Appendices

Appendix No. 1 – Geotechnical Investigation

Appendix No. 2 – Leachate Analysis

Appendix No. 3 – Commissioning Plan

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Appendix No. 1 – Geotechnical Investigation

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STRUCterre consulting

Geotechnical Investigation

Job No: J477212_Rev1

IW PROJECTS

Tamala Park Tank Farm

Lot 9043 #1700K Marmion Avenue, Tamala Park, WA

23 April 2025

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Privacy & Confidentiality Notice

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Disclaimer

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1. Project Details

1.1 Introduction

At the request of Ian Watkins of IW Projects, Structerre Consulting (Structerre) have conducted a Geotechnical Investigation at Lot 9043 #1700k Marmion Avenue, Tamala Park, WA. The purpose of the investigation was to provide the following for the proposed development of a tank farm.

- Desktop study summarising the geology, groundwater, site history (obtained from historical photographs) and potential presence of Acid Sulfate Soils (ASS).
- Summary of encountered ground and groundwater conditions.
- Site Classification in accordance with AS2870.
- Earthquake site factor in accordance with AS1170.4.
- Site preparation requirements for earthworks, including site traffic, excavation, reuse of materials and batter slopes.
- Ground bearing capacity and estimated settlements for pad and strip footings founded at 0.5m and 1.0m.
- Geotechnical design parameters for retaining structures and or deep foundations.
- Preliminary pavement design parameter, indicative California Bearing Ratio (CBR) values determined from penetrometer results and ground conditions encountered.

This report details the scope of the geotechnical investigation, presents an interpretation of ground conditions and material properties across the site, provides geotechnical design parameters for the design of the proposed infrastructure, and evaluates the suitability of materials for use in earthworks. Interpretation of site conditions is based on the subsurface lithology revealed during the investigation programme, visual assessments of the in-situ materials and the results of in situ field tests.

Terms of reference for this investigation were presented in a Structerre Consulting proposal reference Q111478 (dated 13 February 2025), which was submitted to and accepted by IW Projects.

1.2 Site Description

The site is located at - Lot 9043 #1700k Marmion Avenue, Tamala Park, within the City of Wanneroo, WA. Marmion Avenue lies to the west of the site, with bushland to the north and residential addresses to the south. Connelly Avenue lies to the east of the site.

The site generally slopes downward from north to south.

We understand that the site is to be used for the proposed development of a proposed tank farm.

1.3 Field Investigation – Scope of Works

The field investigation was carried out on 28 February 2025 and comprised:

- Four (4) Sample Retrieval Probes (SRP) to a refusal depth of 0.9m over the site for material assessment and soil profiling.
- Two (2) Electric Friction Cone Penetrometer Test's (EFCPT's) to a depth of 0.7m over the site for material assessment and soil profiling.
- Four (4) Perth Sand Penetrometer (PSP) tests in accordance with AS 1289.6.3.3-1997 to a depth of 0.45m for evaluation of relative densities of the upper layers.

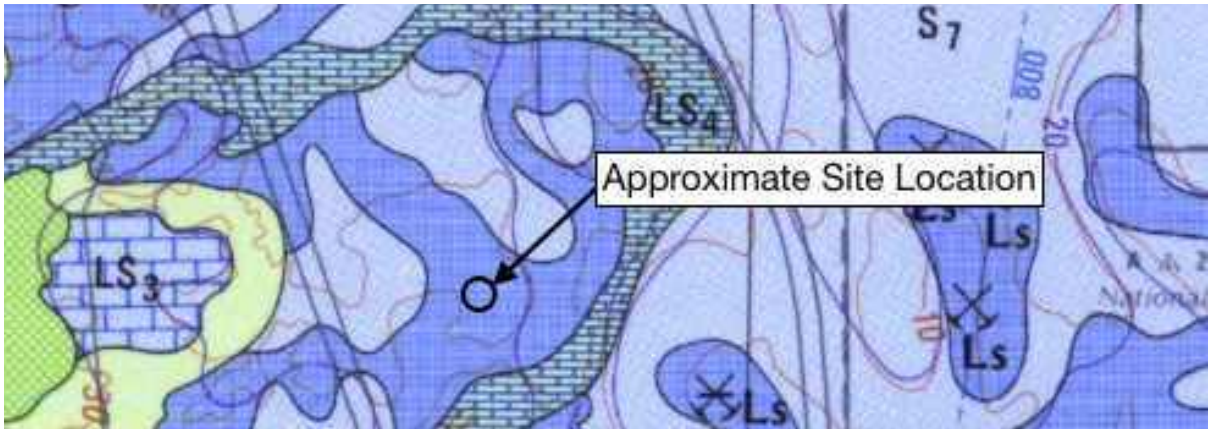
The test locations are shown on the attached site plan in Appendix A.

Suitable qualified geotechnical personnel from Structerre supervised and undertaken all the fieldwork, interpretation and terminology used in this report are in accordance with the guidelines presented in AS1726-2017 Geotechnical Site Investigations.

2. Desk Study

2.1 Geological Setting

The Yanchep sheet 1: 50,000 Environmental Geology Series (Part Sheets 2034 , 1986) prepared by the Geological Survey of Western Australia indicates that the following geological layers underlie the site:



LS1 — LIMESTONE (LS_1) – light, yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin (Tamala Limestone Qtl)

2.2 Ground Surface and Groundwater Level

Publicly available topographic mapping service Landgate Map Viewer indicates the ground surface level at this site was approximately 37.5m Australian Height Datum (AHD).

According to the Perth Groundwater Atlas (Waters & Rivers Commission) groundwater is expected to be intersected with the range of 0.5m (maximum) and 0.8m (minimum) AHD. It should be noted that the groundwater levels can vary significantly due to seasonal variation and the data from the recorded range should be used only as a guide.

2.3 Acid Sulfate soils

Information from publicly available Landgate website indicates that the site lies within a zone of no known risk of ASS occurring within 3.0m of natural surface.

2.4 Site History

Historical aerial photographs dating back to 1965 are publicly available through Landgate Map Viewer were assessed and a summary is presented in Table 1.

Table 1 – Historical Site Information

Date	Description
1953	The site is bushland
1989	Marmion Avenue developed
1995	Tamala Park Disposal developed
2004	Large scale development of the landfill site (expansion west)
2024	No large-scale developments occur onsite outside of the ongoing operations of a landfill site.

3. Results of the Investigation

3.1 Subsurface Soil Profile

The subsurface soil profile presented below was determined from the ground conditions encountered during the investigation and laboratory test results:

Table 2 – Subsurface Soil Profile

Depth to Base of Strata (m)	Geological Setting	Material Description
0.1	SURFICIAL *(BH01 and CPT1 Only)*	TOPSOIL
0.3 – 0.9 *(Ave. 0.6)*	NATURAL	SAND (fine to medium grained) with fine to medium grained gravel (limestone), non-plastic, dense to very dense
Not penetrated >0.9	NATURAL	LIMESTONE

The soils encountered are consistent with the expected site conditions as predicted from the Environmental Geology Map. It is important to note that there may be pockets of fill on site that are deeper than that encountered by the investigation boreholes. The subsurface soil conditions encountered are presented in the bore logs, within Appendix C.

3.2 Groundwater

Groundwater was not encountered during the investigation. However, based on the Perth Groundwater Atlas, the groundwater is expected to be encountered approximately 37.3m below the existing ground level.

3.3 Laboratory Test Results

Samples were tested by Structerre's in-house NATA accredited laboratory for soil compaction via Modified Maximum Dry Density (MMDD) as per AS 1289 5.2.1-2003 and California Bearing Ratio (CBR) as per AS 1289.6.1.1-2017, and Organic Content as per ASTM D2974.

3.3.1 Modified Maximum Dry Density (MMDD) and California Bearing Ratio (CBR)

The test certificates are presented in Appendix D and are summarised in Table 5 below.

Table 3 – CBR Test Results

Test Hole	Depth (m)	Soil Description	Optimum Moisture Content (%)	Maximum Dry Density (t/m³)	2.5mm Penetration (%)	5mm Penetration (%)
BH01	0.1-0.2	SAND with limestone	10.5	1.85	30	-
SAND (Imported Fill) @ 95% MMDD*					12	

** Implies the maximum dry density ratio using Modified compaction in accordance with AS 1289 5.2.1-2003.*

Based on the above results a conservative soaked CBR of 20% would be recommended for the natural subgrade materials.

4. Geotechnical Construction Considerations

4.1 Site Classification

AS 2870-2011 Residential Slabs and Footings provides guidance on site classification for residential slabs and footing design based on the expected ground surface movement and depth of expected moisture changes.

Although the proposed development falls outside the scope of AS 2870, site classification can be used to assist in the design of foundations. The foundation design should be undertaken by a Structural Engineer, taking into consideration ground bearing capacity and the acceptable total and differential settlements of the proposed foundation system.

Based on results of this investigation the site can be classified as an equivalent Class "A" provided that all unsuitable materials are removed and replaced with engineer-controlled sand fill materials in accordance with earthwork recommendations outlined in Section 4.3 in this report.

4.2 Seismic Site Subsoil Class

The seismic subsoil site class has been assessed in accordance with AS 1170.4-2007, using the results of this investigation and published information.

Table 4 – Summary of Seismic Parameters

Hazard Factor	Site Sub-soil Class
0.09	Class Ce – shallow soil site

4.3 Earthworks

All earthworks shall be undertaken in accordance with AS 3798-2007 Guidelines on earthworks for commercial and residential developments and are to include the following:

- All unsuitable materials to be stripped and removed from the site. Unsuitable materials include vegetation, topsoils, uncontrolled filling, and any deleterious and organic materials. (This includes the large stockpile encountered onsite).
- The stockpile was visually assessed to be mainly SAND with limestone and covered with vegetation regrowth. If reuse of the material is required, further assessment will be required (Particle Size Distribution & Organic Content to ascertain the percentage of fines and organic respectively within the stockpile).
- It is considered that the near surface materials will require improvement. Therefore, it is proposed to excavate and stockpile the materials for reuse, provided it is dry, free from clay/silt (i.e., <5%), organic and deleterious materials. The depth of excavation may vary depending on conditions encountered (i.e. FILL) and is subject to assessment. However, it is envisaged that an average depth of excavation would be approximately -0.5m below design levels.

- Post excavation, the base is to be assessed by a representative from this office to confirm suitability.
- Based on the initial geotechnical results, post site visit (and assuming the underlying material is limestone bedrock). The exposed base is to be cross ripped to a depth of approximately 0.4m to create a SAND / LIMESTONE matrix, moisture conditioned and proof compacted.
- Excavation should not exceed 1.2m without adequate temporary shoring and/or safe excavation practices (e.g., benching, and / or batters), or undermine any surrounding structures. A 1V:2H slope should be maintained for temporary excavations. If excavation is required closer than the 1V:2H slope would allow, it is recommended that this office be contacted for retaining design.
- Proof compact the exposed (ripped) base. The compaction requirements are set out in the table below, as per AS 3798-2007:

Table 5 – Compaction Requirements

Item	Application	Minimum relative compaction %
		Minimum density index (Cohesionless soils)
2	Commercial – fills to support minor loadings, including floor loading of up to 20kPa and isolated pad or strip footings to 100kPa	75
3	Fill to support pavements General Fill Subgrade (to a depth of 0.3m)	 70 75

- After excavation, ripping and proof compaction, the exposed base is to be assessed and approved by an authorised representative from this office prior to backfilling. At this stage it can be assessed whether any further compaction of the base is required.
- The ground level should be built up to design levels with the stockpiled sand materials and imported fill. If required, the imported fill should consist of free draining sand with not more than 5% passing a 75µm sieve and be free of organic matter and other deleterious materials.
- The fill sand materials should be placed in layers not exceeding 300mm loose thickness and compacted to achieve the values stated in the table above. As a guide a minimum of 7 PSP blows over the interval 150 – 450mm, 9 PSP blows over the interval 450 – 750mm and 11 PSP blows over the interval 750 – 1050mm should be achieved, however it is recommended that this be verified with appropriate laboratory testing.

- For design loadings above 100kPa additional compactive effort may be required over the base. Bearing capacities as outlined in Section 4.5 of this report can be achieved with compaction of the base of foundation to a minimum of 95% modified maximum dry density as determined by AS1289 5.2.1 and 5.4.1, to a minimum depth of 0.5m below the base of foundation.
- After remedial earthworks have been completed, the earthworks should be assessed and approved by an authorised qualified representative from this office.

It is considered that standard small to medium sized earthmoving equipment would be appropriate for the proposed earthworks. The near surface ground is competent and should not pose an issue to site traffic movements.

The surficial material encountered on site can be deemed as 'easy' to excavate with medium sized earthwork equipment (i.e., a 20t excavator). An allowance should be made due to the early refusal at an average depth of 0.6m. It was not possible to confirm if this refusal occurred due to limestone bedrock, or fill materials (controlled or uncontrolled)

4.4 Geotechnical Design Parameters

Based on the field investigation and test results, the interpreted geotechnical soil parameters of the encountered materials are presented in the below table.

Table 6 – Geotechnical Design Parameters

Soil Type	Depths (m)	Friction Angle Ø (°)	Cohesion C (kPa)	Density Y (t/m³)	Elastic Modulus E (MPa)
SAND	0.0 – 0.6	35	0	1.80	30
LIMESTONE	0.6 +	35	30	2.1	100

4.5 Shallow Footings – Allowable Soil Bearing Capacities

Based on the findings of the current preliminary geotechnical investigation, shallow pad and strip footings are considered appropriate for the proposed development. Allowable bearing capacities for shallow footings at the site have been calculated under the following assumptions:

- The site preparation procedures specified in Section 4.3 have been carried out.
- The specified level of compaction has been achieved below the base of each footing.
- Loads are vertical and not eccentric.
- Isolated footings (i.e., interaction of foundations has not been considered).
- The foundations are flexible.
- A factor of safety (FoS) of 3.0 against bearing capacity failure.
- Maximum allowable settlement of 20mm.

The tables below present the allowable bearing pressures for pad and strip footings of various dimensions, with embedment depths of 0.5m and 1.0m below finished surface level

Table 7 – Allowable Bearing Capacities for Pad Footings

Minimum Depth of Embedment (m)	Minimum Plan Dimension (m)	Allowable Bearing Capacities (kPa)	Settlement (mm)
0.5	0.5	200	< 20
	1.0	>250*	
	1.5		
	2.0		
1.0	0.5	>250*	< 20
	1.0		
	1.5		
	2.0		

Table 8 – Allowable Bearing Capacities for Strip Footings

Minimum Depth of Embedment (m)	Minimum Plan Dimension (m)	Allowable Bearing Capacities (kPa)	Settlement (mm)
0.5	0.5	160	< 20
	1.0	220	
	1.5	>250*	
1.0	0.5	200	< 20
	1.0	250	
	1.5	>250*	

** Note: it is recommended to limit these values to 250kPa.*

The recommended allowable bearing capacities are dependent on the site being dry and well drained, so that the foundation material does not become saturated.

The actual allowable bearing capacity of a particular foundation will be dependent on its location, geometry and founding depth, as well as the founding horizon. Therefore, once specific foundation geometries have been determined and the earthworks completed, it is recommended that the allowable bearing capacity and associated settlements be verified.

Additionally, should undermining issue prevent the excavation of the near surface loose materials, it is recommended that the allowable bearing capacity be reviewed. However, this will likely result in lower allowable bearing capacities.

4.6 Retaining Walls

Any retaining walls proposed to be installed at the site will likely support sandy soils. Where imported granular backfill is to be used in conjunction with retaining walls, the geotechnical properties will vary depending upon the nature of the granular materials imported.

For cohesion-less free draining sand, the following parameters can be used as a guide for design purposes:

Table 9 – Retaining Wall Design Parameters

Parameters	Design Values
Angle of internal friction (Ø)	32°
Coefficient of active earth pressure (Kpa)	0.307 Kpa
Coefficient of passive earth pressure (Kpa)	3.255 Kpa
At rest coefficient of earth pressure (KO)	0.470
Bulk density	18 KN/m^3

Retaining structures should be designed in accordance with AS 4678-2002 Earth Retaining Structures. Guidance on allowable footing bearing pressures is provided in Section 4.5. Where significant eccentric and /or horizontal loading is applied, further assessment will be required.

Retaining wall design should ensure adequate drainage to the rear of the wall via weepholes or proper designed drainage system. Handheld compaction equipment is utilised within 2.0m of the walls, to reduce the potential increase in lateral pressure on the retaining wall.

Experience indicates that excavation immediately in front of retaining walls may cause movement to the wall to occur. This can lead to cracking of adjoining structures and needs to be accounted for in the design and construction sequencing of the new works.

5. Conclusions

A site investigation was carried out at the proposed commercial development site to assess the geotechnical conditions. Parameter and design recommendations are incorporated in the body of the report. The following conclusions have been drawn from the site investigation:

- The subsurface soil profile encountered comprised dense to very dense sand to the average refusal depth of 0.6m.
- The water table was not encountered during the investigation
- The site can be classified as an equivalent Class “A” in accordance with AS 2870-2011 provided the recommended earthworks are undertaken.
- Recommended earthworks include stripping of fill sand and unsuitable materials, excavation of loose materials, proof compaction of the base, placement of engineered fill and compaction of final level.
- Allowable bearing capacity for pad footings range from 200kPa to 250kPa and from 160kPa to 250kPa for strip footings. The estimation of settlement of the footings is limited to 20mm.

6. Limitation of Field Investigations

This report has been prepared in accordance with general accepted consulting practice for the Client using information supplied at the time and for the project specific requirements as understood by Structerre. To the best of our knowledge the information contained in this report is accurate at the date of issue, however it should be emphasised that any changes to ground conditions and/or the proposed structures may invalidate the recommendations given herein.

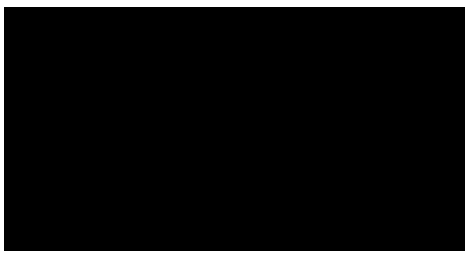
The conclusions and recommendations in this report are based on the site conditions revealed through selective point sampling, representing the conditions of the site in total, although the area investigated represents only a small portion of the site. The actual characteristics may vary significantly between successive test locations and sample intervals other than where observations, explorations and investigations have been made.

The materials and their geotechnical properties presented in this report may not represent the full range of materials and strengths that exist on site and the recommendations should be regarded as preliminary in nature. Allowances should be made for variability in ground conditions and any consequent impact on the development. Structerre accepts no responsibility and shall not be liable for any consequence of variations in ground conditions. If ground conditions encountered during construction are different to that described in this report, this office should be notified immediately.

Should you require further information or clarification of any of the recommendations provided within this report, please contact the undersigned.

For and on behalf of Structerre Consulting.

Geotechnical Assistant Manager



Senior Geotechnical Engineer

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23 April 2025

Job #	Revision	Authored	Checked	Authorised
J477212	1	LYG	ENG	MEC

7. References

Department of Water – Perth Groundwater Atlas

Landgate Map Viewer

The Yanchep sheet 1: 50,000 Environmental Geology Series (Part Sheets 2034 , 1986) prepared by the Geological Survey of Western Australia

AS 1170.4-2007 Structural design actions – Earthquake actions in Australia

AS 1289.5.2.1- 2017 Methods of testing soils for engineering purposes – Soil compaction and density tests – Determination of the dry density / moisture content relation of a soil using modified compactive effort.

AS 1289.6.1.1-2014 Methods of testing soils for engineering purposes – Soil strength and consolidation tests – Determination of the California Bearing Ratio of a soil – Standard laboratory method for a remoulded specimen.

AS 1289.6.3.3-1997 Methods of testing soils for engineering purposes – Soil strength and consolidation tests – Determination of the penetration resistance of a soil – Perth sand penetrometer test

AS 1726-2017 Geotechnical Site Investigation

AS 2870-2011 Residential Slabs and Footings

AS 3798-2007 Guidelines on Earthworks for Commercial and Residential Developments

Appendix A – Site Plan

Note: Showing approximate test locations only

LEGEND

- Borehole
- Electric Friction Cone Penetrometer Test

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PROJECT #: D355788

JOB #: J477212

CLIENT: **IW Projects**

SCALE: NTS

TITLE: Geotechnical Investigation Site Plan

DATE: 28 Feb '25

DRAWN BY: MM

CHECKED BY: LY

Appendix B – Site Photos

PHOTO 1 - Facing north from BH4 location

PHOTO 2 - Facing southwest from BH3 location

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PROJECT #:	D355788
CLIENT:	**IW Projects**
JOB #:	J477212
SCALE:	NTS
TITLE:	Site Photographs
DATE:	28 Feb '25
DRAWN BY:	MM
CHECKED BY:	LY

PHOTO 3 - Facing east from BH1 location

PHOTO 4 - Facing southwest from BH2 location

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PROJECT #:	D355788
CLIENT:	**IW Projects**
JOB #:	J477212
SCALE:	NTS
TITLE:	Site Photographs
DATE:	28 Feb '25
DRAWN BY:	MM
CHECKED BY:	LY

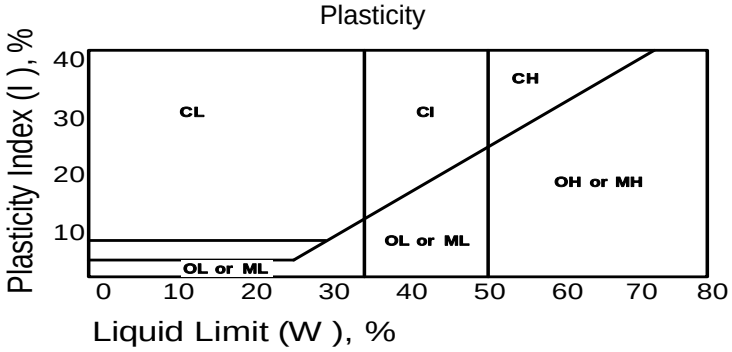
Appendix C – Borelogs & Terminology

BORELOG TERMINOLOGY

Particle Size Distribution

Major Division	Subdivision	Size
Boulders		>200mm
Cobbles		200 - 63mm
Gravel	Coarse	63 - 20mm
	Medium	20- 6mm
	Fine	6 - 2.36mm
Sand	Coarse	2.36 - 0.6mm
	Medium	0.6 - 0.2mm
	Fine	0.2 - 0.075mm

Plasticity



Consistency of Cohesive Soils

Term	Undrained Strength Su (kPa)	Field Guide
Very Soft	< 12	Exudes between the fingers when squeezed in hand
Soft	12 - 25	Can be moulded by light finger pressure
Firm	25 - 50	Can be moulded by strong finger pressure
Stiff	50 - 100	Cannot be moulded by Fingers. Can be indented by thumb.
Very Stiff	100 - 200	Can be indented by thumb nail
Hard	> 200	Can be indented with difficulty by thumb nail.
Friable	-	Crumbles or powders when scraped by thumbnail

Consistency/Density of Non-Cohesive Soils

Term	Density Index (%)	SPT "N" Value Comparison
Very Loose	< 15	0 - 4
Loose	15 - 35	4 - 10
Medium Dense	35 - 65	10 - 30
Dense	65 - 85	30 - 50
Very Dense	> 85	> 50

Moisture Content

D	Dry
M	Moist
W	Wet
S	Saturated

Minor Components

Term	Assessment Guide	Proportion of Minor Component In:
Trace	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component	Coarse grained soils: < 5 % Fine grained soils: <15%
With	Presence easily detected by feel or eye, soil properties little different to general properties of primary component	Coarse grained soils: 5 - 12 % Fine grained soils: 15 - 30%

Soil Legend

FILL	CLAY	GRAVEL	CONCRETE
TOPSOIL	SILT	LIMESTONE	COMBINATIONS
PEAT	SAND	BEDROCK	eg: Clay, Silty, Sandy

USCS

GW	Well graded gravel	SC	Clayey sand	OL	Organic low plasticity silt	CL	Low plasticity clay
GP	Poorly graded gravel	SM	Silty sand	ML	Low plasticity silt	CI	Intermediate plasticity clay
SW	Well graded sand			MH	High plasticity silt	CH	High plasticity clay
SP	Poorly graded sand			OH	Organic high plasticity silt	PT	Peat

DOC:GE:3.003

WA | QLD | NSW | VIC

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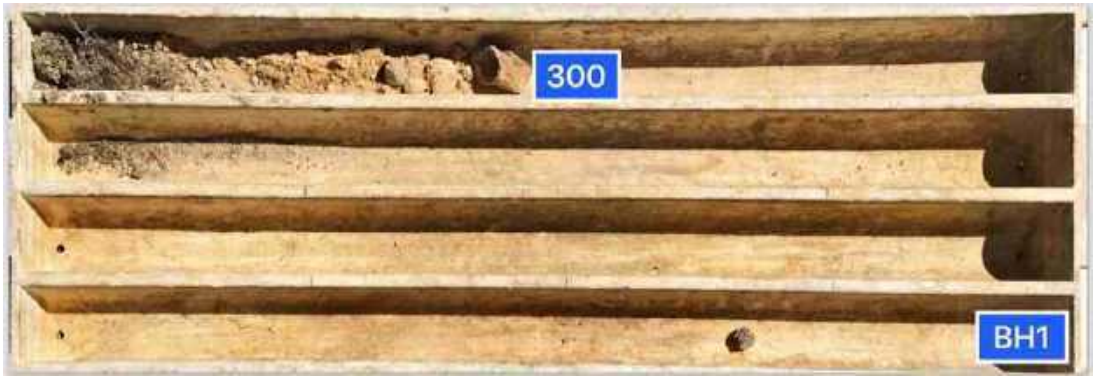
Borehole Record: BH1

Project: Proposed Tamala Park Tank Farm - Lot 9043 #1700K Marmion Av Tamala Park
Location: Tamala Park Reuse Shop, Marmion Avenue, Tamala Park WA
Loc Comment:
Job No: D355788 / J477212

Position: Easting: 379447.97
Northing: 6491309.61
Elevation: 40.88(m)
Inclination:

Date Drilled: 28/02/2025
Drill Rig
Drill Supplier
Logged/Checked: Ethan Rice

Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	PSP Results
0.1	Non-soil		TS	Topsoil			
	Natural		SP	Natural SAND SP: medium dense to dense, pale brown, fine to medium grained, with fine to medium sized gravel, dry, limestone .	D	MD-D	
				BH1 refusal at 0.3m (Limestone)			



Depth: m

This report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

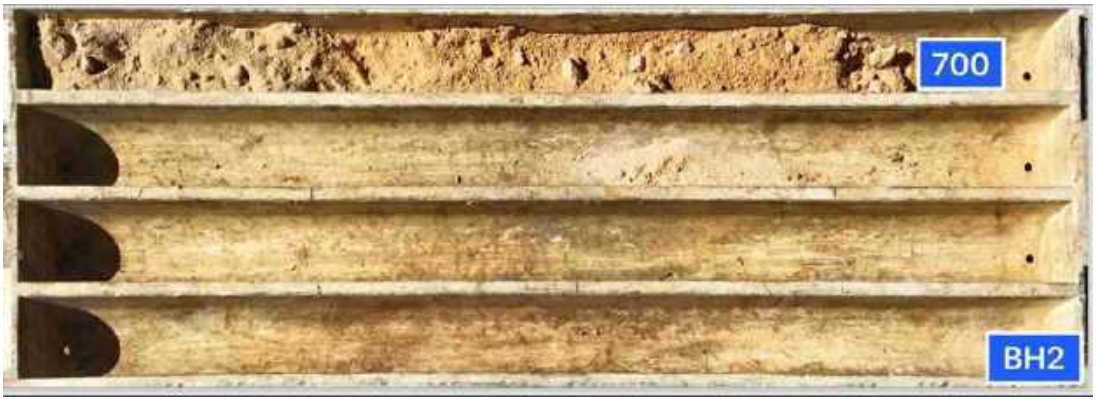
Borehole Record: BH2

Project: Proposed Tamala Park Tank Farm - Lot 9043 #1700K Marmion Av Tamala Park
Location: Tamala Park Reuse Shop, Marmion Avenue, Tamala Park WA
Loc Comment:
Job No: D355788 / J477212

Position: Easting: 379452.31
Northing: 6491322.26
Elevation: 40.01(m)
Inclination:

Date Drilled: 28/02/2025
Drill Rig
Drill Supplier
Logged/Checked: Ethan Rice

Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	PSP Results (0 5 10 15 20 25)
	Natural		SP	Natural SAND SP: medium dense to dense, pale brown, fine to medium grained, with fine to medium sized gravel, dry, limestone .	D	MD-D	
				BH2 Terminated at 0.7m (limestone refusal)			



Depth: m

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Borehole Record: BH3

Project: Proposed Tamala Park Tank Farm - Lot 9043 #1700K Marmion Av Tamala Park
Location: Tamala Park Reuse Shop, Marmion Avenue, Tamala Park WA
Loc Comment:
Job No: D355788 / J477212

Position: Easting: 379472.73
Northing: 6491321.67
Elevation: 38.87(m)
Inclination:

Date Drilled: 28/02/2025
Drill Rig
Drill Supplier
Logged/Checked: Ethan Rice

Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	PSP Results
	Natural		SP	Natural SAND SP: medium dense to dense, pale brown, fine to medium grained, with fine to medium sized gravel, dry, limestone .	D	MD-D	
				BH3 refusal at 0.7m (limestone refusal)			

PSP Results: 0 5 10 15 20 25

Depth: m

This report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

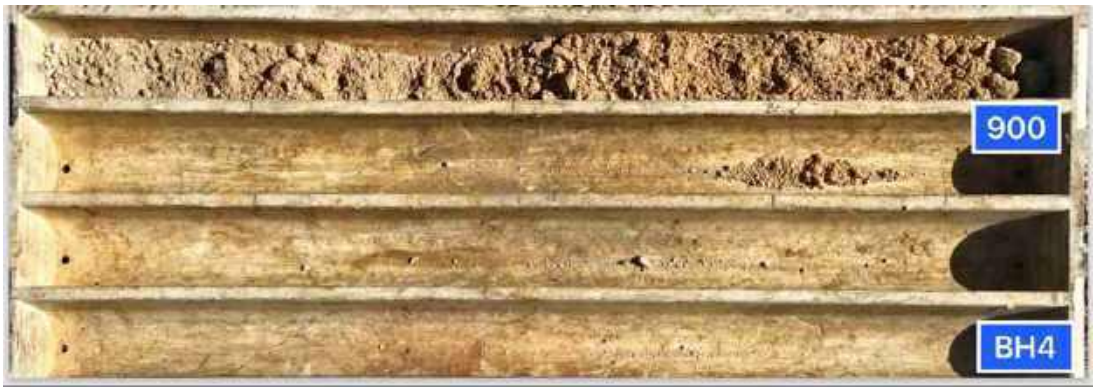
Borehole Record: BH4

Project: Proposed Tamala Park Tank Farm - Lot 9043 #1700K Marmion Av Tamala Park
Location: Tamala Park Reuse Shop, Marmion Avenue, Tamala Park WA
Loc Comment:
Job No: D355788 / J477212

Position: Easting: 379472.38
Northing: 6491310.72
Elevation: 39.95(m)
Inclination:

Date Drilled: 28/02/2025
Drill Rig
Drill Supplier
Logged/Checked: Ethan Rice

Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	PSP Results (0 5 10 15 20 25)
	Natural		SP	Natural SAND SP: medium dense to dense, pale brown, fine to medium grained, with fine to medium sized gravel, dry, limestone .	D	MD-D	
				BH4 refusal at 0.9m (limestone refusal)			



Depth: m

This report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

Appendix D – Laboratory Test Results

Malaga Laboratory
44 Crocker Drive, Malaga, WA 6090
Post: PO Box 792, Balcatta WA 6914
Ph : (08) 9205 4500
Email: wageotechlab@structerre.com.au
Website: www.structerre.com.au
ABN: 71 349 772 837 / ACN: 008 966 283

California Bearing Ratio Test Report

Report Number: CBR:25S-02520
Date of Issue17/03/2025
Issue Number: 1

Client:	IW Projects
Client Address:	6 Anembo Close Duncraig WA 6023
Project:	PROPOSED TAMALA PARK TANK FARM - Lot 9043 #1700K MARMION AV TAMALA PARK
Project No:	D355788

Accreditation Number 18742

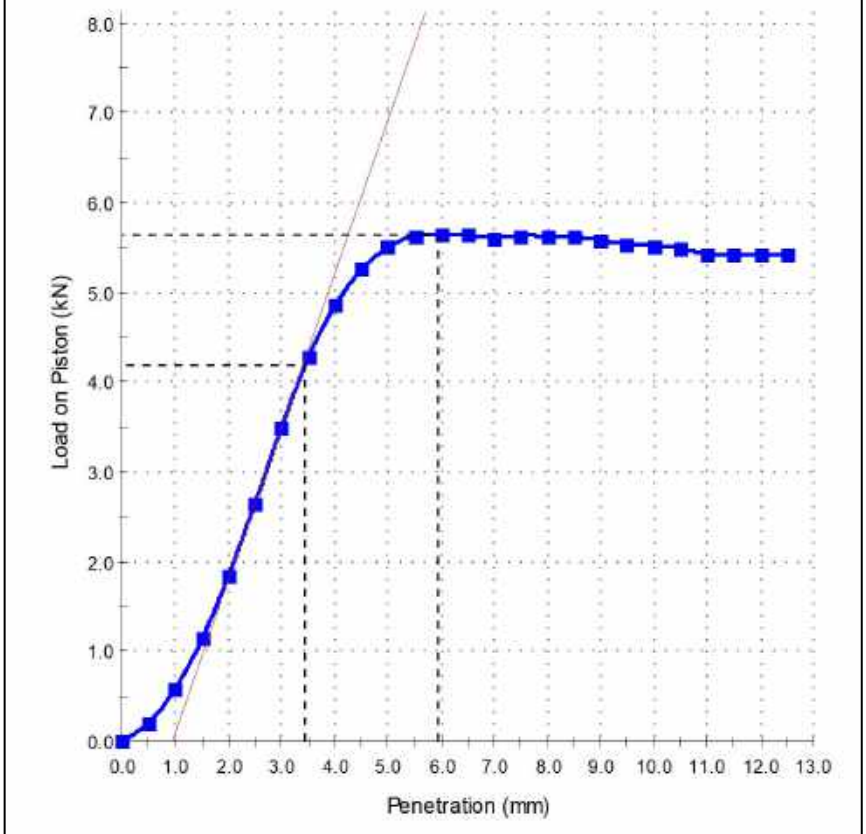
[redacted]

Accredited for compliance with ISO/IEC 17025

Sample Details

Sample ID:	#1700 Marion Av Tamala Park	**Field Sample ID:**	Sample 1
Date Tested:	12/03/2025	**Date Sampled:**	28/02/2025
Soil Description:	Sand with Limestone	**Proposed Use:**	Fill
Depth of Test:	100-300	**Depth of Layer:**	
Sampling Method:	AS1289 1.2.1 6.4 - uncompacted/compacted	**TRN:**	-
Work Order ID:	W25-01116		

Load vs Penetration



Test Results

	AS 1289.6.1.1
CBR at 2.5mm (%):	**30**
Dry Density before Soaking (t/m³):	1.76
Density Ratio before Soaking (%):	95.0
Moisture Content before Soaking (%):	10.5
Moisture Ratio before Soaking (%):	99.0
Dry Density after Soaking (t/m³):	1.79
Density Ratio after Soaking (%):	97.0
Swell (%):	-1.5
Moisture Content of Top 30mm (%):	13.7
Moisture Content of Remaining Depth (%):	13.7
Compaction Hammer Used:	Modified AS 1289.5.2.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Retained on 19 mm Sieve (%):	2
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Curing Time (h):	24
Plasticity Determination Method:	Visual/Tactile

Comments

Malaga Laboratory
44 Crocker Drive, Malaga, WA 6090
Post: PO Box 792, Balcatta WA 6914
Ph : (08) 9205 4500
Email: wageotechlab@structerre.com.au
Website: www.structerre.com.au
ABN: 71 349 772 837 / ACN: 008 966 283

Report Number: MDD:25S-02520
Date of Issue17/03/2025
Issue Number: 1

Maximum Dry Density Report

Client:	IW Projects
Client Address:	6 Anembo Close Duncraig WA 6023
Project:	PROPOSED TAMALA PARK TANK FARM - Lot 9043 #1700K MARMION AV TAMALA PARK
Project No:	D355788

Accreditation Number 18742

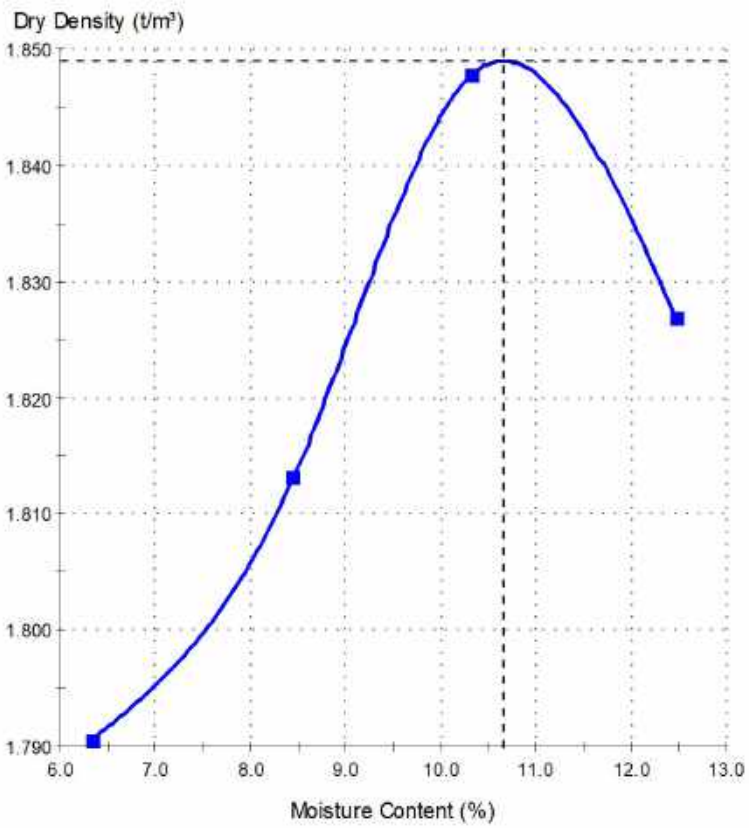
[redacted]

Accredited for compliance with ISO/IEC 17025

Sample Details

Sample ID:	#1700 Marion Av Tamala Park	**Field Sample ID:**	Sample 1
Date Tested:	06/03/2025	**Date Sampled:**	28/02/2025
Soil Description:	Sand with Limestone	**Proposed Use:**	Fill
Depth of Test:	100-300	**Depth of Layer:**	
Sampling Method:	AS1289 1.2.1 6.4 - uncompacted/compacted	**TRN:**	-
Work Order ID:	W25-01116		

Dry Density - Moisture Content Relationship



Test Results

AS 1289.5.2.1

Modified MDD (t/m³):	**1.85**
Modified OMC (%):	**10.5**
Retained Sieve (mm):	19.0
Oversize Material (%):	1
Curing Time (h):	2
LL Method:	Visual / Tactile

Comments

Appendix E – EFCPT Traces

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: IW Projects

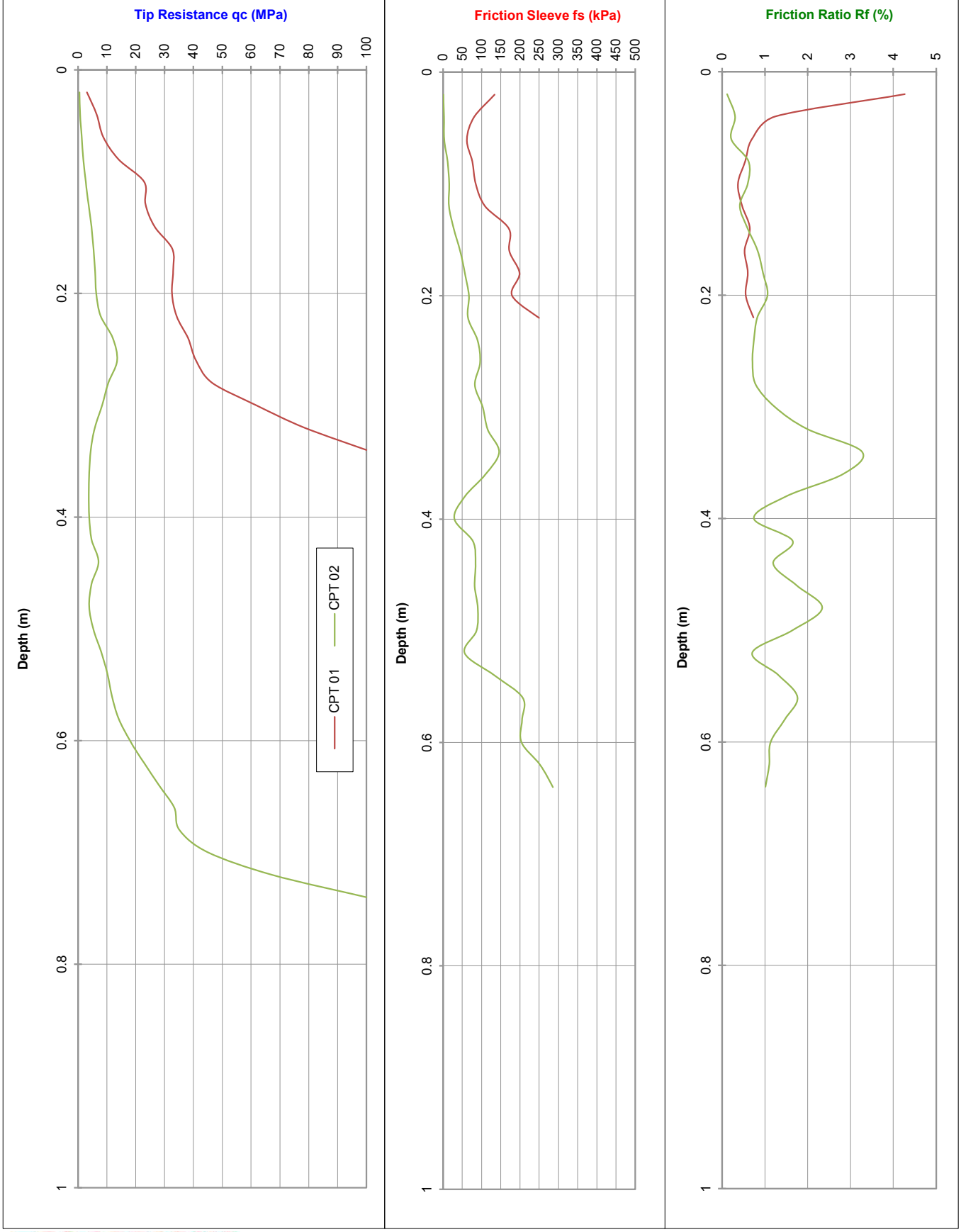
Job No.: J477212

PROJECT: D355788

Date/s: 28-Feb-2025

LOCATION: 1700K Marmion Avenue Tamala Park

ALL DATA



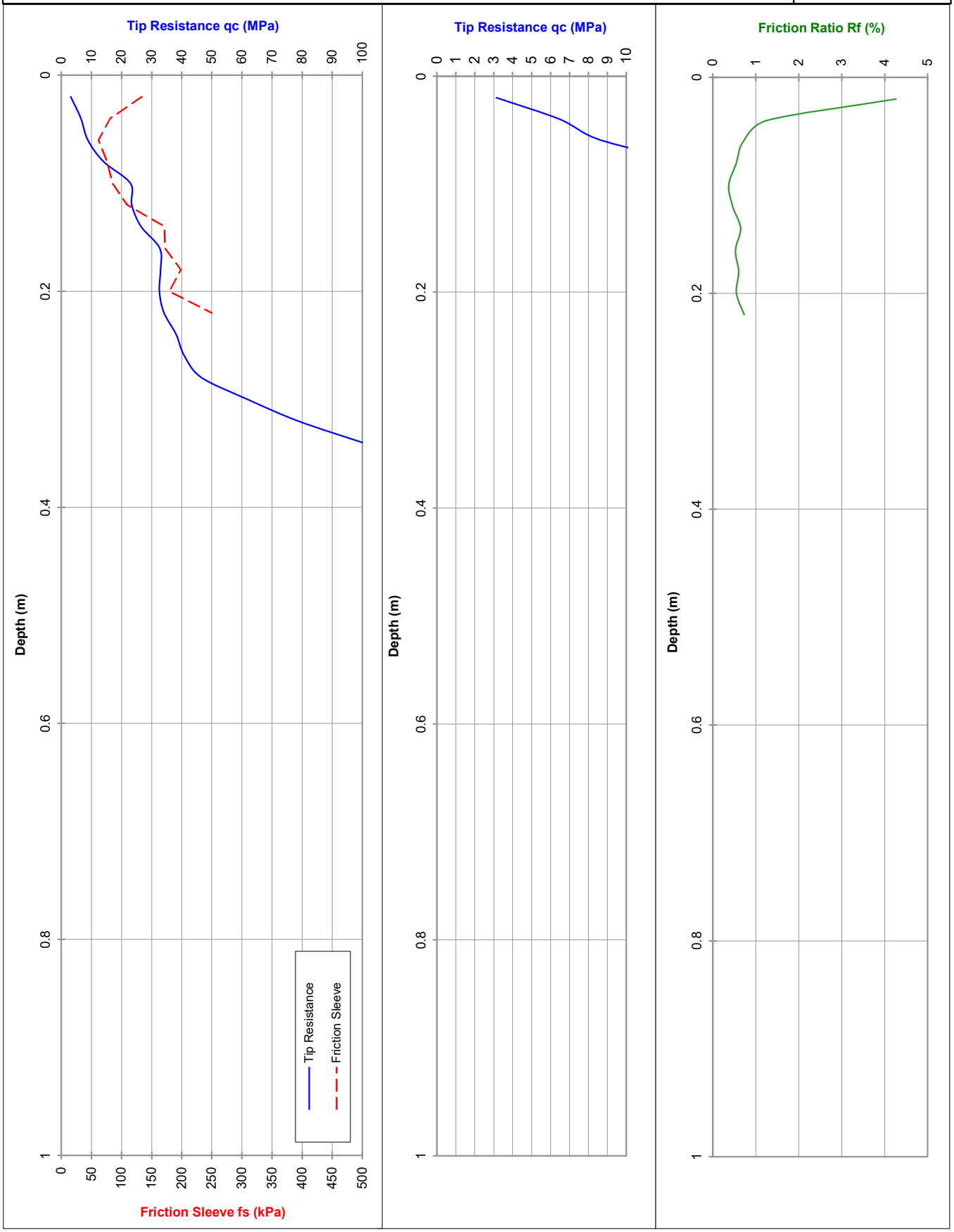
PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999
and IRTP 2001 for friction reducer

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: IW Projects	Job No.: J477212	Probe I.D
PROJECT: D355788	RL (m): 41.25	**CPT 01**
LOCATION: 1700K Marmion Avenue Tamala Park	Co-ords: 379455.15mE, 6491312.71mN	28-Feb-25



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 0.3

Dummy probe to (m):

Refusal: 100 MPa

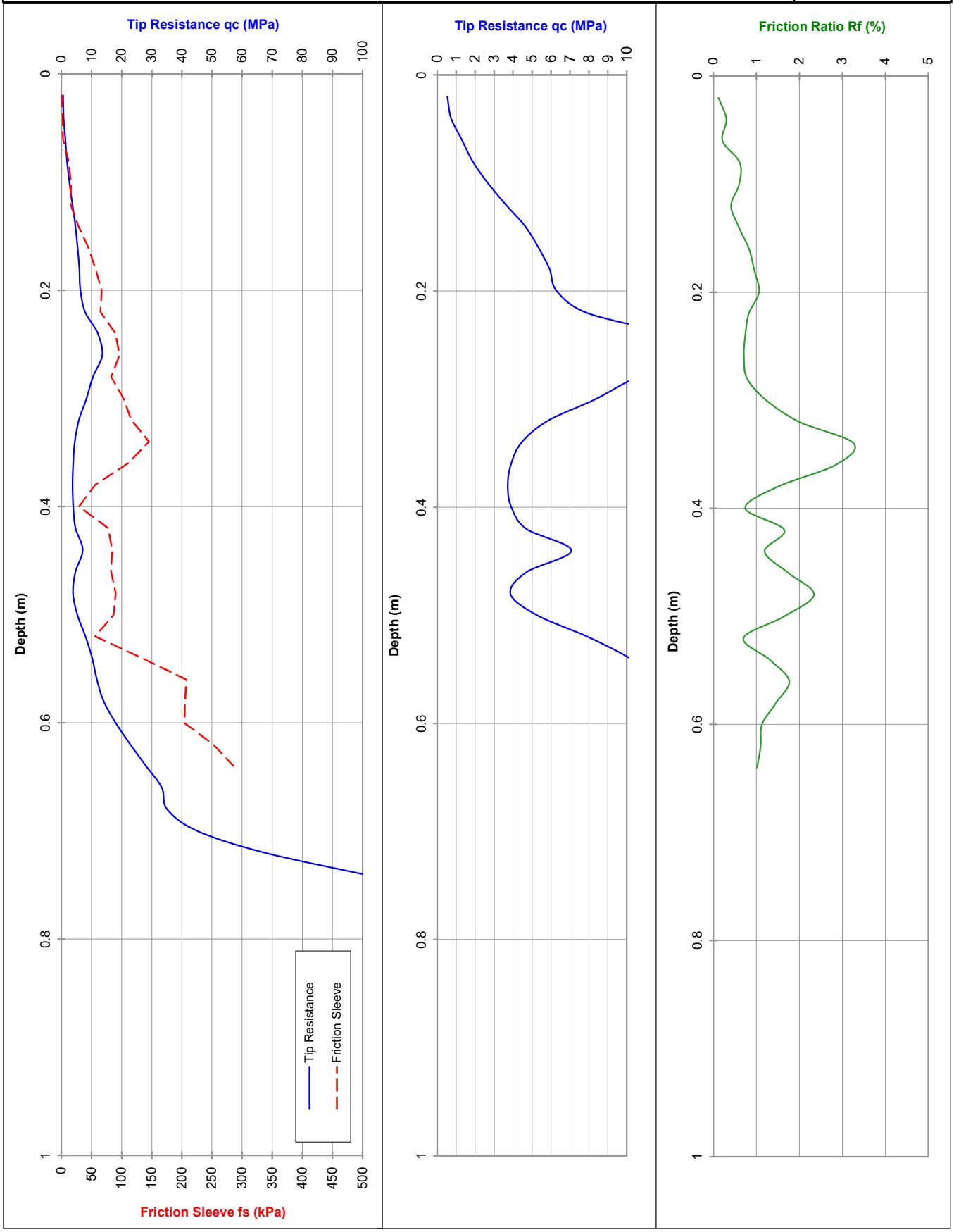
Cone I.D.: EC38

File: SC1051TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: IW Projects	Job No.: J477212	Probe I.D
PROJECT: D355788	RL (m): 41.45	**CPT 02**
LOCATION: 1700K Marmion Avenue Tamala Park	Co-ords: 379467.77mE, 6491314.79mN	28-Feb-25



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 0.43

Dummy probe to (m):

Refusal: 100 MPa

Cone I.D.: EC38

File: SC1052TT

Rig Type: 22t truck (Track-Truck)

Appendix No. 2 – Leachate Analysis

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Analyte grouping/Analyte	Column1	*pH Value*	Electrical Conductivity @ 25°C	Total Dissolved Solids @180°C	Suspended Solids (SS)	Colour (True)	pH Colour	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 2-	Chloride	Calcium
Unit		pH Unit	µS/cm	mg/L	mg/L	PCU	pH Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Limit of reporting		0.01	1	10	5	1	0.01	1	1	1	1	1	1	1
ERTECH No. 2	04/07/2024	7.82	32000	13700	10	15000	7.91	<1	<1	16700	16700	151	3250	30
ERTECH No. 3	04/07/2024	7.86	32100	14200	11	15000	7.91	<1	<1	17300	17300	163	3150	25
STAGE 2 PHASE 1 No. 2	04/07/2024	8.57	48500	34300	80	15000	8.67	<1	6120	18900	25000	402	8510	23
BATTER POND 1	04/07/2024	8.01	15800	9340	90	15000	8.30	<1	<1	7650	7650	116	1850	205
ERTECH No. 2	19/09/2024	7.86	32500	12900	<5	6000	7.97	<1	<1	14300	14300	<20	3750	26
ERTECH No. 3	19/09/2024	7.94	33400	14200	<5	10000	8.07	<1	<1	15900	15900	<200	3950	27
STAGE 2 PHASE 1 No. 2	19/09/2024	8.06	38800	17400	<5	14000	8.20	<1	<1	16400	16400	<200	5150	19
BATTER POND 1	19/09/2024	8.07	39200	17400	<5	10000	8.19	<1	<1	17800	17800	<200	5050	191
ERTECH No. 2	14/11/2024	7.98	30900	13300	12	10000	7.96	<1	<1	14400	14400	150	3320	23
ERTECH No. 3	14/11/2024	7.93	31800	13200	10	14000	7.89	<1	<1	14600	14600	166	3410	26
STAGE 2 PHASE 1 No. 2	14/11/2024	8.18	10900	6220	59	3000	8.20	<1	<1	3940	3940	221	1450	160
BATTER POND 1	14/11/2024	7.97	28600	12200	10	5000	8.01	<1	<1	12400	12400	143	3190	23
ERTECH No. 3	22/01/25	7.98	30600	14000	<5	18000	7.99	<1	<1	14500	14500	162	3050	18
ERTECH No. 2	22/01/25	8.01	29800	12500	<5	14000	8.06	<1	<1	13700	13700	156	3080	15
BATTER POND 1	22/01/25	8.22	13800	8930	457	8000	8.45	<1	<1	4650	4650	120	2100	219
STAGE 2 PHASE 1 No. 2	22/01/25	8.03	27200	12500	<5	12000	8.07	<1	<1	14300	14300	149	2960	14

Magnesium	Sodium	Potassium	Aluminium	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Zinc	Iron
mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1	1	1	0.01	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.01	0.001	0.005	0.05
49	2770	1390	2.48	0.389	0.360	<0.0010	0.868	0.072	0.018	<0.010	0.388	<0.10	<0.010	0.220	10.3
44	2890	1390	2.87	0.741	0.365	0.0003	1.44	0.031	0.012	0.016	0.443	<0.01	<0.010	0.670	10.2
37	6720	3260	1.83	1.39	0.118	<0.0010	2.09	0.392	0.071	0.016	0.553	<0.10	<0.010	1.10	18.9
56	1640	854	1.11	0.270	0.230	<0.0001	0.701	0.004	<0.001	0.005	0.222	<0.01	<0.010	0.025	2.47
48	2850	1410	2.22	0.373	0.355	<0.0005	0.613	0.183	0.010	<0.005	0.404	<0.05	<0.005	0.178	8.23
44	3010	1470	2.88	0.486	0.350	<0.0005	0.710	0.098	0.013	<0.005	0.427	<0.05	<0.005	0.237	10.6
40	3660	1890	1.99	0.904	0.148	<0.0005	0.918	0.080	0.011	0.007	0.282	<0.05	<0.005	0.690	9.31
56	1040	560	0.52	0.178	0.137	<0.0005	0.272	<0.005	<0.005	<0.005	0.113	<0.05	<0.005	0.040	2.23
49	2870	1320	2.52	0.441	0.366	<0.0005	0.644	0.082	0.010	<0.005	0.379	<0.05	<0.005	0.204	10.7
46	2820	1300	2.50	0.494	0.317	<0.0005	0.676	0.014	0.010	0.006	0.362	<0.05	<0.005	0.194	10.9
65	1220	623	0.50	0.196	0.135	<0.0005	0.219	<0.005	<0.005	<0.005	0.104	<0.05	<0.005	0.027	1.32
66	2780	1300	1.39	0.584	0.067	<0.0005	0.630	0.041	<0.005	<0.005	0.233	<0.05	<0.005	0.082	9.14
36	2960	1440	2.98	0.544	0.268	<0.0010	1.50	0.659	0.023	0.016	0.519	<0.10	<0.010	0.459	12.5
37	2770	1380	2.72	0.502	0.267	<0.0010	1.30	0.114	0.011	0.013	0.452	<0.10	<0.010	0.276	11.6
95	1930	1090	1.50	0.450	0.266	0.0001	0.710	0.006	0.002	0.007	0.220	<0.01	<0.001	0.088	4.82
41	2750	1360	1.26	0.580	0.043	<0.0010	0.906	0.012	<0.010	<0.010	0.266	<0.10	<0.010	0.078	8.80

Bromine	Iodine	Mercury	Trivalent Chromium	Hexavalent Chromium	Total Residual Chlorine	Free Chlorine	Weak Acid Dissociable Cyanide	Fluoride	Ammonia as N	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Total Kjeldahl Nitrogen as N	Total Nitrogen as N	Total Phosphorus as P
mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
0.1	0.1	0.0001	0.01	0.01	0.01	0.01	0.004	0.1	0.01	0.01	0.01	0.01	0.1	0.1	0.01
1.9	<1.0	<0.0005	0.87	<0.10	<0.01	<0.01	<0.020	1.1	2820	<0.10	0.35	0.35	3470	3470	35.8
18.2	4.3	<0.0005	1.44	<0.10	<0.01	<0.01	<0.020	1.2	2970	<0.10	0.41	0.41	3770	3770	37.7
5.4	<1.0	<0.0005	2.09	<0.10	<0.01	<0.01	<0.020	4.7	3050	<0.20	1.08	1.08	4100	4100	20.3
9.6	2.2	<0.0005	0.70	<0.10	<0.01	<0.01	<0.020	0.5	1110	<0.10	0.16	0.16	1280	1280	13.1
15.0	2.8	<0.0001	0.61	<0.10	<0.01	<0.01	<0.020	1.0	2980	<0.10	0.72	0.72	3160	3160	35.2
16.4	2.9	<0.0001	0.71	<0.20	<0.01	<0.01	<0.020	1.0	3080	<0.20	1.31	1.31	3420	3420	35.1
24.9	3.6	<0.0005	0.92	<0.10	<0.01	<0.01	<0.020	2.7	3340	<0.20	1.07	1.07	3560	3560	37.8
24.6	3.7	<0.0001	0.27	<0.10	<0.01	<0.01	<0.020	2.8	517	<0.20	0.79	0.79	517	518	11.5
17.8	3.1	<0.0005	0.64	<0.20	0.30	0.30	<0.020	0.9	2470	<0.02	0.47	0.47	2690	2690	33.7
17.2	3.1	<0.0005	0.68	<0.20	<0.05	<0.05	<0.020	1.1	2590	<0.05	0.45	0.45	2680	2680	32.6
6.3	1.4	<0.0005	0.22	<0.05	<0.05	<0.05	<0.020	0.5	532	<0.05	<0.10	<0.10	575	575	17.5
19.9	3.2	<0.0005	0.63	<0.10	<0.05	<0.05	<0.020	1.4	2450	<0.10	0.16	0.16	2170	2170	46.2
17.1	2.9	<0.0001	1.50	<0.20	<0.05	<0.05	<0.020	1.4	2340	0.18	0.46	0.64	2570	2570	32.8
16.4	2.8	<0.0001	1.30	<0.10	<0.05	<0.05	<0.020	1.1	2170	0.15	0.38	0.53	2820	2820	29.6
12.7	3.3	<0.0001	0.71	<0.10	<0.05	<0.05	<0.020	<1.0	471	<0.10	0.16	0.16	628	628	18.6
18.7	2.9	<0.0001	0.91	<0.10	<0.05	<0.05	<0.020	1.5	1800	0.12	0.07	0.19	2260	2260	30.0

Sulfide as S2-	Thiosulfate as S2O3 2-	Total Anions	Total Cations	Ionic Balance	Glutaraldehyde	Oil & Grease	Chemical Oxygen Demand	Biochemical Oxygen Demand	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction
mg/L	mg/L	meq/L	meq/L	%	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
0.1	2	0.01	0.01	0.01	1	5	10	2	50	100	50	50	100	100	100
<1.0	56	425	363	8.31	<1	20	5930	404	<50	<100	<50	<50	<100	<100	<100
<1.0	56	434	381	7.01	<1	17	5200	380	110	<100	<50	110	<100	<100	<100
<1.0	112	740	598	11.2	<1	15	12000	842	50	<100	<50	50	<100	<100	<100
6.1	49	205	187	5.14	<1	19	6270	2180	<50	<100	<50	<50	<100	<100	<100
<0.1	56	391	378	1.77	<1	8	7070	160	70	<100	<50	70	<100	<100	<100
<0.1	56	429	394	4.36	<1	8	3700	196	70	<100	<50	70	<100	<100	<100
<0.1	70	473	450	2.48	<1	<5	10100	376	<50	<100	<50	<50	<100	<100	<100
2.8	28	498	111	63.7	<1	<5	3600	403	<50	<100	<50	<50	<100	<100	<100
<1.0	42	382	340	6.15	<1	9	8600	228	<50	<100	<50	<50	<100	<100	<100
<1.0	42	389	346	6.19	<1	10	8830	201	<50	<100	<50	<50	<100	<100	<100
3.2	11	120	120	1.62	<1	8	3400	334	<50	<100	<50	<50	<100	<100	<100
<1.0	42	338	336	0.77	<1	12	6800	194	<50	<100	<50	<50	<100	<100	<100
<10.0	42	380	336	5.98	<1	11	6620	236	<50	<100	<50	<50	<100	<100	<100
<10.0	42	364	314	7.30	<1	8	6200	216	<50	<100	<50	<50	<100	<100	<100
<10.0	56	152	164	2.97	<1	13	3880	746	<50	<100	<50	<50	<100	<100	<100
<10.0	42	370	287	12.9	<1	6	4990	164	<50	<100	<50	<50	<100	<100	<100

>C10 - C40 Fraction (sum)	>C10 - C16 Fraction minus Naphthalene (F2)	Styrene	Isopropylbenzene	n-Propylbenzene	1.3.5-Trimethylbenzene	sec-Butylbenzene	1.2.4-Trimethylbenzene	tert-Butylbenzene	p-Isopropyltoluene	n-Butylbenzene	Vinyl Acetate	2-Butanone (MEK)	4-Methyl-2-pentanone (MIBK)	2-Hexanone (MBK)	Carbon disulfide
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
100	100	5	5	5	5	5	5	5	5	5	50	50	50	50	5
<100	<100	<5	<5	<5	<5	<5	14	<5	50	<5	<50	50	<50	<50	<5
<100	<100	<5	<5	<5	<5	<5	16	<5	70	<5	<50	100	<50	<50	<5
<100	<100	<5	<5	<5	<5	<5	<5	<5	17	<5	<50	2150	<50	<50	<5
<100	<100	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	950	<50	<50	<5
<100	<100	<5	<5	<5	<5	<5	15	<5	57	<5	<50	<50	<50	<50	<5
<100	<100	<5	<5	<5	<5	<5	12	<5	49	<5	<50	130	<50	<50	<5
<100	<100	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	1400	<50	<50	<5
<100	<100	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	190	<50	<50	<5
<100	<100	<5	<5	<5	<5	<5	14	<5	55	<5	<50	210	<50	<50	<5
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<100	<100	<5	<5	<5	<5	<5	16	<5	66	<5	<50	<50	<50	<50	<5

2.2-Dichloropropane	1.2-Dichloropropane	cis-1.3-Dichloropropylene	trans-1.3-Dichloropropylene	1.2-Dibromoethane (EDB)	Dichlorodifluoromethane	Chloromethane	Vinyl chloride	Bromomethane	Chloroethane	Trichlorofluoromethane	1.1-Dichloroethene	Iodomethane	trans-1.2-Dichloroethene	1.1-Dichloroethane	cis-1.2-Dichloroethene
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
5	5	5	5	5	50	50	50	50	50	50	5	5	5	5	5
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1.1.1-Trichloroethane	1.1-Dichloropropylene	Carbon Tetrachloride	1.2-Dichloroethane	Trichloroethene	Dibromomethane	1.1.2-Trichloroethane	1.3-Dichloropropane	Tetrachloroethene	1.1.1.2-Tetrachloroethane	trans-1.4-Dichloro-2-butene	cis-1.4-Dichloro-2-butene	1.1.2.2-Tetrachloroethane	1.2.3-Trichloropropane	Pentachloroethane	1.2-Dibromo-3-chloropropane
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	7	<5	<5	<5	<5	<5
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<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

Chlorobenzene	Bromobenzene	2-Chlorotoluene	4-Chlorotoluene	1.2.3-Trichlorobenzene	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	Phenol	2-Chlorophenol	2-Methylphenol	3- & 4-Methylphenol	2-Nitrophenol	2.4-Dimethylphenol	2.4-Dichlorophenol
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
5	5	5	5	5	5	5	5	5	2	2	2	4	2	2	2
<5	<5	<5	<5	<5	<5	<5	<5	<5	<9	<9	56	22	<9	<9	<9
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<5	<5	<5	<5	<5	<5	<5	<5	<5	47	<2	104	220	<2	<2	<2
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2.6-Dichlorophenol	4-Chloro-3-methylphenol	2.4.6-Trichlorophenol	2.4.5-Trichlorophenol	Pentachlorophenol	Naphthalene	2-Methylnaphthalene	2-Chloronaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	N-2-Fluorenyl Acetamide
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
2	2	2	2	4	2	2	2	2	2	2	2	2	2	2	2
<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9
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<2	<2	<2	<2	<4	<9	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
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Benz(a)anthracene	Chrysene	Benzo(b+j) & Benzo(k)fluoranthene	7.12-Dimethylbenz(a)anthracene	Benzo(a)pyrene	3-Methylcholanthrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	Sum of PAHs	Benzo(a)pyrene TEQ (zero)	Dimethyl phthalate	Diethyl phthalate	Di-n-butyl phthalate	Butyl benzyl phthalate	bis(2-ethylhexyl) phthalate
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
2	2	4	2	2	2	2	2	2	2	2	2	2	2	2	10
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<2	<2	<4	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	<2	<2	<10
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<2	<2	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<10
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<2	<2	<5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<10
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Di-n-octylphthalate	N-Nitrosomethylethylamine	N-Nitrosodiethylamine	N-Nitrosopyrrolidine	N-Nitrosomorpholine	N-Nitrosodi-n-propylamine	N-Nitrosopiperidine	N-Nitrosodibutylamine	N-Nitrosodiphenyl & Diphenylamine	Methapyrilene	2-Picoline	Acetophenone	Nitrobenzene	Isophorone	2.6-Dinitrotoluene	2.4-Dinitrotoluene
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
2	2	2	4	2	2	2	2	4	2	2	2	2	2	4	4
<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	19	<9	<9	<9	<14	<9
<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	22	<9	<9	<9	<14	<9
<9	<9	<9	<9	<9	<9	<9	<17	<9	<9	48	<9	<9	<9	<80	<9
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<2	<2	<2	<4	<10	<10	<2	<10	<4	<2	46	<10	<10	<2	<4	<4
<2	<2	<2	<4	<10	<2	<2	<12	<4	<2	62	<10	<10	<2	<10	<4
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<2	<2	<2	<4	<2	<2	<2	<2	<4	<2	43	<9	<2	<2	<4	<4
<2	<2	<2	<4	<2	<2	<2	<2	<4	<2	26	<9	<9	<2	<9	<4
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<2	<2	<2	<4	<2	<2	<2	<2	<4	<2	44	<6	<2	<2	<4	<4
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<2	<2	<2	<4	<2	<2	<2	<2	<4	<2	103	<4	<2	<2	<4	<4

1-Naphthylamine	4-Nitroquinoline-N-oxide	5-Nitro-o-toluidine	Azobenzene	1.3.5-Trinitrobenzene	Phenacetin	4-Aminobiphenyl	Pentachloronitrobenzene	Pronamide	Dimethylaminoazobenzene	Chlorobenzilate	Bis(2-chloroethyl) ether	Bis(2-chloroethoxy) methane	4-Chlorophenyl phenyl ether	4-Bromophenyl phenyl ether	1.4-Dichlorobenzene
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
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1.3-Dichlorobenzene	1.2-Dichlorobenzene	Hexachloroethane	1.2.4-Trichlorobenzene	Hexachloropropylene	Hexachlorobutadiene	Hexachlorocyclopentadiene	Pentachlorobenzene	Hexachlorobenzene (HCB)	Aniline	4-Chloroaniline	2-Nitroaniline	3-Nitroaniline	Dibenzofuran	4-Nitroaniline	Carbazole
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
2	2	2	2	2	2	10	2	4	2	2	4	4	2	2	2
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<9	<9	<9	<9	<9	<9	<30	<9	<9	68	<9	<9	<9	<9	<9	<9
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<2	<2	<2	<2	<2	<2	<10	<2	<4	<25	<2	<4	<4	<2	<2	<2
<2	<2	<2	<2	<2	<2	<10	<2	<4	80	<9	<4	<4	<2	<2	<2
<2	<2	<2	<2	<2	<2	<10	<2	<4	50	<2	<4	<4	<2	<2	<2
<2	<2	<2	<2	<2	<2	<10	<2	<4	<9	<2	<4	<4	<2	<2	<2
<2	<2	<2	<2	<2	<2	<10	<2	<4	49	<2	<4	<4	<2	<2	<2
<2	<2	<2	<2	<2	<2	<10	<2	<4	50	<2	<4	<4	<2	<2	<2
<2	<2	<2	<2	<2	<2	<10	<2	<4	40	<2	<4	<4	<2	<2	<2
<2	<2	<2	<2	<2	<2	<10	<2	<4	6	<2	<4	<4	<2	<2	<2
<2	<2	<2	<2	<2	<2	<10	<2	<4	24	<2	<4	<4	<2	<2	<2

3.3`-Dichlorobenzidine	alpha-BHC	beta-BHC	gamma-BHC - (Lindane)	delta-BHC	Heptachlor	Aldrin	Heptachlor epoxide	alpha-Endosulfan	4.4`-DDE	Dieldrin	Endrin	beta-Endosulfan	4.4`-DDD	Endosulfan sulfate	4.4`-DDT
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4
<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9
<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9
<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9
<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18
<2	<2	<10	<2	<2	<2	<2	<2	<10	<2	<10	<2	<2	<2	<2	<4
<2	<2	<10	<2	<2	<2	<2	<2	<10	<2	<2	<2	<2	<2	<2	<4
<2	<2	<10	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4
<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4
<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4
<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4
<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4
<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4
<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4
<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4
<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4
<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4

Sum of Aldrin + Dieldrin	Sum of DDD + DDE + DDT	Dichlorvos	Dimethoate	Diazinon	Chlorpyrifos-methyl	Malathion	Fenthion	Chlorpyrifos	Pirimphos-ethyl	Chlorfenvinphos	Prothiofos	Ethion	C6 - C9 Fraction	C10 - C14 Fraction4	C15 - C28 Fraction5
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
4	4	2	2	2	2	2	2	2	2	2	2	2	20	50	100
<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	260	4840	20700
<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	260	3830	15400
<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	200	5230	15800
<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	70	2650	8090
<10	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	220	5600	22600
<4	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	180	5050	22800
<4	<4	<2	<2	<2	<2	<10	<2	<2	<2	<2	<10	<2	160	3950	10700
<4	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<20	1670	3360
<4	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	220	5740	27100
<4	<4	<9	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	230	3760	18400
<4	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<20	850	2620
<4	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	200	4380	12600
<4	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	230	4910	27700
<4	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	250	3220	15700
<4	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<20	2080	8190
<4	<4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	220	3490	11400

C29 - C36 Fraction6	C10 - C36 Fraction (sum)7	C6 - C10 Fraction	C6 - C10 Fraction minus BTEX (F1)	>C10 - C16 Fraction8	>C16 - C34 Fraction9	>C34 - C40 Fraction10	>C10 - C40 Fraction (sum)11	>C10 - C16 Fraction minus Naphthalene (F2)12	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	Sum of BTEX
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
50	50	20	20	100	100	100	100	100	1	2	2	2	2	2	1
540	26100	270	150	5300	20500	290	26100	5290	8	44	20	30	17	47	119
420	19600	270	140	4120	15300	220	19600	4110	8	50	22	33	19	52	132
490	21500	450	420	6110	15200	260	21600	6110	2	14	4	8	5	13	33
350	11100	80	80	3040	7850	200	11100	3040	<1	<2	<2	<2	<2	<2	<1
580	28800	240	120	6070	23500	320	29900	6060	8	43	22	30	18	48	121
580	28400	190	100	5590	23900	320	29800	5580	6	35	16	23	15	38	95
380	15000	150	120	4460	10900	200	15600	4460	4	17	3	5	4	9	33
110	5140	<20	<20	1810	3210	<100	5020	1810	<1	3	<2	<2	<2	<2	3
210	33000	240	130	6380	27100	<100	33500	6370	7	36	18	28	17	45	106
110	22300	240	140	4290	18400	<100	22700	4290	7	39	17	26	16	42	105
110	3580	<20	<20	1140	2440	<100	3580	1140	<1	3	<2	<2	<2	<2	3
140	17100	220	120	4810	12200	<100	17000	4800	7	36	14	26	15	41	98
380	33000	170	120	5770	27400	150	33300	5770	4	17	7	10	7	17	45
200	19100	200	140	3630	15500	<100	19100	3630	4	19	10	14	11	25	58
360	10600	<20	<20	2890	7730	120	10700	2890	<1	<2	<2	<2	<2	<2	<1
160	15000	220	140	3980	10900	<100	14900	3970	6	29	12	20	13	33	80

Naphthalene13	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorononane sulfonic acid (PFNS)	Perfluorodecane sulfonic acid (PFDS)	Column14	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
5	0.0005	0.0005	0.0005	0.0005	0.0002	0.0005	0.0005		0.0020	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
6	3.69	0.0833	1.97	0.0139	0.334	<0.0016	<0.0016		<0.0640	<0.0420	0.445	0.336	1.95	0.0727	0.0988
7	4.21	0.0912	2.12	0.0116	0.275	0.0016	<0.0016		<0.0706	<0.0410	0.502	0.385	1.96	0.0602	0.0985
<5	2.24	0.102	2.90	0.0266	0.800	<0.0016	<0.0016		<0.0920	<0.0355	0.319	0.327	2.32	0.157	0.154
<5	5.14	0.102	1.05	0.0055	0.147	<0.0016	<0.0016		<0.0960	<0.158	1.19	0.344	1.17	0.0325	0.0422
6	<1.00	25.4	0.180	2.39	<0.100	0.538	<0.0070	<0.0200	2.45	2.25	6.24	0.870	3.28	0.130	0.160
5	<1.50	27.6	0.170	2.21	<0.100	0.549	<0.0100	<0.0200	3.01	2.31	8.94	1.04	3.57	0.120	0.110
<5	<0.900	14.3	0.150	4.43	<0.0500	0.792	<0.0070	<0.0150	2.38	1.82	5.35	1.24	3.72	0.205	0.175
<5	<0.180	4.88	<0.0500	0.734	<0.0500	0.236	<0.0035	<0.0045	1.24	2.07	3.53	0.470	1.98	0.0700	0.204
6	<0.0032	4.41	0.0626	1.76	0.0054	0.467	<0.0032	<0.0032	<0.0160	<0.182	1.51	0.812	3.26	0.114	0.166
<5	<0.0031	4.29	0.0491	1.42	0.0056	0.457	<0.0031	<0.0031	<0.0420	<0.132	1.75	0.594	2.83	0.106	0.147
<5	<0.0032	3.87	0.0308	0.687	<0.0032	0.0733	<0.0032	<0.0032	<0.0820	1.12	2.28	0.575	1.35	0.0292	0.0298
9	<0.0032	4.54	0.0961	2.89	0.0136	0.692	<0.0032	<0.0032	<0.0320	<0.210	1.44	1.10	4.22	0.203	0.176
<5	<0.0031	5.35	0.0352	1.59	0.0083	0.383	0.0049	<0.0031	0.0308	0.317	2.60	0.570	3.31	0.0930	0.153
<5	<0.0076	5.70	0.0383	1.55	<0.0076	0.399	0.0084	<0.0076	0.0221	0.214	2.32	0.613	3.19	0.102	0.138
<5	0.0086	7.76	0.0216	0.906	0.0067	0.152	<0.0032	<0.0032	0.0888	1.35	3.85	0.623	2.12	0.0492	0.0704
11	<0.0031	4.20	0.0708	2.53	0.0120	0.591	<0.0031	<0.0031	0.0352	0.578	1.80	0.796	3.67	0.137	0.192

Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.001	0.001	0.001	0.0005	0.0005	0.001	0.001	0.001	0.001	0.0002
0.0060	0.0077	<0.0016	<0.0040	0.0084	<0.004	<0.004	0.313	0.024	0.203	0.0454	<0.002	0.246	0.042	0.014	2.30
0.0092	0.0130	0.0022	<0.0039	0.0069	<0.004	<0.004	0.257	0.023	0.184	0.0605	<0.002	0.244	0.035	0.020	2.40
0.0098	0.0085	<0.0016	<0.0039	0.0222	<0.004	<0.004	0.086	0.005	0.256	0.0787	<0.002	0.417	0.062	0.006	3.70
0.0045	0.0029	<0.0016	<0.0041	0.0037	<0.004	<0.004	0.037	<0.004	0.0792	0.0206	<0.002	0.274	0.018	0.006	1.20
<0.100	<0.100	<0.100	<0.250	<0.100	<0.250	<0.250	<0.250	<0.250	0.494	0.111	0.011	0.624	0.079	0.020	2.93
<0.100	<0.100	<0.100	<0.250	<0.100	<0.250	<0.250	<0.250	<0.250	0.291	<0.100	0.011	0.537	0.061	0.009	2.76
<0.0500	<0.0500	<0.0500	<0.125	<0.0500	<0.125	<0.125	<0.125	<0.125	0.291	0.0909	0.024	0.967	0.077	0.011	5.22
<0.0500	<0.0500	<0.0500	<0.125	<0.0500	<0.125	<0.125	<0.125	<0.125	0.155	<0.0500	0.003	0.282	0.031	0.003	0.970
0.0083	0.0074	<0.0032	<0.0080	0.0087	<0.008	<0.008	0.210	0.020	0.295	0.0542	<0.003	0.324	0.057	0.014	2.23
0.0066	0.0075	<0.0031	<0.0078	0.0084	<0.008	<0.008	0.220	0.024	0.196	0.0347	<0.003	0.233	0.037	0.015	1.88
<0.0032	<0.0032	<0.0032	<0.0079	<0.0032	<0.008	<0.008	<0.008	<0.008	0.0210	<0.0032	<0.003	0.692	0.005	<0.003	0.760
0.0069	0.0054	<0.0032	<0.0079	0.0132	<0.008	<0.008	0.139	0.022	0.284	0.0656	<0.003	0.580	0.045	0.009	3.58
0.0077	0.0049	<0.0031	<0.0077	0.0062	<0.008	<0.008	0.196	<0.008	0.180	0.0442	<0.001	0.274	0.038	0.010	1.97
<0.0076	<0.0076	<0.0076	<0.0191	<0.0076	<0.019	<0.019	0.217	<0.019	0.221	0.0375	<0.001	0.307	0.047	0.009	1.95
0.0054	0.0038	<0.0032	<0.0079	0.0044	<0.008	<0.008	0.022	<0.008	0.0552	0.0146	<0.001	0.995	0.012	0.006	1.06
0.0067	<0.0031	<0.0031	<0.0077	0.0113	<0.008	<0.008	0.123	<0.008	0.246	0.0466	<0.001	0.453	0.042	0.006	3.12

Sum of PFAS (WADER List)	Sum of PFAS	Escherichia coli	Coliforms	Legionella pneumophila	Legionella Species	Legionella Pneumophila SG1	Legionella Pneumophila SG2-14	Total Legionella	Gross alpha	Gross beta	Gross beta activity - 40K	1.2-Dichloroethane-D4	Toluene-D8	4-Bromofluorobenzene	2-Fluorophenol
µg/L	µg/L	CFU/100mL	CFU/100mL	CFU/mL	CFU/mL	CFU/mL	CFU/mL	CFU/mL	Bq/L	Bq/L	Bq/L	%	%	%	%
0.0002	0.0002	1	1	10	10	10	10	10	0.05	0.10	0.10	5	5	5	2
9.01	9.90	<2	<2	<10	<10	Not Detected	Not Detected	<10	<0.54	36.8	<1.07	87.4	101	84.8	ND
9.73	10.6	~10	50	<10	<10	Not Detected	Not Detected	<10	<0.54	37.6	<1.08	82.9	99.3	97.6	ND
9.38	10.3	<2	<2	<10	<10	Not Detected	Not Detected	<10	<0.80	94.3	<1.61	98.4	94.7	81.9	ND
9.33	9.67	33000	130000	<10	<10	Not Detected	Not Detected	<10	<0.26	25.1	<0.53	94.9	95.1	84.3	ND
44.1	45.2	<2	<2	<10	<10	Not Detected	Not Detected	<10	<0.53	39.8	5.27	81.8	99.8	89.4	ND
49.8	50.5	<2	<2	<10	<10	Not Detected	Not Detected	<10	<0.54	40.4	3.74	87.9	96.4	93.7	ND
35.1	36.0	<2	<2	<10	<10	Not Detected	Not Detected	<10	<0.62	53.4	6.35	94.5	96.2	95.3	ND
15.4	15.9	320	6400	<10	<10	Not Detected	Not Detected	<10	<0.16	14.9	<0.32	86.2	100.0	118	ND
12.6	13.6	<10	<10	<10	<10	Not Detected	Not Detected	<10	<0.50	36.6	<1.00	101	96.1	94.4	33.5
11.6	12.4	<10	<10	<10	<10	Not Detected	Not Detected	<10	<0.50	35.2	<1.00	102	93.8	94.3	16.1
10.6	10.8	570	2200	<10	<10	Not Detected	Not Detected	<10	<0.18	17.5	<0.36	97.6	101	99.1	15.7
15.5	16.5	<10	<10	<10	<10	Not Detected	Not Detected	<10	<0.48	34.8	<0.95	99.4	97.2	93.6	27.7
14.5	15.2	<2	<2	<10	<10	Not Detected	Not Detected	<10	<0.54	36.6	<1.07	93.5	95.8	96.9	27.7
14.4	15.1	<2	<2	<10	<10	Not Detected	Not Detected	<10	<0.52	34.4	<1.03	95.3	102	108	29.7
17.8	18.1	~900	110000	<10	<10	Not Detected	Not Detected	<10	<0.24	25.1	<0.47	92.0	104	104	31.8
14.7	15.5	<2	<2	<10	<10	Not Detected	Not Detected	<10	<0.47	34.1	<0.94	91.7	101	98.7	30.5

Phenol-d6	2-Chlorophenol-D4	2.4.6-Tribromophenol	Nitrobenzene-D5	1.2-Dichlorobenzene-D4	2-Fluorobiphenyl	Anthracene-d10	4-Terphenyl-d14	1.2-Dichloroethane-D415	Toluene-D816	4-Bromofluorobenzene17	13C4-PFOS	13C8-PFOA
%	%	%	%	%	%	%	%	%	%	%	%	%
2	2	2	2	2	2	2	2	2	2	2	0.0005	0.0005
ND	ND	ND	ND	ND	ND	ND	ND	120	99.4	109	122	118
ND	ND	ND	ND	ND	ND	ND	ND	111	97.8	110	118	112
ND	ND	ND	ND	ND	ND	ND	ND	131	93.2	108	98.0	112
ND	ND	ND	ND	ND	ND	ND	ND	127	94.2	108	126	111
ND	ND	ND	ND	ND	ND	ND	ND	104	99.5	95.9	112	88.1
18.8	ND	ND	ND	ND	ND	ND	ND	112	96.0	99.4	108	91.3
17.4	ND	ND	ND	ND	ND	ND	ND	121	95.7	96.4	104	90.9
ND	ND	ND	ND	ND	ND	ND	ND	110	99.8	109	113	97.7
35.5	56.8	74.4	62.2	32.6	79.9	69.5	6.3	113	95.0	89.2	125	101
18.2	25.9	50.1	32.3	18.7	50.0	45.2	4.0	113	90.7	86.6	104	92.4
12.9	28.4	37.6	30.0	24.6	29.6	28.8	26.8	109	97.9	92.8	104	127
28.2	47.3	64.8	55.4	32.5	74.2	60.0	47.8	111	94.1	85.7	108	111
18.6	50.8	84.8	57.1	56.2	60.5	54.0	43.9	92.8	92.1	96.3	89.3	101
17.4	44.8	65.5	87.6	43.8	45.5	63.4	47.9	94.7	98.4	106	83.1	101
19.7	43.9	63.9	80.5	39.3	49.1	57.4	38.8	91.7	100	103	93.3	104
17.8	42.5	58.2	79.3	40.8	49.6	64.3	45.6	91.4	96.8	100	88.0	90.4

Appendix No. 3 – Commissioning Plan

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Pipeline and Tank Farm Commissioning Plan

Note:
This Commissioning Plan provides a list of actions to be undertaken during the commissioning of the various components of infrastructure within the pipeline and tank farm.

All activities are to be successfully achieved/executed (✓).

In the event that an activity is not successfully achieved/executed (✕), then the cause for this needs to be investigated and resolved, and that portion of the commissioning plan repeated until a successful outcome has been achieved.

Date of Commissioning:

Item	Activity	✓/✕
A	Wastewater Tank and Wastewater Pipeline Commissioning	
A1	Check that wastewater macerator pump is switched off.	
A2	Fill wastewater tank with freshwater from vehicle washdown facility (vehicle wash wastewater to bypass to biofilter and not to enter the wastewater tank). If tank inflow from the vehicle washdown facility is too slow, to speed up the commissioning process, a water cart can be used to also fill the wastewater tank.	
A3	Confirm that float switch activates mobile phone alarm (High High level alarm on) at 300 mm below overflow into biofilter.	
A4	Record the reading of the flowmeter into Tank 1, for future calculation of Tank 1 volume.	
A5	Ensure that all valves in the tank farm are set to only fill Tank 1 from the wastewater pipeline, including that the wastewater bypass to landfill is closed, then switch on wastewater macerator pump to commence filling Tank 1.	
A6	Confirm float switch activates the pump at or above High level (minimum 1 m above tank floor level, maximum 500 mm below overflow level).	
A7	Assumption is that the wastewater tank will empty faster than it is being filled – water level will drop in the tank, if not, decrease the incoming flow rate.	
A8	Confirm that float switch activates mobile phone alarm (High High level alarm off) at -400 mm below overflow into biofilter (100 mm below the High High alarm on level).	
A9	Switch off pump when tank level drops below High Level - approximately 1 m above tank floor, but maximum High level of 500 mm below the tank overflow into biofilter – water level in the tank will commence rising.	
A10	Switch on macerator pump.	
A11	Confirm float switch activates the pump at High level – approximately 1 m above tank floor, but maximum High level of 500 mm below the tank overflow into biofilter.	
A12	Inspect wastewater pipeline and confirm no leakages from pipeline or fittings and that Tank 1 is filling.	
A13	Wastewater tank will then slowly empty into Tank 1 (pump out flow rate greater than inflow rate).	
A14	Confirm that wastewater macerator pump switches off at tank Low level (level determined by pump manufacturer).	
A15	Wastewater tank will then fill, and the pump will switch on at High level and continue to cycle on and off until the inflow into the tank is stopped.	
A16	Wastewater tank and pipeline commissioning complete.	

Item	Activity	✓/✗
B	Tank 1 System Commissioning	
B1	Tank 1 filled by wastewater tank macerator pump. A water cart cannot be used to fill Tank 1, as the tank volume is required to be read from the flowmeter.	
B2	Confirm that all valves are correctly set to only fill Tank 1 from the wastewater tank, and that the wastewater bypass pipeline electrically actuated valve is closed – this should have been done for the wastewater tank commissioning.	
B3	Fill Tank 1 to confirm that the float valve shuts off at High level.	
B4	Check flowmeter reading to confirm that the tank High volume is approximately 83.3 kL (=250 m^3/3).	
B5	After float valve has stopped the inflow, hold down float valve to overfill the tank.	
B6	Confirm that float switch activates the mobile phone alarm (High High level alarm on) and closes/opens electrically actuated valves (2 x closed and 1 x open) at High High level.	
B7	As alarm goes off, check flow meter reading to confirm the volume between High level and High High level is approximately 4.2 kL (5% of tank volume).	
B8	Confirm High High level is approximately 150 mm below tank overflow level.	
B9	Confirm wastewater bypass line is flowing to landfill.	
B10	Switch off wastewater pump.	
B11	Drain some water out of Tank 1 into Tank 2 under gravity by opening/closing tank farm valves.	
B12	Confirm that when water level drops 150 mm below High level, that the float switch activates the mobile phone alarm messages (High High alarm off) and opens/closes electrically actuated valves (2 x opened and 1 x closed).	
B13	When the water level in Tank 1 drops to at least 500 mm below the High level, stop draining water out of Tank 1 into Tank 2 under gravity by closing/opening tank farm valves.	
B14	Switch on wastewater pump.	
B15	Confirm that Tank 1 commences to refill, and that the wastewater bypass electrically actuated valve has closed. Only refill the tank for approximately 1 minute to confirm pump flow functionality.	
B16	Switch off wastewater pump.	
B17	Inspect all pipelines and fittings to confirm no water leakage.	
B18	Tank 1 wastewater inlet system commissioning complete.	
B19	Tank 1 water level should be at approximately 500 mm below High level after commissioning the wastewater inlet system, if not drain more water out of Tank 1 into Tank 2.	
B20	To test the leachate pipeline 3” float valve, use a Principal Supply pump to pump water from Tank 2 into Tank 1 – via Tank 2 bottom outlet pipe and Tank 1 top inlet pipe.	
B21	Fill Tank 1 to confirm float valve shuts off at High level.	
B22	No requirement to overfill the tank, as the float switch functionality has been confirmed above.	
B23	Inspect all pipelines and fittings to confirm no water leakage.	
B24	Tank 1 leachate inlet/outlet system commissioning complete.	

Item	Activity	✓/✗
C	Tank 2 System Commissioning	
C1	Partially fill Tank 2, up to approximately 500 mm below High level, from Tank 1 using gravity (will only half fill the tank) and/or the Principal Supply pump to pump water from Tank 1 into Tank 2 – via Tank 1 bottom outlet pipe and Tank 2 top inlet pipe.	
C2	Confirm that all valves are correctly set to only fill Tank 2 from the wastewater tank, and that the wastewater bypass pipeline electrically actuated valve is closed.	
C3	Fill Tank 2 from the wastewater tank to confirm that the float valve shuts off at High level.	
C4	Note the flowmeter reading after filling the tank to the High level (to be able to calculate the volume between High level and High High level. Providing that all three tanks are the same type/size and the inlet float valves are all installed at the same level and have the same float arm length/shape, there is no requirement to confirm the Tank 2 operating volume up to the High level, as the assumption is that all three tanks have the same volume, and hence, can rely on the Tank 1 volume check to confirm the volume of Tank 2.	
C5	After float valve has stopped the inflow, hold down float valve to overfill the tank.	
C6	Confirm that float switch activates the mobile phone alarm (High High level alarm on) and closes/opens electrically actuated valves (2 x closed and 1 x open) at High High level.	
C7	As alarm goes off, check flow meter reading to confirm the volume between High level and High High level is approximately 4.2 kL (5% of tank volume).	
C8	Confirm High High level is approximately 150 mm below tank overflow level.	
C9	Confirm wastewater bypass line is flowing to landfill.	
C10	Switch off wastewater pump.	
C11	Drain some water out of Tank 2 into Tank 3 under gravity by opening/closing tank farm valves.	
C12	Confirm that when water level drops 150 mm below High level, that the float switch activates the mobile phone alarm messages (High High alarm off) and opens/closes electrically actuated valves (2 x opened and 1 x closed).	
C13	When the water level in Tank 2 drops to at least 500 mm below the High level, stop draining water out of Tank 2 into Tank 3 under gravity by closing/opening tank farm valves.	
C14	Switch on wastewater pump.	
C15	Confirm that Tank 2 commences to refill, and that the wastewater bypass electrically actuated valve has closed. Only refill the tank for approximately 1 minute to confirm pump flow functionality.	
C16	Switch off wastewater pump.	
C17	Inspect all pipelines and fittings to confirm no water leakage.	
C18	Tank 2 wastewater inlet system commissioning complete.	
C19	Tank 2 water level should be at approximately 500 mm below High level after commissioning the wastewater inlet system, if not drain more water out of Tank 2 into Tank 3.	
C20	To test the leachate pipeline 3” float valve, use a Principal Supply pump to pump water from Tank 3 into Tank 2 – via Tank 3 bottom outlet pipe and Tank 2 top inlet pipe.	
C21	Fill Tank 2 to confirm float valve shuts off at High level.	

Item	Activity	✓/✗
C22	No requirement to overfill the tank, as the float switch functionality has been confirmed above.	
C23	Inspect all pipelines and fittings to confirm no water leakage.	
C24	Tank 2 leachate inlet/outlet system commissioning complete.	
D	Tank 3 System Commissioning	
D1	Partially fill Tank 3, up to approximately 500 mm below High level, from Tank 2 using gravity (will only half fill the tank) and/or the Principal Supply pump to pump water from Tank 2 into Tank 3 – via Tank 2 bottom outlet pipe and Tank 3 top inlet pipe.	
D2	Confirm that all valves are correctly set to only fill Tank 3 from the wastewater tank, and that the wastewater bypass pipeline electrically actuated valve is closed.	
D3	Fill Tank 3 from the wastewater tank to confirm that the float valve shuts off at High level.	
D4	Note the flowmeter reading after filling the tank to the High level (to be able to calculate the volume between High level and High High level. Providing that all three tanks are the same type/size and the inlet float valves are all installed at the same level and have the same float arm length/shape, there is no requirement to confirm the Tank 3 operating volume up to the High level, as the assumption is that all three tanks have the same volume, and hence, can rely on the Tank 1 volume check to confirm the volume of Tank 3.	
D5	After float valve has stopped the inflow, hold down float valve to overfill the tank.	
D6	Confirm that float switch activates the mobile phone alarm (High High level alarm on) and closes/opens electrically actuated valves (2 x closed and 1 x open) at High High level.	
D7	As alarm goes off, check flow meter reading to confirm the volume between High level and High High level is approximately 4.2 kL (5% of tank volume).	
D8	Confirm High High level is approximately 150 mm below tank overflow level.	
D9	Confirm wastewater bypass line is flowing to landfill.	
D10	Switch off wastewater pump.	
D11	Drain some water out of Tank 3 into Tank 2 under gravity by opening/closing tank farm valves.	
D12	Confirm that when water level drops 150 mm below High level, that the float switch activates the mobile phone alarm messages (High High alarm off) and opens/closes electrically actuated valves (2 x opened and 1 x closed).	
D13	When the water level in Tank 3 drops to at least 500 mm below the High level, stop draining water out of Tank 3 into Tank 2 under gravity by closing/opening tank farm valves.	
D14	Switch on wastewater pump.	
D15	Confirm that Tank 3 commences to refill, and that the wastewater bypass electrically actuated valve has closed. Only refill the tank for approximately 1 minute to confirm pump flow functionality.	
D16	Switch off wastewater pump.	
D17	Inspect all pipelines and fittings to confirm no water leakage.	
D18	Tank 3 wastewater inlet system commissioning complete.	

Item	Activity	✓/✗
D19	Tank 3 water level should be at approximately 500 mm below High level after commissioning the wastewater inlet system, if not drain more water out of Tank 3 into Tank 2.	
D20	To test the leachate pipeline 3" float valve, use a Principal Supply pump to pump water from Tank 2 into Tank 3 – via Tank 2 bottom outlet pipe and Tank 3 top inlet pipe.	
D21	Fill Tank 3 to confirm float valve shuts off at High level.	
D22	No requirement to overfill the tank, as the float switch functionality has been confirmed above.	
D23	Inspect all pipelines and fittings to confirm no water leakage.	
D24	Tank 3 leachate inlet/outlet system commissioning complete.	
E	Leachate Pipeline Commissioning	
Note: • It will take approximately 19 m^3 of water to fill the ring main pipeline. • Due to the incompressibility of water, when the pipeline is full of water, the pump used to fill the pipeline will likely automatically switch off at maximum pressure head, as there is no flow out of the pipeline. If this occurs, then to keep the pump operating and hence to maintain a water pressure in the pipeline during commissioning, it may be necessary to leave a scour point partially open to continuously release some water from the pipeline.		
E1	Open all DN100 and DN150 isolation valves on the leachate ring main pipeline, and the DN50 isolation valves on all air release valves, including in tank farm. Ensure all DN100 isolation valves at scour points are closed and end caps are removed. Ensure all DN50 isolation valves at air control T-pieces are closed and blanked flanges are removed.	
E2	Set isolation valves in the tank fam to enable filling of the leachate pipeline from Tank 3 (which should be full from commissioning), using the Principal Supply pump to pump water from Tank 3 into the pipeline – via Tank 3 bottom outlet pipe and the T-piece in the leachate pipeline.	
E3	Commence pumping into the leachate pipeline – the air release valves should automatically eject air as the pipeline fills.	
E4	The pump should cease pumping once the pipeline is pressurised – pipeline full of water, with no air pockets.	
E5	Inspect pipeline and fittings to confirm no water leakage.	
E6	Slightly open DN50 isolation valves at each air control T-piece. There should only be a very small volume of air expelled from the small air pocket in each T-piece. This indicates that the air release valve is functioning properly, and the pipeline is completely full of air. If the pipeline pressure drops, the pump may need to be restarted to fill the void of the evacuated air.	
E7	Close DN150 isolation valve immediately to the west of the ring main pipeline tie-in point (to stop clockwise flow in the ring main) and, while the pump is running, open the scour point immediately to the west of the closed isolation valve to confirm that water flows anticlockwise around the complete ring main pipeline. Close scour point and open DN150 isolation valve to revert back to a fully open pipeline.	

Item	Activity	✓/✗
E8	While the pump is running, open each scour point, one at a time, to confirm that water flows out of the pipeline. No need to recheck the scour point that has been tested for anticlockwise pipeline flow.	
E9	Open one or two of the lower scour points (one may already be partially open to maintain the pipeline pressure) to empty all three leachate storage tanks of all commissioning water. In the tank farm, open and close valves accordingly to pump out all of the tanks. Be aware that there will be a significant volume of water pumped out of the tanks, and this could result in some erosion at the scour point(s). It may be necessary to only partially open the scour point valve(s) to reduce the discharge flow rate. Once the tanks are empty, switch off the pump.	
E10	Open all scour points to drain the pipeline and to confirm that the air release valves allow air into the pipeline under negative pressure. When water cease flowing out of the pipeline, close all scour points.	
E11	Confirm that all scour points are closed and replace end caps. Confirm that all isolation valves at the air control T-pieces have been closed and replace blanked flanges. Confirm that all DN100 and DN150 isolation valves on the pipeline are open. In the tank farm, close isolation valves either side of the pump connections to the pipework. Remove pump from pipework. Reconnect end caps onto pipework.	
E12	Inspect all pipelines and fittings to confirm no water leakage.	
E13	Leachate ring main pipeline system commissioning complete.	