Appendix I – Moisture content test results

Cardno Geotech Pty Ltd
ABN: 48 137 480 034
Address:
72 McCombe Road,
Davenport WA 6230

Laboratory: Geotech Bunbury
Phone: 08 9726 2187 Fax: 08 9721 2348
Email: paul.kent@cardno.com

MOISTURE CONTENT REPORT

Client:	GHD Pty Ltd	Report Number:	5029/R/1984-1
Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 1 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6396	5029/S/6399	5029/S/6401	5029/S/6402
ID / Client ID	-	-	-	-
Lot Number	A01 Sample 3 Depth 0.6m	A01 Sample 6 Depth 1.2m	A01 Sample 8 Depth 1.8m	A01 Sample 9 Depth 2.0m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	13/08/2015	13/08/2015	13/08/2015	13/08/2015
Material Source	-	-	-	-
Material Type	Grey Silty SAND	Yellow silty SAND	Brown clayey Sand	Grey Silty SAND
Test Request				
Area				
Moisture Content (%)	**15.4**	**15.2**	**14.7**	**14.5**

Sample Number	5029/S/6404	5029/S/6405	5029/S/6407	5029/S/6412
ID / Client ID	-	-	-	-
Lot Number	A01 Sample 11 Depth 2.8m	A01 Sample 13 Depth 3.8m	A01 Sample 16 Depth 7.5m	A02 Sample 4 Depth 0.8m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	13/08/2015	13/08/2015	13/08/2015	13/08/2015
Material Source	-	-	-	-
Material Type	Grey Silty SAND	Grey Silty SAND	Grey Silty SAND	Yellow silty SAND
Test Request				
Area				
Moisture Content (%)	**14.0**	**16.6**	**20.6**	**18.4**

Remarks

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Approved Signatory: Janine Fischer
Form ID: W20Rep Rev 1

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MOISTURE CONTENT REPORT

Client:	GHD Pty Ltd	Report Number:	5029/R/1984-1
Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 2 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6414	5029/S/6416	5029/S/6418	5029/S/6419
ID / Client ID	-	-	-	-
Lot Number	A02 Sample 6 Depth 1.3m	A02 Sample 8 Depth 1.8m	A02 Sample 10 Depth 2.3m	A02 Sample 11 Depth 2.5m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	14/08/2015	14/08/2015	14/08/2015	14/08/2015
Material Source	-	-	-	-
Material Type	Grey Sandy CLAY	Yellow silty SAND	Grey Silty SAND	Grey Sandy CLAY
Test Request				
Area				
Moisture Content (%)	**16.5**	**15.9**	**17.1**	**16.4**

Sample Number	5029/S/6420	5029/S/6422	5029/S/6423	5029/S/6424
ID / Client ID	-	-	-	-
Lot Number	A02 Sample 12 Depth 2.8m	A03 Sample 2 Depth 0.2m	A03 Sample 3 Depth 0.5m	A03 Sample 4 Depth 0.7m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	14/08/2015	14/08/2015	14/08/2015	19/08/2015
Material Source	-	-	-	-
Material Type	Grey Silty SAND	Grey Silty SAND	Grey Sandy CLAY	Yellow silty SAND
Test Request				
Area				
Moisture Content (%)	**15.2**	**13.5**	**12.4**	**14.1**

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MOISTURE CONTENT REPORT

Client:	GHD Pty Ltd	Report Number:	5029/R/1984-1
Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 3 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6426	5029/S/6428	5029/S/6429	5029/S/6430
ID / Client ID	-	-	-	-
Lot Number	A03 Sample 6 Depth 1.3m	A03 Sample 8 Depth 1.8m	A03 Sample 9 Depth 2.1m	A03 Sample 10 Depth 2.3m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	19/08/2015	19/08/2015	19/08/2015	19/08/2015
Material Source	-	-	-	-
Material Type	Brown clayey Sand	Yellow silty SAND	Yellow silty SAND	Grey SAND
Test Request				
Area				
Moisture Content (%)	**11.9**	**14.5**	**15.3**	**17.3**

Sample Number	5029/S/6439	5029/S/6440	5029/S/6442	5029/S/6443
ID / Client ID	-	-	-	-
Lot Number	A04 Sample 7 Depth 1.5m	A04 Sample 8 Depth 1.8m	A04 Sample 10 Depth 2.3m	A04 Sample 11 Depth 2.5m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	19/08/2015	19/08/2015	19/08/2015	19/08/2015
Material Source	-	-	-	-
Material Type	Yellow silty SAND	Yellow silty SAND	Yellow silty SAND	Grey Clayey SAND
Test Request				
Area				
Moisture Content (%)	**20.3**	**16.9**	**15.3**	**14.3**

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Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 4 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6444	5029/S/6450	5029/S/6452	5029/S/6453
ID / Client ID	-	-	-	-
Lot Number	A04 Sample 12 Depth 2.8m	A05 Sample 6 Depth 1.3m	A05 Sample 8 Depth 1.8m	A05 Sample 9 Depth 2.0m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	19/08/2015	19/08/2015	19/08/2015	19/08/2015
Material Source	-	-	-	-
Material Type	Grey SAND	Yellow silty SAND	Grey Silty SAND	Grey Clayey SAND
Test Request				
Area				
Moisture Content (%)	**14.2**	**16.2**	**15.5**	**13.6**

Sample Number	5029/S/6454	5029/S/6458	5029/S/6459	5029/S/6467
ID / Client ID	-	-	-	-
Lot Number	A05 Sample 10 Depth 2.2m	A05 Sample 15 Depth 4.8m	A05 Sample 18 Depth 7.5m	A06 Sample 8 Depth 1.7m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	19/08/2015	19/08/2015	19/08/2015	19/08/2015
Material Source	-	-	-	-
Material Type	Grey Clayey SAND	Grey Silty SAND	Grey Silty SAND	Grey Clayey SAND
Test Request				
Area				
Moisture Content (%)	**16.0**	**13.6**	**21.6**	**13.7**

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Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 5 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6468	5029/S/6473	5029/S/6474	5029/S/6475
ID / Client ID	-	-	-	-
Lot Number	A06 Sample 9 Depth 2.1m	A07 Sample 3 Depth 0.5m	A07 Sample 4 Depth 0.8m	A07 Sample 5 Depth 1.0m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	19/08/2015	19/08/2015	19/08/2015	19/08/2015
Material Source	-	-	-	-
Material Type	Grey Silty SAND	Grey Clayey SAND	Yellow Sandy SILT	Yellow silty SAND
Test Request				
Area				
Moisture Content (%)	**13.0**	**18.8**	**16.6**	**17.4**

Sample Number	5029/S/6482	5029/S/6484	5029/S/6486	5029/S/6487
ID / Client ID	-	-	-	-
Lot Number	A07 Sample 12 Depth 2.8m	A08 Sample 2 Depth 0.2m	A08 Sample 4 Depth 0.8m	A08 Sample 5 Depth 1.0m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	19/08/2015	24/08/2015	24/08/2015	24/08/2015
Material Source	-	-	-	-
Material Type	Grey SAND	Grey Silty SAND	Grey Silty SAND	Grey Silty SAND
Test Request				
Area				
Moisture Content (%)	**12.5**	**10.5**	**9.7**	**12.5**

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Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 6 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6488	5029/S/6489	5029/S/6490	5029/S/6491
ID / Client ID	-	-	-	-
Lot Number	A08 Sample 6 Depth 1.2m	A08 Sample 7 Depth 1.5m	A08 Sample 8 Depth 1.8m	A08 Sample 9 Depth 2.0m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	24/08/2015	24/08/2015	24/08/2015	24/08/2015
Material Source	-	-	-	-
Material Type	Grey Silty SAND	Brown clayey Sand	Yellow silty SAND	Grey Clayey SAND
Test Request				
Area				
Moisture Content (%)	**12.7**	**11.8**	**12.0**	**13.7**

Sample Number	5029/S/6496	5029/S/6497	5029/S/6498	5029/S/6499
ID / Client ID	-	-	-	-
Lot Number	A09 Sample 2 Depth 0.2m	A09 Sample 3 Depth 0.5m	A09 Sample 4 Depth 0.8m	A09 Sample 5 Depth 1.0m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	24/08/2015	24/08/2015	25/08/2015	25/08/2015
Material Source	-	-	-	-
Material Type	Grey Clayey SAND	Yellow silty SAND	Brown clayey Sand	Yellow SAND
Test Request				
Area				
Moisture Content (%)	**11.3**	**14.5**	**11.4**	**11.5**

Remarks

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Client:	GHD Pty Ltd	Report Number:	5029/R/1984-1
Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 7 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6500	5029/S/6501	5029/S/6503	5029/S/6506
ID / Client ID	-	-	-	-
Lot Number	A09 Sample 6 Depth 1.4m	A09 Sample 7 Depth 1.6m	A09 Sample 9 Depth 2.0m	A09 Sample 12 Depth 2.6m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	25/08/2015	25/08/2015	25/08/2015	25/08/2015
Material Source	-	-	-	-
Material Type	Grey SAND	Yellow SAND	Grey SAND	Grey SAND
Test Request				
Area				
Moisture Content (%)	**15.2**	**13.4**	**14.0**	**16.3**

Sample Number	5029/S/6514	5029/S/6515	5029/S/6516	5029/S/6517
ID / Client ID	-	-	-	-
Lot Number	A11 Sample 2 Depth 0.2m	A11 Sample 3 Depth 0.5m	A11 Sample 4 Depth 0.8m	A11 Sample 5 Depth 1.0m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	25/08/2015	25/08/2015	25/08/2015	25/08/2015
Material Source	-	-	-	-
Material Type	Grey Silty SAND	Yellow SAND	Grey SAND	Grey SAND
Test Request				
Area				
Moisture Content (%)	**16.0**	**16.7**	**13.3**	**14.9**

Remarks

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Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 8 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6518	5029/S/6520	5029/S/6521	5029/S/6522
ID / Client ID	-	-	-	-
Lot Number	A11 Sample 6 Depth1.3m	A11 Sample 8 Depth 1.8m	A11 Sample 9 Depth 2.0m	A11 Sample 10 Depth 2.3m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	25/08/2015	25/08/2015	25/08/2015	25/08/2015
Material Source	-	-	-	-
Material Type	Grey Silty SAND	Grey Sandy CLAY	Grey SAND	Grey SAND
Test Request				
Area				
Moisture Content (%)	**18.5**	**18.8**	**18.9**	**16.4**

Sample Number	5029/S/6524	5029/S/6529	5029/S/6530	5029/S/6532
ID / Client ID	-	-	-	-
Lot Number	A11 Sample 12 Depth 2.8m	A12 Sample 5 Depth 1.0m	A12 Sample 6 Depth 1.3m	A12 Sample 8 Depth 1.8m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	25/08/2015	26/08/2015	26/08/2015	26/08/2015
Material Source	-	-	-	-
Material Type	Grey Clayey SAND	Brown SAND	Yellow Gravelly SAND	Grey SAND
Test Request				
Area				
Moisture Content (%)	**17.0**	**13.6**	**12.4**	**14.0**

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Client:	GHD Pty Ltd	Report Number:	5029/R/1984-1
Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 9 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6533	5029/S/6534	5029/S/6536	5029/S/6542
ID / Client ID	-	-	-	-
Lot Number	A12 Sample 9 Depth 2.0m	A12 Sample 10 Depth 2.3m	A12 Sample 12 Depth 2.8m	A13 Sample 6 Depth 1.4m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	26/08/2015	26/08/2015	26/08/2015	27/08/2015
Material Source	-	-	-	-
Material Type	Grey Clayey SAND	Grey SAND	Grey SAND	Grey Clayey SAND
Test Request				
Area				
Moisture Content (%)	**13.7**	**13.4**	**15.1**	**16.0**

Sample Number	5029/S/6545	5029/S/6546	5029/S/6547	5029/S/6551
ID / Client ID	-	-	-	-
Lot Number	A13 Sample 9 Depth 2.0m	A13 Sample 10 Depth 2.3m	A13 Sample 11 Depth 2.5m	A14 Sample 3 Depth 0.4m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	27/08/2015	27/08/2015	27/08/2015	27/08/2015
Material Source	-	-	-	-
Material Type	Grey SAND	Grey SAND	Grey Sandy CLAY	Yellow SAND
Test Request				
Area				
Moisture Content (%)	**20.0**	**18.1**	**18.5**	**20.3**

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Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 10 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6552	5029/S/6553	5029/S/6554	5029/S/6555
ID / Client ID	-	-	-	-
Lot Number	A14 Sample 4 Depth 0.8m	A14 Sample 5 Depth 1.0m	A14 Sample 6 Depth 1.3m	A14 Sample 7 Depth 1.5m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	28/08/2015	28/08/2015	28/08/2015	28/08/2015
Material Source	-	-	-	-
Material Type	Grey Sandy CLAY	Grey SAND	Grey SAND	Grey Clayey SAND
Test Request				
Area				
Moisture Content (%)	**18.9**	**13.5**	**10.6**	**12.1**

Sample Number	5029/S/6556	5029/S/6564	5029/S/6565	5029/S/6566
ID / Client ID	-	-	-	-
Lot Number	A14 Sample 8 Depth 1.8m	A15 Sample 4 Depth 0.9m	A15 Sample 5 Depth 1.0m	A15 Sample 6 Depth 1.3m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	28/08/2015	28/08/2015	28/08/2015	28/08/2015
Material Source	-	-	-	-
Material Type	Grey SAND	Grey SAND	Grey Sandy CLAY	Grey Silty SAND
Test Request				
Area				
Moisture Content (%)	**14.5**	**19.1**	**21.2**	**21.6**

Remarks

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MOISTURE CONTENT REPORT

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Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 11 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6567	5029/S/6569	5029/S/6571	5029/S/6574
ID / Client ID	-	-	-	-
Lot Number	A15 Sample 7 Depth 1.5m	A15 Sample 9 Depth 2.0m	A15 Sample 11 Depth 2.5m	A15 Sample 14 Depth 4.2m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	28/08/2015	28/08/2015	28/08/2015	28/08/2015
Material Source	-	-	-	-
Material Type	Grey Silty SAND	Grey Sandy CLAY	Grey SAND	Grey SAND
Test Request				
Area				
Moisture Content (%)	**26.3**	**14.5**	**15.9**	**17.1**

Sample Number	5029/S/6577	5029/S/6579	5029/S/6580	5029/S/6581
ID / Client ID	-	-	-	-
Lot Number	A16 Sample 3 Depth 0.6m	A16 Sample 5 Depth 1.0m	A16 Sample 6 Depth 1.3m	A16 Sample 7 Depth 1.5m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	28/08/2015	28/08/2015	28/08/2015	28/08/2015
Material Source	-	-	-	-
Material Type	Grey Sandy CLAY	Grey Silty SAND	Grey Silty SAND	Grey Silty SAND
Test Request				
Area				
Moisture Content (%)	**28.2**	**21.1**	**26.1**	**25.2**

Remarks

NATA

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

Accreditation Number: 5029

Approved Signatory: Janine Fischer
Form ID: W20Rep Rev 1

Cardno Geotech Pty Ltd
ABN: 48 137 480 034
Address:
72 McCombe Road,
Davenport WA 6230

Laboratory: Geotech Bunbury
Phone: 08 9726 2187 Fax: 08 9721 2348
Email: paul.kent@cardno.com

MOISTURE CONTENT REPORT

Client:	GHD Pty Ltd	Report Number:	5029/R/1984-1
Client Address:	GHD House, 239 Adelaide Terrace, PERTH	Project Number:	5029/P/256
Project:	Keane Road Pressure Main	Lot Number:	Various
Location:	Perth	Internal Test Request:	5029/T/1144
Component:		Client Reference/s:	61/32259
Area Description:		Report Date / Page:	09/09/2015 Page 12 of 12

Test Procedures:	AS1289.2.1.1

Sample Number	5029/S/6582	5029/S/6583	5029/S/6589	5029/S/6590
ID / Client ID	-	-	-	-
Lot Number	A16 Sample 8 Depth 1.8m	A16 Sample 9 Depth 2.0m	A17 Sample 3 Depth 0.6m	A17 Sample 4 Depth 0.8m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	28/08/2015	28/08/2015	28/08/2015	28/08/2015
Material Source	-	-	-	-
Material Type	Grey Sandy CLAY	Grey Silty SAND	Grey Sandy CLAY	Grey Silty SAND
Test Request				
Area				
Moisture Content (%)	**24.7**	**22.9**	**21.9**	**22.5**

Sample Number	5029/S/6591	5029/S/6593	5029/S/6595	5029/S/6597
ID / Client ID	-	-	-	-
Lot Number	A17 Sample 5 Depth 1.1m	A17 Sample 7 Depth 1.5m	A17 Sample 9 Depth 2.0m	A17 Sample 11 Depth 2.5m
Date / Time Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015
Date Tested	28/08/2015	28/08/2015	28/08/2015	28/08/2015
Material Source	-	-	-	-
Material Type	Grey Silty SAND	Grey Sandy CLAY	Grey Sandy CLAY	Grey Silty SAND
Test Request				
Area				
Moisture Content (%)	**21.3**	**25.2**	**30.7**	**19.0**

Remarks

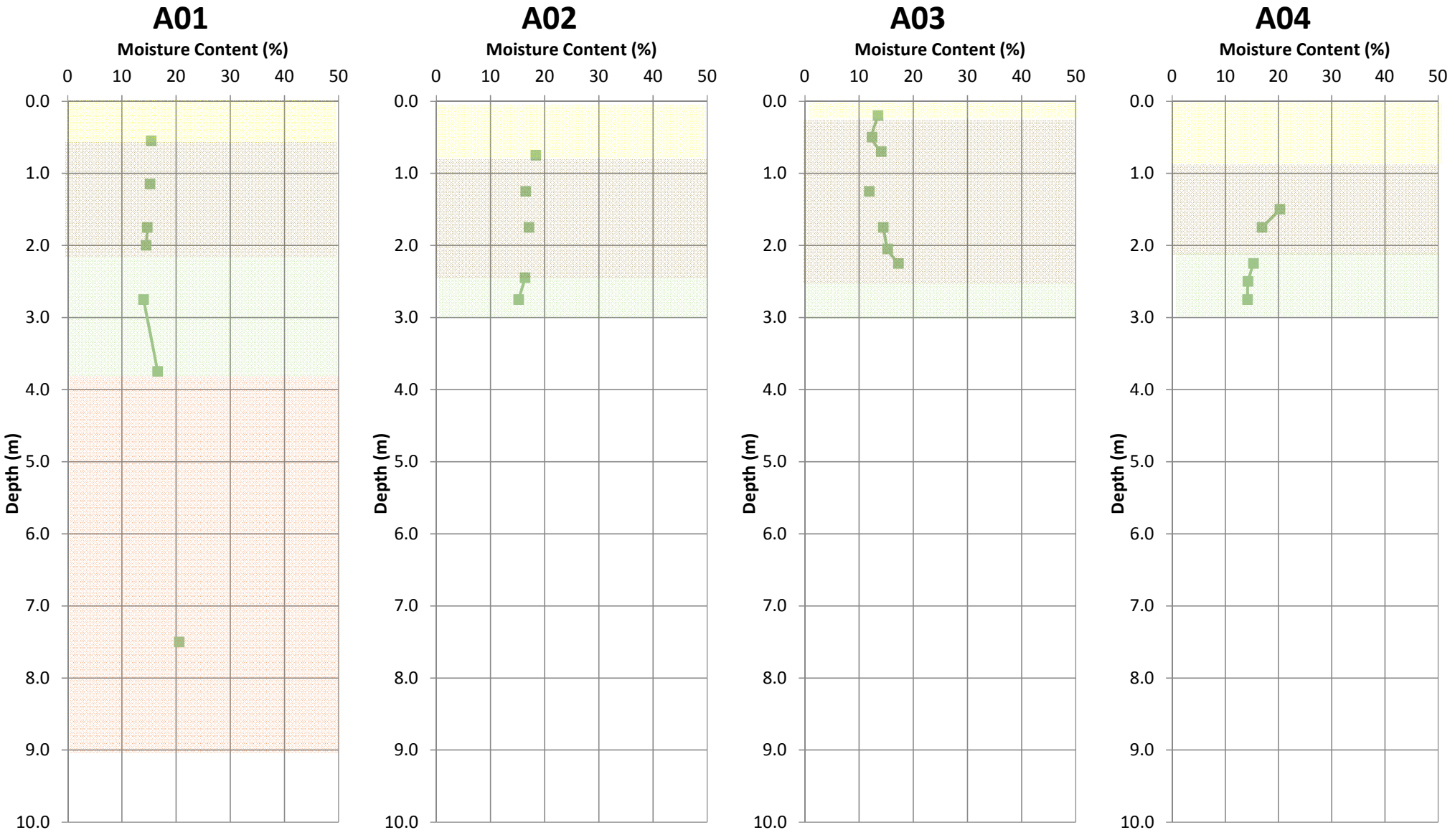
NATA

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

Accreditation Number: 5029

Approved Signatory: Janine Fischer
Form ID: W20Rep Rev 1

Appendix J – Logs of moisture content versus depth



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Drawn: TL	Date: 26/10/2015	Job Number: 61/32259	A4
Checked	Date		
Revision: 0	Date	Cad Reference: NA	

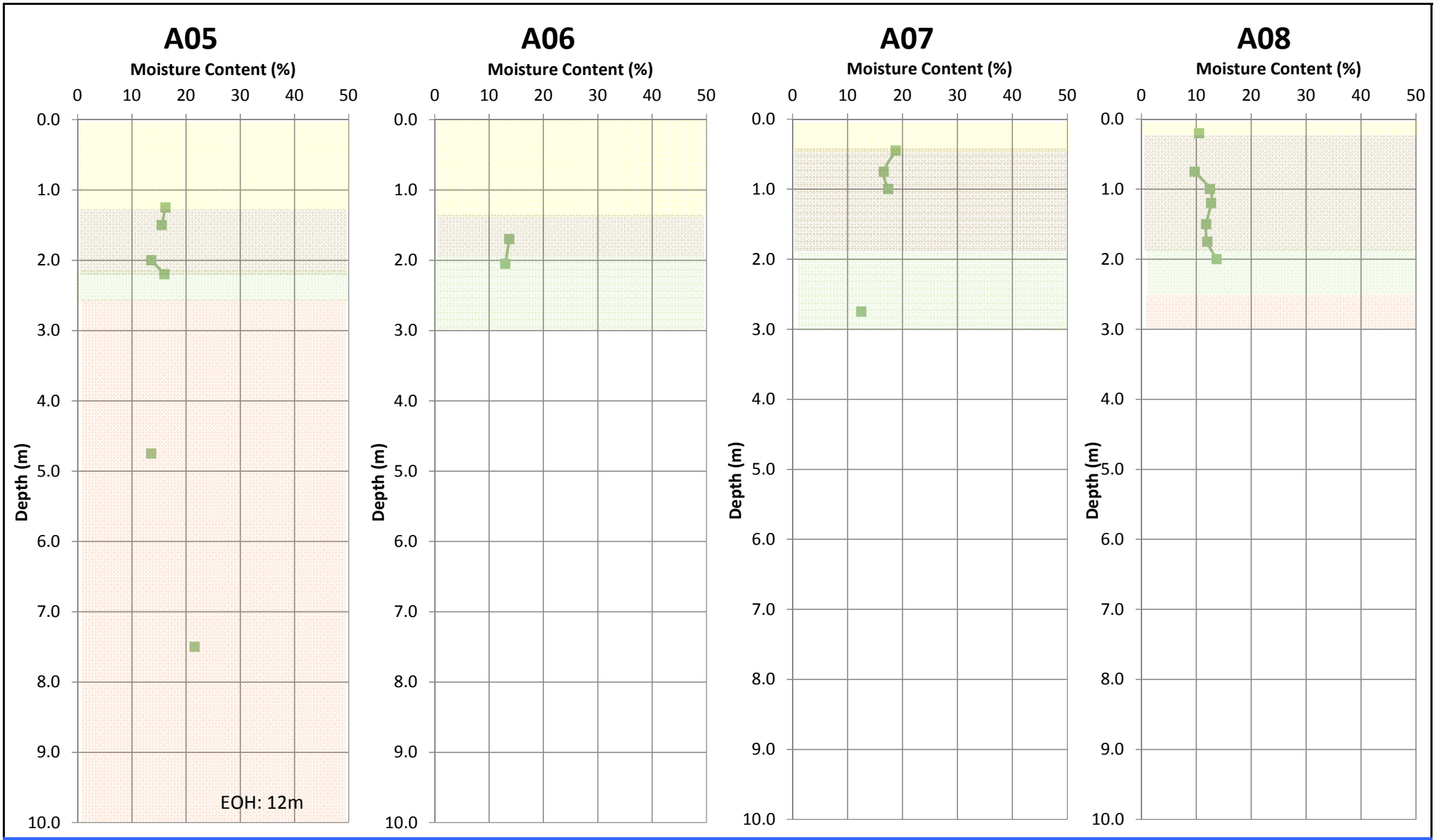
This drawing should be read in conjunction with report number 32259/151422/

Title: Moisture Content vs Depth A01 - A04

Client: Water Corporation

Project: Ballanup Sewer Pressure Main: Anstey-Keane Dampland Hydrological Assessment

Figure No



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Drawn: TL	Date: 26/10/2015	Job Number: 61/32259	A4
Checked	Date		
Revision: 0	Date	Cad Reference: NA	

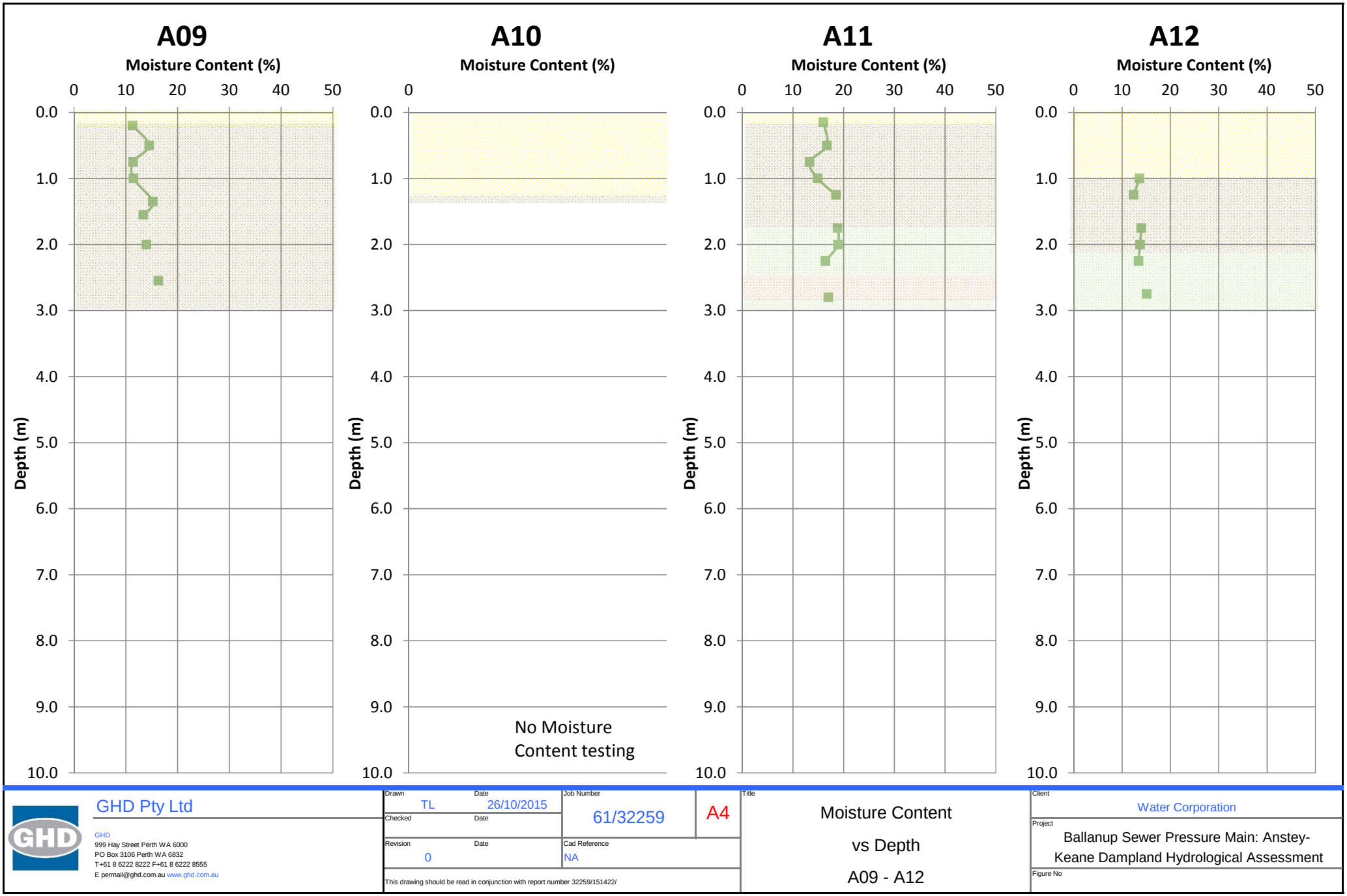
This drawing should be read in conjunction with report number 32259/151422/

Title: Moisture Content vs Depth A05 - A08

Client: Water Corporation

Project: Ballanup Sewer Pressure Main: Anstey-Keane Dampland Hydrological Assessment

Figure No



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Drawn: TL	Date: 26/10/2015	Job Number: 61/32259	A4
Checked	Date		
Revision: 0	Date	Cad Reference: NA	

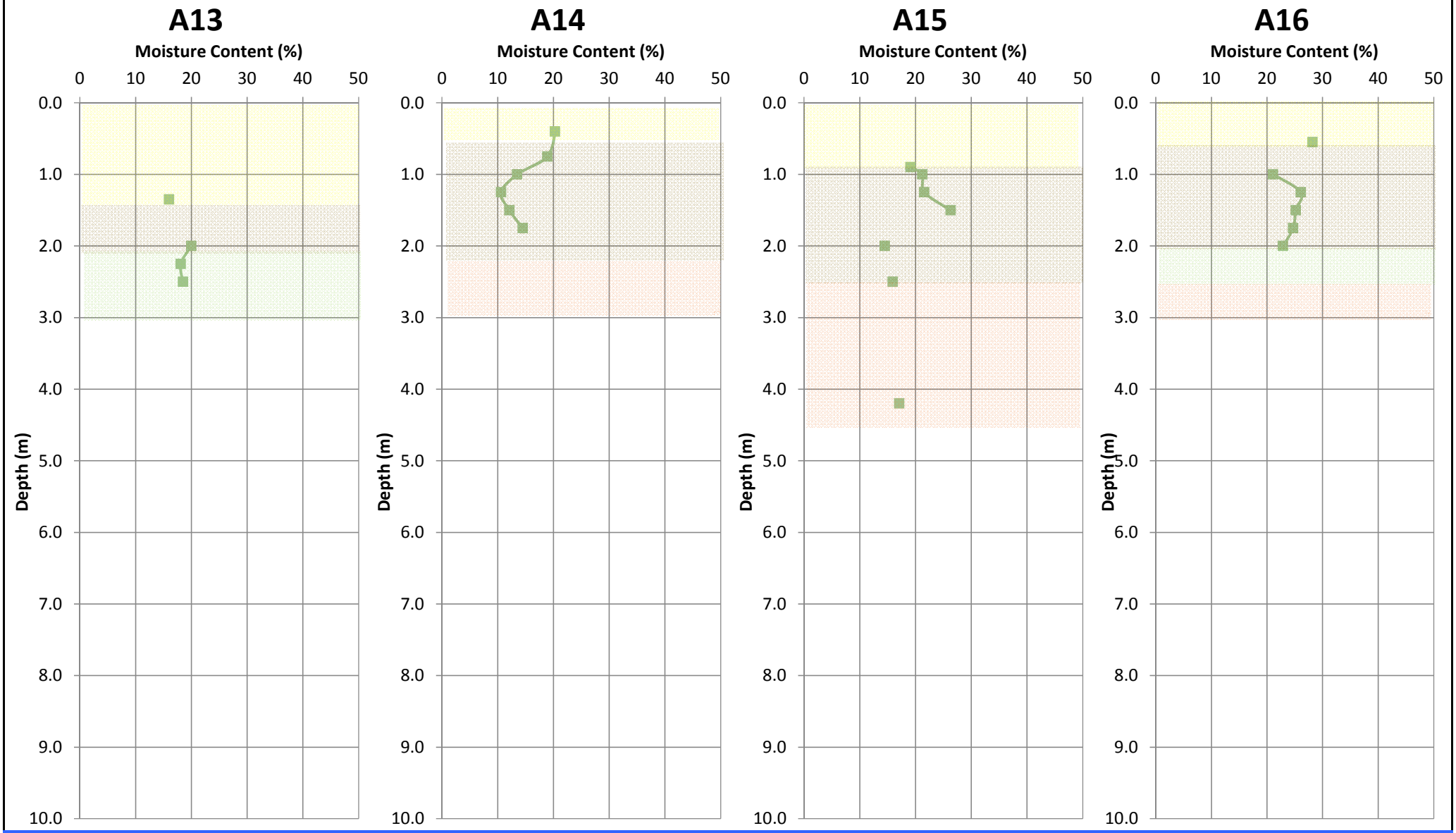
This drawing should be read in conjunction with report number 32259/151422/

Title: Moisture Content vs Depth A09 - A12

Client: Water Corporation

Project: Ballanup Sewer Pressure Main: Anstey-Keane Dampland Hydrological Assessment

Figure No



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Drawn: TL	Date: 26/10/2015	Job Number: 61/32259	A4
Checked	Date		
Revision: 0	Date	Cad Reference: NA	

This drawing should be read in conjunction with report number 32259/151422/

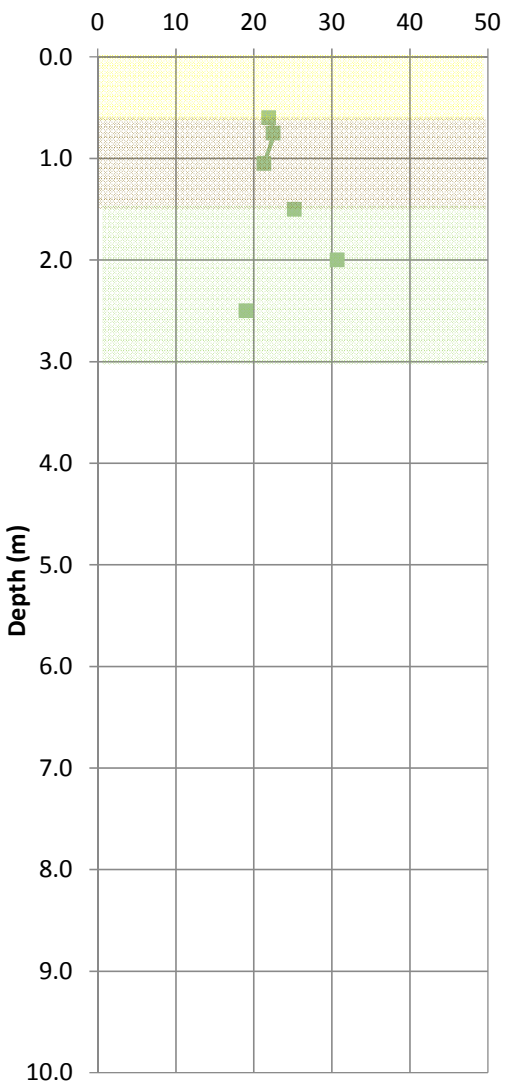
Title: Moisture Content vs Depth A13 - A15

Client: Water Corporation

Project: Ballanup Sewer Pressure Main: Anstey-Keane Dampland Hydrological Assessment

Figure No

A17



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Drawn: TL	Date: 26/10/2015	Job Number: 61/32259	A4	Title: Moisture Content vs Depth A17	Client: Water Corporation
Checked	Date				Project: Ballanup Sewer Pressure Main: Anstey-Keane Dampland Hydrological Assessment
Revision: 0	Date	Cad Reference: NA			Figure No

This drawing should be read in conjunction with report number 32259/151422/

Appendix K – Organic content test results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP1513555**	Page	: 1 of 9
Client	: **CARDNO GEOTECH**	Laboratory	: Environmental Division Perth
Contact	: PAUL KENT	Contact	: Customer Services EP
Address	: 72 McCombe Road Halifax, Bunbury Australia 6230	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: paul.kent@cardno.com.au	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: 08 9726 2187	Telephone	: +61-8-9209 7655
Facsimile	: ----	Facsimile	: +61-8-9209 7600
Project	: Keane Road Pressure Main	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: CG16-76	Date Samples Received	: 03-Sep-2015 10:20
C-O-C number	: ----	Date Analysis Commenced	: 10-Sep-2015
Sampler	: ----	Issue Date	: 10-Sep-2015 14:36
Site	: ----		
		No. of samples received	: 31
Quote number	: ----	No. of samples analysed	: 31

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Jeremy Truong	Laboratory Supervisor	Perth Inorganics

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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	A01-3-0.6m (S/6396)	A01-8-1.8m (S/6401)	A02-6-1.3m (S/6414)	A02-11-2.5m (S/6419)	A03-3-0.5m (S/6423)
				Client sampling date / time	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]
Compound	CAS Number	LOR	Unit		EP1513555-001	EP1513555-002	EP1513555-003	EP1513555-004	EP1513555-005
					Result	Result	Result	Result	Result
EP004: Organic Matter									
^ **Organic Matter**	----	0.5	%		<0.5	<0.5	<0.5	<0.5	<0.5
^ **Total Organic Carbon**	----	0.5	%		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	A03-6-1.3m (S/6426)	A04-5-1.0m (S/6437)	A04-11-2.5m (S/6443)	A05-9-2.0m (S/6453)	A05-10-2.2m (S/6454)
				Client sampling date / time	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]
Compound	CAS Number	LOR	Unit		EP1513555-006	EP1513555-007	EP1513555-008	EP1513555-009	EP1513555-010
					Result	Result	Result	Result	Result
EP004: Organic Matter									
^ **Organic Matter**	----	0.5	%		<0.5	<0.5	<0.5	<0.5	<0.5
^ **Total Organic Carbon**	----	0.5	%		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	A06-8-1.7m (S/6467)	A07-3-0.5m (S/6473)	A07-9-2.0m (S/6479)	A08-7-1.5m (S/6489)	A08-9-2.0m (S/6491)
			Client sampling date / time	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]
Compound	CAS Number	LOR	Unit	EP1513555-011	EP1513555-012	EP1513555-013	EP1513555-014	EP1513555-015
				Result	Result	Result	Result	Result
EP004: Organic Matter								
^ **Organic Matter**	----	0.5	%	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Total Organic Carbon**	----	0.5	%	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	A09-2-0.2m (S/6496)	A09-4-0.8m (S/6498)	A11-8-1.8m (S/6520)	A11-12-2.8m (S/6524)	A12-5-1.0m (S/6529)
				Client sampling date / time	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]
Compound	CAS Number	LOR	Unit		EP1513555-016	EP1513555-017	EP1513555-018	EP1513555-019	EP1513555-020
					Result	Result	Result	Result	Result
EP004: Organic Matter									
^ **Organic Matter**	----	0.5	%		<0.5	<0.5	<0.5	**0.6**	**0.9**
^ **Total Organic Carbon**	----	0.5	%		<0.5	<0.5	<0.5	<0.5	**0.5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	A12-9-2.0m (S/6533)	A13-6-1.4m (S/6542)	A13-11-2.5m (S/6547)	A14-4-0.8m (S/6552)	A14-7-1.5m (S/6555)
				Client sampling date / time	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]
Compound	CAS Number	LOR	Unit		EP1513555-021	EP1513555-022	EP1513555-023	EP1513555-024	EP1513555-025
					Result	Result	Result	Result	Result
EP004: Organic Matter									
^ **Organic Matter**	----	0.5	%		<0.5	<0.5	<0.5	<0.5	<0.5
^ **Total Organic Carbon**	----	0.5	%		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	A15-5-1.0m (S/6565)	A15-9-2.0m (S/6569)	A16-3-0.6m (S/6577)	A16-8-1.8m (S/6582)	A17-3-0.6m (S/6589)
				Client sampling date / time	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]	[02-Sep-2015]
Compound	CAS Number	LOR	Unit		EP1513555-026	EP1513555-027	EP1513555-028	EP1513555-029	EP1513555-030
					Result	Result	Result	Result	Result
EP004: Organic Matter									
^ **Organic Matter**	----	0.5	%		<0.5	<0.5	<0.5	<0.5	<0.5
^ **Total Organic Carbon**	----	0.5	%		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	A17-7-1.5m (S/6593)	----	----	----	----
				Client sampling date / time	[02-Sep-2015]	----	----	----	----
Compound	CAS Number	LOR	Unit		EP1513555-031	--------	--------	--------	--------
					Result	Result	Result	Result	Result
EP004: Organic Matter									
^ **Organic Matter**	----	0.5	%		<0.5	----	----	----	----
^ **Total Organic Carbon**	----	0.5	%		<0.5	----	----	----	----

Appendix L – Infiltration testing logs

HAND AUGER LOG

Location No.:	**P01**
	Sheet 1 of 1

Client: Water Corporation
Project: Balannup / Keane Road Pressure Main Additional Geotechnical Investigation
Job No.: 6132259

Coordinates: **E** 400 345, **N** 6443 728
Ground Surface Elevation: +22.8m AHD **Total Depth:** 0.4m
Commenced: 31-Jul-15 **Completed:** 31-Jul-15
Equipment Operator: T Lillo

Equipment: Hand Auger
Hole Diameter (mm): 50

Logged:	T Lillo	31-Jul-15
Processed:	T Lillo	01-Dec-15
Checked:		01-Dec-15

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
					SP	SAND Pale grey, fine to medium grained, trace fines BASSENDEAN SAND	M W	VL-L			Infiltration testing carried out at 0.15m depth	
	▼	0.35 [+22.5]				Termination Depth = 0.35m (Water/ Collapsing)						

HAND AUGER LOG

Location No.:	**P02**
	Sheet 1 of 1

Client: Water Corporation
Project: Balannup / Keane Road Pressure Main Additional Geotechnical Investigation
Job No.: 6132259

Coordinates: **E** 400 219, **N** 6443 840
Ground Surface Elevation: +22.8m AHD **Total Depth:** 0.4m
Commenced: 31-Jul-15 **Completed:** 31-Jul-15
Equipment Operator: T Lillo

Equipment: Hand Auger
Hole Diameter (mm): 50

Logged:	T Lillo	31-Jul-15
Processed:	T Lillo	01-Dec-15
Checked:		01-Dec-15

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
					SP	SAND Pale grey, fine to medium grained, trace fines BASSENDEAN SAND	M W	VL-L			Infiltration testing carried out at 0.25m depth	
	▼	0.40 [+22.4]				Termination Depth = 0.4m (Water/ Collapsing)						

HAND AUGER LOG

Location No.:	**P03**
	Sheet 1 of 1

Client: Water Corporation
Project: Balannup / Keane Road Pressure Main Additional Geotechnical Investigation
Job No.: 6132259

Coordinates: **E** 400 400, **N** 6443 822
Ground Surface Elevation: +22.6m AHD **Total Depth:** 0.6m
Commenced: 31-Jul-15 **Completed:** 31-Jul-15
Equipment Operator: T Lillo

Equipment: Hand Auger
Hole Diameter (mm): 50

Logged:	T Lillo	31-Jul-15
Processed:	T Lillo	01-Dec-15
Checked:		01-Dec-15

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
					SP	SAND Pale brown, fine to medium grained. BASSENDEAN SAND	D-M	VL-L			Infiltration testing carried out at 0.3m depth	
	▼	0.60 [+22.0]				Termination Depth = 0.6m (Water/ Collapsing)	M-W					

HAND AUGER LOG

Location No.: **P04**

Sheet 1 of 1

Client: Water Corporation
Project: Balannup / Keane Road Pressure Main Additional Geotechnical Investigation
Job No.: 6132259

Coordinates: **E** 400 513, **N** 6443 596
Ground Surface Elevation: +22.5m AHD **Total Depth:** 0.4m
Commenced: 31-Jul-15 **Completed:** 31-Jul-15
Equipment Operator: T Lillo

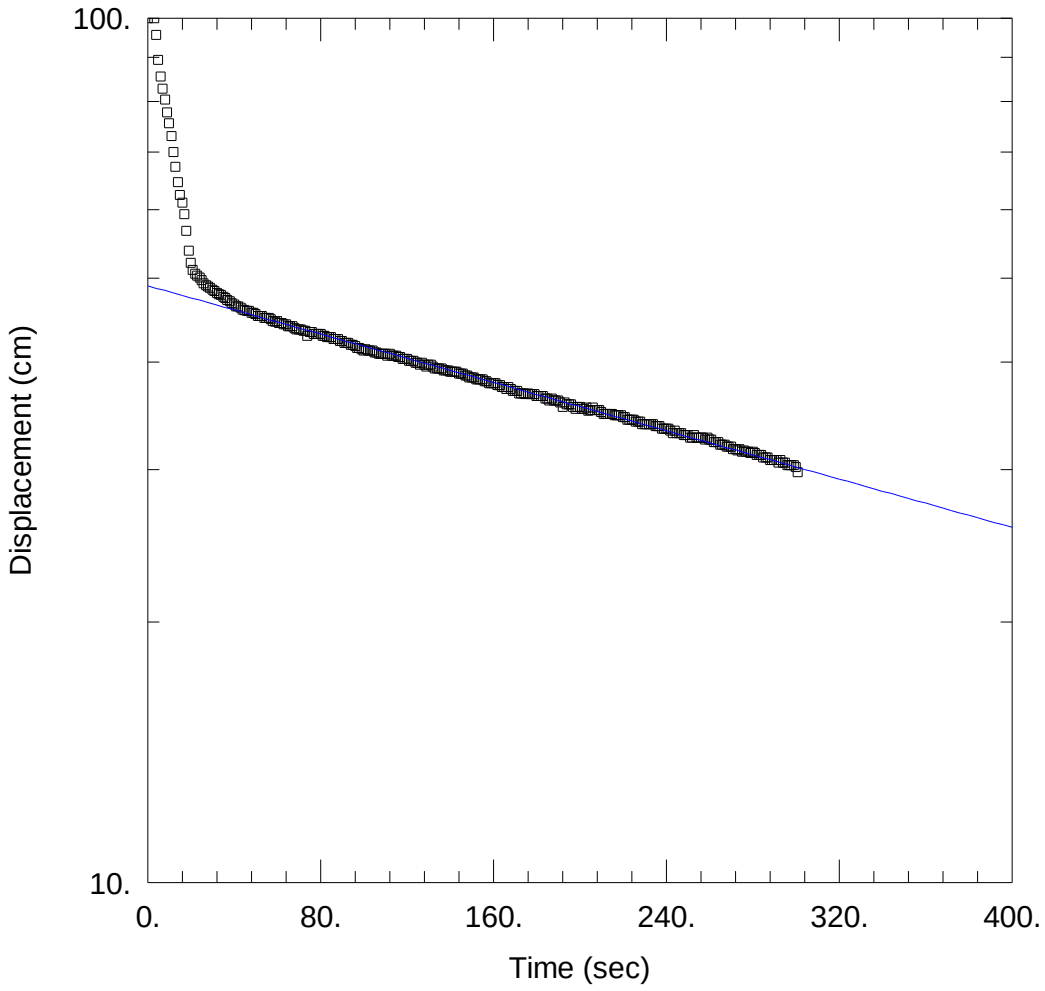
Equipment: Hand Auger
Hole Diameter (mm): 50

Logged:	T Lillo	31-Jul-15
Processed:	T Lillo	01-Dec-15
Checked:		01-Dec-15

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
					SP	SAND Pale brown-grey, fine to medium grained. BASSENDEAN SAND	M M-W	VL-L			Infiltration testing carried out at 0.25m depth	
	▼	0.35 [+22.2]				Termination Depth = 0.35m (Water/ Collapsing)						

Appendix M – Rising head test results

A01S



WELL TEST ANALYSIS

Data Set: G:\...\A01_shallow.aqt
Date: 09/09/15 Time: 17:13:07

PROJECT INFORMATION

Company: GHD
Client: Water Corporation
Project: 6132259
Location: Antsey-Keane Wetland
Test Well: A01-Shallow
Test Date: 08/09/2015

AQUIFER DATA

Saturated Thickness: 120. cm Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

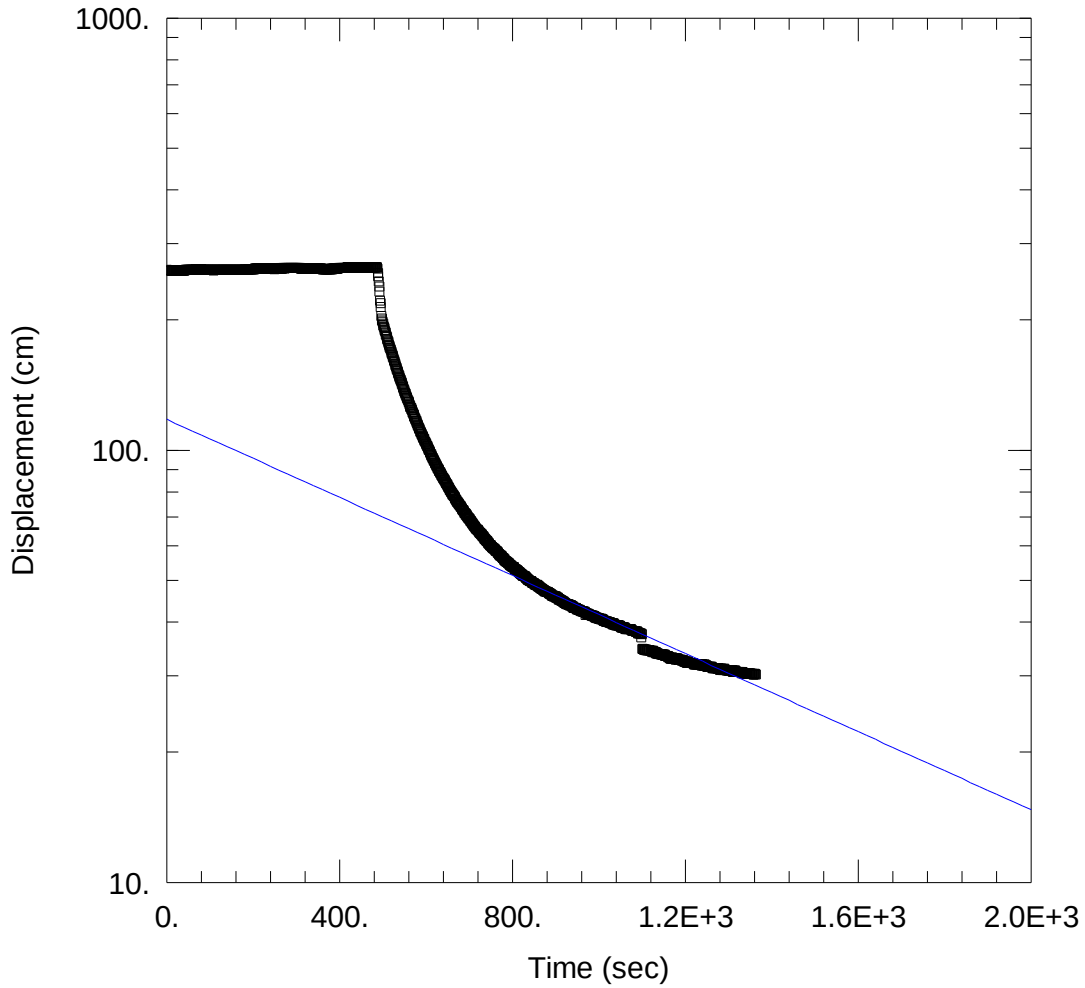
Initial Displacement: 100. cm
Total Well Penetration Depth: 190. cm
Casing Radius: 50. cm
Static Water Column Height: 100. cm
Screen Length: 100. cm
Well Radius: 50. cm

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 15.32 m/day y0 = 49. cm

A01D



WELL TEST ANALYSIS

Data Set: G:\61\32259\Technical\Hydrogeolocial\Rising head analysis\Aqtesolv\A01_deep.aqt
Date: 09/10/15 Time: 15:41:21

PROJECT INFORMATION

Company: GHD
Client: Water Corporation
Project: 6132259
Location: Antsey-Keane Wetland
Test Well: A01-Deep
Test Date: 08/09/2015

AQUIFER DATA

Saturated Thickness: 1000. cm Anisotropy Ratio (Kz/Kr): 1.

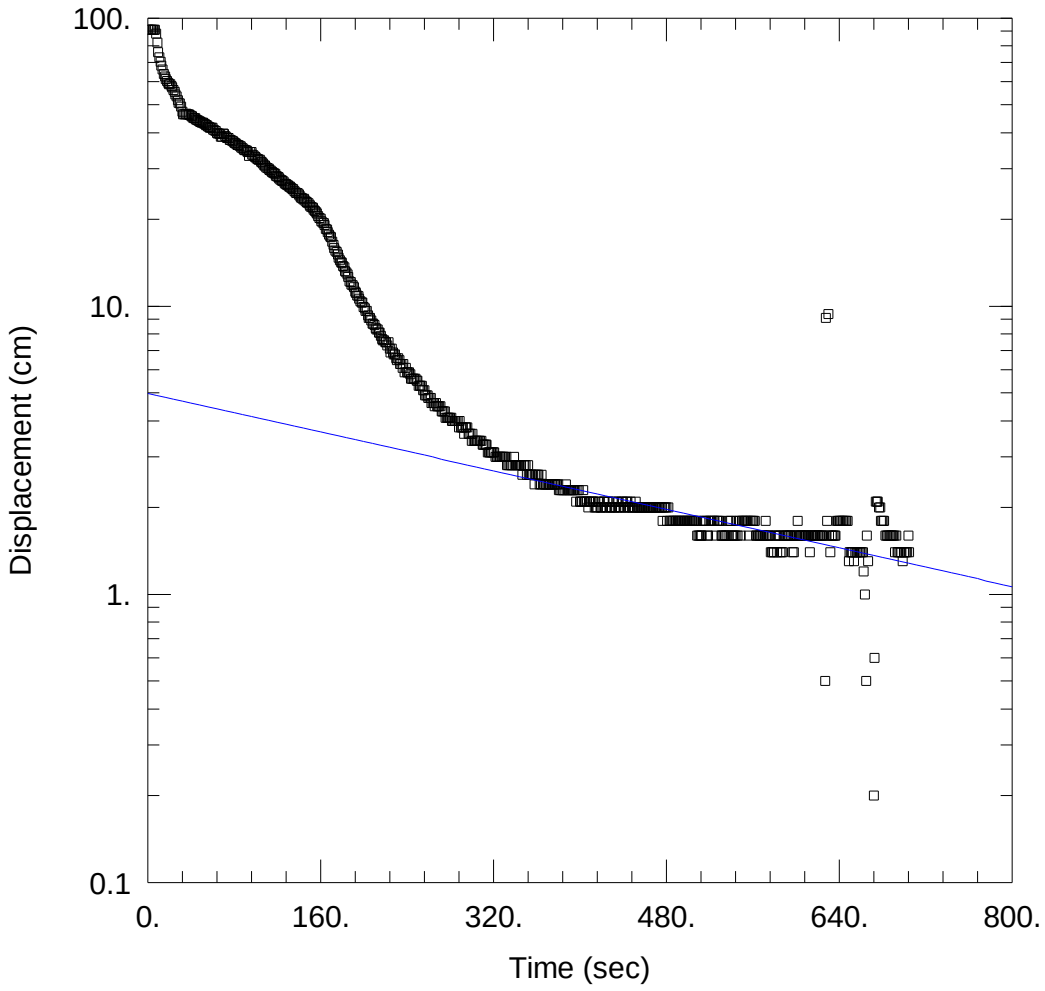
WELL DATA (New Well)

Initial Displacement: 261. cm
Total Well Penetration Depth: 1000. cm
Casing Radius: 50. cm
Static Water Column Height: 828. cm
Screen Length: 500. cm
Well Radius: 50. cm

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 4.534 m/day
y0 = 117.8 cm

A05S



WELL TEST ANALYSIS

Data Set: G:\...\A05_shallow.aqt
Date: 09/10/15 Time: 10:12:04

PROJECT INFORMATION

Company: GHD
Client: Water Corporation
Project: 6132259
Location: Antsey-Keane Wetland
Test Well: A05-Shallow
Test Date: 08/09/2015

AQUIFER DATA

Saturated Thickness: 175. cm Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

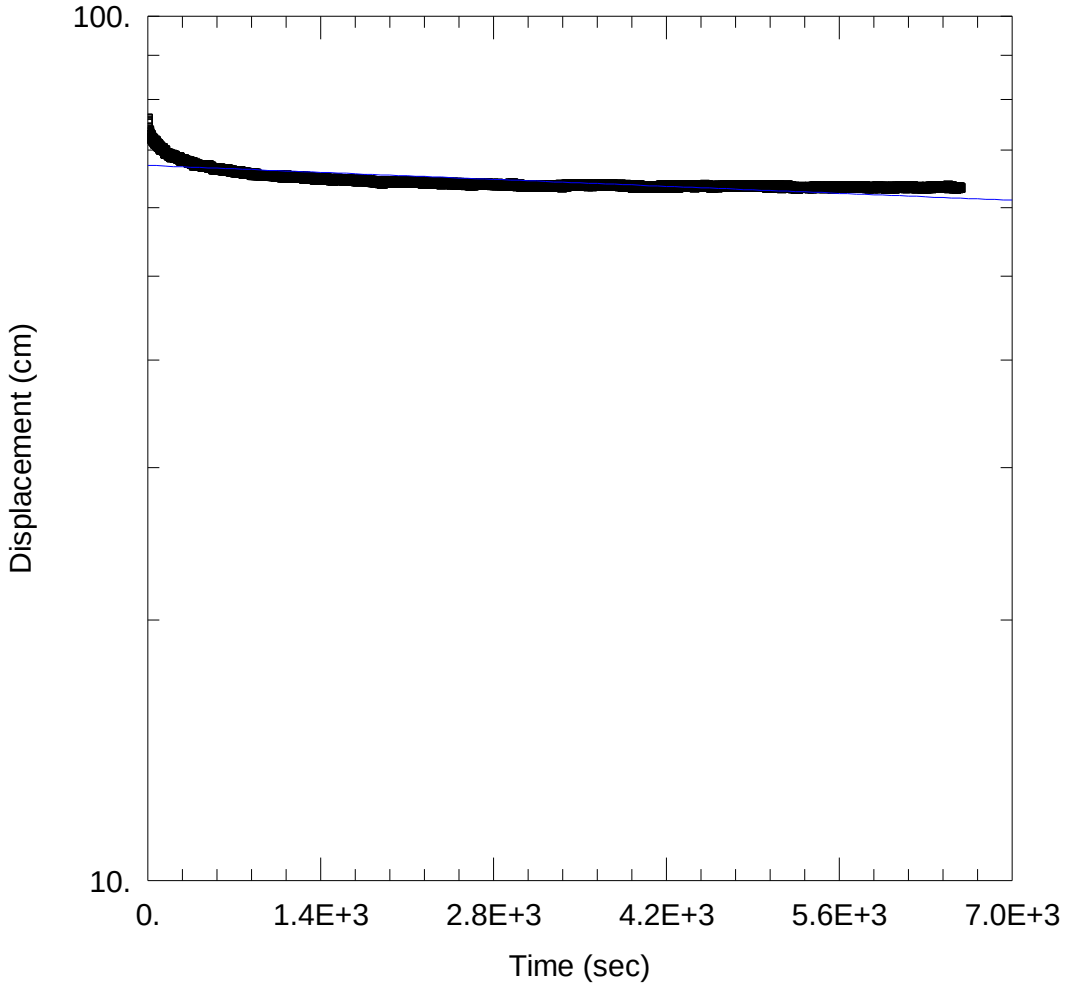
Initial Displacement: 91. cm
Total Well Penetration Depth: 200. cm
Casing Radius: 50. cm
Static Water Column Height: 91. cm
Screen Length: 150. cm
Well Radius: 50. cm

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 13.76 m/day
y0 = 4.974 cm

A07



WELL TEST ANALYSIS

Data Set: G:\61\32259\Technical\Fieldwork\Bore development and GW sampling\Aqtesolv\A07.aqt
Date: 09/10/15 Time: 11:26:57

PROJECT INFORMATION

Company: GHD
Client: Water Corporation
Project: 6132259
Location: Antsey-Keane Wetland
Test Well: A07
Test Date: 08/09/2015

AQUIFER DATA

Saturated Thickness: 150. cm Anisotropy Ratio (Kz/Kr): 1.

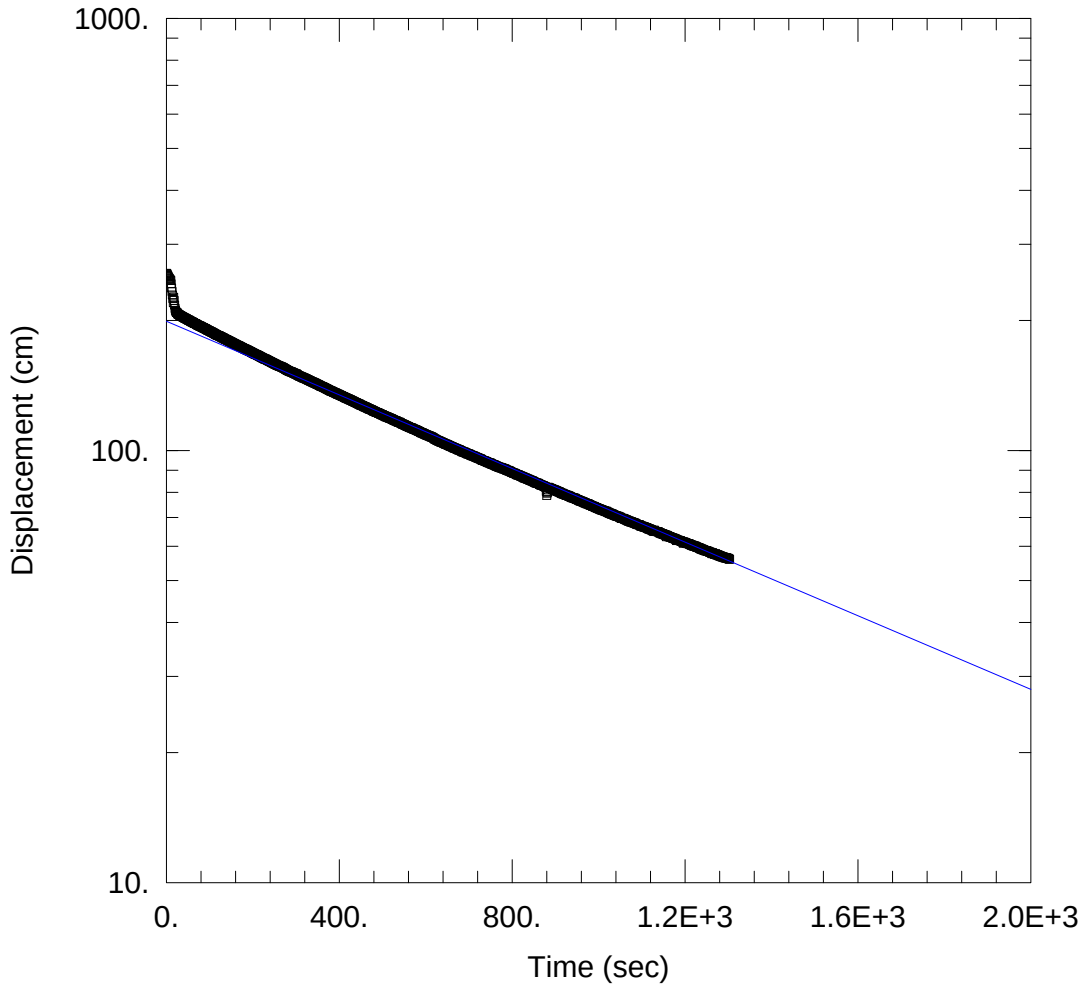
WELL DATA (New Well)

Initial Displacement: 76. cm
Total Well Penetration Depth: 150. cm
Casing Radius: 50. cm
Static Water Column Height: 76. cm
Screen Length: 100. cm
Well Radius: 50. cm

SOLUTION

Aquifer Model: Unconfined
K = 0.2072 m/day
Solution Method: Hvorslev
y0 = 67.15 cm

A15



WELL TEST ANALYSIS

Data Set: G:\61\32259\Technical\Hydrogeological\Rising head analysis\Aqtesolv\A15.aqt
Date: 10/19/15 Time: 09:23:52

PROJECT INFORMATION

Company: GHD
Client: Water Corporation
Project: 6132259
Location: Antsey-Keane Wetland
Test Well: A15
Test Date: 08/09/2015

AQUIFER DATA

Saturated Thickness: 600. cm Anisotropy Ratio (Kz/Kr): 1.

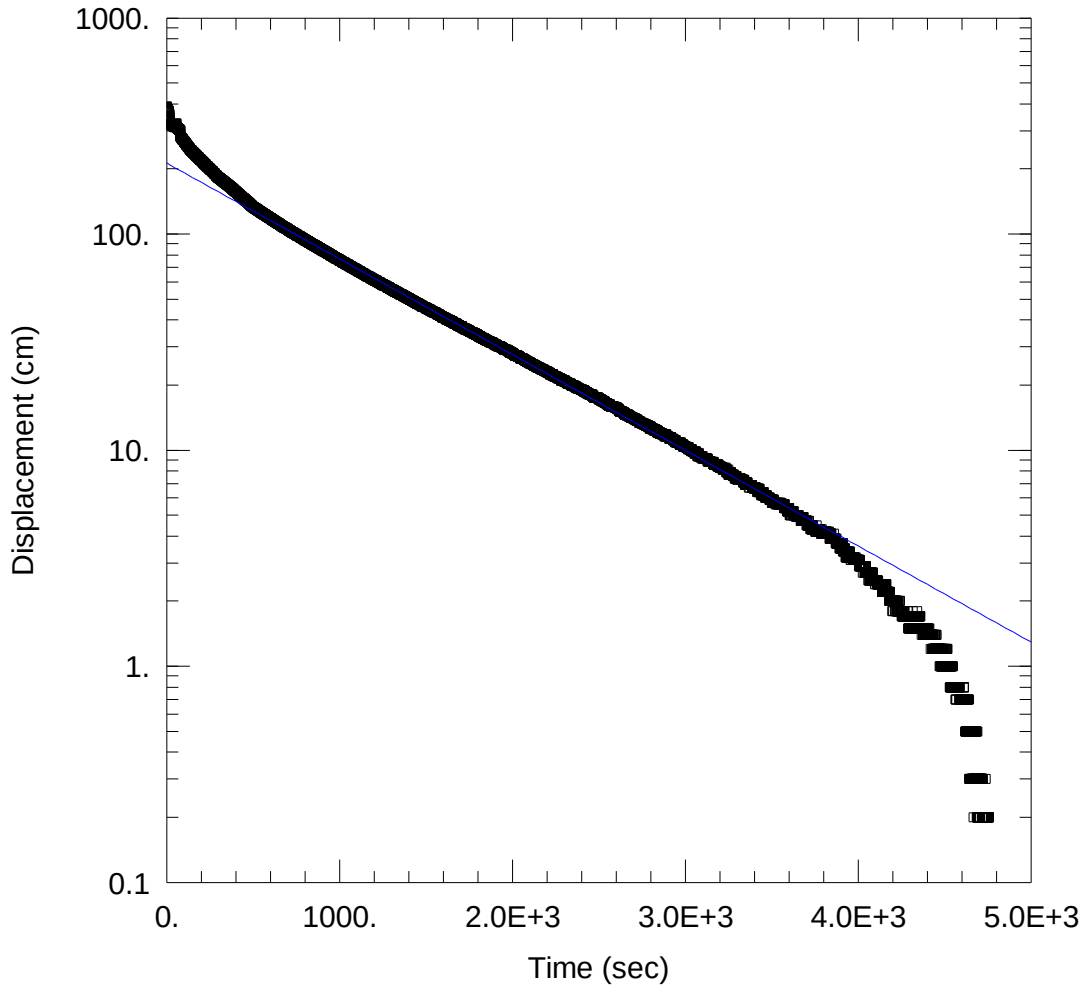
WELL DATA (New Well)

Initial Displacement: 257. cm
Total Well Penetration Depth: 348. cm
Casing Radius: 50. cm
Static Water Column Height: 257. cm
Screen Length: 100. cm
Well Radius: 50. cm

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 9.334 m/day
y0 = 199.1 cm

AR6



WELL TEST ANALYSIS

Data Set: G:\61\32259\Technical\Fieldwork\Bore development and GW sampling\Aqtesolv\AR6.aqt
Date: 09/10/15 Time: 12:08:18

PROJECT INFORMATION

Company: GHD
Client: Water Corporation
Project: 6132259
Location: Antsey-Keane Wetland
Test Well: AR6
Test Date: 08/09/2015

AQUIFER DATA

Saturated Thickness: 600. cm Anisotropy Ratio (Kz/Kr): 1.

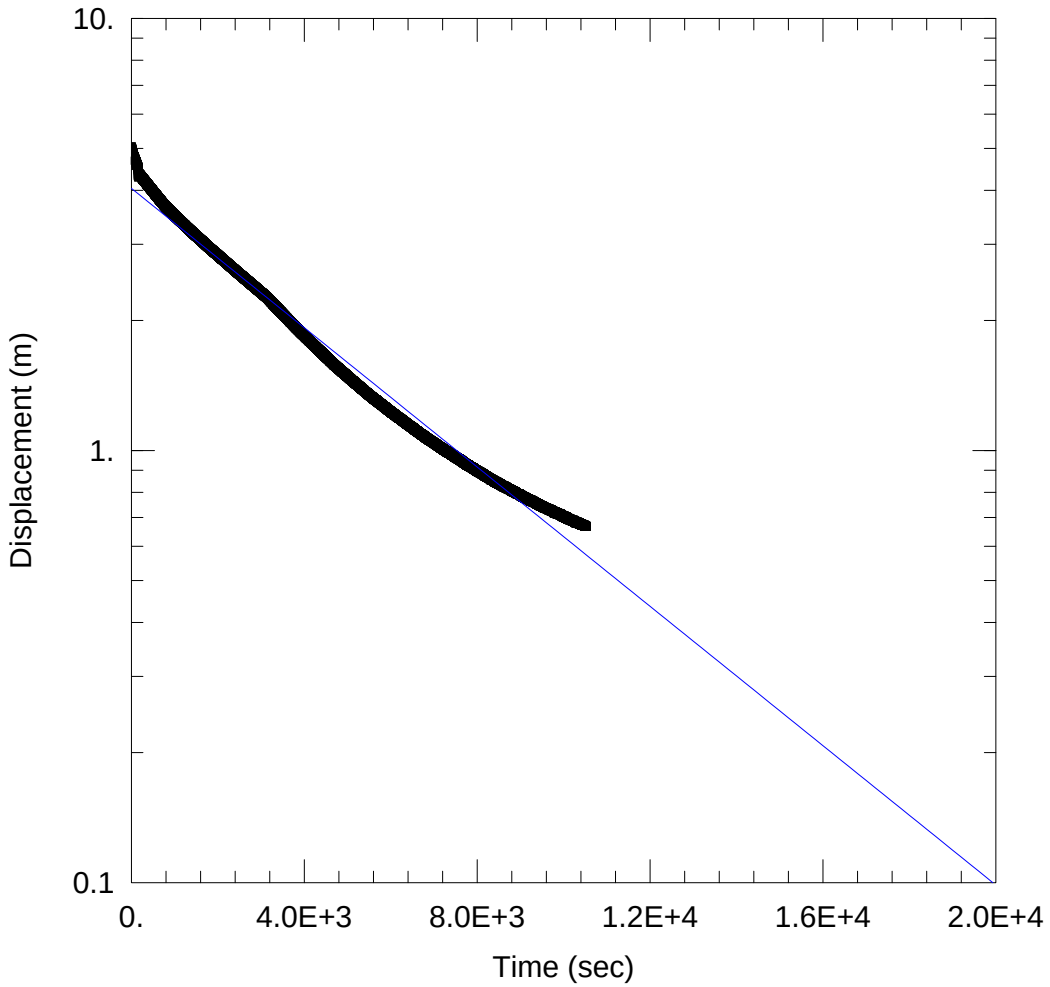
WELL DATA (New Well)

Initial Displacement: 389. cm
Total Well Penetration Depth: 574. cm
Casing Radius: 50. cm
Static Water Column Height: 389. cm
Screen Length: 350. cm
Well Radius: 50. cm

SOLUTION

Aquifer Model: Unconfined
K = 4.583 m/day
Solution Method: Bouwer-Rice
y0 = 212.9 cm

BH06S



WELL TEST ANALYSIS

Data Set:
Date: 10/08/15 Time: 12:29:13

PROJECT INFORMATION

Company: GHD
Client: Water Corporation
Project: 6132559
Location: Balannup/Keane Road Main
Test Well: BH06S
Test Date: 2/10/15

AQUIFER DATA

Saturated Thickness: 8. m Anisotropy Ratio (Kz/Kr): 1.

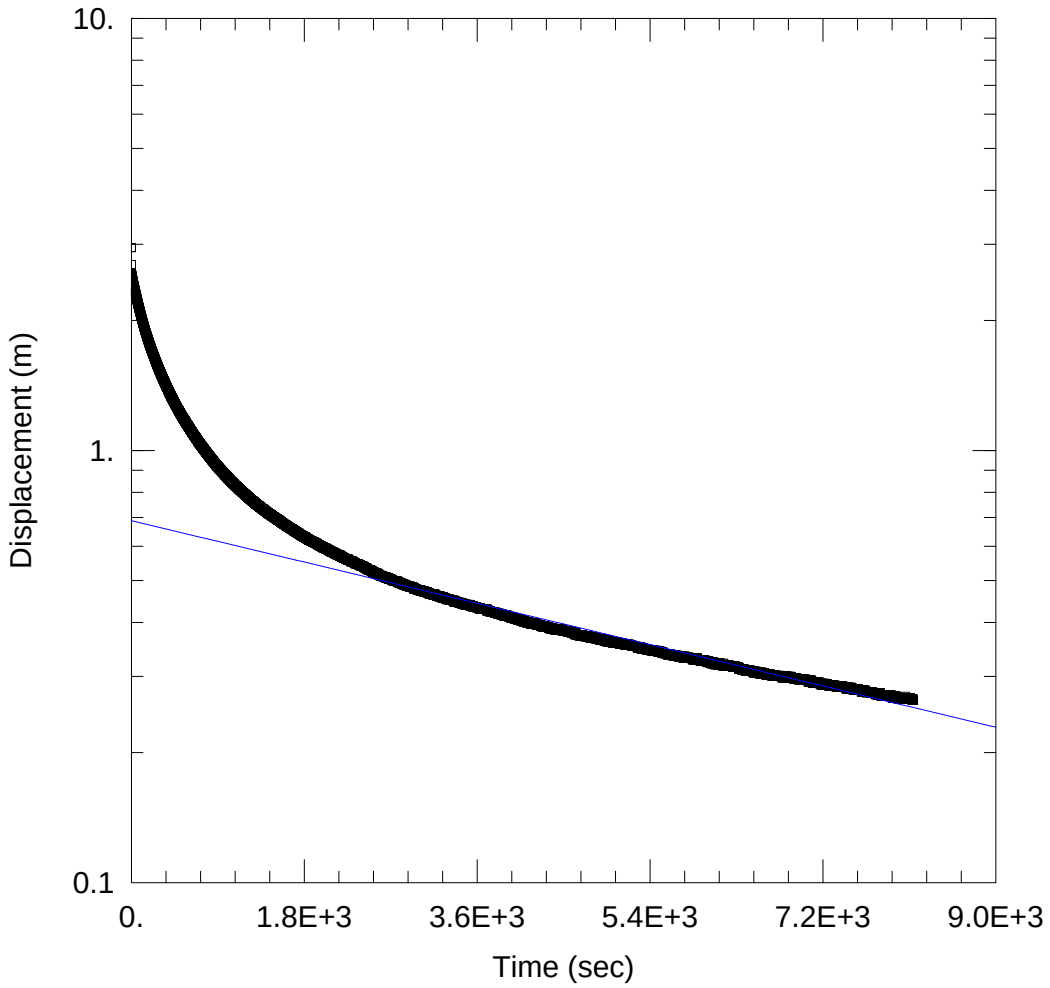
WELL DATA (BH06S)

Initial Displacement: 5.036 m
Total Well Penetration Depth: 8.18 m
Casing Radius: 0.06 m
Static Water Column Height: 6.45 m
Screen Length: 6.45 m
Well Radius: 0.06 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.01681 m/day
y0 = 4.042 m

BH06N



WELL TEST ANALYSIS

Data Set: G:\61\32259\Technical\Hydrogeological\Rising head analysis\Aqtesolv\BH06N.aqt
Date: 10/19/15 Time: 09:30:02

PROJECT INFORMATION

Company: GHD
Client: Water Corporation
Project: 6132559
Location: Balannup/Keane Road Main
Test Well: BH06N
Test Date: 2/10/15

AQUIFER DATA

Saturated Thickness: 8. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH06N)

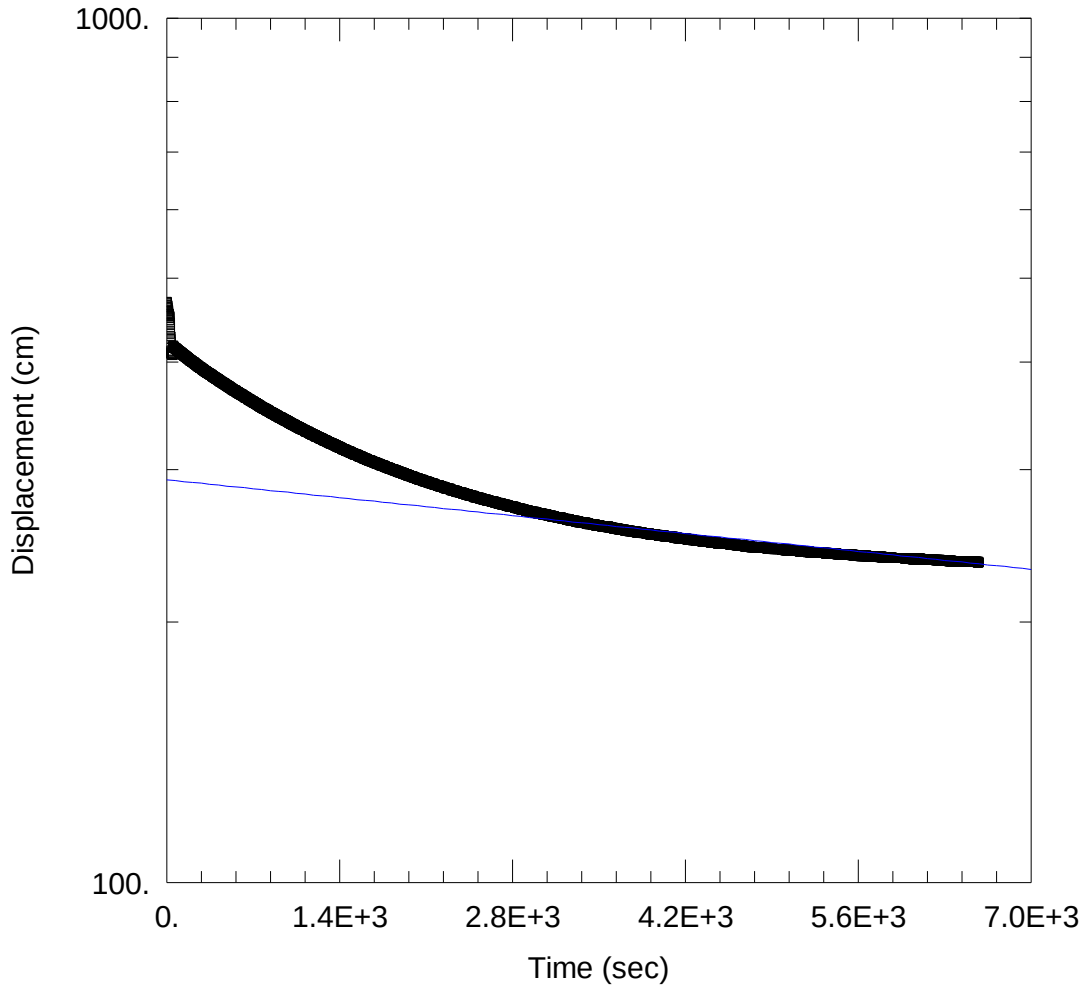
Initial Displacement: 2.947 m
Total Well Penetration Depth: 8. m
Casing Radius: 0.05 m
Static Water Column Height: 6. m
Screen Length: 6. m
Well Radius: 0.05 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 0.01206 m/day y0 = 0.6878 m

BH25



WELL TEST ANALYSIS

Data Set: G:\61\32259\Technical\Fieldwork\Bore development and GW sampling\Aqtesolv\BH25.aqt
Date: 09/10/15 Time: 12:30:04

PROJECT INFORMATION

Company: GHD
Client: Water Corporation
Project: 6132259
Location: Antsey-Keane Wetland
Test Well: BH25
Test Date: 08/09/2015

AQUIFER DATA

Saturated Thickness: 800. cm Anisotropy Ratio (Kz/Kr): 1.

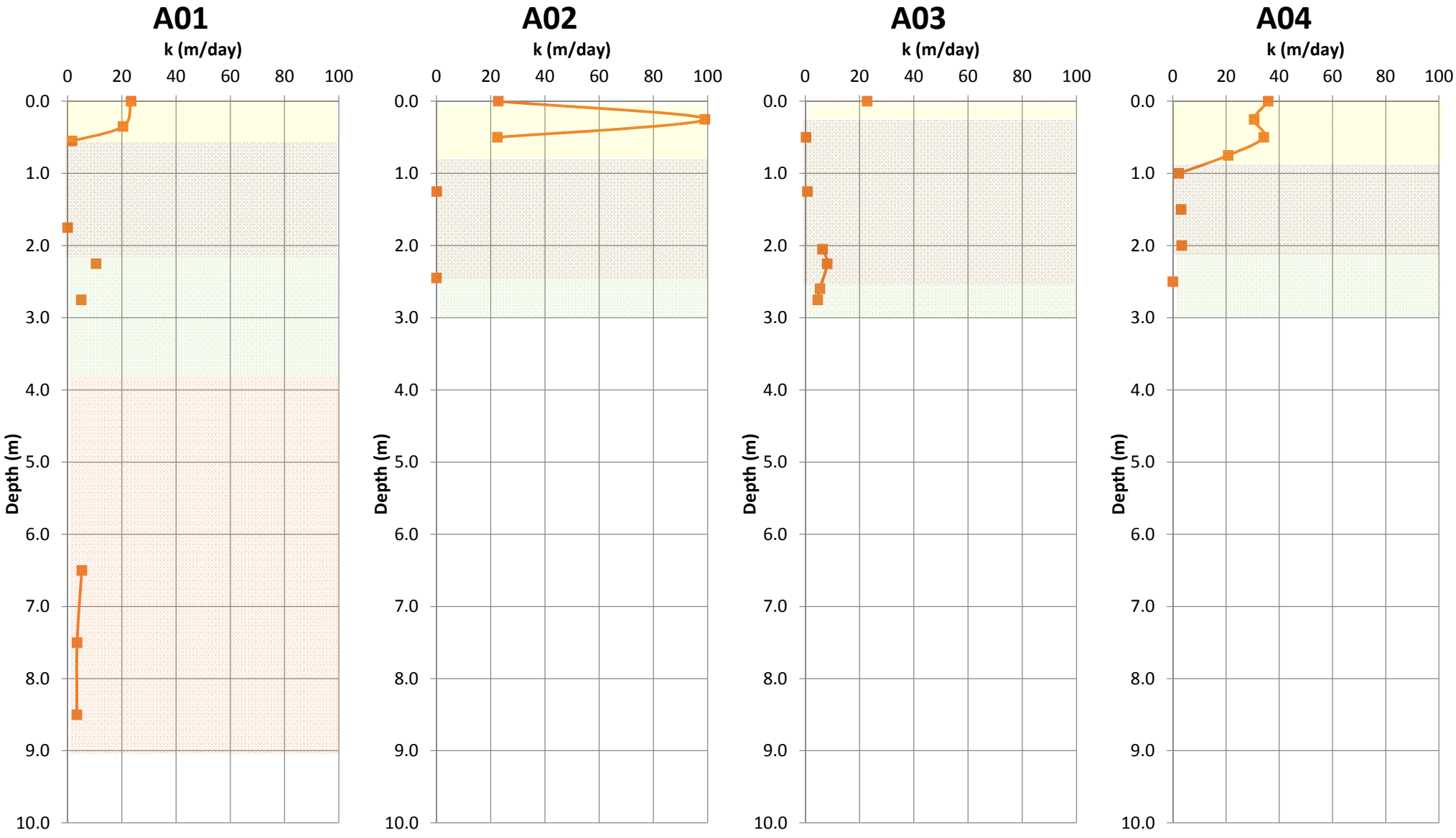
WELL DATA (New Well)

Initial Displacement: 469. cm
Total Well Penetration Depth: 653. cm
Casing Radius: 50. cm
Static Water Column Height: 469. cm
Screen Length: 500. cm
Well Radius: 50. cm

SOLUTION

Aquifer Model: Unconfined
K = 0.1137 m/day
Solution Method: Bouwer-Rice
y0 = 292.2 cm

Appendix N – Logs of conductivity versus depth



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Drawn: TL	Date: 26/10/2015	Job Number: 61/32259	A4
Checked	Date		
Revision: 0	Date	Cad Reference: NA	

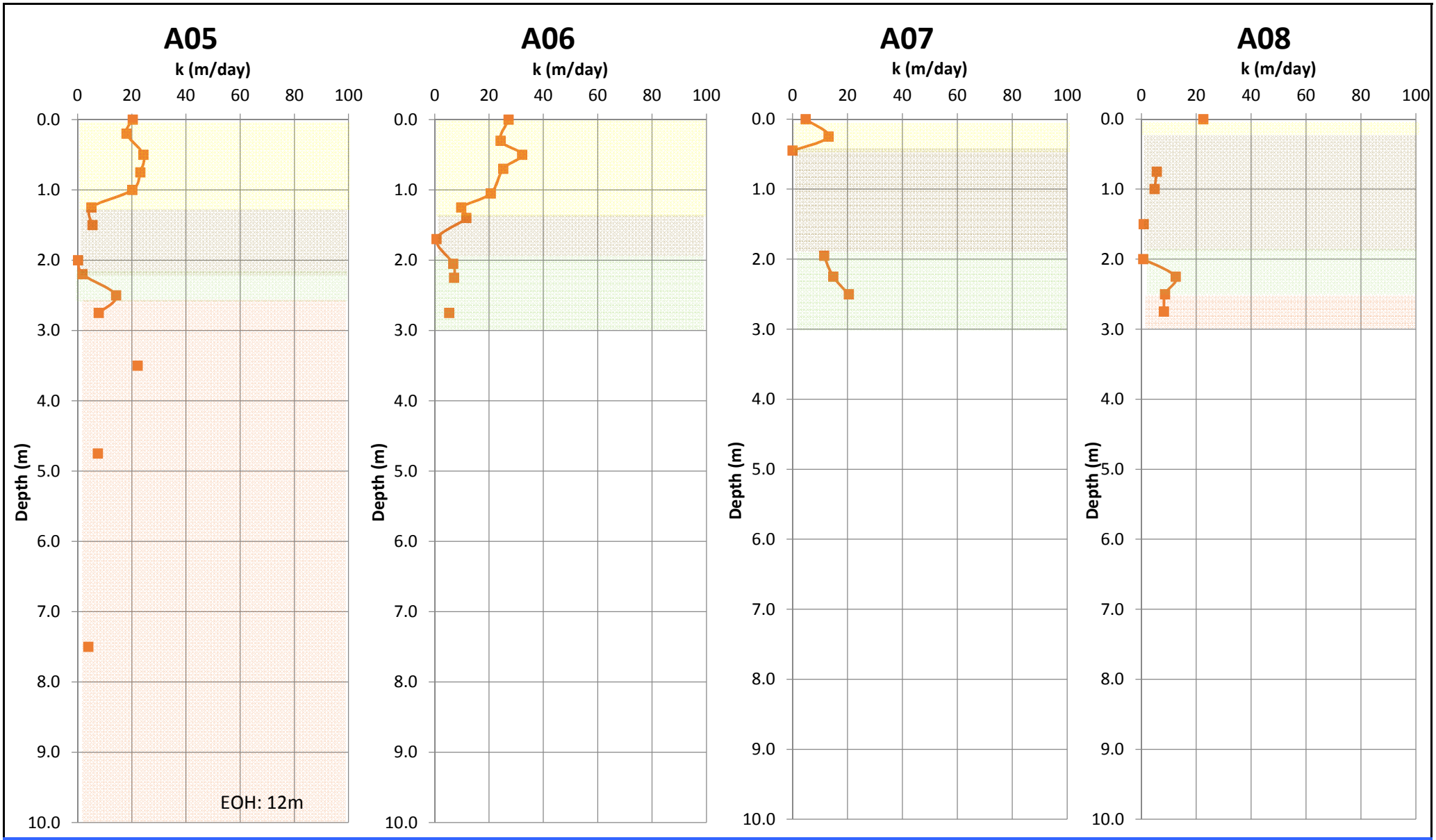
This drawing should be read in conjunction with report number 32259/151422/

Title: Coefficient of Permeability vs Depth A01 - A04

Client: Water Corporation

Project: Ballanup Sewer Pressure Main: Anstey-Keane Dampland Hydrological Assessment

Figure No



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Drawn: TL	Date: 26/10/2015	Job Number: 61/32259	A4
Checked	Date		
Revision: 0	Date	Cad Reference: NA	

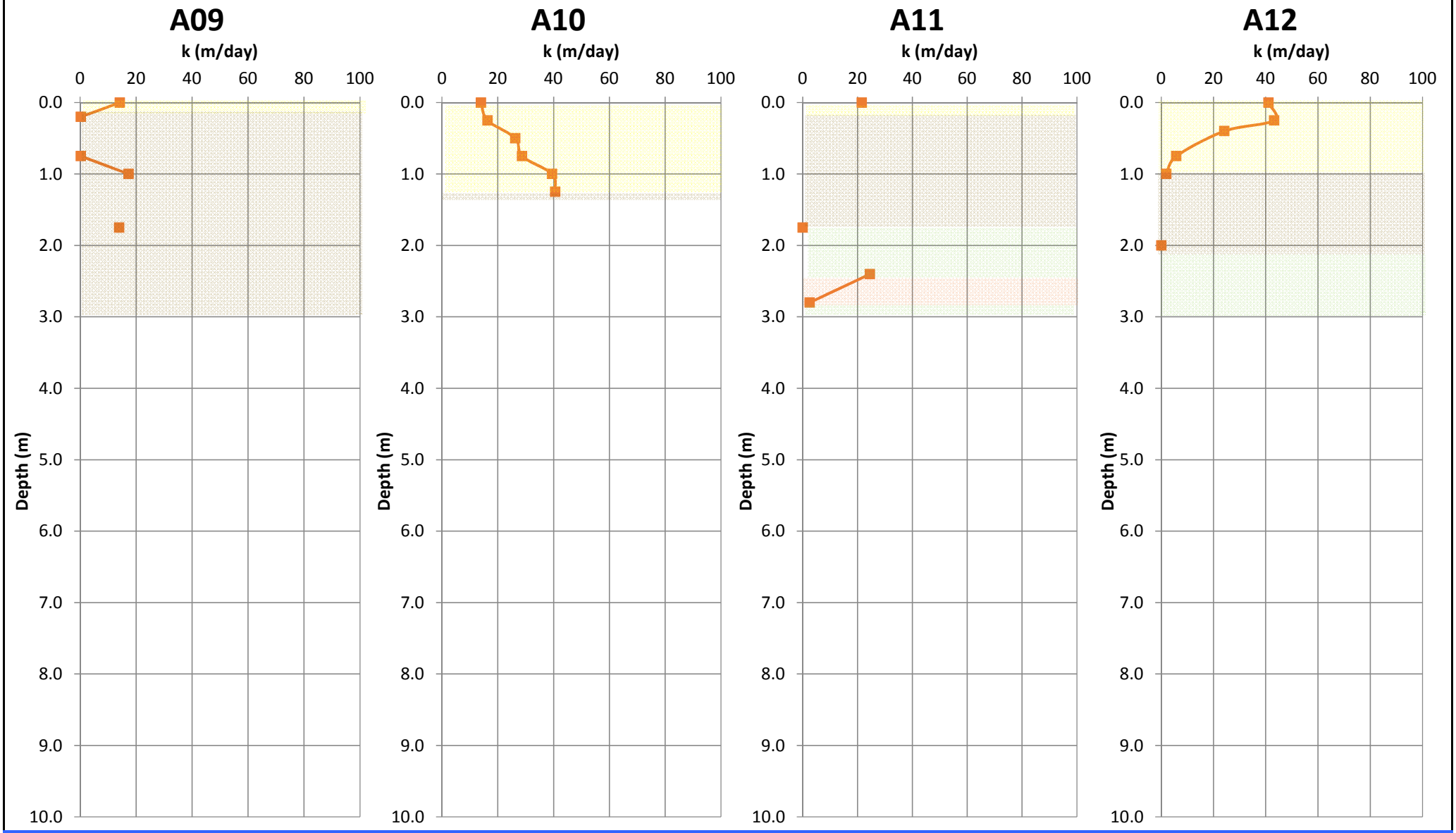
This drawing should be read in conjunction with report number 32259/151422/

Title: Coefficient of Permeability vs Depth A05 - A08

Client: Water Corporation

Project: Ballanup Sewer Pressure Main: Anstey-Keane Dampland Hydrological Assessment

Figure No



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Drawn: TL	Date: 26/10/2015	Job Number: 61/32259	A4
Checked	Date		
Revision: 0	Date	Cad Reference: NA	

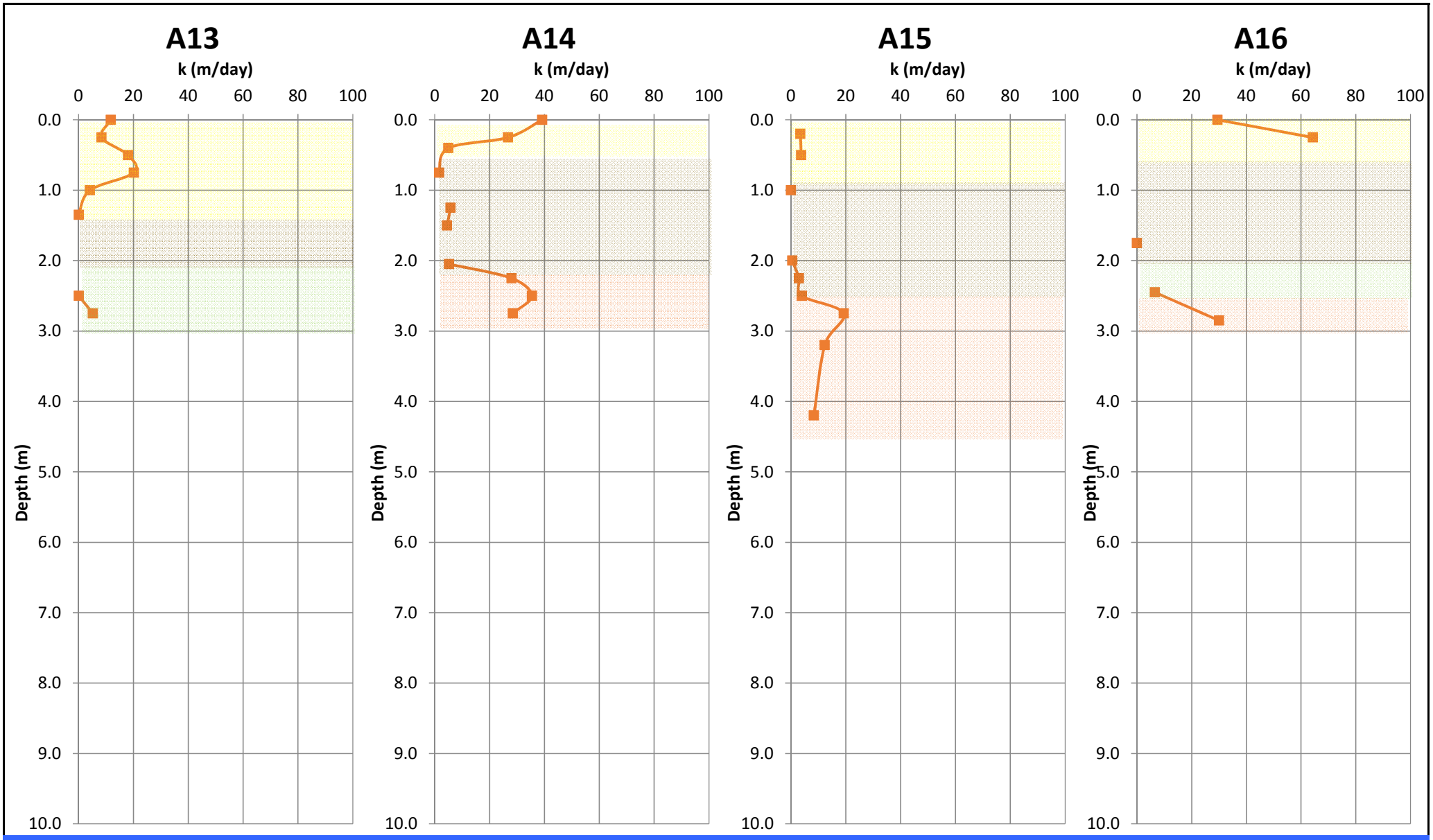
This drawing should be read in conjunction with report number 32259/151422/

Title: Coefficient of Permeability vs Depth A09 - A12

Client: Water Corporation

Project: Ballanup Sewer Pressure Main: Anstey-Keane Dampland Hydrological Assessment

Figure No



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Drawn: TL	Date: 26/10/2015	Job Number: 61/32259	A4
Checked	Date		
Revision: 0	Date	Cad Reference: NA	

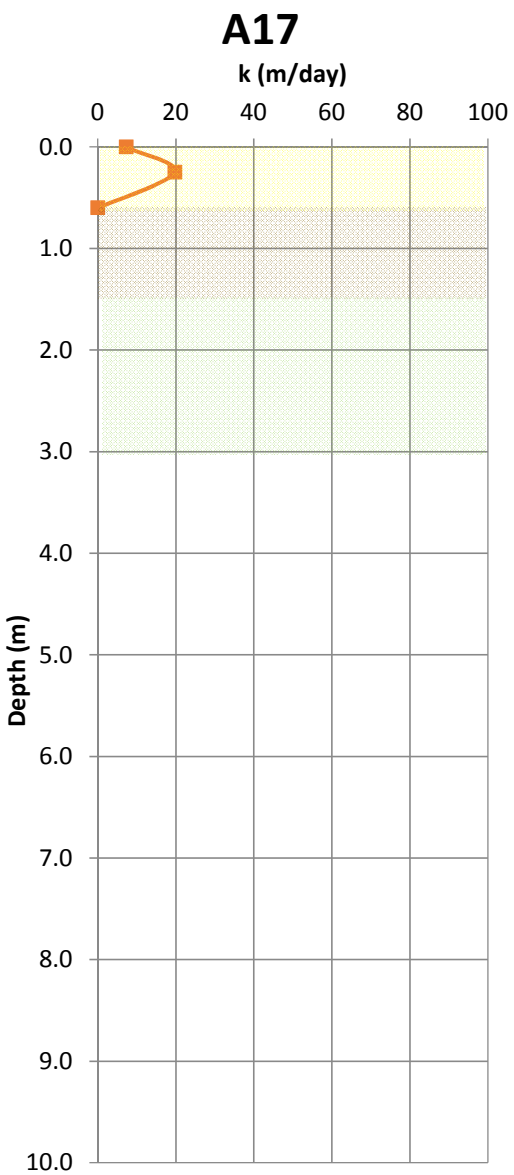
This drawing should be read in conjunction with report number 32259/151422/

Title: Coefficient of Permeability vs Depth A13 - A15

Client: Water Corporation

Project: Ballanup Sewer Pressure Main: Anstey-Keane Dampland Hydrological Assessment

Figure No



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Drawn: TL	Date: 26/10/2015	Job Number: 61/32259	A4	Title: Coefficient of Permeability vs Depth A17	Client: Water Corporation
Checked	Date				Project: Ballanup Sewer Pressure Main: Anstey-Keane Dampland Hydrological Assessment
Revision: 0	Date	Cad Reference: NA			Figure No

This drawing should be read in conjunction with report number 32259/151422/

Appendix O – Lot 101 Water Quality Data

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP1513740**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: MR WAYNE SCHOFER	Contact	: Customer Services EP
Address	: 239 ADELAIDE TERRACE PERTH WA 6004	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: wayne.schofer@ghd.com	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: +61 08 6222 8222	Telephone	: +61-8-9209 7655
Facsimile	: +61 08 9429 6555	Facsimile	: +61-8-9209 7600
Project	: 61/32259	Page	: 1 of 2
Order number	: ----	Quote number	: ES2015GHDSER0820 (EN/005/15)
C-O-C number	: ----	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: CHRISTINE HUG		

Dates

Date Samples Received	: 09-Sep-2015 12:25 PM	Issue Date	: 10-Sep-2015
Client Requested Due Date	: 16-Sep-2015	Scheduled Reporting Date	: **16-Sep-2015**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not intact.
No. of coolers/boxes	: 1	Temperature	: 1.8 - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 9 / 9

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
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (SamplesPerth@alsenviro.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of Work Order.
- **pH analysis should be conducted within 6 hours of sampling.**

Sample Container(s)/Preservation Non-Compliances

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

- **No sample container / preservation non-compliance exist.**

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.

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EA010P Conductivity (PC)	WATER - EA015H Total Dissolved Solids - High Level	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EP1513740-001	[08-Sep-2015]	A05_Shallow	✓	✓	✓
EP1513740-002	[08-Sep-2015]	A05_deep	✓	✓	✓
EP1513740-003	[08-Sep-2015]	A01_shallow	✓	✓	✓
EP1513740-004	[08-Sep-2015]	A01_deep	✓	✓	✓
EP1513740-005	[08-Sep-2015]	A07	✓	✓	✓
EP1513740-006	[08-Sep-2015]	BH13	✓	✓	✓
EP1513740-007	[08-Sep-2015]	AR5	✓	✓	✓
EP1513740-008	[08-Sep-2015]	AR6	✓	✓	✓
EP1513740-009	[08-Sep-2015]	A15	✓	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS PAYABLE (Brisbane)

- A4 - AU Tax Invoice (INV)	Email	ap-fss@ghd.com

CHRISTINE HUG

- *AU Certificate of Analysis - NATA (COA)	Email	christine.hug@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	christine.hug@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	christine.hug@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	christine.hug@ghd.com
- Chain of Custody (CoC) (COC)	Email	christine.hug@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	christine.hug@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	christine.hug@ghd.com
- EDI Format - XTab (XTAB)	Email	christine.hug@ghd.com

WAYNE SCHOFER

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

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP1513740**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: MR WAYNE SCHOFER	Contact	: Customer Services EP
Address	: 239 ADELAIDE TERRACE PERTH WA 6004	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: wayne.schofer@ghd.com	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: +61 08 6222 8222	Telephone	: +61-8-9209 7655
Facsimile	: +61 08 9429 6555	Facsimile	: +61-8-9209 7600
Project	: 61/32259	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 09-Sep-2015 12:25
C-O-C number	: ----	Date Analysis Commenced	: 11-Sep-2015
Sampler	: CHRISTINE HUG	Issue Date	: 16-Sep-2015 17:05
Site	: ----		
		No. of samples received	: 9
Quote number	: ----	No. of samples analysed	: 9

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Jeremy Truong	Laboratory Supervisor	Perth Inorganics

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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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.

- ED041G (Sulfate Turbidimetric): LOR for samples 'A01_shallow' raised due to possible sample matrix interference.
- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	A05_Shallow	A05_deep	A01_shallow	A01_deep	A07
				Client sampling date / time	[08-Sep-2015]	[08-Sep-2015]	[08-Sep-2015]	[08-Sep-2015]	[08-Sep-2015]
Compound	CAS Number	LOR	Unit		EP1513740-001	EP1513740-002	EP1513740-003	EP1513740-004	EP1513740-005
					Result	Result	Result	Result	Result
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		166	5450	286	2430	3410
EA015: Total Dissolved Solids									
^ Total Dissolved Solids @180°C	----	10	mg/L		2360	4820	654	2940	1880
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		57	104	100	145	202
Total Alkalinity as CaCO3	----	1	mg/L		57	104	100	145	202
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	64	<10	112	30
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		17	1820	32	690	1020
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		7	36	23	10	15
Magnesium	7439-95-4	1	mg/L		4	126	5	35	32
Sodium	7440-23-5	1	mg/L		29	891	42	429	622
Potassium	7440-09-7	1	mg/L		<1	9	7	5	8
EN055: Ionic Balance									
^ Total Anions	----	0.01	meq/L		1.62	54.8	2.90	24.7	33.4
^ Total Cations	----	0.01	meq/L		1.94	51.2	3.56	22.2	30.6
^ Ionic Balance	----	0.01	%		----	3.41	10.3	5.41	4.38

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	BH13	AR5	AR6	A15	----
			Client sampling date / time	[08-Sep-2015]	[08-Sep-2015]	[08-Sep-2015]	[08-Sep-2015]	----
Compound	CAS Number	LOR	Unit	EP1513740-006	EP1513740-007	EP1513740-008	EP1513740-009	--------
				Result	Result	Result	Result	Result
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	12300	3360	2860	3710	----
EA015: Total Dissolved Solids								
^ Total Dissolved Solids @180°C	----	10	mg/L	6900	2000	2790	2490	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	65	531	<1	419	----
Total Alkalinity as CaCO3	----	1	mg/L	65	531	<1	419	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	143	147	643	541	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	4270	724	556	668	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	52	11	16	16	----
Magnesium	7439-95-4	1	mg/L	224	37	79	26	----
Sodium	7440-23-5	1	mg/L	2220	624	432	738	----
Potassium	7440-09-7	1	mg/L	13	6	4	8	----
EN055: Ionic Balance								
^ Total Anions	----	0.01	meq/L	125	34.1	29.1	38.5	----
^ Total Cations	----	0.01	meq/L	118	30.9	26.2	35.2	----
^ Ionic Balance	----	0.01	%	2.82	4.96	5.23	4.42	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP1513740**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: MR WAYNE SCHOFER	Contact	: Customer Services EP
Address	: 239 ADELAIDE TERRACE PERTH WA 6004	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: wayne.schofer@ghd.com	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: +61 08 6222 8222	Telephone	: +61-8-9209 7655
Facsimile	: +61 08 9429 6555	Facsimile	: +61-8-9209 7600
Project	: 61/32259	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 09-Sep-2015
C-O-C number	: ----	Date Analysis Commenced	: 11-Sep-2015
Sampler	: CHRISTINE HUG	Issue Date	: 16-Sep-2015
Site	: ----	No. of samples received	: 9
Quote number	: ----	No. of samples analysed	: 9

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Jeremy Truong	Laboratory Supervisor	Perth Inorganics

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
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
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA010P: Conductivity by PC Titrator (QC Lot: 211769)									
EP1513723-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	1040	1030	0.678	0% - 20%
EP1513740-004	A01_deep	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	2430	2450	0.804	0% - 20%
EA015: Total Dissolved Solids (QC Lot: 210504)									
EP1513739-008	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	21	17	18.4	No Limit
EP1513740-008	AR6	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	2790	2680	4.14	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 211771)									
EP1513740-004	A01_deep	ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	145	145	0.00	0% - 20%
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	145	145	0.00	0% - 20%
EP1513741-005	Anonymous	ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	4	5	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	4	5	0.00	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 213343)									
EP1513662-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	122	122	0.00	0% - 20%
EP1513740-006	BH13	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	143	146	1.79	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 213342)									
EP1513662-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	119	120	0.00	0% - 20%
EP1513740-006	BH13	ED045G: Chloride	16887-00-6	1	mg/L	4270	4400	3.01	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 210638)									
EP1513725-003	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	27	28	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	31	32	0.00	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	6	6	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	178	177	0.00	0% - 20%
EP1513740-005	A07	ED093F: Calcium	7440-70-2	1	mg/L	15	15	0.00	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	32	31	0.00	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	8	8	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	622	610	1.89	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA010P: Conductivity by PC Titrator (QCLot: 211769)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	24800 µS/cm	95.9	95	105
EA015: Total Dissolved Solids (QCLot: 210504)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	94.4	83	111
				<10	293 mg/L	100	70	130
ED037P: Alkalinity by PC Titrator (QCLot: 211771)								
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	95.5	76	126
				<1	200 mg/L	93.1	90	106
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 213343)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	104	89	113
				<1	100 mg/L	86.9	79	121
ED045G: Chloride by Discrete Analyser (QCLot: 213342)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	105	84	120
				<1	1000 mg/L	106	84	110
ED093F: Dissolved Major Cations (QCLot: 210638)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	100	91	109
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	99.3	90	108
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	100	90	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	99.3	87	111

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 213343)							
EP1513662-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	95.7	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 213342)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
ED045G: Chloride by Discrete Analyser (QCLot: 213342) - continued							
EP1513642-006	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	105	70	130

QA/QC Compliance Assessment for DQO Reporting

Work Order	: **EP1513740**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: MR WAYNE SCHOFER	Telephone	: +61-8-9209 7655
Project	: 61/32259	Date Samples Received	: 09-Sep-2015
Site	: ----	Issue Date	: 16-Sep-2015
Sampler	: CHRISTINE HUG	No. of samples received	: 9
Order number	: ----	No. of samples analysed	: 9

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010P: Conductivity by PC Titrator							
Miscellaneous Plastic bottle -unpreserved (EA010-P)							
A05_Shallow, A05_deep, A01_shallow, A01_deep, A07, BH13, AR5, AR6, A15	**08-Sep-2015**	**----**	----	----	**11-Sep-2015**	06-Oct-2015	✓
EA015: Total Dissolved Solids							
Miscellaneous Plastic bottle -unpreserved (EA015H)							
A05_Shallow, A05_deep, A01_shallow, A01_deep, A07, BH13, AR5, AR6, A15	**08-Sep-2015**	**----**	----	----	**11-Sep-2015**	15-Sep-2015	✓
ED037P: Alkalinity by PC Titrator							
Miscellaneous Plastic bottle -unpreserved (ED037-P)							
A05_Shallow, A05_deep, A01_shallow, A01_deep, A07, BH13, AR5, AR6, A15	**08-Sep-2015**	**----**	----	----	**11-Sep-2015**	22-Sep-2015	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Miscellaneous Plastic bottle -unpreserved (ED041G)							
A05_Shallow, A05_deep, A01_shallow, A01_deep, A07, BH13, AR5, AR6, A15	**08-Sep-2015**	**----**	----	----	**15-Sep-2015**	06-Oct-2015	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride by Discrete Analyser							
Miscellaneous Plastic bottle -unpreserved (ED045G)							
A05_Shallow, A05_deep, A01_shallow, A01_deep, A07, BH13, AR5, AR6, A15	**08-Sep-2015**	**----**	----	----	**15-Sep-2015**	06-Oct-2015	✓
ED093F: Dissolved Major Cations							
Miscellaneous Plastic bottle -unpreserved (ED093F)							
A05_Shallow, A05_deep, A01_shallow, A01_deep, A07, BH13, AR5, AR6, A15	**08-Sep-2015**	**----**	----	----	**11-Sep-2015**	15-Sep-2015	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	17	**11.76**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	2	15	**13.33**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	14	**14.29**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	2	11	**18.18**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	17	**11.76**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	15	**6.67**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	14	**14.29**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	2	11	**18.18**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	17	**5.88**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	15	**6.67**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	14	**7.14**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	1	11	**9.09**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	17	**5.88**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	14	**7.14**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)

AR1					mg/L															
	WL	EC µS	pH	Temp	TSS	TN	TKN	Ammonia	Nitrate	Nitrite	TP	FRP	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Mercury	Zinc
16/05/2013	3.02	375	5.69	22.2	810	8.1	7.8	0.71	0.28	0.006	0.52	0.007	0.001	0.0001	0.003	0.001	0.001	0.001	0.00005	0.005
22/08/2013	2.42	328	6.12	19.6	100	4	2.4	0.12	1.6	0.005	0.9	0.78	0.05	0.01	0.01	0.01	0.02	0.03	0.00005	0.02
26/11/2013	2.33	399	6.05	20.94	19	1.2	1.2	0.24	0.005	0.013	0.61	0.47	0.001	0.0001	0.001	0.009	0.002	0.001	0.00006	0.063
24/02/2014	2.87	620	6.35	26.1	85	2.3	2.3	0.45	0.005	0.005	1.1	1	0.001	0.0001	0.003	0.002	0.002	0.001	0.00005	0.01
20/05/2014	3.08	491	6.92	19.86	78	2.4	2.4	0.57	0.005	0.005	2.4	1.7	0.001	0.0001	0.001	0.001	0.002	0.001	0.00005	0.003
25/08/2014	2.2	0	6.05	20.53	67	3.4	2.6	0.01	0.82	<0.005	0.73	0.44	<0.001	<0.0001	0.001	0.019	0.005	<0.001	<0.00005	0.16
AR2					mg/L															
	WL	EC µS	pH	Temp	TSS	TN	TKN	Ammonia	Nitrate	Nitrite	TP	FRP	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Mercury	Zinc
16/05/2013	4.14	600	4.14	21.3	1400	83	80	0.53	3	0.08	0.68	0.35	0.004	0.0001	0.047	0.017	0.011	0.015	0.001	0.34
22/08/2013	1.84	842	4.27	19.4	490	43	43	0.6	0.005	0.27	2.4	1.6	0.05	0.01	0.01	0.01	0.02	0.03	0.00005	0.02
26/11/2013	1.88	424	4.32	25.32	1200	8.4	6.1	0.72	2.3	0.045	0.64	0.67	0.001	0.0001	0.001	0.004	0.001	0.005	0.00005	0.034
24/02/2014	2.5	1250	4.37	26.9	220	12	12	1.6	0.05	0.5	1	1.4	0.001	0.0001	0.007	0.002	0.007	0.007	0.00005	0.023
20/05/2014	2.44	1680	5.41	20.01	250	37	37	0.76	0.005	0.34	1.4	1.5	0.009	0.0001	0.007	0.001	0.004	0.006	0.00005	0.013
25/08/2014	1.6	0	4.65	21.06	320	3.3	2.3	0.57	0.94	0.024	0.36	0.35	<0.001	<0.0001	<0.001	0.005	<0.001	<0.001	<0.00005	0.017
AR3					mg/L															
	WL	EC µS	pH	Temp	TSS	TN	TKN	Ammonia	Nitrate	Nitrite	TP	FRP	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Mercury	Zinc
16/05/2013	5.63	10550	5.63	22.9	10000	10	10	3.2	0.048	<.005	0.01	0.005	0.001	0.0001	0.002	0.001	0.005	0.001	0.00005	0.001
22/08/2013	1.65	13580	5.83	19.7	32000	15	15	2.5	0.036	0.005	0.01	0.005	0.05	0.01	0.01	0.01	0.02	0.03	0.00005	0.02
26/11/2013	1.32	14350	6.08	26.42	5	1.5	1	0.63	0.005	0.58	0.05	0.005	0.001	0.0001	0.001	0.004	0.001	0.001	0.00005	0.11
24/02/2014	3.9	16360	5.76	31.4	1900	3	3	2.3	0.005	0.005	0.05	0.01	0.001	0.0001	0.002	0.001	0.004	0.001	0.00005	0.035
20/05/2014	2.95	17200	6.48	20.83	320	2.7	2.7	2	0.005	0.005	0.01	0.014	0.001	0.0001	0.002	0.001	0.001	0.001	0.00005	0.004
25/08/2014	0.62	0	5.94	21.48	<5	2.7	2.7	1.3	<0.005	<0.005	0.02	<0.005	<0.001	<0.0001	0.002	<0.001	<0.001	<0.001	<0.00005	0.006
AR4					mg/L															
	WL	EC µS	pH	Temp	TSS	TN	TKN	Ammonia	Nitrate	Nitrite	TP	FRP	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Mercury	Zinc
16/05/2013	3.22	1262	5.21	21.2	2700	18	18	1.5	0.024	0.005	0.02	0.014	0.003	0.0001	0.002	0.001	0.002	0.001	0.00005	0.002
22/08/2013	2.18	1314	5.63	18.4	980	2.9	2.8	1.3	0.12	0.005	0.29	0.024	0.05	0.01	0.01	0.01	0.02	0.03	0.00005	0.02
26/11/2013	1.88	1270	4.37	26.06	110	0.6	0.5	0.48	0.061	0.008	0.05	0.032	0.001	0.0001	0.001	0.001	0.001	0.001	0.00005	0.045
24/02/2014	3.9	1280	4.11	29.4	170	4.5	4.5	0.61	0.005	0.005	0.05	0.021	0.001	0.0001	0.002	0.001	0.005	0.001	0.00005	0.003
20/05/2014	3.37	1500	5.92	19.47	190	4.5	4.5	1.1	0.005	0.005	0.06	0.028	0.001	0.0001	0.002	0.001	0.002	0.001	0.00005	0.005
25/08/2014	1.73	0	5.33	21.48	1,100	3.7	3.7	1	<0.005	<0.005	0.05	0.032	<0.001	<0.0001	0.001	<0.001	0.001	<0.001	<0.00005	0.009
AR5					mg/L															
	WL	EC µS	pH	Temp	TSS	TN	TKN	Ammonia	Nitrate	Nitrite	TP	FRP	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Mercury	Zinc
16/05/2013	2.62	24300	7.23	21.8	180	8	5.1	0.1	2.8	0.012	0.19	0.15	0.026	0.0001	0.001	0.009	0.004	0.001	0.00005	0.003
22/08/2013	0.69	3060	7.65	18.3	1900	20	8	0.01	12	0.005	0.5	0.44	0.06	0.01	0.01	0.01	0.02	0.03	0.00005	<0.02
26/11/2013	1.54	2390	7.34	24.13	26	22	0.4	0.01	22	0.005	0.61	0.59	0.052	0.0001	0.001	0.013	0.004	0.001	0.00005	0.008
24/02/2014	2.88	7700	7.44	29.2	63	8.6	2.3	0.06	6.2	0.14	0.29	0.29	0.031	0.0005	0.002	0.008	0.007	0.001	0.00005	0.01
20/05/2014	3.1	27000	7.7	19.97	40	2.9	2.3	0.01	0.58	0.077	0.31	0.23	0.037	0.0001	0.001	0.003	0.007	0.001	0.00005	0.002
25/08/2014	0.63	300	7.91	19.29	11	14	1.4	0.02	13	<0.005	0.56	0.51	0.052	<0.0001	<0.001	0.008	0.004	<0.001	<0.00005	0.003
AR6					mg/L															
	WL	EC µS	pH	Temp	TSS	TN	TKN	Ammonia	Nitrate	Nitrite	TP	FRP	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Mercury	Zinc
16/05/2013	3.99	5750	5.42	22	13000	11	11	0.82		0.005	0.01	0.005	0.003	0.0001	0.002	0.001	0.003	0.001	0.00005	0.018
22/08/2013	1.41	1950	7.65	18.8	1400	4.6	4.1	0.15	0.42	0.033	0.01	0.005	0.05	0.01	0.01	0.01	0.02	0.03	0.00007	0.02
26/11/2013	1.72	3290	5.25	23.54	230	0.4	0.4	0.41	0.005	0.005	0.05	0.006	0.001	0.0001	0.014	0.001	0.015	0.019	0.00005	0.038
24/02/2014	3.5	4020	5.23	25.2	58000	31	31	1.4	0.05	0.5	0.24	0.25	0.005	0.0001	0.013	0.002	0.011	0.01	0.00012	0.013
20/05/2014	3.61	4020	6.05	20.06	530	4.4	4.4	0.37	0.005	0.005	0.01	0.005	0.006	0.0001	0.011	0.001	0.007	0.004	0.00005	0.008
25/08/2014	1.24	1	4.95	20.42	230	5.4	5.4	0.1	<0.005	<0.005	0.04	<0.005	0.003	<0.0001	0.013	0.005	0.009	0.013	<0.00005	0.022

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A Jennings	W Schafer		W Schafer		18 Nov 2015

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APPENDIX B

Alternative pipeline – Predicted Clearing Impacts


KEANE
43mx4m=172m2
108mx4m=432m2
A7872
RD
28mx4m=112m2
ANSTEY
37421
552
A1203