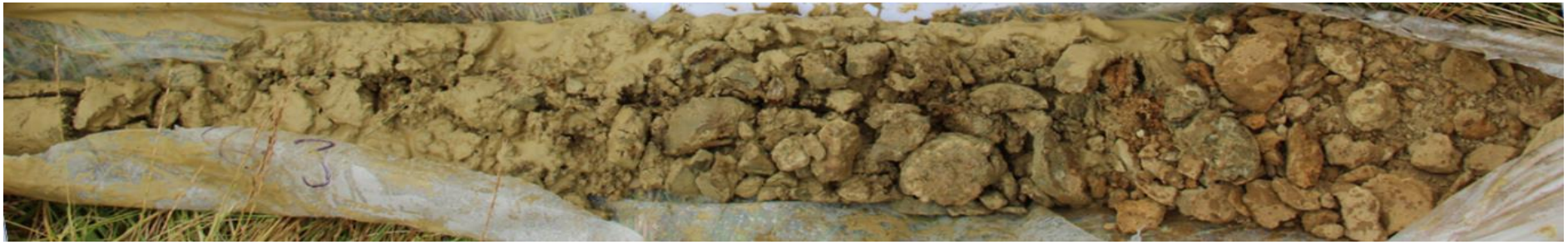
Woodlawn Seepage Investigation MB25 Total Depth = 9.0m

7.8m

7.8m

8.3m

8.3m



9.0m

Woodlawn Seepage Investigation

MB26S

Total Depth = 6.0m

0.0m

2.3m

3.4m

4.5m

6.0m

Woodlawn Seepage Investigation

MB27D

Total Depth = 18.0m

1.5m

2.3m

5.3m

8.0m

8.0m

8.5m

8.5m

9.1m

Woodlawn Seepage Investigation MB27D Total Depth = 18.0m

9.1m

9.8m

9.8m

11.0m

11.0m

13.1m

13.1m

14.7m

Woodlawn Seepage Investigation MB27D Total Depth = 18.0m

14.7m

16.3m

16.3m

18.0m

Woodlawn Seepage Investigation

MB28

Total Depth = 9.0m

1.5m

2.2m

2.2m

3.3m

3.3m

4.1m

4.1m

Woodlawn Seepage Investigation MB28 Total Depth = 9.0m

5.0m

5.0m

6.8m

6.8m

7.5m

8.2m

9.0m

Woodlawn Seepage Investigation MB29 Total Depth = 9.0m

1.5m

2.4m

2.4m

4.6m

4.6m

6.0m

Woodlawn Seepage Investigation

MB30

Total Depth = 12.0m

1.5m

2.2m

2.2m

3.7m

3.7m

4.3m

4.3m

4.8m

Woodlawn Seepage Investigation

MB30

Total Depth = 12.0m

4.8m

5.2m

5.2m

6.4m

6.4m

7.5m

7.5m

9.0m

Woodlawn Seepage Investigation

MB30

Total Depth = 12.0m

9.0m

9.5m

11.0m

11.4m

11.4m

12.0m

Woodlawn Seepage Investigation

MB31

Total Depth = 9.0m

1.5m

2.2m

2.2m

5.2m

5.2m

5.5m

5.5m

6.0m

Woodlawn Seepage Investigation MB31 Total Depth = 9.0m

6.0m

6.6m

6.6m

7.0m

7.0m

7.7m

7.7m

Woodlawn Seepage Investigation

MB31

Total Depth = 9.0m

8.4m

8.4m

9.0m

Woodlawn Seepage Investigation

NB9 - Backfilled

Total Depth = 10.0m

1.5m

2.5m

2.5m

4.5m

4.5m

5.5m

5.5m

6.0m

Appendix D

Geotechnical Analytical Laboratory Reports

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

ATTERBERG LIMITS TEST REPORT

Test Method: AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1

Client	AECOM Services Pty Ltd	**Report No.**	16120939-AL
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	5/1/17-16/1/17
		Report Date	16/01/2017
Project	60528427 - Woodlawn		

Sample No.	16120939	16120940	16120941	16120942	16120943	16120944
Test Date	10/01/2017	10/01/2017	10/01/2017	10/01/2017	10/01/2017	10/01/2017
Client ID	ED1_BH1_ 0.0m	ED1_BH2_ 0.0m	ED2_BH1_ 0.0m	ED2_BH2_ 0.0m	ED1_BH1_ 1.0m	ED2_BH2_ 1.0m
Depth (m)	0.00	0.00	0.00	0.00	1.00	1.00
Liquid Limit (%)	36	51	35	41	38	39
Plastic Limit (%)	19	19	21	20	21	16
Plasticity Index (%)	17	32	14	21	17	23
Linear Shrinkage (%)	9.0	13.5	7.0	12.0	8.0	10.5
Moisture Content (%)	22.2	24.6	14.1	19.0	22.2	6.5

Sample No.	-	-	-	-	-	-
Test Date	-	-	-	-	-	-
Client ID	-	-	-	-	-	-
Depth (m)	-	-	-	-	-	-
Liquid Limit (%)	-	-	-	-	-	-
Plastic Limit (%)	-	-	-	-	-	-
Plasticity Index (%)	-	-	-	-	-	-
Linear Shrinkage (%)	-	-	-	-	-	-
Moisture Content (%)	-	-	-	-	-	-

NOTES/REMARKS: The samples were tested oven dried, dry sieved and in a 125-250mm mould.

Sample/s supplied by the client * Cracking occurred + Curling occurred

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Park

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PERMEABILITY BY CONSTANT HEAD TEST REPORT

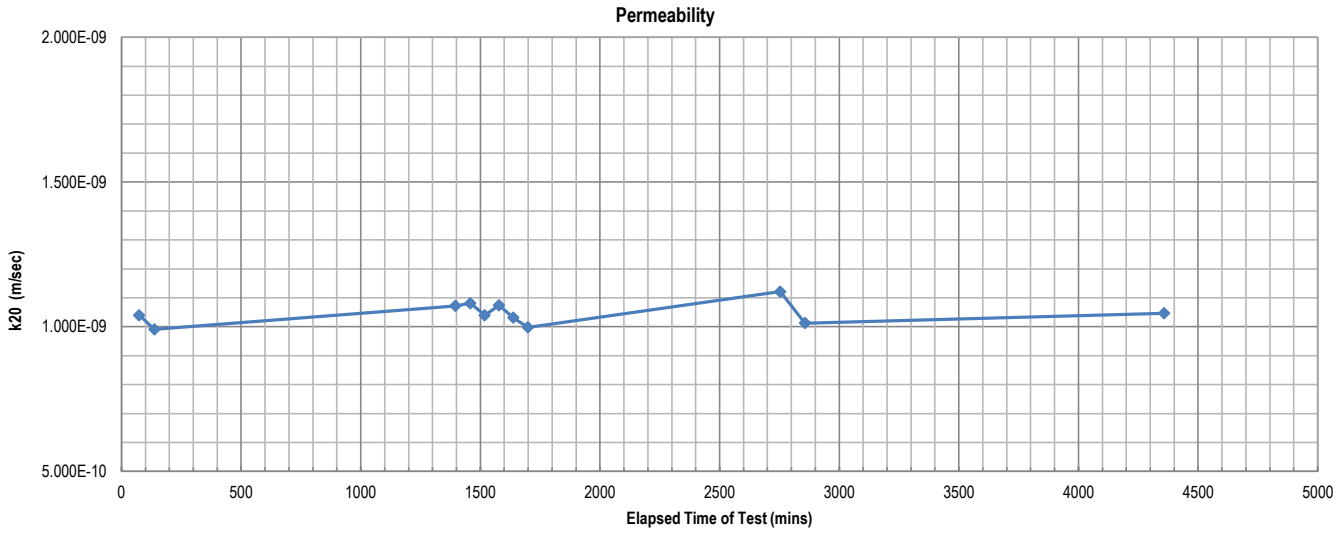
Test Method AS 1289 6.7.3, 5.1.1 , KH2 (Based on K H Head (1988) Manual of Laboratory Testing,10.7)

Client	AECOM Services Pty Ltd	**Report No.**	16120939-CHP
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	12/01/2017
		Report Date	25/01/2017
Project	60528427 - Woodlawn		
Client ID	ED1_BH1_0.0m	**Depth (m)**	0.00
Description	CLAYEY SILT- mottled grey/ yellow brown	**Sample Type**	Remoulded Soil Specimen

RESULTS OF TESTING

Field Dry Density (t/m^3)	**1.60**	Confining Pressure	**150**
Field Moisture Content (%)	**22.4**	Back Pressure	**50**
Placement Moisture Content (%)	**22.4**	Effective Stress Applied (kPa)	**100**
Moisture Ratio (%)	**100.1**	Water Type	**De-Ionized**
Placement Wet Density (t/m^3)	**1.96**	Percentage Material Retained/Sieve Size (mm)	**0 % / 2.36 mm**
Density Ratio (%)	**99.9**	Sample Height and Diameter (mm)	**59.9 / 47.8 mm**

PERMEABILITY $k_{(20)}$ = 1.0 x 10^{-09} (m/sec)



Remarks: The above specimen was remoulded to a target of 100% of Field Density and at Field Moisture Content.

Sample/s supplied by client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Channon

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

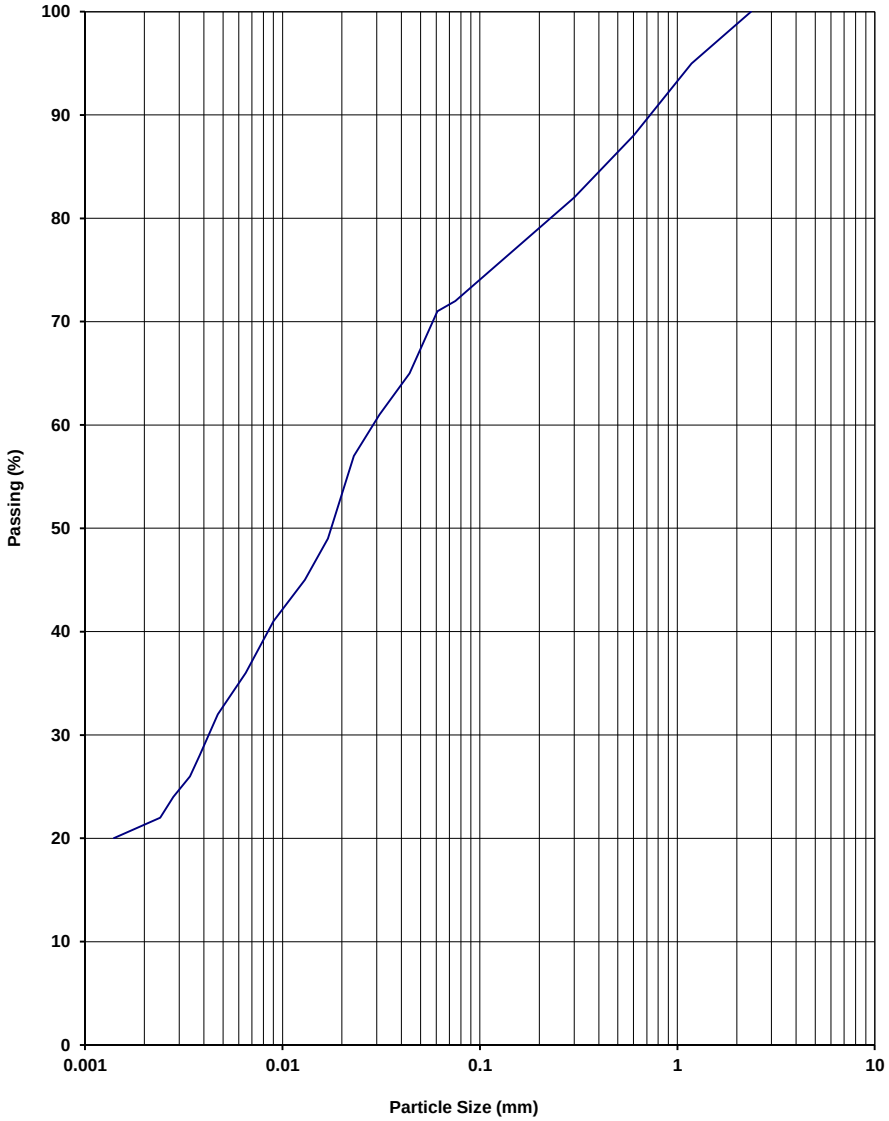
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	AECOM Services Pty Ltd	**Report No.**	16120939-G
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	3/1/17-11/1/17
		Report Date	11/1/2017
Project	60528427 - Woodlawn		
Client ID	ED1_BH1_0.0m	**Depth (m)**	0.00

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	
2.36	100
1.18	95
0.600	88
0.425	85
0.300	82
0.150	77
0.075	72
0.061	71
0.044	65
0.031	61
0.023	57
0.017	49
0.013	45
0.009	41
0.0065	36
0.0047	32
0.0038	28
0.0034	26
0.0028	24
0.0024	22
0.0014	20



NOTES/REMARKS: -

Moisture Content 22.2% -2.36mm Soil Particle Density(t/m^3) 2.60

Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Park

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PERMEABILITY BY CONSTANT HEAD TEST REPORT

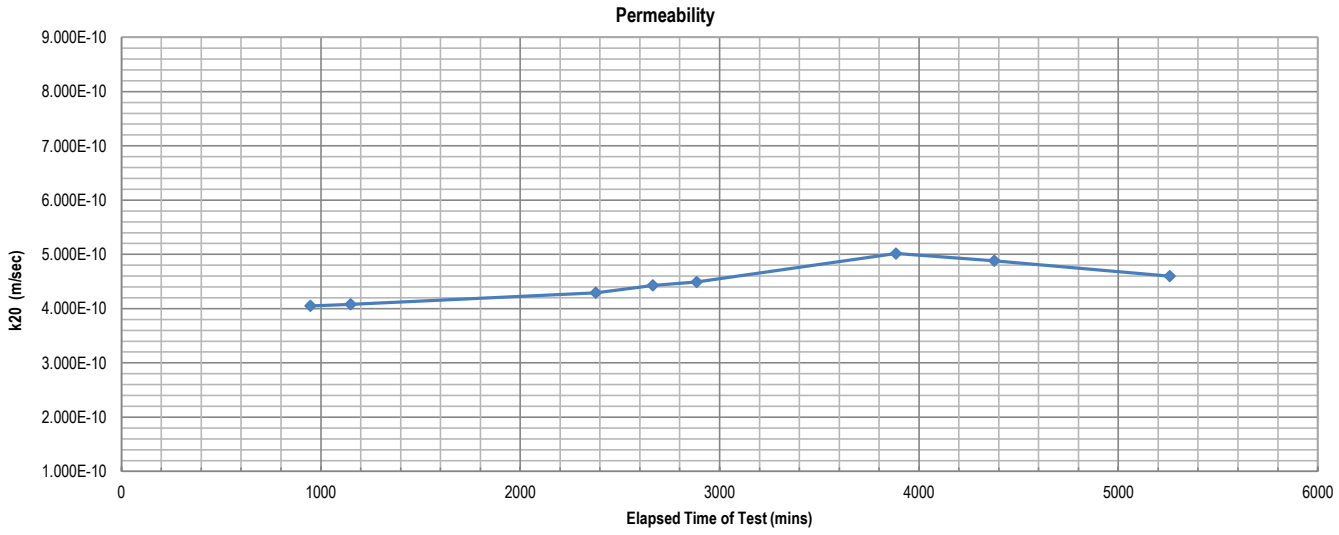
Test Method AS 1289 6.7.3, 5.1.1 , KH2 (Based on K H Head (1988) Manual of Laboratory Testing,10.7)

Client	AECOM Services Pty Ltd	**Report No.**	16120940-CHP
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	23/01/2017
		Report Date	30/01/2017
Project	60528427 - Woodlawn		
Client ID	ED1_BH2_0.0m	**Depth (m)**	0.00
Description	SILTY CLAY - grey/brown/yellow	**Sample Type**	Remoulded Soil Specimen

RESULTS OF TESTING

Field Dry Density (t/m^3)	**1.43**	Confining Pressure	**150**
Field Moisture Content (%)	**23.0**	Back Pressure	**50**
Placement Moisture Content (%)	**23.0**	Effective Stress Applied (kPa)	**100**
Moisture Ratio (%)	**99.8**	Water Type	**De-Ionized**
Placement Wet Density (t/m^3)	**1.77**	Percentage Material Retained/Sieve Size (mm)	**0 % / 2.36 mm**
Density Ratio (%)	**100.6**	Sample Height and Diameter (mm)	**59.8 / 47.7 mm**

PERMEABILITY $k_{(20)} = 4.6 \times 10^{-10}$ **(m/sec)**



Remarks: The above specimen was remoulded to a target of 100% of Field Density and at Field Moisture Content.

Sample/s supplied by client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Channon

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

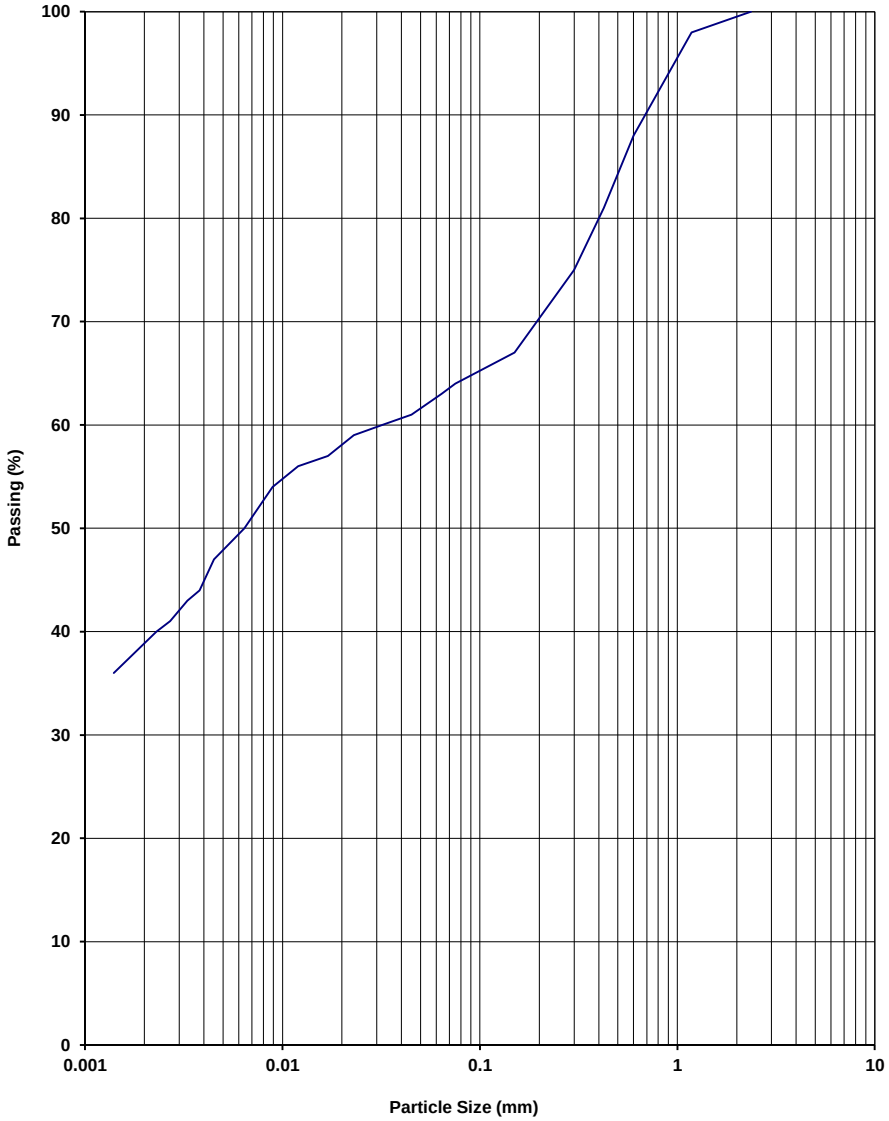
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	AECOM Services Pty Ltd	**Report No.**	16120940-G
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	3/1/17-11/1/17
		Report Date	11/1/2017
Project	60528427 - Woodlawn		
Client ID	ED1_BH2_0.0m	**Depth (m)**	0.00

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	
2.36	100
1.18	98
0.600	88
0.425	81
0.300	75
0.150	67
0.075	64
0.064	63
0.045	61
0.032	60
0.023	59
0.017	57
0.012	56
0.0089	54
0.0064	50
0.0045	47
0.0038	44
0.0033	43
0.0027	41
0.0023	40
0.0014	36



NOTES/REMARKS: -

Moisture Content 24.6% -2.36mm Soil Particle Density(t/m^3) 2.54

Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Park

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PERMEABILITY BY CONSTANT HEAD TEST REPORT

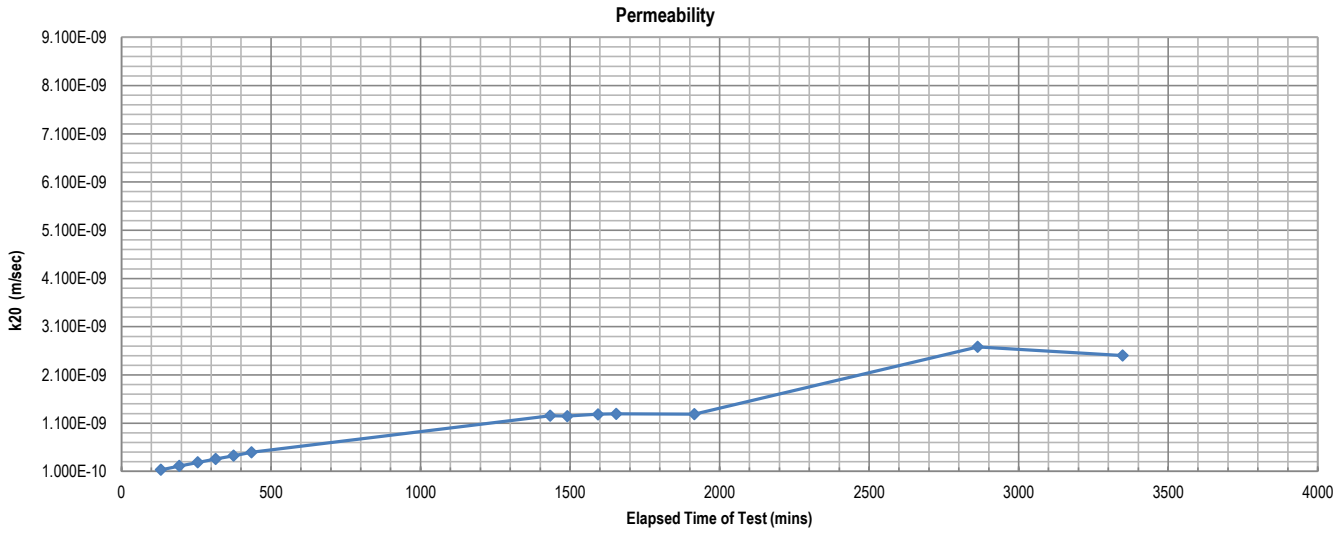
Test Method AS 1289 6.7.3, 5.1.1 , KH2 (Based on K H Head (1988) Manual of Laboratory Testing,10.7)

Client	AECOM Services Pty Ltd	**Report No.**	16120941-CHP
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	12/01/2017
		Report Date	25/01/2017
Project	60528427 - Woodlawn		
Client ID	ED2_BH1_0.0m	**Depth (m)**	0.00
Description	CLAYEY SILT - white/yellow	**Sample Type**	Remoulded Soil Specimen

RESULTS OF TESTING

Field Dry Density (t/m^3)	**1.51**	Confining Pressure	**150**
Field Moisture Content (%)	**15.6**	Back Pressure	**50**
Placement Moisture Content (%)	**15.6**	Effective Stress Applied (kPa)	**100**
Moisture Ratio (%)	**99.7**	Water Type	**De-ionized**
Placement Wet Density (t/m^3)	**1.75**	Percentage Material Retained/Sieve Size (mm)	**0 % / 2.36 mm**
Density Ratio (%)	**100.4**	Sample Height and Diameter (mm)	**59.8 / 47.7 mm**

PERMEABILITY $k_{(20)} = 2.6 \times 10^{-09}$ (m/sec)



Remarks: The above specimen was remoulded to a target of 100% of Field Density and at Field Moisture Content.

Sample/s supplied by client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Channon

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

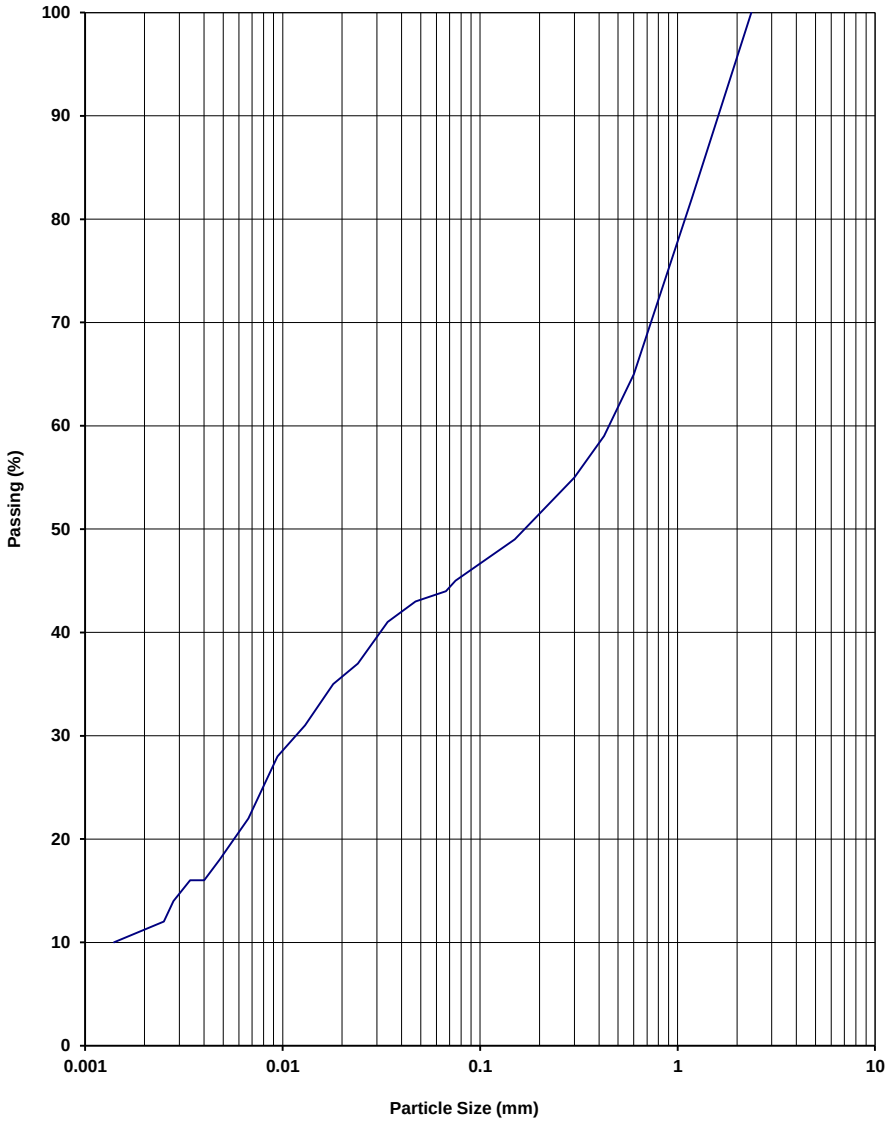
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	AECOM Services Pty Ltd	**Report No.**	16120941-G
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	3/1/17-11/1/17
		Report Date	11/1/2017
Project	60528427 - Woodlawn		
Client ID	ED2_BH1_0.0m	**Depth (m)**	0.00

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	
2.36	100
1.18	82
0.600	65
0.425	59
0.300	55
0.150	49
0.075	45
0.067	44
0.047	43
0.034	41
0.024	37
0.018	35
0.013	31
0.0094	28
0.0067	22
0.0048	18
0.004	16
0.0034	16
0.0028	14
0.0025	12
0.0014	10



NOTES/REMARKS: -

Moisture Content 14.1% -2.36mm Soil Particle Density(t/m^3) 2.58

Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Park

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PERMEABILITY BY CONSTANT HEAD TEST REPORT

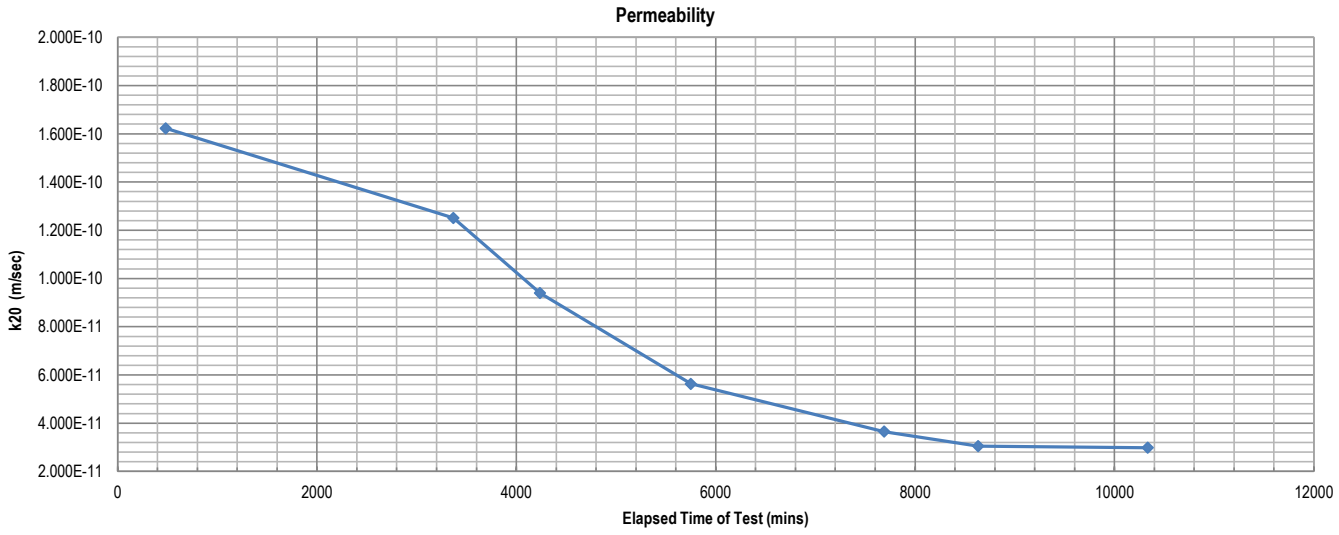
Test Method AS 1289 6.7.3, 5.1.1 , KH2 (Based on K H Head (1988) Manual of Laboratory Testing,10.7)

Client	AECOM Services Pty Ltd	**Report No.**	16120942-CHP
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	16/01/2017
		Report Date	30/01/2017
Project	60528427 - Woodlawn		
Client ID	ED2_BH2_0.0m	**Depth (m)**	0.00
Description	SILTY CLAY - brown	**Sample Type**	Remoulded Soil Specimen

RESULTS OF TESTING

Field Dry Density (t/m^3)	**1.66**	Confining Pressure	**150**
Field Moisture Content (%)	**21.8**	Back Pressure	**50**
Placement Moisture Content (%)	**21.8**	Effective Stress Applied (kPa)	**100**
Moisture Ratio (%)	**100.1**	Water Type	**De-Ionized**
Placement Wet Density (t/m^3)	**2.02**	Percentage Material Retained/Sieve Size (mm)	**0 % / 13.2 mm**
Density Ratio (%)	**100.0**	Sample Height and Diameter (mm)	**91.7 / 72 mm**

PERMEABILITY $k_{(20)} = 3.0 \times 10^{-11}$ (m/sec)



Remarks: The above specimen was remoulded to a target of 100% of Field Density and at Field Moisture Content.

Sample/s supplied by client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Channon

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

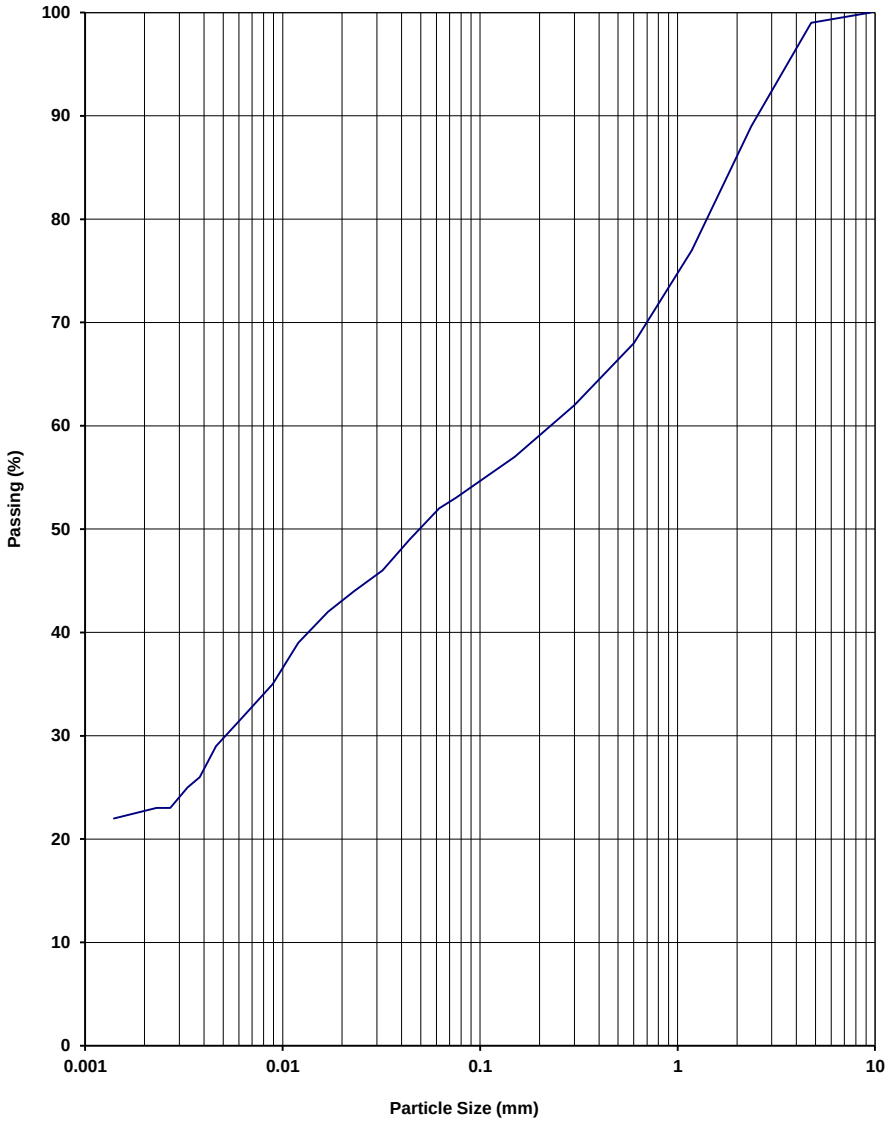
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	AECOM Services Pty Ltd	**Report No.**	16120942-G
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	3/1/17-10/1/17
		Report Date	10/1/2017
Project	60528427 - Woodlawn		
Client ID	ED2_BH2_0.0m	**Depth (m)**	0.00

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	100
4.75	99
2.36	89
1.18	77
0.600	68
0.425	65
0.300	62
0.150	57
0.075	53
0.062	52
0.044	49
0.032	46
0.023	44
0.017	42
0.012	39
0.0089	35
0.0064	32
0.0046	29
0.0038	26
0.0033	25
0.0027	23
0.0023	23
0.0014	22



NOTES/REMARKS: -

Moisture Content 19% -2.36mm Soil Particle Density(t/m^3) 2.55

Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Park

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PERMEABILITY BY CONSTANT HEAD TEST REPORT

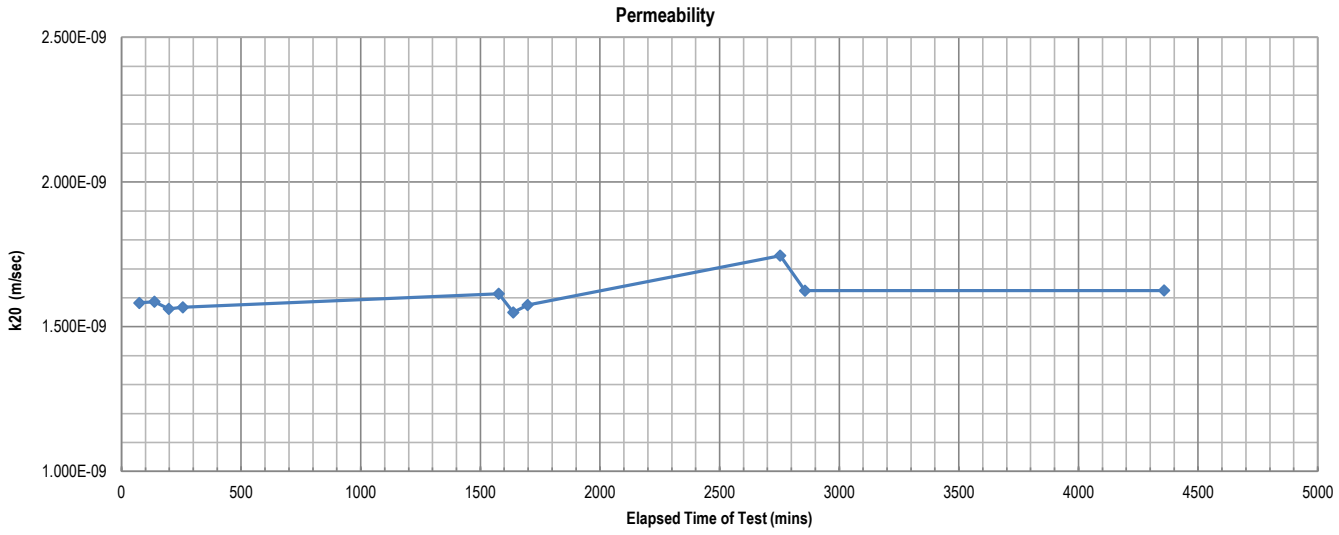
Test Method AS 1289 6.7.3, 5.1.1 , KH2 (Based on K H Head (1988) Manual of Laboratory Testing,10.7)

Client	AECOM Services Pty Ltd	**Report No.**	16120943-CHP
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	16/01/2017
		Report Date	25/01/2017
Project	60528427 - Woodlawn		
Client ID	ED1_BH1_1.0m	**Depth (m)**	1.00
Description	CLAYEY SILT- mottled grey/brown	**Sample Type**	Remoulded Soil Specimen

RESULTS OF TESTING

Field Dry Density (t/m^3)	**1.60**	Confining Pressure	**150**
Field Moisture Content (%)	**23.8**	Back Pressure	**50**
Placement Moisture Content (%)	**23.8**	Effective Stress Applied (kPa)	**100**
Moisture Ratio (%)	**99.9**	Water Type	**De-ionized**
Placement Wet Density (t/m^3)	**1.98**	Percentage Material Retained/Sieve Size (mm)	**0 % / 2.36 mm**
Density Ratio (%)	**100.1**	Sample Height and Diameter (mm)	**60 / 47.8 mm**

PERMEABILITY $k_{(20)} = 1.6 \times 10^{-09}$ (m/sec)



Remarks: The above specimen was remoulded to a target of 100% of Field Density and at Field Moisture Content.

Sample/s supplied by client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Channon

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

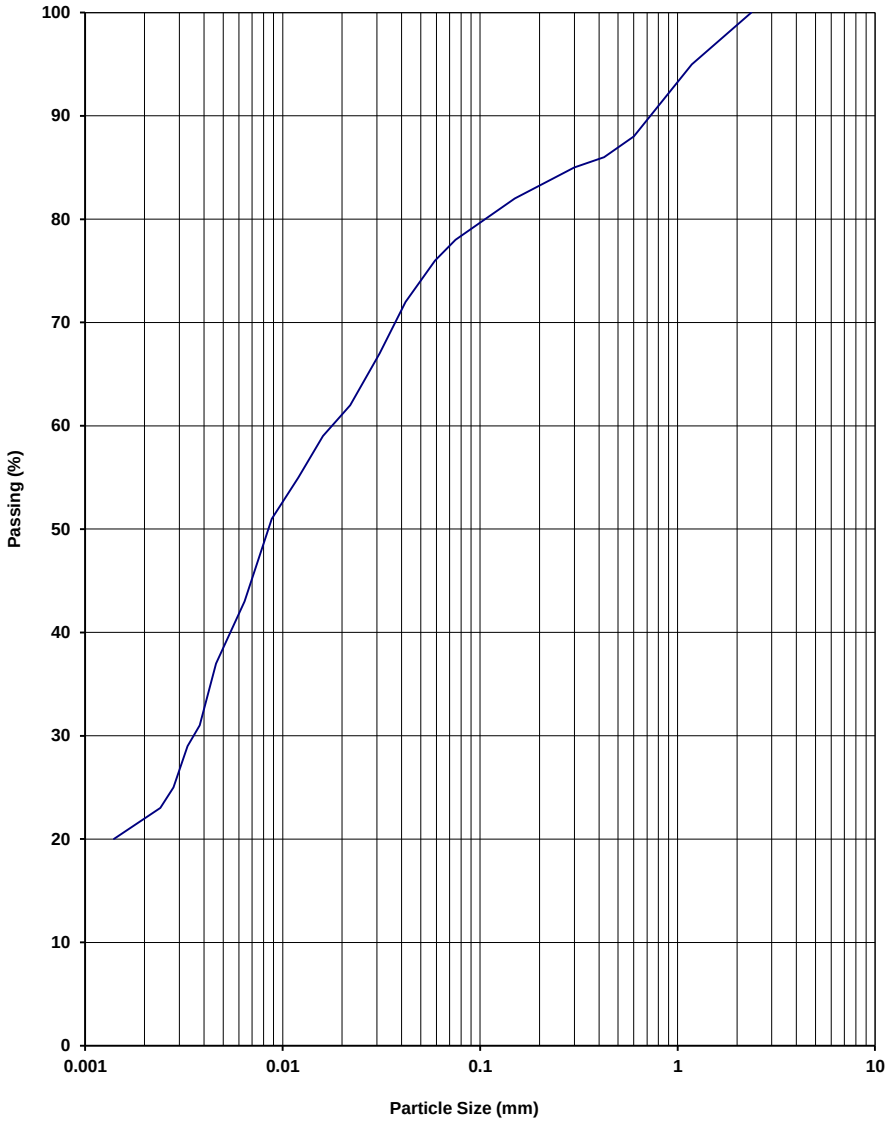
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	AECOM Services Pty Ltd	**Report No.**	16120943-G
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	3/1/17-11/1/17
		Report Date	11/1/2017
Project	60528427 - Woodlawn		
Client ID	ED1_BH1_1.0m	**Depth (m)**	1.00

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	
2.36	100
1.18	95
0.600	88
0.425	86
0.300	85
0.150	82
0.075	78
0.059	76
0.042	72
0.031	67
0.022	62
0.016	59
0.012	55
0.0088	51
0.0064	43
0.0046	37
0.0038	31
0.0033	29
0.0028	25
0.0024	23
0.0014	20



NOTES/REMARKS: -

Moisture Content 22% -2.36mm Soil Particle Density(t/m^3) 2.50

Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Park

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PERMEABILITY BY CONSTANT HEAD TEST REPORT

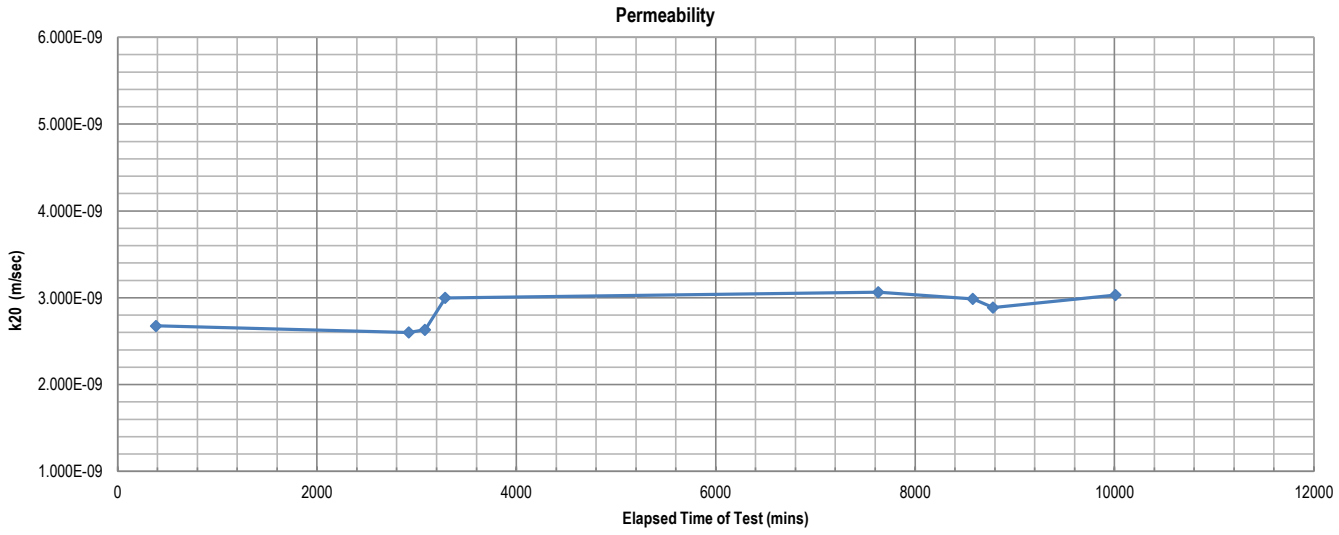
Test Method AS 1289 6.7.3, 5.1.1 , KH2 (Based on K H Head (1988) Manual of Laboratory Testing,10.7)

Client	AECOM Services Pty Ltd	**Report No.**	16120944-CHP
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	16/01/2017
		Report Date	30/01/2017
Project	60528427 - Woodlawn		
Client ID	ED2_BH2_1.0m	**Depth (m)**	1.00
Description	GRAVELLY SANDY SILT - pale brown	**Sample Type**	Remoulded Soil Specimen

RESULTS OF TESTING

Field Dry Density (t/m^3)	**1.93**	Confining Pressure	**150**
Field Moisture Content (%)	**5.8**	Back Pressure	**50**
Placement Moisture Content (%)	**5.8**	Effective Stress Applied (kPa)	**100**
Moisture Ratio (%)	**100.2**	Water Type	**De-ionized**
Placement Wet Density (t/m^3)	**2.06**	Percentage Material Retained/Sieve Size (mm)	**4 % / 6.7 mm**
Density Ratio (%)	**100.7**	Sample Height and Diameter (mm)	**74.4 / 63 mm**

PERMEABILITY $k_{(20)}$ = 3.0×10^{-09} (m/sec)



Remarks: The above specimen was remoulded to a target of 100% of Field Density and at Field Moisture Content.

Sample/s supplied by client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Channon

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

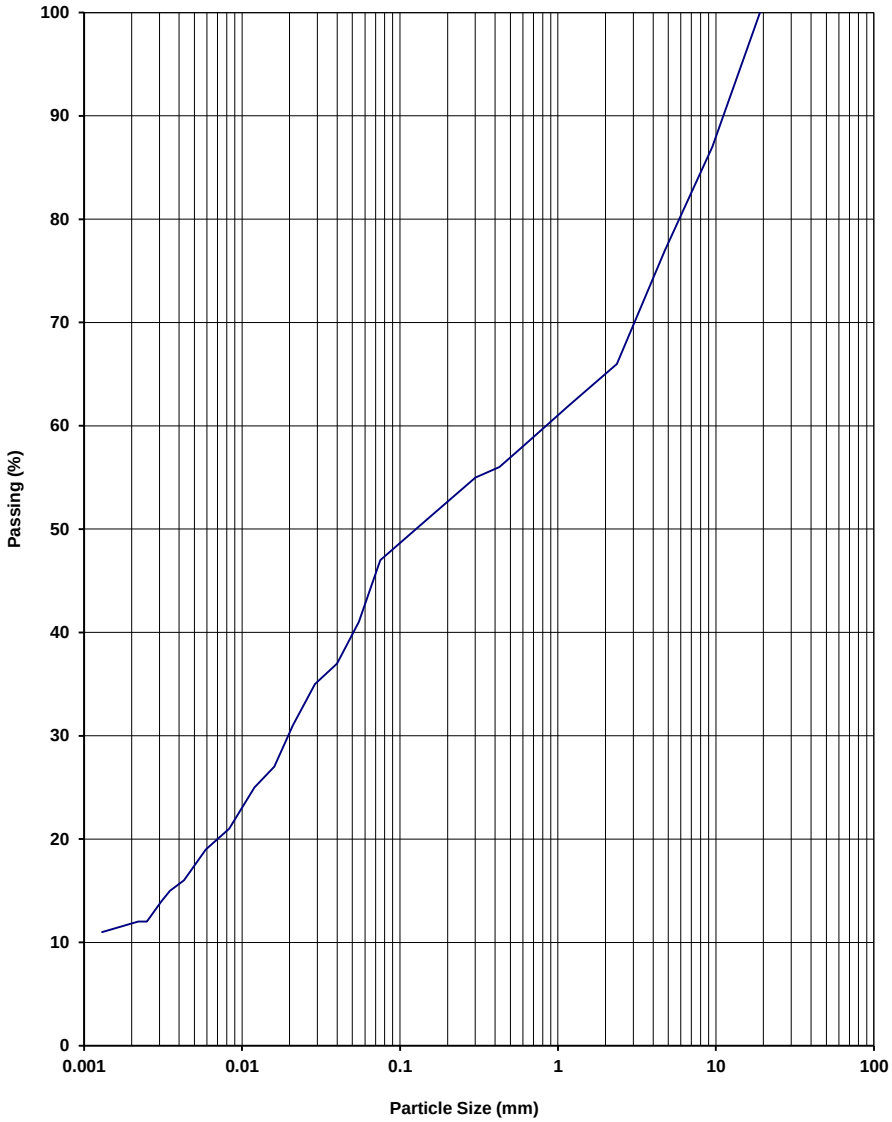
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	AECOM Services Pty Ltd	**Report No.**	16120944-G
Address	PO Box 1307 Fortitude Valley QLD 4006	**Test Date**	3/1/17-11/1/17
		Report Date	11/1/2017
Project	60528427 - Woodlawn		
Client ID	ED2_BH2_1.0m	**Depth (m)**	1.00

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	100
13.2	93
9.5	87
6.7	83
4.75	77
2.36	66
1.18	62
0.600	58
0.425	56
0.300	55
0.150	51
0.075	47
0.055	41
0.04	37
0.029	35
0.021	31
0.016	27
0.012	25
0.0083	21
0.0059	19
0.0043	16
0.0035	15
0.0031	14
0.0025	12
0.0022	12
0.0013	11



NOTES/REMARKS: -

Moisture Content 6.5% -2.36mm Soil Particle Density(t/m^3) 2.87

Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory

C. Park

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

Appendix E

Water Analytical Laboratory Reports

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1700747**	Page	: 1 of 18
Client	: **VEOLIA ENVIRONMENTAL SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR HENRY GUNDRY	Contact	: Customer Services ES
Address	: LEVEL 4, 65 PIRRAMA RD PYRMONT NSW, AUSTRALIA 2009	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 4844 6351	Telephone	: +61-2-8784 8555
Project	: AECOM ED1/ED2 PROJECT	Date Samples Received	: 13-Jan-2017 08:40
Order number	: 7100014445	Date Analysis Commenced	: 13-Jan-2017
C-O-C number	: ----	Issue Date	: 24-Jan-2017 10:25
Sampler	: J.EASTERBROOK & A.O'SULLIVAN		
Site	: ----		
Quote number	: BNBQ/270/16		
No. of samples received	: 12		
No. of samples analysed	: 12		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Dian Dao		Sydney Inorganics, Smithfield, NSW
Nanthini Coilparampi	Laboratory Manager - Inorganics	Sydney Inorganics, Smithfield, NSW
Ravineel Chand		Sydney Organics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG035: Positive Hg results have been confirmed by reanalysis.
- EG020A: Poor matrix spike recovery was obtained for Barium and Vanadium on sample ES1700723 #001 due to matrix interference. Confirmed by reanalysis.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	QC01 DUPLICATE	WB NB1	WB NB2	WB NB3	WB NB4S
			Client sampling date / time	12-Jan-2017 00:00	12-Jan-2017 11:30	12-Jan-2017 11:40	12-Jan-2017 12:00	12-Jan-2017 08:40
Compound	CAS Number	LOR	Unit	ES1700747-001	ES1700747-002	ES1700747-003	ES1700747-004	ES1700747-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.35	7.74	7.53	7.53	7.62
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	8520	842	5420	6590	7360
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	5540	547	3520	4280	4780
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	4130	395	2660	2740	3330
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	278	226	439	533	385
Total Alkalinity as CaCO3	----	1	mg/L	278	226	439	533	385
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	44.4	28.5	30.2	39.2	41.6
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4210	108	2480	2730	3440
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	1040	46	454	629	789
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	637	57	433	392	552
Magnesium	7439-95-4	1	mg/L	617	46	384	429	475
Sodium	7440-23-5	1	mg/L	426	47	206	449	424
Potassium	7440-09-7	1	mg/L	1	<1	3	2	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	0.01	<0.01	<0.01	<0.01
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	7440-39-3	0.001	mg/L	0.005	0.002	0.038	0.039	0.029
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	0.0002	<0.0001	0.0003	<0.0001	0.0001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.003	0.004	0.008
Chromium	7440-47-3	0.001	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.065	0.282	0.275	0.558	0.744

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	QC01 DUPLICATE	WB NB1	WB NB2	WB NB3	WB NB4S
				Client sampling date / time	12-Jan-2017 00:00	12-Jan-2017 11:30	12-Jan-2017 11:40	12-Jan-2017 12:00	12-Jan-2017 08:40
					ES1700747-001	ES1700747-002	ES1700747-003	ES1700747-004	ES1700747-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Nickel	7440-02-0	0.001	mg/L		**0.009**	<0.001	**0.003**	**0.009**	**0.023**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	**0.01**	**0.01**	<0.01
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	**0.025**	<0.005	<0.005
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		----	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		----	----	----	----	----
Boron	7440-42-8	0.05	mg/L		----	----	----	----	----
Barium	7440-39-3	0.001	mg/L		----	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		----	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		----	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		----	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		----	----	----	----	----
Copper	7440-50-8	0.001	mg/L		----	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		----	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		----	----	----	----	----
Lead	7439-92-1	0.001	mg/L		----	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		----	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		----	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		----	----	----	----	----
Silver	7440-22-4	0.001	mg/L		----	----	----	----	----
Iron	7439-89-6	0.05	mg/L		----	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		**0.0001**	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		----	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	**0.6**	**0.3**	**0.3**	**0.3**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.04**	<0.01	**0.03**	**0.08**	**0.03**
EK057G: Nitrite as N by Discrete Analyser									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC01 DUPLICATE	WB NB1	WB NB2	WB NB3	WB NB4S
				Client sampling date / time	12-Jan-2017 00:00	12-Jan-2017 11:30	12-Jan-2017 11:40	12-Jan-2017 12:00	12-Jan-2017 08:40
Compound	CAS Number	LOR	Unit		ES1700747-001	ES1700747-002	ES1700747-003	ES1700747-004	ES1700747-005
					Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser - Continued									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	**0.08**	**0.04**	**0.09**	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	**6.90**	**1.09**	**4.61**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	**6.98**	**1.13**	**4.70**	<0.01
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		**0.05**	<0.01	<0.01	**0.01**	**0.02**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**122**	**8.06**	**73.2**	**85.2**	**102**
Total Cations	----	0.01	meq/L		**101**	**8.67**	**62.2**	**74.4**	**85.1**
Ionic Balance	----	0.01	%		**9.58**	**3.66**	**8.09**	**6.75**	**8.83**
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	95-57-8	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	95-48-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
3- & 4-Methylphenol	1319-77-3	2	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
2-Nitrophenol	88-75-5	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dimethylphenol	105-67-9	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dichlorophenol	120-83-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.6-Dichlorophenol	87-65-0	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	59-50-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.6-Trichlorophenol	88-06-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.5-Trichlorophenol	95-95-4	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	87-86-5	2	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC01 DUPLICATE	WB NB1	WB NB2	WB NB3	WB NB4S
				Client sampling date / time	12-Jan-2017 00:00	12-Jan-2017 11:30	12-Jan-2017 11:40	12-Jan-2017 12:00	12-Jan-2017 08:40
Compound	CAS Number	LOR	Unit		ES1700747-001	ES1700747-002	ES1700747-003	ES1700747-004	ES1700747-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC01 DUPLICATE	WB NB1	WB NB2	WB NB3	WB NB4S
				Client sampling date / time	12-Jan-2017 00:00	12-Jan-2017 11:30	12-Jan-2017 11:40	12-Jan-2017 12:00	12-Jan-2017 08:40
Compound	CAS Number	LOR	Unit		ES1700747-001	ES1700747-002	ES1700747-003	ES1700747-004	ES1700747-005
					Result	Result	Result	Result	Result
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1	%		16.9	19.0	19.7	17.0	17.3
2-Chlorophenol-D4	93951-73-6	1	%		45.0	50.6	51.0	44.0	47.0
2.4.6-Tribromophenol	118-79-6	1	%		71.9	76.9	65.8	56.6	63.2
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1	%		66.0	71.9	72.5	59.5	65.3
Anthracene-d10	1719-06-8	1	%		90.8	88.6	95.3	90.7	99.4
4-Terphenyl-d14	1718-51-0	1	%		81.6	85.3	78.2	75.1	80.7
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		109	109	103	107	113
Toluene-D8	2037-26-5	2	%		96.9	95.7	91.6	93.2	98.2
4-Bromofluorobenzene	460-00-4	2	%		100	99.8	95.9	96.9	103

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WB NB4D	WB NB5	WB NB6	WB NB7	WB NB8
			Client sampling date / time	12-Jan-2017 09:10	12-Jan-2017 12:30	12-Jan-2017 08:15	12-Jan-2017 11:20	12-Jan-2017 11:00
Compound	CAS Number	LOR	Unit	ES1700747-006	ES1700747-007	ES1700747-008	ES1700747-009	ES1700747-010
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.35	7.36	7.84	7.51	7.71
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	8590	12400	5480	6600	5610
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	5580	8060	3560	4290	3650
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	4140	3730	1400	1740	1220
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	275	268	473	320	415
Total Alkalinity as CaCO3	----	1	mg/L	275	268	473	320	415
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	43.5	38.5	48.2	51.2	54.4
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3920	792	279	659	1180
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	1040	3940	1340	1600	923
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	645	410	208	227	144
Magnesium	7439-95-4	1	mg/L	614	658	213	284	209
Sodium	7440-23-5	1	mg/L	432	792	466	539	653
Potassium	7440-09-7	1	mg/L	1	6	<1	<1	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	7440-39-3	0.001	mg/L	0.004	0.111	0.115	0.026	0.032
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.0127	<0.0001	<0.0001	0.0002
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.026	0.012	0.013	0.008
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.068	1.74	0.709	1.75	0.855

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WB NB4D	WB NB5	WB NB6	WB NB7	WB NB8
				Client sampling date / time	12-Jan-2017 09:10	12-Jan-2017 12:30	12-Jan-2017 08:15	12-Jan-2017 11:20	12-Jan-2017 11:00
Compound	CAS Number	LOR	Unit		ES1700747-006	ES1700747-007	ES1700747-008	ES1700747-009	ES1700747-010
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Nickel	7440-02-0	0.001	mg/L		**0.010**	**0.014**	**0.026**	**0.030**	**0.014**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L		<0.005	**0.618**	**0.006**	<0.005	**0.006**
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		----	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		----	----	----	----	----
Boron	7440-42-8	0.05	mg/L		----	----	----	----	----
Barium	7440-39-3	0.001	mg/L		----	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		----	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		----	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		----	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		----	----	----	----	----
Copper	7440-50-8	0.001	mg/L		----	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		----	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		----	----	----	----	----
Lead	7439-92-1	0.001	mg/L		----	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		----	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		----	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		----	----	----	----	----
Silver	7440-22-4	0.001	mg/L		----	----	----	----	----
Iron	7439-89-6	0.05	mg/L		----	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		**0.0001**	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		----	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	**0.4**	**0.2**	**0.4**	**0.4**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.06**	**0.80**	<0.01	<0.01	**0.02**
EK057G: Nitrite as N by Discrete Analyser									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WB NB4D	WB NB5	WB NB6	WB NB7	WB NB8
				Client sampling date / time	12-Jan-2017 09:10	12-Jan-2017 12:30	12-Jan-2017 08:15	12-Jan-2017 11:20	12-Jan-2017 11:00
Compound	CAS Number	LOR	Unit		ES1700747-006	ES1700747-007	ES1700747-008	ES1700747-009	ES1700747-010
					Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser - Continued									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	**0.09**	<0.01	**0.03**	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	**1.20**	<0.01	**0.26**	**0.30**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	**1.29**	<0.01	**0.29**	**0.30**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		**0.04**	**0.01**	**0.01**	**0.01**	**0.07**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**116**	**133**	**53.0**	**65.2**	**58.9**
Total Cations	----	0.01	meq/L		**102**	**109**	**48.2**	**58.1**	**52.8**
Ionic Balance	----	0.01	%		**6.84**	**9.81**	**4.82**	**5.76**	**5.47**
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	95-57-8	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	95-48-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
3- & 4-Methylphenol	1319-77-3	2	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
2-Nitrophenol	88-75-5	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dimethylphenol	105-67-9	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dichlorophenol	120-83-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.6-Dichlorophenol	87-65-0	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	59-50-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.6-Trichlorophenol	88-06-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.5-Trichlorophenol	95-95-4	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	87-86-5	2	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WB NB4D	WB NB5	WB NB6	WB NB7	WB NB8
				Client sampling date / time	12-Jan-2017 09:10	12-Jan-2017 12:30	12-Jan-2017 08:15	12-Jan-2017 11:20	12-Jan-2017 11:00
Compound	CAS Number	LOR	Unit		ES1700747-006	ES1700747-007	ES1700747-008	ES1700747-009	ES1700747-010
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WB NB4D	WB NB5	WB NB6	WB NB7	WB NB8
				Client sampling date / time	12-Jan-2017 09:10	12-Jan-2017 12:30	12-Jan-2017 08:15	12-Jan-2017 11:20	12-Jan-2017 11:00
Compound	CAS Number	LOR	Unit		ES1700747-006	ES1700747-007	ES1700747-008	ES1700747-009	ES1700747-010
					Result	Result	Result	Result	Result
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1	%		19.6	19.5	15.9	16.2	16.8
2-Chlorophenol-D4	93951-73-6	1	%		49.2	51.8	42.7	40.3	44.7
2.4.6-Tribromophenol	118-79-6	1	%		60.6	62.3	51.5	48.2	50.9
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1	%		67.4	65.8	54.8	57.2	60.0
Anthracene-d10	1719-06-8	1	%		74.2	87.5	98.7	95.2	75.9
4-Terphenyl-d14	1718-51-0	1	%		76.7	80.1	71.0	68.9	72.0
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		112	107	107	117	108
Toluene-D8	2037-26-5	2	%		97.4	120	94.8	101	96.1
4-Bromofluorobenzene	460-00-4	2	%		99.8	119	95.9	103	99.5

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	QC03 TRIP BLANK	QC04 RINSATE BLANK	----	----	----
			Client sampling date / time	11-Jan-2017 16:00	12-Jan-2017 10:10	----	----	----
Compound	CAS Number	LOR	Unit	ES1700747-011	ES1700747-012	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	----	6.58	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	9	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	----	6	----	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	----	<1	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	----	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	----	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	----	3	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	----	3	----	----	----
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	----	0.4	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	<1	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	----	2	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	----	<1	----	----	----
Magnesium	7439-95-4	1	mg/L	----	<1	----	----	----
Sodium	7440-23-5	1	mg/L	----	<1	----	----	----
Potassium	7440-09-7	1	mg/L	----	<1	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	----	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	----	----	----	----	----
Boron	7440-42-8	0.05	mg/L	----	----	----	----	----
Barium	7440-39-3	0.001	mg/L	----	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	----	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	----	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	----	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	----	----	----	----	----
Copper	7440-50-8	0.001	mg/L	----	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	----	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	QC03 TRIP BLANK	QC04 RINSATE BLANK	----	----	----
			Client sampling date / time	11-Jan-2017 16:00	12-Jan-2017 10:10	----	----	----
Compound	CAS Number	LOR	Unit	ES1700747-011	ES1700747-012	--------	--------	--------
				Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Nickel	7440-02-0	0.001	mg/L	----	----	----	----	----
Lead	7439-92-1	0.001	mg/L	----	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	----	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	----	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	----	----	----	----	----
Silver	7440-22-4	0.001	mg/L	----	----	----	----	----
Iron	7439-89-6	0.05	mg/L	----	----	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	----	<0.01	----	----	----
Arsenic	7440-38-2	0.001	mg/L	----	<0.001	----	----	----
Boron	7440-42-8	0.05	mg/L	----	<0.05	----	----	----
Barium	7440-39-3	0.001	mg/L	----	<0.001	----	----	----
Beryllium	7440-41-7	0.001	mg/L	----	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	----	<0.0001	----	----	----
Cobalt	7440-48-4	0.001	mg/L	----	<0.001	----	----	----
Chromium	7440-47-3	0.001	mg/L	----	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	----	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	----	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L	----	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L	----	<0.001	----	----	----
Selenium	7782-49-2	0.01	mg/L	----	<0.01	----	----	----
Vanadium	7440-62-2	0.01	mg/L	----	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L	----	<0.005	----	----	----
Silver	7440-22-4	0.001	mg/L	----	<0.001	----	----	----
Iron	7439-89-6	0.05	mg/L	----	<0.05	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	----	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	----	<0.0001	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	----	<0.1	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	----	<0.01	----	----	----
EK057G: Nitrite as N by Discrete Analyser								

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	QC03 TRIP BLANK	QC04 RINSATE BLANK	----	----	----
			Client sampling date / time	11-Jan-2017 16:00	12-Jan-2017 10:10	----	----	----
Compound	CAS Number	LOR	Unit	ES1700747-011	ES1700747-012	--------	--------	--------
				Result	Result	----	----	----
EK057G: Nitrite as N by Discrete Analyser - Continued								
Nitrite as N	14797-65-0	0.01	mg/L	----	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	----	<0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	----	<0.01	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	----	<0.01	----	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	----	**0.12**	----	----	----
Total Cations	----	0.01	meq/L	----	<0.01	----	----	----
Ionic Balance	----	0.01	%	----	----	----	----	----
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1	µg/L	----	<1.0	----	----	----
2-Chlorophenol	95-57-8	1	µg/L	----	<1.0	----	----	----
2-Methylphenol	95-48-7	1	µg/L	----	<1.0	----	----	----
3- & 4-Methylphenol	1319-77-3	2	µg/L	----	<2.0	----	----	----
2-Nitrophenol	88-75-5	1	µg/L	----	<1.0	----	----	----
2.4-Dimethylphenol	105-67-9	1	µg/L	----	<1.0	----	----	----
2.4-Dichlorophenol	120-83-2	1	µg/L	----	<1.0	----	----	----
2.6-Dichlorophenol	87-65-0	1	µg/L	----	<1.0	----	----	----
4-Chloro-3-methylphenol	59-50-7	1	µg/L	----	<1.0	----	----	----
2.4.6-Trichlorophenol	88-06-2	1	µg/L	----	<1.0	----	----	----
2.4.5-Trichlorophenol	95-95-4	1	µg/L	----	<1.0	----	----	----
Pentachlorophenol	87-86-5	2	µg/L	----	<2.0	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1	µg/L	----	<1.0	----	----	----
Acenaphthylene	208-96-8	1	µg/L	----	<1.0	----	----	----
Acenaphthene	83-32-9	1	µg/L	----	<1.0	----	----	----
Fluorene	86-73-7	1	µg/L	----	<1.0	----	----	----
Phenanthrene	85-01-8	1	µg/L	----	<1.0	----	----	----
Anthracene	120-12-7	1	µg/L	----	<1.0	----	----	----
Fluoranthene	206-44-0	1	µg/L	----	<1.0	----	----	----
Pyrene	129-00-0	1	µg/L	----	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1	µg/L	----	<1.0	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC03 TRIP BLANK	QC04 RINSATE BLANK	----	----	----
				Client sampling date / time	11-Jan-2017 16:00	12-Jan-2017 10:10	----	----	----
Compound	CAS Number	LOR	Unit		ES1700747-011	ES1700747-012	--------	--------	--------
					Result	Result	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	1	µg/L		----	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L		----	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1	µg/L		----	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		----	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L		----	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1	µg/L		----	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1	µg/L		----	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		----	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		----	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L		----	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L		----	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L		----	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		----	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L		----	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L		----	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L		----	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		----	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		----	<100	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ Total Xylenes	1330-20-7	2	µg/L		<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC03 TRIP BLANK	QC04 RINSATE BLANK	----	----	----
				Client sampling date / time	11-Jan-2017 16:00	12-Jan-2017 10:10	----	----	----
Compound	CAS Number	LOR	Unit		ES1700747-011	ES1700747-012	--------	--------	--------
					Result	Result	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1	%		**----**	**18.6**	**----**	**----**	**----**
2-Chlorophenol-D4	93951-73-6	1	%		**----**	**51.6**	**----**	**----**	**----**
2.4.6-Tribromophenol	118-79-6	1	%		**----**	**65.2**	**----**	**----**	**----**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1	%		**----**	**73.0**	**----**	**----**	**----**
Anthracene-d10	1719-06-8	1	%		**----**	**88.7**	**----**	**----**	**----**
4-Terphenyl-d14	1718-51-0	1	%		**----**	**89.5**	**----**	**----**	**----**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**105**	**106**	**----**	**----**	**----**
Toluene-D8	2037-26-5	2	%		**90.8**	**93.6**	**----**	**----**	**----**
4-Bromofluorobenzene	460-00-4	2	%		**93.0**	**95.4**	**----**	**----**	**----**

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES1700747**

Client	: **VEOLIA ENVIRONMENTAL SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR HENRY GUNDRY	Contact	: Customer Services ES
Address	: LEVEL 4, 65 PIRRAMA RD PYRMONT NSW, AUSTRALIA 2009	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: henry.gundry@veolia.com.au	E-mail	: ALSEnviro.Sydney@alsglobal.com
Telephone	: +61 02 4844 6351	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 4844 6355	Facsimile	: +61-2-8784 8500
Project	: AECOM ED1/ED2 PROJECT	Page	: 1 of 4
Order number	: ----	Quote number	: EB2014COLLEX0310 (BNBQ/270/16)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: J.EASTERBROOK & A.O'SULLIVAN		

Dates

Date Samples Received	: 13-Jan-2017 08:40	Issue Date	: 13-Jan-2017
Client Requested Due Date	: 20-Jan-2017	Scheduled Reporting Date	: **20-Jan-2017**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Intact.
No. of coolers/boxes	: 4	Temperature	: 20'C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 12 / 12

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Sample QC02 TRIPLICATE will be sent to Eurofins as per coc request.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

Method / Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Dissolved Mercury by FIMS : EG035F		
QC01 DUPLICATE	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB3	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB4S	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB4D	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB6	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB7	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB8	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
Dissolved Metals by ICP-MS - Suite A : EG020A-F		
QC01 DUPLICATE	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB3	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB4S	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB4D	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB6	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB7	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB8	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
Dissolved Metals by ICP-MS - Suite B : EG020B-F		
QC01 DUPLICATE	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB3	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB4S	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB4D	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB6	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB7	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
WB NB8	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
Total Mercury by FIMS : EG035T		
QC04 RINSATE BLANK	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered
Total Metals by ICP-MS - Suite A : EG020A-T		
QC04 RINSATE BLANK	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered
Total Metals by ICP-MS - Suite B : EG020B-T		
QC04 RINSATE BLANK	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Unfiltered

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - ED040F Dissolved Major Anions	WATER - EG020F Dissolved Metals by ICPMS	WATER - NT-13 Extended Water Suite A	WATER - W-03 15 Metals (NEPM Suite)	WATER - W-03T 15 Metals (Total) (NEPM)	WATER - W-18 TRH(C6 - C9)/BTEXN	WATER - W-24 TRH/BTEXN/PAH/Phenols
ES1700747-001	12-Jan-2017 00:00	QC01 DUPLICATE	✓	✓	✓	✓			✓
ES1700747-002	12-Jan-2017 11:30	WB NB1	✓	✓	✓	✓			✓
ES1700747-003	12-Jan-2017 11:40	WB NB2	✓	✓	✓	✓			✓
ES1700747-004	12-Jan-2017 12:00	WB NB3	✓	✓	✓	✓			✓
ES1700747-005	12-Jan-2017 08:40	WB NB4S	✓	✓	✓	✓			✓
ES1700747-006	12-Jan-2017 09:10	WB NB4D	✓	✓	✓	✓			✓
ES1700747-007	12-Jan-2017 12:30	WB NB5	✓	✓	✓	✓			✓
ES1700747-008	12-Jan-2017 08:15	WB NB6	✓	✓	✓	✓			✓
ES1700747-009	12-Jan-2017 11:20	WB NB7	✓	✓	✓	✓			✓
ES1700747-010	12-Jan-2017 11:00	WB NB8	✓	✓	✓	✓			✓
ES1700747-011	11-Jan-2017 16:00	QC03 TRIP BLANK						✓	
ES1700747-012	12-Jan-2017 10:10	QC04 RINSATE BLANK	✓		✓		✓		✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EG020T Total Recoverable Metals by ICPMS (including
ES1700747-012	12-Jan-2017 10:10	QC04 RINSATE BLANK	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EA005-P: pH by PC Titrator							
QC01 DUPLICATE	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	×	----	----
QC04 RINSATE BLA	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	×	----	----
WB NB1	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	×	----	----
WB NB2	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	×	----	----
WB NB3	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	×	----	----
WB NB4D	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	×	----	----
WB NB4S	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	×	----	----
WB NB5	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	×	----	----

WB NB6	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	✘	----	----
WB NB7	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	✘	----	----
WB NB8	Clear Plastic Bottle - Natural	----	12-Jan-2017	13-Jan-2017	✘	----	----

Requested Deliverables

HENRY GUNDRY

- *AU Certificate of Analysis - NATA (COA)	Email	henry.gundry@veolia.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	henry.gundry@veolia.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	henry.gundry@veolia.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	henry.gundry@veolia.com.au
- A4 - AU Tax Invoice (INV)	Email	henry.gundry@veolia.com.au
- Chain of Custody (CoC) (COC)	Email	henry.gundry@veolia.com.au
- EDI Format - ENMRG (ENMRG)	Email	henry.gundry@veolia.com.au
- EDI Format - ESDAT (ESDAT)	Email	henry.gundry@veolia.com.au
- EDI Format - XTab (XTAB)	Email	henry.gundry@veolia.com.au

eurofins | mgt

Certificate of Analysis

AECOM Aust Pty Ltd Sydney
Level 21, 420 George St
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Hayden Seear**

Report **530855-W**
Project name AECOM ED1/ED2 PROJECT - VEOLIA ENVIRONMENTAL SERVICES
Received Date Jan 23, 2017

Client Sample ID			**QC02 TRIPLICATE**
Sample Matrix			**Water**
Eurofins | mgt Sample No.			**S17-Ja09124**
Date Sampled			**Jan 12, 2017**
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C6-C9	0.02	mg/L	< 0.02
BTEX			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002
o-Xylene	0.001	mg/L	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003
4-Bromofluorobenzene (surr.)	1	%	86
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene[N02]	0.01	mg/L	< 0.01
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	0.19
TRH C6-C10	0.02	mg/L	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C10-C14	0.05	mg/L	0.50
TRH C15-C28	0.1	mg/L	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1
TRH C10-36 (Total)	0.1	mg/L	0.5
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	0.001	mg/L	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001
Anthracene	0.001	mg/L	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001
Chrysene	0.001	mg/L	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001
Fluoranthene	0.001	mg/L	< 0.001
Fluorene	0.001	mg/L	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001
Naphthalene	0.001	mg/L	< 0.001
Phenanthrene	0.001	mg/L	< 0.001

Client Sample ID			QC02 TRIPLICATE
Sample Matrix			**Water**
Eurofins | mgt Sample No.			**S17-Ja09124**
Date Sampled			**Jan 12, 2017**
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Pyrene	0.001	mg/L	< 0.001
Total PAH*	0.001	mg/L	< 0.001
2-Fluorobiphenyl (surr.)	1	%	77
p-Terphenyl-d14 (surr.)	1	%	95
Speciated Phenols			
Phenol	0.003	mg/L	< 0.003
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
TRH >C10-C16	0.05	mg/L	0.19
TRH >C16-C34	0.1	mg/L	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

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
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	Jan 23, 2017	7 Day
- Method: TRH C6-C36 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Jan 23, 2017	7 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	Jan 25, 2017	7 Day
- Method: TRH C6-C36 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Jan 25, 2017	7 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
BTEX	Sydney	Jan 23, 2017	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Polycyclic Aromatic Hydrocarbons	Sydney	Jan 25, 2017	7 Day
- Method: E007 Polyaromatic Hydrocarbons (PAH)			
Speciated Phenols	Sydney	Jan 25, 2017	7 Day
- Method: E008 Speciated Phenols			

ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 18217

Company Name:	AECOM Aust Pty Ltd Sydney	**Order No.:**		**Received:**	Jan 23, 2017 1:19 PM
Address:	Level 21, 420 George St Sydney NSW 2000	**Report #:**	530855	**Due:**	Jan 31, 2017
		Phone:	02 8934 0000	**Priority:**	5 Day
		Fax:	02 8934 0001	**Contact Name:**	Hayden Seear

Project Name: AECOM ED1/ED2 PROJECT - VEOLIA ENVIRONMENTAL SERVICES

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Phenol	Polycyclic Aromatic Hydrocarbons	BTEX	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271									
Sydney Laboratory - NATA Site # 18217						X	X	X	X
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 18217									
External Laboratory									
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**				
1	QC02 TRIPLICATE	Jan 12, 2017		Water	S17-Ja09124	X	X	X	X
Test Counts						1	1	1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to '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 prior to sample receipt deadlines as stated on the Sample Receipt Advice.

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

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

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

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%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

1. Where a result is reported as a 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 is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. 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.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. 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							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Speciated Phenols							
Phenol	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	118			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	103			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Toluene	%	110			70-130	Pass	
Ethylbenzene	%	113			70-130	Pass	
m&p-Xylenes	%	110			70-130	Pass	
o-Xylene	%	112			70-130	Pass	
Xylenes - Total	%	110			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	123			70-130	Pass	
TRH C6-C10	%	112			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C10-C14	%	99			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	101			70-130	Pass	
Acenaphthylene	%	102			70-130	Pass	
Anthracene	%	105			70-130	Pass	
Benz(a)anthracene	%	97			70-130	Pass	
Benzo(a)pyrene	%	92			70-130	Pass	
Benzo(b&j)fluoranthene	%	89			70-130	Pass	
Benzo(g.h.i)perylene	%	106			70-130	Pass	
Benzo(k)fluoranthene	%	102			70-130	Pass	
Chrysene	%	112			70-130	Pass	
Dibenz(a.h)anthracene	%	101			70-130	Pass	
Fluoranthene	%	109			70-130	Pass	
Fluorene	%	101			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	99			70-130	Pass	
Naphthalene	%	98			70-130	Pass	
Phenanthrene	%	107			70-130	Pass	
Pyrene	%	111			70-130	Pass	
LCS - % Recovery							
Speciated Phenols							
Phenol	%	99			30-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	%	92			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	S17-Ja09593	NCP	%	112			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S17-Ja09593	NCP	%	99			70-130	Pass	
Toluene	S17-Ja09593	NCP	%	105			70-130	Pass	
Ethylbenzene	S17-Ja09593	NCP	%	107			70-130	Pass	
m&p-Xylenes	S17-Ja09593	NCP	%	105			70-130	Pass	
o-Xylene	S17-Ja09593	NCP	%	106			70-130	Pass	
Xylenes - Total	S17-Ja09593	NCP	%	105			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	S17-Ja09593	NCP	%	90			70-130	Pass	
TRH C6-C10	S17-Ja09593	NCP	%	104			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	S17-Ja09592	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S17-Ja09592	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	S17-Ja09592	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	S17-Ja09592	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	S17-Ja09592	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	S17-Ja09592	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total	S17-Ja09592	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	S17-Ja09592	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
TRH C6-C10	S17-Ja09592	NCP	mg/L	< 0.02	< 0.02	<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

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised By

Nibha Vaidya	Analytical Services Manager
Ryan Hamilton	Senior Analyst-Organic (NSW)
Ryan Hamilton	Senior Analyst-Volatile (NSW)

Glenn Jackson

National Operations 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 or please click here.

CERTIFICATE OF ANALYSIS

Work Order	: **CA1700592**	Page	: 1 of 8
Client	: **VEOLIA ENVIRONMENTAL SERVICES (AUST) P/L**	Laboratory	: ALS Water Resources Group
Contact	: Henry Gundry	Contact	: Client Services
Address	: Woodlawn Bioreactor PO Box 141 Goulburn NSW 2580	Address	: 16B Lithgow Street Fyshwick ACT Australia 2609
Telephone	: ----	Telephone	: +61 2 6202 5404
Project	: Miscellaneous Woodlawn Samples	Date Samples Received	: 01-Feb-2017 07:00
Order number	:	Date Analysis Commenced	: 01-Feb-2017
C-O-C number	: ----	Issue Date	: 10-Feb-2017 10:48
Sampler	: Damien Badowski		
Site	: AECOM ED1/ED2 Poject		
Quote number	: ----		
No. of samples received	: 15		
No. of samples analysed	: 14		

Accreditation No. 992
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Amanda Gonzalez	Laboratory Technician	Inorganics, Fyshwick, ACT
Damien Wilkie	Sample Admission Officer	ALS Environmental, Fyshwick, ACT
Geetha Ramasundara	Chemistry Teamleader	Inorganics, Fyshwick, ACT
Terry OBrien	Laboratory Technician	Inorganics, Fyshwick, ACT
Titus Vimalasiri	Metals Teamleader	Inorganics, Fyshwick, ACT

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- **For samples collected by ALS WRG, sampling was carried out in accordance with Procedure EN67**
- EP035 Performed at ALS Sydney
- EP071 Performed at ALS Sydney
- EP075 (SIM) Performed at ALS Sydney
- EP080 Performed at ALS Sydney
- Result for pH in water tested in the laboratory may be indicative only as holding time is generally not achievable.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC01_DUPLICATE QC01_DUPLICATE	NB1 NB1	NB2 NB2	NB3 NB3	NB4S NB4S
				Client sampling date / time	31-Jan-2017 09:50	31-Jan-2017 09:50	31-Jan-2017 10:28	31-Jan-2017 11:06	31-Jan-2017 13:40
Compound	CAS Number	LOR	Unit		CA1700592-001	CA1700592-003	CA1700592-004	CA1700592-005	CA1700592-006
					Result	Result	Result	Result	Result
ED009: Anions									
Chloride	16887-00-6	0.1	mg/L		**49.2**	**46.5**	**513**	**667**	**940**
Sulfate	14808-79-8	0.4	mg/L		**153**	**147**	**2400**	**4000**	**4130**
ED037F: Alkalinity - Filtered									
Hydroxide Alkalinity as CaCO3	DMO-210-001	0.1	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Carbonate Alkalinity as CaCO3	3812-32-6	0.1	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Bicarbonate Alkalinity as CaCO3	71-52-3	0.1	mg/L		**257**	**257**	**509**	**570**	**410**
Total Alkalinity as CaCO3	----	1	mg/L		**257**	**257**	**509**	**570**	**410**
EG005F: Dissolved Metals by ICP-OES									
Aluminium	7429-90-5	0.02	mg/L		**0.02**	**0.02**	**0.04**	**0.04**	**0.05**
Boron	7440-42-8	0.1	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10
Calcium	7440-70-2	0.05	mg/L		**56.9**	**57.4**	**446**	**460**	**578**
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.001**
Iron	7439-89-6	0.01	mg/L		**0.02**	**0.02**	**0.03**	<0.01	<0.01
Magnesium	7439-95-4	0.05	mg/L		**44.8**	**44.2**	**476**	**584**	**612**
Manganese	7439-96-5	0.001	mg/L		**0.034**	**0.032**	**0.376**	**1.16**	**1.04**
Potassium	7440-09-7	0.1	mg/L		**0.7**	**0.6**	**3.4**	**2.4**	**0.5**
Sodium	7440-23-5	0.1	mg/L		**44.7**	**44.3**	**232**	**435**	**475**
Vanadium	7440-62-2	0.002	mg/L		**0.002**	**0.003**	**0.002**	**0.009**	**0.005**
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	**0.096**	**0.017**	**0.018**
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	1	µg/L		<1	<1	**4**	**6**	**5**
Barium	7440-39-3	0.5	µg/L		**3.1**	**2.9**	**40.5**	**35.2**	**27.2**
Beryllium	7440-41-7	0.1	µg/L		<0.1	<0.1	**0.1**	<0.1	<0.1
Cadmium	7440-43-9	0.05	µg/L		<0.05	<0.05	**2.03**	**0.24**	**0.38**
Cobalt	7440-48-4	0.2	µg/L		**0.4**	**0.4**	**4.0**	**5.8**	**6.6**
Copper	7440-50-8	1	µg/L		**3**	**3**	**6**	**13**	**7**
Lead	7439-92-1	0.2	µg/L		<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	7440-02-0	1	µg/L		**4.6**	**3.9**	**30.8**	**38.8**	**64.9**
Selenium	7782-49-2	1	µg/L		**2**	<1	**29**	**38**	**21**
Silver	7440-22-4	1	µg/L		<1	<1	<1	<1	<1
Mercury	7439-97-6	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	NB4D NB4D	NB5 NB5	NB6 NB6	NB7 NB7	NB8 NB8
				Client sampling date / time	31-Jan-2017 13:10	31-Jan-2017 14:14	31-Jan-2017 15:05	31-Jan-2017 11:52	31-Jan-2017 12:34
Compound	*CAS Number*	*LOR*	*Unit*		CA1700592-007	CA1700592-008	CA1700592-009	CA1700592-010	CA1700592-011
					Result	Result	Result	Result	Result
ED009: Anions									
Chloride	16887-00-6	0.1	mg/L		**1310**	**4590**	**1730**	**2090**	**1090**
Sulfate	14808-79-8	0.4	mg/L		**5160**	**964**	**326**	**811**	**1520**
ED037F: Alkalinity - Filtered									
Hydroxide Alkalinity as CaCO3	DMO-210-001	0.1	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Carbonate Alkalinity as CaCO3	3812-32-6	0.1	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Bicarbonate Alkalinity as CaCO3	71-52-3	0.1	mg/L		**310**	**327**	**501**	**374**	**439**
Total Alkalinity as CaCO3	----	1	mg/L		**310**	**327**	**501**	**374**	**439**
EG005F: Dissolved Metals by ICP-OES									
Aluminium	7429-90-5	0.02	mg/L		**0.05**	**0.04**	**0.03**	**0.03**	**0.03**
Boron	7440-42-8	0.1	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10
Calcium	7440-70-2	0.05	mg/L		**640**	**390**	**233**	**223**	**145**
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.001**
Iron	7439-89-6	0.01	mg/L		**0.01**	**0.09**	**0.11**	<0.01	<0.01
Magnesium	7439-95-4	0.05	mg/L		**783**	**852**	**262**	**370**	**253**
Manganese	7439-96-5	0.001	mg/L		**0.306**	**2.64**	**3.12**	**1.48**	**0.952**
Potassium	7440-09-7	0.1	mg/L		**1.6**	**8.0**	**0.6**	**0.5**	**1.1**
Sodium	7440-23-5	0.1	mg/L		**495**	**878**	**539**	**663**	**717**
Vanadium	7440-62-2	0.002	mg/L		**0.005**	**0.004**	**0.002**	**0.006**	**0.009**
Zinc	7440-66-6	0.005	mg/L		**0.018**	**0.841**	**0.058**	**0.039**	**0.036**
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	1	µg/L		**5**	**37**	**17**	**20**	**8**
Barium	7440-39-3	0.5	µg/L		**10.1**	**111**	**144**	**30.9**	**30.2**
Beryllium	7440-41-7	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	7440-43-9	0.05	µg/L		**0.10**	**15.2**	**0.16**	**0.38**	**0.31**
Cobalt	7440-48-4	0.2	µg/L		**5.9**	**27.2**	**41.8**	**8.8**	**6.1**
Copper	7440-50-8	1	µg/L		**6**	**28**	**6**	**8**	**11**
Lead	7439-92-1	0.2	µg/L		<0.2	**0.4**	**0.3**	<0.2	<0.2
Nickel	7440-02-0	1	µg/L		**56.6**	**47.6**	**50.1**	**48.0**	**26.2**
Selenium	7782-49-2	1	µg/L		**23**	**160**	**62**	**77**	**37**
Silver	7440-22-4	1	µg/L		<1	<1	<1	<1	<1
Mercury	7439-97-6	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1

Analytical Results

Sub-Matrix: **WATER**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	ED1 ED1	ED2 ED2	QC03_TRIP BLANK QC03_TRIP BLANK	QC04_RINSATE BLANK QC04_RINSATE BLANK	----
				Client sampling date / time	31-Jan-2017 14:30	31-Jan-2017 11:15	31-Jan-2017 09:30	31-Dec-2016 10:00	----
					CA1700592-012	**CA1700592-013**	**CA1700592-014**	**CA1700592-015**	--------
					Result	Result	Result	Result	----
EA005: pH									
pH	----	0.01	pH Unit		**3.07**	**3.41**	----	----	----
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	2	µS/cm		**16200**	**23200**	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)									
Total Dissolved Solids (Calc.)	----	2	mg/L		**10500**	**15000**	----	----	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		**7890**	**11100**	----	----	----
ED009: Anions									
Chloride	16887-00-6	0.1	mg/L		**829**	**1440**	----	<0.1	----
Sulfate	14808-79-8	0.4	mg/L		**18500**	**29500**	----	<0.4	----
Fluoride	16984-48-8	0.1	mg/L		**60.5**	**64.7**	----	----	----
ED037: Alkalinity									
Hydroxide Alkalinity as CaCO3	DMO-210-001	0.1	mg/L		<0.1	<0.1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	0.1	mg/L		<0.1	<0.1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	0.1	mg/L		<0.1	<0.1	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		<1	<1	----	----	----
ED037F: Alkalinity - Filtered									
Hydroxide Alkalinity as CaCO3	DMO-210-001	0.1	mg/L		----	----	----	<0.1	----
Carbonate Alkalinity as CaCO3	3812-32-6	0.1	mg/L		----	----	----	<0.1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	0.1	mg/L		----	----	----	**3.4**	----
Total Alkalinity as CaCO3	----	1	mg/L		----	----	----	**3**	----
EG005F: Dissolved Metals by ICP-OES									
Aluminium	7429-90-5	0.02	mg/L		**592**	**500**	----	----	----
Boron	7440-42-8	0.1	mg/L		<0.10	<0.10	----	----	----
Calcium	7440-70-2	0.05	mg/L		**534**	**536**	----	<0.05	----
Chromium	7440-47-3	0.001	mg/L		**0.068**	**0.065**	----	----	----
Iron	7439-89-6	0.01	mg/L		**29.9**	**13.4**	----	----	----
Magnesium	7439-95-4	0.05	mg/L		**1920**	**3230**	----	<0.05	----
Manganese	7439-96-5	0.001	mg/L		**148**	**229**	----	----	----
Potassium	7440-09-7	0.1	mg/L		**8.2**	**5.6**	----	<0.1	----
Sodium	7440-23-5	0.1	mg/L		**486**	**1430**	----	<0.1	----
Vanadium	7440-62-2	0.002	mg/L		<0.002	<0.002	----	----	----

Analytical Results

Sub-Matrix: **WATER**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	ED1 ED1	ED2 ED2	QC03_TRIP BLANK QC03_TRIP BLANK	QC04_RINSATE BLANK QC04_RINSATE BLANK	----
				Client sampling date / time	31-Jan-2017 14:30	31-Jan-2017 11:15	31-Jan-2017 09:30	31-Dec-2016 10:00	----
					CA1700592-012	**CA1700592-013**	**CA1700592-014**	**CA1700592-015**	**--------**
					Result	Result	Result	Result	----
EG005F: Dissolved Metals by ICP-OES - Continued									
Zinc	7440-66-6	0.005	mg/L		**2200**	**2800**	----	----	----
EG005T: Total Metals by ICP-OES									
Aluminium	7429-90-5	0.02	mg/L		**595**	**500**	----	<0.02	----
Boron	7440-42-8	0.01	mg/L		**0.05**	**0.07**	----	<0.01	----
Chromium	7440-47-3	0.001	mg/L		**0.078**	**0.081**	----	<0.001	----
Iron	7439-89-6	0.01	mg/L		**29.9**	**15.5**	----	<0.01	----
Manganese	7439-96-5	0.001	mg/L		**148**	**230**	----	<0.001	----
Zinc	7440-66-6	0.005	mg/L		**2220**	**2990**	----	<0.005	----
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	1	µg/L		**51**	**70**	----	----	----
Barium	7440-39-3	0.5	µg/L		**9.4**	**17.8**	----	----	----
Beryllium	7440-41-7	0.1	µg/L		**82.2**	**142**	----	----	----
Cadmium	7440-43-9	0.05	µg/L		**10300**	**15400**	----	----	----
Cobalt	7440-48-4	0.2	µg/L		**5140**	**7440**	----	----	----
Copper	7440-50-8	1	µg/L		**113000**	**115000**	----	----	----
Lead	7439-92-1	0.2	µg/L		**131**	**99.4**	----	----	----
Nickel	7440-02-0	1	µg/L		**5960**	**10400**	----	----	----
Selenium	7782-49-2	1	µg/L		**350**	**579**	----	----	----
Silver	7440-22-4	1	µg/L		**2**	**2**	----	----	----
Mercury	7439-97-6	0.1	µg/L		<0.1	<0.1	----	----	----
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	1	µg/L		**55**	**74**	----	<1	----
Barium	7440-39-3	0.5	µg/L		**12.2**	**20.0**	----	<0.5	----
Beryllium	7440-41-7	0.1	µg/L		**88.4**	**165**	----	<0.1	----
Cadmium	7440-43-9	0.05	µg/L		**10700**	**16300**	----	<0.05	----
Cobalt	7440-48-4	0.2	µg/L		**5450**	**7510**	----	<0.2	----
Copper	7440-50-8	1	µg/L		**122000**	**114000**	----	<1	----
Lead	7439-92-1	0.2	µg/L		**142**	**104**	----	<0.2	----
Nickel	7440-02-0	1	µg/L		**6410**	**10600**	----	<1	----
Selenium	7782-49-2	1	µg/L		**382**	**599**	----	<1	----
Silver	7440-22-4	1	µg/L		**2**	**3**	----	<1	----
Vanadium	7440-62-2	1	µg/L		<1	<1	----	<1	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	ED1 ED1	ED2 ED2	QC03_TRIP BLANK QC03_TRIP BLANK	QC04_RINSATE BLANK QC04_RINSATE BLANK	----
				Client sampling date / time	31-Jan-2017 14:30	31-Jan-2017 11:15	31-Jan-2017 09:30	31-Dec-2016 10:00	----
Compound	CAS Number	LOR	Unit		CA1700592-012	CA1700592-013	CA1700592-014	CA1700592-015	--------
					Result	Result	Result	Result	----
EG020T: Total Metals by ICP-MS - Continued									
Mercury	7439-97-6	0.1	µg/L		<0.1	<0.1	----	<0.1	----
EK055: Ammonia as N									
Ammonia as N	7664-41-7	0.1	mg/L N		**13.7**	**0.1**	----	----	----
EK057: Nitrite as N									
Nitrite as N	14797-65-0	0.01	mg/L N		<0.01	<0.01	----	----	----
EK058: Nitrate as N									
Nitrate as N	14797-55-8	0.01	mg/L N		**0.68**	<0.05	----	----	----
EK059: Nitrite plus Nitrate as N (NOx)									
Nitrite + Nitrate as N	----	0.05	mg/L N		**0.68**	<0.05	----	----	----
EK071F: Dissolved Reactive Phosphorus as P									
Reactive Phosphorus as P	14265-44-2	0.02	mg/L P		**0.26**	**0.09**	----	----	----
EP035: Phenols (Total)									
Phenols (Total)	----	0.05	mg/L		**0.42**	**0.10**	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1	µg/L		<1.0	<1.0	----	----	----
Benzo(b)fluoranthene	205-99-2	1	µg/L		<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1	µg/L		<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L		<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1	µg/L		<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1	µg/L		<1.0	<1.0	----	----	----
Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	ED1 ED1	ED2 ED2	QC03_TRIP BLANK QC03_TRIP BLANK	QC04_RINSATE BLANK QC04_RINSATE BLANK	----
				Client sampling date / time	31-Jan-2017 14:30	31-Jan-2017 11:15	31-Jan-2017 09:30	31-Dec-2016 10:00	----
Compound	CAS Number	LOR	Unit		CA1700592-012	CA1700592-013	CA1700592-014	CA1700592-015	--------
					Result	Result	Result	Result	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	----	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	----	----
C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	----	----
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	----	----
>C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	----	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	----	----
Toluene	108-88-3	2	µg/L		<2	<2	<2	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	----	----
Total Xylenes	1330-20-7	2	µg/L		<2	<2	<2	----	----
Sum of BTEX	----	1	µg/L		<1	<1	<1	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	----	----

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **CA1700592**

Client	: **VEOLIA ENVIRONMENTAL SERVICES (AUST) P/L**	Laboratory	: ALS Water Resources Group
Contact	: Henry Gundry	Contact	: Client Services
Address	: Woodlawn Bioreactor PO Box 141 Goulburn NSW 2580	Address	: 16B Lithgow Street Fyshwick ACT Australia 2609
E-mail	: henry.gundry@veolia.com	E-mail	: ecowisecustomerservice@alsglobal.com
Telephone	: ----	Telephone	: +61 2 6202 5404
Facsimile	: ----	Facsimile	:
Project	: Miscellaneous Woodlawn Samples	Page	: 1 of 3
Order number	:	Quote number	: CA2013VEOLIA0001
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: AECOM ED1/ED2 Poject		
Sampler	: Damien Badowski		

Dates

Date Samples Received	: 01-Feb-2017 07:00	Issue Date	: 01-Feb-2017
Client Requested Due Date	: 15-Feb-2017	Scheduled Reporting Date	: **15-Feb-2017**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 12.5°C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 15 / 15

General Comments

- This report contains the following information:
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EA010 Conductivity	WATER - EA016 Calculated TDS (from EC)	WATER - ED009 Standard Anions - by IC	WATER - ED037 Alkalinity	WATER - ED037-F Alkalinity - Filtered	WATER - EG020A-F Dissolved Metals (Extended Suite)	WATER - EK055A Ammonia as N
CA1700592-001	31-Jan-2017 09:50	QC01_DUPLICATE QC01...			✓		✓	✓	
CA1700592-002	31-Jan-2017 09:50	QC02_TRIPLICATE QC0...			✓		✓	✓	
CA1700592-003	31-Jan-2017 09:50	NB1 NB1			✓		✓	✓	
CA1700592-004	31-Jan-2017 10:28	NB2 NB2			✓		✓	✓	
CA1700592-005	31-Jan-2017 11:06	NB3 NB3			✓		✓	✓	
CA1700592-006	31-Jan-2017 13:40	NB4S NB4S			✓		✓	✓	
CA1700592-007	31-Jan-2017 13:10	NB4D NB4D			✓		✓	✓	
CA1700592-008	31-Jan-2017 14:14	NB5 NB5			✓		✓	✓	
CA1700592-009	31-Jan-2017 15:05	NB6 NB6			✓		✓	✓	
CA1700592-010	31-Jan-2017 11:52	NB7 NB7			✓		✓	✓	
CA1700592-011	31-Jan-2017 12:34	NB8 NB8			✓		✓	✓	
CA1700592-012	31-Jan-2017 14:30	ED1 ED1	✓	✓	✓	✓		✓	✓
CA1700592-013	31-Jan-2017 11:15	ED2 ED2	✓	✓	✓	✓		✓	✓
CA1700592-015	31-Dec-2016 10:00	QC04_RINSATE BLANK ...			✓		✓	✓	

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EA005 pH	WATER - EA065 Total Hardness as CaCO3	WATER - EK057A Nitrite as N	WATER - EK058A Nitrate as N High Level	WATER - EK059A Nitrite and Nitrate as N (NOx)	WATER - EK071A Ortho Phosphorus as P	WATER - EP075B (SIM) (Subcontracted) PAH (GC/MS - SIM) - Performed at ALS Sydney
CA1700592-012	31-Jan-2017 14:30	ED1 ED1	✓	✓	✓	✓	✓	✓	✓
CA1700592-013	31-Jan-2017 11:15	ED2 ED2	✓	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - EG020A-T Total Metals (Extended Suite)	WATER - EP035 (Subcontracted) Phenols - Total - Performed at ALS Sydney	WATER - W-04 (Subcontracted) TPH BTEX
CA1700592-012	31-Jan-2017 14:30	ED1 ED1	✓	✓	✓
CA1700592-013	31-Jan-2017 11:15	ED2 ED2	✓	✓	✓
CA1700592-014	31-Jan-2017 09:30	QC03_TRIP BLANK QC0...			✓
CA1700592-015	31-Dec-2016 10:00	QC04_RINSATE BLANK ...	✓		

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

Accounts Department

- A4 - AU Tax Invoice (INV)	Email	accounts@veoliawater.com.au

Hayden Seear

- A4 - AU Sample Receipt Notification - Environmental (WRG) (SRN)	Email	hayden.seear@aecom.com
- AU Certificate of Analysis - NATA (WRG) (AU_COA_2_A4_ENV_NATA)	Email	hayden.seear@aecom.com
- Chain of Custody (CoC) (COC)	Email	hayden.seear@aecom.com
- EDI Format - XTab (XTAB)	Email	hayden.seear@aecom.com

Henry Gundry

- A4 - AU Sample Receipt Notification - Environmental (WRG) (SRN)	Email	henry.gundry@veolia.com
- A4 - AU Tax Invoice (INV)	Email	henry.gundry@veolia.com
- AU Certificate of Analysis - NATA (WRG) (AU_COA_2_A4_ENV_NATA)	Email	henry.gundry@veolia.com
- Chain of Custody (CoC) (COC)	Email	henry.gundry@veolia.com
- EDI Format - XTab (XTAB)	Email	henry.gundry@veolia.com

eurofins | mgt

Certificate of Analysis

ALS Water Resources Group (Scoresby)
22 Dalmore Drive
Scoresby
VIC 3179

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **ALS Results**

Report **532955-W**
Project name QC02_TRIPLICATE
Project ID CA1700594
Received Date Feb 02, 2017

Client Sample ID			
Sample Matrix			**Water**
Eurofins | mgt Sample No.			**S17-Fe05249**
Date Sampled			**Jan 31, 2017**
Test/Reference	LOR	Unit	
Chloride	1	mg/L	40
Sulphate (as SO4)	2	mg/L	110
Alkalinity (speciated)			
Total Alkalinity (as CaCO3)	5	mg/L	180
Heavy Metals			
Aluminium (filtered)	0.05	mg/L	< 0.05
Arsenic (filtered)	0.001	mg/L	< 0.001
Barium (filtered)	0.02	mg/L	< 0.02
Beryllium (filtered)	0.001	mg/L	< 0.001
Boron (filtered)	0.05	mg/L	< 0.05
Cadmium (filtered)	0.0002	mg/L	< 0.0002
Chromium (filtered)	0.001	mg/L	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001
Copper (filtered)	0.001	mg/L	0.002
Iron (filtered)	0.05	mg/L	< 0.05
Lead (filtered)	0.001	mg/L	< 0.001
Manganese (filtered)	0.005	mg/L	0.030
Mercury (filtered)	0.0001	mg/L	< 0.0001
Nickel (filtered)	0.001	mg/L	< 0.001
Selenium (filtered)	0.001	mg/L	< 0.001
Silver (filtered)	0.005	mg/L	< 0.005
Vanadium (filtered)	0.005	mg/L	< 0.005
Zinc (filtered)	0.005	mg/L	< 0.005
Alkali Metals			
Calcium (filtered)	0.5	mg/L	53
Magnesium (filtered)	0.5	mg/L	46
Potassium (filtered)	0.5	mg/L	0.6
Sodium (filtered)	0.5	mg/L	45

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

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
Chloride	Sydney	Feb 07, 2017	28 Day
- Method: E033 /E045 /E047 Chloride			
Sulphate (as SO4)	Sydney	Feb 07, 2017	28 Day
- Method: E045 Sulphate			
Alkalinity (speciated)	Sydney	Feb 09, 2017	14 Days
- Method: E035 Alkalinity			
Heavy Metals (filtered)	Sydney	Feb 08, 2017	180 Day
- Method: LTM-MET-3040 Metals in Waters by ICP-MS			
Mercury (filtered)	Sydney	Feb 08, 2017	28 Day
- Method: LTM-MET-3050 Mercury by FIMS			
Alkali Metals (filtered)	Sydney	Feb 08, 2017	180 Day
- Method: E020/E030 Filtered Cations in Water			

eurofins | mgt

ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 18217

Company Name: ALS Water Resources Group (Scoresby)
Address: 22 Dalmore Drive
Scoresby
VIC 3179

Project Name: QC02_TRIPLICATE
Project ID: CA1700594

Order No.:
Report #: 532955
Phone: 03 8756 8100
Fax: 03 9763 8721

Received: Feb 2, 2017 9:30 AM
Due: Feb 9, 2017
Priority: 5 Day
Contact Name: ALS Results

Eurofins | mgt Analytical Services Manager : Mary Makarios

Sample Detail						Aluminium (filtered)	Arsenic (filtered)	Barium (filtered)	Beryllium (filtered)	Boron (filtered)	Cadmium (filtered)	Calcium (filtered)	Chloride	Chromium (filtered)	Cobalt (filtered)	Copper (filtered)	Iron (filtered)	Lead (filtered)	Magnesium (filtered)	Manganese (filtered)	Mercury (filtered)	Nickel (filtered)	Potassium (filtered)	Selenium (filtered)	Silver (filtered)	Sodium (filtered)	Sulphate (as SO4)	Total Alkalinity (as CaCO3)	Vanadium (filtered)	Zinc (filtered)
Melbourne Laboratory - NATA Site # 1254 & 14271																														
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794																														
Perth Laboratory - NATA Site # 18217																														
External Laboratory																														
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**																									
1		Jan 31, 2017		Water	S17-Fe05249	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to '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 prior to sample receipt deadlines as stated on the Sample Receipt Advice.

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

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

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

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%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

1. Where a result is reported as a 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 is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. 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.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. 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							
Chloride	mg/L	< 1			1	Pass	
Sulphate (as SO4)	mg/L	< 2			2	Pass	
Method Blank							
Alkalinity (speciated)							
Total Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Method Blank							
Heavy Metals							
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Barium (filtered)	mg/L	< 0.02			0.02	Pass	
Beryllium (filtered)	mg/L	< 0.001			0.001	Pass	
Boron (filtered)	mg/L	< 0.05			0.05	Pass	
Cadmium (filtered)	mg/L	< 0.0002			0.0002	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Cobalt (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Iron (filtered)	mg/L	< 0.05			0.05	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Manganese (filtered)	mg/L	< 0.005			0.005	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Selenium (filtered)	mg/L	< 0.001			0.001	Pass	
Silver (filtered)	mg/L	< 0.005			0.005	Pass	
Vanadium (filtered)	mg/L	< 0.005			0.005	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Alkali Metals							
Calcium (filtered)	mg/L	< 0.5			0.5	Pass	
Magnesium (filtered)	mg/L	< 0.5			0.5	Pass	
Potassium (filtered)	mg/L	< 0.5			0.5	Pass	
Sodium (filtered)	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Chloride	%	117			70-130	Pass	
Sulphate (as SO4)	%	105			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Total Alkalinity (as CaCO3)	%	80			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium (filtered)	%	96			70-130	Pass	
Arsenic (filtered)	%	98			70-130	Pass	
Barium (filtered)	%	105			70-130	Pass	
Beryllium (filtered)	%	85			70-130	Pass	
Boron (filtered)	%	82			70-130	Pass	
Cadmium (filtered)	%	101			70-130	Pass	
Chromium (filtered)	%	101			70-130	Pass	
Cobalt (filtered)	%	103			70-130	Pass	
Copper (filtered)	%	106			70-130	Pass	
Iron (filtered)	%	100			70-130	Pass	
Lead (filtered)	%	105			70-130	Pass	
Manganese (filtered)	%	101			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Mercury (filtered)			%	100			70-130	Pass	
Nickel (filtered)			%	102			70-130	Pass	
Selenium (filtered)			%	108			70-130	Pass	
Silver (filtered)			%	102			70-130	Pass	
Vanadium (filtered)			%	103			70-130	Pass	
Zinc (filtered)			%	99			70-130	Pass	
LCS - % Recovery									
Alkali Metals									
Calcium (filtered)			%	109			70-130	Pass	
Magnesium (filtered)			%	112			70-130	Pass	
Potassium (filtered)			%	93			70-130	Pass	
Sodium (filtered)			%	105			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Sulphate (as SO4)	S17-Fe02979	NCP	%	103			70-130	Pass	
Spike - % Recovery									
Alkalinity (speciated)				Result 1					
Total Alkalinity (as CaCO3)	S17-Fe02224	NCP	%	78			70-130	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Magnesium (filtered)	S17-Fe07205	NCP	%	107			70-130	Pass	
Potassium (filtered)	S17-Fe05249	CP	%	100			70-130	Pass	
Sodium (filtered)	S17-Fe05249	CP	%	115			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Sulphate (as SO4)	S17-Fe02979	NCP	mg/L	10	9.6	4.0	30%	Pass	
Duplicate									
Alkalinity (speciated)				Result 1	Result 2	RPD			
Total Alkalinity (as CaCO3)	S17-Fe02225	NCP	mg/L	13	13	<1	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium (filtered)	S17-Fe05249	CP	mg/L	53	53	<1	30%	Pass	
Magnesium (filtered)	S17-Fe05249	CP	mg/L	46	45	1.0	30%	Pass	
Potassium (filtered)	S17-Fe05249	CP	mg/L	0.6	0.6	1.0	30%	Pass	
Sodium (filtered)	S17-Fe05249	CP	mg/L	45	46	2.0	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	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Mary Makarios	Analytical Services Manager
Ryan Hamilton	Senior Analyst-Inorganic (NSW)
Ryan Hamilton	Senior Analyst-Metal (NSW)

Glenn Jackson
National Operations 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 or please click here.

Appendix F

Groundwater Sampling Field Sheets

11/1 SLOW RECHARGE

Very turbid, purged.

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. NB1

Date: 11 / 1 / 17

Dip To Water (DTW): 7.0

Sampled By: J.E & A.O.

Dip To Base (DTB): 11.1

Bore Volume [(DTB - DTW) * 2]: 8.2

Bore Volume To Purge [Bore Volume * 3]: 24.6

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments
12/1 11.30	7	7.36	728	7.31	499	16.2	Purged 11/1. Sampled 12/1. Turbid.

SLOW RECHARGE

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. NB2

Date: 11 / 1 / 17

Dip To Water (DTW): 0.02 (2cm from top of casing)

Sampled By: J.E & A.O.

Dip To Base (DTB): 7.3

Bore Volume [(DTB - DTW) * 2]: 14.56

Bore Volume To Purge [Bore Volume * 3]: 43.68

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments
2/1 11:40	10	6.99	4973	4.66	522	20.4	Purged 11/1 - Sampled 12/1. Cloudy. Full to top of casing. (~2cm)

SLOW RECHARGE

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. NB3

Date: 11 / 1 / 17

Dip To Water (DTW): 6.92

Sampled By: J.E. & A.O.

Dip To Base (DTB): 16.04

Bore Volume [(DTB - DTW) * 2]: 6.24

Bore Volume To Purge [Bore Volume * 3]: 18.72

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments
12:00	7.12	5668	7.11	5.34	571	18.08	Purged 11/1. Sampled 12/1. Turbid.

11/1/16 SLOW RECHARGE

~ 12 litres purged (volume)

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. NB45

Date: 11 / 1 / 17

Dip To Water (DTW): 1.35

Sampled By: J.E & A.O.

Dip To Base (DTB): 7.08

Bore Volume [(DTB - DTW) * 2]: 11.46

Bore Volume To Purge [Bore Volume * 3]: 34.38

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments
12/1 8:40	~10	7.10	6239	5.99	482	16.76	Purged 11/1. Clear, sampled 12/1

DUPLICATE & TRIPLICATE SAMPLES

FAST
PURGED 11/1/17

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. NB4D

Date: 11 / 1 / 17

Dip To Water (DTW): 1.43

Sampled By: J.E & J.EV

Dip To Base (DTB): 18.45

Bore Volume [(DTB - DTW) * 2]: 34.04

Bore Volume To Purge [Bore Volume * 3]: 102-12

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments
9:10	40	6.83	7180	2.30	491	16.07	Purged 11/1. Duplicate & triplicate samples
							taken from this well water clear, sampled

12/1

11/1/17 - SLOW RECHARGE

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. NB5

Date: 11 / 1 / 17

Dip To Water (DTW): 7.26

Sampled By: J.E & A.O

Dip To Base (DTB): 10.05

Bore Volume [(DTB - DTW) * 2]: 5.58

Bore Volume To Purge [Bore Volume * 3]: 16.74

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments
9:50	Bore Volume						Well purged, insufficient to sample (spill)
12:30	5	6.67	11450	5.73	536	20.59	Sampled, cloudy.
					536		

2/1

11/1/17 SLOW RECHARGE

~13 litres — dry.

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. NB6 Date: 11 / 1 / 17

Dip To Water (DTW): 2.42 Sampled By: J.E & A.O.

Dip To Base (DTB): 7.03

Bore Volume [(DTB - DTW) * 2]: 4.61 x 2 = 9.22

Bore Volume To Purge [Bore Volume * 3]: ~~13.83~~ 27.66

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments
2/1 8:15	~10	7.01	4698	4.92	497	16.8	Purged 11/1. Turbid, sampled.

SLOW RECHARGE

Turbid.

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. NB7

Date: 11 / 1 / 17

Dip To Water (DTW): 5.22

Sampled By: J.E & ~~J.E~~ A.O.

Dip To Base (DTB): 13

Bore Volume [(DTB - DTW) * 2]: 15.56

Bore Volume To Purge [Bore Volume * 3]: 46.7

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments
2/1 11:20	10	6.71	5431	4.66	511	15.75	Turbid. Purged 11/1. Sampled 12/1, turbid.

SLOW RECHARGE

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. NB8

Date: 11 / 1 / 17

Dip To Water (DTW): 6.05

Sampled By: J.E & ~~J.E~~ A.O.

Dip To Base (DTB): 10.08

Bore Volume [(DTB - DTW) * 2]: 8.06

Bore Volume To Purge [Bore Volume * 3]: 24.18

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments
12/1 11:00	5	7.09	4830	5.7	461	18.02	Turbid. Purged 11/1. Sampled 12/1.

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. NB9 – Well not developed, hole only. Date: 11 / 1 / 17

Dip To Water (DTW): _____

Dip To Base (DTB): _____

Bore Volume [(DTB - DTW) * 2]: _____

Bore Volume To Purge [Bore Volume * 3]: _____

Sampled By: _____

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments

VEOLIA

Woodlawn Bioreactor Landfill Groundwater Sampling Data Sheet

Bore No. QC04 RINSATE SAMPLE

Date: 12 / 1 / 17

Dip To Water (DTW): _____

Dip To Base (DTB): _____

Bore Volume [(DTB - DTW) * 2]: _____

Bore Volume To Purge [Bore Volume * 3]: _____

Sampled By: J.E & A.O

Field Analysis:

Time	Volume Removed (L)	pH	EC (uS/cm)	DO (mg/L)	ORP	T (deg. C)	Comments
10:10	5	8.47	5.6	7.75	442	24.48	• Sampled after decontamination from sampling of NB5 (09:50)
							• Water supplied by ALS - same as trip blank.
							• Normal decontamination process followed - wash down w/ demin (bucket & probe)

Sampling Field Sheet

Note: all parameters must be completed.

Sampling Run

VEOLIA WOODLAWN GROUNDWATER

Job Number

Date

31/1/17

Sampling Staff

DB

ALS Water Resources Group
Canberra
Work Order Reference
CA1700592

Telephone : +61 2 6202 5404

Weather Conditions

Cloud Cover		Temperature	
Fine	✓	Hot	✓
Overcast		Warm	
Raining		Cool	
		Cold	

Wind		Wind Direction			
Calm		Not applicable		South	
Breeze		North		South West	
Gusty		North East		West	
Strong	✓	East		North West	✓
		South East			

Other Observations

ALL BORES ONLY NEW.
GRASS HIGH AROUND MOST. SUGGEST CLEARING A TRACK TO ALL BORES TO AVOID FIRE RISK.
MOST BORES NOT RECHARGING - SAMPLES COLLECTED ANYWAY. SEE SITE OBS ON FIELD SHEETS.

11 HRS SAMPLING CHARGE.

Run numbers:

Samples relinquished by:	Samples received by:
Date/Time:	**Date/Time:**

Temperature Range of Samples on Receipt:

5.4°C

GROUNDWATER SAMPLING FIELD SHEET — USING LOW FLOW PURGING

General Information

Client: VEOLIA Project: GROUNDWATER

Site: WOODLAWN Date: 31/1/17.

Bore Details

Bore ID: NB1 Screen: 7-10 m Diameter: 50mm

Capped: ☑ Locked: ☐ Lock ID: ____ Construction Report Sighted: ☐

AHD to TOC: ____ Condition/Comments: ____

GPS Location & Zone

Easting: ____ Northing: ____

Weather

Conditions: OVERCAST

Wind Speed: BREEZY Direction: ____

Temperature: WARM Pressure: ____

Instrumentation

Device Used: SAMPLE PRO Serial Number: ____

WQ Probe: HYDROLAB. Serial Number: ____

In Calibration: ☑ Documented: ☑ Decontaminated: ☑

Flow Cell Used: ☑ Drawdown Meter Used: ☑ MicroPurge CPM: 40ml

Sample Information

Sampler: D. BANOWSKI Time Sampled: 0950

Filtered: ☑ Filter Type: ____

Esky Iced: ☑

Proper use of the drawdown meter ensures the screen can not be dewatered. Best practise requires regular monitoring of water level - at least every time the field parameters are checked - to ensure correct operation.

All Field Sheets must be submitted with COC and scanned into the project file - paper copies are to be stored in the appropriate site/project folder.

Preliminary Standing Water Level section details to be obtained before beginning the bore purging process

Micro to be sampled first. Containers to be filled in accordance with OFM005 - Sample container filling instructions

Time (hh:mm)	Temp (°C) ±0.5	EC (µS/cm) ±3%	pH (units) ±0.05	Redox (mV) ±10	DO (mg/L) ±10%	SWL (m)	Appearance (Colour, Turbidity, Odour, Gas etc.)
0931	16.12	834.6	6.91		6.68	7.86	BROWN TURBID
0937	15.36	830.7	6.73		6.23	8.10	SLOW DOWN PUMP
0939	15.23	831.2	6.85		6.18	8.23	" " " CPM @ 140 ml
0941	14.91	832.8	6.66		6.17	8.24	
0943	14.98	833.2	6.64		6.17	8.25	
0945	14.97	833.0	6.64		6.18	8.26	
0948	14.98	832.9	6.63		6.17	8.27	BROWN TURBID

Standing Water Level

Ground Level to TOC:	0.83
SWL on Arrival to TOC:	7.48
Bore Depth to TOC:	11.10
Pump Placement to TOC:	9.00
Pre-Purge Level to TOC:	7.44
Start of Sampling to TOC:	8.27
End of Sampling to TOC:	8.31
SWL on Departure to TOC:	7.95

General Comments

SLOW RECHARGE

TURBID / BROWN. HARD TO FILTER

DUP 1 + DUP 2.

THIS IS A CONTROLLED COPY UNLESS OTHERWISE MARKED

GROUNDWATER SAMPLING FIELD SHEET — USING LOW FLOW PURGING

ALS

General Information
Client: VEOLIA Project: GROUNDWATER
Site: WOODLAWN Date: 31/1/17

Bore Details
Bore ID: NB2 Screen: 3.3 - 6.3 Diameter: 50mm
Capped: ☑ Locked: ☐ Lock ID: ____ Construction Report Sighted: ☐
AHD to TOC: ____ Condition/Comments: ____

GPS Location & Zone
Easting: ____ Northing: ____

Weather
Conditions: OVERCAST
Wind Speed: BREEZY Direction: ____
Temperature: HOT Pressure: ____

Instrumentation
Device Used: SAMPLE PRO Serial Number: ____
WQ Probe: HYDROLAB. Serial Number: ____
In Calibration: ☐ Documented: ☑ Decontaminated: ☑
Flow Cell Used: ☑ Drawdown Meter Used: ☐ MicroPurge CPM: 1 40PSI

Sample Information
Sampler: D. BARONSKI Time Sampled: 1028
Filtered: ____ Filter Type: ____
Esky Iced: ☑

Proper use of the drawdown meter ensures the screen can not be dewatered. Best practise requires regular monitoring of water level - at least every time the field parameters are checked - to ensure correct operation.

All Field Sheets must be submitted with COC and scanned into the project file - paper copies are to be stored in the appropriate site/project folder.

Preliminary Standing Water Level section details to be obtained before beginning the bore purging process

Micro to be sampled first. Containers to be filled in accordance with OFM005 - Sample container filling instructions

Time (hh:mm)	Temp (°C) ±0.5	EC (µS/cm) ±3%	pH (units) ±0.05	Redox (mV) ±10	DO (mg/L) ±10%	SWL (m)	Appearance (Colour, Turbidity, Odour, Gas etc.)
1013	18.40	5196	6.57		0.70	1.12	CLEAR CLEAR.
1015	18.15	5190	6.46		0.93	1.77	SLOW PUMP DOWN
1017	18.23	5193	6.41		1.66	2.44	PUMP SET TO MIN
1019	18.25	5195	6.40		2.18	2.60	
1021	18.26	5199	6.42		2.19	2.62	
1023	18.25	5198	6.44		2.18	~~DDS~~.	2.63m
1025	18.25	5199	6.42		2.17	2.65	

Standing Water Level
Ground Level to TOC: 0.80
SWL on Arrival to TOC: 0.16
Bore Depth to TOC: 7.31
Pump Placement to TOC: 6.00
Pre-Purge Level to TOC: QUICKFLOW
Start of Sampling to TOC: 2.65
End of Sampling to TOC: 2.84
SWL on Departure to TOC: 2.82

General Comments
SLOW RECHARGE PUMP ON MINIMUM
RINSATE BEFORE SAMPLING.
CLEAR CLEAR.

THIS IS A CONTROLLED COPY UNLESS OTHERWISE MARKED

GROUNDWATER SAMPLING FIELD SHEET — USING LOW FLOW PURGING

ALS Environmental

General Information
Client: VEOLIA Project: GROUNDWATER
Site: WOODMAN Date: 31/1/17

Bore Details
Bore ID: NB3 Screen: 6-9m Diameter: 50mm
Capped: ☐ Locked: ☐ Lock ID: ____ Construction Report Sighted: ☐
AHD to TOC: ____ Condition/Comments: ____

GPS Location & Zone
Easting: ____ Northing: ____

Weather
Conditions: OVERCAST
Wind Speed: GUST Direction: ____
Temperature: HOT Pressure: ____

Instrumentation
Device Used: SAMPLE PRO Serial Number: ____
WQ Probe: HYDROLAB. Serial Number: ____
In Calibration: ☐ Documented: ☑ Decontaminated: ☐
Flow Cell Used: ☑ Drawdown Meter Used: ☐ MicroPurge CPM: 4 40PSI

Sample Information
Sampler: D. BADOWSKI Time Sampled: 1106.
Filtered: ____ Filter Type: ____
Esky Iced: ☑

Proper use of the drawdown meter ensures the screen can not be dewatered. Best practise requires regular monitoring of water level - at least every time the field parameters are checked - to ensure correct operation.

All Field Sheets must be submitted with COC and scanned into the project file - paper copies are to be stored in the appropriate site/project folder.

Preliminary Standing Water Level section details to be obtained before beginning the bore purging process

Micro to be sampled first. Containers to be filled in accordance with OFM005 - Sample container filling instructions

Time (hh:mm)	Temp (°C) ±0.5	EC (µS/cm) ±3%	pH (units) ±0.05	Redox (mV) ±10	DO (mg/L) ±10%	SWL (m)	Appearance (Colour, Turbidity, Odour, Gas etc.)
1050	17.31	5474	6.89		5.54	7.37	CLEAR - SLIGHT BROWN
1052	16.38	5463	6.67		4.58	7.41	COLOUR
1054	16.07	5472	6.62		4.30	7.42	
1056	15.94	5681	6.52		3.53	7.42	
1058	15.83	6270	6.34		1.66	7.45	
1100	15.85	6268	6.32		1.64	7.45	RECHARGING??
1102	15.82	6268	6.34		1.65	7.45	
1104	15.93	6269	6.31		1.64	7.46	

Standing Water Level

Ground Level to TOC:	0.83
SWL on Arrival to TOC:	7.26
Bore Depth to TOC:	10.05
Pump Placement to TOC:	8.5
Pre-Purge Level to TOC:	7.19
Start of Sampling to TOC:	7.46
End of Sampling to TOC:	7.46
SWL on Departure to TOC:	7.49

General Comments
GOOD RECHARGE
CLEAR/CLEAR

THIS IS A CONTROLLED COPY UNLESS OTHERWISE MARKED

GROUNDWATER SAMPLING FIELD SHEET — USING LOW FLOW PURGING

General Information
Client: VEOLIA Project: GROUNDWATER
Site: WOODLAWN Date: 31/1/17

Bore Details
Bore ID: NB4D Screen: 14.7-17.7 Diameter: 50mm
Capped: ☑ Locked: ☐ Lock ID: ____ Construction Report Sighted: ☐
AHD to TOC: ____ Condition/Comments: ____

GPS Location & Zone
Easting: ____ Northing: ____

Weather
Conditions: FINE
Wind Speed: STRONG Direction: ____
Temperature: HOT Pressure: ____

Instrumentation
Device Used: SAMPLE PRO Serial Number: ____
WQ Probe: HYDROLAB Serial Number: ____
In Calibration: ☑ Documented: ☑ Decontaminated: ☑
Flow Cell Used: ☑ Drawdown Meter Used: ☑ MicroPurge CPM: 4 BOBS

Sample Information
Sampler: D-BANOSKI Time Sampled: 1310
Filtered: ____ Filter Type: ____
Esky Iced: ☑

Proper use of the drawdown meter ensures the screen can not be dewatered. Best practise requires regular monitoring of water level - at least every time the field parameters are checked - to ensure correct operation.

All Field Sheets must be submitted with COC and scanned into the project file - paper copies are to be stored in the appropriate site/project folder.

Preliminary Standing Water Level section details to be obtained before beginning the bore purging process

Micro to be sampled first. Containers to be filled in accordance with OFM005 - Sample container filling instructions

Time (hh:mm)	Temp (°C) ±0.5	EC (µS/cm) ±3%	pH (units) ±0.05	Redox (mV) ±10	DO (mg/L) ±10%	SWL (m)	Appearance (Colour, Turbidity, Odour, Gas etc.)
1300	19.21	7996	6.33		0.80	1.60	BROWN TURBID
1302	18.92	8002	6.17		0.55	1.60	
1304	18.83	8139	6.02		0.44	1.60	BROWN TURBID
1306	18.82	8134	6.00		0.44	1.60	
1308	18.80	8140	6.03		0.46	1.60	

Standing Water Level

Ground Level to TOC:	0.88
SWL on Arrival to TOC:	1.61
Bore Depth to TOC:	18.48
Pump Placement to TOC:	16.5
Pre-Purge Level to TOC:	1.60
Start of Sampling to TOC:	1.60
End of Sampling to TOC:	1.60
SWL on Departure to TOC:	1.59

General Comments
GOOD BORE RECHARGE - NO DRAW DOWN. BORE SETTED QUICKLY

THIS IS A CONTROLLED COPY UNLESS OTHERWISE MARKED

GROUNDWATER SAMPLING FIELD SHEET — USING LOW FLOW PURGING

General Information
Client: VEOLIA. Project: GROUNDWATER
Site: WOODLAWN Date: 31/1/17

Bore Details
Bore ID: NB45 Screen: 3 - 6m Diameter: 50mm
Capped: ☑ Locked: ☐ Lock ID: ____ Construction Report Sighted: ☐
AHD to TOC: ____ Condition/Comments: ____

GPS Location & Zone
Easting: ____ Northing: ____

Weather
Conditions: FINE
Wind Speed: STRONG Direction: ____
Temperature: HOT Pressure: ____

Instrumentation
Device Used: SAMPLE PRO Serial Number: ____
WQ Probe: HYDROLAB. Serial Number: ____
In Calibration: ☑ Documented: ☑ Decontaminated: ☑
Flow Cell Used: ☑ Drawdown Meter Used: ☑ MicroPurge CPM: 1 BOBI

Sample Information
Sampler: D. BRANSICH Time Sampled: 1340
Filtered: ____ Filter Type: ____
Esky Iced: ☐

Proper use of the drawdown meter ensures the screen can not be dewatered. Best practise requires regular monitoring of water level - at least every time the field parameters are checked - to ensure correct operation.

All Field Sheets must be submitted with COC and scanned into the project file - paper copies are to be stored in the appropriate site/project folder.

Preliminary Standing Water Level section details to be obtained before beginning the bore purging process

Micro to be sampled first. Containers to be filled in accordance with OFM005 - Sample container filling instructions

Time (hh:mm)	Temp (°C) ±0.5	EC (µS/cm) ±3%	pH (units) ±0.05	Redox (mV) ±10	DO (mg/L) ±10%	SWL (m)	Appearance (Colour, Turbidity, Odour, Gas etc.)
1322	23.31	7015	6.28		3.26	1.72	START ON LOWEST SETTING
1324	24.98	7038	6.50		3.36	1.85	CLEAR/CLEAR
1326	21.01	7058	6.33		3.45	1.94	
1328	21.00	7055	6.30		3.40	2.04	
1330	21.20	7066	6.35		3.47	2.13	
1333	21.15	7050	6.35		3.40	2.25	
1336	21.17	7052	6.35		3.44	2.31	
1338	21.15	7055	6.32		3.42	2.40	

Standing Water Level
Ground Level to TOC: 0.82
SWL on Arrival to TOC: 1.52
Bore Depth to TOC: 7.10
Pump Placement to TOC: 5.50
Pre-Purge Level to TOC: 1.08
Start of Sampling to TOC: 2.40
End of Sampling to TOC: 2.62
SWL on Departure to TOC: 2.48

General Comments
PUMP ON LOWEST SETTING. BORE STILL HAS DRAW DOWN. SAMPLE COLLECTED AM/PM

THIS IS A CONTROLLED COPY UNLESS OTHERWISE MARKED

GROUNDWATER SAMPLING FIELD SHEET — USING LOW FLOW PURGING

ALS Environmental

General Information
Client: VEOLIA Project: GROUNDWATER
Site: WOODLAWN Date: 31/1/17

Bore Details
Bore ID: NB5 Screen: 6-9m Diameter: 50mm
Capped: ☐ Locked: ☐ Lock ID: ____ Construction Report Sighted: ☐
AHD to TOC: ____ Condition/Comments: ____

GPS Location & Zone
Easting: ____ Northing: ____

Weather
Conditions: FINE
Wind Speed: HOT Direction: ____
Temperature: STRONG. Pressure: ____

Instrumentation
Device Used: SAMPLE PRO Serial Number: ____
WQ Probe: HYDROLAB. Serial Number: ____
In Calibration: ☐ Documented: ☑ Decontaminated: ☑
Flow Cell Used: ☑ Drawdown Meter Used: ☑ MicroPurge CPM: 160PSI

Sample Information
Sampler: D-BANDOWSKI Time Sampled: 1414
Filtered: ____ Filter Type: ____
Esky Iced: ☑

Proper use of the drawdown meter ensures the screen can not be dewatered. Best practise requires regular monitoring of water level - at least every time the field parameters are checked - to ensure correct operation.

All Field Sheets must be submitted with COC and scanned into the project file - paper copies are to be stored in the appropriate site/project folder.

Preliminary Standing Water Level section details to be obtained before beginning the bore purging process

Micro to be sampled first. Containers to be filled in accordance with OFM005 - Sample container filling instructions

Time (hh:mm)	Temp (°C) ±0.5	EC (µS/cm) ±3%	pH (units) ±0.05	Redox (mV) ±10	DO (mg/L) ±10%	SWL (m)	Appearance (Colour, Turbidity, Odour, Gas etc.)
1400	17.69	11934	5.94		1.44	7.48	PUMP STARTED ON LOW
1402	17.18	11855	5.81		1.07	7.56	SLIGHTLY
1404	17.20	11892	5.71		0.93	7.62	CLEAR / CLEAR
1406	17.20	11903	5.70		0.84	7.68	CANT STOP DRAW DOWN
1408	17.18	11900	5.72		0.84	7.73	NO RECHARGE ??
1410	17.19	11899	5.71		0.84	7.84	

Standing Water Level
Ground Level to TOC: 0.85
SWL on Arrival to TOC: 7.42
Bore Depth to TOC: 10.10
Pump Placement to TOC: 8.50
Pre-Purge Level to TOC: 7.25
Start of Sampling to TOC: 7.84
End of Sampling to TOC: 7.99
SWL on Departure to TOC: 7.91

General Comments
NO RECHARGE. SAMPLE COLLECTED Accordingly.

THIS IS A CONTROLLED COPY UNLESS OTHERWISE MARKED

GROUNDWATER SAMPLING FIELD SHEET — USING LOW FLOW PURGING

General Information
Client: VEOLIA Project: GROUNDWATER
Site: WOODLAWN Date: 31/1/17

Bore Details
Bore ID: NB6 Screen: 2-6 m Diameter: 50mm
Capped: ☐ Locked: ☐ Lock ID: ____ Construction Report Sighted: ☐
AHD to TOC: ____ Condition/Comments: ____

GPS Location & Zone
Easting: ____ Northing: ____

Weather
Conditions: FINE
Wind Speed: STRONG Direction: ____
Temperature: HOT Pressure: ____

Instrumentation
Device Used: SAMPLE PRO. Serial Number: ____
WQ Probe: HYDROLAB. Serial Number: ____
In Calibration: ☑ Documented: ☑ Decontaminated: ☑
Flow Cell Used: ☐ Drawdown Meter Used: ☑ MicroPurge CPM: 1 BOBS

Sample Information
Sampler: D. BANOVSKI Time Sampled: 1505
Filtered: ____ Filter Type: ____
Esky Iced: ☑

Proper use of the drawdown meter ensures the screen can not be dewatered. Best practise requires regular monitoring of water level - at least every time the field parameters are checked - to ensure correct operation.

All Field Sheets must be submitted with COC and scanned into the project file - paper copies are to be stored in the appropriate site/project folder.

Preliminary Standing Water Level section details to be obtained before beginning the bore purging process

Micro to be sampled first. Containers to be filled in accordance with OFM005 - Sample container filling instructions

Time (hh:mm)	Temp (°C) ±0.5	EC (µS/cm) ±3%	pH (units) ±0.05	Redox (mV) ±10	DO (mg/L) ±10%	SWL (m)	Appearance (Colour, Turbidity, Odour, Gas etc.)
1454	21.00	5649	5.86		1.00	2.62	STARTED ON LOWEST
1456	20.14	5703	5.81		0.65	~~2.69~~ 2.69	PUMP SETTING
1458	19.45	5675	5.79		0.50	2.77	
1500	18.46	5680	5.79		0.46	2.84	
1502	18.60	5706	5.77		0.45	2.95	

Standing Water Level
Ground Level to TOC: 0.76
SWL on Arrival to TOC: 2.59
Bore Depth to TOC: 7.07
Pump Placement to TOC: 5.50
Pre-Purge Level to TOC: 2.36
Start of Sampling to TOC: 3.02
End of Sampling to TOC: 3.19
SWL on Departure to TOC: 3.14

General Comments
BORE HAS DRAWDOWN. PUMP ON LOWEST SETTING. NO RECHARGE. SAMPLE COLLECTED ANYWAY

THIS IS A CONTROLLED COPY UNLESS OTHERWISE MARKED

GROUNDWATER SAMPLING FIELD SHEET — USING LOW FLOW PURGING

ALS Environmental

General Information
Client: VEOLIA Project: GROUNDWATER
Site: WOODLAWN Date: 31/1/17

Bore Details
Bore ID: NB7 Screen: 6-12.0m Diameter: 50mm
Capped: ☑ Locked: ☐ Lock ID: ____ Construction Report Sighted: ☐
AHD to TOC: ____ Condition/Comments: ____

GPS Location & Zone
Easting: ____ Northing: ____

Weather
Conditions: OVERCAST
Wind Speed: GUSTY Direction: ____
Temperature: HOT Pressure: ____

Instrumentation
Device Used: SAMPLE PRO Serial Number: ____
WQ Probe: HYDROLAB. Serial Number: ____
In Calibration: ☑ Documented: ☑ Decontaminated: ☑
Flow Cell Used: ☐ Drawdown Meter Used: ☑ MicroPurge CPM: 1 BOPS

Sample Information
Sampler: D. BROWN Time Sampled: 1152
Filtered: ____ Filter Type: ____
Esky Iced: ☑

Proper use of the drawdown meter ensures the screen can not be dewatered. Best practise requires regular monitoring of water level - at least every time the field parameters are checked - to ensure correct operation.

All Field Sheets must be submitted with COC and scanned into the project file - paper copies are to be stored in the appropriate site/project folder.

Preliminary Standing Water Level section details to be obtained before beginning the bore purging process

Micro to be sampled first. Containers to be filled in accordance with OFM005 - Sample container filling instructions

Time (hh:mm)	Temp (°C) ±0.5	EC (µS/cm) ±3%	pH (units) ±0.05	Redox (mV) ±10	DO (mg/L) ±10%	SWL (m)	Appearance (Colour, Turbidity, Odour, Gas etc.)
1138	18.33	6533	6.40		4.91	5.53	SLIGHTLY TURBID
1140	16.80	6732	6.21		2.98	5.75	
1142	18.46	6714	6.12		2.86	5.99	SLOW DOWN PUMP.
1144	18.17	6746	6.10		2.82	6.13	PUMP ON LOW FLOW.
1146	18.20	6742	6.10		2.79	6.20	
1148	18.22	6740	6.11		2.78	6.27	CAN'T STOP DRAW DOWN
1150	18.22	6739	6.12		2.77	6.32	
1152	18.20	6738	6.11		2.79	6.38	

Standing Water Level
Ground Level to TOC: 0.97
SWL on Arrival to TOC: 5.40
Bore Depth to TOC: ~~10.00~~ 13.02
Pump Placement to TOC: 10.00
Pre-Purge Level to TOC: 5.08
Start of Sampling to TOC: 6.38
End of Sampling to TOC: 6.52
SWL on Departure to TOC: 6.80

General Comments
BORE NOT RECHARGING. CAN'T STOP DRAWDOWN - SAMPLE COLLECTED ANYWAY.

THIS IS A CONTROLLED COPY UNLESS OTHERWISE MARKED

GROUNDWATER SAMPLING FIELD SHEET — USING LOW FLOW PURGING

ALS

General Information
Client: GEOLINK Project: GROUNDWATER
Site: WOODLAWN Date: 31/1/17

Bore Details
Bore ID: WB8 Screen: 6-9m Diameter: 50mm
Capped: ☑ Locked: ☐ Lock ID: ____ Construction Report Sighted: ☐
AHD to TOC: ____ Condition/Comments: ____

GPS Location & Zone
Easting: ____ Northing: ____

Weather
Conditions: FINE
Wind Speed: GUSTY Direction: ____
Temperature: HOT Pressure: ____

Instrumentation
Device Used: SAMPLE PRO Serial Number: ____
WQ Probe: HYDROLAB Serial Number: ____
In Calibration: ☑ Documented: ☑ Decontaminated: ☑
Flow Cell Used: ☑ Drawdown Meter Used: ☑ MicroPurge CPM: 160s1

Sample Information
Sampler: D. BROWNSILL Time Sampled: 1234
Filtered: ____ Filter Type: ____
Esky Iced: ☑

Proper use of the drawdown meter ensures the screen can not be dewatered. Best practise requires regular monitoring of water level - at least every time the field parameters are checked - to ensure correct operation.

All Field Sheets must be submitted with COC and scanned into the project file - paper copies are to be stored in the appropriate site/project folder.

Preliminary Standing Water Level section details to be obtained before beginning the bore purging process

Micro to be sampled first. Containers to be filled in accordance with OFM005 - Sample container filling instructions

Time (hh:mm)	Temp (°C) ±0.5	EC (µS/cm) ±3%	pH (units) ±0.05	Redox (mV) ±10	DO (mg/L) ±10%	SWL (m)	Appearance (Colour, Turbidity, Odour, Gas etc.)
1222	18.35	5190	6.53		0.94	6.53	BROWN TURBID
1224	18.94	5097	6.37		1.24	6.65	START ON CPM 2
1226	19.10	5229	6.36		1.76	6.71	PUMP ON LOW.
1228	19.68	5257	6.37		2.26	6.78	
1230	19.66	5245	6.37		2.24	6.80	
1232	19.66	5250	6.37		2.25	6.83	

Standing Water Level

Ground Level to TOC:	0.89
SWL on Arrival to TOC:	6.24
Bore Depth to TOC:	10.10
Pump Placement to TOC:	9.00
Pre-Purge Level to TOC:	6.00
Start of Sampling to TOC:	6.83
End of Sampling to TOC:	6.96
SWL on Departure to TOC:	7.10

General Comments
SAMPLE BROWN / TURBID
SLOW RECHARGE. SWL SLOWLY DROPPING
PUMP ON LOWEST SETTING.

THIS IS A CONTROLLED COPY UNLESS OTHERWISE MARKED

Lakes and Dams Field Sheet

Note: all parameters must be completed.

Site	EO 2		Time	1115	
Total Depth (m)		Tube/Zoop Depth (m)	Bottom Sample Depth (m)		
Temp	24.62	DO 7.14	pH	8.16	SpC 22,693.

Conditions (circle)				
Water surface	calm	choppy	waves	Other
Turbidity	low	mod	high	Other
Odour	normal	sewage	petrol	Other
Water colour	green	brown	yellow	Other
Macrophytes	absent	sparse	healthy	Other
Blue-green algae	absent	sparse	healthy	Other

comments/observations

Site	EO 1		Time	1430	
Total Depth (m)		Tube/Zoop Depth (m)	Bottom Sample Depth (m)		
Temp	28.28	DO 6.79	pH	8.38	SpC 16085

Conditions (circle)				
Water surface	calm	choppy	waves	Other
Turbidity	low	mod	high	Other
Odour	normal	sewage	petrol	Other
Water colour	green	brown	yellow	Other
Macrophytes	absent	sparse	healthy	Other
Blue-green algae	absent	sparse	healthy	Other

comments/observations

Very windy and water splashes up onto banks/shore

Site			Time		
Total Depth (m)		Tube/Zoop Depth (m)	Bottom Sample Depth (m)		
Temp		DO	pH		SpC

Conditions (circle)				
Water surface	calm	choppy	waves	Other
Turbidity	low	mod	high	Other
Odour	normal	sewage	petrol	Other
Water colour	green	brown	yellow	Other
Macrophytes	absent	sparse	healthy	Other
Blue-green algae	absent	sparse	healthy	Other

comments/observations

Appendix G

QC – Data Validation

Appendix G

8.0 QC – Data Validation

The *National Environmental Protection (Assessment of Site Contamination Measure* (ACM NEPM, Schedule B [2]) *Site Characterisation* (May 2013) specifies that the nature and quality of the data produced in an investigation will be determined by the Data Quality Objectives (DQOs). As referenced by the NEPM, the DQO process is detailed in the United States EPA *Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4* (2006, EPA/240/B-06/001).

Based on the outcomes of the DQO process the quality of the data collected as part of the investigation was assessed on a range of factors including:

- documentation and data completeness
- data quality, comparability, representativeness, and precision and accuracy for sampling and analysis.

8.1 Field Quality Control

Definitions of the QA/QC samples collected are provided in the table below.

Table 8 Quality Sample Definitions

Type of Sample	Definition
Field Blank	A deionized water sample that is prepared prior to field sampling, carried to the sampling site, and exposed to site atmosphere during sampling. Field blank results are used to screen for field volatile contaminants that might not travel through the septum of a travel blank, but might contaminate samples on-site.
Rinsate	Used to assess the adequacy of the decontamination of the sampling equipment. A sample of analyte-free water supplied by the laboratory was poured over the decontaminated equipment prior to the collection of the next sample. The sample was analysed for the same suite as the primary samples.
Trip Blank	Used to assess if contamination is introduced during shipping and field handling procedures. A sample of analyte-free media is taken from the laboratory to the sampling site and returned to the laboratory without being exposed to the sampling procedures. Only analysed for volatile compounds.
Duplicate	Used to document the precision of the sampling process. Independent samples which are sampled as close as possible to the primary sample in space and time. They are separate samples taken from the same source and stored in separate containers and analysed independently.
Triplicate (Interlab)	Used to document inter-laboratory precision. Independent samples which are sampled as close as possible to the primary sample in space and time. They are separate samples taken from the same source and stored in separate containers and analysed at the secondary laboratory.

The field Quality Assurance / Quality Control (QA/QC) procedures established for the project are summarised below:

- Use of standard procedures for groundwater sampling.
- Use of a new pair of disposable nitrile gloves for each groundwater sample collection event.
- Use of calibrated equipment.

- Use of appropriate equipment decontamination procedures or using disposable equipment if possible.
- Use of laboratory prepared and supplied sampling containers appropriate for each analyte investigated.
- Use of appropriate sample Chain of Custody (COC) documentation.
- Analysis of inter-laboratory field (split) duplicate samples at a rate of one per 20 primary samples.
- Collection and analysis of a rinsate sample per day of sampling and trip blank sample per cooler of sampling.
- The relative percentage difference (RPD) of the primary and duplicate sample results to be less than 30% to 50% for groundwater samples.

Field sampling QC analytical results are presented in **Tables A** through to **C** and summarised below:

- One duplicate / triplicate sample set (QC01 and QC02) was collected during sampling at MB23 and analysed at ALS for the same suite as the primary sample. A second duplicate/triplicate set was collected during the first sampling round; however, the limited amount of sample collected prevented full analysis of the triplicate sample. It is considered the DQO has been met in terms of sample number, however, some analytes were not tested for in the triplicate samples. Results indicate that the RPDs were within the acceptable limits for the primary and triplicate laboratories (**Tables A and B**).
- One water trip blank (QC03_TRIP BLANK) along with one equipment rinsate sample (QC04_RINSATE BLANK) which was obtained during sampling were submitted to ALS for analysis. All results (**Table C)** were below the LORs indicating that appropriate decontamination procedures were used during field activities and the absence of cross-contamination during sample transit.

8.2 Laboratory Quality Control

The DQOs and acceptable limits defined for the assessment of the laboratory analytical data included:

- maximum acceptable sample holding time is 14 days for organic analyses and six months for metal analyses;
- samples to be appropriately preserved and handled;
- laboratory LOR to be less than the adopted criteria;
- laboratory method blank analyses to be less than the laboratory LOR;
- laboratory duplicate samples to be analysed at a rate of one in 20 samples, when the batch size exceeds five samples. The RPDs of laboratory duplicates analysed to be less than 50%;
- matrix spike recoveries to be conducted by the laboratory at a rate of one in 20 samples;
- laboratory control sample (LCS) analysis to be conducted at a rate of one in 20 samples;
- matrix spike, LCS and Surrogate recoveries to be within the acceptable range of 70-130%.

The results of the laboratory QA/QC review and data validation are discussed below. Supporting QA/QC documentation is provided on the laboratory certificates of analysis.

- Samples were received by the laboratory chilled and intact.
- With the exception of holding time exceedances for pH (1 day), ammonia (3 days) and nitrate (2 days) in Batch ES1700747, all samples were submitted to the laboratory within the recommended holding times.
- Method blank sample results were less than laboratory LORs.
- No laboratory duplicate outliers were reported.

- Matrix spike (MS) recoveries were below the acceptable limits for sulfate, chloride (both not determined) and barium and vanadium in Batch ES1700747.
- LCS recoveries were in the acceptable limits and met the AECOM DQO.
- Surrogate recoveries were in the acceptable limits.

8.3 Data Usability

While minor non-conformances with the frequency of QC samples have been identified, these non-conformances are not considered to adversely impact the purpose of the investigation with respect to comparison against the adopted assessment criteria. The results demonstrate adequate reproducibility in terms of field sampling and the analytical techniques adopted in the laboratory and sample integrity in the field, transport and handling in the laboratory.

It is therefore concluded that, for the purposes of this investigation, the data are suitable for interpretation and acceptable for use in this assessment.

Appendix H

Geochemical Seepage Assessment

Appendix H

9.0 Geochemical Seepage Assessment

9.1 Introduction

The nature and extent, and pathway for potential pollutants from ED1 and ED2 to seep into the surrounding environment was assessed based on the data collected over the past 20 years from the evaporation dams and associated network of groundwater monitoring bores. The historical data covered the period when the mine was operational (pre-march 1998) and when from the time mining operations ceased (post-March 1998 to present day). This historical data was augmented by groundwater quality data collected from nine new bores installed as part of the current investigation.

The general approach for interpreting the Woodlawn seepage chemistry data is:

- Plotting the available data on Stiff and/or Piper diagrams, and grouping related plots (for example, all wells intercepting a specific formation) with the evaporation dam polygon for visual comparison.
- Geochemical modelling to calculate mineral saturation indices (SI) for each sample using The Geochemist's Workbench computer code (Bethke and Aqueous Solutions LLC 2012) and examining differences between evaporation dam water and seepage quality.
- Determining the effect of mixing on the observed concentration differences by applying mixing using The Geochemist's Workbench (Bethke and Aqueous Solutions LLC 2012).

Seepage plumes at Woodlawn can be difficult to detect because groundwater samples obtained within mineralised areas can contain naturally high concentrations of major and trace elements and show large natural chemical variations even within a small area. If the groundwater monitoring network is sufficient or established in areas so that seepage plumes may be intercepted and sampled, the use of a conservative element or compound unique to the evaporation dam water is required to 'trace' its movements as it travels with the seepage plume and distinguish potential causes for increased seepage concentrations.

The use of electrical conductivity (EC) as a measure of salinity and chloride ion (Cl^-) concentrations for seepage assessment within SML20 is not considered robust since the regional deposition include sedimentary and metamorphosed sedimentary rocks of marine origin, which are naturally high in salt content such as halite (NaCl), and similar chloride concentrations in ED1 and ED2 are observed relative to background groundwater.

Similarly, the use of pH as a tracer can mask seepage flow because as acidic water from the evaporation dams seeps into the surrounding subsurface environment, it further reacts with other minerals in the surrounding rock material. If the acid is partially or completely neutralised by the dissolution of common carbonate minerals in rocks, it will raise the pH of the plume and can lead to precipitation and thus removal of metals such as Al, Cu, Pb and Zn from the original seepage water.

It is noted that water samples from ED1 and ED2 have been analysed historically for total (unfiltered) metal concentrations that include those weakly bound to suspended particulate matter rather than 'dissolved' (filterable) concentrations. Total metal concentrations may not be representative or adequately describe the fate and behaviour and aqueous metal transport in groundwater if a significant portion of the metal was present in particulate form. Therefore, the use of total metal concentrations as a tracer is considered non-robust.

In view of the above, the sulfate ion ($SO4\ \ 2-$) is used as a tracer because it is a major dissolved constituent of the evaporation dam water (relative to background groundwater) and travels generally unimpeded along groundwater flow paths. It is recognised that anhydrite/gypsum ($CaSO_4$) is absent in the Woodlawn mineralisation (McKay and Hazeldene 1987) and the main mineral phase is barite ($BaSO_4$), which is highly insoluble.

9.2 Data Quality

Although water quality data have been collected over the past 20 years from the evaporation dams and associated network of groundwater monitoring bores, not all parameters have been consistently measured for each water sample during each sampling event. For example, most groundwater samples were not analysed for bicarbonate ($HCO3\ -$) concentration. Bicarbonate is a major dissolved component of groundwater and is the dominant form of inorganic carbon species and source of alkalinity in natural waters at pH values of 6.5 to 8.5.

The inconsistency in the water quality analysis resulted in the need to exclude water samples with incomplete water quality analysis from the seepage assessment.

9.3 ED1 Water Quality

Figure 13 shows the major chemical composition of selected ED1 water samples in terms of Stiff diagrams. These samples were collected between 1992 and 2017. During this period, the water contained within ED1 has remained highly acidic (pH 2.38 to pH 3.54) with high sulfate concentrations (13000 mg/L to 19250 mg/L with an average of 16406 mg/L).

It is recognised that water contained in ED1 (and ED2) do not contain any effective bicarbonate alkalinity since it is highly acidic (pH < 4). As such, a bicarbonate concentration of 0.1 mg/L (i.e. the laboratory limit of reporting (LOR)) was used for graphing purposes.

Figure 13 shows that the major ion compositions of water samples from ED1 have remained unchanged since the cessation of mining operations (blue polygons) compared to those obtained during mining operations (orange polygons). **Figure 13** indicates that dilution due to rainfall and pre-concentration due to evaporation over the past 25 years and water management practices since the cessation of mining has not resulted in substantial change in water quality or composition based on major anions and cation chemistry.

9.4 ED2 Water Quality

Figure 14 shows the chemical composition of selected ED2 water samples in terms of Stiff diagrams. These samples were collected between 1992 and 2017. The water contained within ED2 has remained highly acidic (pH 2.67 to pH 3.45) during this period with elevated sulfate concentrations. The sulfate concentrations measured in water samples from ED2 ranged from 13700 mg/L to 41000 mg/L (average of 29540 mg/L), which is comparatively higher than those measured in ED1.

Figure 14 shows that the ionic compositions of the water body in ED2 since the cessation of mining operations (blue polygons) have resulted in a general increase or decrease in sulfate and magnesium concentrations compared to those observed during mining operations (orange polygons). These fluctuations are indicative of the greater influence of dilution (due to rainfall) and pre-concentration (due to evaporation) processes on the smaller volume of water stored in ED2 compared to ED1 (as of July 2016, 150 megalitres (ML) compared to 220 ML, respectively).

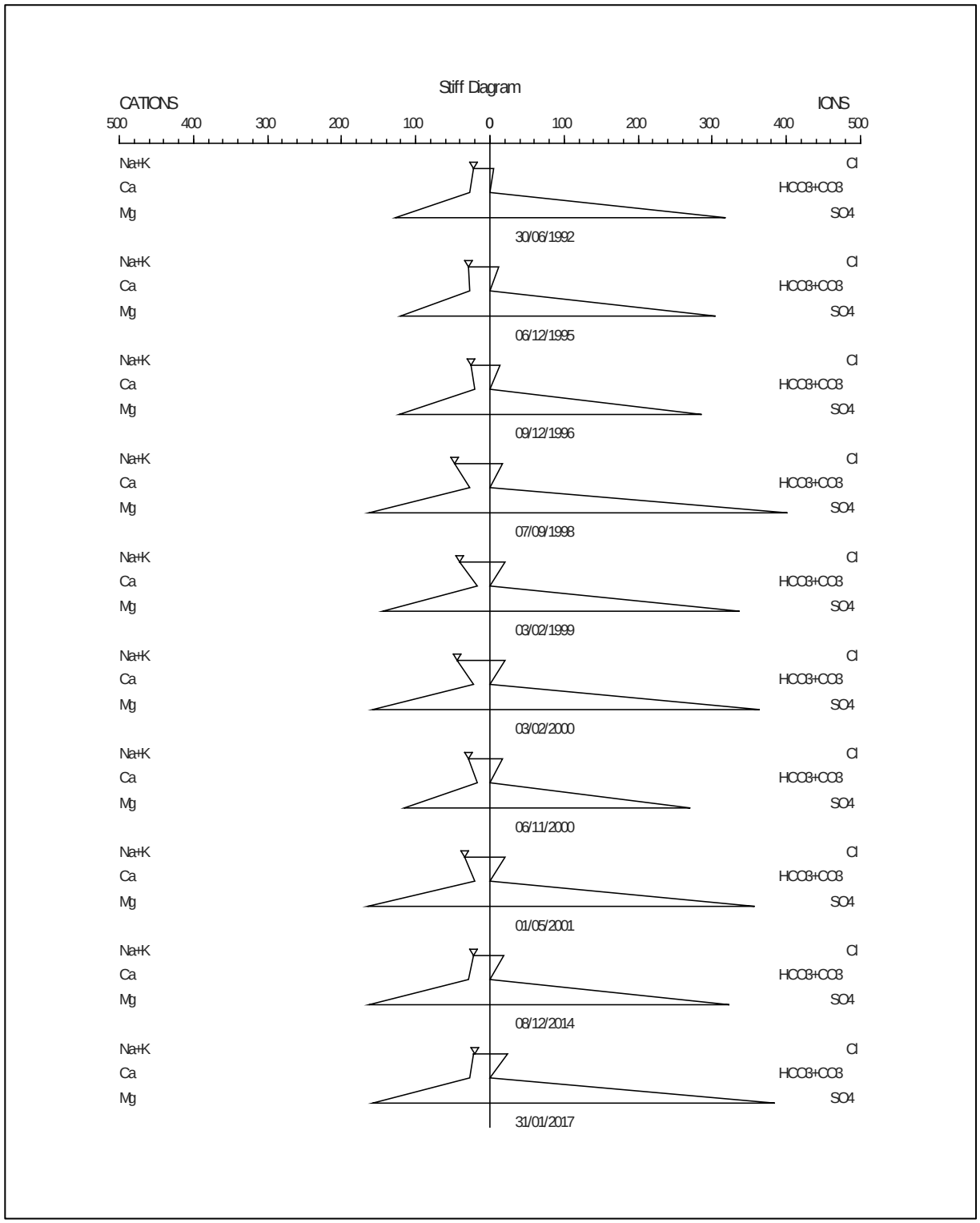


Figure 13 Stiff diagrams for ED1 water samples

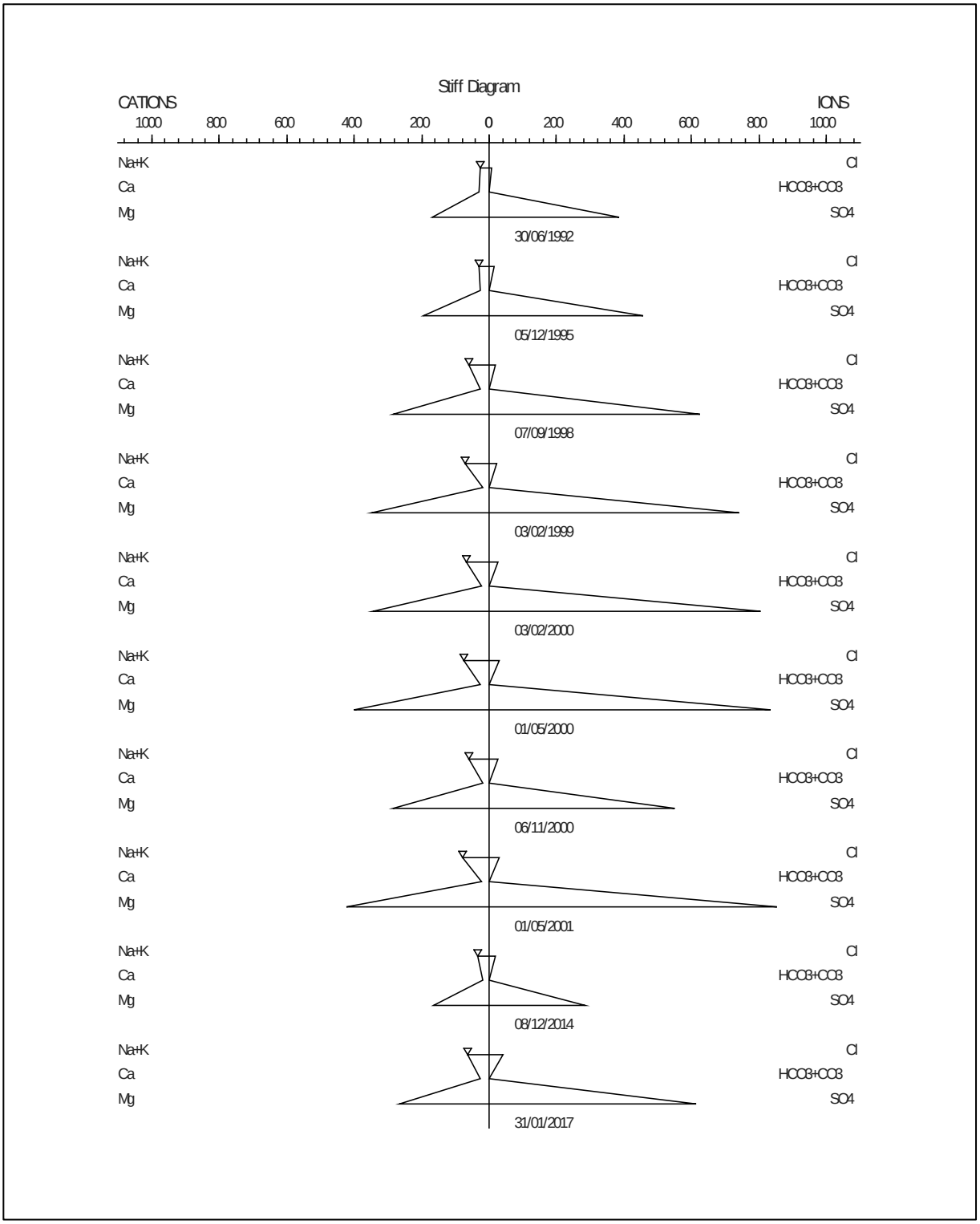


Figure 14 Stiff diagrams for ED2 water samples

9.5 Seepage Monitoring

The comparative change in major ion concentrations in selected ED2 water and groundwater samples are plotted as Stiff diagrams in **Figure 15**. The Stiff diagrams indicate that groundwater samples from MB10, MB26S, MB27D and MB2 have chemical compositions similar to the water contained within ED1, unlike the groundwater samples from the remainder of monitoring bores (**Figure 15**).

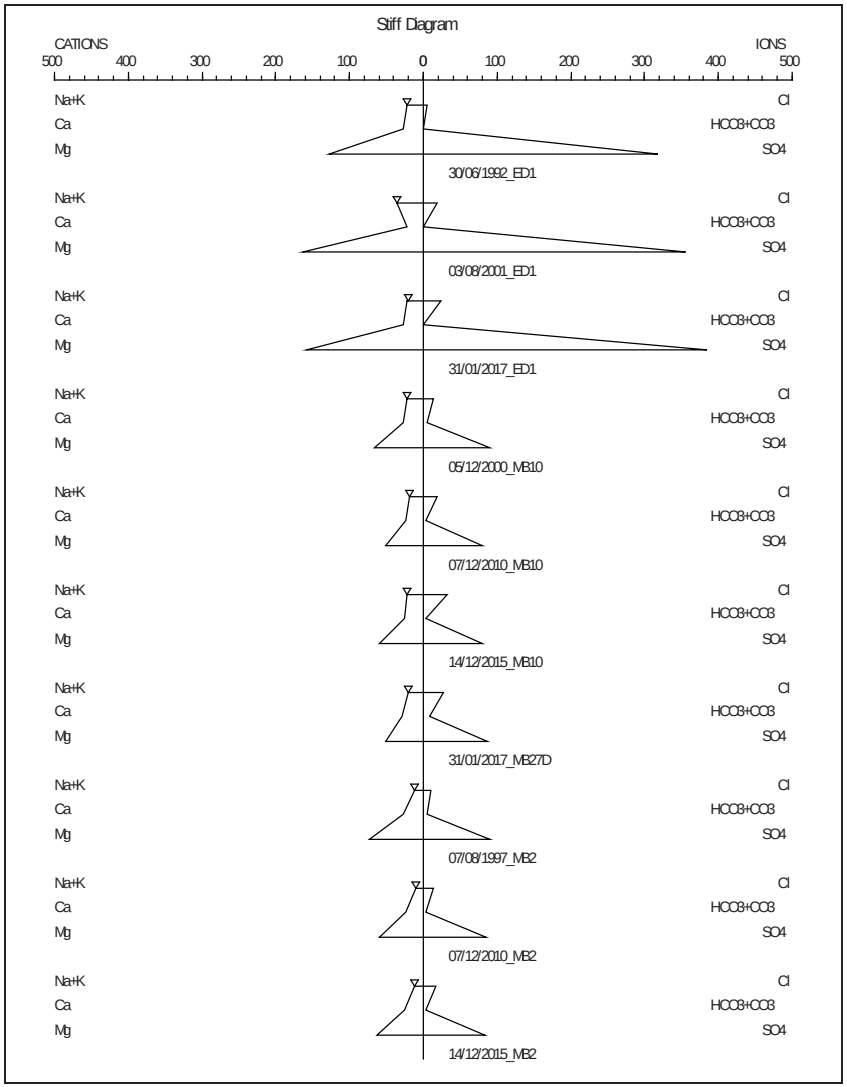
The ED1 water and MB10, MB26S, MB27D and MB2 groundwater samples are Mg-SO_4 type. Seepage bores MB10, MB27D and MB2 monitor the groundwater quality within the Silurian sequence intruded by extensive Lower Devonian dolerite (diabase), gabbro and minor spilite. However, groundwater (except MB26S) within the Cenozoic alluvium, consisting of sand, gravel and clay, is mainly Na-Cl and Mg-Cl type based on the analysis of MB28, MB29, MB30 and MB31 groundwater samples. The shape of the Stiff diagrams (**Figure 15**) shows that groundwater samples collected from within shallow alluvium (MB29) is distinct from groundwater sampled in relatively deeper zones (MB28, MB30 and MB31), which tend to contain more magnesium and chloride.

Water samples from monitoring bores MB13 and MB23 is considered to be representative of background groundwater quality within the Silurian-Devonian dolerite or the contact between the Lower Devonian and Silurian-Devonian sequence. Monitoring bore MB13 is located on the western boundary of SML20, while MB23 is located approximately 100 m north-west of ED2. The background groundwater within the Silurian-Devonian dolerite is Na/Mg-Cl type (MB13) whereas, near the contact between the Lower Devonian and Silurian-Devonian sequence, the groundwater is Mg-HCO_3 type. Groundwater at MB29, located 400 m north-east embankment of ED1, is Na-Cl type and is considered representative of the background groundwater quality within the Cenozoic alluvium.

Monitoring bore MB3, located up-gradient of the Woodlawn Mine Site and adjacent to the Woodlawn Farm, intersect groundwater that is representative of background conditions at the contact between the Silurian-Devonian (quartz sandstone and shale) and Middle to Upper Silurian formations (acid tuffs). Groundwater samples collected from MB7 is representative of background metamorphic and marine based deposition of the Middle to Upper Silurian sequence. Groundwater samples obtained from both MB3 and MB7 are Mg-Cl type.

Figure 15 shows that concentrations of sulfate, calcium (Ca) and magnesium (Mg) in groundwater have increased compared to background along the natural drainage channel that underlie Crisps Creek defined by monitoring bores MB10, MB26S, MB27D and MB2. In particular, sulfate concentrations (3030 mg/L to 5200 mg/L) measured in MB10, MB2 and MB27D have increased markedly compared to background concentrations (<150 mg/L) measured in MB13 and MB23. The sulfate concentrations in groundwater samples from MB26S (3920 mg/L to 5160 mg/L) is also elevated relative to background at MB29 (279 mg/L to 326 mg/L). To provide some context to these sulfate levels, the sulfate concentration in typical seawater is 2700 mg/L (Hem 1992).

Figure 15 Stiff diagrams for selected ED1 water and groundwater samples



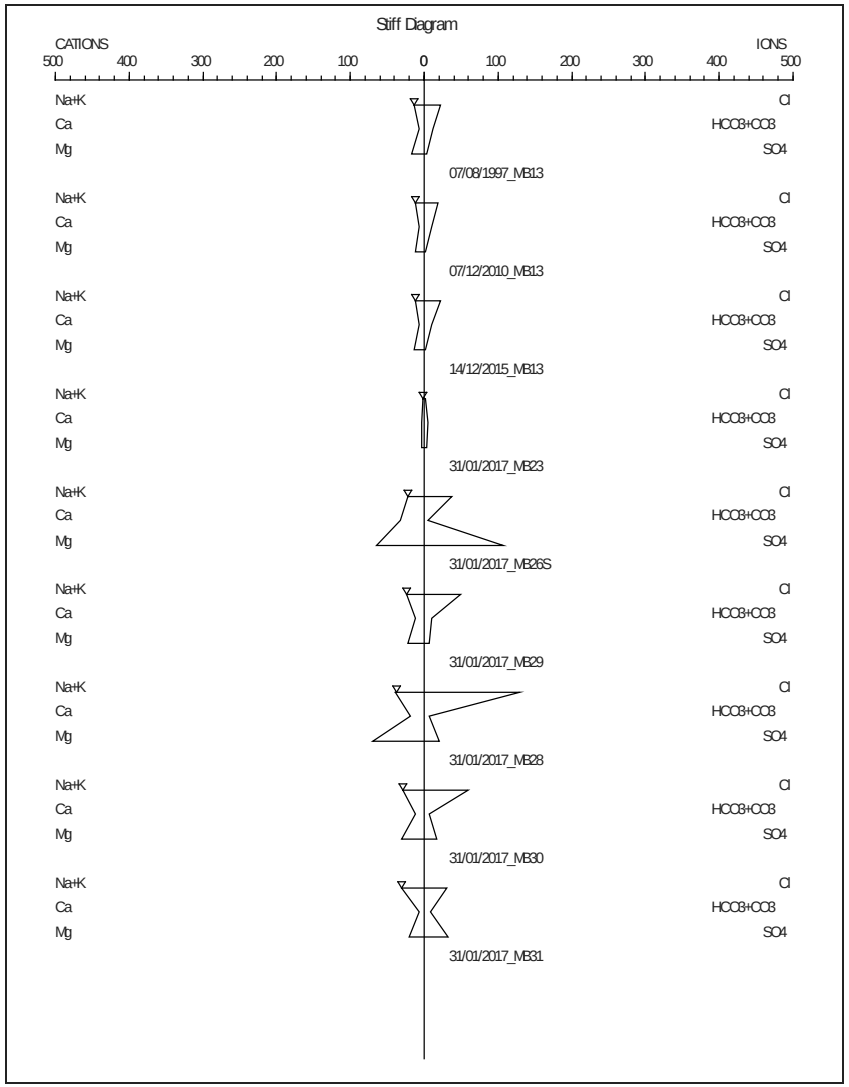


Figure 16 shows that the groundwater at MB11and MB12 have changed significantly over time and have similar chemical compositions to the water contained within ED2. During the same period, the pH of the groundwater has become progressively acidic (pH <4) with increasing sulfate concentrations. The sulfate concentrations (4730 mg/L to 63000 mg/L) measured in MB11and MB12 have increased markedly compared to background concentrations (<150 mg/L) measured in MB13 and MB23. The results indicate the seepage of sulfate-rich, acidic water contained within ED2. Monitoring bores MB11 and MB12 are both located ~50 m down-gradient from the western embankment and intersect groundwater located within the contact between the Lower Devonian and Silurian-Devonian sequence.

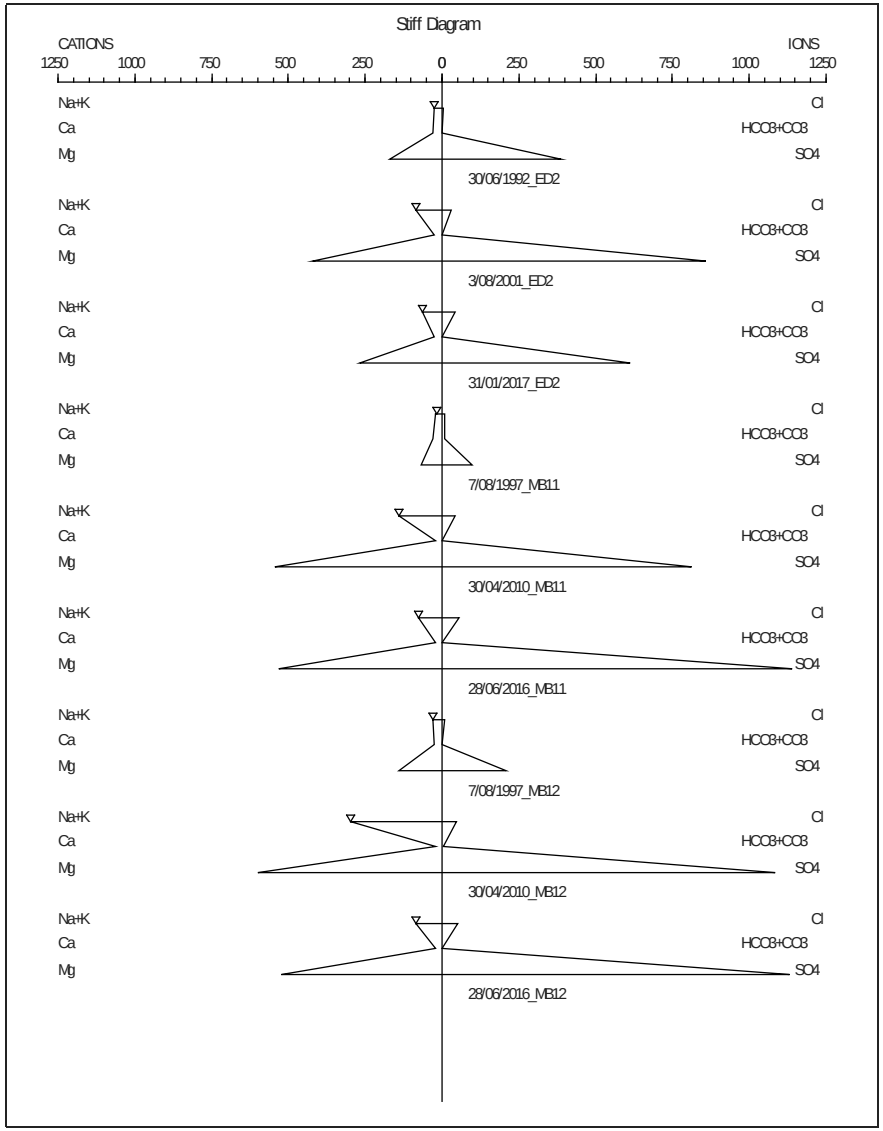
The ED2 water and MB11, MB12, MB19, MB20, MB24 and MB25 groundwater samples are Mg-SO_4 type. Monitoring bores MB19 and MB20, located about 60 m down-gradient of MB11 and MB12, are both assumed to intersect groundwater within the Cenozoic alluvium (borelogs for MB19 and MB20 were available for these bores at the time of this assessment). The potential migration of the sulfate-rich plume within the alluvium south of the assumed seepage line along Allianoyonyiga Creek was monitored by MB25. Groundwater within the weathered rhyolite in the Lower Devonian sequence was monitored by seepage bore MB24, which is located approximately 600 m downstream of the western embankment along the drainage line.

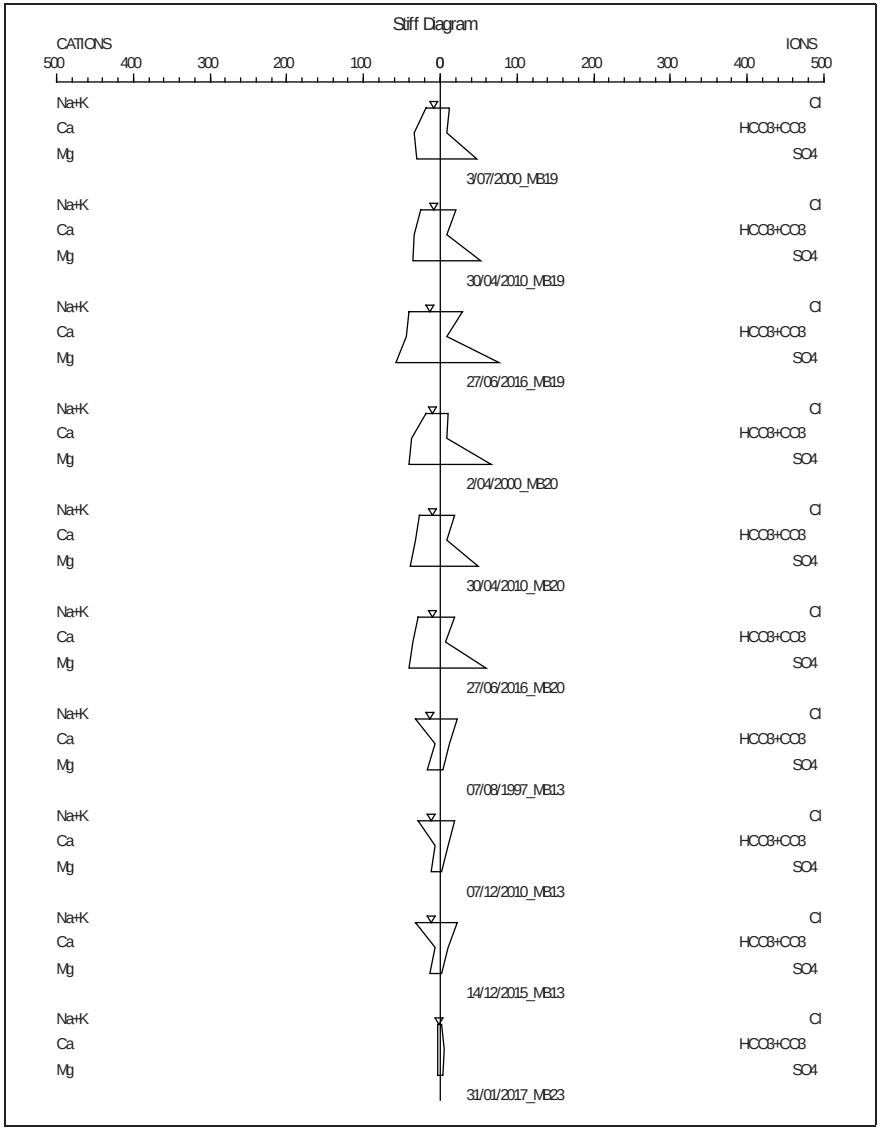
Figure 16 and **Figure 17** show that concentrations of sulfate, Ca and Mg in groundwater have increased compared to background along the natural drainage channel that underlie Allianoyonyiga Creek downgradient of MB11 and MB12. The concentrations of sulfate measured in groundwater samples within the alluvium at MB19 (2060 mg/L to 3700 mg/L), MB20 (1900 mg/L to 3190 mg/L) and MB25 (2730 mg/L to 4000 mg/L) are elevated relative to background at MB29 (279 mg/L to 326 mg/L). Sulfate concentrations in groundwater intersecting the Lower Devonian sequence (at MB24) have also increased substantially, with values ranging from 2400 mg/L to 2480 mg/L compared to background concentrations of <150 mg/L measured in MB13.

The change in the seepage chemistry indicates that groundwater along the drainage channel beneath Crisps Creek and Allianoyonyiga Creek may be due to:

- Water-rock interactions involving mainly mineral dissolution, and/or
- Seepage of ponded water containing elevated sulfate concentrations from the evaporation dams (ED1 and ED2).

Figure 16 Stiff diagrams for selected ED2 water and groundwater samples





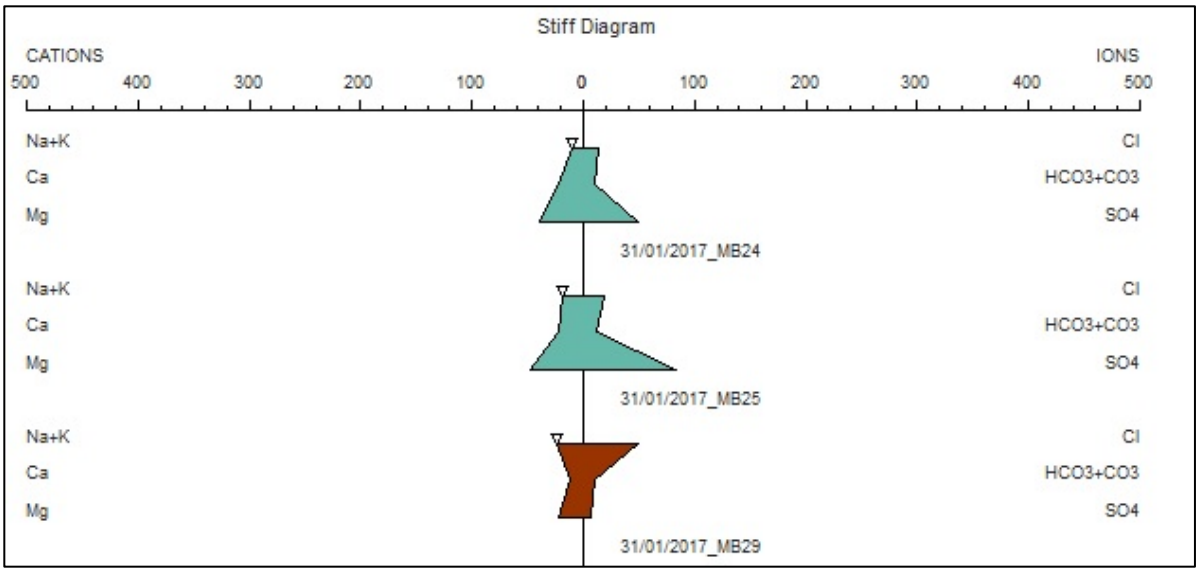


Figure 17 Stiff diagrams for monitoring bore MB24 and MB25 compared to MB29 (background)

9.6 Mineral Dissolution

In the sedimentary setting, the three main sources of SO_4^{2-} are seawater, evaporite minerals (primarily anhydrite ($CaSO_4$) and gypsum ($CaSO_4 \cdot 2H_2O$)) and pyrite (which must be oxidized to form SO_4^{2-}) (Dworkin and Land 1996; Hounslow 1995).

To assess if the dissolution of evaporite (gypsum and/or anhydrite) and carbonate (calcite and/or dolomite) is a plausible water-rock process in the system, $(Ca + Mg)$ versus $(SO_4^{2-}+HCO_3^-)$ graphs were constructed (**Figure 18** and **Figure 19**). Data plotting close to the 1:1 line is indicative of these dissolution reactions occurring. If ion exchange is the process, it will shift the points to the right due to an excess of $SO_4^{2-}+HCO_3^-$ (Cerling *et al*, 1989; Fisher and Mullican, 1997):

$$Na_2 \equiv Clay + Ca^{2+}(Mg^{2+}) \rightarrow 2Na^+ + Ca(Mg) \equiv Clay \qquad [2]$$

Reverse ion exchange processes tends to shift the points to the left due to a large excess of $Ca + Mg$, which can be explained by the following reaction:

$$2Na^+ + Ca(Mg) \equiv Clay \rightarrow Na_2 \equiv Clay + Ca^{2+}(Mg^{2+}) \qquad [3]$$

Figure 18 shows that most groundwater water samples collected along the drainage channel beneath Cripps Creek plot close to the 1:1 line, suggesting that the dissolution of gypsum/anhydrite, calcite and/or dolomite is the dominant reactions occurring in this system. Similarly, groundwater samples collected further down-gradient of MB11 and MB12 along the drainage channel beneath Allianoyonyiga Creek also plot close to the 1:1 line (**Figure 19**). Most groundwater samples collected immediately down-gradient of western embankment of ED2 at MB11 and MB12 plot well to the right of the 1:1 line (**Figure 19**) due to excess sulfate concentrations (groundwater at MB11/MB12 do not contain detectable alkalinity).

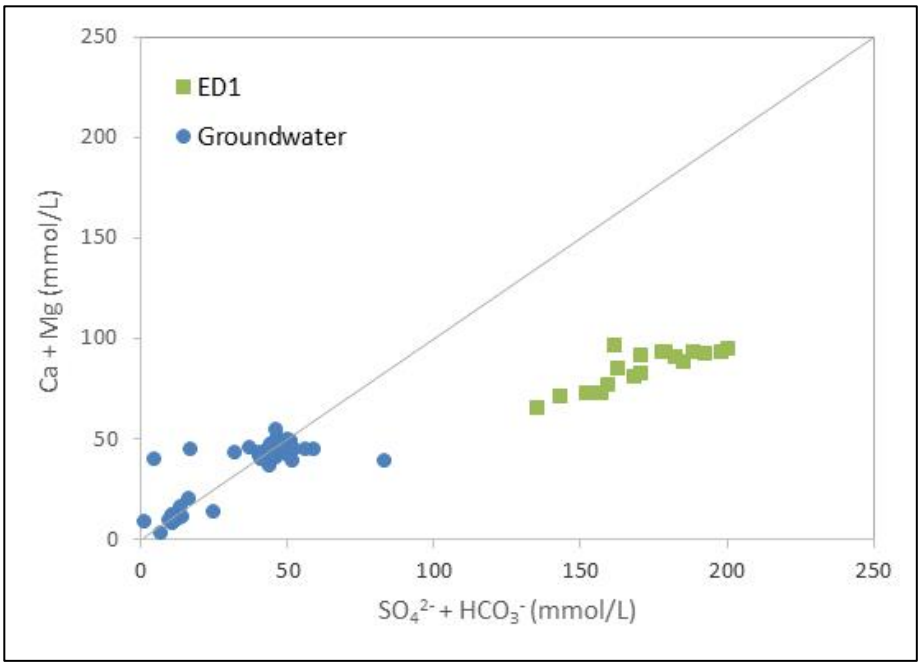


Figure 18 Ca+Mg versus SO_4^{2-}+HCO_3^- concentrations for selected ED1 water and groundwater samples

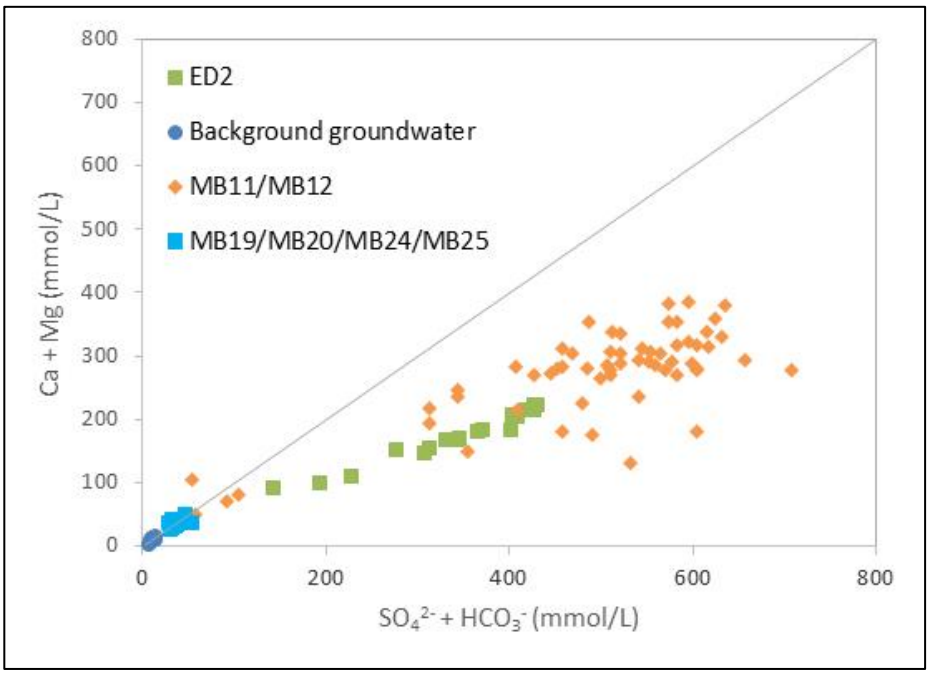


Figure 19 Ca+Mg versus SO_4^{2-}+HCO_3^- concentrations for selected ED2 water and groundwater samples

The stability of minerals with respect to dissolved constituents in the water samples, shown in **Figure 15** to **Figure 17**, were further evaluated by computing mineral saturation indices (SI).

Mineral SI, defined as $\log_{10}$ of the ratio of the ion activity quotient (Q) divided by the equilibrium constant (K) ($\log_{10}(Q/K)$), were computed using The Geochemist's Workbench (GWB) chemical equilibrium model (Bethke and Aqueous Solutions LLC 2012) based on the *thermo.dat* thermodynamic database. A log SI > 0 is considered as oversaturated with respect to the selected mineral and thus will tend to precipitate out of solution. A log SI < 0 indicates that the water is undersaturated with respect to the selected mineral and will tend to dissolve the mineral. When log SI is equal to zero,

there is no tendency for net dissolution or net precipitation of the mineral (i.e. the mineral is in equilibrium with solution).

Table 9 shows that gypsum/anhydrite ($CaSO_4$) is strongly under-saturated (negative SI values) in the background groundwater samples within the alluvium (MB29), Silurian-Devonian dolerite (MB13) and contact between the Lower Devonian and Silurian-Devonian sequence (MB23). These waters will generally tend to dissolve these sulfate-minerals.

Background groundwater intersecting the Silurian-Devonian dolerite (MB13) is oversaturated (positive SI values) with respect to calcite/aragonite and disordered dolomite (**Table 9**). As such, these mineral phases will tend to precipitate out of solution. It is recognised that although disordered dolomite is predicted to precipitate, this is considered unlikely to occur in the field due to kinetic factors (i.e. reaction rates) that constrain its precipitation under normal sedimentary environments (Tucker *et al.* 2009). Conversely, background groundwater intersecting alluvium (MB29) and the contact between the Lower Devonian and Silurian-Devonian sequence (MB23) will tend to dissolve these carbonate minerals.

The Woodlawn mineralisation occurs within the Middle to Upper Silurian sequence. Background groundwater (MB7) intersecting siliceous, coarse grained tuff within the Middle to Upper Silurian are under-saturated with respect to gypsum and anhydrite and oversaturated with carbonates (calcite/aragonite and dolomite) (**Table 9**). Therefore, these waters will tend to dissolve gypsum/anhydrite and precipitate carbonates. Groundwater samples from MB3, representative of background conditions at the contact between the Silurian-Devonian (quartz sandstone and shale) and Middle to Upper Silurian formations (acid tuffs), is under-saturated with respect to these minerals.

Increasing (less negative) SI values for calcite/aragonite and dolomite is observed between the ED1 water and groundwater samples collected along the natural drainage channel that underlie Crisps Creek (MB10, MB26S, MB27D and MB2) (**Table 9**), indicating possible mineral dissolution or mixing with higher concentration water along the flow path. In contrast, decreasing (more negative) SI values for gypsum/anhydrite is observed between ED1 water and the groundwater, suggesting potential mineral precipitation or dilution mixing with a lower concentration source of water

Along the natural drainage channel that underlies Allianoyonyiga Creek, increasing (less negative) SI values for calcite, dolomite and gypsum and decreasing (more negative) SI values for anhydrite and aragonite are observed between the ED2 water and groundwater samples (MB11, MB12, MB19, MB20, MB24 and MB25) (**Table 10**).

Table 9 Calculated mineral saturation indices for selected ED1 water and groundwater samples

Date	Monitoring Location	Mineral Saturation Index (Log_{10} (K/Q))				
		Anhydrite	Gypsum	Aragonite	Calcite	Dolomite (dis)[1]
30/06/1992	ED1	-0.154	0.024	-11.44	-11.27	-22.41
3/08/2001	ED1	-0.233	-0.056	-11.41	-11.24	-22.16
31/01/2017	ED1	-0.150	0.028	-12.10	-11.94	-23.65
5/12/2000	MB10	-0.331	-0.153	-0.324	-0.159	-0.501
7/12/2010	MB10	-0.400	-0.222	0.473	0.638	1.047
14/12/2015	MB10	-0.383	-0.206	-0.179	-0.014	-0.232
31/01/2017	MB27D	-0.304	-0.127	-1.01	-0.843	-2.007
7/08/1997	MB2	-0.329	-0.151	-0.587	-0.422	-0.985
7/12/2010	MB2	-0.383	-0.205	0.239	0.404	0.642
14/12/2015	MB2	-0.365	-0.187	-0.244	-0.079	-0.332
31/01/2017	MB29	-1.464	-1.288	-1.510	-1.345	-2.991
31/01/2017	MB28	-1.123	-0.948	-1.741	-1.576	-3.122
31/01/2017	MB30	-1.191	-1.015	-1.162	-0.997	-2.117

Date	Monitoring Location	Mineral Saturation Index (Log_{10} (K/Q))				
		Anhydrite	Gypsum	Aragonite	Calcite	Dolomite (dis)[1]
31/01/2017	MB31	-1.069	-0.892	-0.922	-0.757	-1.626
7/08/1997	MB13	-1.930	-1.752	0.080	0.245	0.276
7/12/2010	MB13	-2.413	-2.236	0.710	0.875	1.475
14/12/2015	MB13	-2.164	-1.987	0.256	0.420	0.558
31/01/2017	MB23	-1.927	-1.749	-0.860	-0.695	-1.902
31/01/2017	MB26S	-0.240	-0.063	-0.779	-0.615	-1.481
23/06/2009	MB3	-2.374	-2.197	-1.150	-0.985	-2.462
28/03/2012	MB3	-2.374	-2.196	-0.652	-0.487	-1.457
19/09/2016	MB3	-2.470	-2.292	-0.189	-0.024	-0.549
6/12/1996	MB7	-1.914	-1.738	0.793	0.958	1.956
28/05/2009	MB7	-1.745	-1.570	0.113	0.277	0.475
28/03/2012	MB7	-1.808	-1.632	0.184	0.349	0.643
28/06/2016	MB7	-1.848	-1.672	0.504	0.669	1.302

Note 1: Disordered dolomite.

Table 10 Calculated mineral saturation indices for selected ED2 water and groundwater samples

Date	Monitoring Location	Mineral Saturation Index (Log_{10} (K/Q))				
		Anhydrite	Gypsum	Aragonite	Calcite	Dolomite (dis)[1]
30/06/1992	ED2	-0.089	-21.50	0.089	-11.02	-10.85
3/08/2001	ED2	-0.123	-21.97	0.055	-11.49	-11.33
31/01/2017	ED2	-0.114	-20.50	0.063	-10.643	-10.48
7/08/1997	MB11	-0.261	-1.049	-0.084	-0.584	-0.419
30/04/2010	MB11	-0.234	-16.51	-0.057	-8.860	-8.696
28/06/2016	MB11	-0.167	-17.93	0.009	-9.561	-9.396
7/08/1997	MB12	-0.279	-6.593	-0.101	-3.571	-3.406
30/04/2010	MB12	-0.167	0.412	0.009	-0.402	-0.237
28/06/2016	MB12	-0.199	-18.32	-0.022	-9.770	-9.605
3/07/2000	MB19	-0.358	-0.029	-0.181	0.121	0.285
30/04/2010	MB19	-0.342	1.371	-0.164	0.794	0.959
27/06/2016	MB19	-0.203	0.379	-0.025	0.248	0.413
2/04/2000	MB20	-0.240	-0.185	-0.062	0.008	0.173
30/04/2010	MB20	-0.388	0.763	-0.210	0.460	0.625
27/06/2016	MB20	-0.305	0.569	-0.127	0.372	0.537

Date	Monitoring Location	Mineral Saturation Index (Log_{10} (K/Q))				
		Anhydrite	Gypsum	Aragonite	Calcite	Dolomite (dis)[1]
31/01/2017	MB24	-0.510	-0.685	-0.332	-0.344	-0.179
31/01/2017	MB25	-0.393	-0.985	-0.215	-0.536	-0.371
7/08/1997	MB13	-1.930	0.276	-1.752	0.080	0.245
7/12/2010	MB13	-2.413	1.475	-2.236	0.710	0.875
14/12/2015	MB13	-2.164	0.558	-1.987	0.256	0.420
31/01/2017	MB23	-1.927	-1.902	-1.749	-0.860	-0.695
31/01/2017	MB29	-1.464	-2.991	-1.288	-1.510	-1.345

Note 1: Disordered dolomite.

Chemical equilibrium modelling, based on calculated mineral SI, suggests potential anhydrite and/or gypsum precipitation in groundwater along the drainage channel beneath Crisp Creek and Allianoyonyiga Creek, or dilution mixing with a lower concentration source of water. Sulfate-mineral precipitation is inconsistent with increasing sulfate concentration measured in down-gradient groundwater over time or relative to background). Dilution mixing is not plausible because higher sulfate concentrations are measured in evaporation dam water compared to background groundwater quality.

The chemical equilibrium modelling suggests gypsum dissolution or mixing with higher concentration groundwater along flow paths beneath Allianoyonyiga Creek. The former is inconsistent with observations that anhydrite/gypsum ($CaSO_4$) is absent in the Woodlawn mineralisation (McKay and Hazeldene 1987) and the main sulfate mineral phase is barite ($BaSO_4$), which is highly insoluble. Mixing with higher concentration groundwater is not plausible since lower sulfate concentration is observed in background groundwater compared to water contained in ED2. Higher sulfate concentrations measured at MB11 and MB12 indicates sulfate inputs from sources other than those derived from the evaporation dam water (possibly localised oxidation of pyrite).

In view of the above, the hydrochemistry data and mineral SI calculations indicate that the water contained within ED1 and ED2 is the source of the high sulfate concentrations measured in down-gradient groundwater samples. As the acidic water from ED1 and ED2 seeps beneath the dam and transits along the natural drainage channel that underlie Crisp Creek and Allianoyonyiga Creek, respectively, it dissolves and reacts with carbonate minerals. Since the pH of the groundwater along the flow path remains circum-neutral, this suggests that the rate of seepage is low such that the acid buffering capacity of the natural groundwater and surrounding rocks are not exceeded. Natural groundwater recharge by rainfall is unlikely to provide sufficient buffering since rainwater is naturally weakly acidic (due to atmospheric CO_2) and contains very low acid buffering capacity. The low seepage rate is likely in response to the decreasing hydraulic head exerted by the water in the evaporation dams since the cessation of mining and the low permeability of the subsurface below and in the surrounds of ED1 and ED2.

In view of this, mixing experiments based on geochemical modelling was used to assess whether the observed seepage chemistry is the plausible result of mixing of evaporation dam water and groundwater sources.

9.7 Geochemical Mixing Modelling

The effect of mixing between evaporation water and groundwater sources on the observed seepage chemistry was evaluated using The Geochemist's Workbench (Bethke and Aqueous Solutions LLC 2012). The REACT module was used to develop reaction path models to predict the chemical speciation and the solution's saturation state with respect to minerals in response to changes in water chemistry due to mixing. For reaction path modelling, the software first performs a speciation calculation to bring the aqueous system to equilibrium. It then begins tracing the reaction path by

adjusting a system component (e.g. sulfate concentration and pH) one incremental step at a time and recalculates the new equilibrium state. This continues until the default 100 increments (or reaction path steps) have been added. The sum of all steps is known as the reaction path.

Model simulations were conducted in which the background groundwater source was mixed with evaporation dam water through a titration, with results evaluated in 10% increments. The mixing simulation conditions therefore ranged from pure background groundwater to pure evaporation dam water. The simulation of a range of mixing ratios is intended to provide indicative conditions that may occur when these two water types are mixed and reacted together.

The water contained within ED1 was considered as an open system to atmospheric oxygen, and groundwater are oxygenated with an electron activity (pε) of 3.4 (i.e. +200 millivolts (mV)). The average composition of ED1 water (June 1992 to January 2017) and background groundwater within the Silurian-Devonian dolerite (August 1997 to January 2017) was used in model simulations.

shows the predicted change in sulfate concentrations and pH due to mixing of groundwater within the Silurian-Devonian dolerite with ED1 water. The results of the geochemical modelling suggests that mixing fraction (i.e. ratio of evaporation dam water to groundwater) between 0.26 to 0.47 would result in sulfate concentrations down-gradient of ED1 ranging from approximately 3000 mg/L to 5100 mg/L compared to observed concentrations ranging from 3030 mg/L to 5200 mg/L measured in MB10, MB27D and MB2 groundwater samples. At these mixing fractions, the pH in the resulting groundwater () is predicted to range from pH 5.8 to pH 6.5 (observed pH in groundwater samples range from pH 5.6 to 7.9).

The predicted change in sulfate concentrations and pH due to the mixing of background groundwater, intersecting the Lower Devonian/Silurian-Devonian sequence, with ED2 water is shown in . It is predicted that mixing fractions from 0.10 to 0.11 would result in groundwater containing sulfate concentrations ranging from 2300 mg/L to 2500 mg/L (), with pH values ranging from 6.89 to 6.92 (). This is comparable to the pH values (6.42 to 6.99) and sulfate concentrations (2400 mg/L to 2500 mg/L) measured at monitoring bore MB24, which is located along the flow path beneath Allianoyonyiga Creek approximately 600 m downstream of the western embankment of ED2. The predicted sulfate concentrations in the hypothetical groundwater do not reconcile with those measured in MB11 and MB12 because the model simulations does not take into account additional sulfate inputs derived from the oxidation of localised mineral sulfides such as pyrite.

The geochemical mixing simulation results suggest that the observed seepage chemistry is plausible as a result of the mixing between evaporation dam water and groundwater sources. It is recognised that the predicted mixing fraction would be reduced if acid buffering reactions of the surrounding rocks is taking into account in the model simulations.

9.8 Conclusions

The nature and extent, and pathway for potential pollutants from ED1 and ED2 to seep into the surrounding environment has been assessed based on the data collected over the past 20 years from the evaporation dams and associated network of groundwater monitoring bores.

The hydrochemistry data combined with chemical equilibrium (i.e. mineral SI) and geochemical mixing modelling indicate that the water contained within ED1 and ED2 is the source of the high sulfate concentrations measured in down-gradient groundwater samples along the natural drainage channel that underlie Crisp Creek and Allianoyonyiga Creek, respectively.

As the acidic water from ED1 and ED2 seep beneath the dam and transits along the natural drainage channel that underlie Crisp Creek and Allianoyonyiga Creek, respectively, it dissolves and reacts with carbonate minerals. Since the pH of the groundwater along the flow path remains circum-neutral, this suggests that the rate of seepage is low such that the acid buffering capacity of the natural groundwater and surrounding rocks are not exceeded.