

Appendix B – Figures

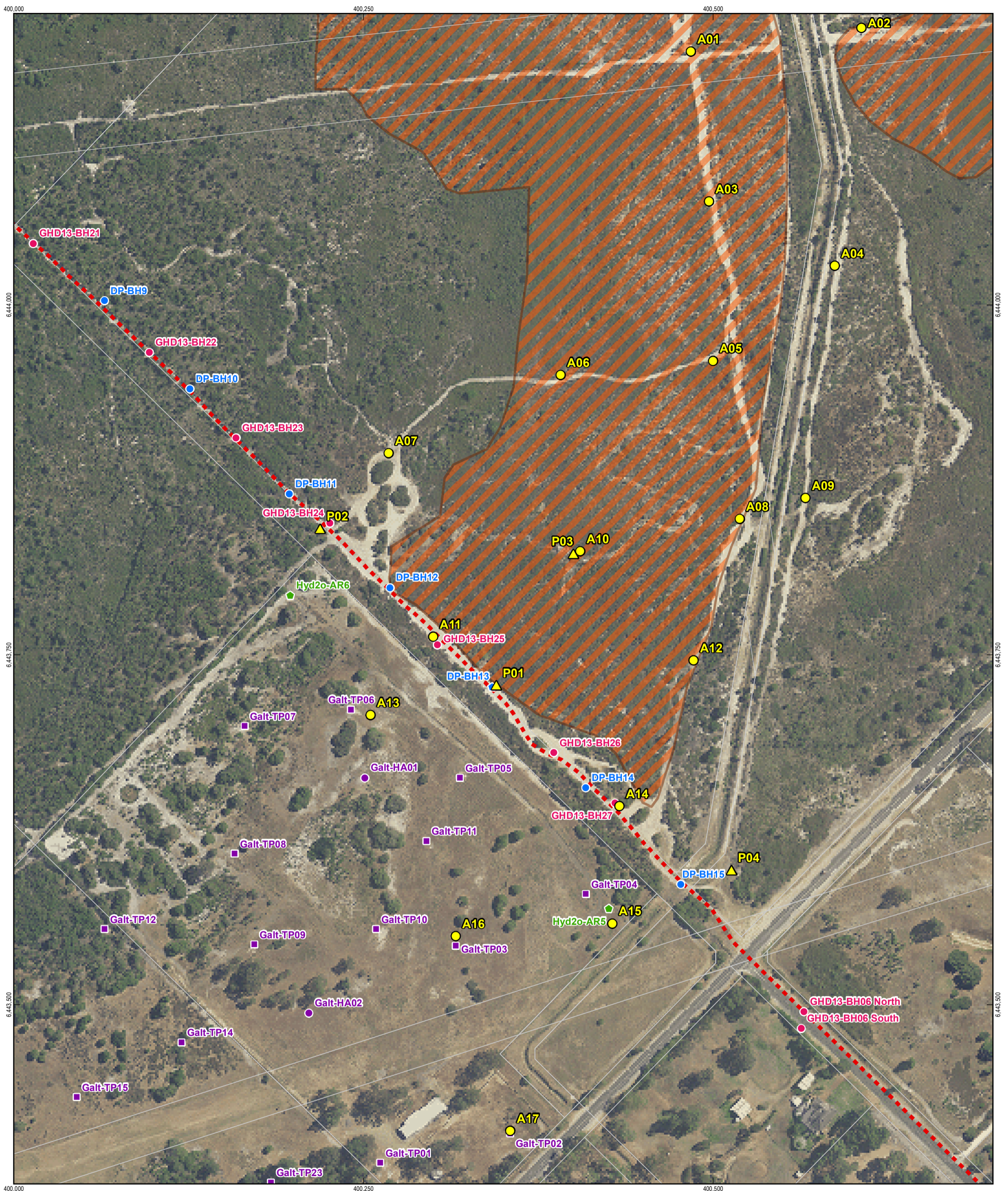
Figure B1: Locality Plan

Figure B2: Surface Catchments and Drainage

Figure B3: Top of Clayey Sand

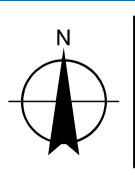
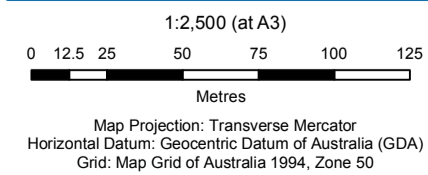
Figure B4: Thickness of Clayey Sand

Figure B5: Limit of Oxidation Extents



LEGEND

- ▲ Infiltration Test (GHD 2015)
- Borehole (GHD 2015)
- Borehole (GHD 2013)
- Borehole (Galt 2013)
- Test Pit (Galt 2013)
- ◆ Monitoring Bore (Hyd2o 2013)
- Borehole (Douglas Partners 2008)
- ◆ Monitoring Bore (Douglas Partners 2008)
- - - Sewer Main
- Cadastre
- Threatened Ecological Community SCP10a

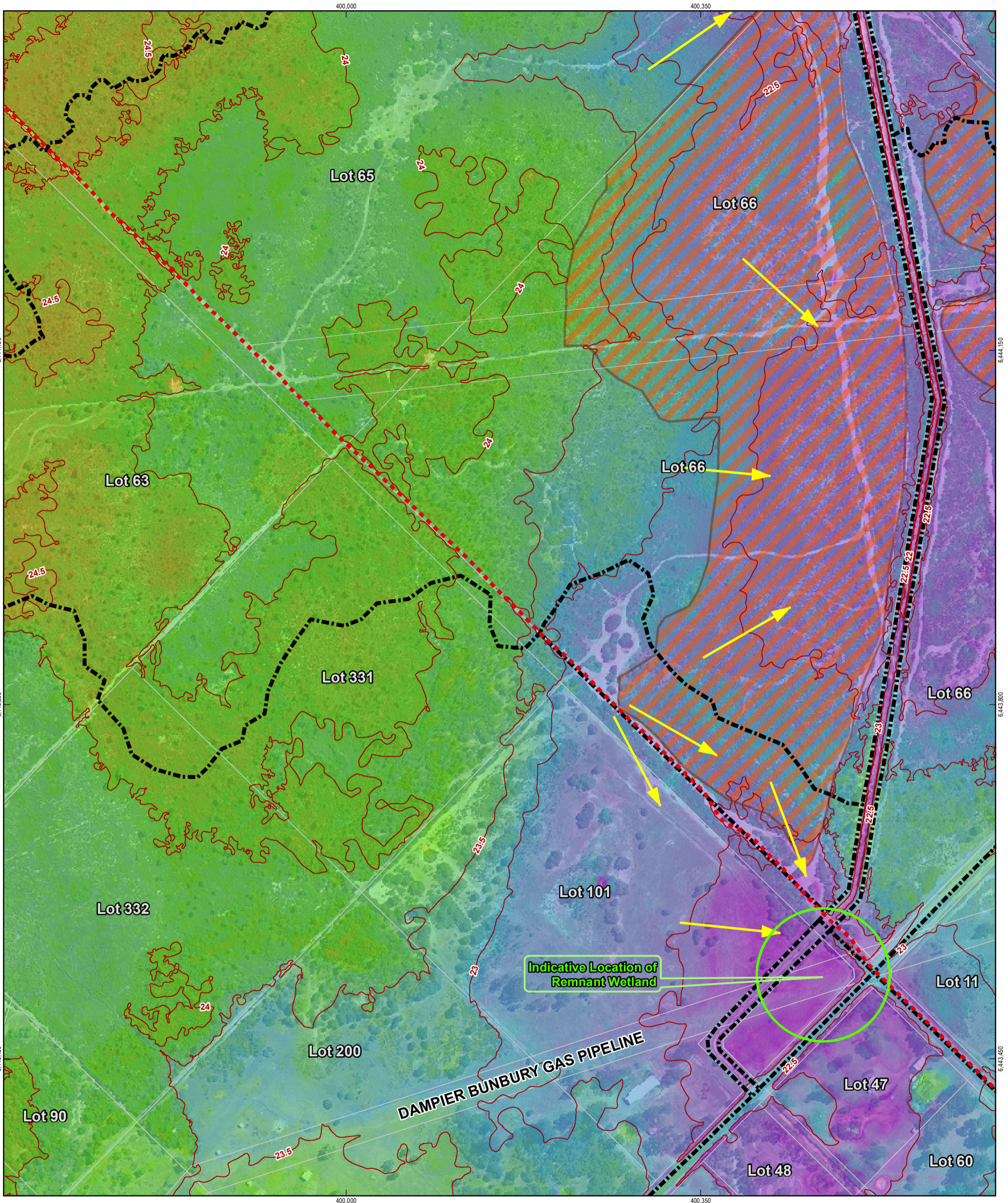


Water Corporation
Balannup Sewer Pressure Main
Anstey-Keane Dampland Hydrological Investigations

Job Number | 61-32259
Revision | 1
Date | 30 Oct 2015

Locality Plan

Figure B1



LEGEND

- Contour (0.5 m)
- ➔ Drainage Direction
- - - Sewer Main
- Surface Catchment
- Cadastre
- Threatened Ecological Community SCP10a

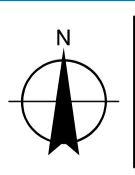
Elevation (m AHD)

26 25 24 23 22 21

1:3,500 (at A3)

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

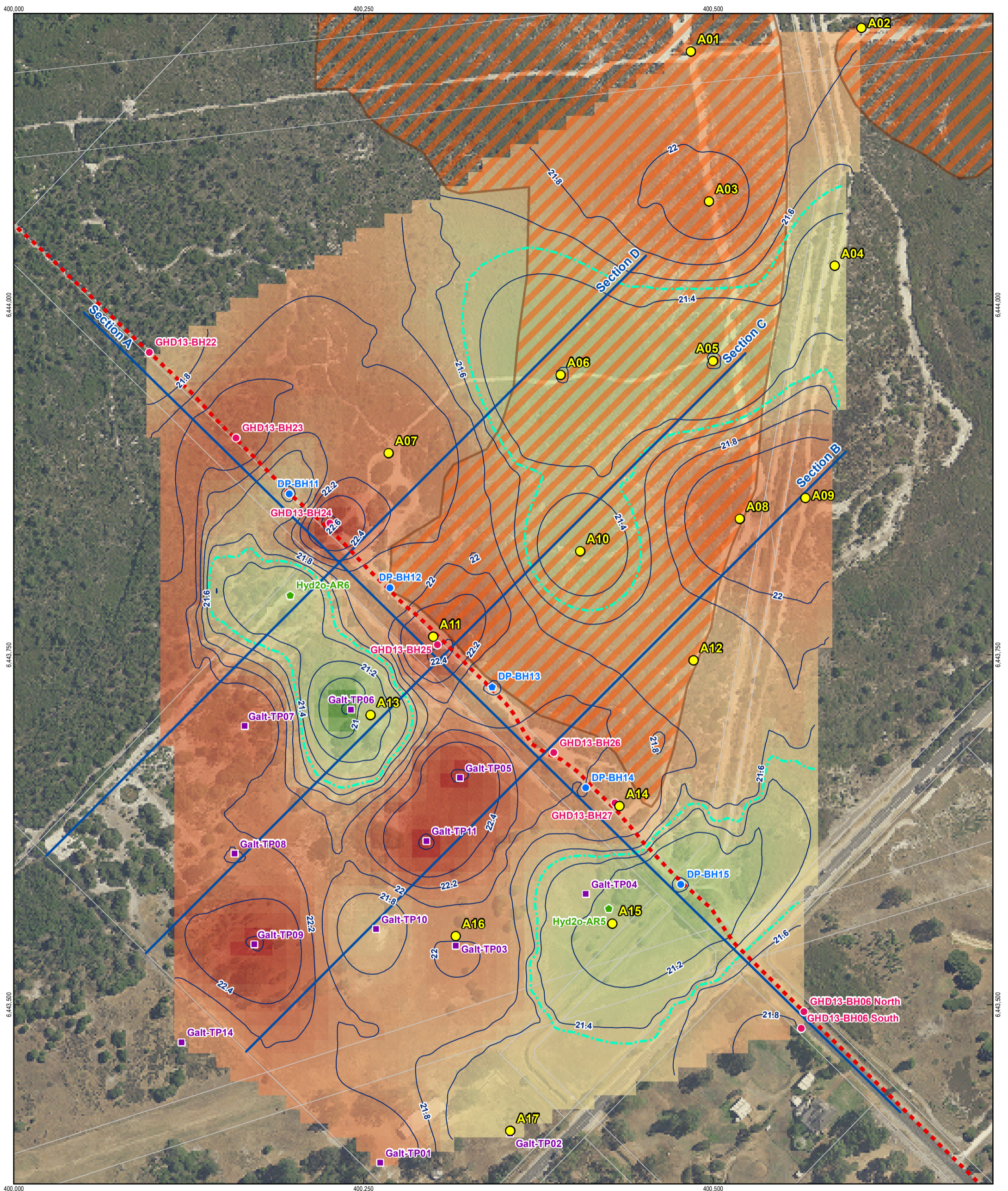


Water Corporation
Balannup Sewer Pressure Main
Anstey-Keane Dampland Hydrological Investigations

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Surface Catchments

Figure B2



LEGEND

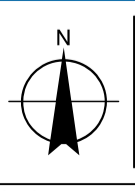
Borehole (GHD 2015)	Monitoring Bore (Hyd2o 2013)	Top of Clayey Sand (m AHD)	Threatened Ecological Community SCP10a
Borehole (GHD 2013)	Borehole (Douglas Partners 2008)	Indicative Perched Groundwater System	Top of Clayey Sand (m AHD)
Test Pit (Galt 2013)	Monitoring Bore (Douglas Partners 2008)	Sewer Main	22.6 22.4 22.2 22.0 21.8 21.6 21.4 21.2 21.0 20.8
	Cadastre		

1:2,500 (at A3)

0 12.5 25 50 75 100 125

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

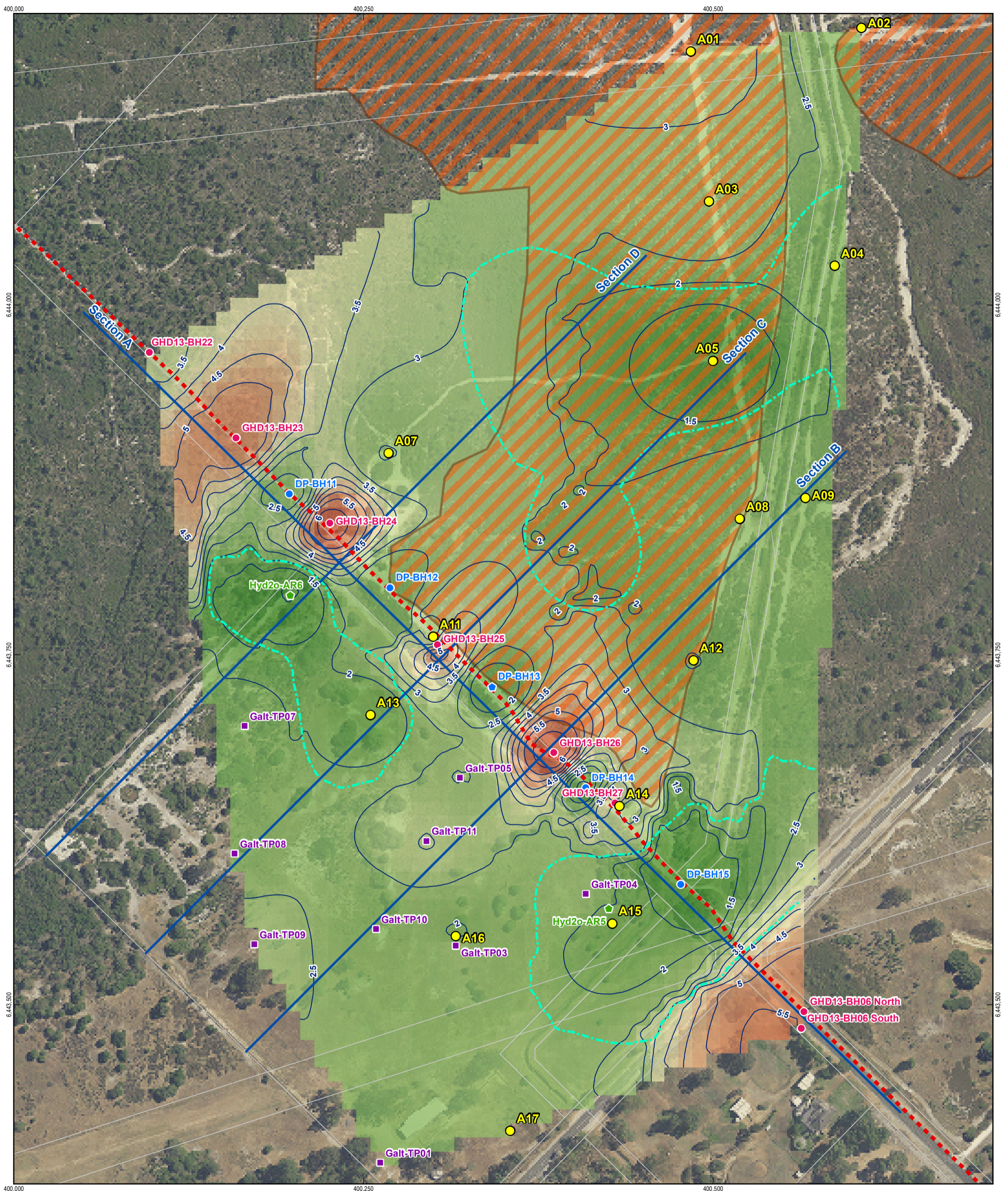


Water Corporation
Balannup Sewer Pressure Main
Anstey-Keane Dampland Hydrological Investigations

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Top of Clayey Sand

Figure B3

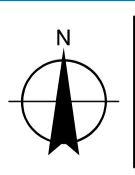


LEGEND

Borehole (GHD 2015)	Monitoring Bore (Hyd2o 2013)	Thickness of Clayey Sand (m)	Threatened Ecological Community SCP10a
Borehole (GHD 2013)	Borehole (Douglas Partners 2008)	Indicative Perched Groundwater System	Thickness of Clayey Sand (m)
Test Pit (Galt 2013)	Monitoring Bore (Douglas Partners 2008)	Sewer Main	
		Cadastre	

1:2,500 (at A3)

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

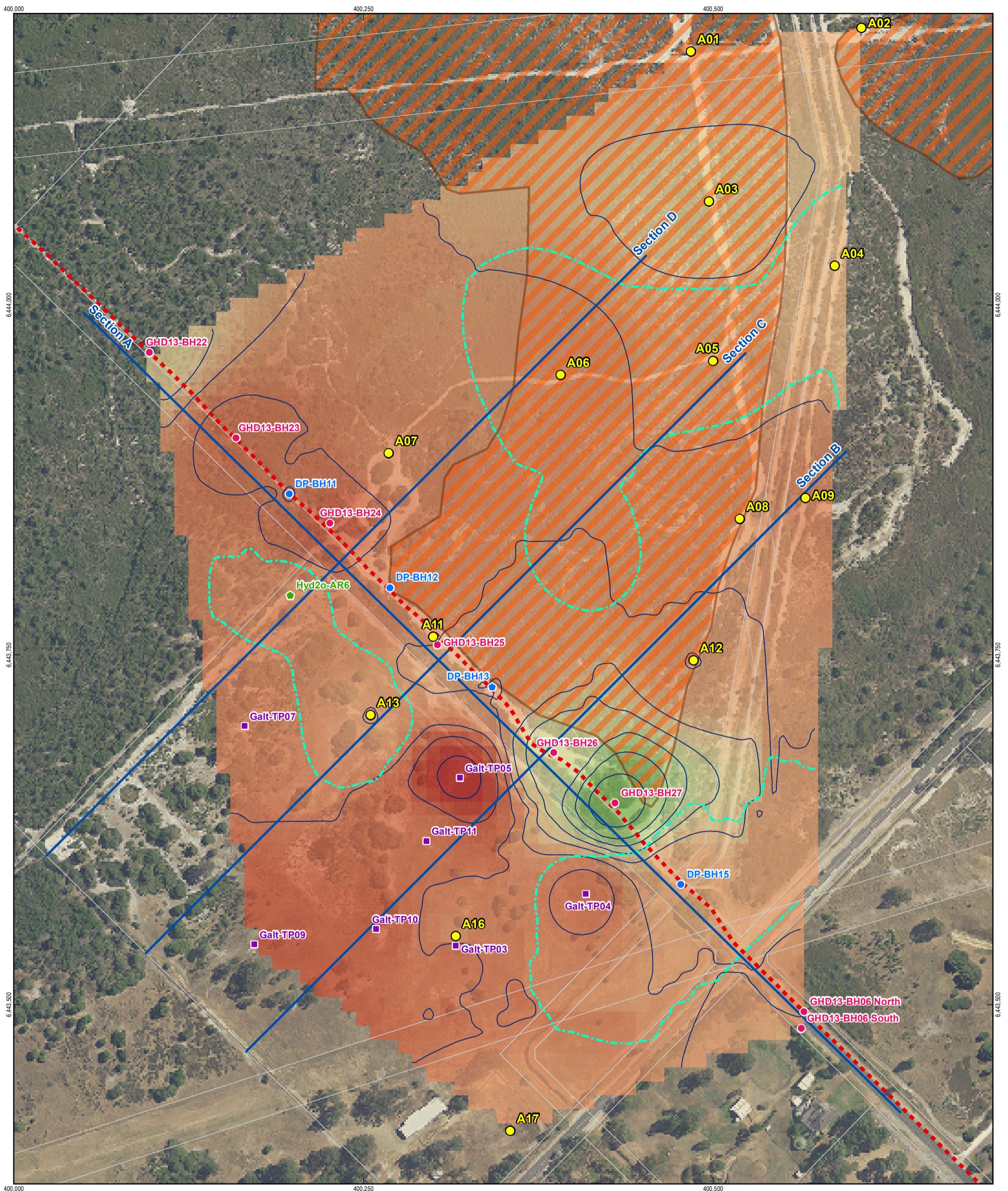


Water Corporation
Balannup Sewer Pressure Main
Anstey-Keane Dampland Hydrological Investigations

Job Number | 61-32259
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Thickness of Clayey Sand

Figure B4

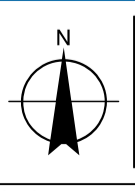


LEGEND

Borehole (GHD 2015)	Monitoring Bore (Hyd2o 2013)	Limit of Oxidation Extents (m AHD)	Threatened Ecological Community SCP10a
Borehole (GHD 2013)	Borehole (Douglas Partners 2008)	Indicative Perched Groundwater System	Limit of Oxidation Extents (m AHD)
Test Pit (Galt 2013)	Monitoring Bore (Douglas Partners 2008)	Sewer Main	
	Cadastre		22 21 20 19 18 17

1:2,500 (at A3)

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50



Water Corporation
Balannup Sewer Pressure Main
Anstey-Keane Dampland Hydrological Investigations

Job Number | 61-32259
Revision | 1
Date | 30 Oct 2015

Limit of Oxidation Extents

Figure B5

Appendix C – Borehole logs



WELL CONSTRUCTION BORE LOG

Well No.:

A01

Sheet 1 of 2

Client: Water Corporation **Coordinates:** E 400 484, N 6444 181
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.5m AHD **Total Depth:** 9.0m
 Additional Geotechnical Investigation **Commenced:** 29-Jul-15 **Completed:** 29-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical
Flushing Fluid: none **Logged:** T Whitnall 29-Jul-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Processed:** SB Olivares 01-Dec-15
Checked:

Depth Scale (m)	Daily Progress/Observations				Depth (m) [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Well Components	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method												
0 1 2 3 4 5				Push Probing				SP	SAND Grey, fine to medium grained, trace rootlets. BASSENDEAN SAND? Pale brown.	M - W	VL to L?	0.00	B1	Wells installed at separate locations (within 1m of each other)	0 1 2 3 4 5	
					0.6 [+21.93]			SP / SC	SAND / CLAYEY SAND Grey to pale grey, sand is fine to medium grained, with some clay. GUILDFORD FORMATION	M		0.35	B2			
					0.8 [+21.68]			SC	CLAYEY SAND Pale brown, mottled orange, sand is fine to medium grained, trace gravel sized subrounded ferricrete nodules. GUILDFORD FORMATION		St	0.55	B3			
												0.75	B4			
												1.00	B5			
												1.15	B6			
												1.75	B7			
												2.00	B8			
						2.3 [+20.23]							2.25			B9
						2.6 [+19.93]			SP	SAND Green grey, fine to medium grained, with trace clay, slight organic odour. GUILDFORD FORMATION	W	MD?	2.50			B10
									SC	CLAYEY SAND Green, sand is fine to medium grained, trace pockets of black organic material up to 10mm. GUILDFORD FORMATION 2.7m: Large pockets of organic material, 50mm long (root?).	M - W	St	2.75			B11
						3.8 [+18.68]			SP	SAND Brown, fine to medium grained, with trace clay, organic odour, trace pockets of black organic materials up to 10mm. GUILDFORD FORMATION	W	MD?	3.75			B12

Base of shallow well

GENERAL LOG 6132259 - BALANNUP.GPJ GHDLIB.GDT 11/12/15



WELL CONSTRUCTION BORE LOG

Well No.:

A01

Sheet 2 of 2

Client: Water Corporation **Coordinates:** E 400 484, N 6444 181
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.5m AHD **Total Depth:** 9.0m
 Additional Geotechnical Investigation **Commenced:** 29-Jul-15 **Completed:** 29-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical
Flushing Fluid: none **Logged:** T Whitnall 29-Jul-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Processed:** SB Olivares 01-Dec-15
Checked:

Depth Scale (m)	Daily Progress/Observations				Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Well Components	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method													
6				Push Probing				SP	SAND Brown, fine to medium grained, with trace clay, organic odour, trace pockets of black organic materials up to 10mm. GUILDFORD FORMATION 5.1 to 5.2m: CLAYEY SAND layer.	W	MD?	3.75 5.25	B12			6	
7						7.3 [+15.23]		SM	SILTY SAND Dark brown, sand is fine grained, trace organic odour. Below 7.9m: Becoming green and fine to medium grained.	M	St	7.50	B14 B15			7	
8						8.8 [+13.68]		SP	SAND Green grey, with trace clay, organic odour, trace fine to coarse subrounded quartz/ chert gravel. Termination Depth = 9.00m (Target Depth)	W	MD - D	8.50	B16			8	
9						9.0 [+13.48]										Base of deep well	9
10																	10

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BOREHOLE LOG

Borehole No.:

A02

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 606, N 6444 198
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.6m AHD **Total Depth:** 3.0m
 Additional Geotechnical Investigation **Commenced:** 27-Jul-15 **Completed:** 27-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical **Logged:** T Whitnall 27-Jul-15
Flushing Fluid: none **Processed:** SB Olivares 01-Dec-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Checked:**

Depth Scale (m)	Daily Progress/Observations				Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method												
				Push Probing		0.8 [+21.80]			SP	SAND Pale white/grey, fine to medium grained, trace rootlets to 0.7m, no odour. BASSENDEAN SAND	M - W VL - L?		B1	Note: Top 0.15 to 0.20m, possibly disturbed fill from adjacent tracks. Groundwater (0.9m): Temp: 15.4°C Sal: 198 ppm pH: 9.8 Cond: 420 uS 1.0m: PP = 3.25 1.2m: PP = 3.5 1.5m: PP = 3.0 1.75m: PP > 4.5 2.0: PP = 3.0 2.25: PP = 3.75 2.5m: PP = 3.75 2.75m: PP = 3.75 3.0m: PP > 4.5		
										M			B2			
													B3			
													B4			
1								SC	0.75m: Trace black, fine to medium grained gravel size rounded freecrete nodules. CLAYEY SAND Light brown mottled orange, sand is fine to coarse grained. GUILDFORD FORMATION	M - W St			B5			
													B6			
													B7			
													B8			
													B9			
													B10			
													B11			
													B12			
3						3.0 [+19.60]			Termination Depth = 3.00m (Target Depth)							3
4																4
5																5

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BOREHOLE LOG

Borehole No.:

A03

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 497, N 6444 074
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.3m AHD **Total Depth:** 3.0m
 Additional Geotechnical Investigation **Commenced:** 29-Jul-15 **Completed:** 29-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical
Flushing Fluid: none **Logged:** T Whitnall 29-Jul-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Processed:** SB Olivares 01-Dec-15
Checked:

Depth Scale (m)	Daily Progress/Observations				Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method												
0 1 2 3	Push Probing				0.2 [+22.10]			SP	SAND Pale grey brown, fine to medium grained.	M - VL -	VL -	0.00	B1			
					SC			BASSENDAN SAND	SM	F -	0.20	B2				
								CLAYEY SAND Brown grey, fine to medium grained, with some clay.		St	0.30	B3				
								GUILDFORD FORMATION								
								0.7m: Pale yellow brown, with trace orange mottled, with trace gravel sized ferricrete nodules, subrounded.	M -	St	0.70	B4				
											1.00	B5				
											1.25	B6				
											1.50	B7				
											1.75	B8				
											2.05	B9				
											2.25	B10				
											2.60	B11				
				2.75	B12											
				2.1 [+20.20]		SP	SAND Pale brown, sand is fine to medium grained, with some clay. GUILDFORD FORMATION	W	MD	2.05	B9					
				2.6 [+19.66]		SP / SC	2.55m: Green. SAND / CLAYEY SAND Grey green, fine to medium grained, with trace clay, slight organic odour, with trace pockets of organic material up to 10mm. GUILDFORD FORMATION	W		2.60	B11					
				3.0 [+19.25]												
									Termination Depth = 3.00m (Target Depth)							



WELL CONSTRUCTION BORE LOG

Well No.:

A05

Sheet 1 of 3

Client: Water Corporation **Coordinates:** E 400 500, N 6443 960
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.5m AHD **Total Depth:** 12.0m
 Additional Geotechnical Investigation **Commenced:** 28-Jul-15 **Completed:** 28-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical
Flushing Fluid: none **Logged:** T Whitnall 28-Jul-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Processed:** SB Olivares 01-Dec-15
Checked:

Depth Scale (m)	Daily Progress/Observations				Depth (m) [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Well Components	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method												
0.00							SP	SAND Pale grey, fine to medium grained, trace rootlets. BASSENDEAN SAND Grey.	M	VL-L?	0.00	B1			0	
0.20											0.20	B2				0
0.50								Pale brown.	W		0.50	B3				0
0.75											0.75	B4				0
1.00											1.00	B5				0
1.25					1.3 [+21.25]		SP	Below 1.15m: Becoming grey/brown. SAND Pale brown, sand is fine to medium grained, with some clay. GUILDFORD FORMATION	D-M	MD	1.25	B6				1
1.50											1.50	B7				1
1.75					1.8 [+20.75]		SC	CLAYEY SAND Pale brown, fine to medium grained. GUILDFORD FORMATION		St	1.75	B8	1.8m: PP = 3.5			1
2.00											2.00	B9	2.15m: PP > 4.5			2
2.20								Green, slight organic odour.			2.20	B10				2
2.50					2.5 [+20.00]		SP	SAND Brown, fine to medium grained, trace clay, organic odour. GUILDFORD FORMATION	W	MD?	2.50	B11	2.5m: PP = 2.5			2
2.75								2.9 to 3.25m: Green, more clayey.			2.75	B12				3
3.25								3.25 to 4.1m: Sample liquified.				B13				3
3.50											3.50					3
4.25											4.25	B14				4
4.75								Brown, fine to coarse grained sand, with some clay, local CLAYEY SAND zones.	M-W		4.75	B15			4	
5.00															5	

GENERAL LOG 6132259 - BALANNUP.GPJ GHDLIB.GDT 11/12/15



WELL CONSTRUCTION BORE LOG

Well No.:

A05

Sheet 2 of 3

Client: Water Corporation **Coordinates:** E 400 500, N 6443 960
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.5m AHD **Total Depth:** 12.0m
 Additional Geotechnical Investigation **Commenced:** 28-Jul-15 **Completed:** 28-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical
Flushing Fluid: none **Logged:** T Whitnall 28-Jul-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Processed:** SB Olivares 01-Dec-15
Checked:

Depth Scale (m)	Daily Progress/Observations				Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Well Components	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method													
6				Push Probing				SP	SAND Brown, fine to medium grained, trace clay, organic odour. GUILDFORD FORMATION	W	MD?	4.75	B15				6
7					7.1 [+15.40]			SP / SM	SAND / SILTY SAND Brown, sand is fine, with some pockets up to 20mm of black material (trace organics). GUILDFORD FORMATION		F-St	5.75	B16				7
8												6.50	B17				8
												7.50	B18				
9					8.7 [+13.65]			SP	SAND Light grey, fine to medium grained. GUILDFORD FORMATION	W	MD?						9
10									Below 9.8m: Brown.								10

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WELL CONSTRUCTION BORE LOG

Well No.:

A05

Sheet 3 of 3

Client: Water Corporation **Coordinates:** E 400 500, N 6443 960
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.5m AHD **Total Depth:** 12.0m
 Additional Geotechnical Investigation **Commenced:** 28-Jul-15 **Completed:** 28-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical
Flushing Fluid: none **Logged:** T Whitnall 28-Jul-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Processed:** SB Olivares 01-Dec-15
Checked:

Depth Scale (m)	Daily Progress/Observations				Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Well Components	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method													
11				Push Probing					SP	SAND Light grey, fine to medium grained. GUILDFORD FORMATION Light grey. Brown.	W	MD?					11
12					12.0 [+10.50]					Termination Depth = 12.00m (Target Depth)						Base of deep well	12
13																	13
14																	14
15																	15

GENERAL LOG 6132259 - BALANNUP.GPJ GHDLIB.GDT 11/12/15



BOREHOLE LOG

Borehole No.:

A06

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 391, N 6443 950
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.6m AHD **Total Depth:** 3.0m
 Additional Geotechnical Investigation **Commenced:** 29-Jul-15 **Completed:** 29-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical **Logged:** T Whitnall 29-Jul-15
Flushing Fluid: none **Processed:** SB Olivares 01-Dec-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Checked:**

Depth Scale (m)	Daily Progress/Observations				Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method												
0									SP	SAND Grey, fine to medium grained, trace rootlets. BASSENDEAN SAND	M	VL - L?	0.00	B1		0
0.30													0.30	B2		0.30
0.50													0.50	B3		0.50
0.70										D - M			0.70	B4		0.70
1.05													1.05	B5		1.05
1.25													1.25	B6		1.25
1.40													1.40	B7		1.40
1.7						1.7 [+20.90]			SC	CLAYEY SAND Pale brown, sand is fine to medium grained, with some clay. GUILDFORD FORMATION		St	1.70	B8		1.70
2.1						2.1 [+20.55]			SP	1.95m: Green, slight organic odour. SAND Grey, green, fine to medium grained, with trace clay, with trace black pockets of organic material up to 10mm, organic odour. GUILDFORD FORMATION	M - W	MD?	2.05	B9		2.05
2.25													2.25	B10		2.25
2.50													2.50	B11		2.50
2.75													2.75	B12		2.75
3.0						3.0 [+19.60]				Termination Depth = 3.00m (Target Depth)						3.0
4																4
5																5

GENERAL LOG 6132259 - BALANNUP.GPJ_GHDLIB.GDT 11/12/15



WELL CONSTRUCTION BORE LOG

Well No.:

A07

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 267, N 6443 891
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.6m AHD **Total Depth:** 3.0m
 Additional Geotechnical Investigation **Commenced:** 29-Jul-15 **Completed:** 29-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical **Logged:** T Whitnall 29-Jul-15
Flushing Fluid: none **Processed:** SB Olivares 01-Dec-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Checked:**

Depth Scale (m)	Daily Progress/Observations				Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Well Components	Depth Scale (m)	
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method													
1 2 3				Push Probing	0.3 [+22.40]		SM	SILTY SAND Dark grey, sand is fine to medium grained, trace organics, trace rootlets.	M	VL - L?	0.00	B1			Base of well	1 2 3	
					0.5 [+22.20]		SP	TOPSOIL / BASSENDEAN SAND	M - W	MD	0.25	B2					
							SC	SAND Orange, becoming dark grey at base, sand is fine to medium grained, trace rootlets. BASSENDEAN SAND	D - M	St	0.45	B3					
								CLAYEY SAND Pale brown/orange, trace orange mottling, sand is fine to medium grained, with some clay. GUILDFORD FORMATION 0.45 to 0.6m, dark brown. 0.6m: 30mm layer with some gravel sized orange ferricrete nodules. 0.85 to 0.95m: Layer with some gravel sized orange ferricrete nodules.			0.75	B4					
											1.00	B5					
											1.25	B6					
											1.50	B7					
						1.8 [+20.90]		SP	SAND Brown, fine to medium grained, trace clay. GUILDFORD FORMATION 1.9m: Pale grey, organic odour, with trace pockets of black organic material up to 20mm.	W	MD?	1.75	B8				
											1.95	B9					
											2.25	B10					
											2.50	B11					
						2.8 [+19.90]		SC	CLAYEY SAND Green brown, sand is fine to medium grained. GUILDFORD FORMATION	D - M	St	2.75	B12				
					3.0 [+19.65]			Termination Depth = 3.00m (Target Depth)								4 5	



BOREHOLE LOG

Borehole No.:

A08

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 519, N 6443 847
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.4m AHD **Total Depth:** 3.0m
 Additional Geotechnical Investigation **Commenced:** 28-Jul-15 **Completed:** 28-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical **Logged:** T Whitnall 28-Jul-15
Flushing Fluid: none **Processed:** SB Olivares 01-Dec-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Checked:**

Depth Scale (m)	Daily Progress/Observations				Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method											
				Push Probing	0.2 [+22.15]			SP	SAND Pale grey, fine to medium grained. BASSENDEAN SAND	M	MD	0.00	B1	Groundwater sample (0.2m): Temp: 13°C Sal: 62 ppm pH: 9.4 Cond: 156uS tds: 82 0.4m: PP = 0.75 0.75m: PP = 2.5 1.15m: PP = 2.5 1.35m: PP = 2.25 1.8m: PP = 2.25 2.3m: PP = 2.25	
							SC	CLAYEY SAND Light brown, fine to medium grained, trace pockets of black organic material up to 10mm, possibly charcoal/ash. GUILDFORD FORMATION 0.75 to 1.2m: Less clayey At 1.2m: 5mm thick orange bands. From 1.2m: Pale brown mottled orange, becoming more clayey. From 1.8m: With trace green mottling and trace pockets of black organic material up to 10mm.	W	St	0.20	B2			
												0.50	B3		
												0.75	B4		
1												1.00	B5		
												1.20	B6		
												1.50	B7		
												1.75	B8		
2												2.00	B9		
					2.3 [+20.10]			SP	SAND Green, fine to medium grained, with some clay, slight organic odour. GUILDFORD FORMATION 2.5m: Grey, with trace clay, organic (peaty?) odour.		MD?	2.25	B10		
												2.50	B11		
												2.75	B12		
3					3.0 [+19.35]				Termination Depth = 3.00m (Target Depth)						
4															
5															

GENERAL LOG 6132259 - BALANNUP.GPJ GHDLIB.GDT 11/12/15



BOREHOLE LOG

Borehole No.:

A09

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 566, N 6443 862
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.3m AHD **Total Depth:** 3.0m
 Additional Geotechnical Investigation **Commenced:** 27-Jul-15 **Completed:** 27-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical **Logged:** T Whitnall 27-Jul-15
Flushing Fluid: none **Processed:** SB Olivares 01-Dec-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Checked:**

Depth Scale (m)	Daily Progress/Observations				Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method											
				Push Probing	0.2 [+22.10]			SP	SAND Pale grey, fine to medium grained, trace rootlets.	W	VL - L?	0.00	B1	Groundwater sample (0.2m): Temp: 19.7°C Sal: 50.1 ppm pH: 10.3 Cond: 108.70uS tds: 60.3 0.3m: PP = 2.5 0.8m: PP > 4.5 1.15m: PP = 1.5 1.4m: PP = 1.5 1.65m: PP = 3.5 1.9m: PP = 2.75 2.2m: PP = 4.0	
					0.5 [+21.70]		SC	BASSEDEAN SAND CLAYEY SAND Grey, sand is fine to medium grained, trace rootlets.	M	St	0.20	B2			
							SM	GUILDFORD FORMATION			0.50	B3			
							SC	SILTY SAND Pale grey, sand is fine grained. GUILDFORD FORMATION			0.75	B4			
1								CLAYEY SAND Pale brown mottled orange, sand is fine to medium grained. GUILDFORD FORMATION 1.0 to 1.35m: Medium grained gravel sized subrounded ferricrete nodule. 1.35m: Brown. 1.55m: Green, slight organic odour.			1.00	B5			
											1.35	B6			
											1.55	B7			
											1.75	B8			
2								Below 1.9m: With trace black organic pockets up to 5mm.			2.00	B9			
											2.25	B10			
					2.4 [+19.90]		SP	SAND Brown, sand is fine to medium grained, with some clay, organic odour. GUILDFORD FORMATION 2.53m: 20mm clayey sand layer	W	MD?	2.40	B11			
									M		2.55	B12			
3					3.0 [+19.30]			Termination Depth = 3.00m (Target Depth)							
4															
5															



CLIENTS
PEOPLE
PERFORMANCE



HAND AUGER LOG

Location No.: **A10**

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 405, N 6443 824
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.6m AHD **Total Depth:** 1.4m
 Additional Geotechnical Investigation **Commenced:** 31-Jul-15 **Completed:** 31-Jul-15
Job No.: 6132259 **Equipment Operator:** T Whitnall

Equipment: Hand Auger **Logged:** T Whitnall 31-Jul-15
Hole Diameter (mm): 100 **Processed:** SB Olivares 01-Dec-15
Checked: 01-Dec-15

Depth Scale (m)	Water	Depth (m) [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
0					SP	SAND Pale brown, fine to medium grained. BASSENDEAN SAND	M	VL-L	0.00 0.30 0.30 0.50 0.50 0.80 0.80 1.00 1.00 1.25 1.25 1.30	B1 B2 B3 B4 B5 B6 B7		0
1.30		1.35 [+21.3]			SC	CLAYEY SAND Pale orange, sand is fine to medium grained. GUILDFORD FORMATION Termination Depth = 1.35m (Water/ Collapsing)	W	F-St				1
2												2
3												3
4												4
5												5



WELL CONSTRUCTION BORE LOG

Well No.:

A11

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 300, N 6443 761
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.5m AHD **Total Depth:** 3.0m
 Additional Geotechnical Investigation **Commenced:** 29-Jul-15 **Completed:** 29-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical **Logged:** T Whitnall 29-Jul-15
Flushing Fluid: none **Processed:** SB Olivares 01-Dec-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Checked:**

Depth Scale (m)	Daily Progress/Observations				Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Well Components	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method												
0 1 2 3 4 5			Push Probing		0.2 [+22.35]		SP	SAND Pale grey, fine to medium grained. BASSENDEAN SAND	W	L	0.00	B1		Base of well		
					0.15		SC	CLAYEY SAND Pale brown, sand is fine to medium grained. GUILDFORD FORMATION At 0.25m: grey layer (ash?) ~20mm thick. At 0.6m: layer with some quartz gravel 20mm thick. Below 0.6m, with trace quartz gravel. Below 0.9m: with trace orange mottles.	M	St	0.15	B2				
					0.50					0.50	B3					
					0.75					0.75	B4					
					1.00					1.00	B5					
					1.25					1.25	B6					
					1.50					1.50	B7					
					1.75					1.75	B8					
					2.00					2.00	B9					
					2.25					2.25	B10					
					2.40					2.40	B11					
					2.80					2.80	B12					
				2.4 [+20.10]			SAND Pale brown, fine to medium grained, organic odour. GUILDFORD FORMATION	MD		2.40						
				2.8 [+19.70]			CLAYEY SAND / SAND Dark brown, with some clay, organic odour. GUILDFORD FORMATION	St		2.80						
				3.0 [+19.50]		SC/ SP	CLAYEY SAND / SAND Dark brown, with some clay, organic odour. GUILDFORD FORMATION									
							Termination Depth = 3.00m (Target Depth)									

GENERAL LOG 6132259 - BALANNUP.GPJ GHDLIB.GDT 11/12/15



BOREHOLE LOG

Borehole No.:

A13

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 255, N 6443 707
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.6m AHD **Total Depth:** 3.0m
 Additional Geotechnical Investigation **Commenced:** 31-Jul-15 **Completed:** 31-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical
Flushing Fluid: none **Logged:** T Whitnall 31-Jul-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Processed:** SB Olivares 01-Dec-15
Checked:

Depth Scale (m)	Daily Progress/Observations				Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method											
				Push Probing	+22.50		SP	SAND		W	VL-L?	0.00	B1		
							SP	Dark grey, sand is fine to medium grained, with trace rootlets and moss at surface, with trace organics. TOPSOIL				0.25	B2		
								SAND				0.50	B3		
								BASSEDEAN SAND				0.75	B4		
1								0.1 to 0.6m, light grey.				1.00	B5	Groundwater Sample: (1m) Temp: 17.4°C Sal: 223 ppm pH: 8.48 Cond: 519uS tds: 283 1.45m: PP = 2.5 1.6m: PP = 2.25 1.9m: PP > 4.5 2.2m: PP > 4.5 2.4m: PP > 4.5 2.6m: PP > 4.5	1
					1.4 [+21.25]		SC	CLAYEY SAND		M	St	1.35	B6		
								Light brown, fine to medium grained, with trace orange mottling. GUILDFORD FORMATION				1.50	B7		
2								Below 1.25m, mottled orange.				1.75	B8		
								2.7m: Green, slight organic odour. GUILDFORD FORMATION				2.00	B9		
					2.7 [+19.90]		SP	SAND				2.25	B10		
								Green, grey, fine to medium grained, with trace clay. GUILDFORD FORMATION				2.50	B11		
3					3.0 [+19.60]			Termination Depth = 3.00m (Target Depth)				2.75	B12		
4															
5															



WELL CONSTRUCTION BORE LOG

Well No.:

A15

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 422, N 6443 557
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.1m AHD **Total Depth:** 4.5m
 Additional Geotechnical Investigation **Commenced:** 31-Jul-15 **Completed:** 31-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical **Logged:** T Whitnall 31-Jul-15
Flushing Fluid: none **Processed:** SB Olivares 01-Dec-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Checked:**

Depth Scale (m)	Daily Progress/Observations				Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Well Components	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method												
					0.2 [+21.89]		SM	SAND Dark grey, fine to medium grained, with trace organics, trace rootlets. TOPSOIL	W	L-MD	0.00	B1	Groundwater sample (0.2m): Temp: 21.9°C Sal: 72.8 ppm pH: 6.4 Cond: 162.90uS tds: 897			
							SP	SAND Pale grey, sand is fine to medium grained, trace clay with depth. BASSENDEAN SAND	M		0.20	B2				
											0.50	B3				
											0.90	B4				
1					0.9 [+21.19]		SC	CLAYEY SAND Pale grey, sand is fine to medium grained, with some clay. GUILDFORD FORMATION	St		1.10	B5	1.2m: PP = 1.5			
								1.4m: Brown, locally very weakly cemented. Below 1.6m: pale brown.			1.25	B6	1.4m: PP = 1.75			
											1.50	B7	1.55m: PP = 0.75			
											1.75	B8	1.75m: PP = 3.0			
2											2.00	B9	2.0m: PP = 3.0			
									D		2.25	B10	2.25m: PP = 3.25			
											2.50	B11	2.55m: PP = 3.75			
					2.5 [+19.59]		SP	SAND Pale brown, with trace clay. GUILDFORD FORMATION	MD		2.75	B12	2.8m: PP = 3.5			
3											3.20	B13				
									W							
											4.20	B14				
4									M							
					4.5 [+17.59]			Termination Depth = 4.50m (Target Depth)								
5																

GENERAL LOG 6132259 - BALANNUP.GPJ GHD\IB.GDT 11/12/15



BOREHOLE LOG

Borehole No.:

A16

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 316, N 6443 549
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.6m AHD **Total Depth:** 3.0m
 Additional Geotechnical Investigation **Commenced:** 31-Jul-15 **Completed:** 31-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical
Flushing Fluid: none **Logged:** T Whitnall 31-Jul-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Processed:** SB Olivares 01-Dec-15
Checked:

Depth Scale (m)	Daily Progress/Observations				Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method											
					+22.45		SP	SAND		W	L-MD	0.00	B1		
							SP	Dark grey, sand is fine to medium grained, trace organics, trace rootlets, moss and grass at surface. TOPSOIL		W		0.25	B2		
					0.6 +22.00		SC	SAND Light brown, fine to medium grained. BASSENDEAN SAND		M	F-St	0.55	B3	0.65m: PP = 0.75	
1								CLAYEY SAND Light brown, trace orange mottled, sand is fine to medium grained. GUILDFORD FORMATION				0.75	B4		
												1.00	B5	1.0m: PP = 2.0	
												1.25	B6	1.2m: PP = 2.75	
												1.50	B7	1.45m: PP = 1.25	
								1.55m: Grey brown, trace orange mottle, becoming more clayey.			St	1.75	B8	1.75m: PP = 1.25	
2												2.00	B9	1.9m: PP = 1.25	
								2.0m: Grey, green, grading more sandy, slight organic odour.				2.25	B10	2.15m: PP = 1.0	
					2.5 +20.05		SP	SAND Grey, green, fine to medium grained, trace clay. GUILDFORD FORMATION		W	MD	2.45	B11	2.35m: PP = 0.5	
3					3.0 +19.55			Below 2.7m: dark brown, trace organics. 2.9m: Pale grey, slight organic odour.				2.85	B12		
								Termination Depth = 3.00m (Target Depth)						Groundwater sample (3m): Temp: 20.4°C Sal: 4.38 ppm pH: 7.5 Cond: 7.22uS	
4															
5															

GENERAL LOG 6132259 - BALANNUP.GPJ_GHDLIB.GDT 11/12/15



BOREHOLE LOG

Borehole No.:

A17

Sheet 1 of 1

Client: Water Corporation **Coordinates:** E 400 355, N 6443 410
Project: Balannup / Keane Road Pressure Main **Ground Surface Elevation:** +22.4m AHD **Total Depth:** 3.0m
 Additional Geotechnical Investigation **Commenced:** 31-Jul-15 **Completed:** 31-Jul-15
Job No.: 6132259 **Contractor:** Direct Push Probe **Driller:** Direct Push Probing Pty Ltd

Rig Type & Mounting: Tracked mounted Geoprobe 6620DT **Inclination:** Vertical
Flushing Fluid: none **Logged:** T Whitnall 31-Jul-15
Hole Diameter (mm): 120 **Casing Size:** N/A **Processed:** SB Olivares 01-Dec-15
Checked:

Depth Scale (m)	Daily Progress/Observations				Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
	Date	Casing Depth (m)	Fluid Depth (m)	Drilling Method												
				Push Probing		0.2 [+22.25]		SP	SAND Dark grey, fine to medium grained, trace organics, trace rootlets, grass at surface.	W	L-MD	0.00	B1			
								SP	TOPSOIL SAND Pale brown, fine to medium grained.			0.25	B2			
						0.6 [+21.80]		SM	BASSEDEAN SAND Below 0.45m, brown.			0.60	B3			
1								SM	SILTY SAND Grey, sand is fine to medium grained, locally very weakly cemented.	D-M	MD	0.75	B4	0.8m: PP = 3.75		1
						1.1 [+21.35]		SC / CL	CLAYEY SAND / SANDY CLAY Pale brown mottled orange.			1.05	B5	1.25m: PP = 4.25		
						1.5 [+20.90]		CH	SANDY CLAY Greyy grey, high plasticity, fine to medium grained sand.		F	1.50	B7	1.7m: PP = 1.0		
2								CH	GUILDFORD FORMATION			1.75	B8			
						2.00						2.00	B9	2.0m: PP = 1.25		2
						2.3 [+20.15]		SC	CLAYEY SAND Green grey, medium to high plasticity, fine to medium grained sand.			2.25	B10	2.25m: PP = 0.25		
								SC	GUILDFORD FORMATION 2.5m: Grey brown, trace organics, organic odour.			2.50	B11	2.5m: PP = 1.0		
									2.85m: Grading more sandy.	W		2.85	B12	2.7m: PP = 4.0		
3					▽	3.0 [+19.40]			Termination Depth = 3.00m (Target Depth)					Groundwater rose to ~1.5m Groundwater sample (3m): Temp: 20.5°C Sal: 2.16 ppm Cond: 4.60uS tds: 2.45		3
4																4
5																5

