrient stripping capability.
pH[1]	5.8 to 7.8	6-8	4.5-6	<4.5,>8		Low to Medium	In situ soil not considered to be significantly erodible.
Exchangeable Sodium Percentage[1]	Not Reportable	<10	10-20	<20		-	
Electric Conductivity (dS/m)[1]	0.014 to 0.110	<0.3	0.3 – 2.0	>2.0		Low	
Emerson Class[1]	NIL	> 4	4	1 - 3		-	-

***Notes: 1)** Level of constraint based on our interpretation of AS1547 description of "non-dispersive soils". **2)** Phosphorus retention index requirements are based on our interpretation of The Department of Primary Industries and Regional Development Standards for Land Resource Mapping (2005), as this is not specified in AS1547.*

Figures





Legend

- Site Boundary
- Borehole
- Machine Auger Borehole
- Cone Penetration Test
- Direct Push Borehole / Groundwater Monitoring Well
- Machine Auger Borehole / Guelph Permeameter
- Guelph Permeameter

N

0 50 100 150 200 250
Meters

NOTES
Aerial Imagery and Cadastre sourced from Landgate/SLIP



SCALE	1:3,250	(A3)
DRAWN	CED	
DATE DRAWN	11/9/2025	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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CLIENT	**CLIENT**
PROJECT	PROJECT
LOCATION	51 STIRLING CRESCENT HIGH WYCOMBE
TITLE	SITE & LOCATION PLAN

Job No	Fig No	Rev
WAG250138-01	FIGURE 1	**A**





Legend

- Site Boundary
- Borehole
- Machine Auger Borehole
- Cone Penetration Test
- Direct Push Borehole / Groundwater Monitoring Well
- Machine Auger Borehole / Guelph Permeameter
- Guelph Permeameter

WAG250256-01-TLF

- Borehole
- Borehole / Infiltration Test
- Cone Penetration Test
- Guelph Permeameter

WAG240438-01-TLF

- Borehole
- Borehole / Standpipe
- Cone Penetration Test
- Guelph Permeameter
- Guelph Permeameter / Standpipe
- Infiltration Test

WAG230463-01-TLF

- Borehole
- Borehole / Infiltration Test
- Cone Penetration Test
- Permeability Test
- Sediment Sample

WAG230133-01-FTL

- Borehole
- Borehole / Infiltration Test
- Infiltration Test

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP



SCALE	1:3,250	(A3)
DRAWN	CED	
DATE DRAWN	11/9/2025	
CHECKED	_	
DATE CHECKED	_	
PROJECTION	GDA 1994 MGA Zone 50	

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CLIENT	**CLIENT**
PROJECT	PROJECT
LOCATION	51 STIRLING CRESCENT HIGH WYCOMBE
TITLE	SITE & LOCATION PLAN WITH PREVIOUS GALT TEST LOCATIONS

Job No	Fig No	Rev
WAG250138-01	FIGURE 1	**A**

Appendices

Appendix A: Site Photographs

Photograph 1: Site photo near BH13. Water ponded at ground surface



Photograph 2: Near BH02 facing west. Wetland area near Lewis Road.



Photograph 3: Near BH01 facing south east



Photograph 4: Near CPT01 facing north. Wetland area near Lewis Road / drainage line in northern part of site.



Photograph 5: Near BH04 facing north



Photograph 6: Near CPT08 facing west. Drainage line adjacent borehole.



Photograph 7: Near BH10 facing east



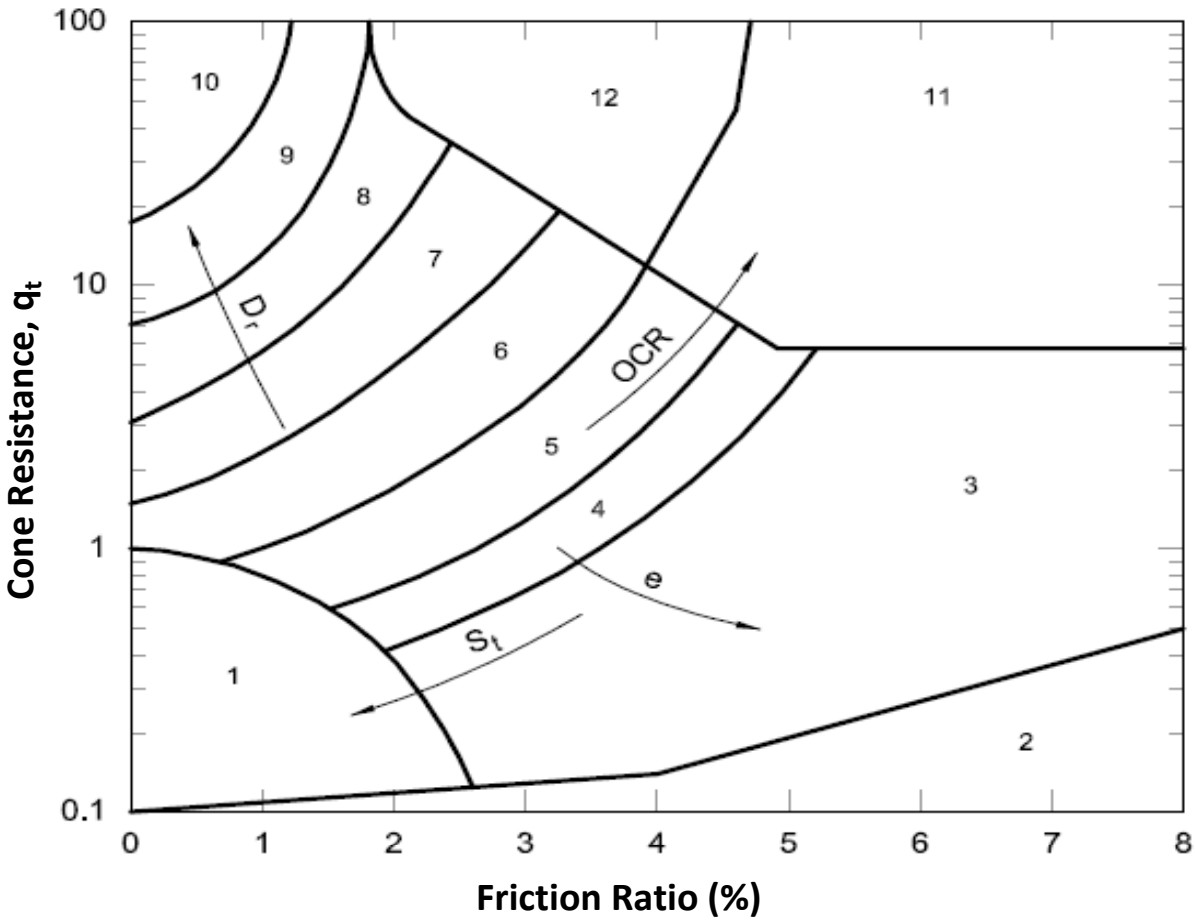
Photograph 8: Near BH15 facing south east



Photograph 9: Near BH06 facing south west



Appendix B: CPT Test Results



DEFINITIONS

q_t : Cone tip resistance corrected for pore water pressure
S_t : Sensitivity
e : Void ratio
D_r : Relative density
OCR : Overconsolidation ratio
OC : Overconsolidated

SOIL BEHAVIOUR TYPE ZONES

1. Sensitive fine grained
2. Organic material
3. Clay
4. Silty clay to clay
5. Clayey silt to silty clay
6. Sandy silt to clayey silt
7. Silty sand to sandy silt
8. Sand to silty sand
9. Sand
10. Gravelly sand to sand
11. Very stiff fine grained material (OC/cemented)
12. Sand to clayey sand (OC/cemented)

NOTES

A. Some overlap in type zones is expected
B. Local correlations are preferred and may indicate soil type boundaries that are different from those shown above

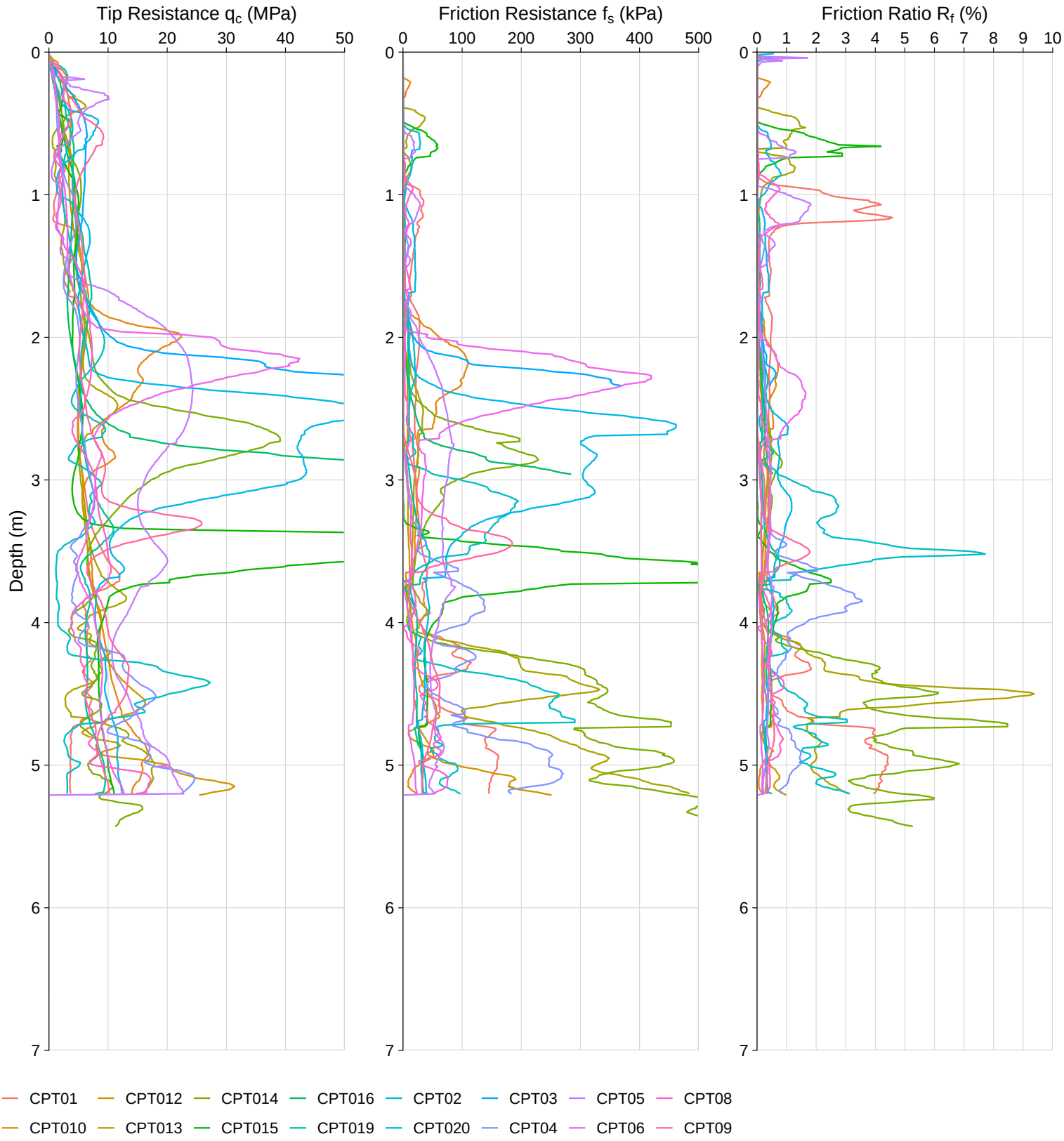
Reference: Robertson, P.K., Campanella, R.G., Gillespie, D. and Grieg, J. (1986) "Use of Piezometer Cone Data". Proceedings of the ASCE Speciality Conference In Situ '86: Use of In Situ Tests in Geotechnical Engineering, Blacksburg, pp 1263-80, American Society of Civil Engineers (ASCE)

Galt GEOTECHNICS

CONE PENETRATION TESTING (CPT) SOIL TYPE INTERPRETATION

CONE PENETRATION TEST

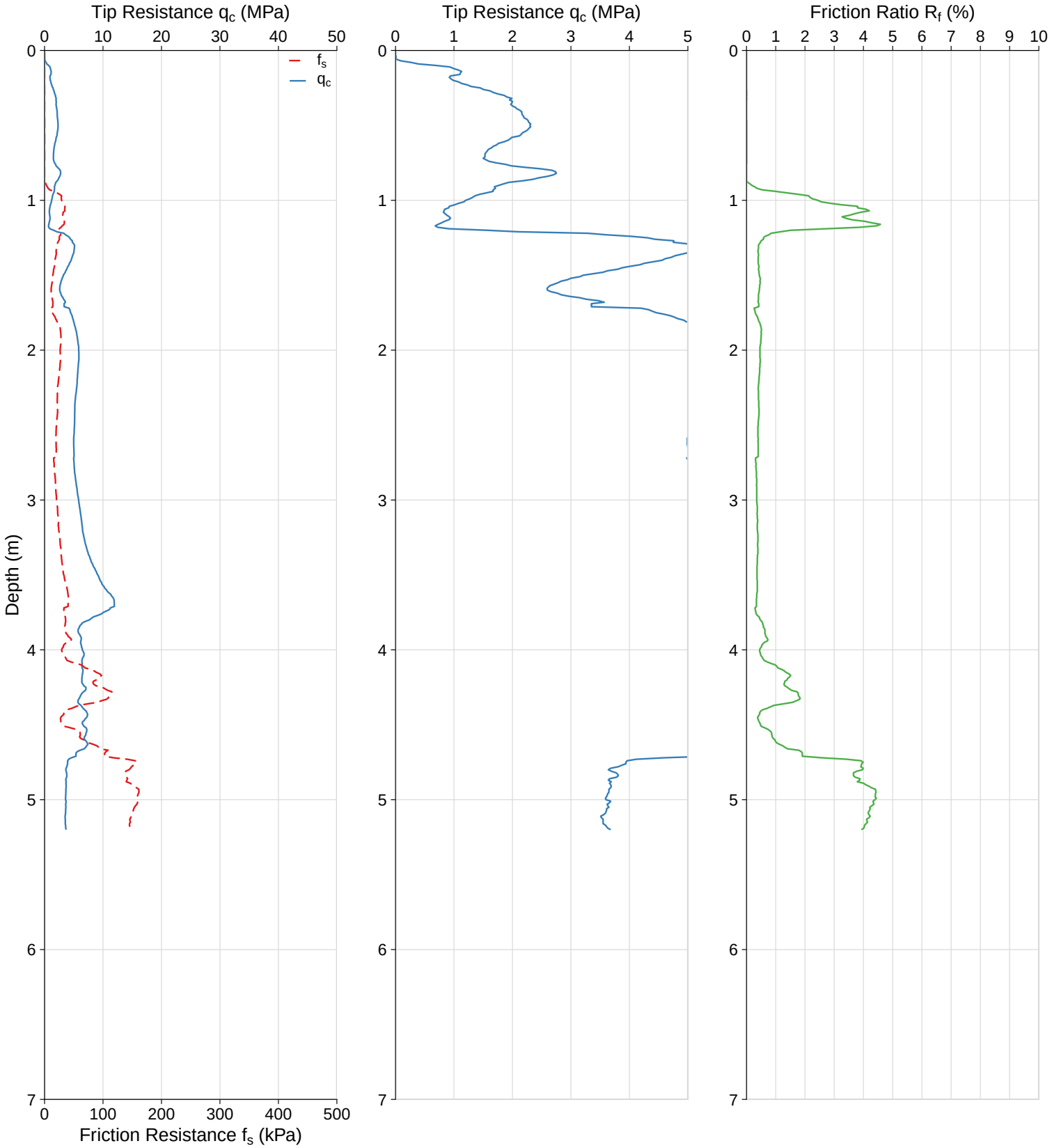
ALL TESTS		**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



RIG: Pagani TG 73-200 200kN

CONE PENETRATION TEST

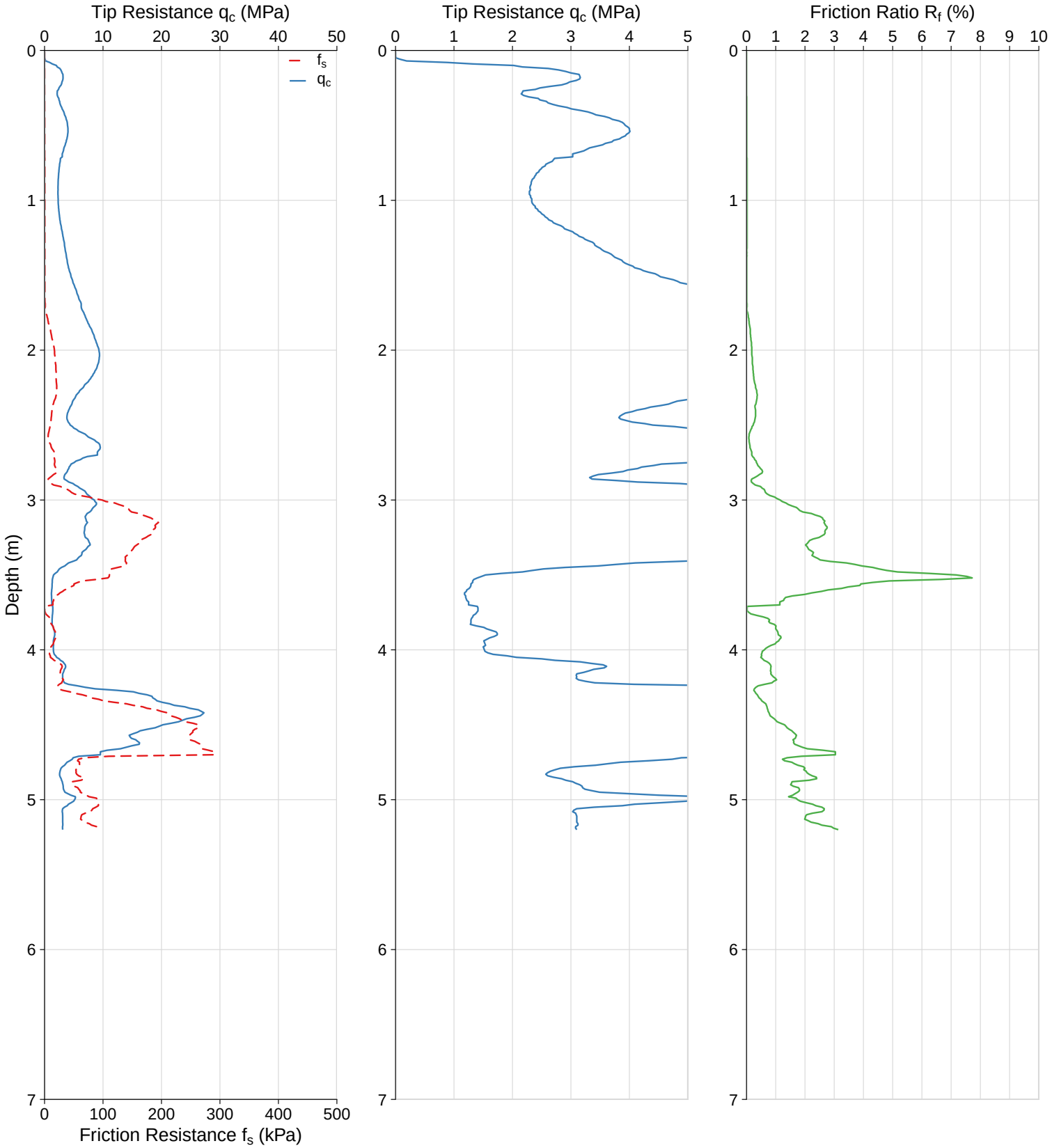
CPT ID:	CPT01	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.6m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

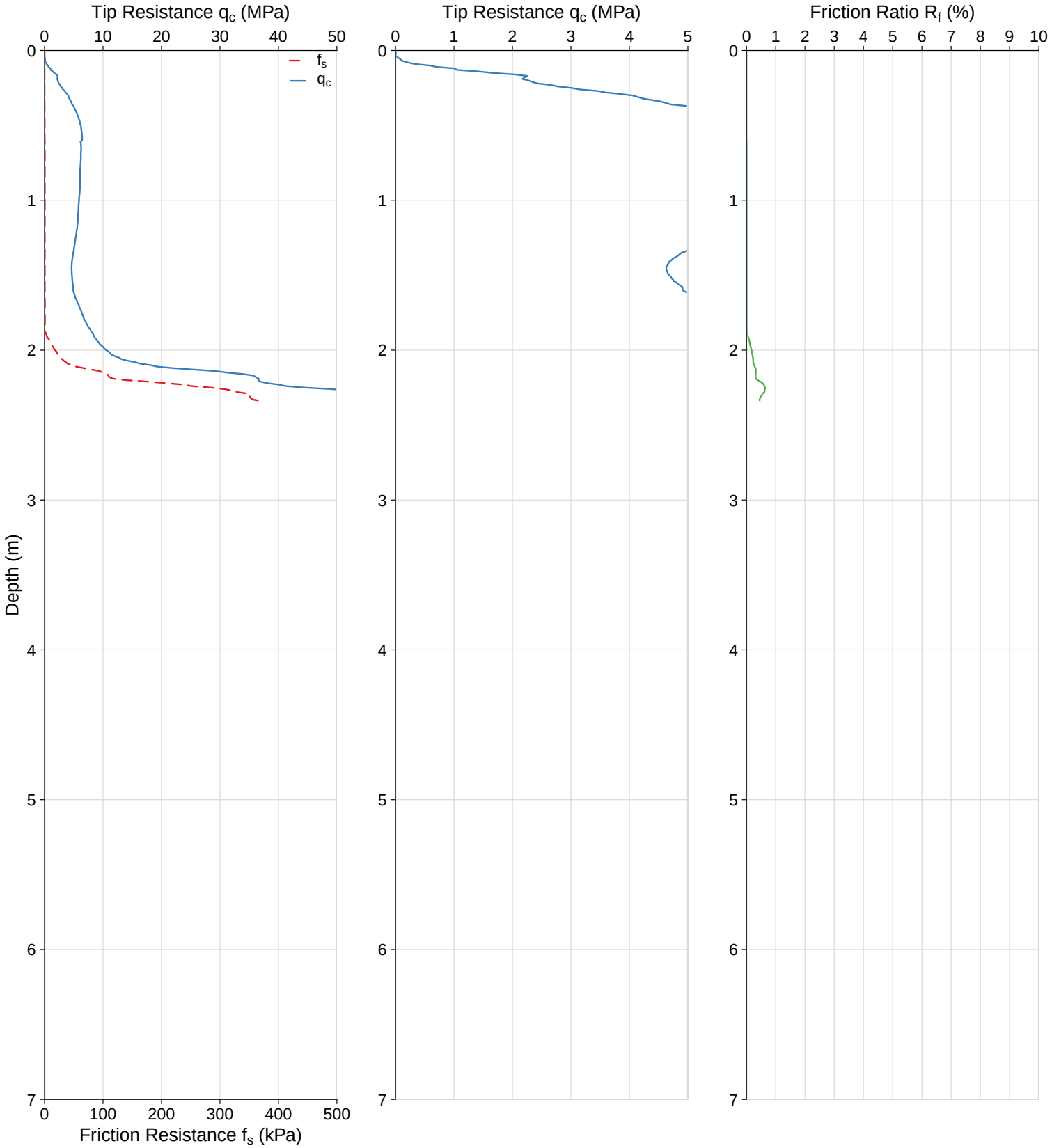
CPT ID:	CPT02	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.4m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

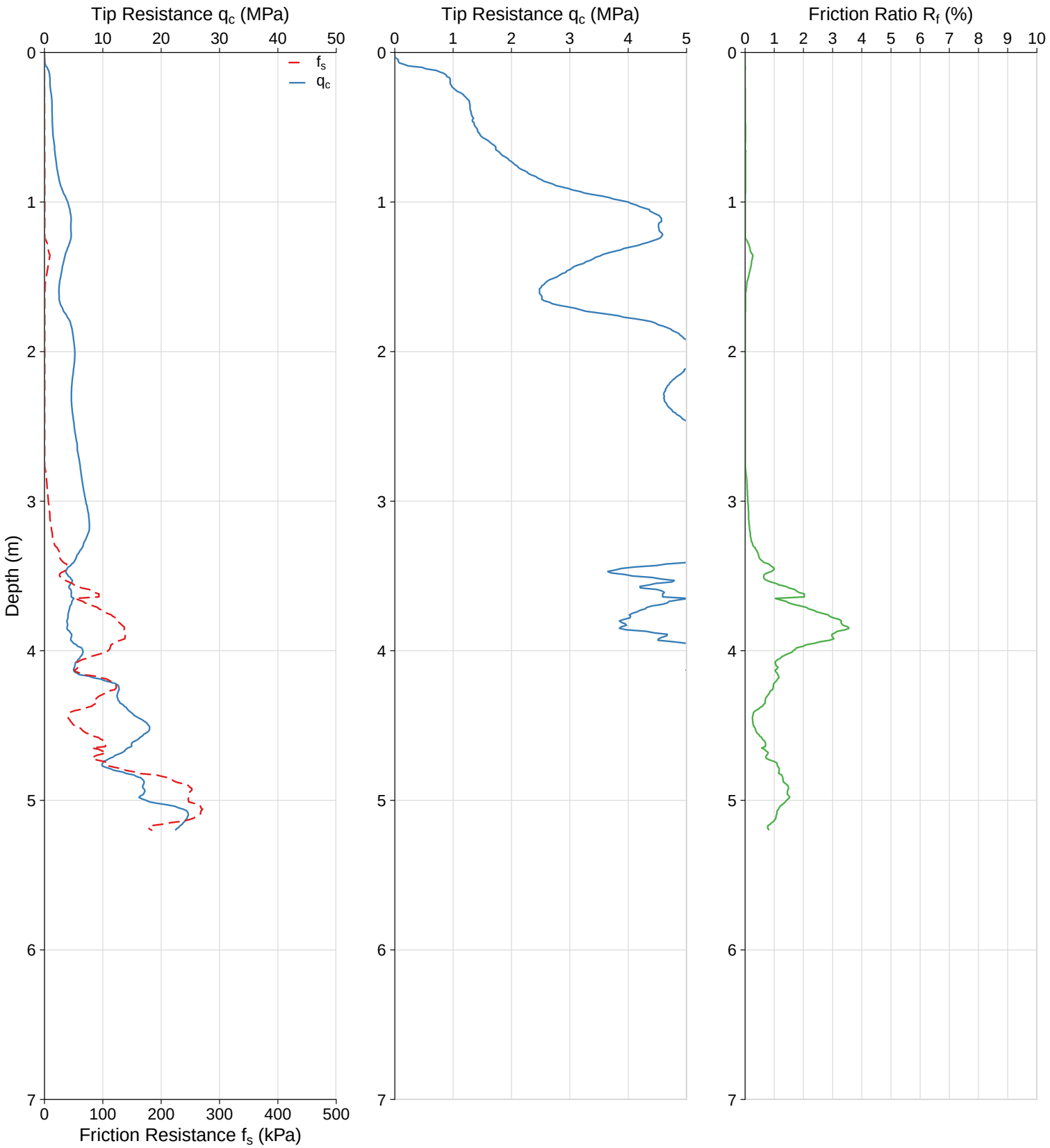
CPT ID:	CPT03	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 1.7m	**CO-ORDS:**	
TERMINATION:	Refused, 2.34m	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

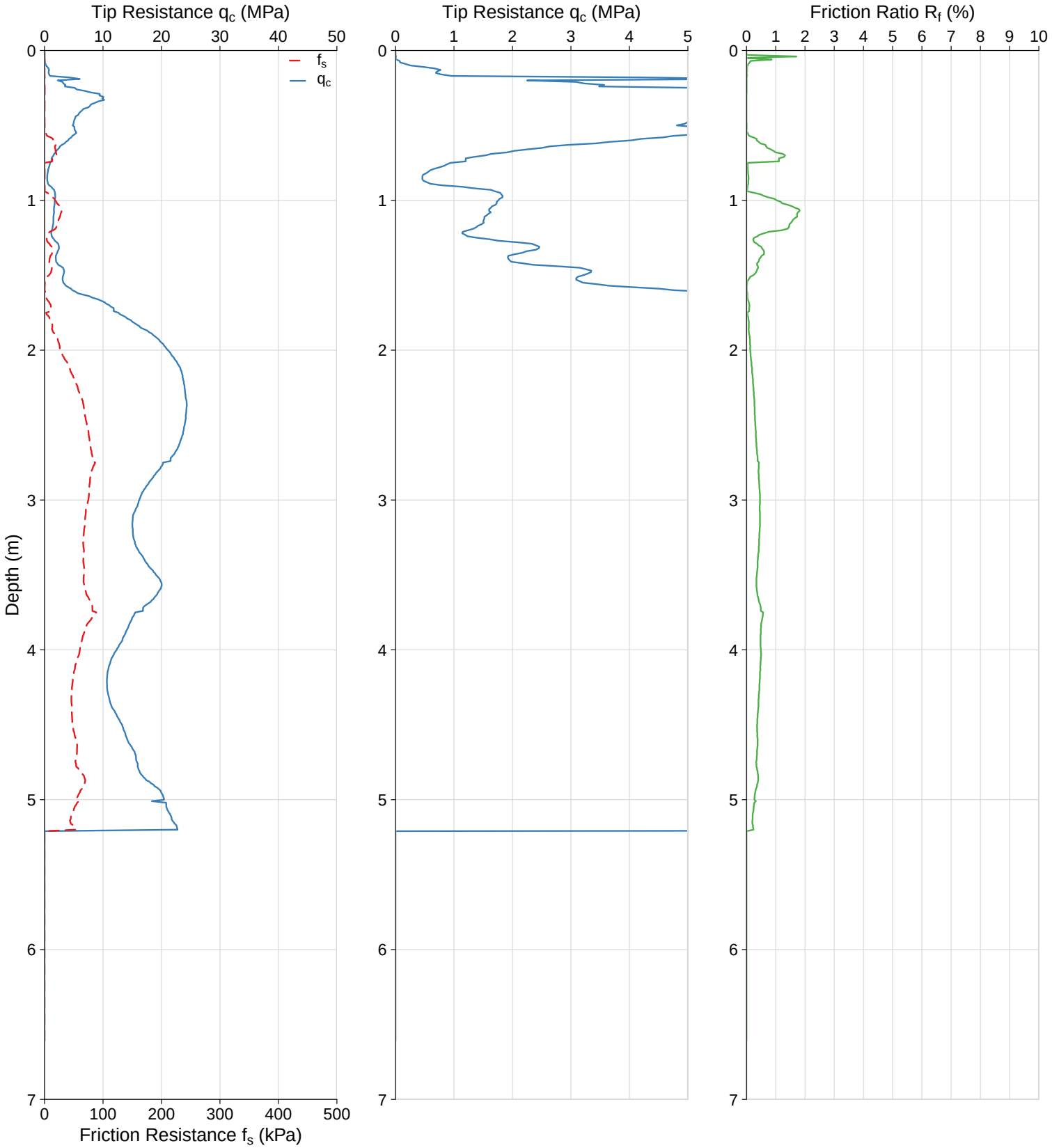
CPT ID:	CPT04	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

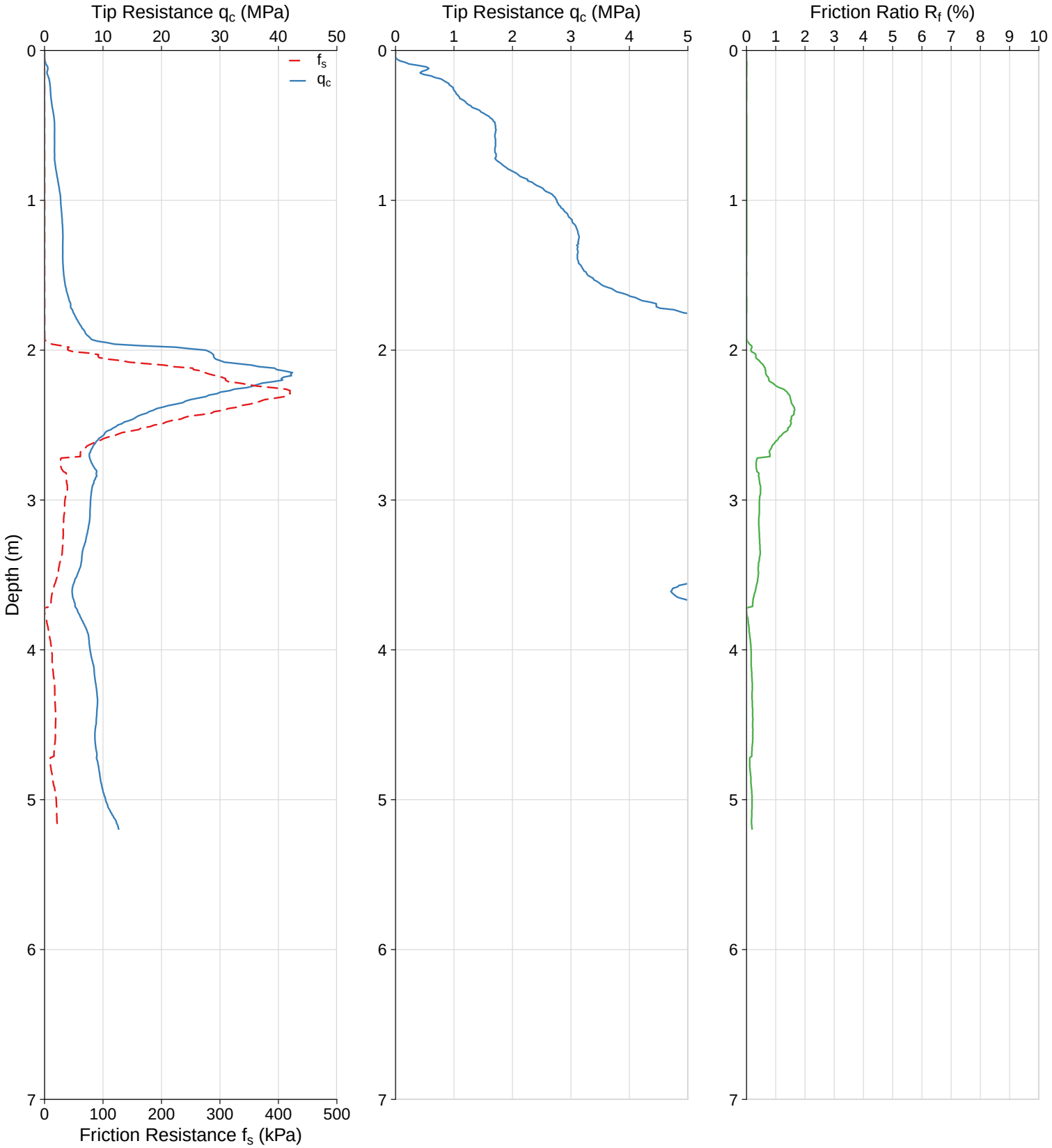
CPT ID:	CPT05	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.6m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

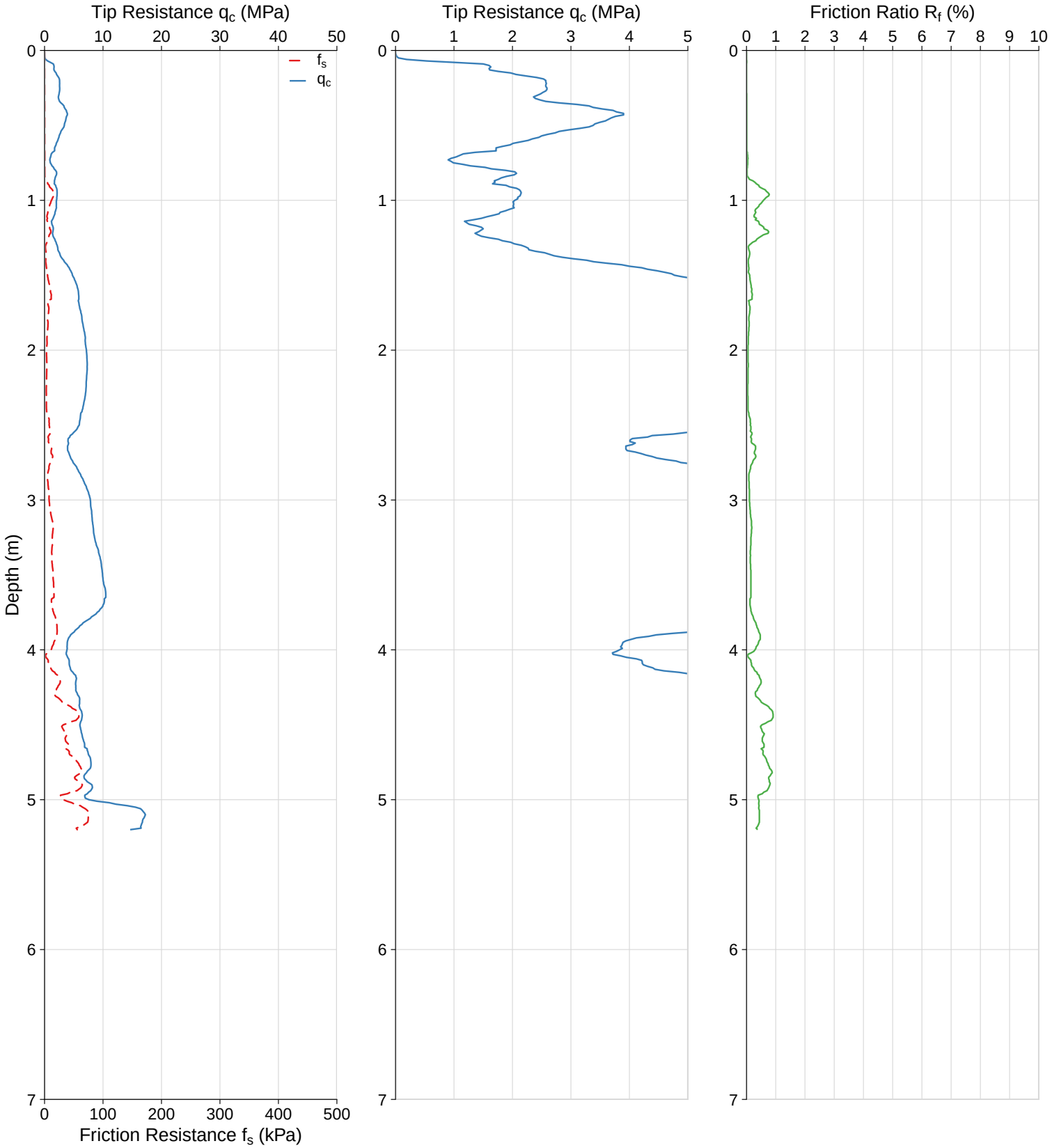
CPT ID:	CPT06	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 0.8m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

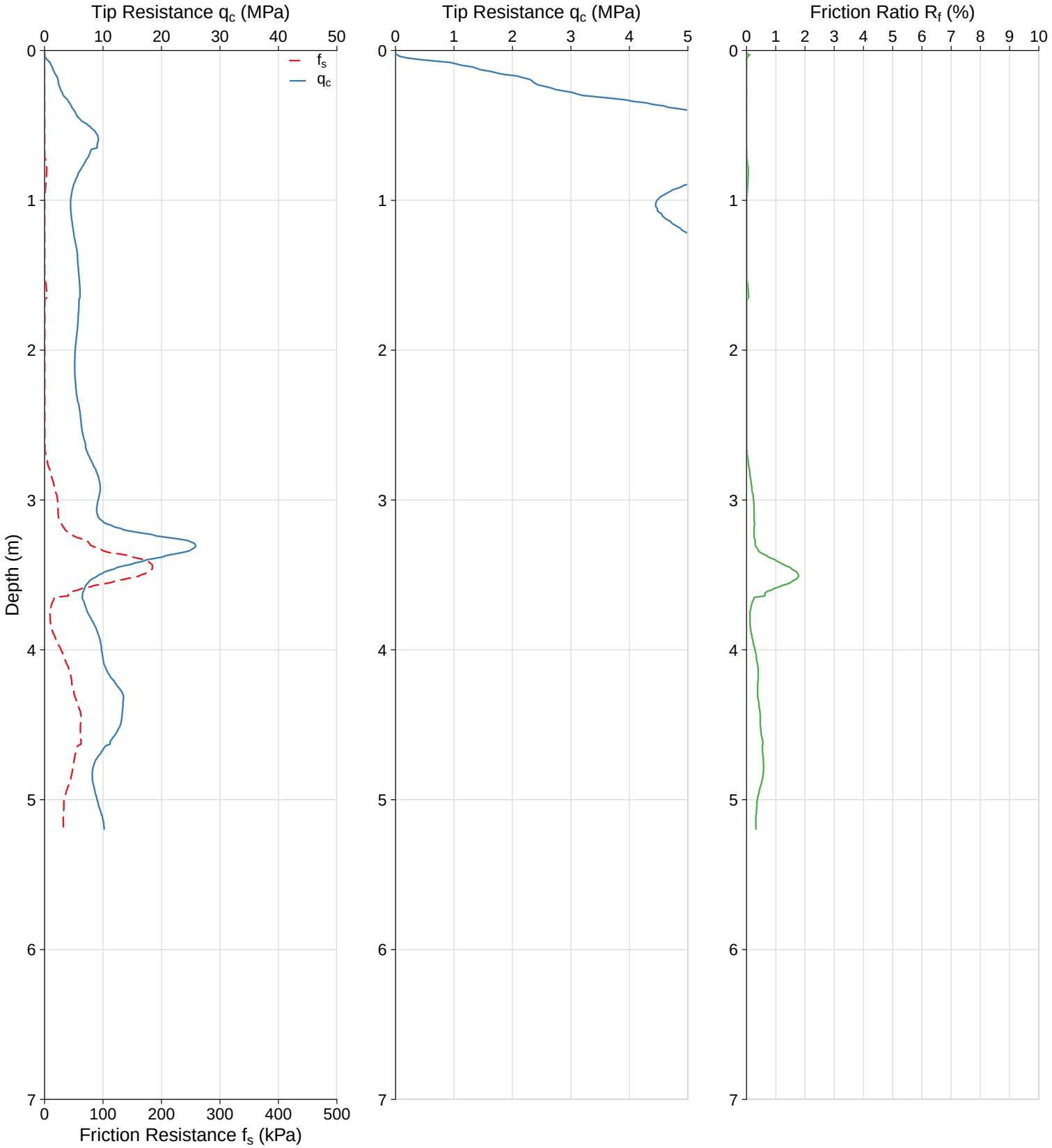
CPT ID:	CPT08	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.2m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

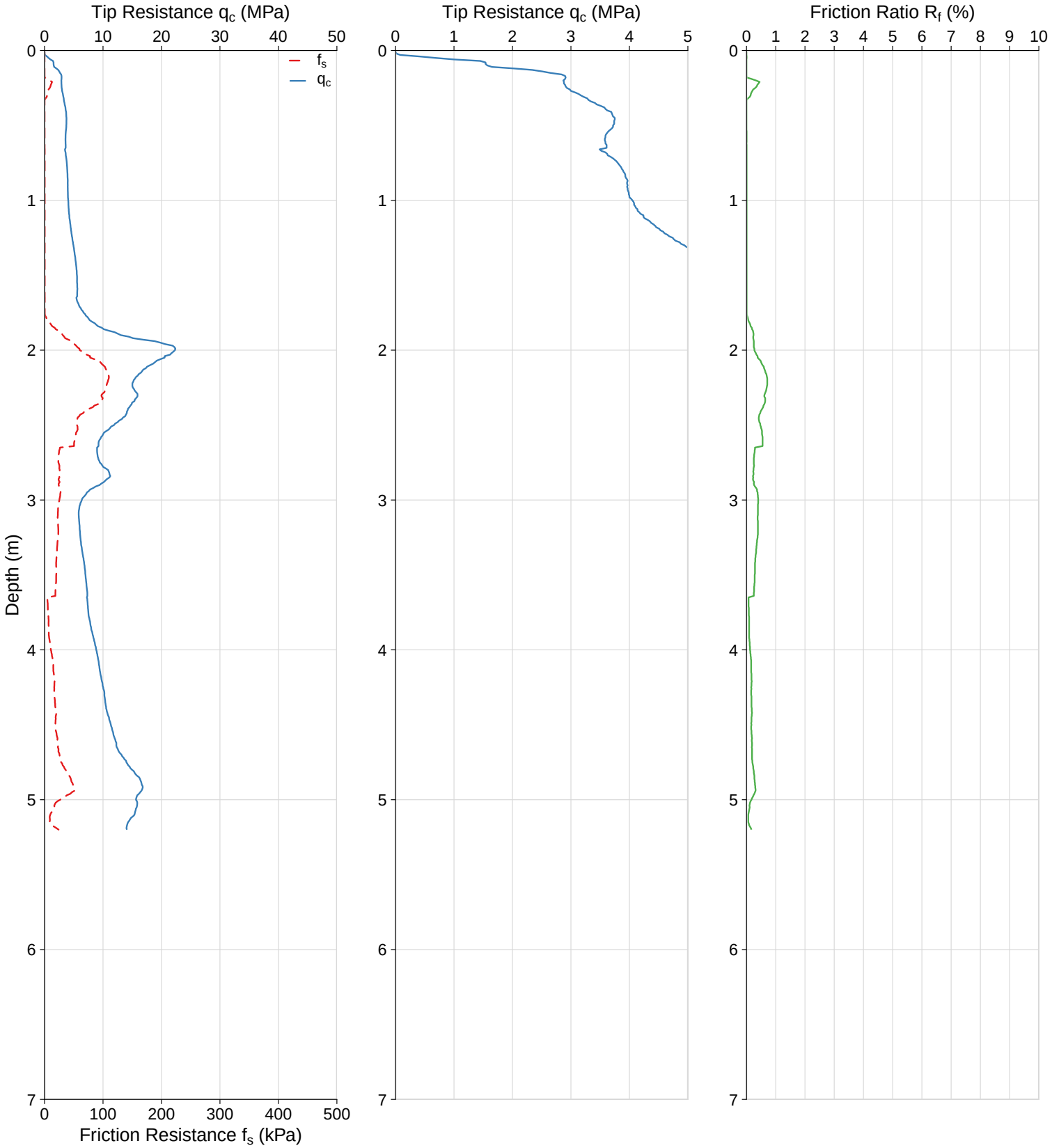
CPT ID:	CPT09	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 1.4m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

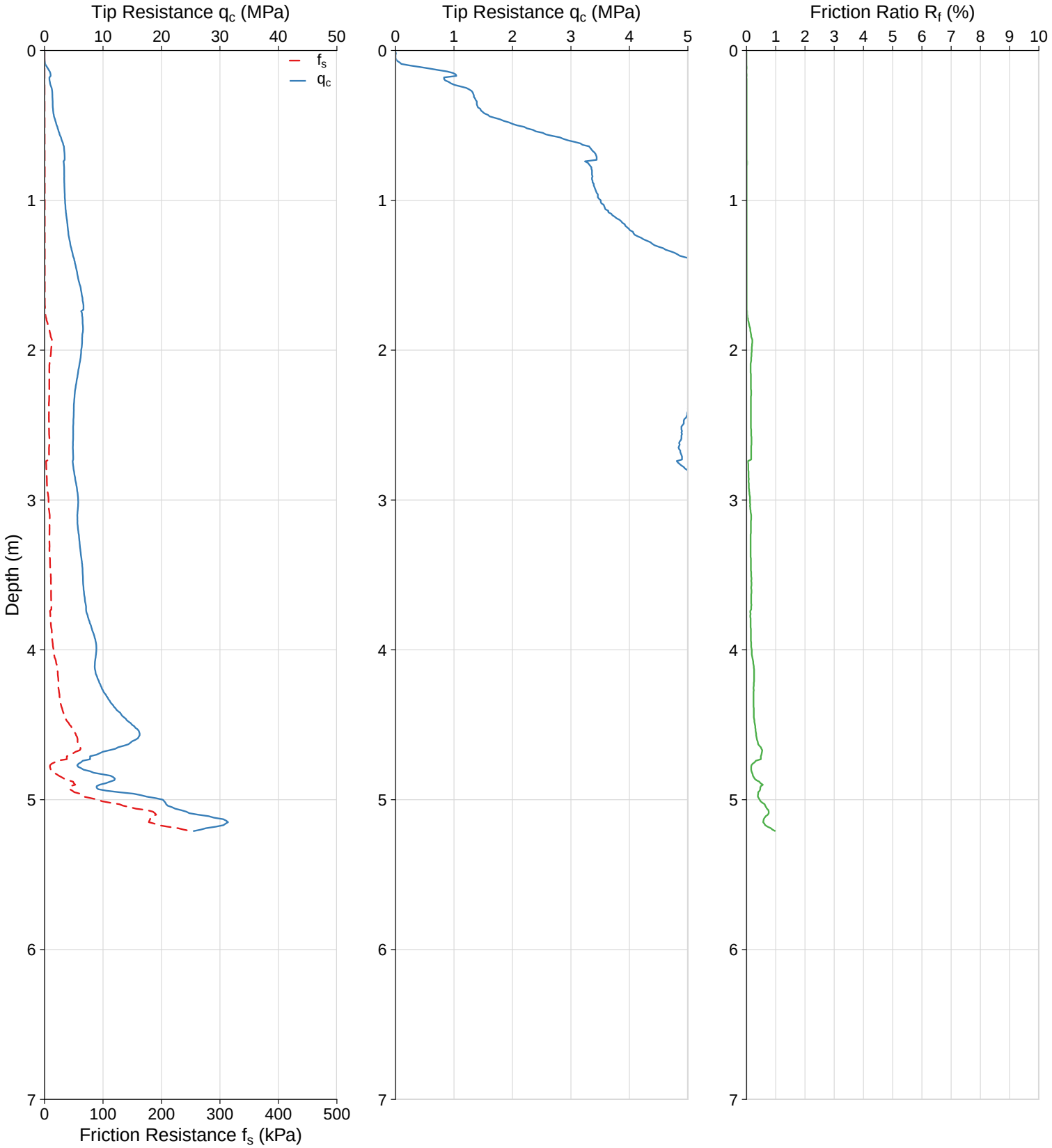
CPT ID:	CPT010	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.2m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

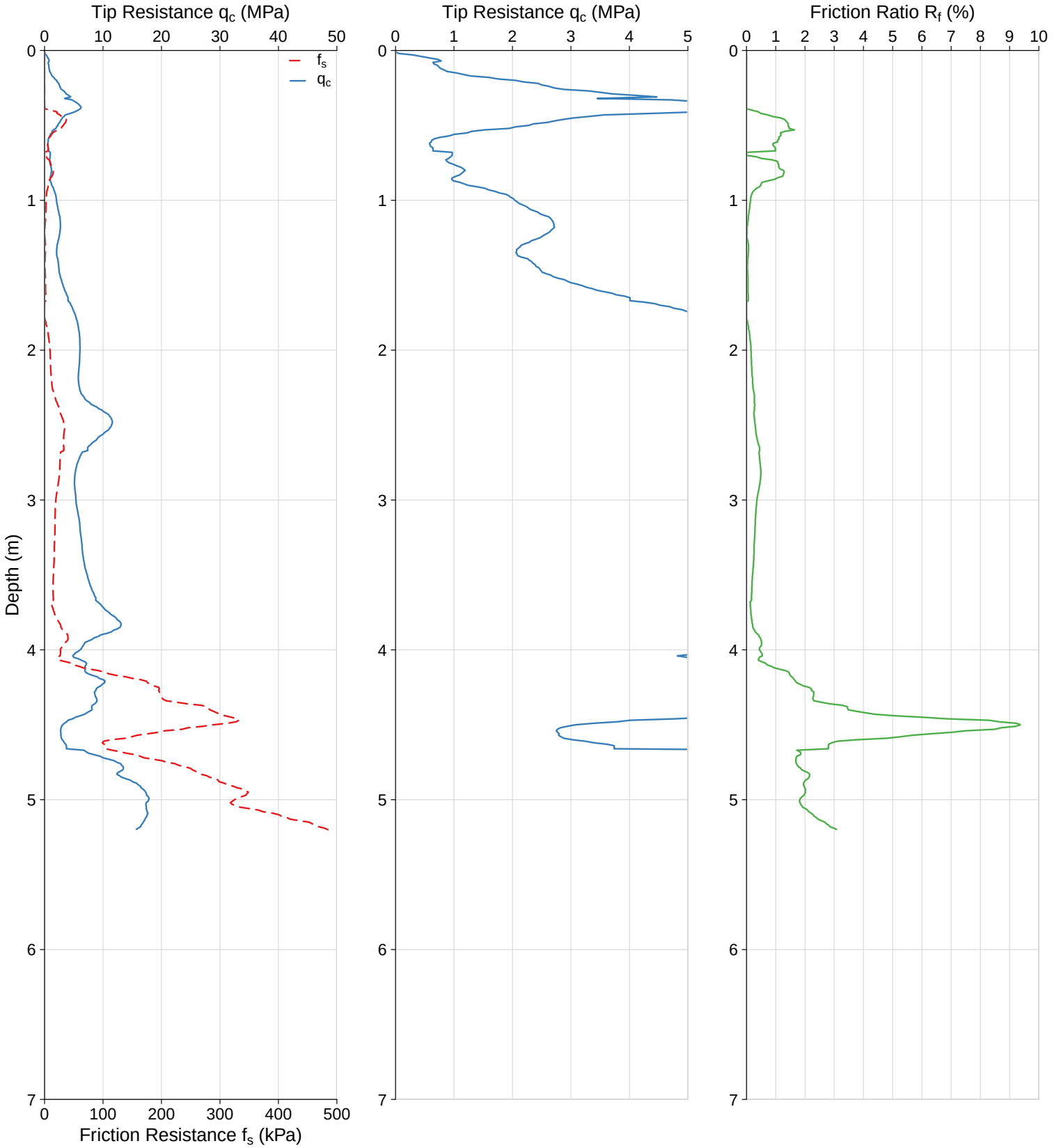
CPT ID:	CPT012	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Collapsed, water at 0.6m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

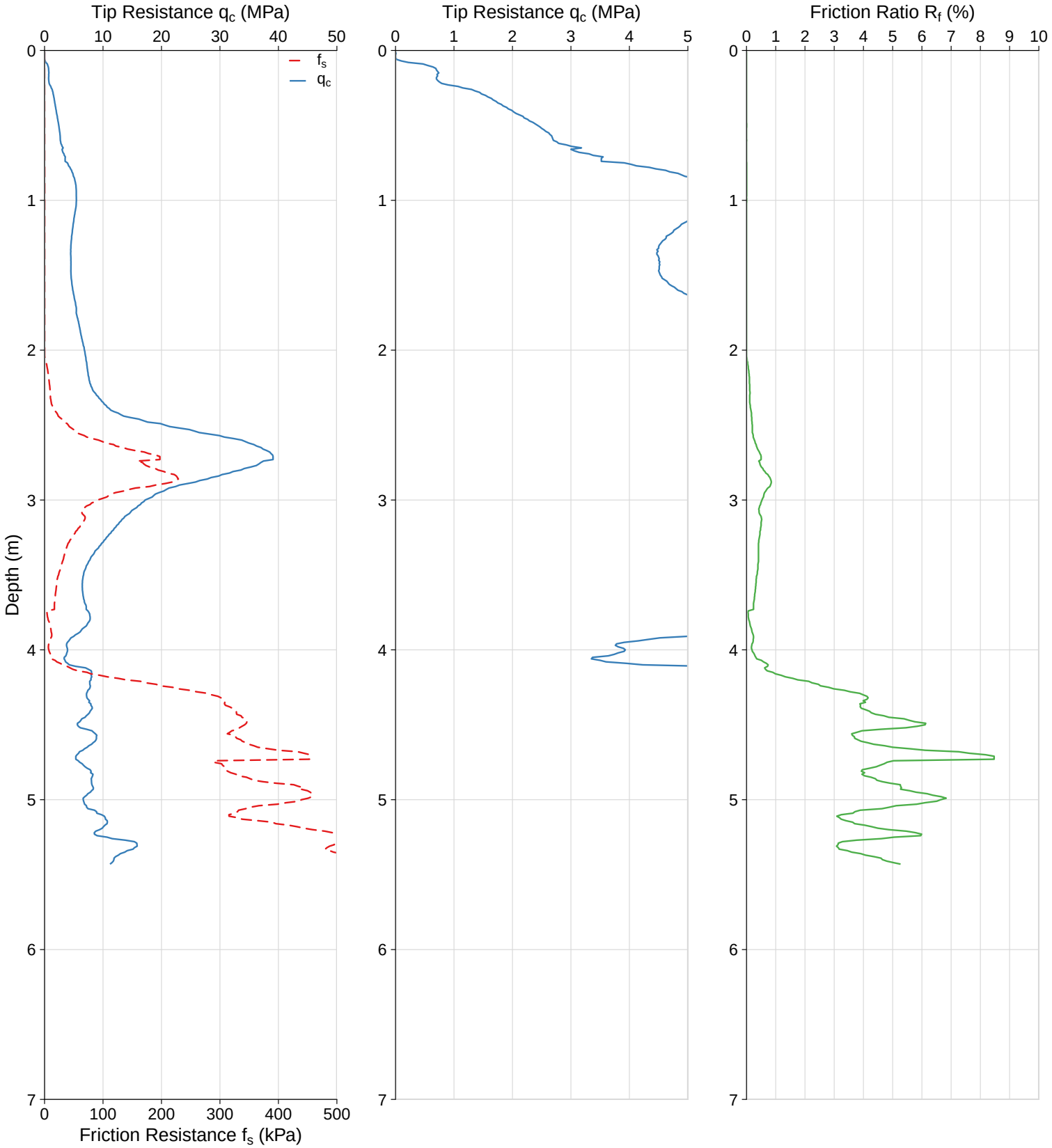
CPT ID:	CPT013	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Wet surface	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

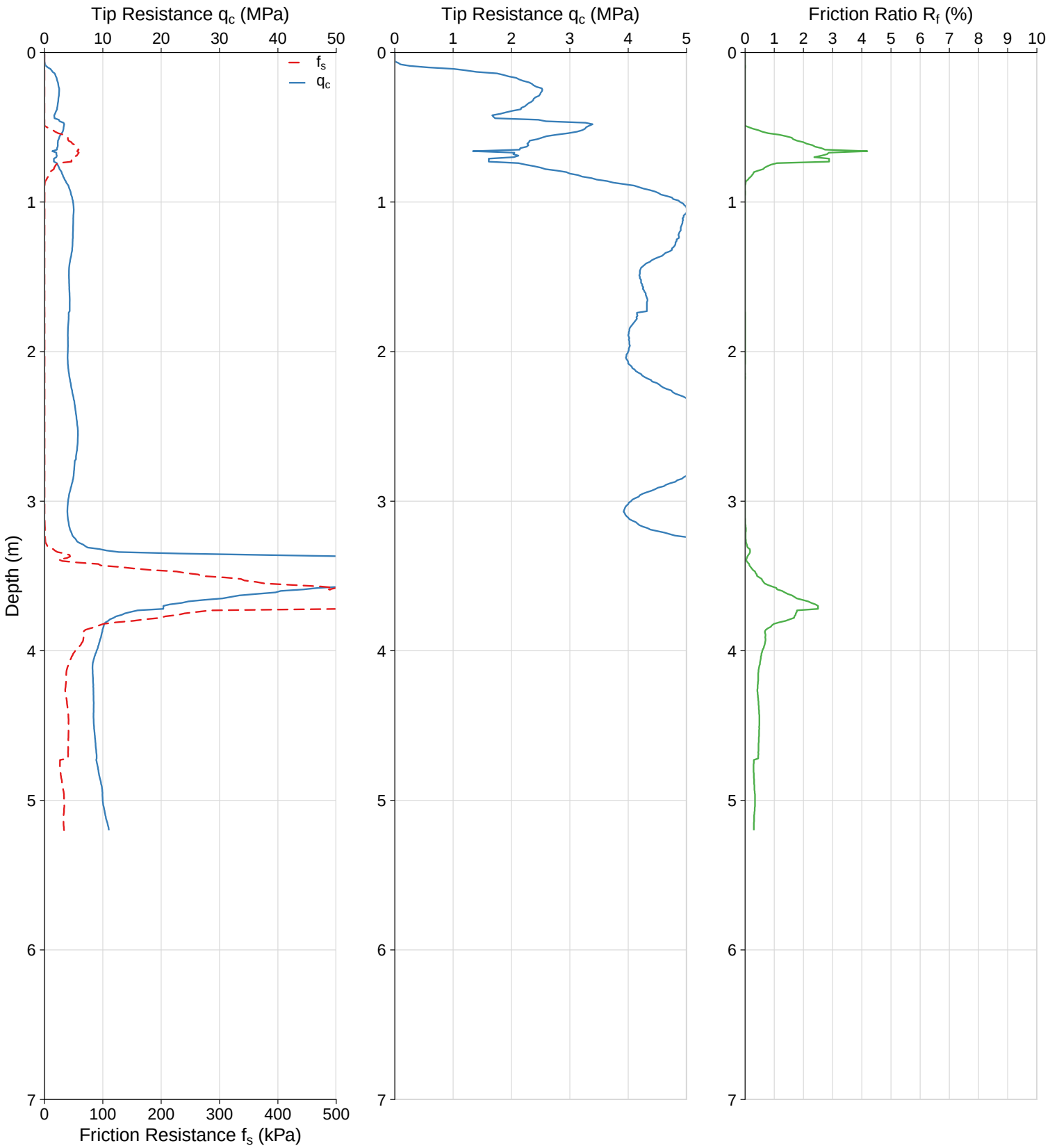
CPT ID:	CPT014	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 0.8m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

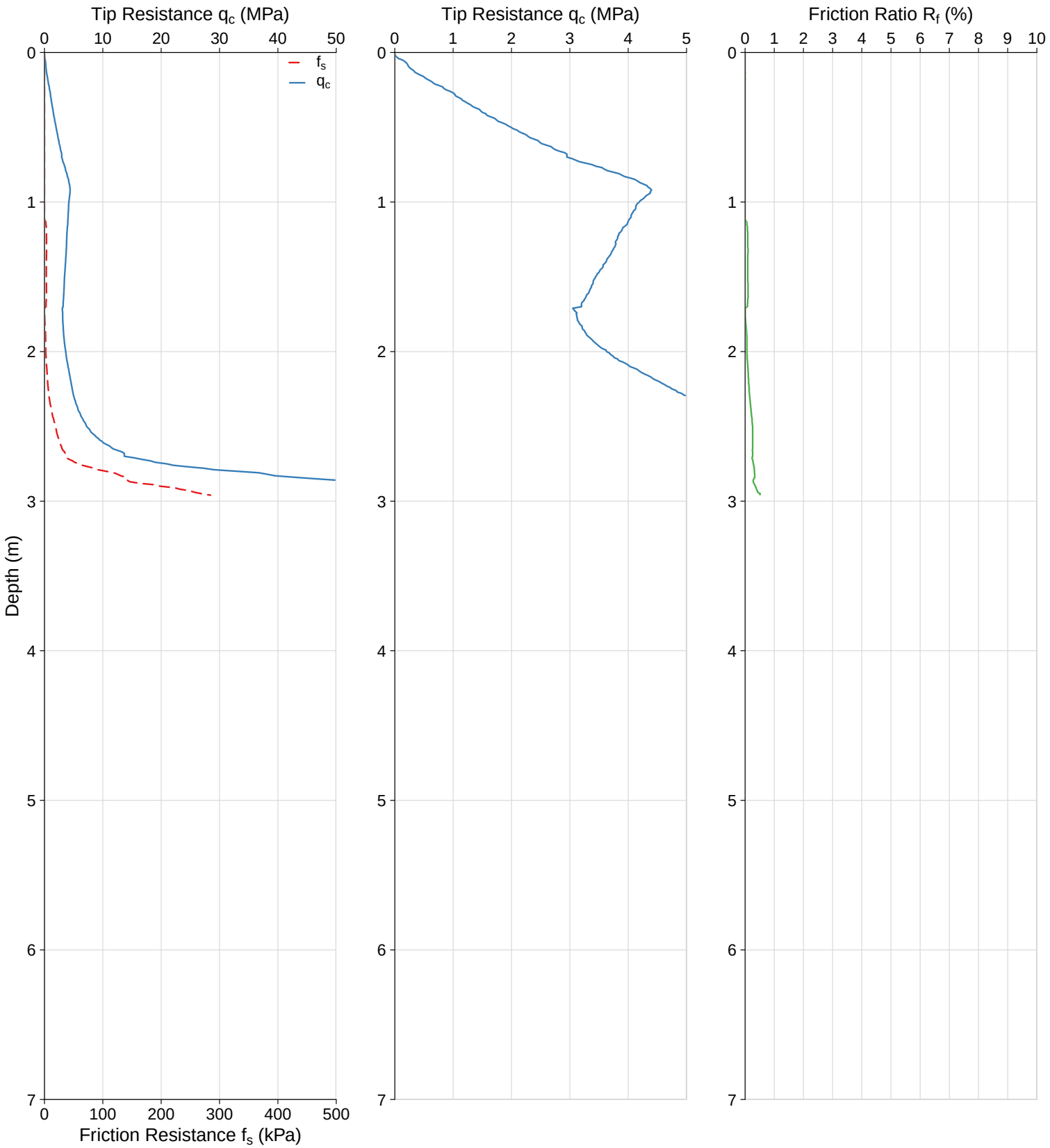
CPT ID:	CPT015	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 0.8m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

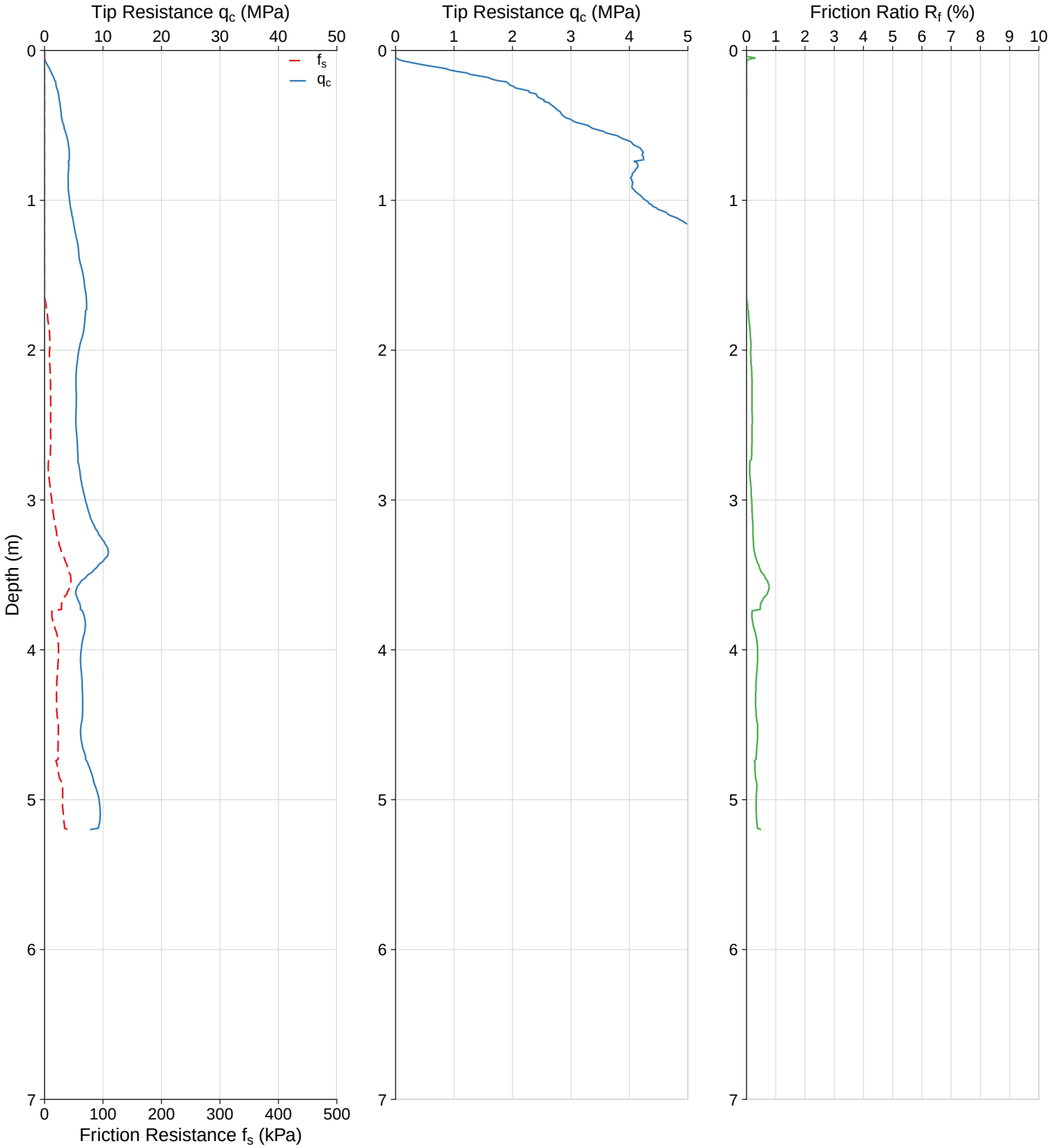
CPT ID:	CPT016	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 1.1m	**CO-ORDS:**	
TERMINATION:	Refused	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

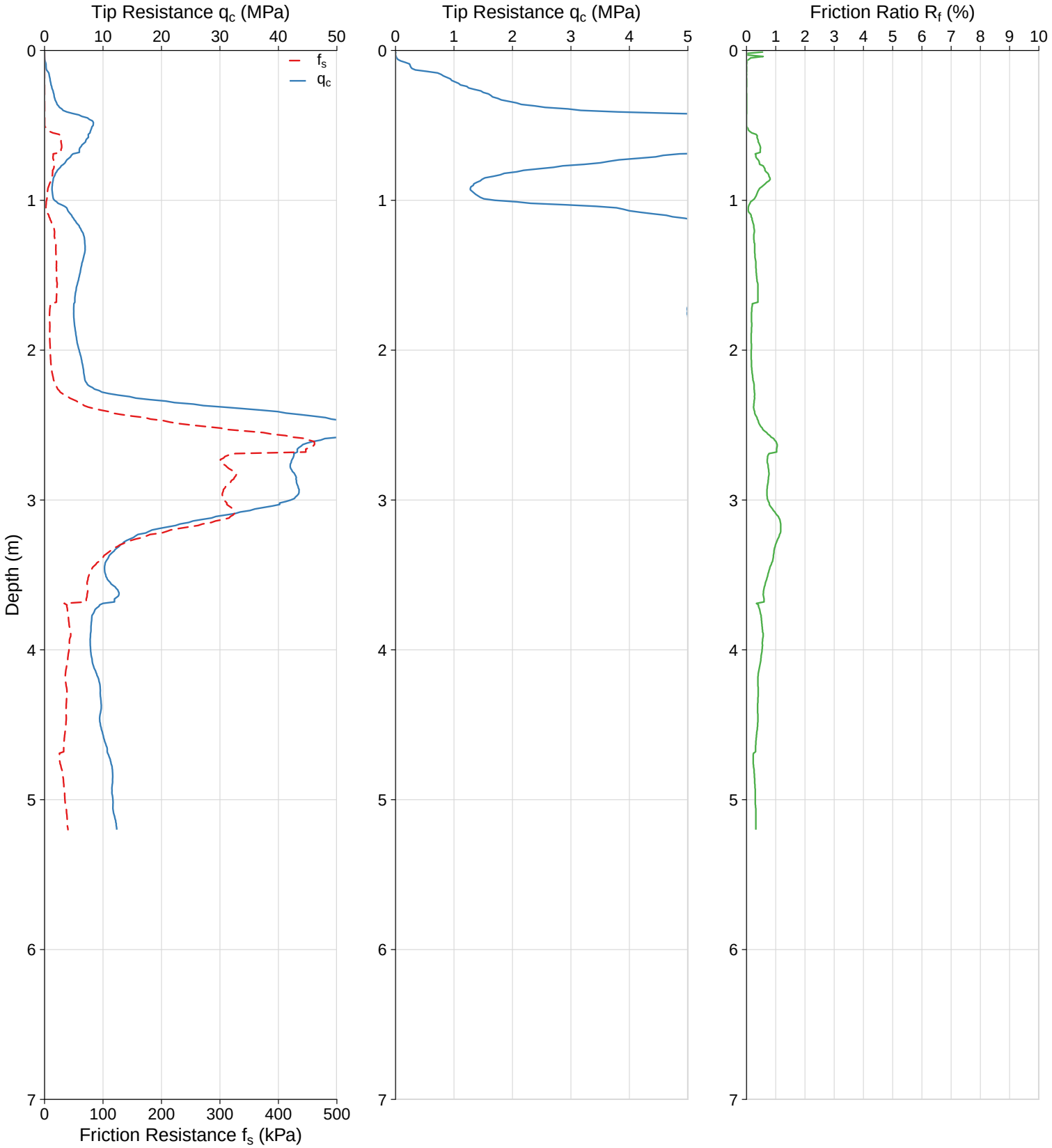
CPT ID:	CPT019	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 0.8m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

CONE PENETRATION TEST

CPT ID:	CPT020	**CLIENT:**	Galt Geotechnics
JOB NUMBER:	GBI25186-WAG250138	**PROJECT:**	Proposed Development
DATE:	05/09/2025	**LOCATION:**	High Wycombe



WATER:	Water at 0.8m	**CO-ORDS:**	
TERMINATION:	Target Depth	**ELEVATION:**	
DUMMY PROBE:		**PRE-DRILL:**	
RIG:	Pagani TG 73-200 200kN	**WASHER/DISC:**	Steel

Appendix C: Machine Borehole Logs

METHOD OF SOIL DESCRIPTION
BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG & SOIL CLASSIFICATION SYMBOLS

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

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

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

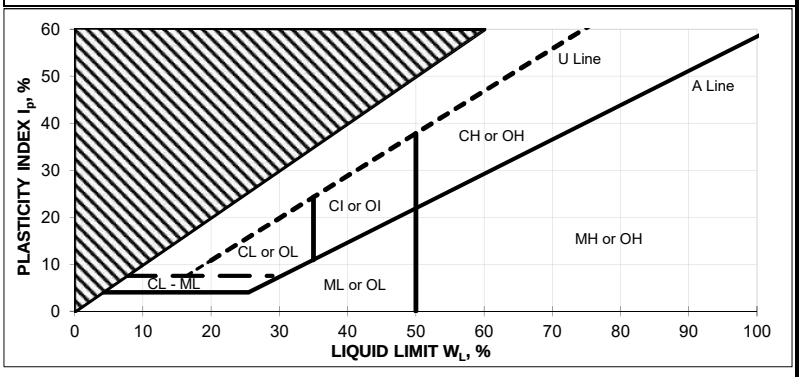
SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

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

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

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

PLASTICITY - MODIFIED CASAGRANDE CHART - AS1726-2017



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

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

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

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

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

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

EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS

METHOD OF DRILLING OR EXCAVATION

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

SUPPORT

T	Timbering

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

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

WATER

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

SAMPLING AND TESTING

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

ROCK CORE RECOVERY

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

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

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

BOREHOLE: BH01

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 28/08/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼				SP	TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics (0.1)	M		0	
								SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey, trace fines				
0.5											0.5	
1									M		1	
1.5							SP				1.5	
2											2	
2.5									W		2.5	
3								(3.0)			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 2.1 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH01
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH02

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 28/08/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼				SP	TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, brown, trace to with gravel, trace fines, trace organics			0	
								0.3				
0.5							SP/SM	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, with fines, trace to with organics	M		0.5	
								0.9				
1				Bulk	BH02-01		SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, low plasticity clay, trace gravel, trace organics	W		1	
1.5											1.5	
2							SC	pale grey mottled dark grey			2	
								2.3				
2.5							SC/CL	Sandy CLAY/Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey, low to medium plasticity clay			2.5	
3								3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 0.8 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH02
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH03

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼	Bulk	BH03-01		SP	TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace fines, trace organics	M		0	
								0.1 SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey-white, trace fines				
0.5											0.5	
									M			
1							SP				1	
1.5											1.5	
2								2.0 grey			2	
2.5							SP		W		2.5	
								2.6 trace coffee rock gravel				
3							SP	3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 1.6 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH03
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH04

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 28/08/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼	Bulk	BH04-01		SP/SM	TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey mottled brown, trace to with fines, with organics	M		0	No Guelph testing due to high ground water
								0.2				
							SP/SM	SAND: fine to medium grained, sub-angular to sub-rounded, dark grey/brown, trace to with fines, trace organics	W			
0.5											0.5	
								0.7				
							SC	Organic Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, dark brown, medium plasticity clay	W			
1											1	
								1.4				
1.5							SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, brown/grey, low plasticity clay	W		1.5	
								2.0				
2							SP-SC	Fine to coarse grained, sub-angular to sub-rounded, dark grey/white, with fines			2	
2.5											2.5	
3								3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 0.1 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH04
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH05

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 28/08/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼				SP	TOPSOIL: SAND: fine to medium grained, sub-angular to sub-rounded, dark grey/brown, trace fines, trace organics	M		0	
								0.3				
0.5							SP	SAND: fine to medium grained, sub-angular to sub-rounded, dark grey, trace fines	W		0.5	
1								1.3			1	

Borehole terminated at 1.3 m, due to collapse
Groundwater encountered at 0.6 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH05
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH06

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

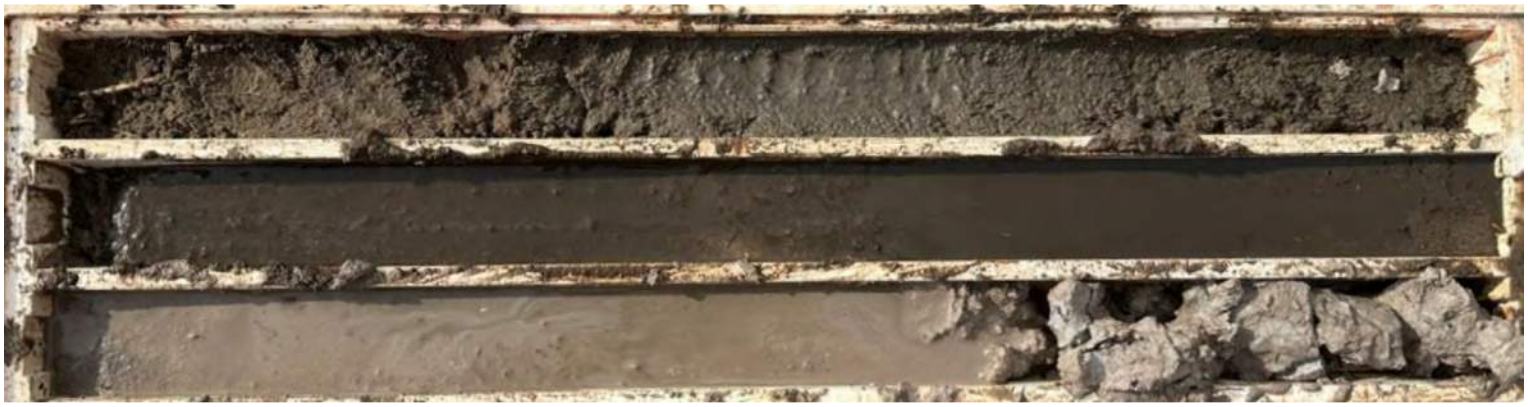
Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼	Bulk	BH06-01		SP	TOPSOIL: SAND: fine to medium grained, sub-angular to sub-rounded, brown-grey, trace fines, trace organics	M		0	
								0.3				
							SP/SC	SAND: fine to coarse grained, sub-angular to sub-rounded, brown-grey, with fines, trace organics				
0.5											0.5	
1									W		1	
1.5											1.5	
2								2.0			2	
							SP/SC	grey	W			
2.5								2.6			2.5	
							SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, grey, low plasticity clay	W			
3								3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 0.4 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH06
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH09

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

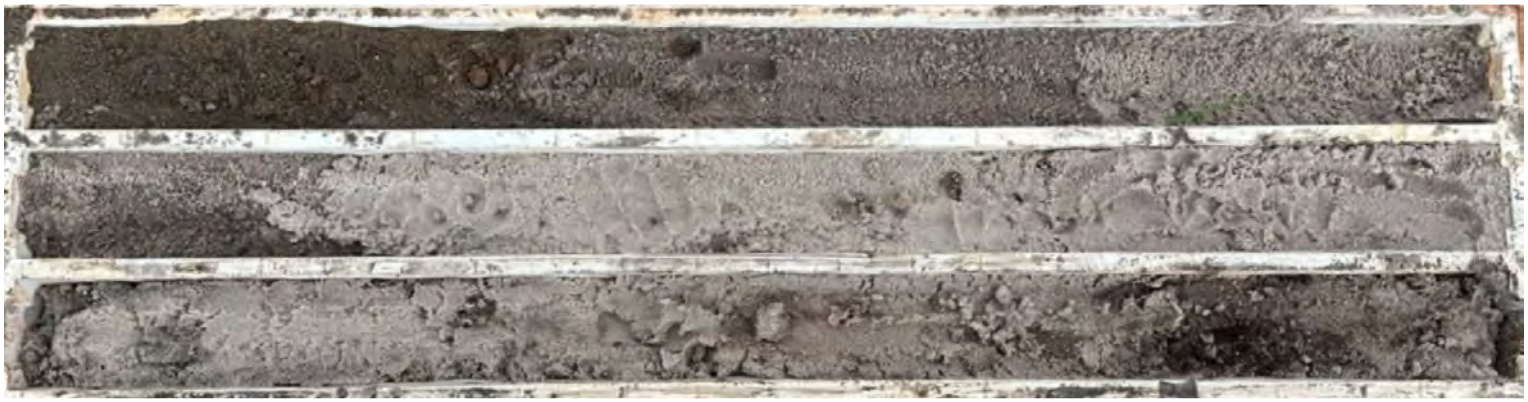
Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼				SP	FILL: TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, trace lateritic gravel, trace/with organics	M		0	
								0.3				
							SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace fines	M			
0.5											0.5	
1								1.3			1	
							SP	pale grey	M			
1.5											1.5	
								2.0				
2							SP	pale grey mottled dark grey	W		2	
2.5											2.5	
3								3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 1.8 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

Galt GEOTECHNICS

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH09
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH10

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: GBI
Drill Rig: EVH Scout 1750
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: KS
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Consistency Density	Depth (m)	Additional Remarks
0	AD/V		▼				SP	TOPSOIL: SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace fines, trace organics	M		0	
								0.3				
0.5								SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey/white, trace fines			0.5	
1				Bulk	BH10-01				M		1	
1.5							SP				1.5	
2									W		2	
2.5											2.5	
3								3.0			3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 1.6 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH10
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH11

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: DPP
Drill Rig: 7822DT
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Additional Remarks
				ASS	BH11/0.00			Grass 0.1			
				ASS	BH11/0.25		SP	SAND: fine to medium grained, sub-angular to sub-rounded, dark brown/grey, trace organics, with fine to coarse grained gravel (up to 0.6 m) trace fines			
0.5				ASS	BH11/0.50			0.6	M	0.5	
				ASS	BH11/0.75		SP	becomes dark grey			
1			▼	ASS	BH11/1.00			1.1		1	
				ASS	BH11/1.25		SP	becomes fine to coarse grained, pale grey			
1.5	AD/V	E		ASS	BH11/1.50					1.5	
				ASS	BH11/1.75						
2				ASS	BH11/2.00				W	2	
				ASS	BH11/2.25						
2.5				ASS	BH11/2.50					2.5	
				ASS	BH11/2.75						
3				ASS	BH11/3.00			3.0		3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 1.0 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH11
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE/MONITORING WELL: BH12/MW01

Project Name: WAG250138-01
Client Name: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres,

Contractor: DPP
Drill Rig: 7822DT
Hole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Checked By: TM
Date Checked: 22/09/2025

Drill Method	Depth (m)	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Well	Additional Remarks
AD/V	0	E	▼	ASS	BH12/MW01/0.00		PT	PEAT: Fiberous, spongy, organic odour, dark brown, with sand	M	0	SUP; Concrete; Bentonite Solid	SUP: +0.68 Solid: 0-0.5 Screen: 0.5-3.0 Concrete:0-0.1 Bentonite: 0.1-0.4 Gravel: 0.4-3.0
				ASS	BH12/MW01/0.25							
	0.5			ASS	BH12/MW01/0.50			0.6		0.5		
				ASS	BH12/MW01/0.75		SP	Organic SAND: fine to medium grained, sub-angular to sub-rounded, dark brown/grey				
	1			ASS	BH12/MW01/1.00					1		
				ASS	BH12/MW01/1.25			1.4				
	1.5			ASS	BH12/MW01/1.50		SP	SAND: fine to medium grained, sub-angular to sub-rounded, pale brown/grey, trace fines	W	1.5	Gravel; Screen	
				ASS	BH12/MW01/1.75							
	2			ASS	BH12/MW01/2.00					2		
				ASS	BH12/MW01/2.25							
	2.5			ASS	BH12/MW01/2.50			2.6		2.5		
				ASS	BH12/MW01/2.75		SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, blue grey, low plasticity clay				
	3			ASS	BH12/MW01/3.00			3.0		3		

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 1.0 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH12/MW01
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH13

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: DPP
Drill Rig: 7822DT
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Additional Remarks
0	AD/V	E	▼	ASS	BH13/0.00			Grass (0.1)	M	0	
				ASS	BH13/0.25		SP	SAND: fine to medium grained, sub-angular to sub-rounded, dark brown/grey, trace organics, trace fines			
0.5				ASS	BH13/0.50					0.5	
				ASS	BH13/0.75						
1				ASS	BH13/1.00				W	1	
				ASS	BH13/1.25						
1.5				ASS	BH13/1.50					1.5	
				ASS	BH13/1.75		SP	becomes fine to coarse grained (1.7)			
2				ASS	BH13/2.00			becomes pale brown/grey (2.0)		2	
				ASS	BH13/2.25						
2.5				ASS	BH13/2.50		SP			2.5	
				ASS	BH13/2.75						
3				ASS	BH13/3.00			(3.0)		3	

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 0.9 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH13
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE/MONITORING WELL: BH14/MW03

Project Name: WAG250138-01
Client Name: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres,

Contractor: DPP
Drill Rig: 7822DT
Hole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Checked By: TM
Date Checked: 22/09/2025

Drill Method	Depth (m)	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Well	Additional Remarks
AD/V	0	E	▼	ASS	BH14/MW03/0.00		SP	Gravelly SAND: sub-angular to sub-rounded, fine to medium grained sand, brown, rounded to sub-rounded, fine to medium grained gravel, trace fines	M	0	SUP Concrete	SUP: +0.65 Solid: 0-0.5 Screen: 0.5-3.0 Concrete:0-0.1 Bentonite: 0.1-0.5 Gravel: 0.5-3.0
				ASS	BH14/MW03/0.25						Solid Bentonite	
	0.5			ASS	BH14/MW03/0.50					0.5		
				ASS	BH14/MW03/0.75			0.9				
	1			ASS	BH14/MW03/1.00		SP	SAND: fine to medium grained, sub-angular to sub-rounded, dark grey, trace gravel (up to 1.5 m), trace fines		1		
				ASS	BH14/MW03/1.25							
	1.5	E		ASS	BH14/MW03/1.50			1.5		1.5		
				ASS	BH14/MW03/1.75		SP	becomes brown	W		Gravel Screen	
	2			ASS	BH14/MW03/2.00			2.0		2		
				ASS	BH14/MW03/2.25		CL	Sandy CLAY: low plasticity, blue grey, sub-angular to sub-rounded, fine to coarse grained sand				
	2.5			ASS	BH14/MW03/2.50					2.5		
				ASS	BH14/MW03/2.75							
	3			ASS	BH14/MW03/3.00			3.0		3		

Borehole terminated at 3.0 m, target depth
Groundwater encountered at 0.28 m depth

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH14/MW03
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE: BH15

Project Name: WAG250138-01
Client: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres, High Wycombe

Contractor: DPP
Drill Rig: 7822DT
Borehole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Date Checked: 22/09/2025
Checked By: TM

Depth (m)	Drill Method	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Additional Remarks
0	AD/V	E	▼	ASS	BH15/0.00		SP	SAND: fine to medium grained, sub-angular to sub-rounded, brown, trace organics, trace fines	M	0.5	
				ASS	BH15/0.25						
				ASS	BH15/0.50						
								0.7			
				ASS	BH15/0.75		SP	becomes grey			
1				ASS	BH15/1.00					1	
				ASS	BH15/1.25						
1.5				ASS	BH15/1.50					1.5	
				ASS	BH15/1.75						
								1.8			
								becomes fine to coarse grained	W		
2				ASS	BH15/2.00					2	
				ASS	BH15/2.25		SP				
2.5				ASS	BH15/2.50					2.5	
				ASS	BH15/2.75						
3				ASS	BH15/3.00			3.0		3	
								Borehole terminated at 3.0 m, target depth Groundwater encountered at 1.1 m depth			

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH15
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

BOREHOLE/MONITORING WELL: BH16/MW02

Project Name: WAG250138-01
Client Name: Dynamic Planning & Developments
Project: LSP Amendment
Location: Hatch Court & Stirling Cres,

Contractor: DPP
Drill Rig: 7822DT
Hole Diameter: 90 mm
Inclination: -90

Date: 05/09/2025
Logged By: SB
Checked By: TM
Date Checked: 22/09/2025

Drill Method	Depth (m)	Penetration Resistance	Water Level	Sample Information: Sample Type	Sample Information: Sample Number	Graphic Log	Soil Class	Soil/Rock Material Description	Moisture Condition	Depth (m)	Well	Additional Remarks
AD/V	0	E	▼	ASS	BH16/MW02/0.00		SP	SAND: fine to medium grained, sub-angular to sub-rounded, brown, trace rootlets (up to 0.3 m), trace fines	M	0	SUP, Concrete	SUP: +0.62 Solid: 0-0.5 Screen: 0.5-3.0 Concrete:0-0.1 Bentonite: 0.1-0.5 Gravel: 0.5-3.0
				ASS	BH16/MW02/0.25						Solid, Bentonite	
	0.3							becomes grey				
	0.5			ASS	BH16/MW02/0.50		SP			0.5		
	0.7							becomes fine to coarse grained				
				ASS	BH16/MW02/0.75							
	1			ASS	BH16/MW02/1.00					1		
				ASS	BH16/MW02/1.25		SP					
	1.5			ASS	BH16/MW02/1.50					1.5		
				ASS	BH16/MW02/1.75				W		Gravel Screen	
	2			ASS	BH16/MW02/2.00					2		
	2.0							Gravelly SAND: sub-angular to sub-rounded, fine to medium grained, dark brown, angular to subangular, fine to coarse grained gravel, with coffee rock, trace/with fines				
				ASS	BH16/MW02/2.25							
	2.5			ASS	BH16/MW02/2.50		SP-SM			2.5		
				ASS	BH16/MW02/2.75							
	3			ASS	BH16/MW02/3.00					3		
	3.0							Borehole terminated at 3.0 m, target depth Groundwater encountered at 1.15 m depth				

Notes: -



Depth Range: 0.0 - 3.0 m

PROJECT	WAG250138-01	**PROJECT NO.**	LSP Amendment
CLIENT	Dynamic Planning & Developments	**LOG:**	BH16/MW02
LOCATION	High Wycombe, WA	**FIGURE NO.**	Appendix

Appendix D: Guelph Permeameter Test Results

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH01/G01

$$K = \frac{4.4Q\left[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}\right]}{2\ \pi H^2}$$

Spreadsheet Legend

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	Comment field
	Field not used
	Fixed field

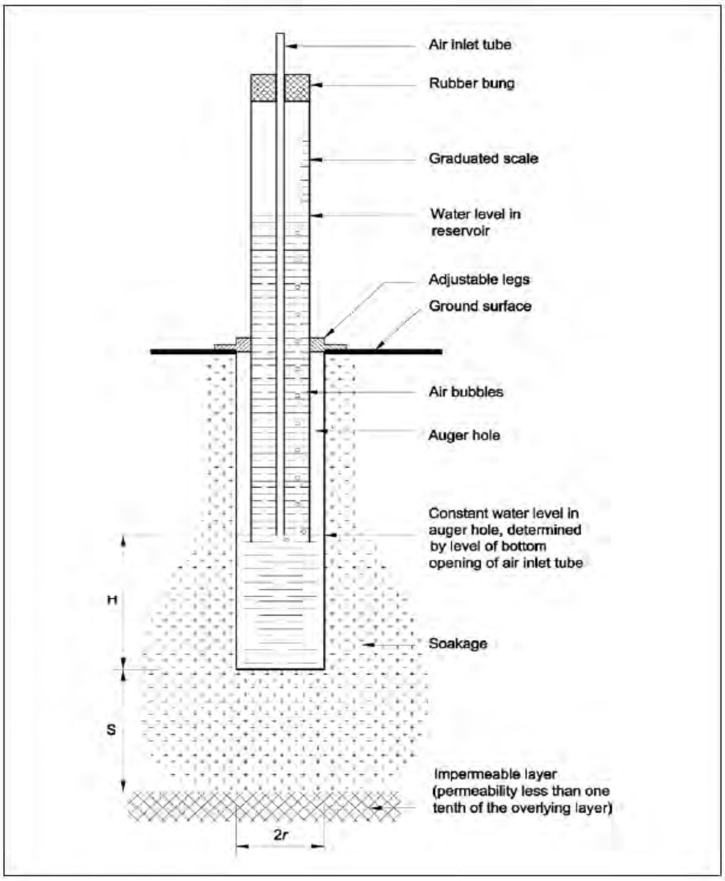
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	38	cm
H	Head of water above base	8	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	52		
0.5	40	12.00	24.00
1	30	10.00	20.00
1.5	20.5	9.50	19.00
2	10	10.50	21.00
2.5	0	10.00	20.00
AVERAGE - LAST 5 READINGS			20.80

Calculation

Steady State Flow	20.80	cm/min
Flow from reservoir (Q)	755.04	cm^3/min
K_{sat}	1.737	cm/min
K_{sat}	2.894E-04	m/s
K_{sat}	**25.01**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH02/G02

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

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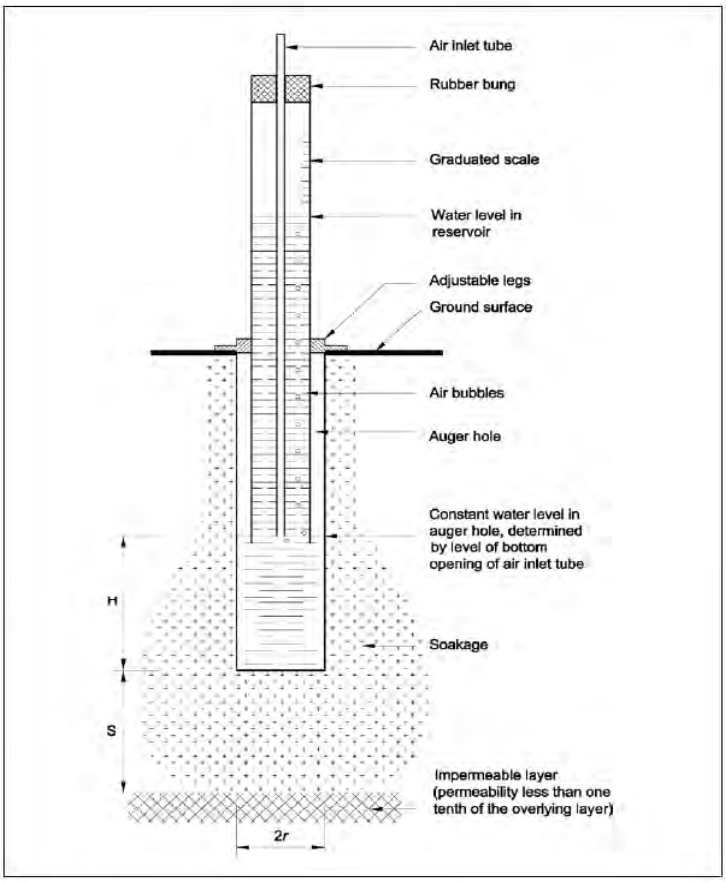
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	42	cm
H	Head of water above base	11	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	46.5		
2	45.5	1.00	0.50
4	42.5	3.00	1.50
6	41	1.50	0.75
8	39.5	1.50	0.75
10	36	3.50	1.75
12	34	2.00	1.00
14	32	2.00	1.00
16	29.8	2.20	1.10
AVERAGE - LAST 5 READINGS			1.12

Calculation

Steady State Flow	1.12	cm/min
Flow from reservoir (Q)	40.66	cm^3/min
K_{sat}	0.065	cm/min
K_{sat}	1.091E-05	m/s
K_{sat}	**0.94**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH03/G03

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

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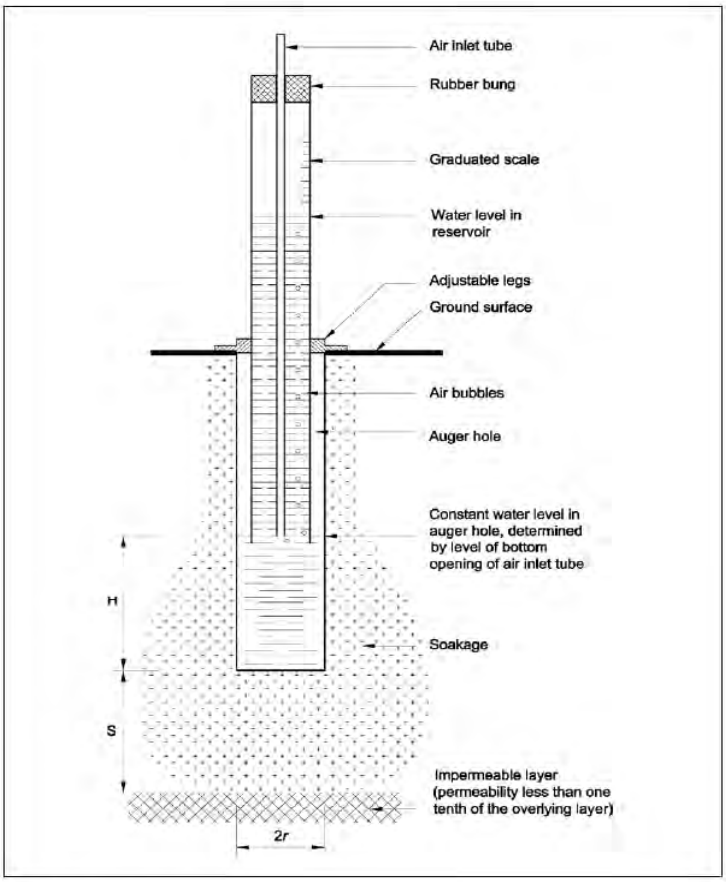
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	57	cm
H	Head of water above base	23	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	71		
0.33	66	5.00	15.15
0.66	59	7.00	21.21
1.33	45	14.00	20.90
1.66	38	7.00	21.21
1.99	28	10.00	30.30
2.33	21	7.00	20.59
2.66	11	10.00	30.30
2.99	1	10.00	30.30
		AVERAGE - LAST 5 READINGS	26.54

Calculation

Steady State Flow	26.54	cm/min
Flow from reservoir (Q)	963.47	cm^3/min
K_{sat}	0.628	cm/min
K_{sat}	1.047E-04	m/s
K_{sat}	**9.05**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH05/G05

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

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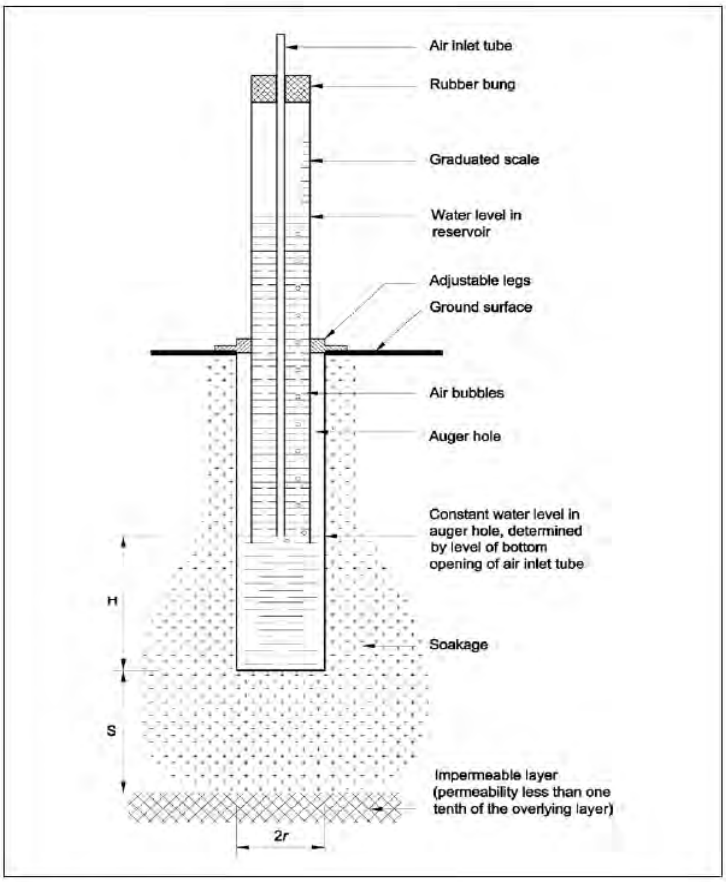
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	44	cm
H	Head of water above base	14	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	53.5		
5	49	4.50	0.90
10	45	4.00	0.80
15	41	4.00	0.80
20	38	3.00	0.60
25	35	3.00	0.60
30	31.5	3.50	0.70
AVERAGE - LAST 5 READINGS			0.70

Calculation

Steady State Flow	0.70	cm/min
Flow from reservoir (Q)	25.41	cm^3/min
K_{sat}	0.031	cm/min
K_{sat}	5.139E-06	m/s
K_{sat}	**0.44**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH09/G09

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

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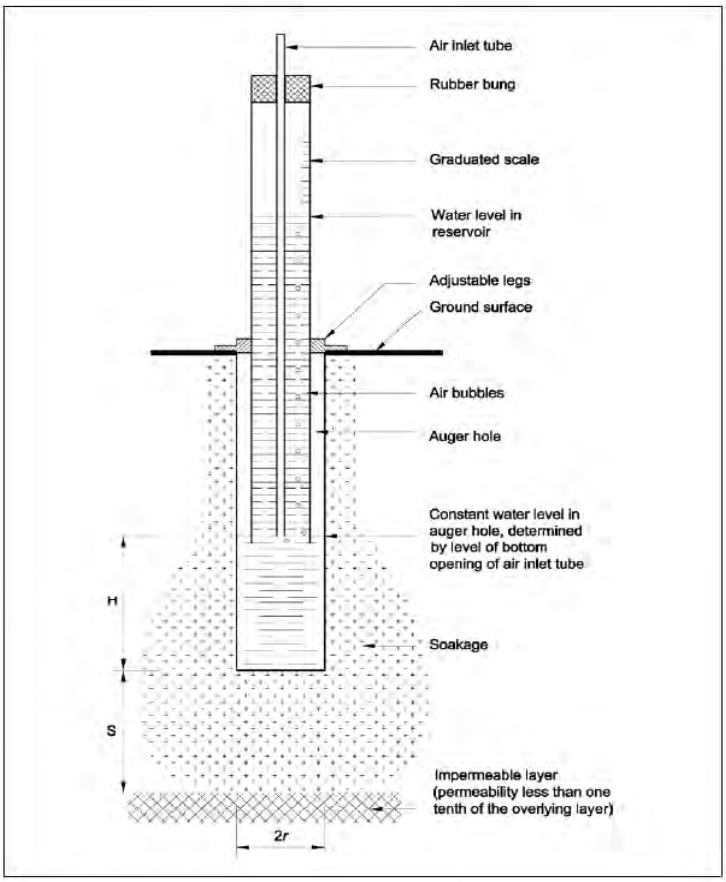
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	52	cm
H	Head of water above base	16	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	72.5		
1	62	10.50	10.50
2	52.5	9.50	9.50
3	46	6.50	6.50
4	38	8.00	8.00
5	28.5	9.50	9.50
6	23.6	4.90	4.90
7	14.5	9.10	9.10
8	8	6.50	6.50
9	1.5	6.50	6.50
AVERAGE - LAST 5 READINGS			7.30

Calculation

Steady State Flow	7.30	cm/min
Flow from reservoir (Q)	264.99	cm^3/min
K_{sat}	0.274	cm/min
K_{sat}	4.559E-05	m/s
K_{sat}	**3.94**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH10/G10

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

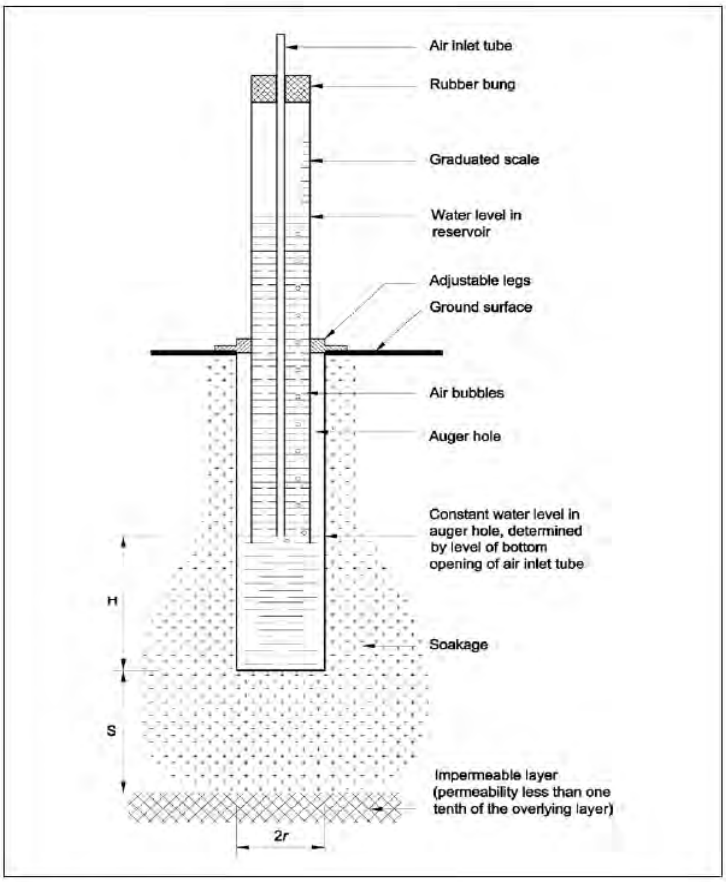
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	47	cm
H	Head of water above base	11	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	58		
1	53	5.00	5.00
2	50	3.00	3.00
3	44	6.00	6.00
4	40	4.00	4.00
5	36	4.00	4.00
6	32	4.00	4.00
AVERAGE - LAST 5 READINGS			4.20

Calculation

Steady State Flow	4.20	cm/min
Flow from reservoir (Q)	152.46	cm^3/min
K_{sat}	0.245	cm/min
K_{sat}	4.090E-05	m/s
K_{sat}	**3.53**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Job No:	WAG250138-01
Client:	DPD
Project:	LSP Amendment
Location:	Hatch Crt and Stirling Crs
	High Wycombe
Test Name	BH15/G07

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

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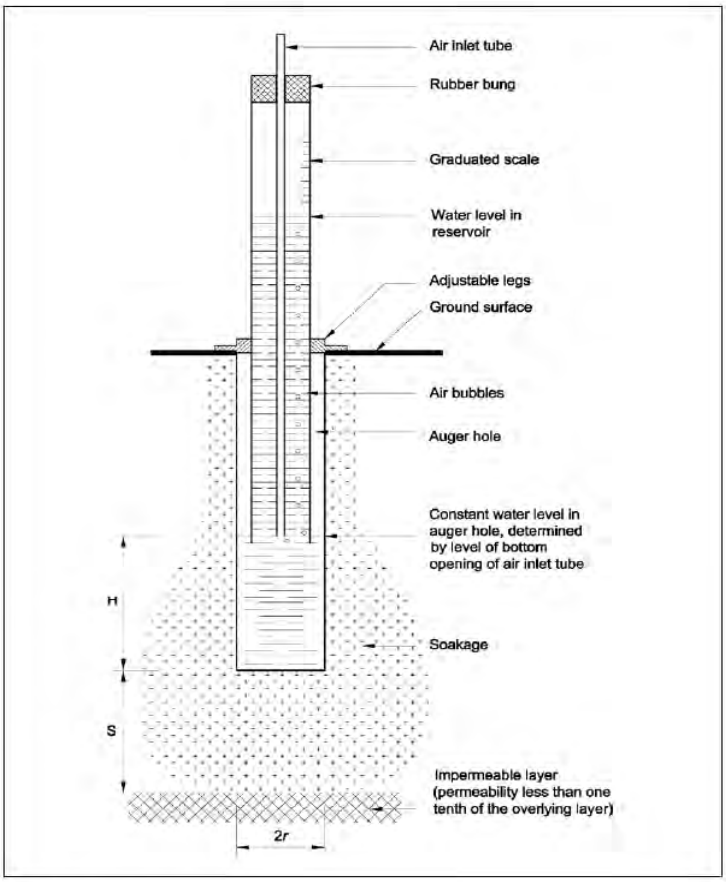
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	53	cm
H	Head of water above base	16	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	60		
0.5	48	12.00	24.00
1	38	10.00	20.00
1.5	31	7.00	14.00
2	20	11.00	22.00
2.5	12	8.00	16.00
3	2.5	9.50	19.00
AVERAGE - LAST 5 READINGS			18.20

Calculation

Steady State Flow	18.20	cm/min
Flow from reservoir (Q)	660.66	cm^3/min
K_{sat}	0.682	cm/min
K_{sat}	1.137E-04	m/s
K_{sat}	**9.82**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Appendix E: Water Balance

WA Site & Soil Evaluation
Irrigation area sizing

Please read the attached notes before using this spreadsheet

Water Balance for Zero Storage

Site Address:	**Hatch Court and Stirling Crescent, High Wycombe WA**		
Date:	Wednesday, 24 September 2025	**Assessor:**	Tyrone Mardesic

INPUT DATA

Design Wastewater Flow	Q	5,000	L/day	Based on maximum potential occupancy and derived from the Supplement to Regulation 29 and Schedule 9 - Wastewater system loading rates
Design Irrigation Rate	DIR	50.0	mm/day	Based on soil texture class/permeability and derived from Table M1 of AS/NZS 1547:2012
Nominated Land Application Area	L	108	m^2	[1]
Crop Factor	C	0.8-1.0	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type[2]
Rainfall Runoff Factor	RF	1.0	unitless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff
Mean Monthly Rainfall Data		Midland		BoM Station and number
Mean Monthly Pan Evaporation Data		Upper Swan		BoM Station and number or data from the Evaporation Data for Western Australia Report (https://researchlibrary.agric.wa.gov.au/cgi/viewcontent.cgi?article=1058&context=rmtr

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	**365**
Rainfall	R		mm/month	10	13.1	16.9	40.3	100.1	159.1	162	122.1	74.1	46.7	22.3	10.7	**777.4**
Evaporation	E		mm/month	327	281	241	136	89	63	60	87	110	161	221	303	**2079**
Crop Factor	C		unitless	1.00	1.00	0.90	0.90	0.80	0.80	0.80	0.80	0.90	1.00	1.00	1.00	
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	327	281	217	122	71	50	48	70	99	161	221	303	**1970.5**
Percolation	B	DIRxD	mm/month	1550.0	1400	1550.0	1500.0	1550.0	1500.0	1550.0	1550.0	1500.0	1550.0	1500.0	1550.0	**18250.0**
Outputs		ET+B	mm/month	1877.0	1681	1766.9	1622.4	1621.2	1550.4	1598.0	1619.6	1599.0	1711.0	1721.0	1853.0	**20220.5**
INPUTS																
Retained Rainfall	RR	RxRF	mm/month	10	13.1	16.9	40.3	100.1	159.1	162	122.1	74.1	46.7	22.3	10.7	**777.4**
Applied Effluent	W	(QxD)/L	mm/month	1435.2	1296.3	1435.2	1388.9	1435.2	1388.9	1435.2	1435.2	1388.9	1435.2	1388.9	1435.2	**16898.1**
Inputs		RR+W	mm/month	1445.2	1309.4	1452.1	1429.2	1535.3	1548.0	1597.2	1557.3	1463.0	1481.9	1411.2	1445.9	**17675.5**
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-431.8	-371.6	-314.8	-193.2	-85.9	-2.4	-0.8	-62.3	-136.0	-229.1	-309.8	-407.1	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage for Nominated Area	N		mm	0.00												
	V	NxL	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	83	84	89	95	102	108	108	104	98	93	88	84	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: 108 m^2

CELLS

	Please enter data in blue cells
XX	Enter available Land Application Area
XX	Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS

NOTES

[1] This value should be the largest of the following: land application area required based on the most limiting nutrient balance or minimum area required for zero storage

[2] Values selected are suitable for grass in WA

Appendix F: Laboratory Test Results

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15432_1_PI
Project:	Proposed HCLIA	*Sample No.*	WG25.15432
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH02 (1 - 1.5m)	*Date Tested:*	16/09/2025

TEST RESULTS - Consistency Limits (Casagrande)

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

AS 1289.3.1.1	**Liquid Limit (%)**	**28**
AS 1289.3.2.1	**Plastic Limit (%)**	**23**
AS 1289.3.3.1	**Plasticity Index (%)**	**5**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**2.5**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:



Name: Connor Budimir

Date: 17/September/2025

NATA WORLD RECOGNISED ACCREDITATION

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

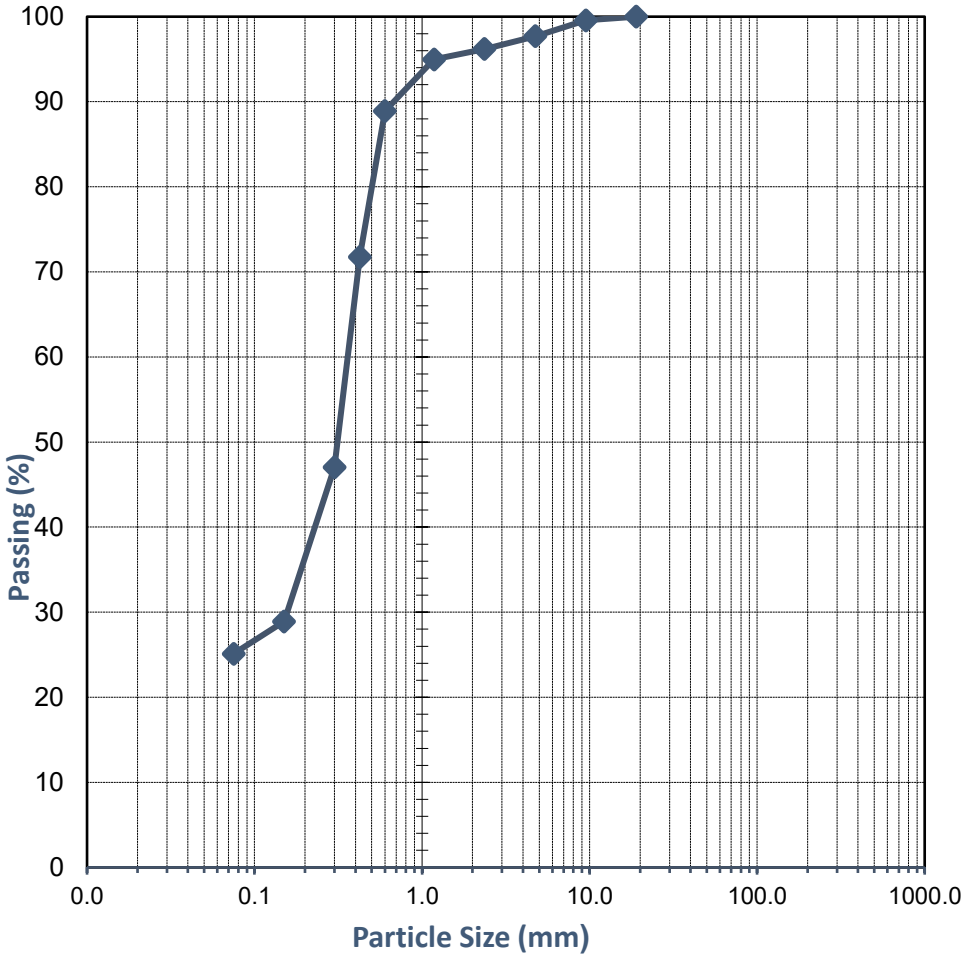
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15432_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15432
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH02 (1 - 1.5m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	98
2.36	96
1.18	95
0.600	89
0.425	72
0.300	47
0.150	29
0.075	25



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

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SOIL | AGGREGATE | CONCRETE | CRUSHING

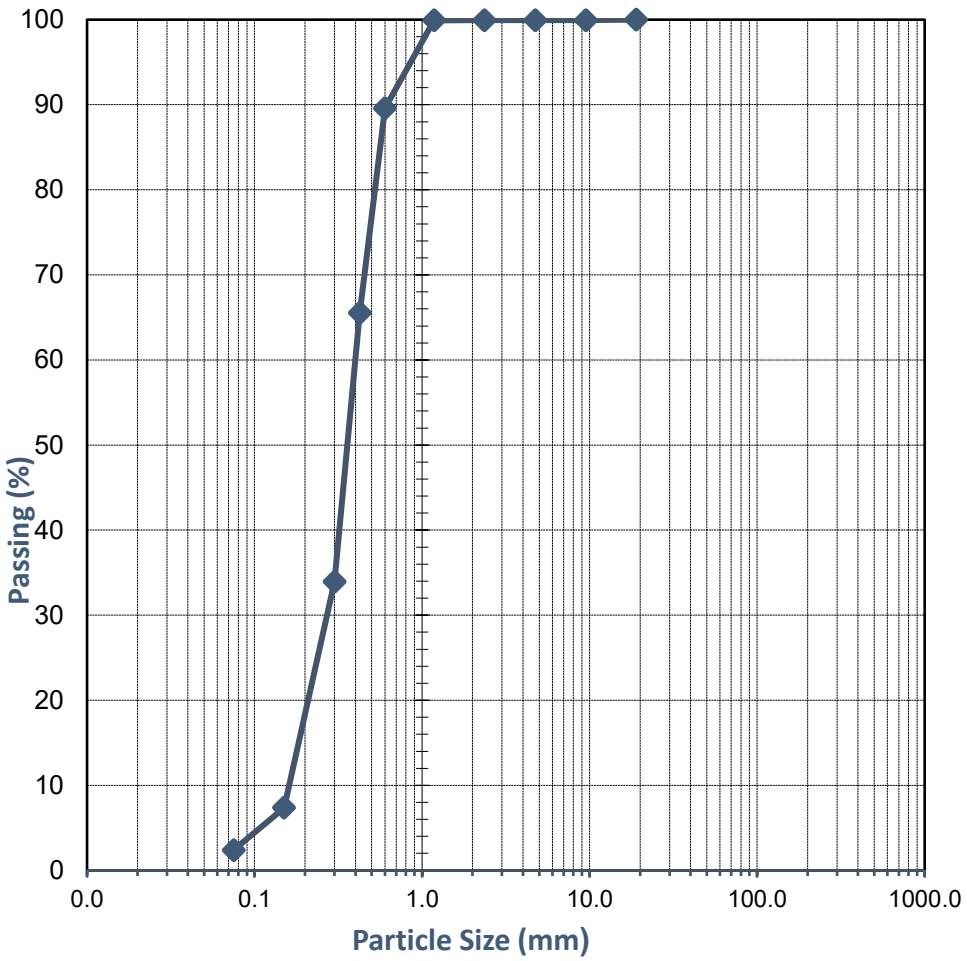
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15433_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15433
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH03 (1.5 - 1.8m)	*Date Tested:*	15/09 - 17/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	100
2.36	100
1.18	100
0.600	90
0.425	66
0.300	34
0.150	7
0.075	2



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.2, 3.2.1, 3.3.1 & 3.4.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15434_1_PI
Project:	Proposed HCLIA	*Sample No.*	WG25.15434
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH04 (1 - 1.4m)	*Date Tested:*	16/09/2025

TEST RESULTS - Consistency Limits (Casagrande)

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

AS 1289.3.1.2	**Liquid Limit (%)**	**46**
AS 1289.3.2.1	**Plastic Limit (%)**	**40**
AS 1289.3.3.1	**Plasticity Index (%)**	**6**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**3.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen**	**-**

Approved Signatory:

Name: Danielle Reynolds

Date: 18/September/2025

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SOIL | AGGREGATE | CONCRETE | CRUSHING

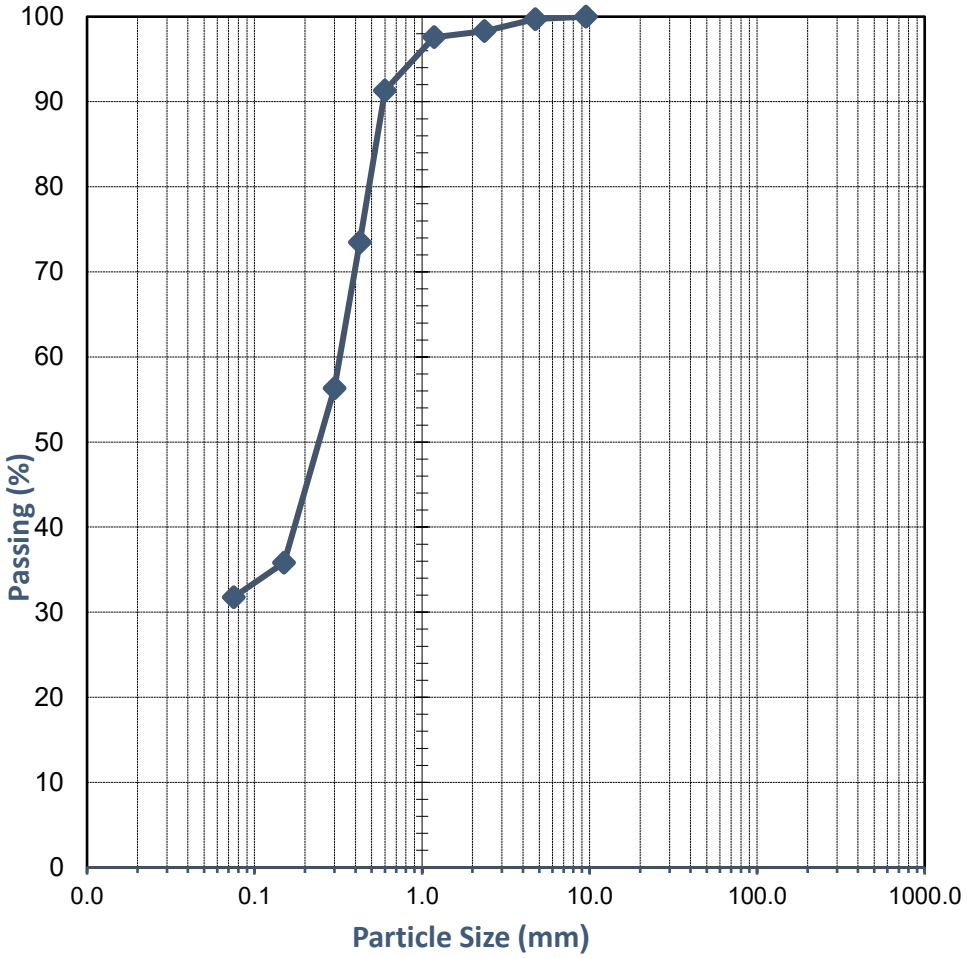
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15434_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15434
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH04 (1 - 1.4m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	98
1.18	98
0.600	91
0.425	73
0.300	56
0.150	36
0.075	32



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

NATA **Accreditation No. 20599**
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

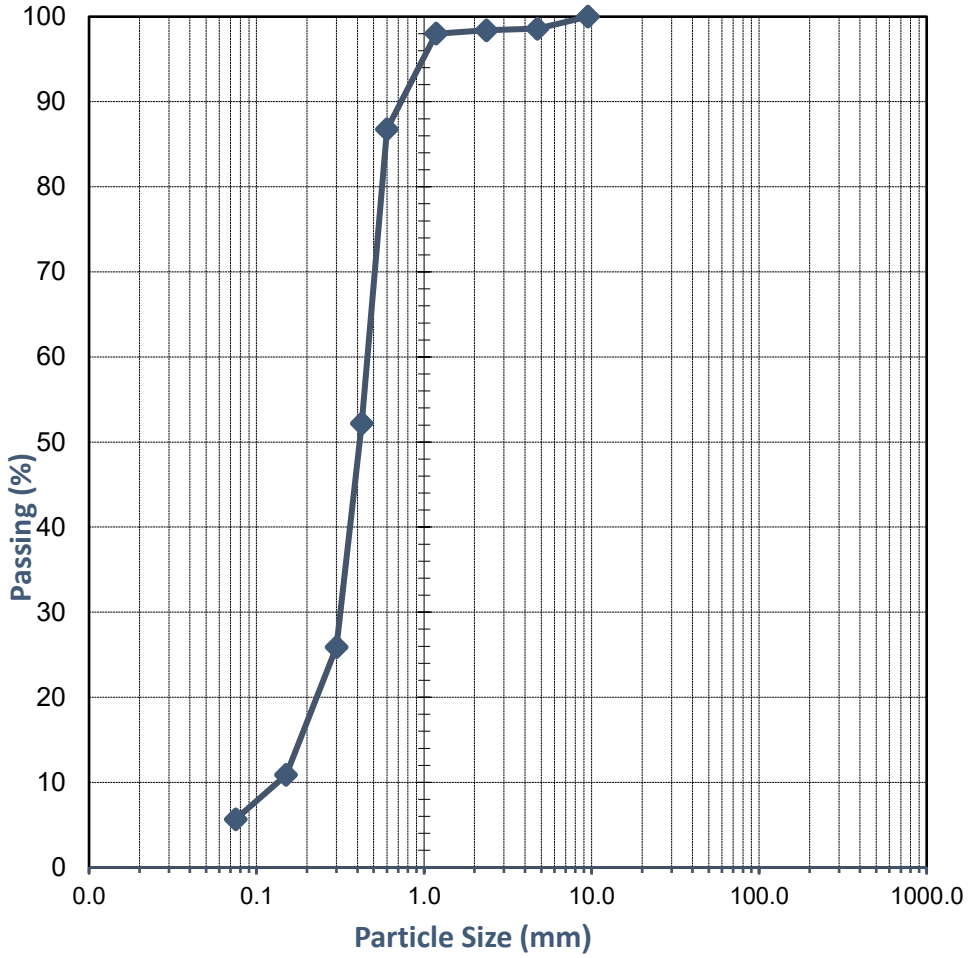
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15435_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15435
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH06 (0.6 - 1.0m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	99
2.36	98
1.18	98
0.600	87
0.425	52
0.300	26
0.150	11
0.075	6



Comments:

Approved Signatory:

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Date: 17/September/2025

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SOIL | AGGREGATE | CONCRETE | CRUSHING

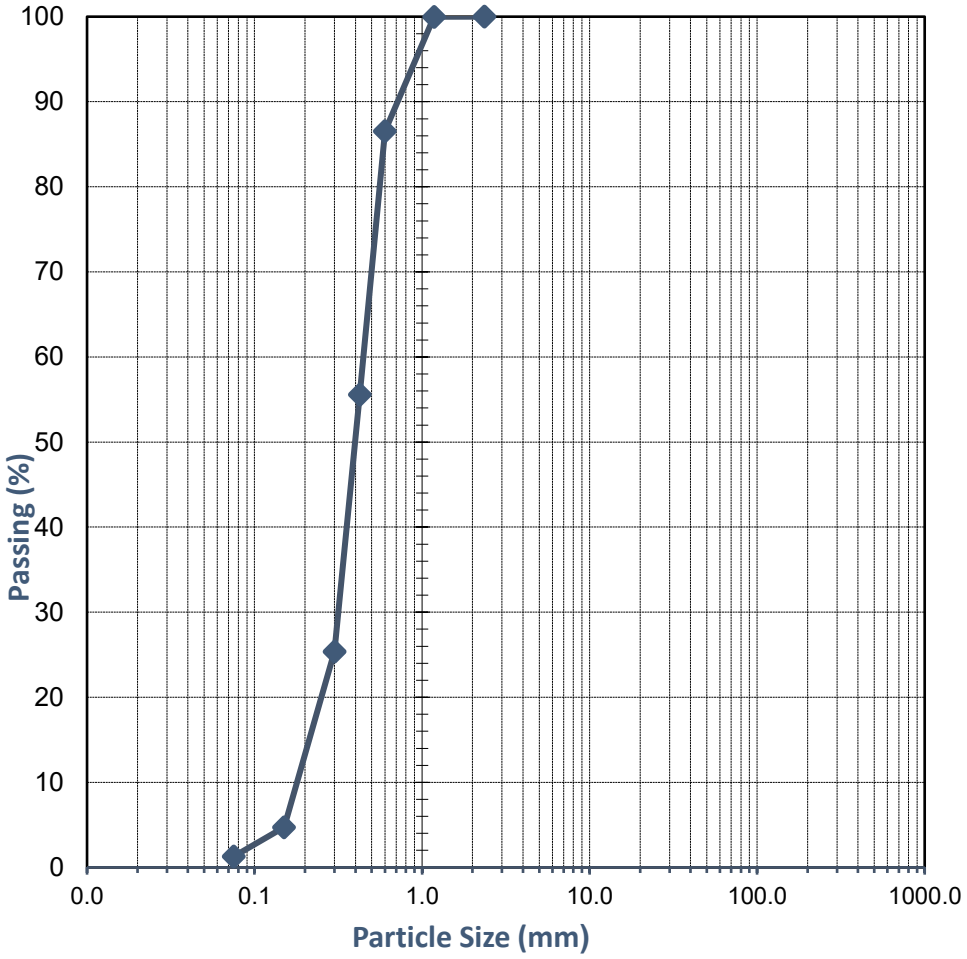
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15436_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15436
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	BH10 (1 - 1.5m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	87
0.425	56
0.300	25
0.150	5
0.075	1



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

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SOIL | AGGREGATE | CONCRETE | CRUSHING

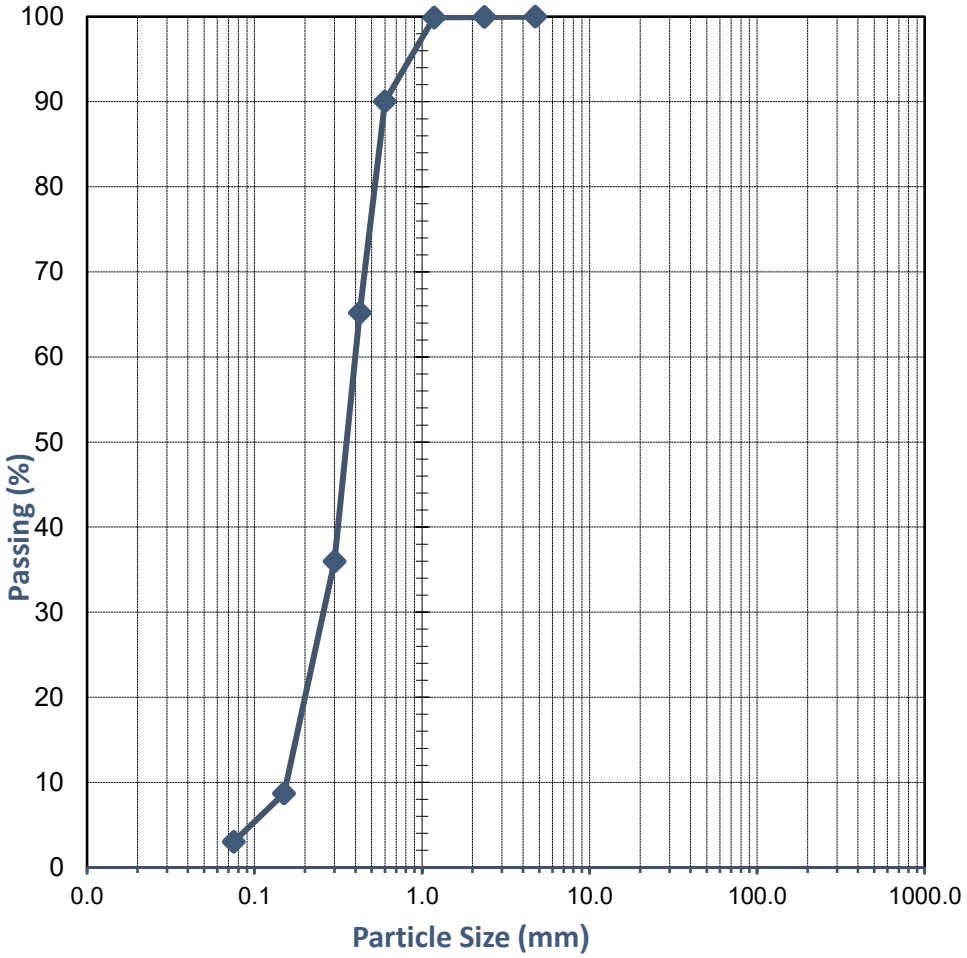
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15437_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15437
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	G07 (0.5 - 0.6m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	100
2.36	100
1.18	100
0.600	90
0.425	65
0.300	36
0.150	9
0.075	3



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

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SOIL | AGGREGATE | CONCRETE | CRUSHING

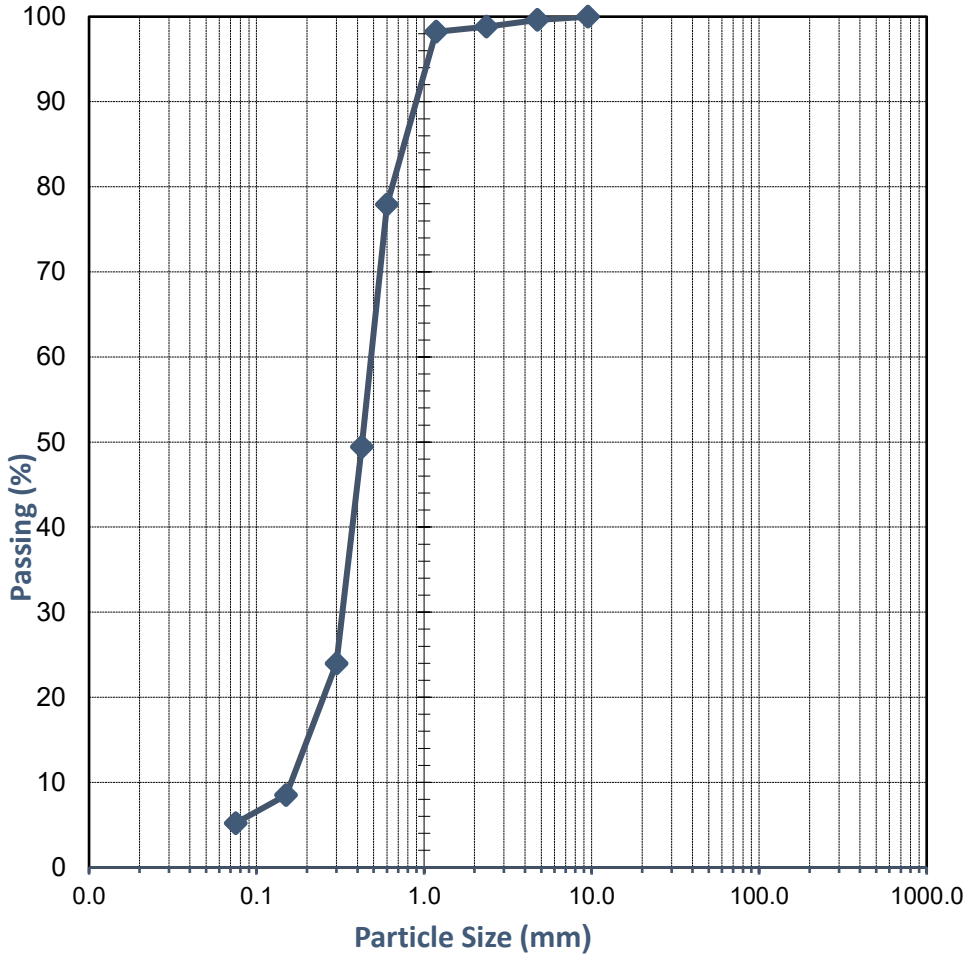
TEST REPORT - AS 1289.3.6.1

Client:	Dynamic Planning and Developments	*Ticket No.*	S18630
Client Address:	-	*Report No.*	WG25.15438_1_PSD
Project:	Proposed HCLIA	*Sample No.*	WG25.15438
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	5/09/2025
Sample Identification:	G10 (0.4 - 0.5m)	*Date Tested:*	15/09 - 16/09/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	99
1.18	98
0.600	78
0.425	49
0.300	24
0.150	8
0.075	5



Comments:

Approved Signatory:

Name: Connor Budimir

Date: 17/September/2025

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.4.1.1

Client:	Dynamic Planning and Developments	*Ticket No.*	C597
Client Address:	-	*Report No.*	WC25.779-782_1_OMC
Project:	Proposed HCLIA	*Sample No.*	WC25.779-782
Location:	Hatch Court and Stirling Crescent, High Wycombe	*Date Sampled:*	Not Specified
Sample Identification:	Various - see below	*Date Tested:*	16/09/2025 - 17/09/2025

TEST RESULTS - Organic Matter Content of Soil - Normal Method

Sampling Method: **Sampled by Client, Tested as Received**

Sample Number	Sample Identification	Material Description	Organic Matter (%)
WC25.779	BH04 (1 - 1.4m)	Sandy Silt	10.7
WC25.780	BH06 (0.6 - 1.0m)	Sand	1.2
WC25.781	G07 (0.5 - 0.6m)	Sand	0.4
WC25.782	G10 (0.4 - 0.5m)	Sand	1.1

Comments:

Approved Signatory:

Name: Courtney Watt

Date: 18/September/2025

NATA WORLD RECOGNISED ACCREDITATION

Accreditation No. 20599
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Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
7-11 Catalano Road Canning Vale WA 6155
ph +61 8 9317 2505
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PGI0989

Client Details

Client	Western Geotechnical & Laboratory Services
Contact	Laboratory
Address	235 Bank Street, WELSHPOOL, WA, 6101

Sample Details

Your Reference	S18630 / Proposed HCLIA
Number of Samples	5 Soil
Date Samples Received	12/09/2025
Date Instructions Received	12/09/2025

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 soils and on an as received basis for other matrices.

Report Details

Date Final Results Expected	23/09/2025
Date of Issue	19/09/2025

NATA Accreditation Number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Lien Tang, Assistant Operations Manager Lucas Yii, Inorganics Team Leader Varsha Ho Wing, Inorganics and Metals Supervisor
Laboratory Manager	Michael Kubiak

Certificate of Analysis PGI0989

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PGI0989-01	WG25.15432 / BH02 (1-1.5m)	Soil	12/09/2025	12/09/2025
PGI0989-02	WG25.15434 / BH04 (1-1.4m)	Soil	12/09/2025	12/09/2025
PGI0989-03	WG25.15435 / BH06 (0.6-1.0m)	Soil	12/09/2025	12/09/2025
PGI0989-04	WG25.15437 / G07 (0.5-0.6m)	Soil	12/09/2025	12/09/2025
PGI0989-05	WG25.15438 / G10 (0.4-0.5m)	Soil	12/09/2025	12/09/2025

Certificate of Analysis PGI0989

Inorganics - General Physical Parameters (Soil)

Envirolab ID	Units	PQL	PGI0989-01	PGI0989-02	PGI0989-03	PGI0989-04	PGI0989-05
Your Reference			WG25.15432 / BH02 (1-1.5m)	WG25.15434 / BH04 (1-1.4m)	WG25.15435 / BH06 (0.6-1.0m)	WG25.15437 / G07 (0.5-0.6m)	WG25.15438 / G10 (0.4-0.5m)
Date Sampled			12/09/2025	12/09/2025	12/09/2025	12/09/2025	12/09/2025
pH	pH units		8.4	4.8	7.3	7.8	7.7
Electrical Conductivity	µS/cm	2.0	300	1000	110	14	73

Certificate of Analysis PGI0989

PBI/PRI (Soil)

Envirolab ID	Units	PQL	PGI0989-01	PGI0989-02	PGI0989-03	PGI0989-04	PGI0989-05
Your Reference			WG25.15432 / BH02 (1-1.5m)	WG25.15434 / BH04 (1-1.4m)	WG25.15435 / BH06 (0.6-1.0m)	WG25.15437 / G07 (0.5-0.6m)	WG25.15438 / G10 (0.4-0.5m)
Date Sampled			12/09/2025	12/09/2025	12/09/2025	12/09/2025	12/09/2025
Phosphorus Retention Index	-		21	200	4.0	0.50	1.5

Method Summary

Method ID	Methodology Summary
AGRI-003_PRI	Phosphorous Retention index (PRI) is the ratio of adsorbed phosphorus to the equilibrium concentration. Phosphorus is extracted using KCl and determined colourimetrically. Result value is used to calculate PRI as per Allen and Jefferey.
INORG-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis can be completed outside of the recommended holding times. Solids are reported from a 1:5 water extract unless otherwise specified. Alternatively, pH is determined in a 1:5 extract using 0.01M calcium chloride or a solid is extracted at a ratio of 1:2.5 (AS1289.4.3.1), pH is measured in the extract.
INORG-002	Conductivity and Salinity - measured using a conductivity cell at 25°C. Soil results reported from a 1:5 Soil:Water extract unless otherwise specified. Please note Resistivity is estimated by calculation and may not correlate with results otherwise obtained using the Resistivity current method (based on AS 1289.4.4.1), depending on the nature of the soil being analysed. Blanks may yield EC readings >1µS/cm, this is likely due to adsorption of Carbon Dioxide while the blank sample is sat on the instrument autosampler prior to analysis. The values are generally insignificant (<5µS/cm) compared to most actual sample conductivities.

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 volumes are typically provided by customers (often as flow rate(s) and sampling time(s) and/or simply volume(s) sampled or exposure times (determines 'volume' passive badges are exposed to)). Hence in such circumstances the volume measurement is inevitably not covered by Envirolab's NATA accreditation. An exception may occur where Envirolab Newcastle does the sampling where accreditation exists for certain types of sampling and hence volume determination(s). Note air volumes are often used to determine concentrations for dust and/or analyses on filters, sorbents and in impingers. For canister sampling, the air volume is covered by Envirolab's NATA accreditation.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from the latest "Australian Drinking Water Guidelines", published by NHMRC. No guideline values have been set for Total Coliforms in drinking water. Increased concentrations should be investigated. Total Coliforms are not considered useful as indicators of the presence of faecal contamination.

Where we have provided guideline values eg. ADWG Health Value, it is the responsiblity of the reader to decide if the water is fit for consumption. Please note that the tests we have conducted are just a selection of common tests to give you a general idea of drinking water quality. There are many other tests included in the ADWG that we have not tested for.

Data Quality Assessment Summary PGI0989

Client Details

Client	Western Geotechnical & Laboratory Services
Your Reference	S18630 / Proposed HCLIA
Date Issued	19/09/2025

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 PGI0989

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
EC | Soil	1-5	15/09/2025	15/09/2025	16/09/2025	Yes
pH | Soil	1-5	15/09/2025	15/09/2025	16/09/2025	Yes
PRI | Soil	1-5	12/09/2025	16/09/2025	18/09/2025	Yes

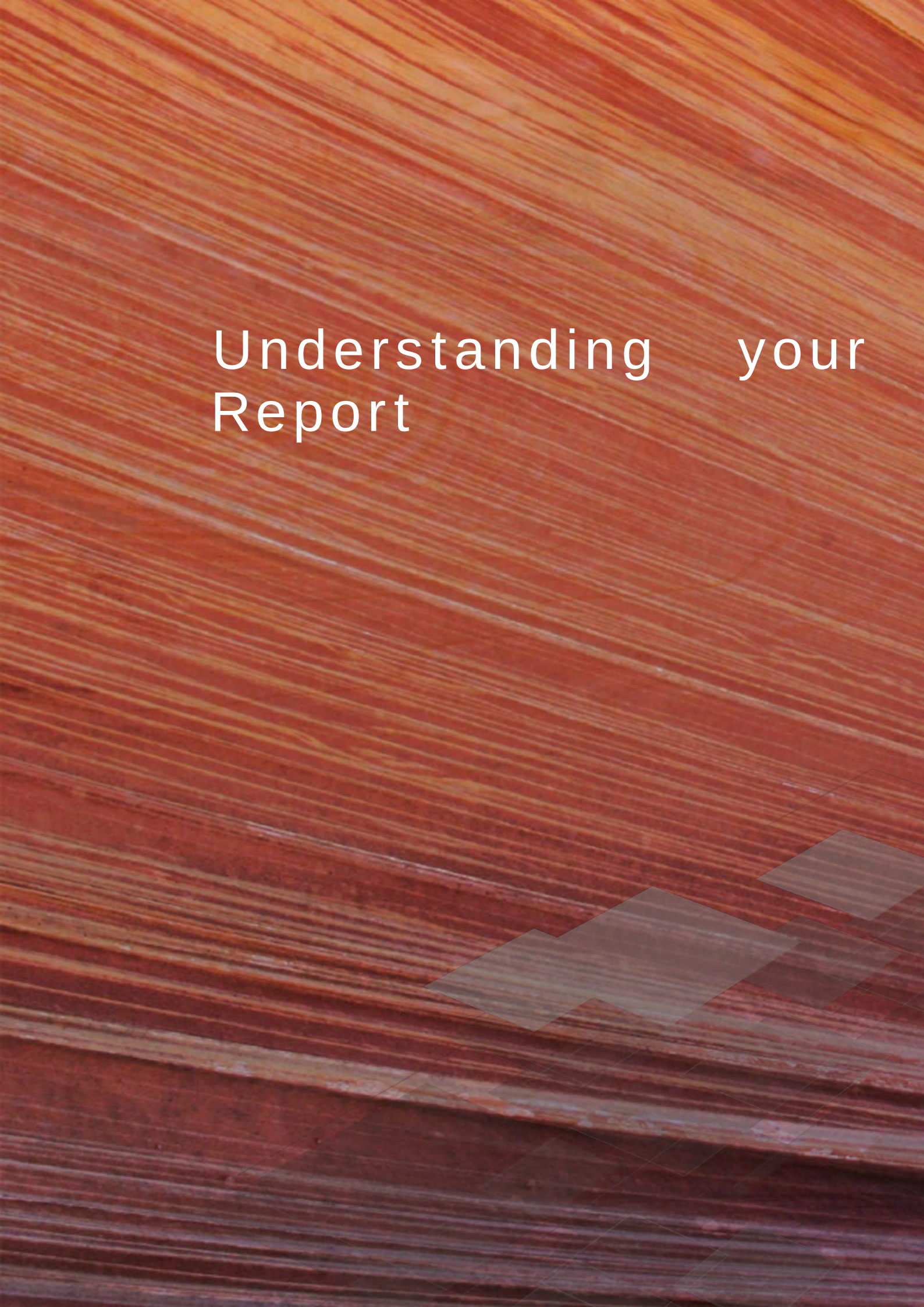
Quality Control PGI0989

INORG-001|Inorganics - General Physical Parameters (Soil) | Batch BGI2590

Analyte	Units	PQL	Blank	DUP1 PGI0989-03 Samp | QC | RPD %	LCS %
pH	pH units		5.9	7.3 | 7.5 | 2.43	102
Electrical Conductivity	µS/cm	2.0	<2.0	108 | 108 | 0.00	98.4

AGRI-003_PRI|PBI/PRI (Soil) | Batch BGI2709

Analyte	Units	PQL	Blank	DUP1 PGI0989-01 Samp | QC | RPD %	LCS %
Phosphorus Retention Index	-		0.00	20.5 | 20.3 | 1.08	75.6



Understanding your Report

1. EXPECTATIONS OF THE REPORT

The following sections have been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

2. THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- the project objectives as we understood them and as described in this report;
- the specific site mentioned in this report; and
- the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- the report was not written for you;
- the report was not written for the site specific to your development;
- the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

3. DATA PROVIDED BY THIRD PARTIES

Where data is provided by third parties, it will be identified as such in our reports. We necessarily rely on the completeness and accuracy of data provided by third parties in order to draw conclusions presented in our reports. We are not responsible for omissions, incomplete or inaccurate data associated with third party data, including where we have been requested to provide advice in relation to field investigation data provided by third parties.

4. SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques prepared by Galt. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

5. THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

6. CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

7. SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

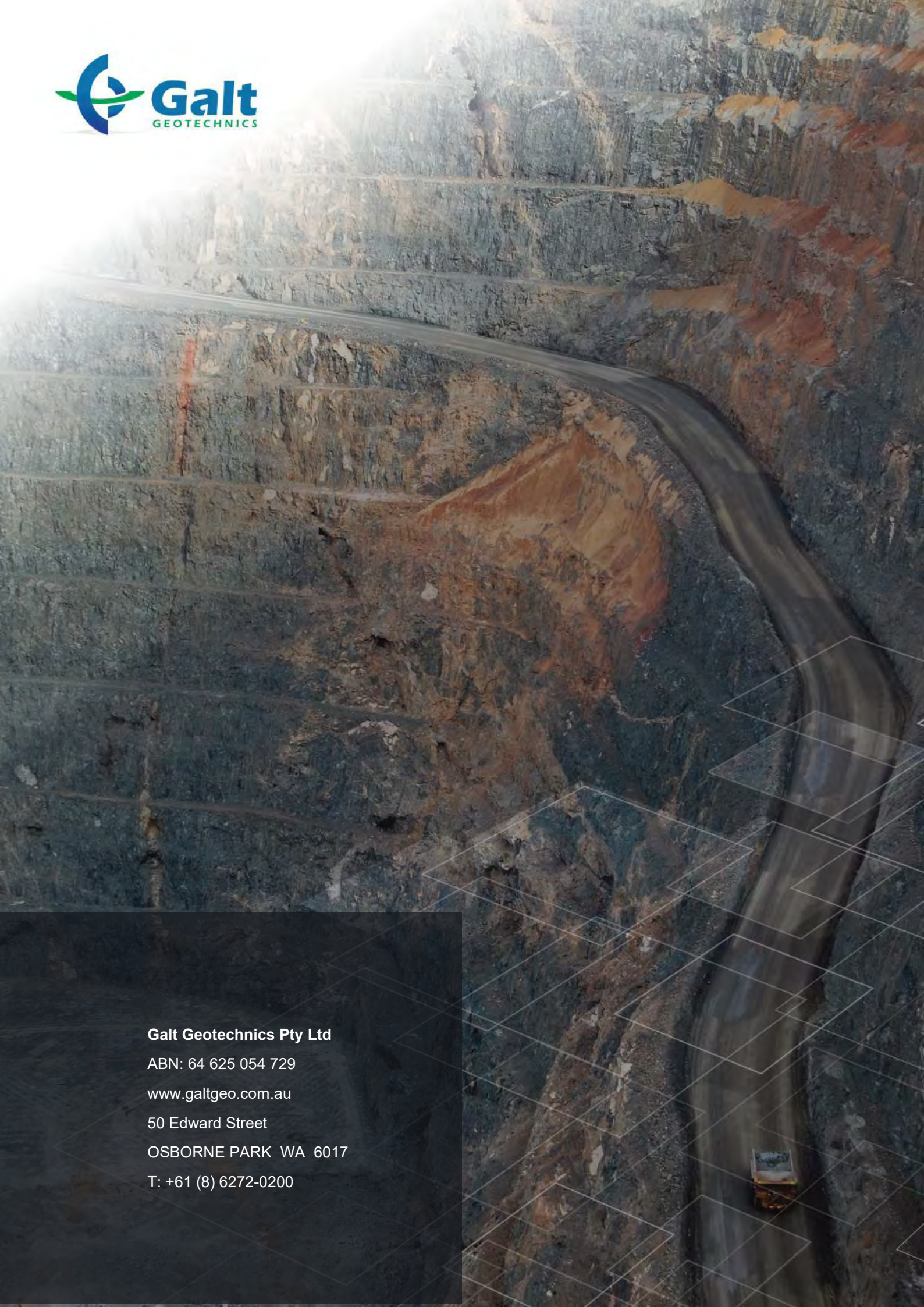
The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

8. ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

Geotechnical advice presented in a Galt Environmental report has been provided by Galt Geotechnics under a sub-contract agreement. Similarly, environmental advice presented in a Galt Geotechnics report has been provided by Galt Environmental under a sub-contract agreement.

Unless specifically noted otherwise, no parties shall draw any inferences about the applicability of the Western Australian state government landfill levy from the contents of this document.



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Appendix C REPORTS

FORMER LWMS AND SURROUNDING WATER MANAGEMENT

EXECUTIVE SUMMARY

This Local Water Management Strategy (LWMS) has been prepared to support a Scheme Amendment for Hatch Court - Stirling Crescent, High Wycombe (the site) being made by Hames Sharley. The site is currently zoned *urban* under the Metropolitan Region Scheme (MRS) and zoned *urban development* under the Local Planning Scheme No 3 (LPS 3) (District Scheme). The Scheme Amendment, will seek rezoning of the lots under the Local Planning Scheme, from '*Urban Residential*' to '*Light Industrial*'.

The total area of the site is approximately 31 hectares and bound by Adelaide St to the north, Stirling Crescent to the east, Kalamunda Rd to the south and Perth Airport land to the west, The Scheme Amendment proposal for the site seeks to create a light industrial development consisting of 16 lots, varying in size from 1 ha to 3 ha, and include 18m wide road reserves to service the lots. The existing resource enhancement wetlands on site will be rehabilitated and protected and a site specific wetland management plan prepared and implemented as part of the development.

The current land use of the site is rural residential. The topography of the site is relatively flat, varying from 24.0 mAHD to 20.0 mAHD. The majority of the site consists of Bassendean Sands but three large areas of peaty clay soils associated with the resource enhancement sumpland wetlands (DPaW, 2015) and drainage easement are present on site. High to moderate risk of acid sulfate soils (Class III ASS risk as per DER, 2016) occurring within 3 m of the natural ground surface within these areas exist and shall be further investigated as part of future development stages.

Groundwater investigations conducted on site (ENV Australia, 2009) indicated that depth to maximum groundwater levels ranged from 0.45 to 2.14 m and the geotechnical and engineering services reports (Brown Geotechnical, 2014 and Development Engineering Consultants, 2014) indicated that imported clean fill sand ranging from 1 to 3m in depth will be required to achieve appropriate separation between finished levels and the groundwater.

In terms of water management, sustainable water use within the development will be achieved via the use of water efficient fixtures and fittings in buildings, water wise landscaping on lot and off lot and implementation of rainwater tanks to manage roof runoff and augment non-potable use in buildings.

The stormwater management strategy is based on detention and treatment of the 1 year 1 hour ARI event at source using a combination of swales and bioretention systems and attenuation of post development flows up to 1 in 100 year ARI event, (i.e. maintaining post development flow rates at pre-development rates) via rainwater tanks (on lot) and above and below ground detention and infiltration (on and off-lot). Conveyance of the 5 year ARI event

from road and upstream catchments will be achieved via a combination of piped system and through the rehabilitation of the existing open drain into a living stream within the boundaries of the resource enhancement wetland and buffer.

Future development of the site is expected to occur over a number of years. There are likely to be changes to water management best practices in this time, as such there may be a need to modify the approach taken in this document to reflect this. Any changes will be addressed during the development phase, within Urban Water Management Plans (UWMP) prepared for individual stages of the development. Such UWMPs will need to comply with the requirements of this LWMS and those set by the overarching Kalamunda Rd District Water Management Strategy (ENV Australia, 2009).

1.0 INTRODUCTION

Syrinx Environmental was commissioned by Hames Sharley to prepare a Local Water Management Strategy (LWMS) to support a Scheme Amendment for Lots 1, 8, 9 and 1499 Stirling Crescent, Lots 10 – 16 and 51 – 53 Hatch Court and Lot 200 and 201 Kalamunda Road, High Wycombe (hereafter referred to as the site). The Scheme Amendment for the site will seek rezoning of the lots under the Local Planning Scheme from *'Urban Residential'* to *'Light Industrial'*.

The site is approximately 31 hectares in area and bound by Adelaide St to the north, Stirling Crescent to the east, Kalamunda Rd to the south and Perth Airport land to the west, in High Wycombe, Shire of Kalamunda (Figure 1).

This LWMS has been prepared in general accordance with the overarching *Kalamunda Road District Water Management Strategy* (ENV Australia, 2009), the *Better Urban Water Management* (WAPC, 2008) and the *Stormwater Management Manual for WA* (DoW, 2007), and provides an integrated whole of water cycle management approach to support the Scheme Amendment. The proposed light industrial development is currently in concept design stage, therefore it is expected that further investigations will be required in future design stages to support future Urban Water Management Plans (UWMPs).

1.1 INTEGRATED WHOLE OF WATER CYCLE MANAGEMENT PRINCIPLES

The processes of integrating whole of water cycle management in new developments is described in the *Better Urban Water Management* (WAPC, 2008) with due consideration given to urban water in different stages of the planning system in Western Australia. The key principles of integrated water cycle management as outlined in the *State Planning Policy 2.9 Water Resources* (Government of WA, 2006) are:

1. Consideration to all water resources, including wastewater, in water planning;
2. Integration of water and land use planning;
3. The sustainable and equitable use of all water sources, having consideration to the needs of all water users, including the community, industry and the environment;
4. Integration of human water use and natural water processes; and
5. A whole of catchment integration of natural resource use and management.

Achieving integrated urban water management can be facilitated through the use of Water Sensitive Urban Design (WSUD) employed during planning. General objectives of WSUD (WAPC, 2008) are:

1. To manage a water regime;

2. To maintain and where possible enhance water quality;
3. To encourage water conservation;
4. To maintain and where possible enhance water related environmental values; and
5. To enhance water related recreational and cultural values.

The above mentioned principles and objectives are further addressed in Section 8.0 of this report.

1.2 PLANNING BACKGROUND

The site is zoned *urban* under the Metropolitan Region Scheme (MRS) and zoned *urban development* under the Local Planning Scheme No 3 (LPS 3) (District Scheme).

This LWMS has been prepared as part of the Scheme Amendment and is consistent with the planning framework detailed in the Better Urban Water Management (WAPC 2008). The context of this document within the planning framework is demonstrated in Table 1.

Table 1 Context of this document within the land planning and water planning processes.

Planning Stage	Planning Document	Supporting Urban Water Management Document
Metropolitan Region Scheme - Scheme Amendment	MRS Scheme amendment Document	Kalamunda Rd District Water Management Strategy (ENV Australia, 2009)
Local	Local Structure Plan / Local Planning Scheme Amendment	Hatch Court - Stirling Crescent Scheme Amendment Local Water Management Strategy **This document**
Subdivision	Subdivision Proposal	Urban Water Management Plan (for individual stages of development) **Future preparation by developers**

1.3 PREVIOUS STUDIES

Previous relevant studies covering land planning, water, environmental and geotechnical aspects of the site include:

- *Kalamunda Rd District Water Management Strategy* (ENV Australia, 2009).
- *Hatch Court - Stirling Crescent High Wycombe Local Water Management Strategy* (Hyd2o Hydrology, 2015).

- *Geotechnical Investigation for Local Structure Plan Stirling Crescent / Hatch Court High Wycombe Western Australia* (Brown Geotechnical 2014).
- *Hatch Court - Stirling Crescent Local Structure Plan* (Planning Solutions, 2015)
- *Hatch Court - Stirling Crescent High Wycombe Environmental Assessment Report* (PGV Environmental 2014a).
- *Hatch Court - Stirling Crescent High Wycombe Review of Wetland Management Category and Boundary* (PGV Environmental, 2014b).

2.0 PROPOSED DEVELOPMENT

The proposed light industrial development consists of 16 lots varying in size from 1 ha to 3 ha. The development will maintain 18m wide road reserves to service the lots. A concept development plan has been provided by Hames Sharley and is shown in Figure 2.

The proposed development has considered the existing adjacent industrial developments to the east, (within Perth Airport's land), and to the north (north of Adelaide Street), and the pre-development site features such as the large lot sizes, the presence of three resource enhancement wetlands, which will be retained and protected with appropriate buffers (see Section 4.2), the modified drainage line dissecting the northern portion of the site west to east, and finally the presence of shallow groundwater and variety of soil conditions, which will be addressed via imported fill and subsoil drainage (see Section 6.1). The proposed development has also been guided by the overarching *Kalamunda Rd District Water Management Strategy*.

3.0 DESIGN CRITERIA

Key design criteria for the development have been guided by the following documents:

- *Better Urban Water Management* (WAPC 2008);
- *Kalamunda Rd District Water Management Strategy* (ENV Australia, 2009);
- *Stormwater Management Manual for WA* (Department of Water, 2007); and
- *Decision Process for Stormwater Management in WA* (Department of Water 2009).
- *On-Site Stormwater Detention: Commercial, Industrial, Institutional and Community Developments. General conditions, specifications and guidelines for the construction of on-site stormwater detention facilities (Shire of Kalamunda, 2011)*

3.1 WATER AND WASTEWATER SERVICING

Water efficiency / demand management: reduction of overall consumption and reduction in water wastage or wasteful uses by using technologies, appliances and processes that increase the efficiency of water use.

Fit for purpose water supply: incorporation of harvesting, recovery, use and reuse of alternative water sources for the most beneficial purpose. Water sources available on-site are: rainwater, groundwater, stormwater and wastewater. In accordance with best practice, the cleanest water should be used for the cleanest purposes where possible (i.e. the '*fit for purpose*' approach).

Wastewater Servicing: provision of a reticulated wastewater system which meets agency requirements.

Stormwater management: The stormwater management strategy for this site has been developed with the following design objectives:

- Detention and treatment of the 1 year 1 hour ARI event (or initial 17mm of rain) as close to source as possible;
- Lot stormwater not to be discharged to adjoining properties;
- Conveyance of the 5 year peak ARI event within pipe/swale systems; and
- Attenuation of post development increased flows up to 1 in 100 year ARI event, i.e. maintaining flow rates at pre-development rates.

4.0 PRE DEVELOPMENT ENVIRONMENT

The 31 hectare site is bound by Adelaide St to the north, Stirling Crescent to the east, Kalamunda Rd to the south and Perth Airport land to the west, in High Wycombe, Shire of Kalamunda (Figure 1).

The current site use consists of rural residential lots. The site contains grass covered paddocks, residential buildings, trees and shrub vegetation. A few ornamental water bodies are present within private lots. Three resource enhancement wetlands, to be retained, protected and managed, are present on site and these are further discussed in Section 4.2. An open drain connects the two northern wetlands, traversing the northern portion of the site from east to west, just north of Hatch Court. The southern portion of lot 200 currently receives road runoff from Stirling Crescent.

4.1 TOPOGRAPHY

The site is relatively flat with minor contour variations ranging from 24 m AHD (metres Australian Height Datum) to 20 mAHD, and a general fall to the west (Figure 3). A gentle depression and open channel runs from east to west across the site with elevations of 21.0 mAHD at the eastern boundary to 20mAHD at the western boundary. The northern boundary of the site sits around 24.0 mAHD, while the southern boundary sits around 23.0 mAHD. The northern portion of the site falls towards the open channel. Topographic data for the site was obtained from the *Perth Groundwater Atlas* (DoW, 2004).

4.2 WETLAND CLASSIFICATION

According to the geomorphic wetland, Swan Coastal Plain dataset (WA Atlas, Landgate Shared Land Information Platform), three resource enhancement wetlands (sumplands) are present on site (Figure 4). Two of these resource enhancement sumplands (Unique Feature Identifier UFI 15939 and 15940) are located on the northern portion of the site and form part of the existing drainage line, which transverses the site east to west. The third resource enhancement sumpland (UFI 15778) is located in the central / south-eastern portion of the site. Resource enhancement wetlands are classified as wetlands that may have been partially modified, but still support substantial ecological attributes and functions (EPA, 2008). The management objectives for these wetlands include, revegetation protection and

The remainder of the site, except for the northwest corner, is classified as multiple use wetlands (sumplands UFI 15777, 15780 and 15898 and damplands UFI 15267 and 15779). Multiple use wetlands are classified as wetlands that are significantly degraded, possessing few natural attributes and limited human-use interest (EPA, 2008).

The boundary of wetlands, including a 30m buffer zone to protect the resource enhancement wetlands, as defined by PGV Environmental (2014), is illustrated in Figure 4. All resource enhancement wetlands will be retained within the proposed development, enhanced via weed control and protected by fencing and signage and (as discussed in Section 7.0).

4.3 DER CONTAMINATED SITE REGISTRY

A Basic Summary of Records Request was conducted online, within the DER database of known contaminated sites. The search did not identify the site as a known contaminated site, either prior to, or after, the commencement of the *Contaminated Sites Act 2003*.

It is important to note that the database does not contain information pertaining to other classifications, including sites classified as '*report not substantiated*', '*possibly contaminated – investigation required*', '*not contaminated – unrestricted use*' and '*decontaminated*'.

The closest DER registered contaminated site is located approximately 1.0 km to the northeast of the proposed development, at street address 390 Stirling Crescent, Hazelmere, WA 6055, classified as *Remediated for restricted use* due to the presence of metals and hydrocarbons (such as from degraded diesel or oil) in groundwater.

4.4 SOILS AND GEOLOGY

Geological information for the area was obtained from the *Geological Survey of Western Australia (GSWA), 1:50,000 Environmental Geology Series Maps* (Gozzard, 1986) and is shown in Figure 5. Regional mapping indicates that the site is characterised by areas of the following geological units:

- S8 - Sand - white to pale grey at surface, yellow at depth, fine-medium grained, moderately sorted, subangular and subrounded, minor heavy minerals of Aeolian origin. (Bassendean Sand);
- S10 - Sand - as S8 over sandy clay to clayey sands of the Guildford Formation of Aeolian origin (Bassendean Sand over Guildford Formation); and
- Cps - Peaty Clay - dark grey to black with variable sand content of lacustrine origin.

The underlying Guildford formation has low permeability, is associated with a high water table and is prone to flooding. The peaty clay unit is associated with local depressions. (Gozzard, 1986).

Brown Geotechnical completed a detailed geotechnical investigation of the site in August 2014 (Brown Geotechnical 2014) for Marwon Pty Ltd. A total of 43 excavation pits were profiled to a depth of 2.5 m below ground level (mBGL). Topsoil was present over the majority of the site to a maximum depth of 0.4 mBGL and average thickness of approximately 0.2m. The top soil was underlain by (Brown Geotechnical 2014):

- Organic Deposits - consisting of loose dark grey and black organic rich silty sand deposits between 0.4 - 1.0 m thick in test holes near the wetlands and open drain/ stream area.
- Fill material - uncontrolled fill consisting of dense brown clayey sand with some building rubble and organics. This material was observed near low lying areas / wetlands and likely used to raise ground levels for paddocks.
- Silty Sands - generally encountered below the peaty organic deposits associated with wetlands and low lying areas and also present below 1.5m depth under layer of coffee rock in the northern portion of the site.
- Sands - medium dense, medium grained, grey sand present below the topsoil or fill material in the majority of the site with the exception of the wetland areas.

- Coffee Rock - consisting of dense, weakly cemented, fine to medium grained, dark brown iron rich, silty sand coffee rock was present below 2m depth in the central portion of the site and present intermittently below 1.5m in the northern portion of the site.

Brown Geotechnical (2014) indicated that the majority of the site soils presented good drainage characteristics, with permeability of the in-situ sands ranging from $4x10^{-4}$ m/s to $5x10^{-4}$ m/s, typical of the Bassendean sands ($1x10^{-4}$ to $1x10^{-5}$ m/s). The clayey sand fill material and silty sands associated with the low lying peaty areas (wetlands) presented poor drainage characteristics.

4.5 ACID SULFATE SOILS

Acid Sulfate Soils are naturally occurring soils, sediment and peats that contain iron sulfide, predominantly in the form of pyrite materials. These soils are commonly found in low-lying coastal land, estuarine and saline wetlands, and freshwater groundwater-dependent wetlands in WA (DER, 2015).

The environmental risks associated with ASS are through oxidation, as a result of direct exposure to oxygen (e.g. open excavations), or from the lowering of the water table during dewatering (e.g. dewatering operations for construction projects). When left undisturbed in a benign, anoxic state (PASS), there is a relatively low risk to the environment and human health.

When disturbed (AASS), oxygen from the atmosphere reacts with iron sulfides in the soil, resulting in the production of sulfuric acid. This acidity releases elements such as metals and nutrients from the soil profile, which can then be mobilised and transported to waterways, wetlands and groundwater systems. This has the potential to cause significant environmental and economic impacts including fish kills, contamination of groundwater resources, and corrosion of concrete and steel infrastructure.

A review of maps identifying the risk and presence of ASS in Western Australia, developed by the DER (DER, 2016), shows the majority of the site is located within an area classified as *Class II 'low to moderate risk of acid sulfate soils occurring within 3 m of the natural soil surface'*. However, three large areas of *Class III 'High to moderate risk of acid sulfate soils occurring within 3 m of the natural soil surface'*, associated with the presence of peaty clay soils, drainage line and the resource enhancement wetland areas, occur on site. This information is presented in Figure 6.

As such, future works involving land disturbance or modifications to drainage and/or the water table may require local site specific ASS investigations and subsequent management, in accordance with DER guidelines.

4.6 GROUNDWATER

Previous groundwater investigations have been undertaken by ENV Australia and are presented in the *Kalamunda Rd DWMS* (ENV Australia, 2009). The investigation showed that the average annual maximum groundwater levels (AAMGL) sit at, or near the surface, across the site (Figure 7) and depth to groundwater (AAMGL) ranged from 0.45m (MW02) to 2.14m (MW06) across the site (ENV Australia, 2009). Groundwater flows in a northerly direction. These results indicate that a combination of subsoil drainage and raised lots (with imported clean sand fill) will be required to manage groundwater levels within the development.

A review of groundwater quality was conducted by Hyd2o (Hyd2o, 2015) as part of a previous LWMS prepared for portions the site. The Hyd2o review identified that groundwater pH across the site indicates neutral to slightly acidic water quality (ranging from 4.10 at MW05) to 6.25 at MW06) and mean total nitrogen (TN) concentrations ranging from 1.5 mg/L (MW05) to 3.2 mg/L (MW04). Mean total phosphorus (TP) concentrations ranged from 0.05 mg/L (MW05) to 2.75 mg/L (MW04), which are in exceedance of ANZECC (2000) guidelines.

The review concluded that the level of nutrients in groundwater at the site is typical of expected groundwater quality in Perth's semi-rural areas. A summary of the groundwater levels and water quality data is provided in the Table 2 below (ENV Australia, 2009; Hyd2o 2015):

Table 2 Summary of previously collected groundwater data

Bore	Maximum recorded groundwater level (mAHD)	AAMGL (mAHD)	Depth to AAMGL	EC (ms/cm)	pH	TP (mg/L)	PO4 (mg/L)	TN (mg/L)	NOx (mg/L)
MW01	22.27	22.07	1.22	ND	ND	ND	ND	ND	ND
MW02	21.48	21.28	0.45	ND	ND	ND	ND	ND	ND
MW03	21.45	21.25	1.75	0.47	**5.57**	**0.27**	**0.20**	**2.5**	0.03
MW04	21.17	20.97	0.89	0.74	**5.77**	**2.75**	**2.72**	**3.2**	0.05
MW05	19.85	19.65	1.56	0.34	**4.1**	0.05	0.02	**1.5**	**0.19**
MW06	22.00	21.80	2.14	0.62	**6.25**	**0.73**	**0.76**	**2.0**	**0.33**

Table Notations:

'ND' denotes no data.

Highlighted cell indicates result in exceedence of ANZECC (2000) fresh water guidelines.

4.7 SITE SURFACE DRAINAGE

An existing open drain transverses the site, running in a westerly direction, along Stirling Crescent and then through the central area of the site. The drain then discharges into a control weir, and is piped underneath the adjacent industrial lot downstream of the site, within Perth Aiport's land. The discharge point is located to the western side of Abernethy Road.

Between July 2008 and May 2009, the maximum recorded water level in the drain was 21.39 mAHD, which is approximately 1 m below the existing natural surface (ENV Australia, 2009). The drain is steep sided, with an approximate depth of 1 m to 1.5 m, and a maximum width of 5 m. The drain receives flow from road catchments along both Stirling Crescent and Adelaide Street, in addition to excess flows from the Jacaranda Springs residential estate compensating basin along Stirling Crescent. Within the Jacaranda Springs estate, there exists a number of stormwater compensating basins, which attenuate flows prior to discharging from the development (Hyd2o, 2015).

According to information provided by Perth Airport Pty Ltd (PAPL), the estimated 100 year ARI peak flow from the upstream catchment is 0.273 m^3/s the Site. It has previously been noted that the 10 year outflow estimate from Jacaranda springs was advised as being 0.07 m^3/s, which is considerably lower than PAPL calculations (Hyd2o, 2015). While there is no data available for 100 year ARI flows from Jacaranda Springs to the drain, Hyd2o (2015) estimated a peak flow capacity of approximately 100 l/s for the piped culvert outflow from the downstream Jacaranda Spring basin without overtopping of Stirling Crescent.

As part of the Scheme Amendment, the drain alignment will be maintained as it provides connectivity between the resource enhancement wetlands and drainage flow path for upstream catchments, including Jacaranda Springs. Within the wetlands and buffer areas the drain will be rehabilitated into a living stream and pipe/culverts will be provided under roads and impervious areas of the industrial lot.

4.7.1 Pre Development Discharge Estimates

The site is located within the Perth Airport Northern Drain Catchment; the ultimate discharge point is located on land owned by PAPL. Previous modelling work undertaken by PAPL has calculated that the site's pre-development 100 year peak flow is 0.801 m^3/s (Hyd2o, 2015). In order to comply with current Department of Water, WAPC and PAPL requirements, peak post-development flow rates cannot exceed 0.801 m^3/s.

4.8 ENVIRONMENTAL ASSESSMENT

PGV Environmental (2014) conducted an environmental assessment of the northern portion of the site (excluding lot 200 and 201) in 2014. PGV's findings for flora and fauna are summarised below:

4.8.1 Vegetation Condition

The site has been heavily modified due to historical clearing for rural purposes. The native vegetation remaining on site occurs sporadically and is generally in poor condition. In general, PGV Environmental (2014) concluded that the vegetation on the majority of the site is Completely Degraded to Degraded, with the exception of a small portion the resource enhancement wetland along Stirling Crescent where vegetation condition varied from Degraded to Good due to the presence of a small stand of dense *Melaleuca raphiophylla* over *Astartea fascicularis* and *Lepidosperma longitudinale*. Similar to other areas of the Site this area is surrounded by the Declared Weeds Arum Lily (*Zantedeschia aethiopica*); *Cotton Bush (Gomphocarpus fruticosus),* and other introduced species such as Bulrush (*Typha orientalis*), kikuyu grass, Japanese pepper and other pasture species.

According to PGV Environmental (2014), the likelihood of significant flora species listed as Endangered, Threatened or Priority occurring on site varies from none to highly unlikely.

On the 16 February 2016, Syrinx conducted a site visit and ascertained the vegetation condition reported by PGV Environmental (2014). Our findings are in general accordance with PGV Environmental. In addition, the vegetation condition within lots 200 and 201 was assessed and, found to range from Degraded, within the resource enhancement wetland

(which had sporadic occurrences of *Melaleuca preissiana* amongst weeds), to Completely Degraded (Cleared) in the remainder of the lots 200 and 201.

4.8.2 Fauna

In relation to fauna habitat classification, PGV Environmental (2014) concluded that the quality of the fauna habitats on site is very limited, due to the significant loss of native vegetation, and that the upland, wetland and cleared areas of the site can be classified as '*Disturbed fauna habitat*' to '*Highly degraded fauna habitat*'. The wetlands and drainage line are disturbed fauna habitat but provide habitat for some frog and waterbird species and there is anecdotal evidence that it supports a population of Oblong Turtles (*Chelodina oblonga*).

Significant fauna species likely to occur on Site include: Carnaby's Black-Cockatoo, Calyptorhynchus latirostris, Peregrine Falcon *Falco peregrines*, Southern Brown Bandicoot, *Isoodon obesulus* subsp. *fusciventer* and Rainbow Bee-eater, *Merops ornatus*. Fauna management strategies to be adhered to during construction are detailed in PGV Environmental (2014).

5.0 WATER USE SUSTAINABILITY INITIATIVES

This section discusses the water sustainability initiatives to be undertaken at the site. Under consideration are potable and non-potable uses and scheme, groundwater and rainwater supply options.

5.1 WATER SUPPLY

The Water Corporation Integrated Water Supply System will service the future development at the site.

Given the large roof areas of buildings typical of light industrial areas and potential demand for non-potable use, rainwater tanks to collect roof runoff and supply water for non potable-uses are proposed to be used within the industrial lots. Potential uses include toilet flushing, process water (where applicable and demand exists), washdown and fire fighting. Rainwater tanks will also assist in reducing stormwater runoff volumes to be managed and in reducing the use of scheme water. Tank sizing and location requirements are to be addressed at future UWMP stages and can be included in development specific Design Guidelines.

The site is within the Perth (Superficial-Swan) Groundwater Management Area (GMA), Shire of Kalamunda sub-area. There are currently no existing DoW groundwater licences within the site, however the superficial aquifer is not fully allocated within this sub area and

groundwater is available for abstraction (Hyd2o, 2015), should it be considered for irrigation or other non potable uses.

5.2 WATER EFFICIENCY MEASURES TO REDUCE DEMAND

5.2.1 Building Internal Water Use

All buildings are to comply with the building Code of Australia requirements of:

- All tap fittings (other than bath outlets and garden taps) will be minimum of 4-star WELS rated.
- All showerheads will be a minimum 3-star WELS rated
- All toilet flushing systems will be a minimum dual flush, 4-stars WELS rated and urinals will be a minimum of 3-stars WELS rated.

The use of rainwater for no potable uses such as toilet flushing, machine washing and process applications shall be investigated by developers.

5.2.2 External Water Use

In order to reduce water demand outside the building, the development will be consistent with water wise principles and include:

- Water wise landscape with the use of native plants on-lot, on road verges, landscape strips and wetland buffer areas.
- Maximise on site retention of stormwater which serves to irrigate landscaped areas and recharge the superficial aquifer.

5.3 WASTEWATER MANAGEMENT

Wastewater at the site will be managed via discharge to the Water Corporation reticulated network. Appropriate site control measures such as grease traps and solids control, commensurate with the industry serviced, will be addressed as part of future UWMP and building approval stages, in accordance with the Water Corporation requirements.

6.0 GROUNDWATER MANAGEMENT STRATEGY

6.1 SUBSOIL DRAINAGE / IMPORTED FILL

Previous groundwater investigations indicate that the average annual maximum groundwater levels (AAMGL) sit at or near the surface across the site (ENV Australia, 2009). As such, a combination of subsoil drainage and imported fill will be required to allow for a sufficient clearance of groundwater below each developed lot.

A detailed engineering services investigation was undertaken by Development Engineering Consultants (2014) as part of the previous LSP for residential purposes for Lots 1, 8, 9 and 1499 Stirling Crescent and Lots 10 – 16 and 51 – 53 Hatch Court. Their report recommended that imported fill levels of between 1 m to 3 m would be required across the site ahead of any future development, in order to meet the DoW requirement that all sub-soil drainage be free draining and that appropriate clearance is achieved between the invert of infiltration area and the AAMGL.

Where subsoil drainage is required, the depth of the subsoil drainage should be placed at the AAMGL, with a minimum 1.5 m clearance above the invert of the drains (Hyd2o, 2015).

Post-development groundwater levels are to be maintained to pre-development levels. The levels of the finished lots and the depth of required fill shall be addressed at the detailed design phase and within the UWMP.

7.0 WETLAND MANAGEMENT STRATEGY

PGV Environmental conducted an environmental assessment (PGV Environmental 2014a) and review of the wetland management boundary and category for the resource enhancement wetlands on the northern portion of the site (PGV Environmental 2014b) and acknowledged that future developments should protect and enhance the resource enhancement wetlands on site and identified the inclusion of a 30 m nominal buffer zone around the wetlands from where development should be precluded.

As per the recommendations of PGV Environmental (2014a) and in accordance with the Wetland Conservation Policy for Western Australia (Government of Western Australia, 1997), a Wetland Management Plan for the resource enhancement wetlands will need to be completed for the development so that key environmental values and functions of the wetlands are maintained. The management plan will likely be required as a condition of the subdivision so that wetland management procedures are implemented to protect the wetlands from being impacted by development, including construction and post construction

activities. The drainage alignment with the resource enhancement wetlands and buffer zones will be rehabilitated into a living-stream and include appropriate native riparian vegetation.

Pre and post construction weed management within the wetlands will need to be undertaken by qualified weed contractors in order to enhance the wetlands' ecological attributes. The wetlands and buffer zones will be protected with appropriate fencing and signage.

Water sensitive urban design measures, such as swales and bioretention basins, will be implemented on-lot and off-lot to manage the 1 year 1hour ARI event (or equivalent first 16 mm) and prevent untreated flows from reaching the wetlands. Post development, the wetlands will however continue to provide a site drainage function with 100 year peak flow rates maintained at pre-development levels (as discussed in Section 8.0).

8.0 STORMWATER MANAGEMENT STRATEGY

The stormwater management strategy for this site has been developed in line with the BUWM (WAPC) principles and guided by the *On Site Stormwater Detention Guidelines* (Shire of Kalamunda, April 2011), (Appendix 1), resulting in the following design objectives:

- **Ecological Protection:** Detention and treatment of the 1 year 1 hour ARI event (or equivalent initial 16 mm of rain) as close to source as possible;
- **Serviceability:** Conveyance of the 5 year peak ARI event within pipe/swale systems; and
- **Property / Public / Ecological Protection:** Attenuation of post development increased flows up to 1 in 100 year ARI event, i.e. maintaining flow rates at pre-development rates. Lot stormwater not to be discharged to adjoining properties;

8.1 STORMWATER MODELLING

A concept plan for the site has been developed by Hames Sharley (Figure 2) and localised catchments considered based on this plan. Given the on lot requirements to detain stormwater, each lot was considered as an individual catchment, resulting in sixteen (16) industrial lot catchments. The roads internal to the development were split in two (2) catchments. Figure 8 outlines the 18 catchment boundaries used in the stormwater modelling and summarises the stormwater management plan for the site. Note that the location of control measures at the lot level have not been assigned at this stage and will be addressed as part of future design work and captured within subdivision specific UWMPs. The volumes and flows to address ecological protection (1 year 1 hour ARI event), serviceability (5 year peak flow) property/public protection (attenuation of 100 year post development flows) are outlined in this document as discussed below.

Pre-development and post-development conditions have been considered for the site. For the pre-development scenario, currently developed residential lots have been assumed to be 75% pervious and undeveloped lots have been assumed to be 100% pervious. The post-development scenario assumes that industrial lots will be 10% pervious (90% impervious) with the exception of lots containing the resource enhancement wetlands, which will have comparatively higher percentage pervious areas given that the wetlands and buffer areas will be preserved in the post development scenario. The road reserves have been assumed to be 100 % impervious.

Time of concentrations (t_c) required for input were calculated using the Rational Method, based on flow path length, area and slope of catchments. Table 3 and Table 4, provided below, summarise the catchment areas, percentage perviousness and times of concentration for the pre and post-development scenarios, respectively.

Table 3 Pre development scenario (note use is post development)

Pre-development Scenario				
Catchments	Current Use	Area (ha)	% pervious	tc (mins)
1	Rural Residential	2.422	75%	29.68
2	Rural Residential	1.911	75%	30.13
3	Rural Residential	2.931	75%	34.63
4	Rural Residential	1.707	75%	25.94
5	Rural Residential	2.363	75%	23.43
6	Rural Residential	2.519	75%	19.29
7	Rural Residential	1.537	75%	28.16
8	Rural Residential	2.494	75%	29.52
9	Rural Residential	3.021	75%	21.23
10	Undeveloped	0.746	100%	22.25
11	Undeveloped	0.977	100%	22.67
12	Undeveloped	0.933	100%	22.91
13	Undeveloped	1.504	100%	28.24
14	Undeveloped	1.006	100%	22.62
15	Undeveloped	1.011	100%	23.37
16	Undeveloped	1.651	100%	28.73
17	Rural Residential	0.933	75%	35.22
18	Rural Residential	1.013	75%	32.11

Table 4 Post development scenario

Post-development Scenario				
Catchments	Proposed Use	Area (ha)	% pervious	tc (mins)
1	Industrial Lot	2.422	11%	15.22
2	Industrial Lot	1.911	10%	15.45
3	Industrial Lot	2.931	25%	17.76
4	Industrial Lot	1.707	12%	13.30
5	Industrial Lot	2.363	44%	12.02
6	Industrial Lot	2.519	69%	9.89
7	Industrial Lot	1.537	10%	14.44
8	Industrial Lot	2.494	39%	15.14
9	Industrial Lot	3.021	52%	10.89
10	Industrial Lot	0.746	10%	11.41
11	Industrial Lot	0.977	10%	11.63
12	Industrial Lot	0.933	10%	11.75
13	Industrial Lot	1.504	10%	14.48
14	Industrial Lot	1.006	10%	11.60
15	Industrial Lot	1.011	10%	11.98
16	Industrial Lot	1.651	10%	14.73
17	Road	0.933	0%	18.06
18	Road	1.013	0%	16.47

Stormwater modelling for the site has been completed using the following methodologies:

- Rational Method (based on Book VIII of ARR 1998) – spreadsheet based; and
- ILSAX Standard – DRAINS;

Type 2.2 soil was used for DRAINS/ILSAX modelling, which is classified as medium to slow draining.

A review of the results of both methodologies indicated that there are only minor variations in calculated peak flow rates between the two methodologies. The ILSAX Standard - DRAINS methodology has been adopted for this assessment. Following on from the adopted design concept, design values for each catchment have been calculated as follows:

- Detention, treatment and Infiltration of the 1 year 1 hour ARI event at source - volumes calculated based on the post-development 1 year 1 hour ARI event.
- Conveyance of the 5 year peak ARI event within pipe/swale systems - flows calculated based on the peak event flow rate for each catchment.

- Attenuation of post-development flows up to 1 in 100 year ARI event to pre-development rates - storage volumes calculated based on increased flows for the 100 year peak event.

As the post-development time of concentration for each lot is relatively small (at or near 10 minutes), the 20 minute storm is considered the critical storm duration.

The results of the ISLAX Standard - DRAINS modelling are presented in Table 5 below. It should be noted that the 100 year storage volume for each catchment is the volume required to ensure that the existing pre-development flow rates are not exceeded.

Table 5 Post development modelling results

		1 Year, 1 Hour Event	5 Year Peak Event	100 Year Event. Storage required to maintain flows at pre-development rates
Catchment	Use	Volume (m^3)	Flow (m^3/s)	Volume (m^3)
1	Industrial Lot	330.8	0.367	372.2
2	Industrial Lot	264.0	0.290	298.9
3	Industrial Lot	337.4	0.339	380.1
4	Industrial Lot	230.5	0.280	251.0
5	Industrial Lot	203.1	0.257	185.1
6	Industrial Lot	119.8	0.166	60.2
7	Industrial Lot	212.3	0.244	236.6
8	Industrial Lot	233.5	0.260	236.1
9	Industrial Lot	222.6	0.295	181.5
10	Industrial Lot	103.0	0.134	151.0
11	Industrial Lot	135.0	0.174	198.3
12	Industrial Lot	128.9	0.165	189.8
13	Industrial Lot	207.7	0.238	319.4
14	Industrial Lot	139.0	0.179	204.3
15	Industrial Lot	139.6	0.177	206.4
16	Industrial Lot	228.0	0.258	352.0
17	Road	143.2	0.273	109.2
18	Road	155.5	0.315	117.4

The storage requirements for each industrial lot catchment (Catchments 1 - 16) will be achieved on-lot. A combination of aboveground and belowground systems will be used as follows:

- Swales and bioretention systems will be adopted to treat and infiltrate flows generated by the 1 year, 1 hour ARI event from carparks, roads and lay down areas. Additional treatment requirements will be imposed on lot (such as oil - water separators, sand filters, gross pollutant traps) in accordance with the proposed light industrial use and the DoW Water Quality protection note 52 'Stormwater management at industrial sites' (May 2010).

- Above and below ground detention and infiltration to manage up to the 100 year event. This will be achieved via a combination of rainwater tanks to assist with the management of roof runoff and detention and infiltration galleries to manage runoff form carparks, roads and lay down / storage areas. A minimum 0.5m clearance between the invert of the infiltration measures and the AAMGL will be achieved with the use of imported clean fill sand (see Section 6.1).

In addition to the treatment, and storage areas identified above, implementation of pervious pavement within the lot, particularly at staff and visitor parking areas and areas not subject to heavy vehicle traffic loads are to be investigated by the developer at the UWMP stage. Pervious pavement plays an important role in reducing runoff volume and promoting hydrograph attenuation and their use may further reduce the requirements for treatment and infiltration areas on lot.

It is expected that the details of the above structural controls, including location and sizing of swales, bioretention swales/basins and tanks, will be described at the Urban Water Management Plan (UWMP) stage.

Catchments 17 & 18 are road reserves and indicative locations and areas required for the storage & infiltration of the 1 year 1 hour event and attenuation of the increased 100 year peak event from these catchments are shown in Figure 8. At this stage, one bioretention system for each road catchment is proposed. The average storage depth for the bioretention basin for these catchments is assumed to be 0.6m; thus Catchment 17 will require a 240m² basin, and Catchment 18 will require 260m² basin. Basins are to be designed in accordance with the latest biofilter design guidelines provided by Department of Water and include appropriate filtration medium, vegetation selection and include a minimum free board of 0.3m with overflow to the resource enhancement wetland in Catchment 17 and to the drainage easement in catchment 18.

In order to protect property and the public, building floor levels shall be set at 0.5m above the estimated 100 year ARI flood levels, which will be modelled once proposed finished levels for the development are determined and addressed as part of future UWMP.

Further modelling should be undertaken at the UWMP stage, to accurately determine the detailed design requirements of the drainage system.

8.2 INVESTIGATION AND MANAGEMENT OF ACID SULFATE SOILS

Further detailed ASS investigations will be required ahead of future development. Within the existing wetland enhancement areas, there is a moderate to high chance of ASS occurring. Details of further investigations and required management should be included in the future UWMP, and should be undertaken in accordance with relevant Department of Environment Regulation (DER) ASS guidelines.

9.0 SUBDIVISION STAGE - URBAN WATER MANAGEMENT PLANS

For each stage of development within the site, an Urban Water Management Plan (UWMP) will be required to support the subdivision application. The items below will be required to be addressed within each UWMP:

- Demonstrate compliance with this LWMS;
- Provide details of water conservation measures to be implemented on & off lot;
- Provide detailed, lot specific, stormwater management design including location and sizing of rainwater tanks, swales or basins and infiltration galleries and proposed permeable pavement areas;
- Groundwater management - including finished lot levels, depths of fill required and levels of subsoil drainage where required;
- Provide details of ASS management requirements;
- Provide detailed landscape & reticulation plans for irrigation use, where necessary;
- Provide details of any monitoring and reporting to be undertaken;
- Details of the implementation of the UWMP including roles, responsibilities, funding and maintenance arrangements; and
- Provide details of any contingency plans.

10.0 MONITORING

10.1 PRE-DEVELOPMENT MONITORING

It is not expected that any further monitoring events will be undertaken ahead of the sub-division process.

10.2 POST-DEVELOPMENT MONITORING

A detailed surface water and groundwater monitoring program should be undertaken post-development. Monitoring locations should be identified as part of the UWMP stage and monitoring undertaken for three years following practical completion of each stage of the subdivision. An indicative post-development monitoring program and parameters is outlined in Table 6 below.

Table 6 Post-development indicative monitoring program

Monitor	Parameter	Frequency	Trigger	Contingency Action
Groundwater	Level	Every 2 monhts for 3 years	Increase from pre-development levels over two successive winters	Developer to investigate reasons for any change. Notify Shire, DoW and lot owners.
Groundwater	PhysChem, Nutrients, Heavy Metals	Quarterly for 3 years	Increase in TP & TN from predevelopment levels over two consecutive sampling events	Developer to investigate reasons for change. Notify Shire, DoW and lot owners. Identify and remove sources of pollution.
Surface water	PhysChem, Nutrients, Heavy Metals	Quarterly for 3 years	Increase in TP & TN from predevelopment levels over two consecutive sampling events	Developer to investigate reasons for change. Notify Shire, DoW and lot owners. Identify and remove sources of pollution.

11.0 IMPLEMENTATION

The strategies outlined in this LWMS shall be the responsibility of the developer, the Shire of Kalamunda and Department of water. The roles and responsibilities for future stages of work are specified in Table 7 below.

Table 7 Implementation Roles and responsibilities

Item to be implemented	Preparation of UWMPs	Design and Construct	Review and Approval	Short Term Maintenance (Prior to handover)	Long Term Maintenance
On-lot Stormwater Systems	Developer	Lot Owner	Shire and DoW	-	Lot Owner
Off-lot Stormwater Systems	Developer	Developer	Shire and DoW	Developer	Shire
Waterwise Efficiency Packages	Developer	Lot Owner (on-lot) Dveloper (off-lot)	Shire and DoW	-	-
Sustainability Information Packages	Developer	Lot Owner (on-lot) Dveloper (off-lot)	Shire and DoW	-	-
Post Development Monitoring	Developer	Developer	Shire and DoW	Developer (3 years)	-

12.0 REFERENCES

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PGV Environmental (2014b) Hatch Court - Stirling Crescent, High Wycombe. R*eview of Wetland Management Category and Boundary.*

FIGURES

Figure 1 Site Location



N

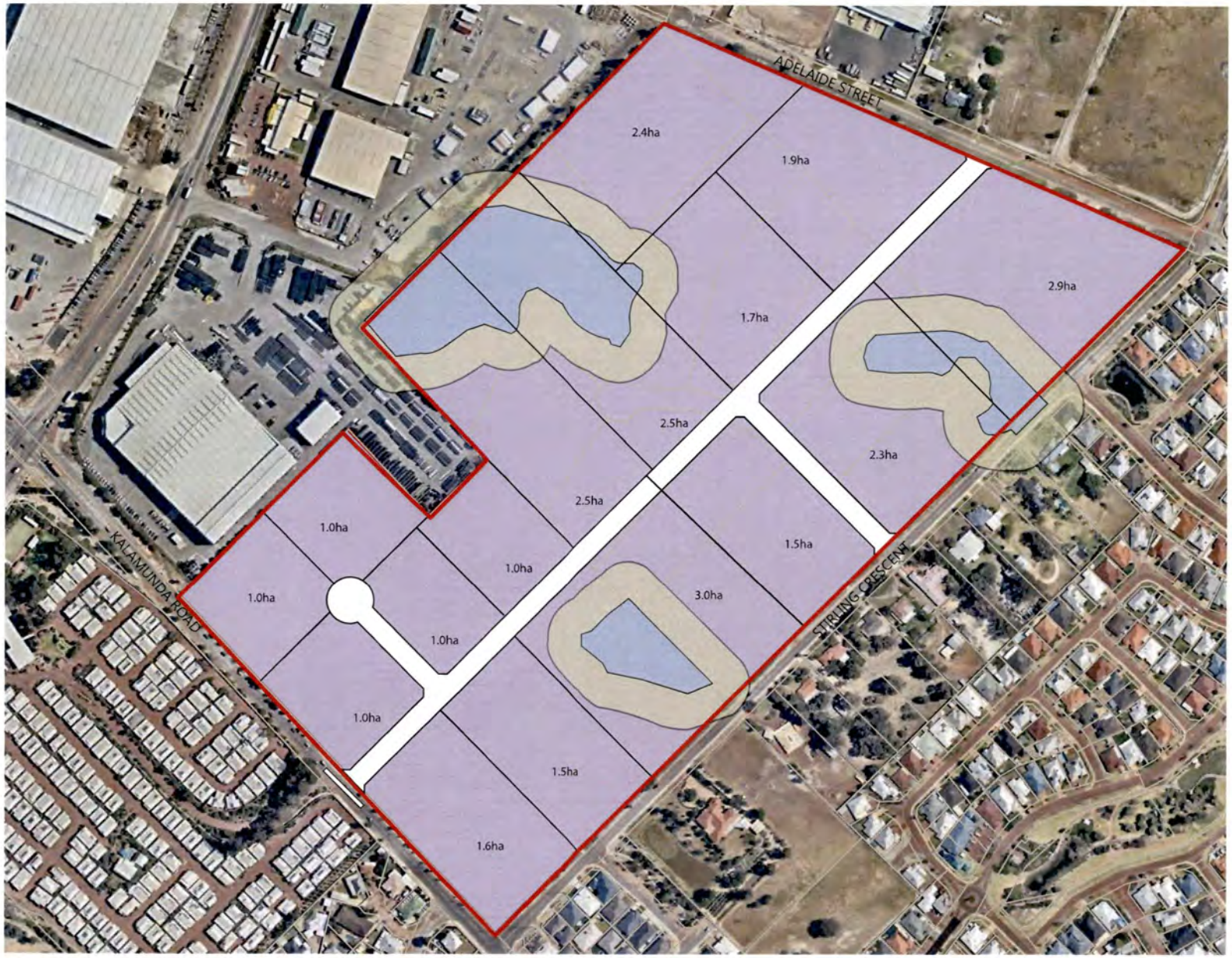
Hatch Court - Stirling Cresent Scheme Amendment, High Wycombe LWMS
Figure 1: Location Plan

Author: Syrinx Environmental PL
Project ID: 1552
Scale: 1:5000
Projection: GDA94 MGA Zone 50
Date: 16 Mar 2016

0 50 100 200 300 400 Meters

SYRINX environmental pl

Figure 2 Development Concept Plan



Legend

- Project Area
- Light Industrial Land Use
- Resource Enhancement Wetland
- 30m Wetland Buffer

N

Hatch Court - Stirling Cresent Scheme Amendment, High Wycombe LWMS
Figure 2: Hames Sharley Concept Plan (received 18/02/2016)

Author: Syrinx Environmental PL
Project ID: 1552
Scale: 1:5000
Projection: GDA94 MGA Zone 50
Date: 01 Apr 2016

0 50 100 200 300 400 Meters

SYRINX environmental pl

Figure 3 Topography



Hatch Court - Stirling Cresent Scheme Amendment, High Wycombe LWMS

Figure 3: Elevation (1m contours)

Author: Syrinx Environmental PL
Project ID: 1552
Scale: 1:5000
Projection: GDA94 MGA Zone 50
Date: 02 Mar 2016

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0 50 100 200 300 400 Meters

SYRINX environmental pl

Figure 4 Wetland Classification Map

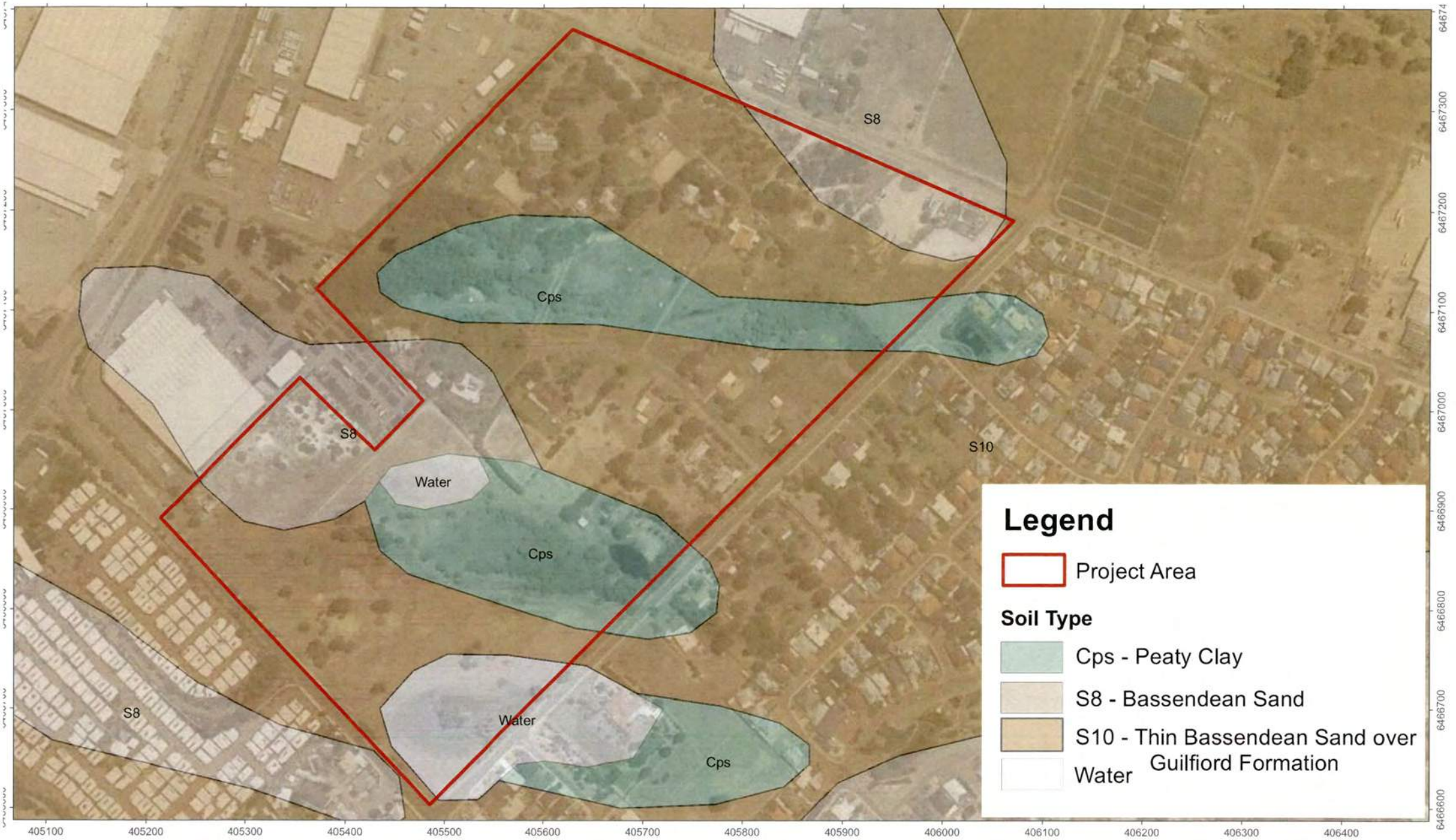


Hatch Court - Stirling Cresent Scheme Amendment, High Wycombe LWMS
Figure 4: Wetland Classification with Resource Enhancement Wetland Buffer

Author: Syrinx Environmental PL
Project ID: 1552
Scale: 1:5000
Projection: GDA94 MGA Zone 50
Date: 01 Apr 2016

SYRINX environmental pl

Figure 5 Soil Map



Hatch Court - Stirling Cresent Scheme Amendment, High Wycombe LWMS
Figure 5: Surface Geology

Author: Syrinx Environmental PL
Project ID: 1552
Scale: 1:5000
Projection: GDA94 MGA Zone 50
Date: 02 Mar 2016

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0 50 100 200 300 400 Meters

SYRINX environmental pl

Figure 6 Acid Sulfate Soil Risk Map

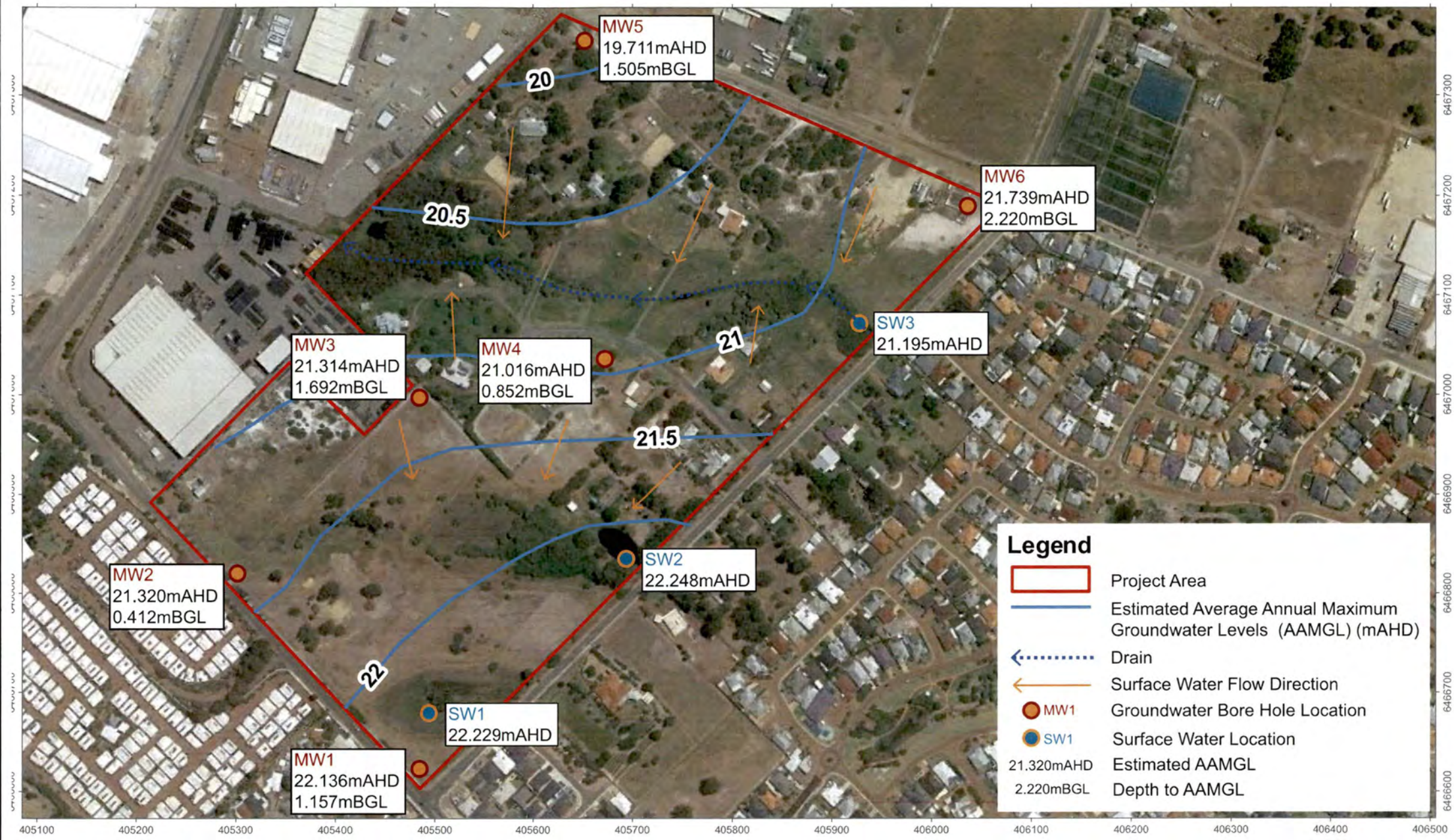


Hatch Court - Stirling Cresent Scheme Amendment, High Wycombe LWMS
Figure 6: Acid Sulfate Soils Risk of Occuring Within 3m of Surface

Author: Syrinx Environmental PL
Project ID: 1552
Scale: 1:5000
Projection: GDA94 MGA Zone 50
Date: 02 Mar 2016

SYRINX environmental pl

Figure 7 Groundwater Contour Map



Hatch Court - Stirling Cresent Scheme Amendment, High Wycombe LWMS

Figure 7: Site Hydrology (data from ENV (2009))

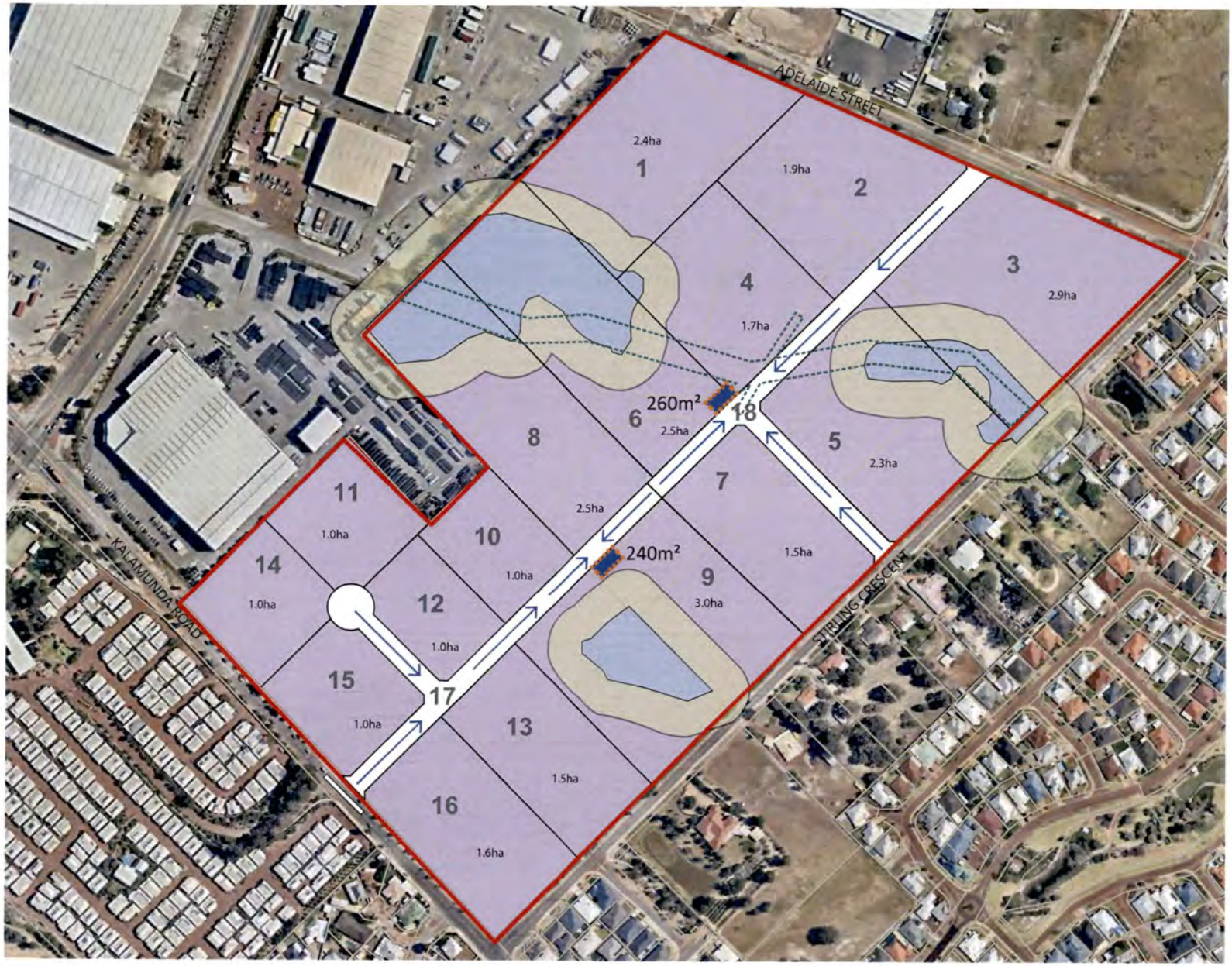
Author: Syrinx Environmental PL
Project ID: 1552
Scale: 1:5000
Projection: GDA94 MGA Zone 50
Date: 31 Mar 2016

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0 50 100 200 300 400 Meters

SYRINX environmental pl

Figure 8 Stormwater Management Strategy



		1 Year, 1 Hour Event	5 Year Peak Event	100 Year Peak Event. Storage required to maintain flows at pre-development rates
Catchment	Use	Volume (m³)	Flow (m³/s)	Volume (m³)
1	Industrial Lot	330.8	0.367	372.2
2	Industrial Lot	264.0	0.290	298.9
3	Industrial Lot	337.4	0.339	380.1
4	Industrial Lot	230.5	0.280	251.0
5	Industrial Lot	203.1	0.257	185.1
6	Industrial Lot	119.8	0.166	60.2
7	Industrial Lot	212.3	0.244	236.6
8	Industrial Lot	233.5	0.260	236.1
9	Industrial Lot	222.6	0.295	181.5
10	Industrial Lot	103.0	0.134	151.0
11	Industrial Lot	135.0	0.174	198.3
12	Industrial Lot	128.9	0.165	189.8
13	Industrial Lot	207.7	0.238	319.4
14	Industrial Lot	139.0	0.179	204.3
15	Industrial Lot	139.6	0.177	206.4
16	Industrial Lot	228.0	0.258	352.0
17	Road	143.2	0.273	109.2
18	Road	155.5	0.315	117.4

Table: Stormwater modelling

Legend

- Project Area
- Flow direction
- 1 year 1 hour infiltration area
- 100 year peak event storage volume required to maintain flows at pre-development flow rates
- 1 Catchment number
- Drainage Easement
- Light Industrial Land Use
- Wetland Reserve
- 30m Wetland Buffer

Notes:

Industrial lot storage and infiltration required to be provided on-lo
Road storage and infiltration requirements as shown.
Average storage depth is assumed at 0.6m.

N

Hatch Court - Stirling Cresent Scheme Amendment, High Wycombe LWMS
Figure 8: Stormwater Mangement Plan

Author: Syrinx Environmental PL
Project ID: 1552
Scale: 1:5000
Projection: GDA94 MGA Zone 50
Date: 16 Mar 2016

0 50 100 200 300 400 Meters

SYRINX environmental pl

07 July 2025

Your Ref:
Our Ref: H25037Av1

Glenn Coffey
Hesperia Projects Pty Ltd
PO Box 782
Subiaco, WA 6904

Dear Glenn,

LOT 14 (LOT 2) HATCH COURT, HIGH WYCOMBE STORMWATER MANAGEMENT PLAN

This Stormwater Management Plan (SMP) has been prepared by Hyd2o on behalf of Hesperia Projects Pty Ltd in support of the development of Lot 14, High Wycombe. This document pertains to Lot 2, herein referred to as the site, which is a parcel resulting from the subdivision of Lot 14 and amalgamation with a portion of Lot 9000 Adelaide St to the northeast.

The site is located within the City of Kalamunda and proposes the establishment of an industrial tenancy. The proposed development will create warehouse space with associated infrastructure and area of hardstand. A copy of a site plan is included as Appendix A.

In relation to water management planning approvals, Better Urban Water Management (Western Australian Planning Commission, WAPC, 2008) typically require an Urban Water Management Plan (UWMP) to be prepared for subdivisions in excess of 25 lots. Based on the scale of the proposed development, a brief letter report Stormwater Management Plan (SMP) is therefore considered appropriate rather than a UWMP to guide future stormwater management planning and engineering design for the site.

This SMP provides an assessment of the site and an overarching plan for stormwater and groundwater management for the site. It contains interpretation of groundwater level data and the required characteristics of the stormwater system based on modelling outcomes and specified discharge requirements of downstream Perth Airport stormwater management infrastructure. Subsequent engineering design for the lots will be required to comply with this SMP.

This SMP has been prepared to meet the requirements of the City of Kalamunda, Department of Water and Environmental Regulation (DWER), and the Better Urban Water Management framework (WAPC, 2008).

1. SITE CHARACTERISTICS

A site conditions plan is included as Figure 1. The site is generally described as having the following existing characteristics:

- The site has been largely cleared for historic use as a rural property. A rural dwelling and associated infrastructure are located in the southwest region.

- The site is surrounded by rural properties to the west, south and east. Industrial lots along Adelaide St are located to the north. Driveway access to the property occurs via Hatch Court to the south. Lot 14 forms part of a collection of rural lots with access via Hatch Court located within a greater area already developed for industrial and residential.
- Based on DWER LiDAR topography the site ranges between 20 mAHD and 22 mAHD with a general grade down from Adelaide St on the northern boundary towards the southwest.
- According to the Perth Sheet 2034 II and Part Sheets 2034 II and 2134 III, Environmental Geology Series (Gozzard, 1986) the site is characterised by having Bassendean sand or Bassendean sand overlaying pebbly silt of the Guildford Formation. The sand is noted to be light grey at surface, yellow at depth, medium to coarse grained, moderately sorted, subangular to sub-rounded quartz of eolian origin. Galt Geotechnics (2025) undertook a due diligence geotechnical investigation at the site in May 2025 and across 8 test pits the general subsurface profile was described as grey/white fine to medium grained sand typically loose at shallow depths becoming medium dense to dense at depth extending to depths from 2m to over 6.5m overlaying the Guilford Formation. These findings were generally consistent with Gozzard (1986). Groundwater was encountered at 4 pit locations at depths ranging from 1.7 to 2.8m below natural surface. During the same investigation permeability tests were conducted and yielded in-situ saturated hydraulic conductivity rates ranging from 2.8 to 3.6 m/d and unsaturated hydraulic conductivity rates ranging from 4 to 39.3 m/d. The geotechnical report is contained in Appendix B.
- The DBCA's geomorphic wetland dataset shows a multiple use wetland extending to the site's southern boundary (UFI#15899). The area to which it extends has been predominantly cleared for present land uses.
- Published DWER acid sulphate risk (ASS) mapping indicates that the site is predominantly mapped as a low to moderate risk of ASS occurring within 3m of natural soil surface.
- DWER's contaminated site database mapping reports no contaminated sites located within the site or in neighbouring lots.
- According to DWER's online Water Register no groundwater license currently exists over the site however there is allocation available in the Perth – Superficial Swan aquifer to facilitate a license application (Appendix C).

2. SURFACE WATER

There are no open water bodies, waterways or drains within the site and the site does not receive any flow from external catchments. Currently any minor event rainfall would infiltrate on site, with any excess in major events occurring as diffuse overland flow towards the southwestern boundary consistent with the natural topography.

Beyond the boundary, flow would continue in this direction towards a City of Kalamunda open drain located in an easement as shown in Figure 2.

The drain ultimately forms part of the Perth Airport Precinct 3 (PAP3) drainage network with the entirety of the site falling within an identified sub-catchment of this network (Catchment 16). A catchment plan for Perth Airport Precinct 3 is contained in Appendix D.

The receiving drain is typically steep sided with an approximate depth of 1m and width of 5m and runs in a southwest direction in an easement through a series of rural landholdings before reaching a wetland which effectively acts as a compensation storage with twin 900mm dia. pipe outlets. This is the discharge point for the sites associated PAP3 sub-catchment into the Lewis Rd drainage system. Based on Perth Airport advice allowable discharge at this point results in a pro-rata discharge rate of 41 L/s/ha for land within this sub-catchment (Appendix D). This estimate was based on predevelopment modelling for this catchment and maintaining post development flows at predevelopment levels to protect downstream environments and infrastructure. The allowable discharge also accounts for inflow from the Jacaranda Springs residential catchment upstream.

3. GROUNDWATER

DWER's online Perth Groundwater Map (DWER, 2025b) shows groundwater flow to the north-west with groundwater levels generally between 17 to 18 mAHD at the site. It is understood that these levels reflect a maximum condition of readings at regional DWER bores in 2019. It should be noted that accuracy of the regional mapping at the site is limited due to the proximity of DWER bore data in the area with the nearest bore located approximately 1.8 km away.

Groundwater has been historically monitored in the local area to facilitate development which included the installation of a bore in close proximity to the site identified as MW5 (Figure 3). The average annual maximum groundwater level (AAMGL) reported at this bore location is 19.71 mAHD as per Hyd2o (2022) as shown in Table 1.

To provide an estimate of groundwater levels across the site MW5 has been used as a point of reference in interpretation of the findings of the preliminary geotechnical investigation undertaken by Galt Geotechnics in May 2025. During pit excavation it was noted that groundwater was encountered at 4 of the 8 pits with all pits excavated to a target depth of 3m. To better interpret this variability in occurrence, depths to groundwater were translated to mAHD based on LiDAR digital elevation model (DEM) at each pit location. The DEM is based on 1 point per square meter survey and is understood to be current to 2008, which would be more recent than the establishment of the current rural property.

The resulting interpretation to groundwater is shown in Table 2 and on Figure 3. Results indicate some inconsistency in groundwater readings in establishing an estimate of regional groundwater at the site. BH4 provides an inferred groundwater reading of 19 mAHD which is considered of relatively large difference to inferred levels of 17.7 mAHD or less at pits approximately 60 to 70m away (no groundwater encountered at BH3 and BH6). As such it is suspected that BH4 is a perched reading. This assumption would also be supported by observations of clayey sand at the base of pit BH4 which is unique to the site as all remaining pits recorded sand throughout.

It is noted that the pits were excavated at the end of May which is generally reflective of a seasonal low condition. As such it would be expected that groundwater would need to rise a full seasonal magnitude in order to achieve a winter condition to what would be more relative to an AAMGL condition. Seasonal fluctuation at MW5 was reported to be in the magnitude of approximately 1m with readings taken from 2008 to 2009 (ENV, 2009). Adding 1m to inferred readings at BH5 and BH7 would generally integrate with the AAMGL of 19.71 mAHD at MW5. The no groundwater reading at BH8 would be inconsistent with this however would still be a reasonable range of analysis error on the basis that groundwater may occur just below the base of the pit.

No readings taken at bores BH2, BH3 & BH6) would infer that groundwater flows in a general southwest direction which would be consistent with the drain and ultimate outlet location southwest of the site.

Based on analysis of available data it is estimated that the AAMGL at the site would occur at approximately 20 mAHD on the northeast boundary and be lower in the remainder of the site. Perching at BH4 appears to be localised and any rise in winter would be expected to be regulated by the continuous permeable sand layer found across the pits.

Table 1: Historic Bores AAMGL

Bore	Easting	Northing	Seasonal Variation 02-10-08 to 16-04-09 (m)	AAMGL (mAHD)
MW5	405657	6467362	0.95	19.71

Table 2: Site Geotechnical Pit Groundwater Interpretation

Pit	Pit Depth (m)	Pit Soil Profile	Depth to GW 28-05-25 (m)	Natural Surface via LiDAR (mAHD)	Base of Pit (mAHD)	Inferred Groundwater Level (mAHD)
BH1	3.0	Sand	1.7	20.3	17.3	18.6
BH2	3.0	Sand	NE	20.2	17.2	-
BH3	3.0	Sand	NE	20.3	17.3	-
BH4	3.0	Sand with Clayey Sand at base	1.9	20.9	17.9	19
BH5	3.0	Sand	2.8	21.3	18.3	18.5
BH6	3.0	Sand	NE	20.7	17.7	-
BH7	3.0	Sand	2.7	21.3	18.3	18.6
BH8	3.0	Sand	NE	21.5	18.5	-

*NE = not encountered

4. WATER USE SUSTAINABILITY

Water supply will be provided via extension of the Water Corporation's Integrated Water Supply System. Rainwater tanks will not be mandated however given large contributing roof areas, use of rainwater tanks as both a water supply source and stormwater management device may be a suitable way to partially offset stormwater storage requirements.

The tenancy may wish to integrate rainwater tanks as part of their water supply and overall stormwater management systems, and this will be provided for by their engineering team during the design and building application process.

Water conservation measures within the development will be consistent with Water Corporation's Waterwise land development criteria and include the implementation of waterwise practices and stormwater treatment and detention compliant with requirements as detailed in Section 5.

5. STORMWATER MANAGEMENT

The key elements of the stormwater management strategy for the site as shown in the site plan (Appendix A) are as follows, consistent with downstream Perth Airport systems requirements, City of Kalamunda Stormwater Design Guidelines (2023) and Better Urban Water Management (WAPC, 2008) requirements as well as integrating principles of Water Sensitive Urban Design (DWER, 2011):

- Permissible discharge of 41 L/s/ha for the site consistent with ultimate development modelling of the downstream drainage system by Perth Airport, based on estimated predevelopment (existing) flows from the associated catchment.
- Hardstand areas to direct stormwater away from building levels and towards dedicated storage areas.
- Retention of first 15mm of hardstand runoff within landscaped biofiltration swale areas.
- Flood storage on site sized to detain up to and inclusive of the 1% AEP event.
- Flood storage provided on site sized to detain up to the 5% AEP event below pad level
- Beyond the 5% AEP event and in management of the 1% AEP event, hardstand areas permitted to provide storage up to a ponding depth of 50mm.

Based on an approximate site area of 0.8 ha, the permissible discharge for the site is 33 L/s to guide modelling and design. In consultation with the project design team the implementation of perimeter drainage swales was considered a suitable option in implementing the stormwater management criteria detailed above. These swales would overflow to the outlet once at capacity.

Stormwater modelling of the proposed system was done using XP-Storm. XP-Storm is an industry standard program that performs detailed hydraulic and hydrological calculations to simulate the performance of stormwater systems for a range of design storm events. The design storms modelled by XP-Storm were based on methodology in Australian Rainfall & Runoff (Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, 2016) and the Bureau of Meteorology Computerised Design Intensity Frequency Duration (IFD) Rainfall

System. Storms modelled ranged from 30 minutes to 72 hour duration for the 1% Annual Exceedance Probability (AEP) event.

Runoff parameters used are indicated in Table 3, consistent with those used in stormwater management planning for nearby industrial developments (Hyd2o, 2024).

Based on in-situ permeability testing results (Galt, 2025) and considering typical biomedia/amended soil performance and potential clogging, a permeability rate of 2.5 m/d was applied to drainage swales for design purposes. It is considered that these swales will act as retention devices with overflow to occur to a drainage pit from which the permissible discharge will be regulated.

Results of the modelling are shown in Table 3 and Figure 4 with XP-Storm modelling outputs contained as Appendix E. It should be noted that given the spill to grate configuration modelled the XP-Storm model outputs include spill heights and volumes associated with indicative flow. These have been specified accordingly in Table 3.

Results show that a drainage swale volume of 186 m^3 equating to an area of 310 m^2 and a depth of 0.6m would be sufficient in meeting the 5% AEP stormwater management criteria. An indicative area to provide this requirement is shown on Figure 4 with swale lengths located along the southwestern perimeter. The 1% AEP event would require 43 m^3 of additional hardstand storage equating to approximately 15% of the remaining hardstand area to a pond at a depth of 50mm.

It should be noted that this stormwater management system concept pertains to Lot 2 to be developed as part of Lot 14. The balance of Lot 14 has been earmarked for development in future. As such a connection with be required to facilitate discharge from the separate stormwater management system and to external infrastructure downstream. This proposed connection will occur via a pipe underneath the proposed site drainage swale as shown in Figure 4. Notably this has been located within the drainage corridor marked on the site plan for this purpose (Appendix A).

Table 3: Stormwater Management

Warehouse Catchment	
Roof @ 95% RO (ha)	0.12
Hardstand @ 100% RO(ha)	0.64
Landscaped/Pervious @ 33% RO (ha)	0.05
Equiv Imp Area (ha)	0.75
Permissible Peak Discharge (L/s)	33
Drainage Swale	
AAMGL (mAHD)	<19.7
Nominal Invert (mAHD)	20.4
Base Area (m^2)	310
Side Slopes (v:h)	1:0
Permeability (m/d)	2.5
15mm Event	
Flood Rise (m)	0.22
Volume (m^3)	68
5% AEP Event	
Flood Rise (m)	0.6 (+0.01 spill height)
Swale Volume (m^3)	186 (+4 spill height vol)
Hardstand Volume (m^3)	0
Peak Discharge (L/s)	32
Critical Duration (hr)	3
1% AEP Event	
Flood Rise (m)	0.6 (+0.03 spill height)
Swale Volume (m^3)	186 (+10 spill height vol)
Hardstand Volume (m^3)	43
Peak Discharge (L/s)	33
Critical Duration (hr)	3

6. GROUNDWATER MANAGEMENT

Based on discussions with the project design team it is understood that site development levels will interface with Adelaide St at approximately 22 mAHD and fall to the rear of the lot at approximately 21 mAHD.

It is noted that the warehouse space is located to the front of the lot and as such it is estimated that the warehouse will have a clearance in excess of 2m to the AAMGL.

With swales located at the rear of the lot and conceptually designed at 0.6m depth, the current minimum swale elevation for consideration is approximately 20.4 mAHD. As such it is estimated that drainage swales will have a minimum clearance in excess of 0.5m to AAMGL in relation to the regional water table. As discussed in Section 3 there appears to be an area of localised perching in the southeast region of the site however groundwater is expected to be regulated by sandy profile connected to the remainder of the site absent of any perching.

Drainage swales will be designed with consideration of the Adoption Guidelines for Stormwater Biofiltration Systems (CRC for Water Sensitive Cities, 2015).

Based on available data it is expected that drainage swales will be able to function on the basis of infiltration without the need of underlying subsoil however as additional data is collected it is recommended that findings are reviewed in reference to detailed design levels.

7. IMPLEMENTATION PLAN

Roles and responsibilities for implementation of this SMP are detailed in Table 4 below.

Construction of the stormwater system within the site will be the responsibility of the developer. Maintenance and management of stormwater infrastructure will be the responsibility of the lot owner and tenant.

Long term maintenance of stormwater drainage infrastructure outside of the site will be the responsibility of the City of Kalamunda.

Maintenance will include but not be limited to street sweeping to reduce any particulate build up, removal of sediment and rubbish in manholes and removal of debris and vegetation build up within biofiltration areas, storages, and council open drain to prevent stormwater blockages.

Table 4: Actions and Responsibilities

Action	Responsibility		
	Developer	City of Kalamunda	Lot Owner / Tenant
Preparation of SMP (this document)	✓		
Review and Assessment of SMP		✓	
Construction of stormwater infrastructure within the site	✓		
Maintenance and management of stormwater infrastructure within site boundaries			✓
Maintenance and management of stormwater infrastructure outside site boundaries		✓	

8. REFERENCES

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Should you have any queries regarding this report, please do not hesitate to contact Sean O'Sullivan or Sasha Martens of this office.

Yours sincerely,



Sean O'Sullivan, Senior Engineering Hydrologist

Attachments

Figure 1: Site Conditions Plan
Figure 2: Surface Water Plan
Figure 3: Groundwater Plan
Figure4: Stormwater Management Plan

Appendix A: Site Plan
Appendix B: Galt Geotechnics Due Diligence Geotechnical Report
APPENDIX C: DWER Water Register Extract
Appendix D: Perth Airport Drainage Advice
Appendix E: XP-Storm Modelling Outputs

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Hyd2o recognise site conditions change and contain varying degrees of non-uniformity that cannot be fully defined by field investigation. Measurements and values obtained from sampling and testing in this document are indicative within a limited timeframe, and unless otherwise specified, should not be accepted as conditions on site beyond that timeframe.

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FIGURES

Date: 23/06/2025 Job No. H25037



Site

DWER LiDAR Contours 1m (mAHD)

Geotech Sites (Galt Geotechnics, 2025)

DBCA Wetlands

Resource Enhancement

Multiple Use

ASS Risk

Moderate to low risk

High to moderate risk

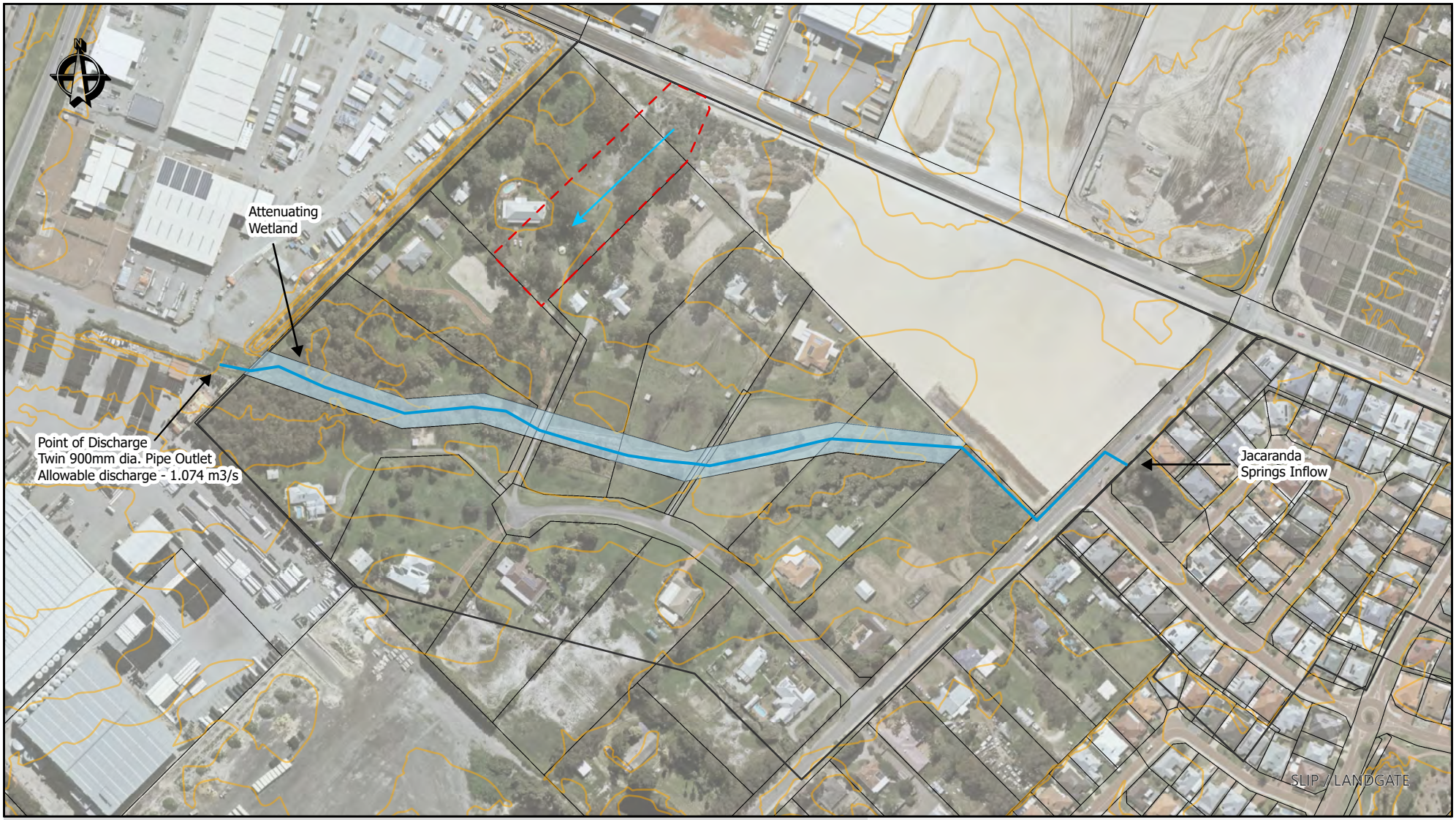
hyd2o

Lot 14 (Lot 2) Hatch Court High Wycombe SMP

Site Conditions Plan

Figure 1

Date: 23/06/2025 Job No. H25037



Site

DWER LiDAR Contours 1m

Predevelopment Surface Flow

Perth Airport P3 Contributing Catchments

Drainage Easement

Drain

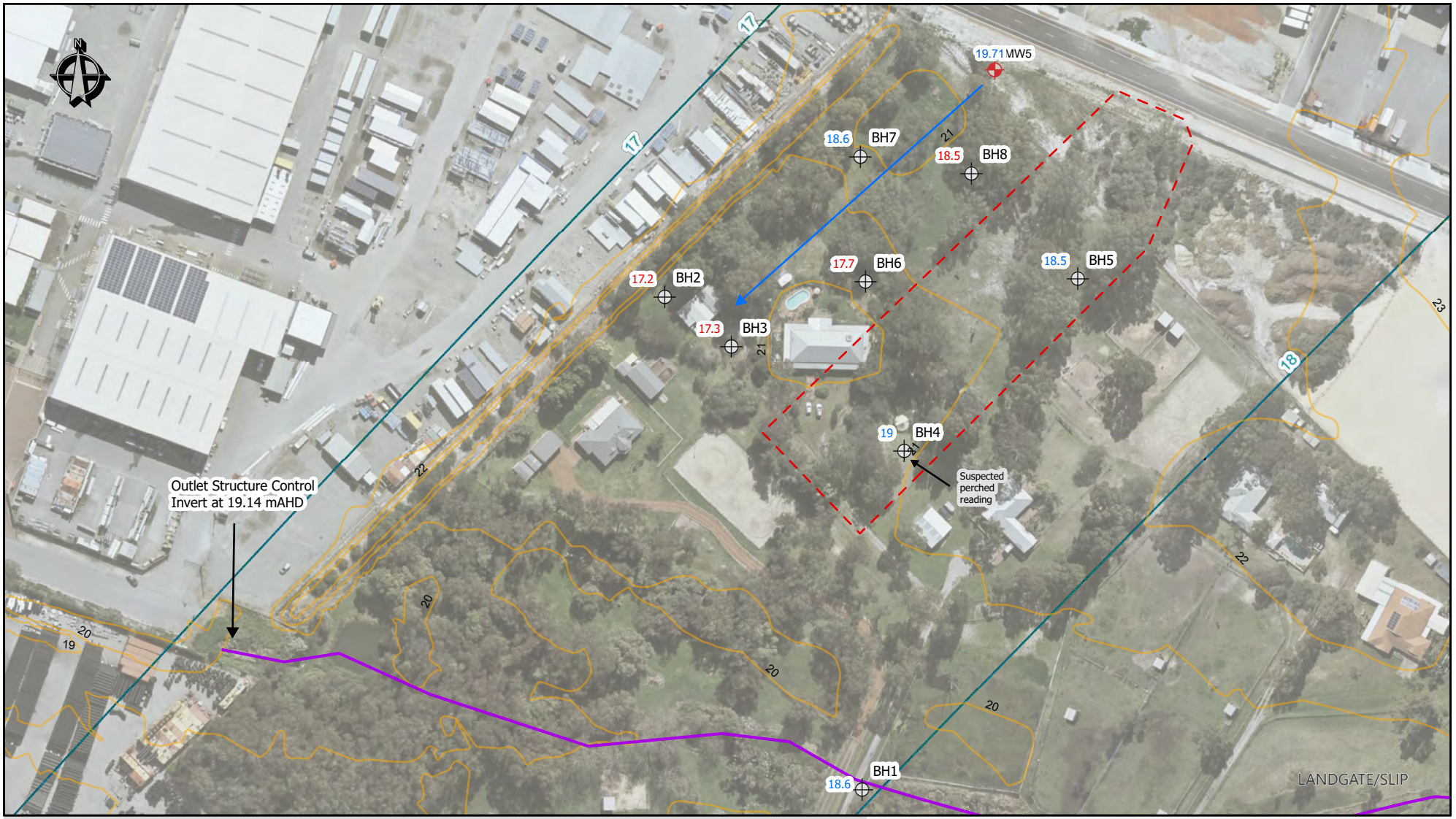
hyd2o

Lot 14 (Lot 2) Hatch Court High Wycombe SMP

Surface Water Plan

Figure 2

Date: 23/06/2025 Job No. H25037



Site

DWER LiDAR Contours 1m

Regional GW DWER 2019 Maximum Contours (mAHD)

Geotech Pits (Undertaken May 2025)

GW Found - Inferred GW Level (mAHD)

No GW - Inferred Base of Pit (mAHD)

Historical Monitoring Bores

AAMGL (mAHD)

Inferred Regional GW Flow Direction

Drain

hyd2o

Lot 14 (Lot 2) Hatch Court High Wycombe SMP

Groundwater Plan

Figure 3

Date: 26/06/2025 Job No. H25037



Site
Drainage Swale
Surface Flow
Indicative Drainage Network
Pipe Beneath Swale
(To provide connection for future development lot)
Roof
Hardstand
Landscape/Pervious

hyd2o

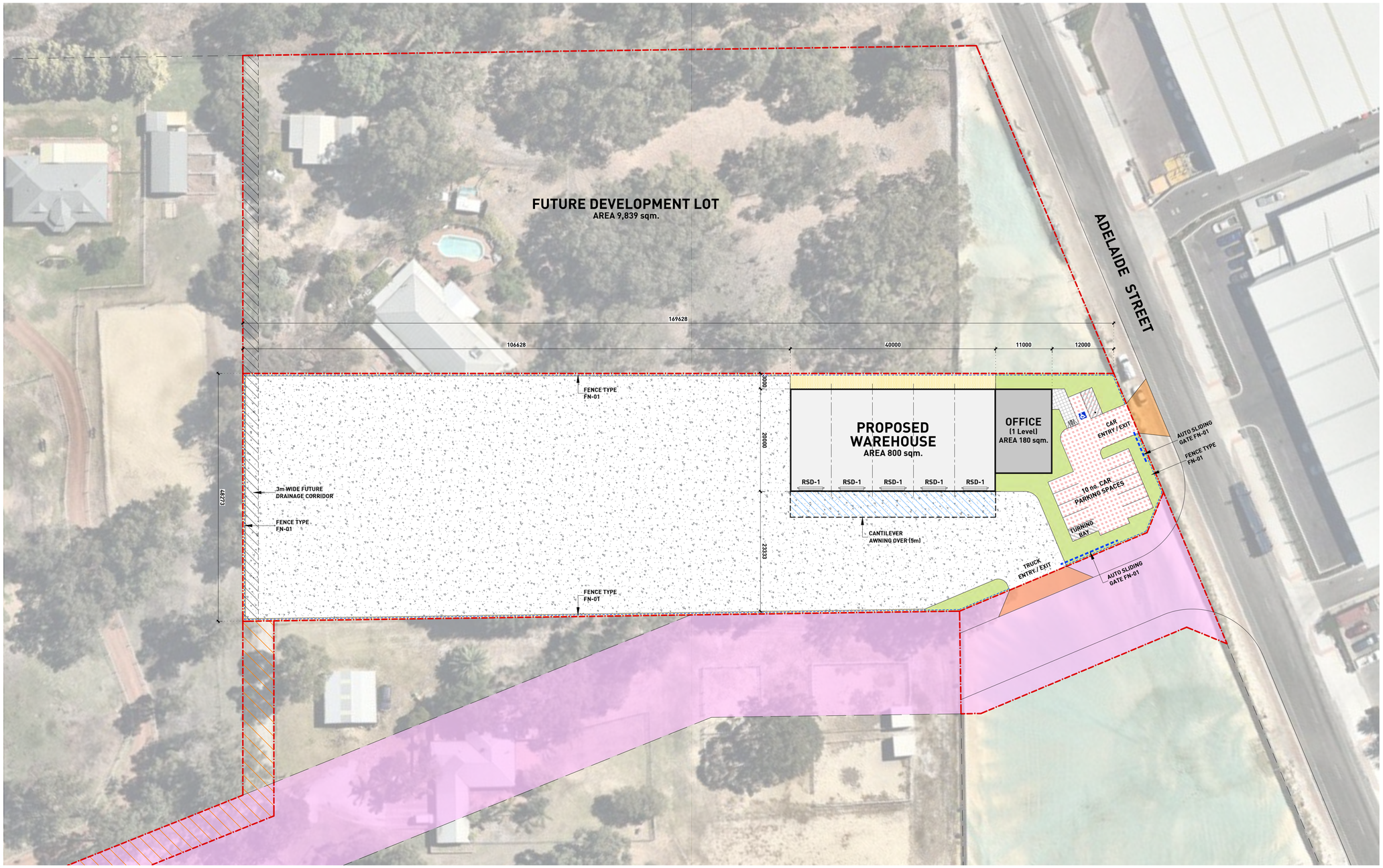
Lot 14 (Lot 2) Hatch Court High Wycombe SMP

Stormwater Management Plan

Figure 4

APPENDIX A
Site Plan

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DEVELOPMENT SUMMARY

PROPOSED SITE AREA	7,987	sqm. approx.
Proposed Warehouse Area	800	sqm.
Office Area (1 Level)	180	sqm
TOTAL BUILDING AREA	980	sqm.
Total Heavy Duty Paving Area	6,010	sqm. approx.
Total Light Duty Paving Area	350	sqm. approx.
Total Aggregate Paving Area	260	sqm. approx.
Total Warehouse Awning Area	200	sqm. approx.
Total Car Parking Provided	10	spaces

PROPOSED FUTURE ROAD RESERVE EXTENSION TO HATCH COURT
(Alignment to be confirmed)

PROPOSED LOT 2 LAND TO BE CONSIDERED FOR FUTURE ROAD RESERVE ACQUISITION
(Subject to separate subdivision proposal)

EXTENT OF HEAVY DUTY PAVING AREA
(Concrete Hardstand)

EXTENT OF LIGHT DUTY PAVING AREA
(Red Asphalt)

EXTENT OF AGGREGATE PAVING AREA

EXTENT OF LANDSCAPE AREA

EXTENT OF WAREHOUSE AWNING AREA

RSD-1 ROLLER SHUTTER DOOR 4.5mW x 4.5mH

LANDSCAPING
Landscaping to be in accordance with requirements of City of Kalamunda. Refer to Landscape Consultant's drawings and specifications for full details.

LIGHTING
External lighting must be designed, baffled and located so as to prevent any adverse effect on adjoining land to the satisfaction of the Responsible Authority. Building mounted flood lights to be provided within the car park area.

CAR PARKING
Car parking spaces to be 5400mm long x 2500mm wide (unless noted otherwise) and be in accordance with requirements of City of Kalamunda.

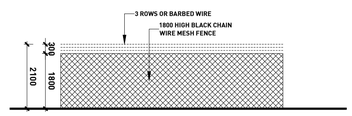
Disabled car parking spaces to be 5400mm long x 2500mm wide, with a shared vacant space of equal size to one side of the allocated disabled space in accordance with A.S. 2890.6 (2009).

All car parking bays to be line marked in 80mm wide white weatherproof paint in accordance with A.S. 2890.1 (2004).

VEHICLE CROSSINGS AND ACCESS
All new vehicle crossings shall be to the requirements of the relevant Statutory Authority.

PLANT & EQUIPMENT
All external plant and equipment to be screened or positioned to prevent unreasonable visual impact.

DISABILITY ACCESS
All building entrances are to be in accordance with A.S. 1428.1 (2009).



FENCE TYPE FN-01
TYPICAL BOUNDARY FENCE & GATE ELEVATION
SCALE 1:100

Site Plan

Drawing Type: Development Application | Drawing No: DA-011(A) | Project No: 2411-430 | Date: 10 June 2025 | Scale: 1:400 @ A1

0 20 40

PROPOSED DEVELOPMENT

Proposed Lot 2 at Lot 14 Hatch Court & Lot 1499 Stirling Crescent, High Wycombe WA

HESPERIA

APPENDIX B
Galt Geotechnics (2025) Geotech Report

Appendix D SURVEY AND LIDAR

1

53

52

51

51

Lewis Rd

67239

67300

67361

67422

366187

366126

Undefined Pit
UTO

1.6-1.8m Chain Mesh & Barbed Wire Fence

1.2m Barbed Wire Fence

1m Barbed Wire Fence

1.8m Chain Mesh & Barbed Wire Fence

Concrete Retaining Wall & Chain mesh/Barbed Wire Fence

Ø350 PVC Culvert
US IL19.02
DS IL18.99

3x1.5m SW PIT Chamber
Base 18.47
2 x Ø450? PVC?
IL18.04

20

See Page 1

See Page 2

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eMail: info@thompsonsurveying.com.au

CLIENT:	DYNAMIC PLANNING	Date:30/09/2025	Drawn: MD	Surveyor: KS	CHKd: MD
PROJECT:	Hatch Court Light Industrial Area, HIGH WYCOMBE	File:23537-002a			
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TITLE:	Drainage and Feature Survey				
DATUM	HOR: PCG94	VERT: A.H.D.			

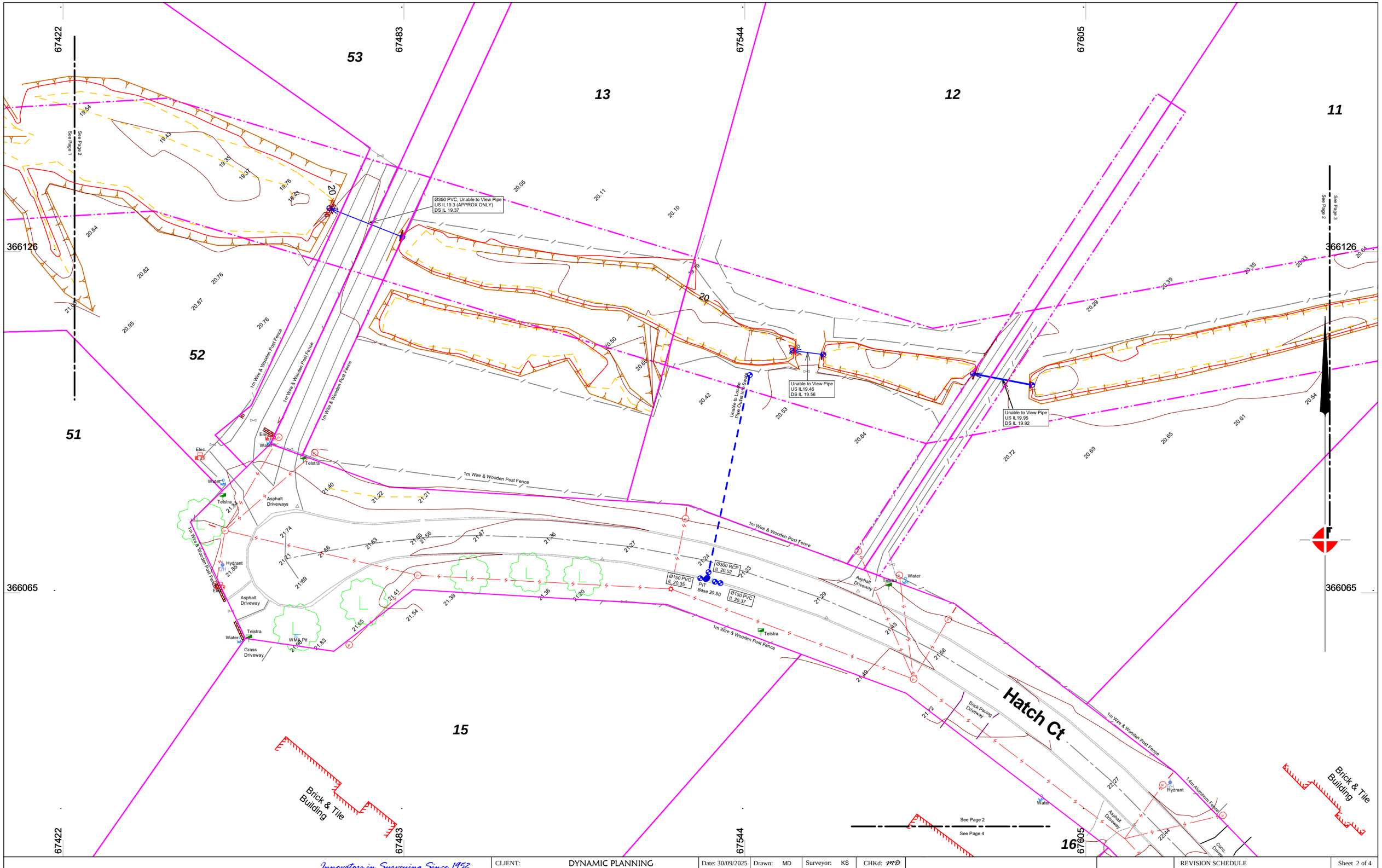
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REVISION SCHEDULE — Sheet 1 of 4

No.	Date	Description

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PROJECT:	Hatch Court Light Industrial Area, HIGH WYCOMBE	File: 23537-002a			
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TITLE:	Drainage and Feature Survey				
DATUM	HOR: PCG94	VERT: A.H.D.			

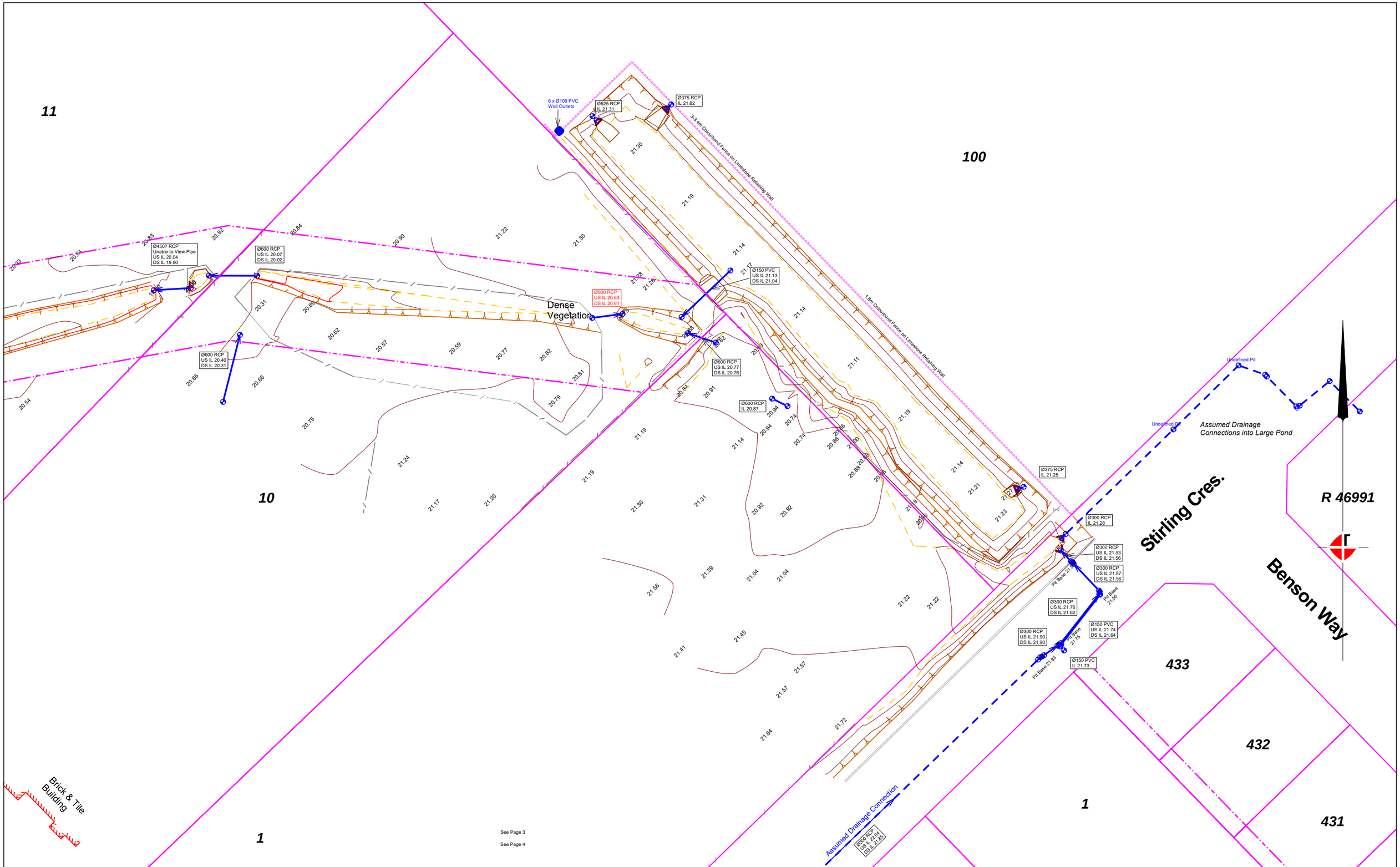
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REVISION SCHEDULE — Sheet 2 of 4

No.	Date	Description

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CLIENT:	DYNAMIC PLANNING	Date: 30/09/2025	Drawn: MD	Surveyor: KS	CHKd: MD
PROJECT:	Hatch Court Light Industrial Area, HIGH WYCOMBE	File: 23537-002a			
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TITLE:	Drainage and Feature Survey				
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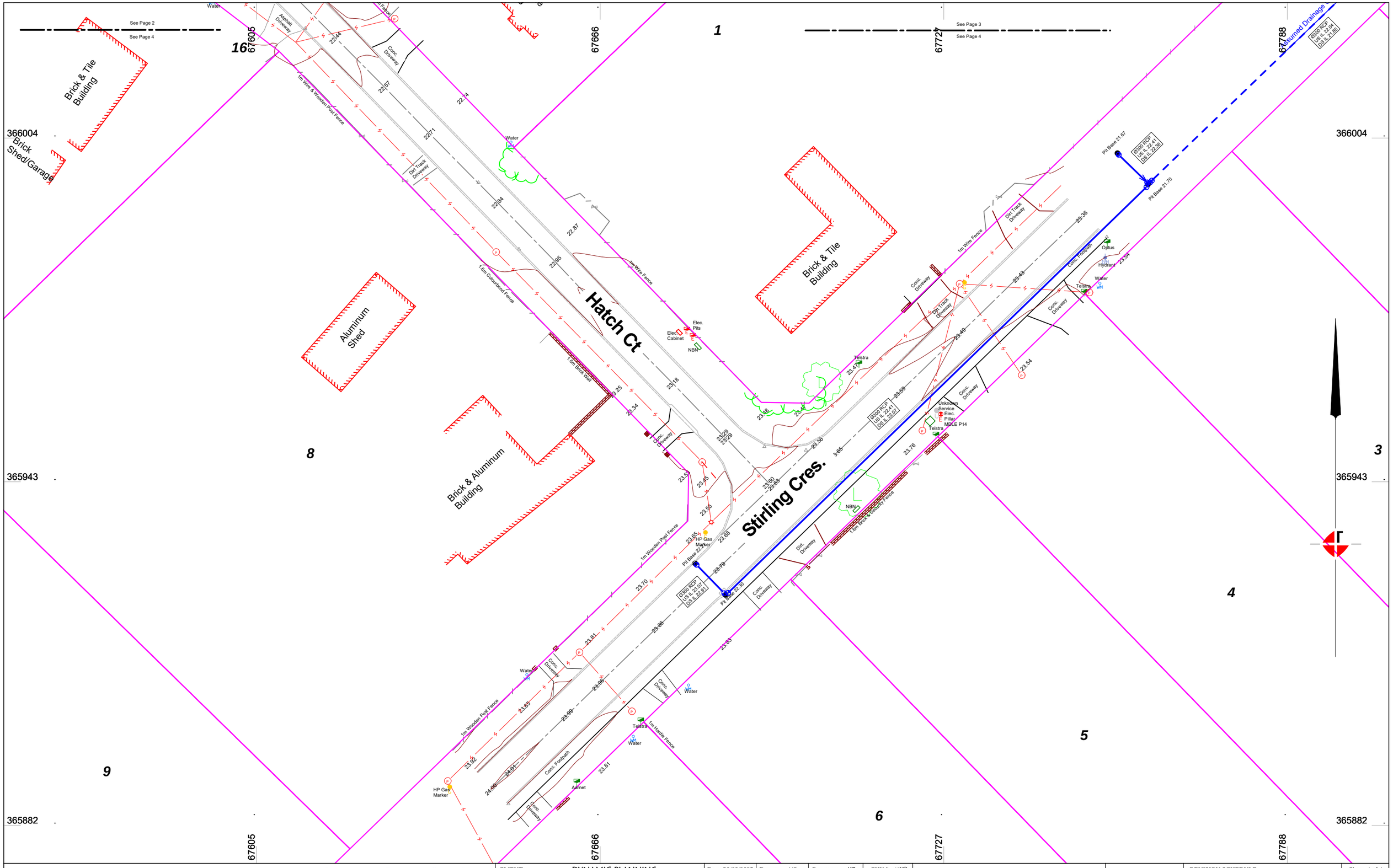
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REVISION SCHEDULE — Sheet 3 of 4

No.	Date	Description

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PROJECT:	Hatch Court Light Industrial Area, HIGH WYCOMBE	File:23537-002a			
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TITLE:	Drainage and Feature Survey				
DATUM	HOR: PCG94	VERT: A.H.D.			

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REVISION SCHEDULE — Sheet 4 of 4

No.	Date	Description

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NOTE : The ground contours and grid heights shown on this plan have been derived from Lidar data supplied by Landgate and captured on the 21/1/2022, utilising Lidar classification types of Ground and Road.

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CLIENT:	DYNAMIC PLANNING & INVESTMENTS	Date: 24/07/2025	Drawn: PS	Surveyor: MD	CHKd: MD
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A.H.D. HEIGHTS DERIVED FROM :	LIDAR DATA				

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REVISION SCHEDULE			Sheet 1 of 1
No.	Date	Description	

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