




Legend

-  Cadastre
-  Site Boundary
-  Registered Groundwater Boreholes



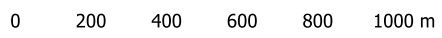
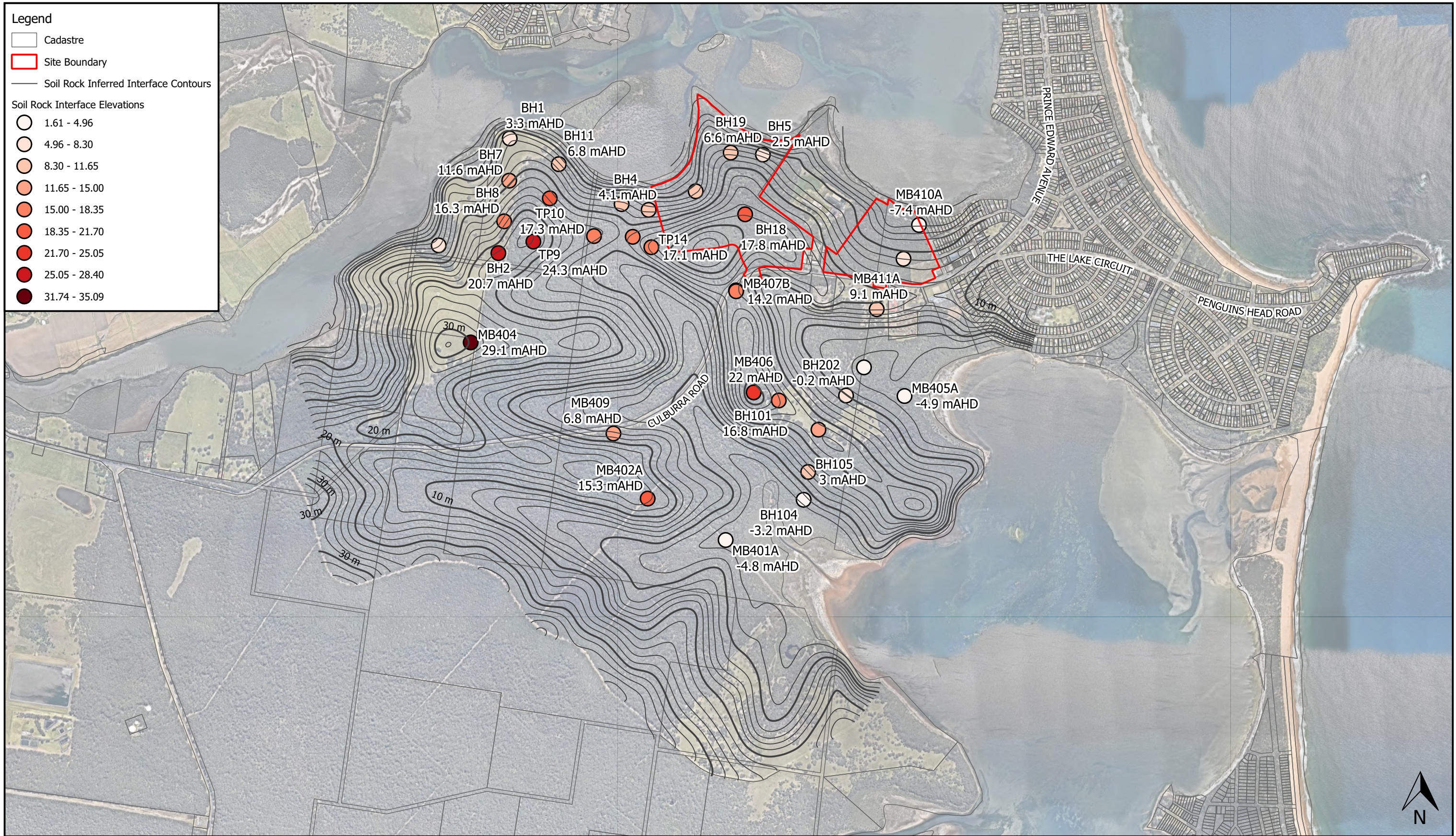
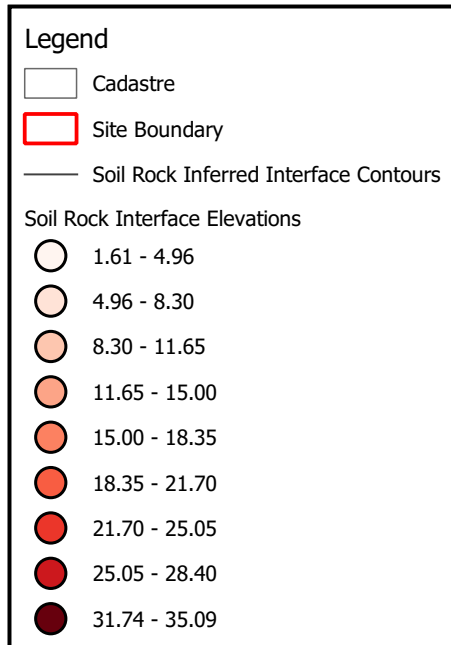
Notes:
 - Aerial image from Nearmap (2019).
 - Registered borehole locations from BoM Groundwater Explorer.

0 200 400 600 800 1000 m

1:20000 @ A3
 Viewport C



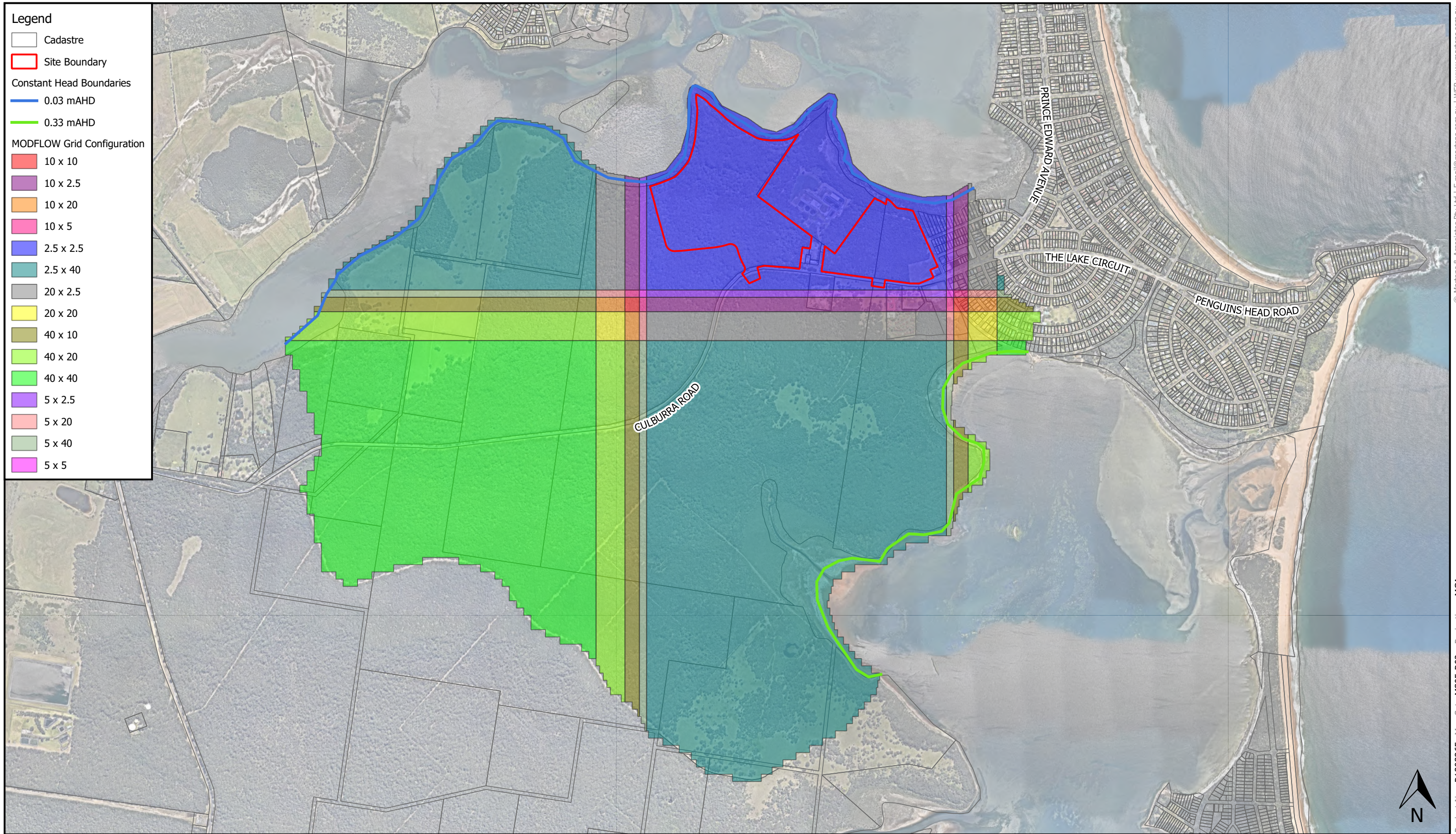
Map Title / Figure:
Registered Boreholes



Notes:
- Aerial image from Nearmap (2019).

1:20000 @ A3
Viewport C

Map Title / Figure:
Soil / Rock Inferred Interface Elevations








0 200 400 600 800 1000 m

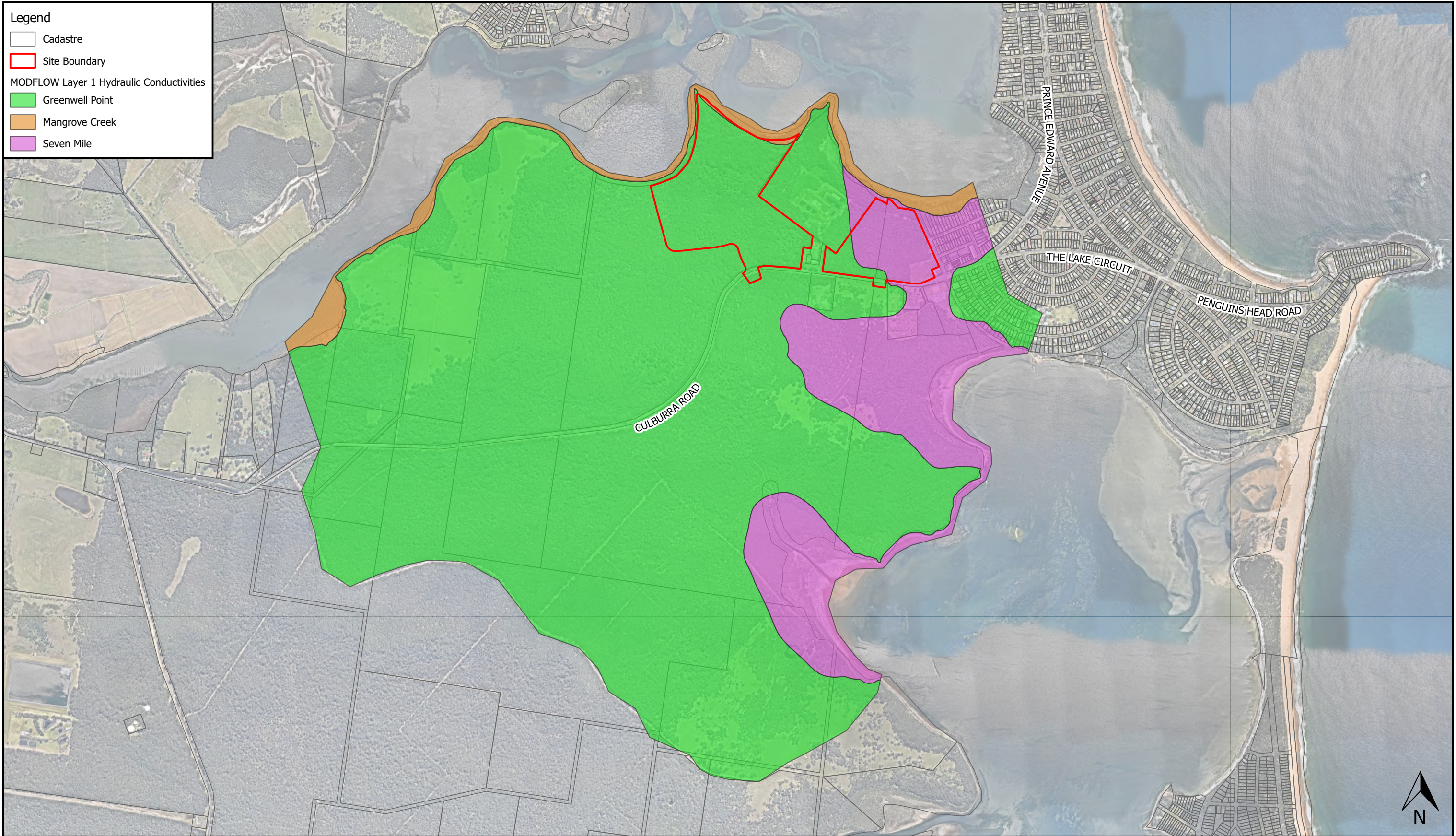
Notes:
- Aerial image from Nearmap (2019).

1:20000 @ A3
Viewport C

Map Title / Figure:
Groundwater Model Extents, Grid Configuration and Boundary Conditions

Legend

-  Cadastre
-  Site Boundary
- MODFLOW Layer 1 Hydraulic Conductivities**
-  Greenwell Point
-  Mangrove Creek
-  Seven Mile













Notes:
- Aerial image from Nearmap (2019).

1:20000 @ A3
Viewport C

Map Title / Figure:
Layer 1 Hydraulic Conductivity Zones

Legend

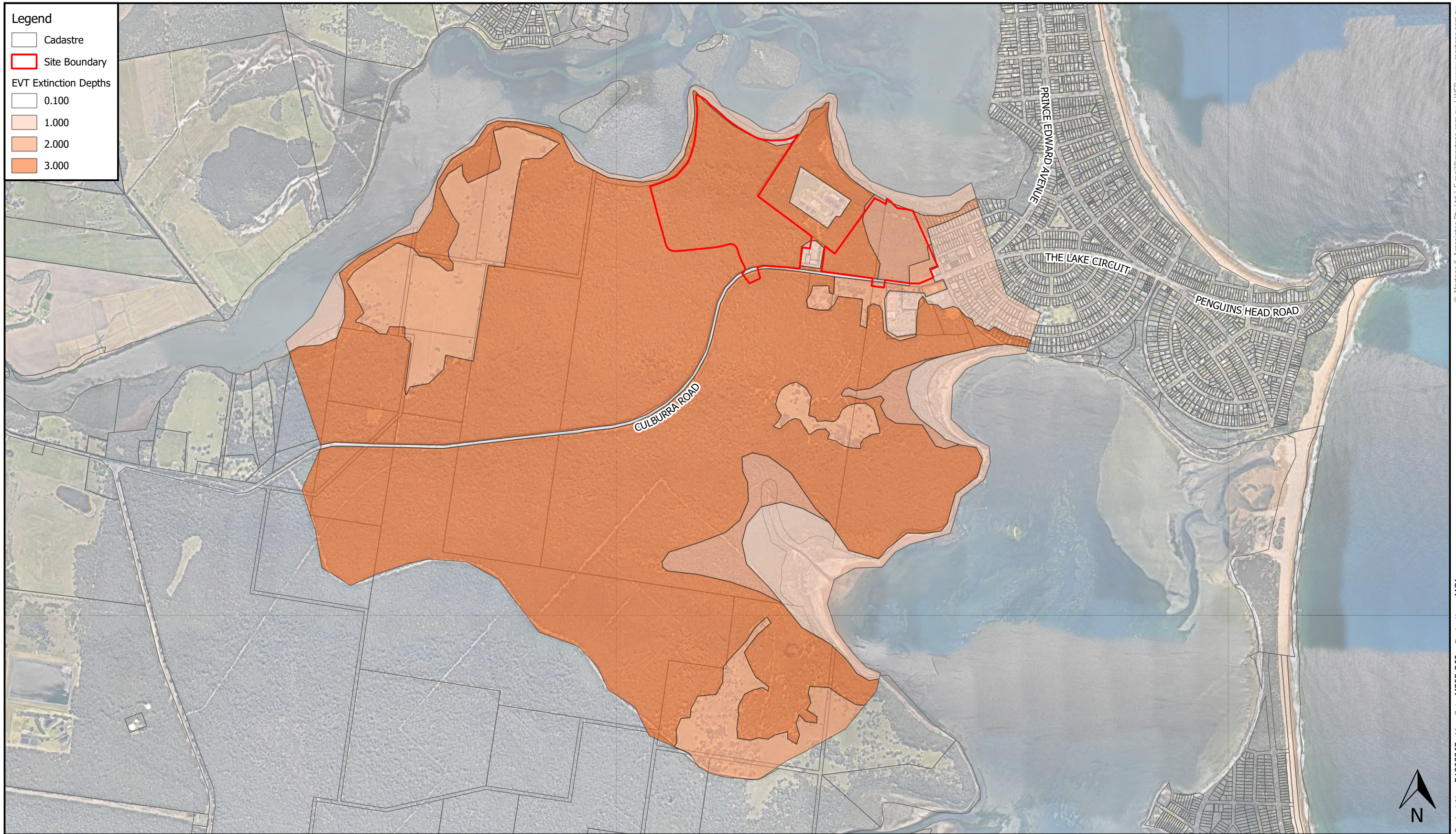
-  Cadastre
-  Site Boundary
- MODFLOW Recharge Zones**
-  Forest
-  Grassed
-  Industrial
-  Mangroves
-  Road
-  Swamp
-  Urban
-  Waste Water Treatment Facility



Notes:
- Aerial image from Nearmap (2019).

1:20000 @ A3
Viewport C

Map Title / Figure:
Existing Model Recharge Zones

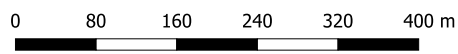
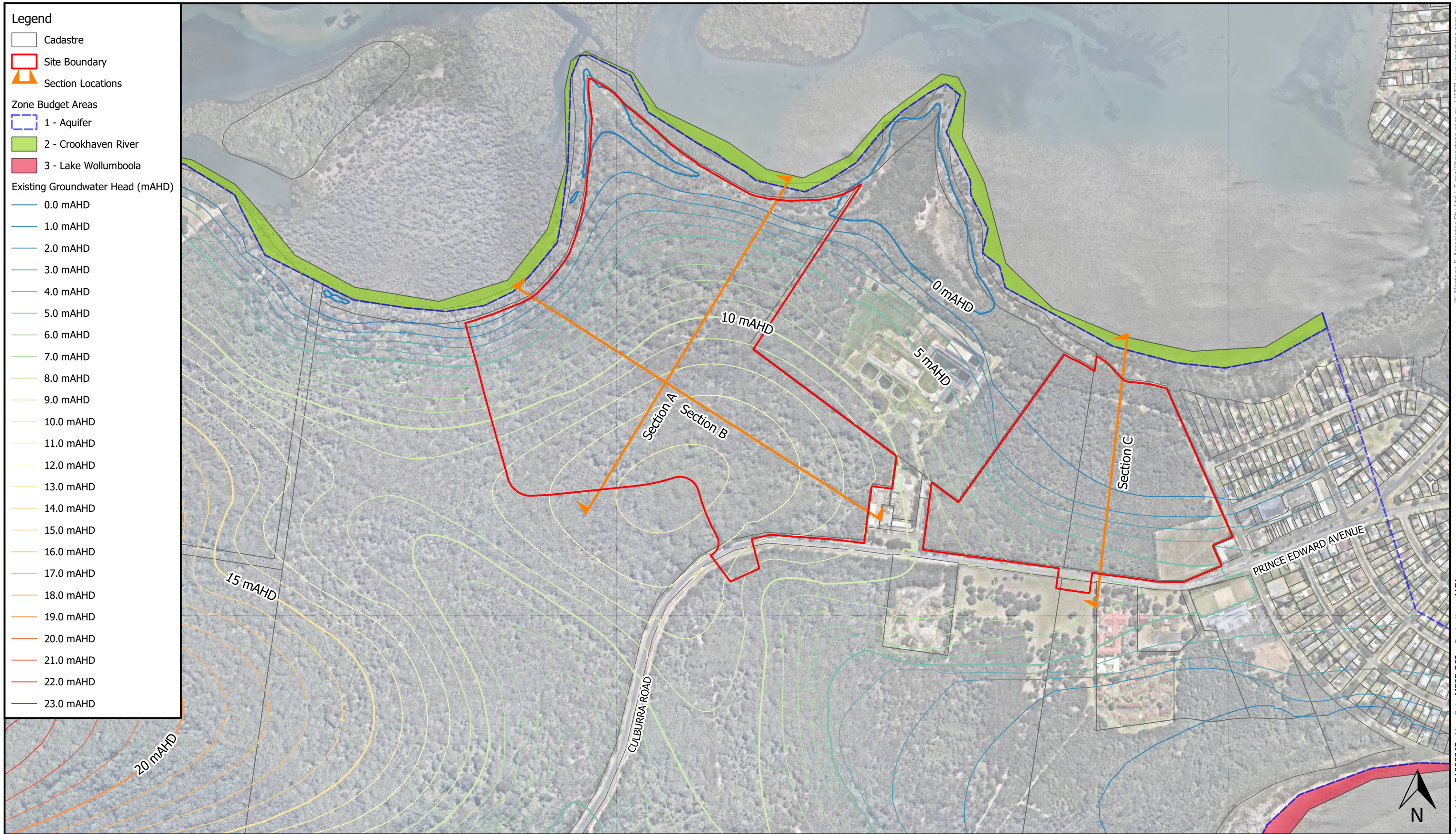


0 200 400 600 800 1000 m

Notes:
- Aerial image from Nearmap (2019).

1:20000 @ A3
Viewport C

Map Title / Figure:
Existing Model Evapotranspiration Extinction Depth Zones



Notes:
- Aerial image from Nearmap (2019).

1:7500 @ A3
Viewport D

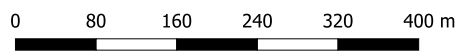
Map Title / Figure:
Existing Conditions Groundwater Heads

Legend

- Cadastre
- Site Boundary

Existing Groundwater Depth (mbgl)

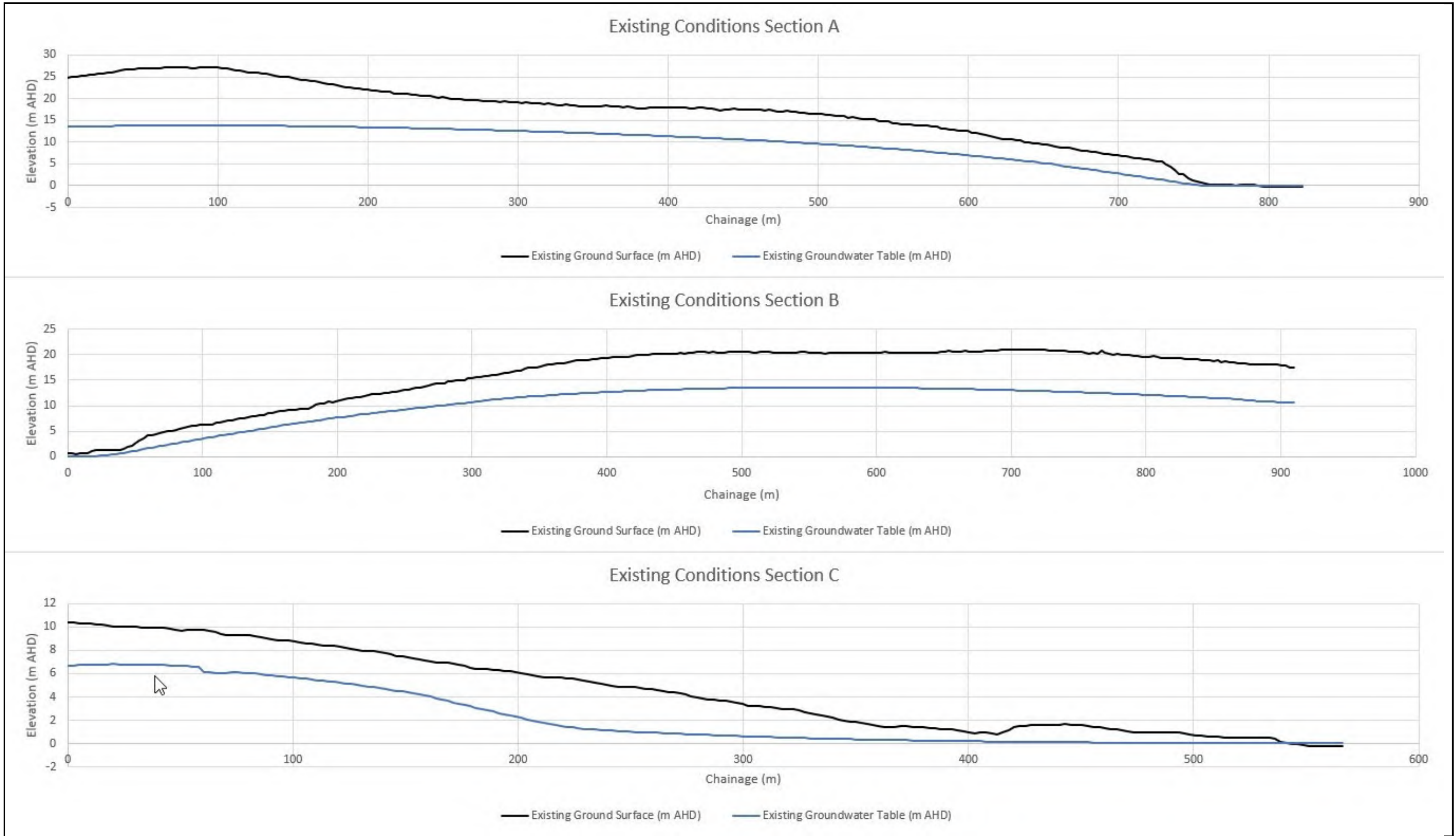
- 1 mbgl
- 2 mbgl
- 3 mbgl
- 4 mbgl
- 5 mbgl
- 6 mbgl
- 7 mbgl
- 8 mbgl
- 9 mbgl
- 10 mbgl
- 11 mbgl



Notes:
- Aerial image from Nearmap (2019).

1:7500 @ A3
Viewport D




Map Title / Figure:
Existing Conditions Depth to Groundwater













Project No: P1203365 Map Set: MS05-R02 Projection: MGA © Martens & Associates Pty Ltd | E mail@martens.com.au | WEB www.martens.com.au

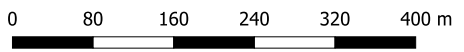
Map Title / Figure: Existing Conditions Groundwater Heads Sections

Legend

-  Cadastre
-  Site Boundary
-  Development Layout

MODFLOW Post-Development Recharge Areas

-  Forest
-  Grassed
-  Industrial
-  Mangroves
-  Pond
-  Road
-  Swamp
-  Urban
-  Waste Water Treatment Facility
-  Bio Filtration/Retention






Notes:
- Aerial image from Nearmap (2019).





1:7500 @ A3
Viewport D

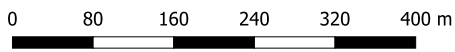
Map Title / Figure:
Post-Development Modified Recharge Areas

Legend

-  Cadastre
-  Site Boundary
-  Development Layout

MODFLOW Post-Development EVT Extinction Depths

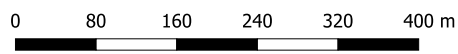
-  0.10
-  1.00
-  2.00
-  3.00



Notes:
- Aerial image from Nearmap (2019).

1:7500 @ A3
Viewport D

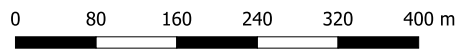
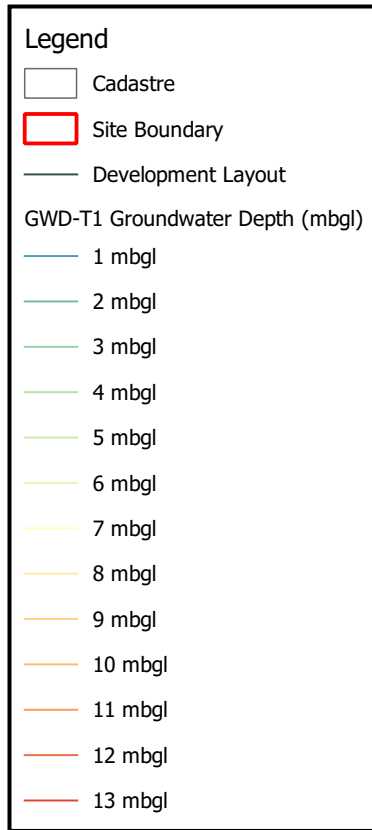
Map Title / Figure:
Post-Development Modified Evapotranspiration Extinction Depth Zones



Notes:
- Aerial image from Nearmap (2019).

1:7500 @ A3
Viewport D

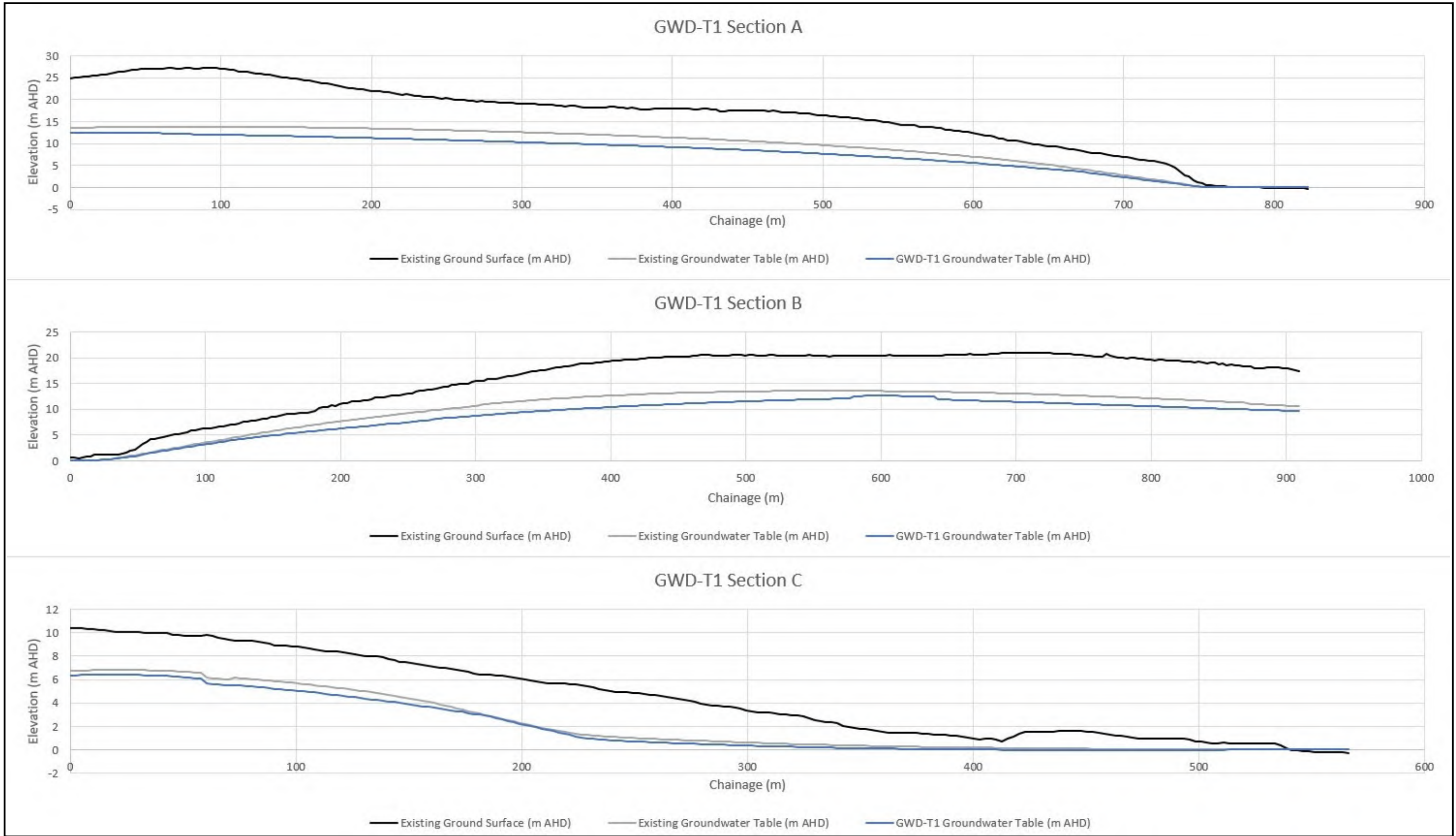
Map Title / Figure:
Post-Development Groundwater Heads - No Stormwater Recharge



Notes:
- Aerial image from Nearmap (2019).

1:7500 @ A3
Viewport D








Map Title / Figure:
Post-Development Depth to Groundwater - No Stormwater Recharge

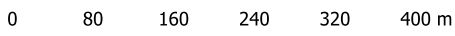


Project No: P1203365 | Map Set: MS05-R02 | Projection: MGA
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Map Title / Figure: Post-Development Groundwater Heads Sections - No Stormwater Recharge

Legend

-  Cadastre
-  Site Boundary
-  Development Layout
-  High-Priority GDEs
-  GDE 40m Buffer
-  Water Treatment Structures
- GWD-T1 Groundwater Drawdown (m)
-  + Drawdown



1:7500 @ A3
 Viewport D

Notes:
 - Aerial image from Nearmap (2019).
 - Positive drawdown is a reduction in the groundwater level while negative drawdown is a raising of the water level.
 - Drawdown between +/- 0.5 m has been disregarded from this analysis.

Post-Development Head Drawdown - No Stormwater Recharge

Map Title / Figure:

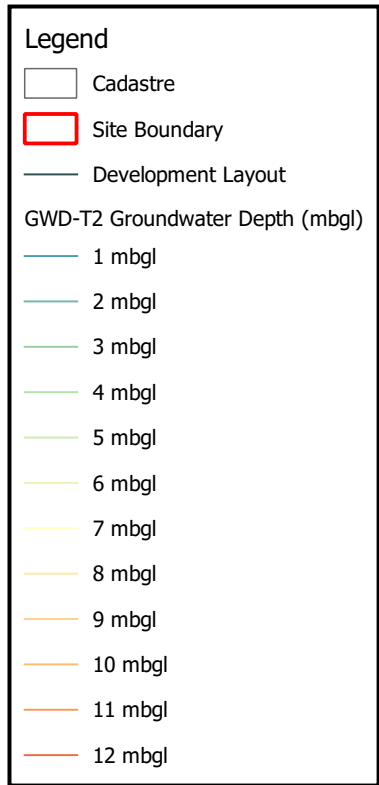


0 80 160 240 320 400 m

Notes:
- Aerial image from Nearmap (2019).

1:7500 @ A3
Viewport D

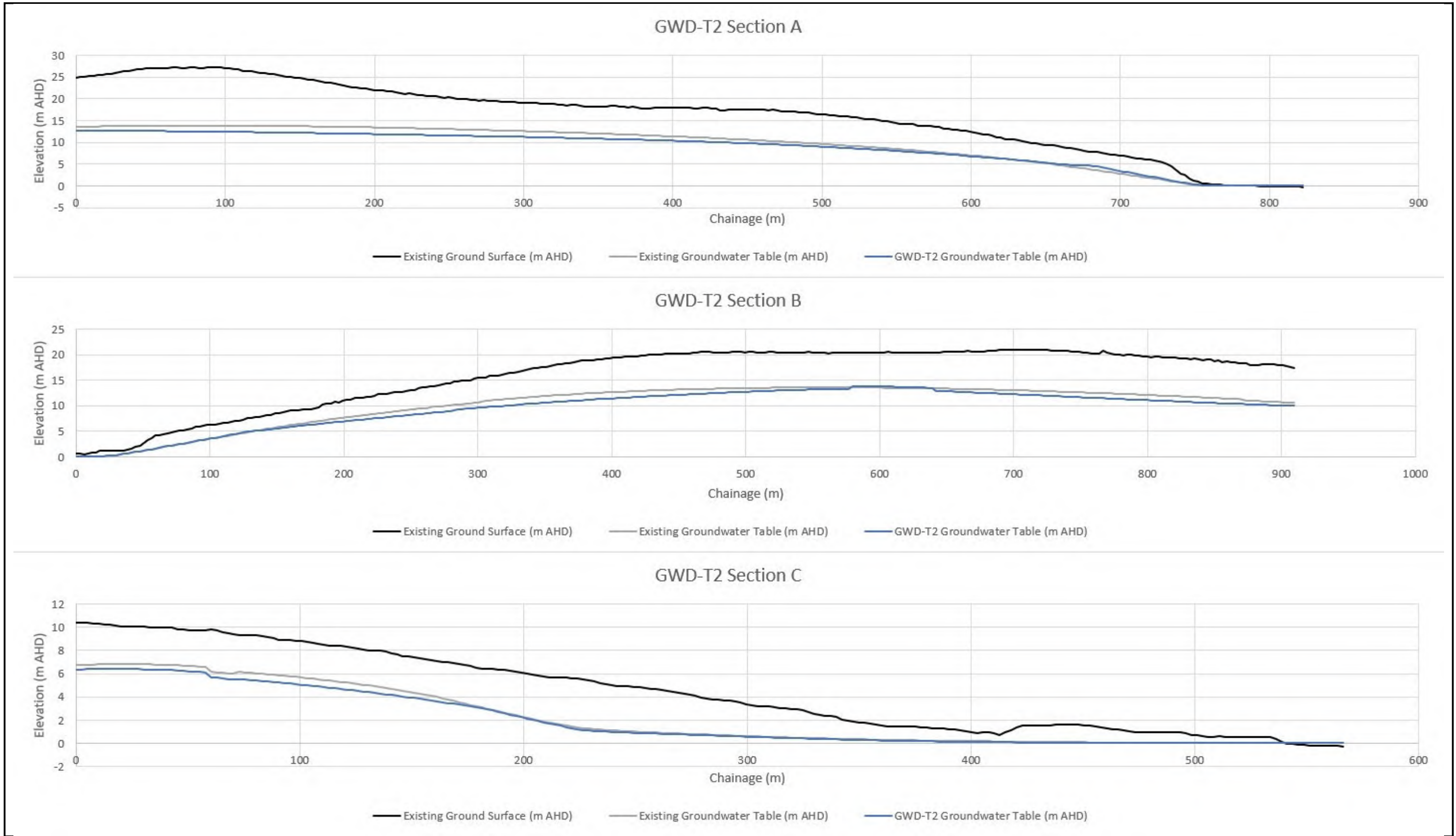
Map Title / Figure:
Post-Development Groundwater Heads - With Stormwater Recharge



Notes:
- Aerial image from Nearmap (2019).

1:7500 @ A3
Viewport D







Map Title / Figure:
Post-Development Depth to Groundwater - With Stormwater Recharge





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 Project No: P1203365 Map Set: MS05-R02 Projection: MGA

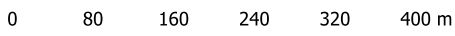
Map Title / Figure: Post-Development Groundwater Heads Sections - With Stormwater Recharge

Legend

-  Cadastre
-  Site Boundary
-  Development Layout
-  High-Priority GDEs
-  GDE 40m Buffer
-  Water Treatment Structures

GWD-T2 Groundwater Drawdown (m)

-  - Drawdown
-  + Drawdown

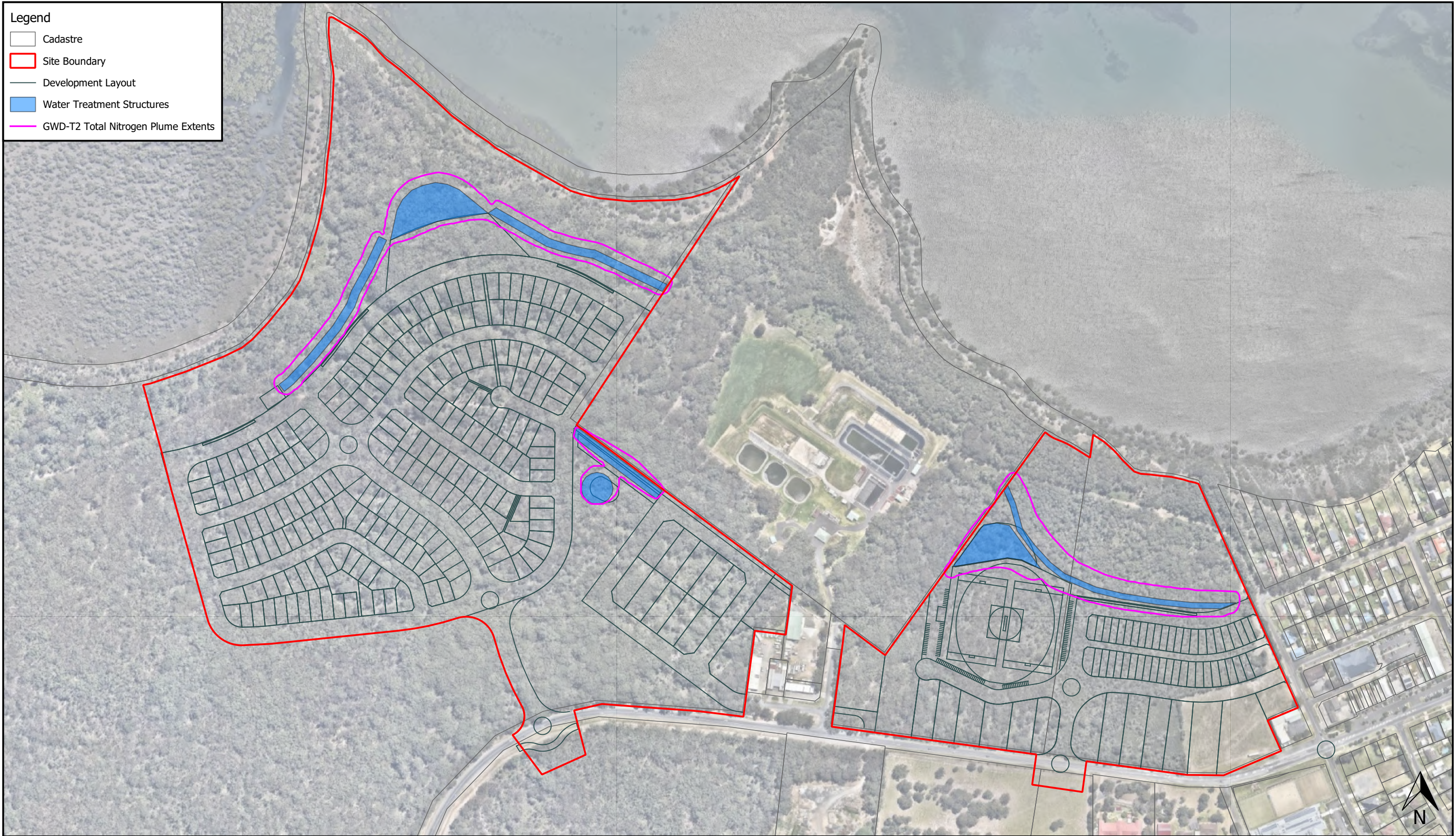


1:7500 @ A3
Viewport D

Notes:
 - Aerial image from Nearmap (2019).
 - Positive drawdown is a reduction in the groundwater level while negative drawdown is a raising of the water level.
 - Drawdown between +/- 0.5 m has been disregarded from this analysis.

Post-Development Head Drawdown - With Stormwater Recharge

Map Title / Figure:



1:5000 @ A3
Viewport E

Legend

- Cadastre
- Site Boundary
- Development Layout
- Water Treatment Structures
- GWD-T2 Total Phosphorous Plume Extents








0 50 100 150 200 250 m

Notes:
- Plume extents based on a minimum concentration of 0.001 mg/L TP.

1:5000 @ A3
Viewport E

Map Title / Figure:
Post-Development Total Phosphorous Plumes - With Stormwater Recharge

Legend

-  Cadastre
-  Site Boundary
-  Development Layout
-  Water Treatment Structures
-  GWD-T2 Faecal Coliforms Plume Extents











0 50 100 150 200 250 m

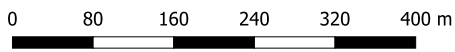
Notes:
- Plume extents based on a minimum concentration of 1 CFU/100mL FC.

1:5000 @ A3
Viewport E

Map Title / Figure:
Post-Development Faecal Coliform Plumes - With Stormwater Recharge

Legend

-  Cadastre
-  Site Boundary
-  Development Layout
- Water Quality Monitoring Locations**
-  Groundwater Monitoring Location
-  Stormwater Monitoring Location
-  Shellfish Monitoring Location
-  Photo Point Monitoring Location
-  Estuary Monitoring Location



Notes:
- Aerial image from Nearmap (2019).

1:7500 @ A3
Viewport D

Map Title / Figure:
Water Quality Monitoring Plan

13 Annexure C: Figures

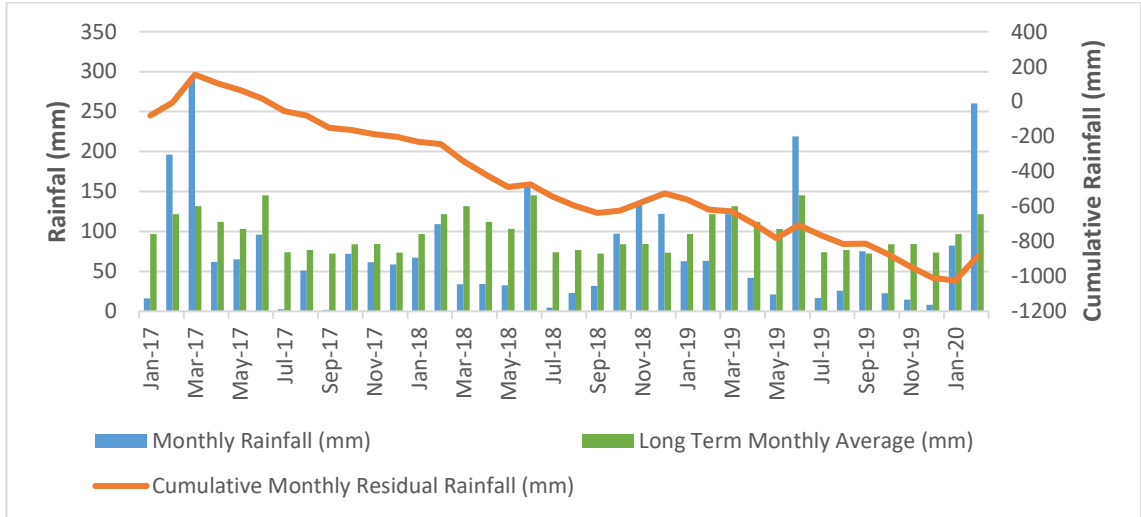


Figure 1: Average and cumulative residual monthly rainfall.

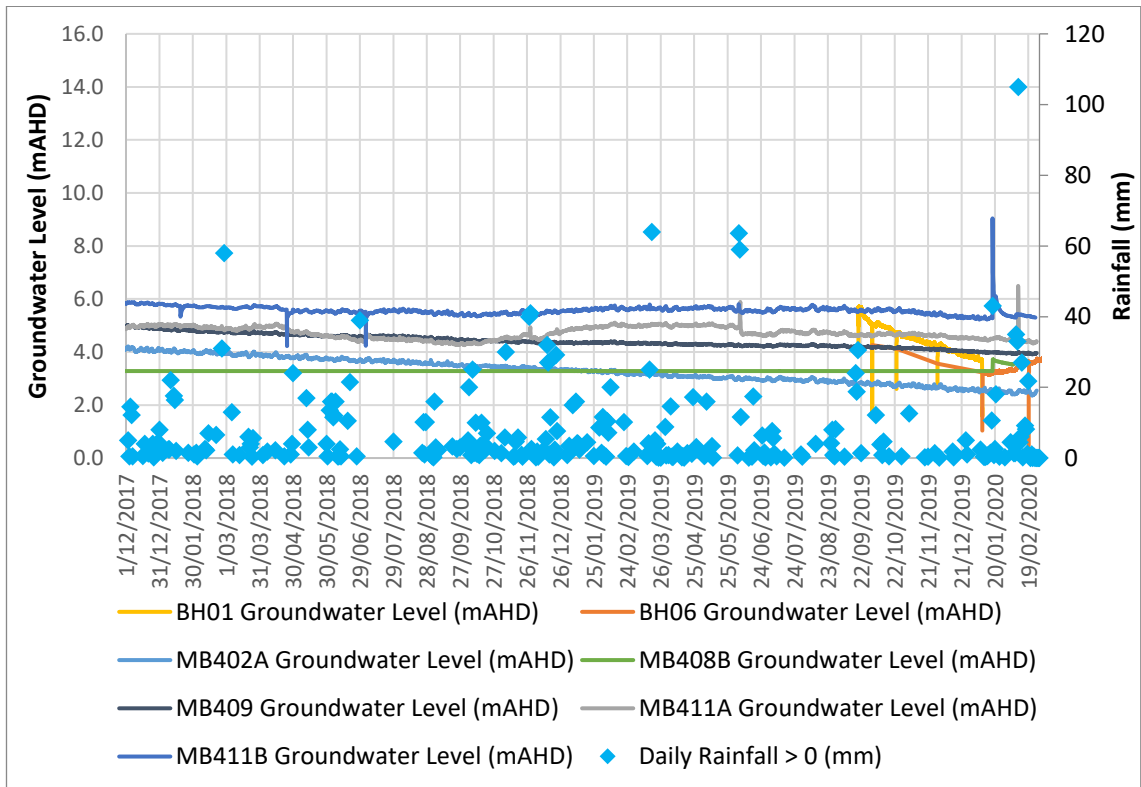


Figure 2: Monitored groundwater levels and daily rainfall chart 1.

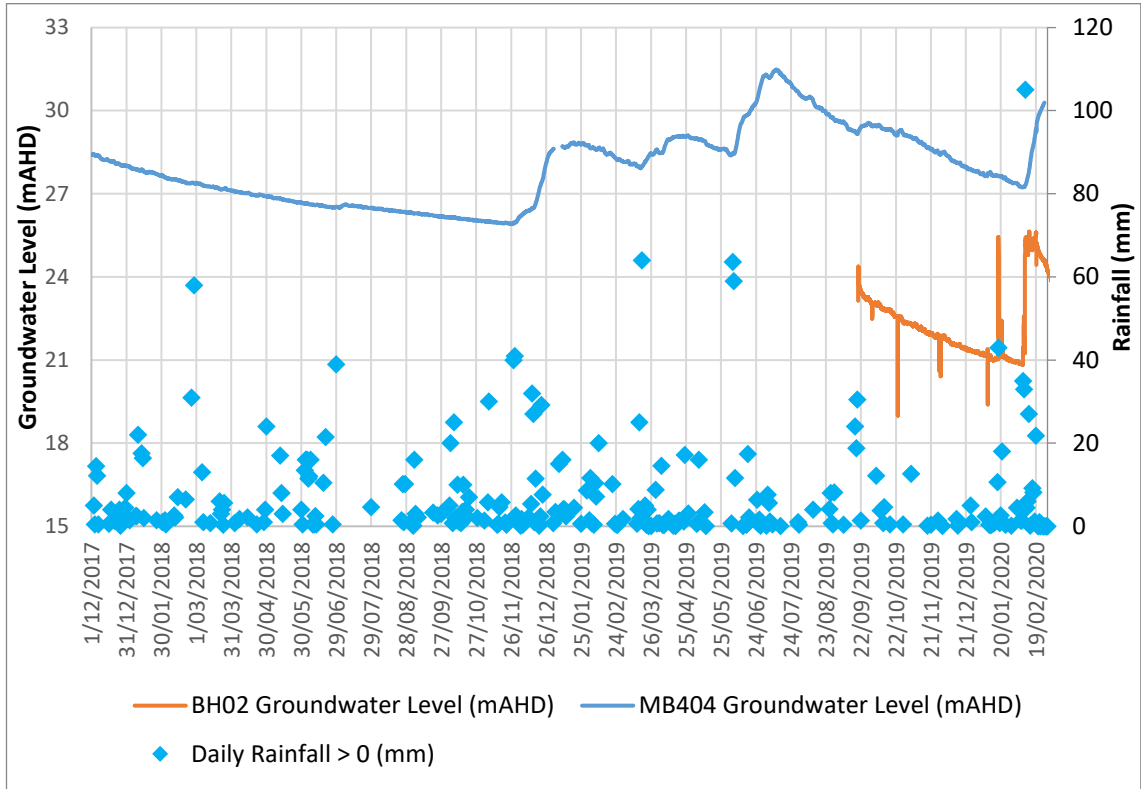


Figure 3: Monitored groundwater levels and daily rainfall chart 2.

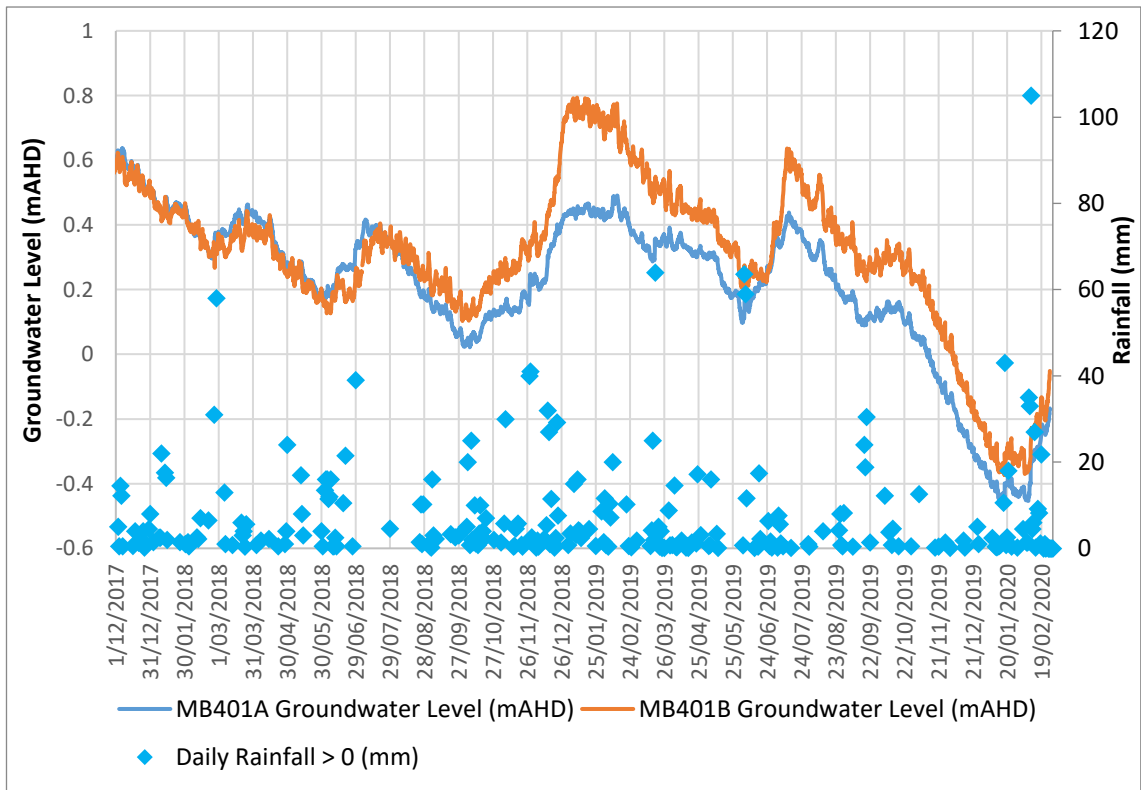


Figure 4: Monitored groundwater levels and daily rainfall chart 3.

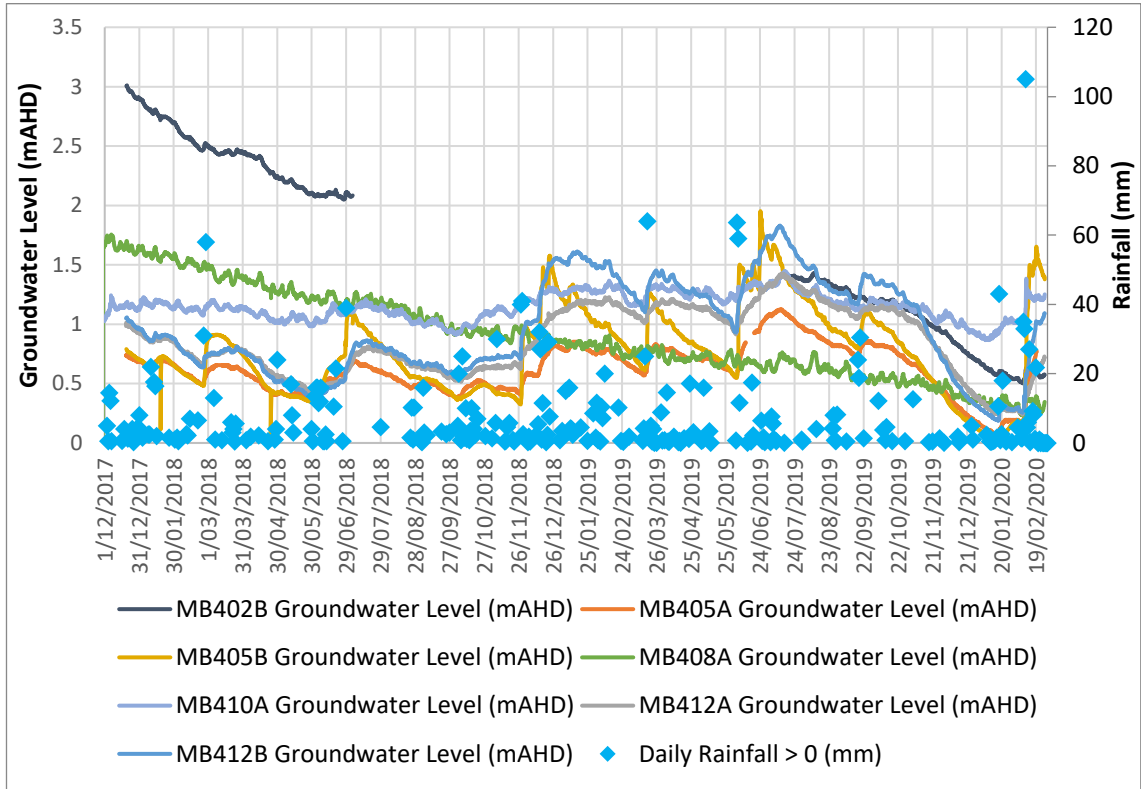


Figure 5: Monitored groundwater levels and daily rainfall chart 4.

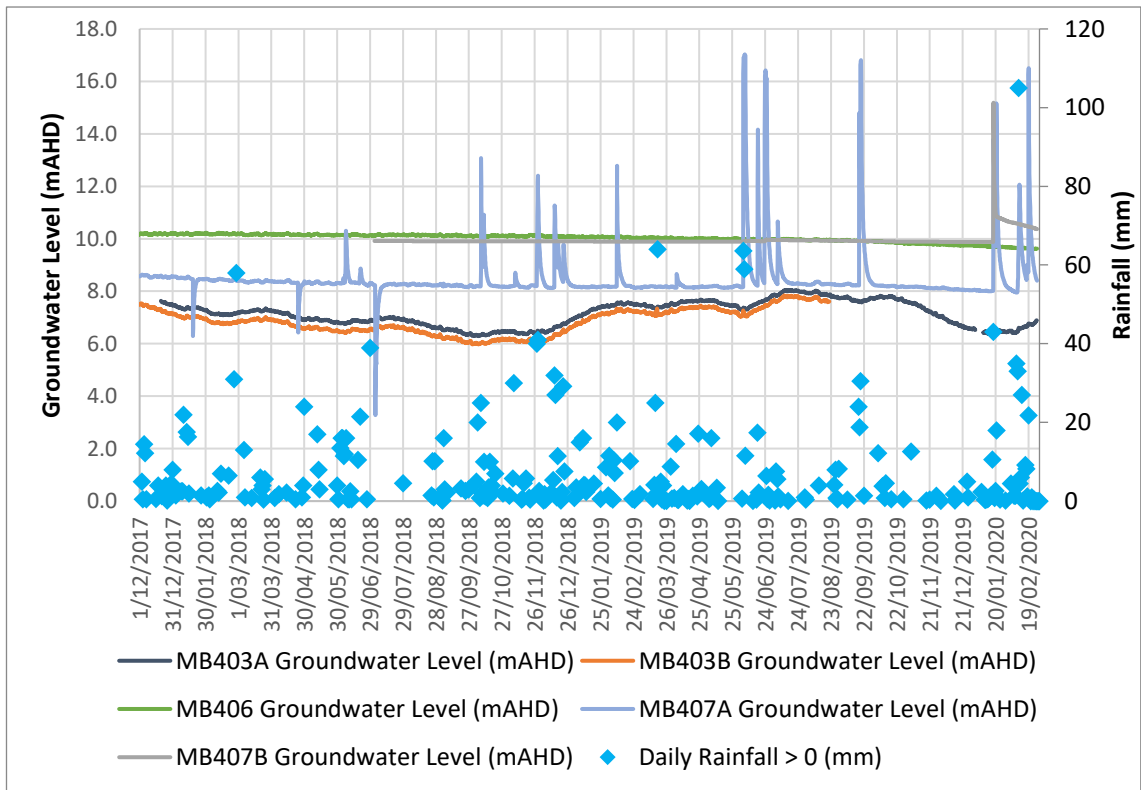


Figure 6: Monitored groundwater levels and daily rainfall chart 5.

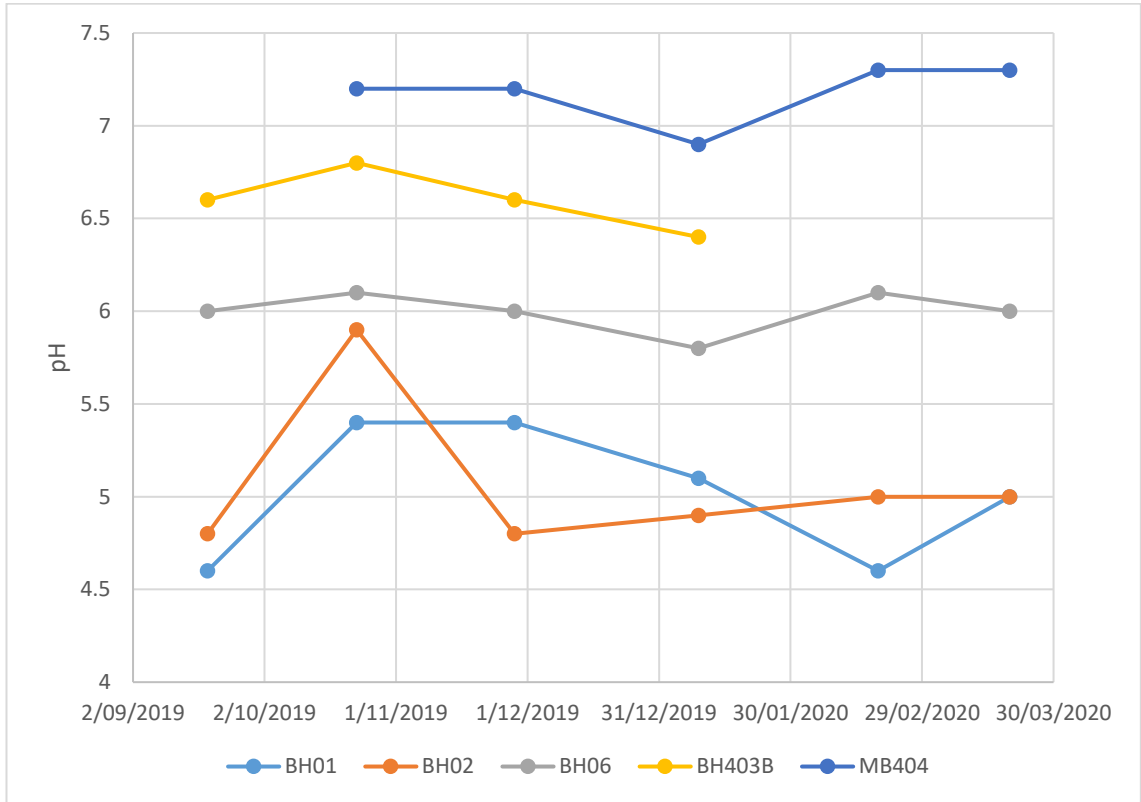


Figure 7: Observed pH readings.

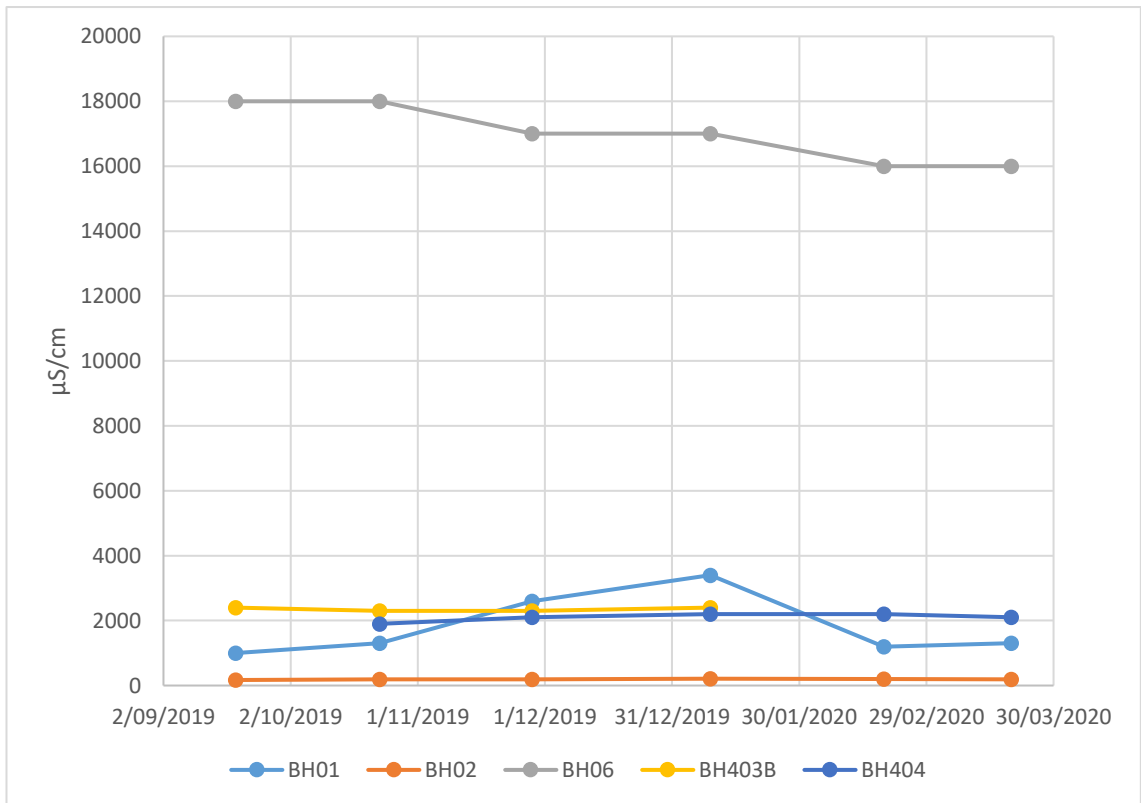


Figure 8: Observed electrical conductivity readings.

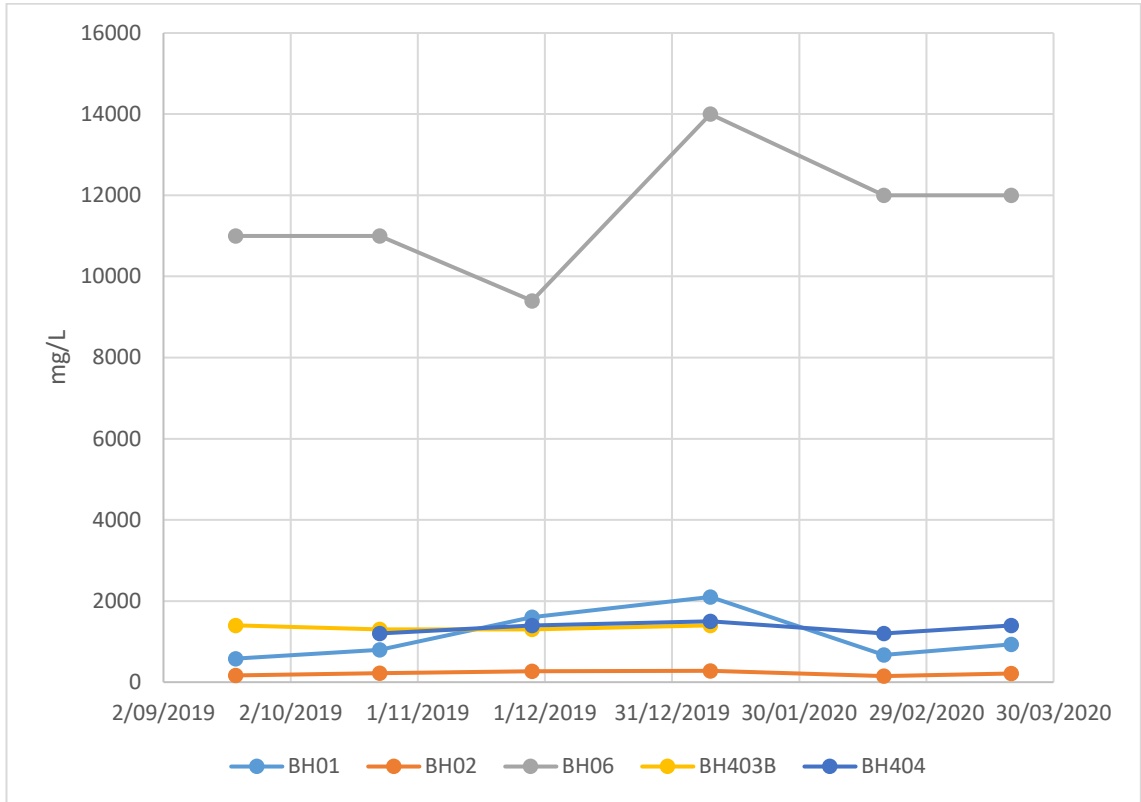


Figure 9: Observed total dissolved solids readings.

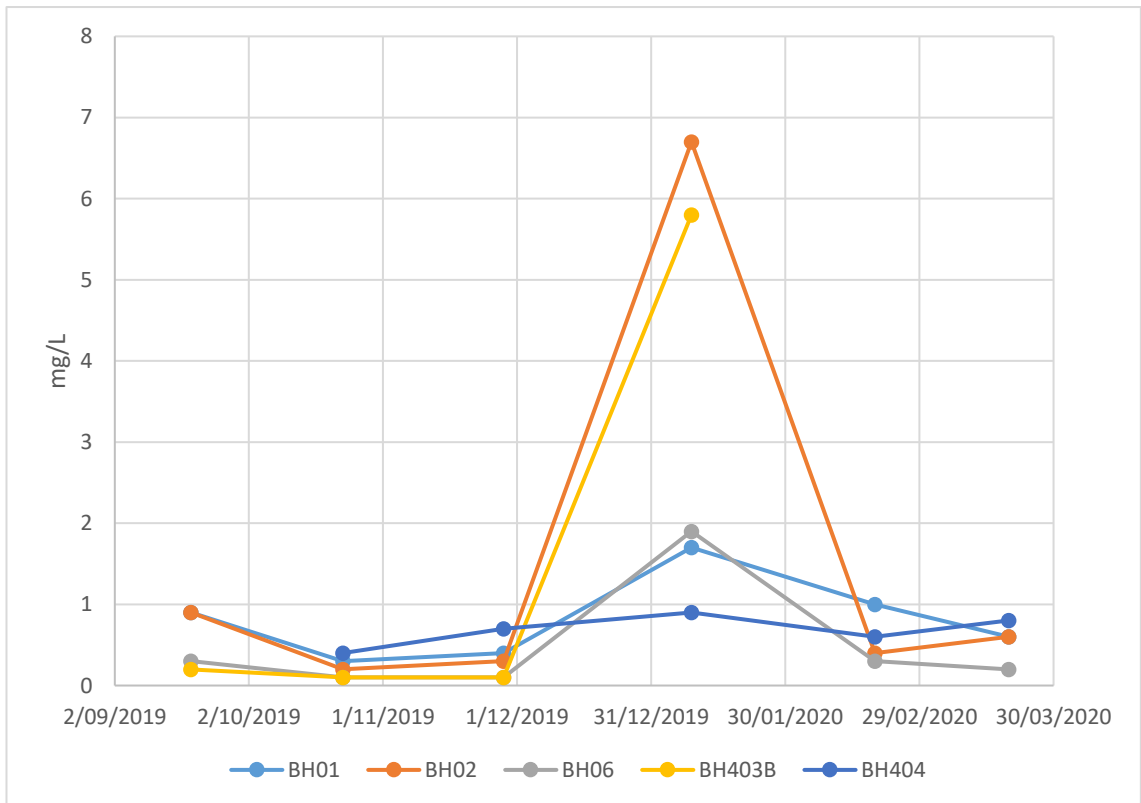


Figure 10: Observed total nitrogen readings.

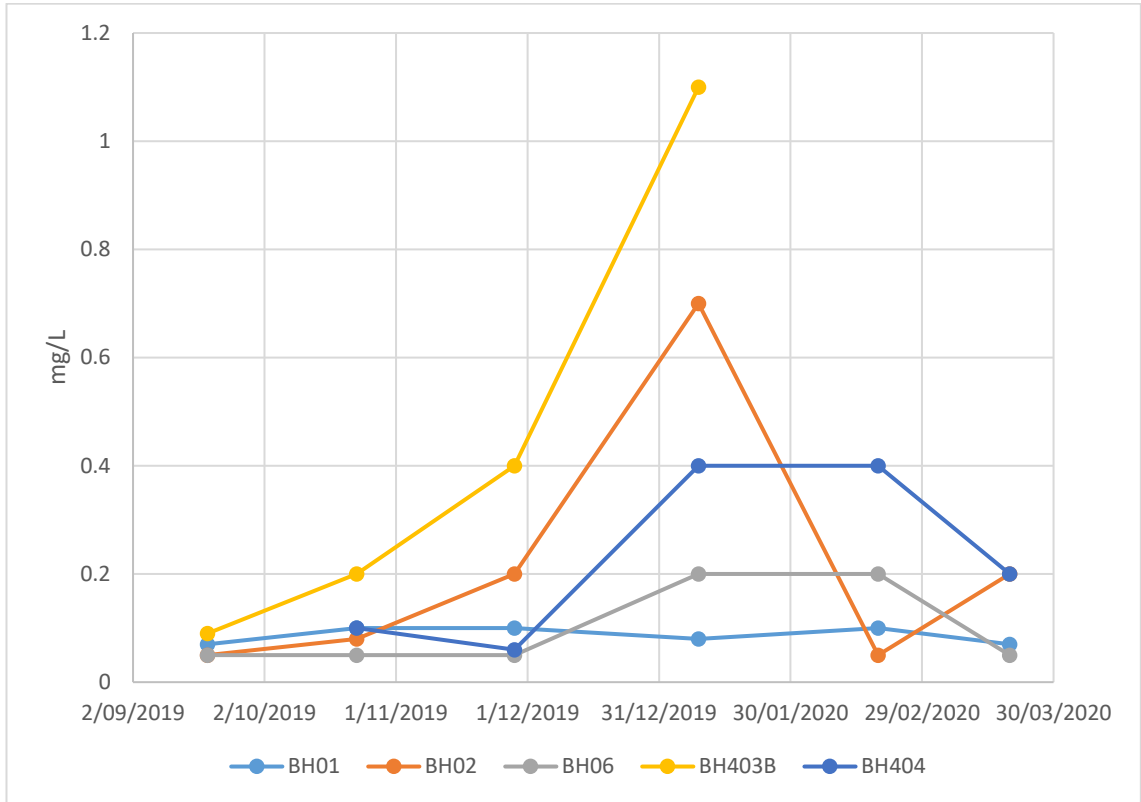


Figure 11: Observed total phosphorous readings.

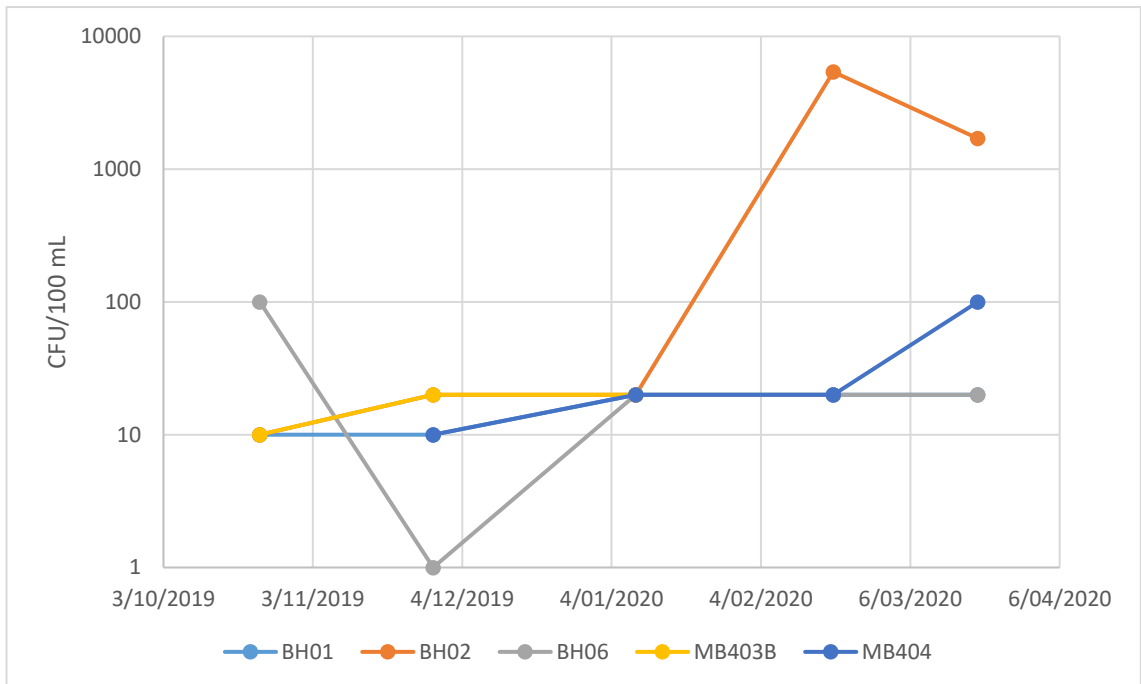


Figure 12: Observed faecal coliforms readings.

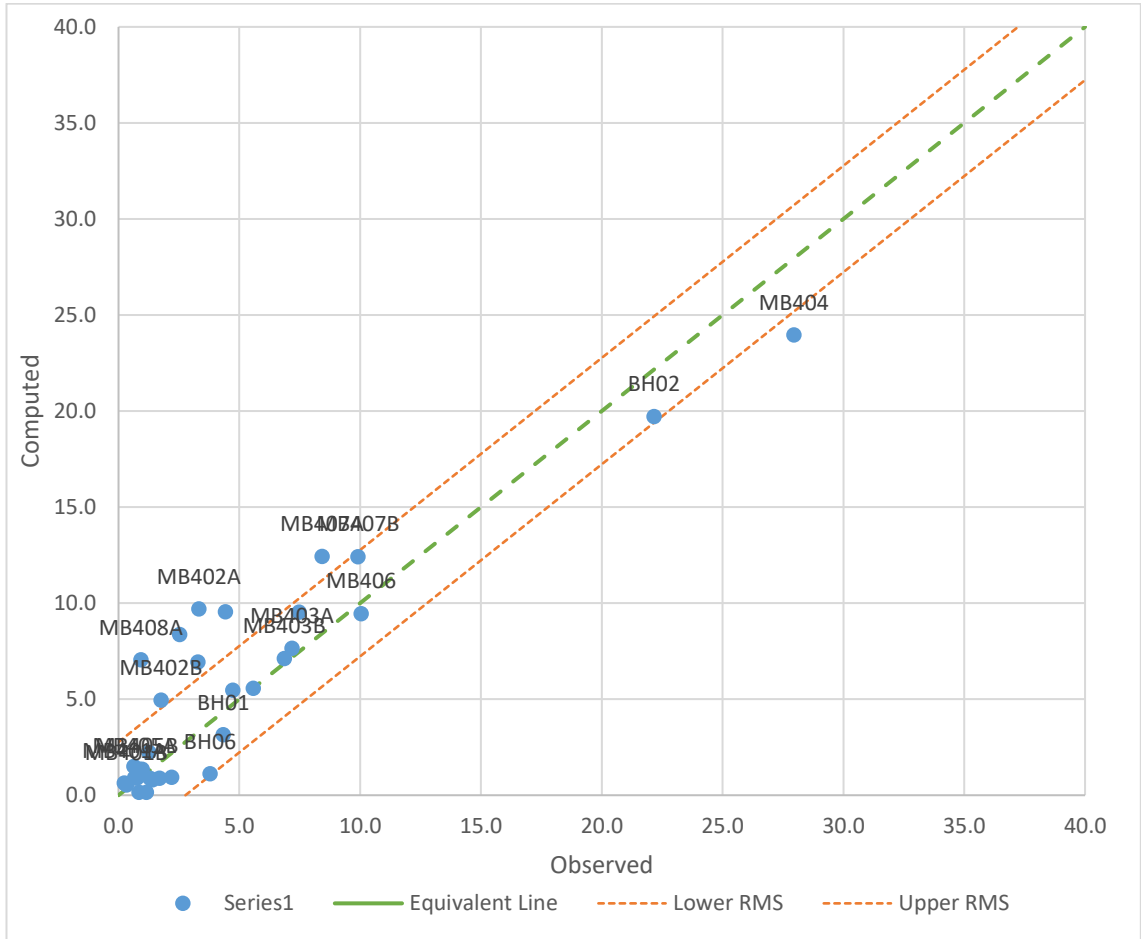


Figure 13: Existing conditions MODFLOW model calibration plot.

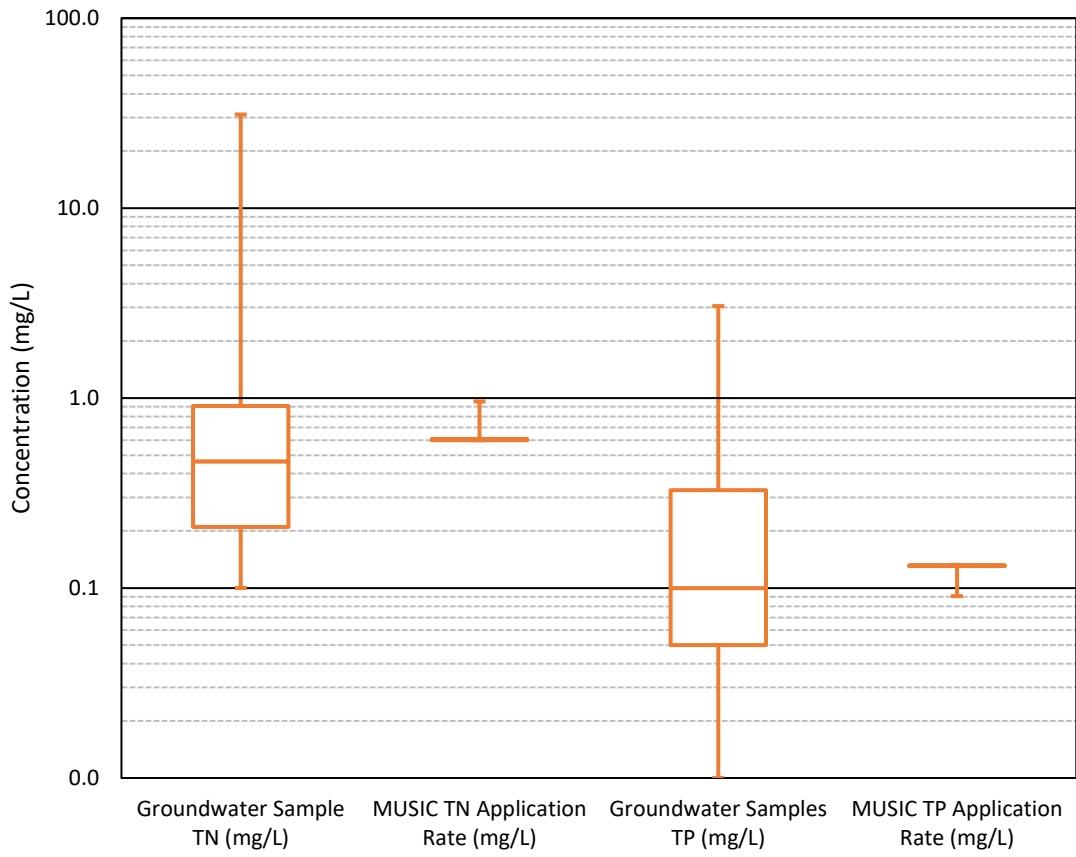


Figure 14: Groundwater samples compared to MUSIC modelled concentrations.


14 Annexure D: Soil Profile Logs

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH401	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Grass	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING	150.750948	RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	1.20 m depth	NORTHING	-34.931613	ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	L	Not Encountered	0.10		3365/BH401/0.0-0.17/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; medium grained sand; trace roots. No roots, slightly pedal.		F		TOPSOIL
			0.20		3365/BH401/0.0-0.2/S/1 D 0.00 m			LC	LIGHT CLAY; medium plasticity; brown; apedal.				RESIDUAL SOIL
	M		0.5		3365/BH401/0.5-0.8/S/1 D 0.50 m						M (<<PL)	St	
	H		1.10					CL-CI	Sandy CLAY; low to medium plasticity; yellow and pale grey; medium grained sand; apedal and layered.		H		1.10: Possible extremely weathered rock.
			1.20						Hole Terminated at 1.20 m (Target depth reached)				
			1.5										
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P1203365BH401-42W01.GPJ <<DrawingFile>> 26/08/2019 11:08 8:30:004 D:\gel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Proj: Martens 2.00 2016-11-13

 <p>MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St. Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au</p>	<p>Engineering Log - BOREHOLE</p>
---	--

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH402	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Grass	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING	150.750861	RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	1.10 m depth	NORTHING	-34.932376	ASPECT	South	SLOPE	<5%

Drilling			Sampling			Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	L	Not Encountered	0.10		3365/BH402/0.0-0.17/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; medium grained sand; weakly structured; pedal; trace roots (grass). No roots; trace coal.		VSt		TOPSOIL	
			0.30		3365/BH402/0.0-0.2/S/1 D 0.00 m									
			0.5		3365/BH402/0.0-0.3/S/1 D 0.00 m				MC	MEDIUM CLAY; medium plasticity; dark grey, dark brown and red; apedal; trace subrounded ironstone gravels.		M (<<PL)	St	RESIDUAL SOIL
			0.95		3365/BH402/0.5-0.8/S/1 D 0.50 m				CL-CI	Sandy CLAY; low to medium plasticity; yellow and grey; fine grained sand; with subrounded to subangular fine grained sandstone gravels; apedal.			H	0.95: Possible extremely weathered rock.
			1.10						Hole Terminated at 1.10 m				1.10: Refusal on fine grained sandstone.	

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P1203365BH401-42B01.GPJ <<DrawingFiles>> 26/08/2019 11:08 8:30:004 D:\gel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Proj: Martens 2.00 2016-11-13



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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH403	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Grass	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING	150.749279	RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 0.90 m depth	NORTHING	-34.931558	ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.15		3365/BH403/0.0-0.17/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown and dark grey; fine grained sand; pedal.	M	St		TOPSOIL
					3365/BH403/0.0-0.2/S/1 D 0.00 m			CL-CI	Silty CLAY; low to medium plasticity; yellow-brown; apedal.	M (<PL)			RESIDUAL SOIL
					3365/BH403/0.0-0.3/S/1 D 0.00 m								
			0.5		3365/BH403/0.4-0.7/S/1 D 0.40 m					M (<PL)	F		
			0.85						Grey with subrounded ironstone gravels.				
			0.90						Hole Terminated at 0.90 m				0.90: Refusal on rock possible ironstone band, siltstone or fine grained sandstone.
			1.0										
			1.5										
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P1203365BH401-42W01.GPJ <<DrawingFiles>> 26/08/2019 11:08 8.30.004 D:\gel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Proj: Martens 2.00 2016-11-13







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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH404	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 1.40 m depth	NORTHING		ASPECT	Southwest	SLOPE	<5%

Drilling			Sampling			Field Material Description									
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
PT	M	Not Encountered	0.30		3365/BH404/0.0-0.17/S/1 D 0.00 m 3365/BH404/0.0-0.2/S/1 D 0.00 m 3365/BH404/0.0-0.2/S/2 D 0.00 m 3365/BH404/0.0-0.2/S/3 D 0.00 m 3365/BH404/0.0-0.2/S/DUP D 0.00 m 3365/BH404/0.5-0.7/S/1 D 0.50 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown and dark grey; fine grained sand; trace roots; pedal.		F		TOPSOIL		
			0.90		3365/BH404/0.9-1.1/S/1 D 0.90 m			MC	MEDIUM CLAY; medium plasticity; grey-brown with trace orange and dark brown; apedal.		M (<<PL)	VSt		RESIDUAL SOIL	
			1.20		3365/BH404/1.2-1.4/S/1 D 1.20 m			HC	HEAVY CLAY; medium to high plasticity; grey, pale grey and yellow; apedal.						
			1.40		3365/BH404/1.2-1.4/S/1 D 1.20 m			SC	Sandy CLAY; low plasticity; yellow and grey; with fine to medium grained sand; with silt; apedal.						
			1.5								Hole Terminated at 1.40 m (Target depth reached)				

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH405	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 1.20 m depth	NORTHING		ASPECT	East	SLOPE	<5%

Drilling			Sampling			Field Material Description									
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
PT	M-H	Not Encountered	0.20		3365/BH404/0.0-0.1/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown and dark grey; with fine to medium grained sand; trace roots; pedal.				TOPSOIL		
			0.30		3365/BH405/0.0-0.1/S/1 D 0.00 m				Pale grey and grey; no roots.						
			0.5		3365/BH405/0.0-0.1/S/1 D 0.00 m		3365/BH405/0.0-0.2/S/1 D 0.20 m		MC	MEDIUM CLAY; low to medium plasticity; red, orange and brown-yellow; with subrounded ironstone gravels; apedal.				RESIDUAL SOIL	
			0.70		3365/BH404/0.4-0.5/S/1 D 0.40 m					Grey, red and yellow-brown.					
			0.80							Trace subrounded to subangular ironstone gravels.					
			1.0				3365/BH404/1.0-1.2/S/1 D 1.00 m				No ironstone gravels.				
			1.20								Hole Terminated at 1.20 m (Target depth reached)				
			1.5												
			2.0												
			2.5												
3.0															
3.5															
4.0															
4.5															

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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



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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH406	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 0.80 m depth	NORTHING		ASPECT	South	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.30		3365/BH406/0.0-0.2/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; with fine to medium grained sand; trace roots; pedal.				TOPSOIL
			0.5		3365/BH406/0.0-0.2/S/2 D 0.00 m			CL-CI	Sandy CLAY; low to medium plasticity; yellow-brown; with fine grained sand; apedal.	M (<<PL)			RESIDUAL SOIL
			0.80		3365/BH406/0.2-0.3/S/1 D 0.20 m								
					3365/BH406/0.5-0.7/S/1 D 0.50 m								
			1.0						Hole Terminated at 0.80 m (Target depth reached)				
			1.5										
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
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CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH407	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 0.90 m depth	NORTHING		ASPECT	East	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.20		3365/BH407/0.0-0.17/S/1 D 0.00 m 3365/BH407/0.1-0.2/S/1 D 0.10 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; with fine to medium grained sand; trace roots; pedal.				TOPSOIL
	H		0.60		3365/BH407/0.1-0.2/S/2 D 0.10 m 3365/BH407/0.1-0.2/S/3 D 0.10 m 3365/BH407/0.3-0.5/S/1 D 0.30 m			CL-CI	Sandy CLAY; low to medium plasticity; yellow-brown; apedal. Pale grey, yellow and red.	M (<<PL)			RESIDUAL SOIL
			0.90		3365/BH407/0.8-0.9/S/1 D 0.80 m					Hole Terminated at 0.90 m (Target depth reached)			
			1.0										
			1.5										
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH408	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 0.70 m depth	NORTHING		ASPECT	Northeast	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.20		3365/BH408/0.0-0.17/S/1 D 0.00 m 3365/BH408/0.1-0.2/S/1 D 0.10 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown and dark grey; with fine to medium grained sand; trace roots; pedal.				TOPSOIL
	M-H		0.5		3365/BH408/0.1-0.2/S/2 D 0.10 m 3365/BH408/0.1-0.2/S/3 D 0.10 m 3365/BH408/0.3-0.5/S/1 D 0.30 m 3365/BH407/0.6-0.7/S/1 D 0.60 m			MC	MEDIUM CLAY; low to medium plasticity; yellow-brown and grey; apedal.	M (<<PL)			RESIDUAL SOIL
			0.70						Hole Terminated at 0.70 m (Target depth reached)				
			1.0										
			1.5										
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
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CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH409	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 0.70 m depth	NORTHING		ASPECT	Northeast	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.20		3365/BH409/0.0-0.17/S/1 D 0.00 m 3365/BH409/0.1-0.2/S/1 D 0.10 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown and dark grey; with fine to medium grained sand; trace roots; pedal.				TOPSOIL
	M-H		0.5		3365/BH409/0.1-0.2/S/2 D 0.10 m 3365/BH409/0.1-0.2/S/3 D 0.10 m 3365/BH409/0.5-0.7/S/1 D 0.50 m			MC	MEDIUM CLAY; low to medium plasticity; yellow-brown and red; apedal.	M (<<PL)			RESIDUAL SOIL
			0.70						Hole Terminated at 0.70 m (Target depth reached)				
			1.0										
			1.5										
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
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CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH410	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 1.00 m depth	NORTHING		ASPECT	Northwest	SLOPE	<5%

Drilling			Sampling			Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M	Not Encountered	0.20		3365/BH410/0.0-0.17/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; with fine to medium grained sand; trace roots; pedal.	M (<PL)			TOPSOIL	
			0.40		3365/BH410/0.1-0.2/S/1 D 0.10 m			MC	MEDIUM CLAY; medium plasticity; yellow-brown; apedal.				RESIDUAL SOIL	
			0.5		3365/BH410/0.1-0.2/S/2 D 0.10 m					Red, yellow and grey.				
			1.00		3365/BH410/0.2-0.4-0.5/S/3 D 0.10 m							M (<PL) to M (<PL)		
					3365/BH410/0.8-1.0/S/1 D 0.80 m									
									Hole Terminated at 1.00 m (Target depth reached)					

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
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CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH411	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 1.20 m depth	NORTHING		ASPECT	Northwest	SLOPE	<5%

Drilling			Sampling			Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M	Not Encountered	0.20		3365/BH11/0.0-0.2/S/1 D 0.00 m 3365/BH411/0.0-0.1/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; with fine to medium grained sand; with roots; pedal.		St		TOPSOIL	
			0.5		3365/BH411/p.4-0.6/S/1 D 0.40 m			MC	MEDIUM CLAY; medium plasticity; yellow-brown and orange-red; apedal.				RESIDUAL SOIL	
			0.90							Grey, red and red- yellow.		M (<<PL)	VSt	
			1.20		3365/BH411/1.0-1.2/S/1 D 1.00 m									
			1.5						Hole Terminated at 1.20 m (Target depth reached)					
			2.0											
			2.5											
			3.0											
			3.5											
			4.0											
			4.5											

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	22/08/2019	COMPLETED	22/08/2019	REF BH412	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 0.80 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M	Not Encountered	0.15		3365/BH412/0.0-0.1/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; trace roots; pedal.				TOPSOIL	
			0.20		3365/BH412/0.1-0.2/S/1 D 0.10 m				MC	With subrounded to subangular gravels. MEDIUM CLAY; low to medium plasticity; yellow-brown; apedal.				RESIDUAL SOIL
			0.60		3365/BH412/0.1-0.2/S/2 D 0.10 m					Red, grey and yellow.		M (<<PL)		
			0.80		3365/BH412/0.2-0.3/S/1 D 0.15 m									
									Hole Terminated at 0.80 m (Target depth reached)					

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS




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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH413	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 0.50 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.20		3365/BH413/0.0-0.1/S/1 D 0.00 m 3365/BH413/0.1-0.2/S/1 D 0.10 m 3365/BH413/0.1-0.2/S/2 D 0.10 m 3365/BH413/0.1-0.2/S/3 D 0.10 m 3365/BH413/0.3-0.4/S/1 D 0.30 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; trace roots; trace quartz/ironstone gravels; pedal.				TOPSOIL
			0.50					MC	MEDIUM CLAY; low to medium plasticity; yellow-brown; trace subrounded to subangular gravels.	M (<<PL)			RESIDUAL SOIL
									Hole Terminated at 0.50 m (Target depth reached)				

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	22/08/2019	COMPLETED	22/08/2019	REF BH414	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 0.60 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.20		3365/BH414/0.0-0.1/S/1 D 0.00 m 3365/BH414/0.0-0.1/S/1 D 0.10 m 3365/BH414/0.1-0.2/S/2 D 0.10 m 3365/BH414/0.1-0.2/S/3 D 0.10 m 3365/BH414/0.4-0.6/S/1 D 0.40 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown and dark grey; with fine to medium grained sand; trace roots; pedal.				TOPSOIL
			0.5					MC	MEDIUM CLAY; low to medium plasticity; yellow-brown with trace red; apedal.	M (<<PL)			RESIDUAL SOIL
			0.60						Hole Terminated at 0.60 m (Target depth reached)				

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH415	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 0.90 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M	Not Encountered	0.20		3365/BH415/0.0-0.1/S/1 D 0.00 m 3365/BH415/0.0-0.1/S/1 D 0.10 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; with fine to coarse grained sand; trace roots; pedal.				TOPSOIL	
			0.40		3365/BH415/0.1-0.2/S/2 D 0.10 m 3365/BH415/0.1-0.2/S/3 D 0.10 m			CL	Sandy CLAY LOAM; low plasticity; dark brown; with fine to coarse grained sand; pedal.				RESIDUAL SOIL	
			0.5		3365/BH415/0.3-0.4/S/1 D 0.30 m 3365/BH415/0.4-0.6/S/1 D 0.40 m 3365/BH415/0.6-0.8/S/1 D 0.60 m			CL	Fine Sandy CLAY LOAM; low plasticity; orange-brown; with subrounded to subangular quartz/ironstone gravels; apedal.	M (<<PL)				
			0.90								Hole Terminated at 0.90 m (Target depth reached)			
			1.0											
			1.5											
			2.0											
			2.5											
			3.0											
			3.5											
			4.0											
			4.5											

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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	22/08/2019	COMPLETED	22/08/2019	REF BH416	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 0.80 m depth	NORTHING		ASPECT	Northeast	SLOPE	<5%

Drilling			Sampling			Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M-H	Not Encountered	0.20		3365/BH416/0.0-0.1/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; with fine to medium grained sand; trace roots; pedal.				TOPSOIL	
			0.35		3365/BH416/0.0-0.1/S/1 D 0.10 m			CL-CI	Sandy CLAY LOAM; low to medium plasticity; yellow-brown; apedal.				RESIDUAL SOIL	
			0.50		3365/BH416/0.1-0.2/S/2 D 0.10 m			MC	MEDIUM CLAY; low to medium plasticity; orange and yellow-brown; trace subangular ironstone gravels; apedal.			M (<<PL)		
			0.80		3365/BH416/0.2-0.3/S/3 D 0.10 m 3365/BH416/0.3-0.4/S/1 D 0.20 m 3365/BH416/0.4-0.5/S/1 D 0.50 m					Yellow, grey and red.				
			1.0						Hole Terminated at 0.80 m (Target depth reached)					
			1.5											
			2.0											
			2.5											
			3.0											
			3.5											
			4.0											
			4.5											

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**Engineering Log -
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CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH417	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 1.10 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description									
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
PT	M	Not Encountered	0.20		3365/BH417/0.0-0.1/S/1 D 0.00 m 3365/BH417/0.0-0.1/S/2 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown and grey; with fine to medium grained sand; trace shrubs/grass roots; pedal.		F		TOPSOIL		
			0.40		3365/BH417/0.0-0.1/S/3 D 0.00 m 3365/BH417/0.0-0.2/S/1 D 0.00 m 3365/BH417/02-0.3-0.5/S/1 D 0.20 m			MC	MEDIUM CLAY; medium plasticity; yellow-brown; apedal. Yellow, grey and red.		St		RESIDUAL SOIL		
			0.80		3365/BH417/0.8-1.0/S/1 D 0.80 m					Yellow, pale grey and red.		M (<<PL)		VSt	
			1.00							Grey and red.					
			1.10								Hole Terminated at 1.10 m (Target depth reached)				

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH418	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 1.00 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M	Not Encountered	0.20		3365/BH418/0.0-0.1/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark grey and dark brown; with fine to medium grained sand; trace shrubs/grass roots; slightly pedal.				TOPSOIL	
			0.40		3365/BH418/0.0-0.1/S/2 D 0.00 m			LC	LIGHT CLAY: low to medium plasticity; yellow-brown and grey; apedal.				RESIDUAL SOIL	
			0.45		3365/BH418/0.0-0.2/S/1 D 0.00 m			MC	With subangular ironstone gravels; inferred ironstone lens to 0.42m.			M (<<PL)		
			1.00		3365/BH418/0.2-0.3-0.3/S/1 D 0.20 m					MEDIUM CLAY; medium plasticity; yellow-orange and pale grey; apedal.				
			1.00		3365/BH418/0.9-1.0/S/1 D 0.90 m				Hole Terminated at 1.00 m (Target depth reached)					

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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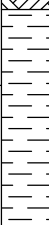


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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	21/08/2019	COMPLETED	21/08/2019	REF BH419	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø50 mm x 1.00 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.25		3365/BH419/0.0-0.17/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown and dark grey; with fine to medium grained sand; trace roots; pedal.				TOPSOIL
			0.5		3365/BH419/0.1-0.2/S/1 D 0.10 m 3365/BH419/0.1-0.2/S/2 D 0.10 m 3365/BH419/0.1-0.2/S/3 D 0.10 m 3365/BH419/0.5-0.8/S/1 D 0.50 m			MC	MEDIUM CLAY; low to medium plasticity; yellow-brown and red; trace subrounded to subangular ironstone gravels; apedal.	M (<<PL)			RESIDUAL SOIL
			1.00						Hole Terminated at 1.00 m (Target depth reached)				

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
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CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH420	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	1.40 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M	Not Encountered	0.20		3365/BH420/0.0-0.2/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark brown; fine to medium grained sand; pedal.				TOPSOIL	
			0.30		3365/BH420/0.0-0.3/S/1 D 0.00 m			LC	LIGHT CLAY; low to medium plasticity; yellow-brown and red; apedal; with subrounded to subangular ironstone gravels. Yellow-brown; no ironstone gravels.				RESIDUAL SOIL	
			0.50		3365/BH420/0.4-0.6/S/1 D 0.40 m				MC	MEDIUM CLAY; medium plasticity; red, pale grey and yellow; apedal; trace subrounded ironstone gravels.	M (<<PL)			VSt
			0.70		3365/BH420/0.8-1.0/S/1 D 0.80 m									
			1.40		3365/BH420/1.2-1.4/S/1 D 1.20 m									
			1.5						Hole Terminated at 1.40 m (Target depth reached)					
			2.0											
			2.5											
			3.0											
			3.5											
			4.0											
			4.5											

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS


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**Engineering Log -
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CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH421	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Grass	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	0.90 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling		Field Material Description									
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M	Not Encountered	0.10		3365/BH421/0.0-0.3/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark grey and dark brown; fine to medium grained sand; pedal; with grass roots. No grass roots.	M (<PL)			TOPSOIL	
			0.40											
			0.5		3365/BH421/0.6-0.8/S/1 D 0.60 m				LC	LIGHT CLAY; low to medium plasticity; yellow-brown; apedal; trace subrounded ironstone gravels.		St		RESIDUAL SOIL
			0.90											
			1.0						Hole Terminated at 0.90 m (Target depth reached)					
			1.5											
			2.0											
			2.5											
			3.0											
			3.5											
			4.0											
			4.5											

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
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CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH422	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Grass	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING	150.728988	RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	0.90 m depth	NORTHING	-34.923648	ASPECT	Northwest	SLOPE	<5%

Drilling			Sampling		Field Material Description									
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M	Not Encountered	0.10		3365/BH422/0.0-0.3/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark grey and dark brown; fine to medium grained sand; pedal; trace roots. No roots.	M (<PL)	F	VSt	TOPSOIL	
			0.35						Trace subrounded ironstone gravels.				St	RESIDUAL SOIL
			0.40						LIGHT CLAY; low to medium plasticity; yellow-brown; apedal.					
			0.90						Hole Terminated at 0.90 m (Target depth reached)					
			1.0											
			1.5											
			2.0											
			2.5											
			3.0											
			3.5											
			4.0											
			4.5											

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS


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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH423	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Trees	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	1.20 m depth	NORTHING		ASPECT	West	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.40		3365/BH423/0.0-0.2/S/1 D 0.00 m 3365/BH423/0.0-0.3/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark grey and dark brown; fine grained sand; pedal; trace shrubs roots (lantana, previously posioned).	M (<PL)			TOPSOIL
	H		0.5		3365/BH423/0.5-0.8/S/1 D 0.50 m			MC	MEDIUM CLAY; medium to high plasticity; yellow, pale grey and red; apedal.	VSt			RESIDUAL SOIL
			1.20						Hole Terminated at 1.20 m (Target depth reached)				
			1.5										
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH424	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Grass and tress	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	0.90 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling			Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M-H	Not Encountered	0.05		3365/BH424/0.0-0.2/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark grey and dark brown; pedal; trace roots. No roots.				TOPSOIL	
			0.15		3365/BH424/0.0-0.3/S/1 D 0.00 m				LC	With subrounded to subangular ironstone gravels. LIGHT CLAY; low to medium plasticity; yellow and grey; apedal; trace subrounded ironstone gravels. Grey and yellow; no ironstone gravels.				RESIDUAL SOIL
			0.20											
			0.30		3365/BH424/0.4-0.6/S/1 D 0.40 m							M (<<PL)	VSt	
			0.50											
			0.90											
			1.00						Hole Terminated at 0.90 m (Target depth reached)				0.90: Refusal on siltstone rock.	
			1.50											
			2.00											
			2.50											
			3.00											
			3.50											
			4.00											
			4.50											

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH425	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs and nature trees	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	1.40 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling		Field Material Description									
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M	Not Encountered	0.14					SL	TOPSOIL: Sandy LOAM; low plasticity; dark grey and dark brown; fine to medium grained sand; slightly pedal.		St		TOPSOIL	
			0.60					LC	Subrounded to subangular ironstone gravels. LIGHT CLAY; low to medium plasticity; orange-brown; apedal.				RESIDUAL SOIL	
			1.10			3365/BH425/0.8-1.0/S/1 D 0.80 m			MC	MEDIUM CLAY; medium plasticity; grey, yellow and red; apedal; trace subrounded ironstone gravels.	M (<<PL)	VSt		
			1.40						HC	HEAVY CLAY; medium to high plasticity; grey, yellow and red; apedal.		H		
			1.5						Hole Terminated at 1.40 m (Target depth reached)					
			2.0											
			2.5											
			3.0											
			3.5											
			4.0											
			4.5											

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS


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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH426	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Grass	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	0.90 m depth	NORTHING		ASPECT	Southwest	SLOPE	<5%

Drilling			Sampling			Field Material Description									
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
PT	M-H	Not Encountered	0.10		3365/BH426/0.0-0.2/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark grey and dark brown; slightly pedal; trace roots. No roots.				TOPSOIL		
			0.30		3365/BH426/0.0-0.3/S/1 D 0.00 m							F		RESIDUAL SOIL	
			0.5		3365/BH426/0.5-0.8/S/1 D 0.50 m				LC	LIGHT CLAY; low to medium plasticity; yellow-brown and orange; apedal.	M (<PL)				
			0.90							Hole Terminated at 0.90 m (Target depth reached)					
			1.0												
			1.5												
			2.0												
			2.5												
			3.0												
			3.5												
			4.0												
			4.5												

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**Engineering Log -
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CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH427	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Small shrubs and grass	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	1.00 m depth	NORTHING		ASPECT	North	SLOPE	<5%

Drilling			Sampling		Field Material Description									
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
PT	M	Not Encountered	0.10		3365/BH427/0.0-0.2/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark grey; slightly/weakly pedal; trace grass roots. No roots.				TOPSOIL	
			0.20		3365/BH427/0.0-0.3/S/1 D 0.00 m			LC	LIGHT CLAY; low to medium plasticity; yellow-brown; apedal.				RESIDUAL SOIL	
			0.80		3365/BH427/0.8-1.0/S/1 D 0.80 m				Pale grey, yellow and red.			M (<PL)	St	
			1.00							Hole Terminated at 1.00 m (Target depth reached)				

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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH428	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Shrubs	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	0.80 m depth	NORTHING		ASPECT	Northwest	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.20		3365/BH428/0.0-0.2/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark grey; fine grained; slightly pedal; trace grass roots and coal.				TOPSOIL
			0.5		3365/BH428/0.0-0.3/S/1 D 0.00 m			FSL	Fine Sandy CLAY; low to medium plasticity; yellow and pale grey; apedal.		M (<<PL)		RESIDUAL SOIL
			0.80		3365/BH428/0.5-0.7/S/1 D 0.50 m								
			1.0						Hole Terminated at 0.80 m (Target depth reached)				
			1.5										
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS


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**Engineering Log -
BOREHOLE**

CLIENT	Allen Price & Scarratts Pty Ltd	COMMENCED	20/08/2019	COMPLETED	20/08/2019	REF BH429	
PROJECT	Soils Investigation	LOGGED		CHECKED		Sheet 1 OF 1	
SITE	Culburra Road, West Culburra	GEOLOGY	Wandrawandian Siltstone	VEGETATION	Grass	PROJECT NO. P1203365	
EQUIPMENT	Push Tube	EASTING		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	0.80 m depth	NORTHING		ASPECT	Northwest	SLOPE	<5%

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT	M	Not Encountered	0.20		3365/BH429/0.0-0.2/S/1 D 0.00 m			SL	TOPSOIL: Sandy LOAM; low plasticity; dark grey; slightly pedal; trace grass roots.	M (<PL)	F		TOPSOIL
			0.5		3365/BH429/0.0-0.3/S/1 D 0.00 m			LC	LIGHT CLAY; low to medium plasticity; red and pale grey; apedal.	M (<PL)	St		RESIDUAL SOIL
			0.80							Hole Terminated at 0.80 m (Target depth reached)			
			1.0										
			1.5										
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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**Engineering Log -
BOREHOLE**

15 Annexure E: Groundwater Well Logs

CLIENT		Allen Price & Associates Pty Ltd		COMMENCED		22.11.10		COMPLETED		22.11.10		REF		BH1					
PROJECT		Engineering Services		LOGGED		GT		CHECKED		AN		Sheet 1 of 1							
SITE		Cullburra Road, West Cullburra		GEOLOGY		Siltstone		VEGETATION		Grasses		PROJECT NO. P1002842							
EQUIPMENT				Hydraulic Auger				EASTING		NA		RL SURFACE		NA					
EXCAVATION DIMENSIONS				0.1mØ X 4.75m depth				NORTHING		NA		ASPECT		North		SLOPE		2-3%	
EXCAVATION DATA						MATERIAL DATA						SAMPLING & TESTING							
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA <small>Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.</small>		CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	WATER WELL DETAILS					
A	Nil	N	M	0.25			SC	SILTY CLAYEY SAND – Dark brown, fine grained sands.		L		A	0.2						
A	Nil	N	M	0.45			SC	SILTY CLAYEY SAND – Light grey, fine grained sands, minor gravels.		L		A	0.4						
A	Nil	N	M	0.6			CL	SILTY CLAY - Brown/orange, gravels (1-15mm, 35%), tending to clay with gravels decreasing.		F		A	0.5						
A	Nil	N	M	0.9			CH	CLAY - Grey/orange/red mottled.		VSt		A	1.0						
A	Nil	N	M	1.0			CH	CLAY - Grey/orange/red mottled.		VSt		A	1.0						
A	Nil	N	M	1.2			CL	SANDY CLAY/EXTREMELY WEATHERED SILTSTONE - Light grey, yellow, cream bands, gravels (approx 5-50mm).		VSt	MD	A	1.5						
A	Nil	N	M	1.6			CL	SANDY CLAY/EXTREMELY WEATHERED SILTSTONE - Light grey, yellow, cream bands, gravels (approx 5-50mm).		VSt	MD	A	1.5						
A	Nil	N	D	2.0			EW HW	EXTREMELY TO HIGHLY WEATHERED SILTSTONE.			MD D	A	2.0						
A	Nil	N	D	2.6			MW	MODERATELY WEATHERED SILTSTONE GRAVELLY CLAY.				A	2.5						
A	Nil	N	D	3.0			MW	MODERATELY WEATHERED SILTSTONE GRAVELLY CLAY.				A	2.5						
A	Nil	N	M	3.2			CL EW	CLAY/EXTREMELY WEATHERED SILTSTONE - Grey.		F		A	3.5						
A	Nil	N	M	4.0			CL EW	CLAY/EXTREMELY WEATHERED SILTSTONE - Grey.		F		A	3.5						
A	Nil	N	M	4.2			CL EW	CLAY/EXTREMELY WEATHERED SILTSTONE - Grey.		F		A	3.5						
A	Nil	N	D	4.75			MW	MODERATELY WEATHERED SILTSTONE.			D	A	4.5						
				5.0				Borehole terminated at 4.75m on moderately to slightly weathered siltstone.											
				6.0															
				7.0															
				8.0															
				9.0															


EQUIPMENT / METHOD	SUPPORT	WATER	MOISTURE	PENETRATION	CONSISTENCY	DENSITY	SAMPLING & TESTING	CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
N Natural exposure X Existing excavation BH Backhoe bucket E Excavator HA Hand auger S Hand spade PT Push tube A Auger CC Concrete Corer	SH Shoring SC Shotcrete RB Rock Bolts Nil No support	N None observed X Not measured Water level Water outflow Water inflow	D Dry M Moist W Wet Wp Plastic limit Wl Liquid limit	L Low M Moderate H High R Refusal	VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard F Friable	VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense	A Auger sample B Bulk sample U Undisturbed sample D Disturbed sample M Moisture content Ux Tube sample (x mm)	pp Pocket penetrometer S Standard penetration test VS Vane shear DCP Dynamic cone penetrometer FD Field density WS Water sample Y USCS N Agricultural

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

CLIENT		Allen Price & Associates Pty Ltd		COMMENCED		22.11.10		COMPLETED		22.11.10		REF		BH2					
PROJECT		Engineering Services		LOGGED		GT		CHECKED		AN		Sheet 1 of 1							
SITE		Cullburra Road, West Cullburra		GEOLOGY		Siltstone		VEGETATION		Grasses		PROJECT NO. P1002842							
EQUIPMENT				Hydraulic Auger				EASTING		NA		RL SURFACE		NA					
EXCAVATION DIMENSIONS				0.1mØ X 7.0m depth				NORTHING		NA		ASPECT		North		SLOPE		3-4%	
EXCAVATION DATA						MATERIAL DATA						SAMPLING & TESTING							
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.		CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	WATER WELL DETAILS					
A	Nil	N	M	0.1			OL	ORGANIC SILTY CLAY – Dark grey/black.		S									
A	Nil	N	M	0.2			CL	SILTY CLAY – Brown/light brown.		S		A	0.2					2842/2/0.2 + B	
A	Nil	N	M	0.6			CL	CLAY – Red, moderately plastic, with light brown/grey mottles increasing with depth.		F		A	0.5					2842/2/0.5 + Att	
A	Nil	N	M	1.0			CH	CLAY – Red, medium plasticity, grey/brown mottles.		St		A	1.0					2842/2/1.0	
A	Nil	N	M	1.1			CH	CLAY - Grey with minor red/brown mottles.		VSt		A	1.2					2842/2/1.2	
A	Nil	N	M	1.2			CH					A	1.5					2842/2/1.5	
A	Nil	N	M	2.0								A	2.0					2842/2/2.0	
A	Nil	N	M	3.0								A	2.5					2842/2/2.5	
A	Nil	N	M	4.0			CL EW	CLAY - EXTREMELY WEATHERED SILTSTONE - Clay to sandy clay, weathered gravels, grey/red/brown.		VSt									
A	Nil	N	M	4.5								A	4.5					2842/2/4.5	
A	Nil	N	M	6.0			CL	SILTSTONE CLAY - Brown/dark grey, minor gravels, highly weathered siltstone.		St		A	6.0	2842/2/6.0					
A	Nil	N	W	7.0			CL EW	CLAY - Dark grey/brown, clay/extremely weathered siltstone.		VSt		A	7.0	2842/2/7.0					
														Borehole terminated at 7.0m on clays.					
														Borehole terminated at 7.0m on clays.					

EQUIPMENT / METHOD	SUPPORT	WATER	MOISTURE	PENETRATION	CONSISTENCY	DENSITY	SAMPLING & TESTING	CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION	
N Natural exposure X Existing excavation BH Backhoe bucket E Excavator HA Hand auger S Hand spade PT Push tube A Auger CC Concrete Corer	SH Shoring SC Shotcrete RB Rock Bolts Nil No support	N None observed X Not measured Water level Water outflow Water inflow	D Dry M Moist Wp Plastic limit WL Liquid limit	L Low M Moderate H High R Refusal	VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard F Friable	VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense	A Auger sample B Bulk sample U Undisturbed sample D Disturbed sample M Moisture content Ux Tube sample (x mm)	pp Pocket penetrometer S Standard penetration test VS Vane shear DCP Dynamic cone penetrometer FD Field density WS Water sample	Y USCS N Agricultural

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

CLIENT		Allen Price & Associates Pty Ltd		COMMENCED		23.11.10		COMPLETED		23.11.10		REF		BH3					
PROJECT		Engineering Services		LOGGED		GT		CHECKED		AN		Sheet 1 of 1							
SITE		Cullburra Road, West Cullburra		GEOLOGY		Siltstone		VEGETATION		None		PROJECT NO. P1002842							
EQUIPMENT				Hydraulic Auger				EASTING		NA		RL SURFACE		NA					
EXCAVATION DIMENSIONS				0.1mØ X 5.5m depth				NORTHING		NA		ASPECT		North		SLOPE		2-3%	
EXCAVATION DATA						MATERIAL DATA						SAMPLING & TESTING							
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA <small>Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.</small>		CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	WATER WELL DETAILS					
A	Nil	N	M	0.15			SM	SILTY SAND – Brown/dark brown, minor gravels.			L	A	0.2	0.635m agl Well Cover Concrete					
A	Nil	N	M	0.35			SP	SAND – Light brown/brown, medium grained sands, gravels (1-5mm, approx 10%).			L	A	0.5	0.6m bgl Bentonite Seal					
A	Nil	N	M	0.8			CL	CLAY - Yellow/brown/orange, red weathered siltstone bands increasing with depth.		F	St	A	1.0	1.0 UPVC Pipe					
A	Nil	N	M	1.05			CL/HW	SANDY CLAY/HIGHLY WEATHERED SILTSTONE - Orange/grey.		VSt		A	1.2	1.2 1.565m bgl					
A	Nil	N	M	1.25			CL/HW	CLAY - HIGHLY WEATHERED SILTSTONE - Grey with red/orange mottles, siltstone bands/gravels.		VSt		A	1.5	1.5					
A	Nil	N	M	1.6			CL/MW/EW	CLAY - MODERATELY TO EXTREMELY WEATHERED SILTSTONE - Grey with red/pink mottles.		VSt		A	2.0	2.0 Sand Pack. UPVC Screen					
A	Nil	N	M	2.0			CL/MW/EW	CLAY - MODERATELY TO EXTREMELY WEATHERED SILTSTONE - Grey with red/pink mottles.		VSt		A	2.0	2.0					
A	Nil	N	M	2.1			CL/MW/EW	CLAY - MODERATELY TO EXTREMELY WEATHERED SILTSTONE - Grey with red/pink mottles.		VSt		A	2.0	2.0					
A	Nil	N	D	3.0			SC/EW	CLAYEY SAND/EXTREMELY WEATHERED SILTSTONE - Grey/pink/red, fine to medium grained sands.		VSt		A	2.5	2.5					
A	Nil	N	D	3.2			MW	MODERATELY WEATHERED SILTSTONE - Orange brown.						3.0					
A	Nil	N	D	4.0			HW/EW	HIGHLY/EXTREMELY WEATHERED SILTSTONE.						4.0					
A	Nil	N	D	5.0			MW/SW	MODERATELY/SLIGHTLY WEATHERED SILTSTONE.						4.565m bgl Well end plug.					
A	Nil	N	D	5.5			EW/MW	EXTREMELY/MODERATELY WEATHERED SILTSTONE.						5.0					
				6.0				Borehole terminated at 5.5m on moderately weathered siltstone.						6.0					
				7.0										7.0					
				8.0										8.0					
				9.0										9.0					
EQUIPMENT / METHOD		SUPPORT		WATER		MOISTURE		PENETRATION		CONSISTENCY		DENSITY		SAMPLING & TESTING		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION			
N Natural exposure		SH Shoring		N None observed		D Dry		L Low		VS Very Soft		VL Very Loose		A Auger sample		pp Pocket penetrometer			
X Existing excavation		SC Shotcrete		X Not measured		M Moist		M Moderate		S Soft		L Loose		B Bulk sample		S Standard penetration test			
BH Backhoe bucket		RB Rock Bolts		∇ Water level		W Wet		H High		F Firm		MD Medium Dense		U Undisturbed sample		VS Vane shear			
E Excavator		Nil No support		∇ Water outflow		Wp Plastic limit		R Refusal		St Stiff		D Dense		D Disturbed sample		DCP Dynamic cone penetrometer			
HA Hand auger				∇ Water inflow		Wl Liquid limit				VSt Very Stiff		VD Very Dense		M Moisture content		FD Field density			
S Hand spade										H Hard				Ux Tube sample (x mm)		WS Water sample			
PT Push tube										F Friable									
A Auger																			
CC Concrete Corer																			
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																			
 (C) Copyright Martens & Associates Pty. Ltd. 2016		MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au										Engineering Log - Borehole							

Quality Sheet No. 4

CLIENT		Allen Price & Associates Pty Ltd		COMMENCED		23.11.10		COMPLETED		23.11.10		REF		BH4			
PROJECT		Engineering Services		LOGGED		GT		CHECKED		AN		Sheet 1 of 1					
SITE		Cullburra Road, West Cullburra		GEOLOGY		Siltstone		VEGETATION		None		PROJECT NO. P1002842					
EQUIPMENT				Hydraulic Auger		EASTING		NA		RL SURFACE		NA					
EXCAVATION DIMENSIONS				0.1mØ X 5.5m depth		NORTHING		NA		ASPECT		North		SLOPE		2-3%	
EXCAVATION DATA						MATERIAL DATA						SAMPLING & TESTING					
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA <small>Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.</small>		CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	WATER WELL DETAILS			
A	Nil	N	M	0.3			SM	SILTY SAND – Brown, gravels (1-10mm, approx 10%).			L	A	0.2				
A	Nil	N	M	0.5			CL	CLAY - Brown/orange, mottles increasing with depth, gravels (1-10mm, approx 10%).		S		A	0.5				
A	Nil	N	M	1.0			CL	CLAY - Grey/brown/red mottles, minor gravels.			F	A	1.0				
A	Nil	N	M	1.2			CL	CLAY - HIGHLY WEATHERED SILTSTONE - Grey with red/orange mottles, siltstone bands/gravels.				A	1.5				
A	Nil	N	M	1.8			CL HW						A				
A	Nil	N	M	2.0			CL	CLAY - MODERATELY TO EXTREMELY WEATHERED SILTSTONE - Grey with red/pink mottles.				A	2.0				
A	Nil	N	M	2.5			CL MW EW						A				
A	Nil	N	D	3.0			SC	CLAYEY SAND/EXTREMELY WEATHERED SILTSTONE - Grey/pink/red/orange, fine to medium grained sands.					4.0				
A	Nil	N	D	4.0			SC EW						B				
A	Nil	N	D	4.5				EXTREMELY/MODERATELY WEATHERED SILTSTONE - Grey/red/pink/orange.					5.0				
A	Nil	N	D	5.0			EW/ MW						A	5.0			
				5.5				Borehole terminated at 5.5m on extremely/moderately weathered siltstone.					6.0				
				6.0									7.0				
				7.0									8.0				
				8.0									9.0				

EQUIPMENT / METHOD	SUPPORT	WATER	MOISTURE	PENETRATION	CONSISTENCY	DENSITY	SAMPLING & TESTING	CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
N Natural exposure X Existing excavation BH Backhoe bucket E Excavator HA Hand auger S Hand spade PT Push tube A Auger CC Concrete Corer	SH Shoring SC Shotcrete Nil No support	N None observed X Not measured Water level Water outflow Water inflow	D Dry M Moist W Wet Wp Plastic limit Wl Liquid limit	L Low M Moderate H High R Refusal	VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard F Friable	VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense	A Auger sample B Bulk sample U Undisturbed sample D Disturbed sample M Moisture content Ux Tube sample (x mm)	pp Pocket penetrometer S Standard penetration test VS Vane shear DCP Dynamic cone penetrometer FD Field density WS Water sample Y USCS N Agricultural

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

CLIENT		Allen Price & Associates Pty Ltd		COMMENCED		24.11.10		COMPLETED		24.11.10		REF		BH5					
PROJECT		Engineering Services		LOGGED		JSF		CHECKED		GT		Sheet 1 of 1							
SITE		Cullburra Road, West Cullburra		GEOLOGY		Siltstone		VEGETATION		Eucalypts		PROJECT NO. P1002842							
EQUIPMENT				Hydraulic Auger				EASTING		NA		RL SURFACE		NA					
EXCAVATION DIMENSIONS				0.95mØ X 5.5m depth				NORTHING		NA		ASPECT		North		SLOPE		5%	
EXCAVATION DATA				MATERIAL DATA								SAMPLING & TESTING							
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA <small>Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.</small>		CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	WATER WELL DETAILS					
A	Nil	N	M	0.3			OL	ORGANIC SANDY SILT – Dark brown.		S		A	0.2	2842/5/0.2					
A	Nil	N	M	1.0			CL	CLAY - Orange/brown mottles, firm grading stiff, tending grey with minor brown and red mottles at depth.		F. St		A	0.5	2842/5/0.5					
A	Nil	N	M	1.3								A	1.0	2842/5/1.0					
A	Nil	N	D	1.7			EW	EXTREMELY WEATHERED SILTSTONE - Orange/grey mottled, dry.				A	1.5	2842/5/1.5					
A	Nil	N	D	2.0			MW	MODERATELY WEATHERED SILTSTONE - Orange/grey mottled, dry.				A	2.5	2842/5/2.5					
A	Nil	N	D	3.0															
A	Nil	N	D	4.0			EW	EXTREMELY WEATHERED SILTSTONE - Orange/grey mottled, dry.											
A	Nil	N	D	4.3			SW	SLIGHTLY WEATHERED SILTSTONE.											
A	Nil	N	D	5.0			MW	MODERATELY WEATHERED WITH EXTREMELY WEATHERED SILTSTONE BANDS.											
				5.5								B	5.5	2842/5/5.5					
				6.0				Borehole terminated at 5.5m on moderately weathered siltstone.											
				7.0															
				8.0															
				9.0															
EQUIPMENT / METHOD		SUPPORT	WATER	MOISTURE	PENETRATION	CONSISTENCY	DENSITY	SAMPLING & TESTING		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION									
N Natural exposure		SH Shoring	N None observed	D Dry	L Low	VS Very Soft	VL Very Loose	A Auger sample	pp Pocket penetrometer	Y	USCS								
X Existing excavation		SC Shotcrete	X Not measured	M Moist	M Moderate	S Soft	L Loose	B Bulk sample	S Standard penetration test	N	Agricultural								
BH Backhoe bucket		RB Rock Bolts	▽ Water level	W Wet	H High	F Firm	MD Medium Dense	U Undisturbed sample	VS Vane shear										
E Excavator		Nil No support	△ Water outflow	Wp Plastic limit	R Refusal	St Stiff	D Dense	D Disturbed sample	DCP Dynamic cone penetrometer										
HA Hand auger			▽ Water inflow	WL Liquid limit		VSt Very Stiff	VD Very Dense	M Moisture content	FD Field density										
S Hand spade						H Hard		Ux Tube sample (x mm)	WS Water sample										
PT Push tube						F Friable													
A Auger																			
CC Concrete Corer																			

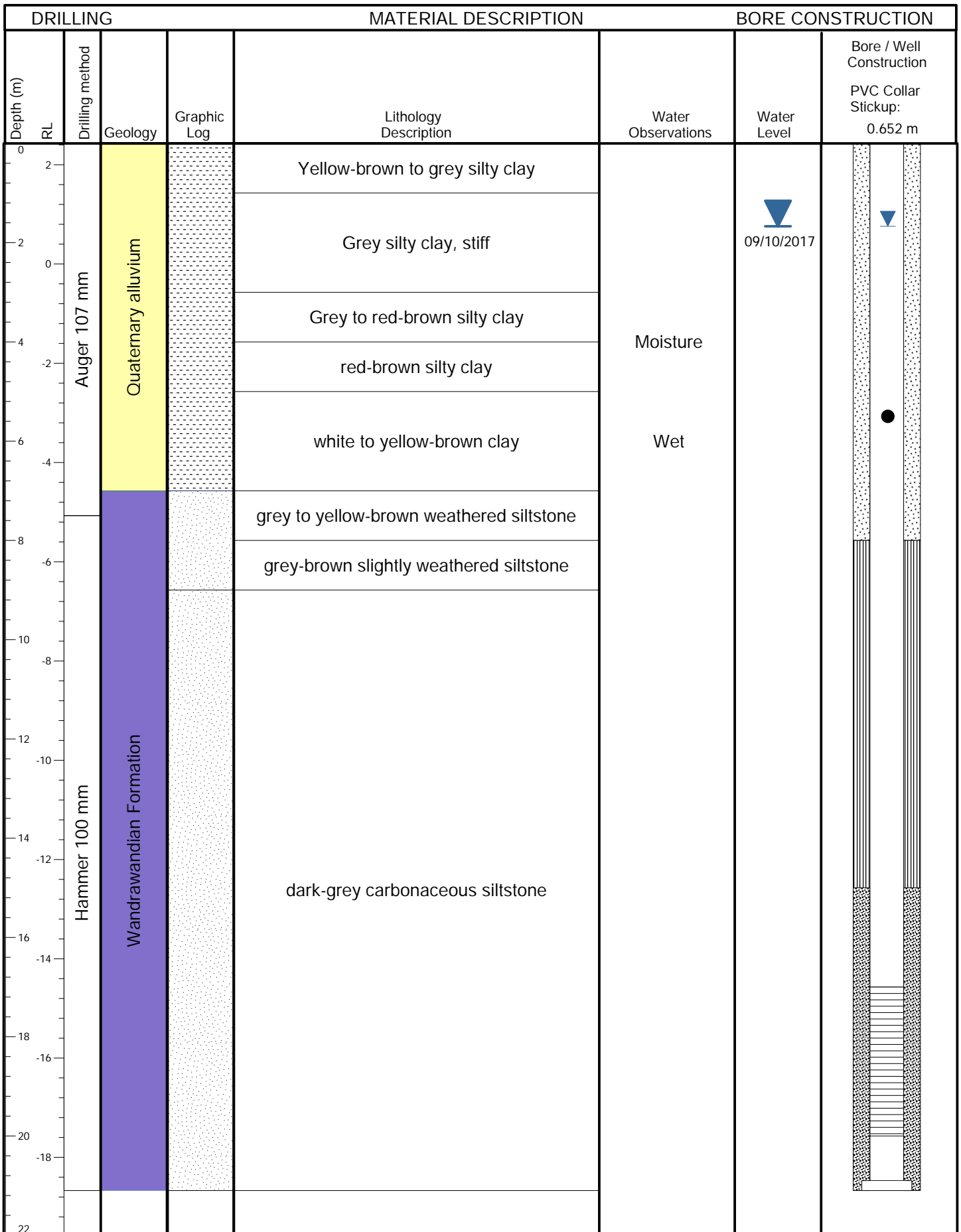
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

CLIENT		Allen Price & Associates Pty Ltd		COMMENCED		23.11.10		COMPLETED		23.11.10		REF		BH6	
PROJECT		Engineering Services		LOGGED		GT		CHECKED		AN		Sheet 1 of 1			
SITE		Cullburra Road, West Cullburra		GEOLOGY		Siltstone		VEGETATION		None		PROJECT NO. P1002842			
EQUIPMENT		Hydraulic Auger		EASTING		NA		RL SURFACE		NA					
EXCAVATION DIMENSIONS		0.1mØ X 5.5m depth		NORTHING		NA		ASPECT		North		SLOPE		1-2%	
EXCAVATION DATA				MATERIAL DATA				SAMPLING & TESTING							
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA <small>Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.</small>		CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	WATER WELL DETAILS	
A	Nil	N	M	0.1			CL	SILTY SANDY CLAY – Dark grey/brown.		S		A	0.2	0.63m agl	
A	Nil	N	M	0.45			CL	SILTY SAND CLAY – Brown/light brown.		S		A	0.5	Concrete	
A	Nil	N	M	0.7			CL	CLAY - Red/orange with light brown mottles increasing with depth, minor gravels (1-10mm, approx 5%).		St				0.5m bgl	
A	Nil	N	M	1.0			CH	CLAY - Grey/cream with red/brown mottles, moderately plastic, gravels (1-5mm, approx 20%).		St		A	1.0	Bentonite Seal	
A	Nil	N	M	1.3										UPVC Pipe	
A	Nil	N	M	2.0			CL HW	CLAY - HIGHLY WEATHERED SILTSTONE - Light grey with red mottles, siltstone gravels bands increasing with depth.		VSt		A	1.5	Sand Pack.	
A	Nil	N	M	2.8								A	2.0	2.33m bgl	
A	Nil	N	M	3.0			CL MW	SANDY CLAY - MODERATELY WEATHERED SILTSTONE - Light brown, gravels (1-50mm, approx 15%).		VSt		B	3.0	UPVC Screen	
A	Nil	N	D	3.3			CL/HW	CLAY/HIGHLY WEATHERED SILTSTONE - Light grey.		VSt					
A	Nil	N	W	4.0								A	3.5		
A	Nil	N	W	5.0			CL EW	CLAY - EXTREMELY WEATHERED SILTSTONE - Dark brown/dark grey with bands of grey clay.		VSt		B	4.5	5.33m bgl	
A	Nil	N	W	5.5				Borehole terminated at 5.5m on extremely weathered siltstone.				A	5.5	Well end plug.	
				6.0											
				7.0											
				8.0											
				9.0											

EQUIPMENT / METHOD	SUPPORT	WATER	MOISTURE	PENETRATION	CONSISTENCY	DENSITY	SAMPLING & TESTING	CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
N Natural exposure X Existing excavation BH Backhoe bucket E Excavator HA Hand auger S Hand spade PT Push tube A Auger CC Concrete Corer	SH Shoring SC Shotcrete RB Rock Bolts Nil No support	N None observed X Not measured Water level Water outflow Water inflow	D Dry M Moist W Wet Wp Plastic limit Wl Liquid limit	L Low M Moderate H High R Refusal	VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard F Friable	VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense	A Auger sample B Bulk sample U Undisturbed sample D Disturbed sample M Moisture content Ux Tube sample (x mm)	pp Pocket penetrometer S Standard penetration test VS Vane shear DCP Dynamic cone penetrometer FD Field density WS Water sample Y USCS N Agricultural

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

CLIENT	Shoalhaven City Council	COMPLETED	18/09/2017	EASTING	293809.642	Borehole No: MB401A Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6130823.531	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	2.43 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	

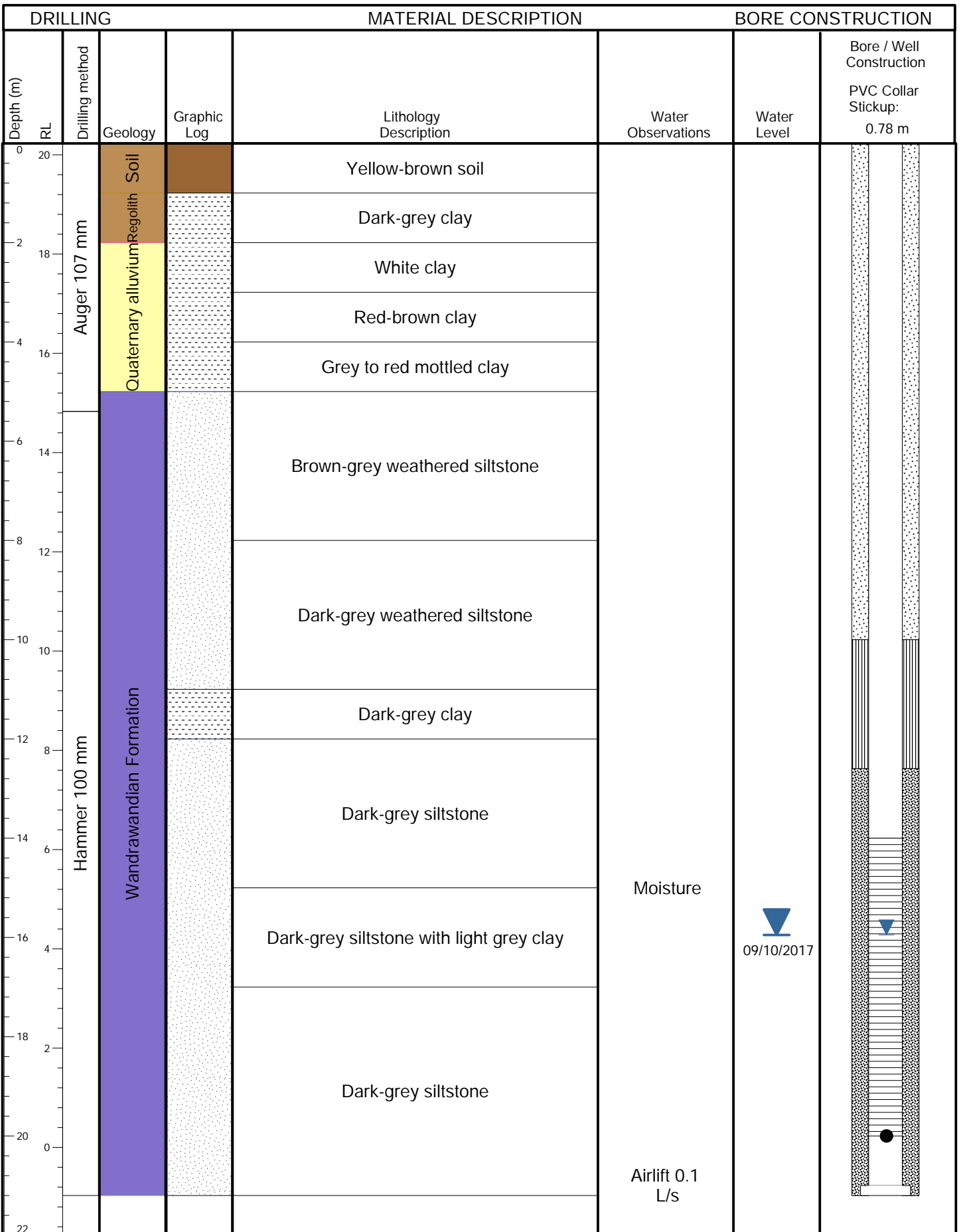


CLIENT	Shoalhaven City Council	COMPLETED	18/09/2017	EASTING	293798.311	Borehole No: MB401B Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6130832.264	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	2.63 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	

DRILLING		MATERIAL DESCRIPTION				BORE CONSTRUCTION		
Depth (m)	Drilling method	Geology	Graphic Log	Lithology Description	Water Observations	Water Level	Bore / Well Construction	
0	Auger 107 mm	Quaternary alluvium		Yellow-brown to grey silty clay			 Bore / Well Construction PVC Collar Stickup: 0.725 m	
0.4								
2								
0.8								
1.6								
1.2								
1.2								
1.6								
0.8								
2								Grey silty clay, stiff
0.4								
2.4								
0								
2.8								
-0.4								
3.2								
-0.8								
3.6								
-1.2								
4					Moisture			
-1.6								
4.4								
-2								
4.8								
-2.4								
5.2								
-2.8								
5.6								
-3.2								
6								
-3.6								
6.4								
-4								
6.8								
-4.4								
7.2								
-4.8								
		Mtandawandian Formation		grey to yellow-brown weathered siltstone				

	HGEO Pty Ltd PO Box 312, Lindfield, NSW 2070. M: 0427 004 338	SWL	Filter sand	Cuttings	GROUNDWATER BOREHOLE LOG
		Sensor	Bentonite	Screen	

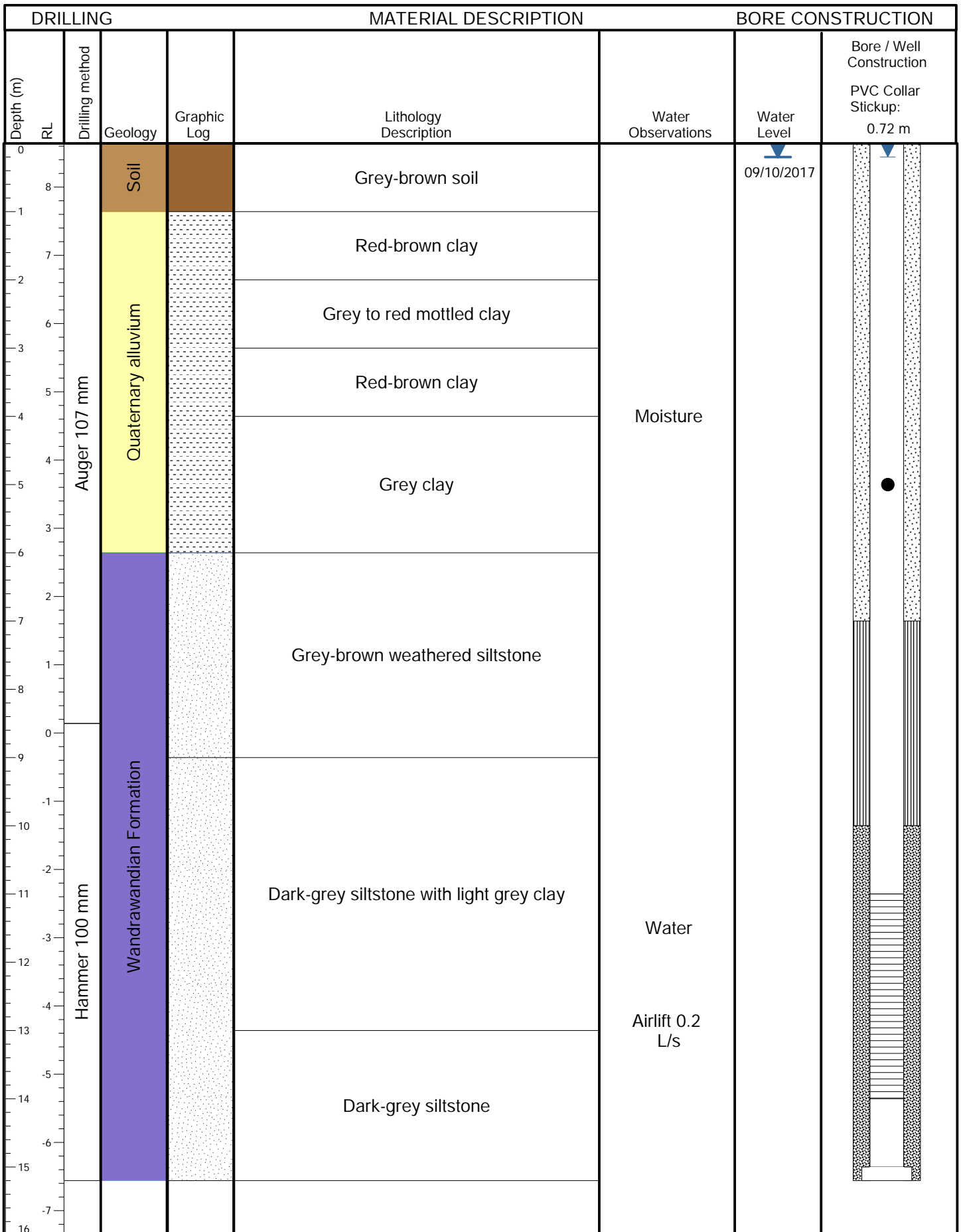
CLIENT	Shoalhaven City Council	COMPLETED	15/09/2017	EASTING	293378.915	Borehole No: MB402A Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6131052.137	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	20.23 mAHD	
PROJECT No:	J21423	LOGGED BY	Sean Moran	DATUM	MGA Zone 56	



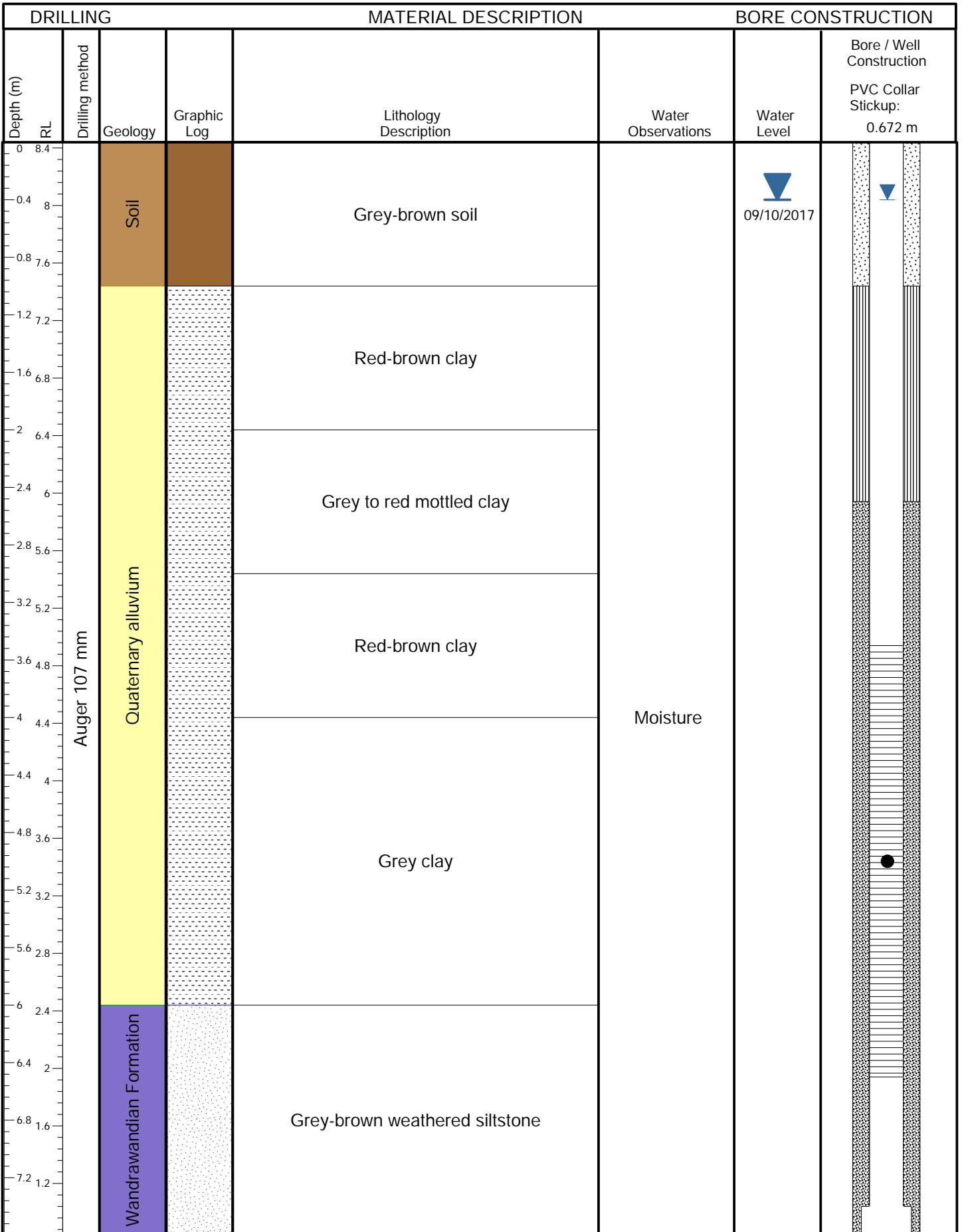
CLIENT	Shoalhaven City Council	COMPLETED	15/09/2017	EASTING	293188.808	Borehole No: MB402B Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6130843.024	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	6.78 mAHD	
PROJECT No:	J21423	LOGGED BY	Sean Moran	DATUM	MGA Zone 56	

DRILLING		MATERIAL DESCRIPTION				BORE CONSTRUCTION				
Depth (m)	RL	Drilling method	Geology	Graphic Log	Lithology Description	Water Observations	Water Level	Bore / Well Construction PVC Collar Stickup: 0.78 m		
0		Auger 107 mm	Soil		Grey-brown soil					
6					Quaternary alluvium		Grey to red mottled clay			
1			Red sandy clay							▼ 09/10/2017
5			Light-grey clay							
2			Red-brown sandy clay							
3			Red-grey clay							
4			Brown-grey clay							
5			Brown clay							
6			Dark-grey clay							
7										
8										
9										
10										
11										
12										
13										

CLIENT	Shoalhaven City Council	COMPLETED	15/09/2017	EASTING	292224.367	Borehole No: MB403A Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6132450.366	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	8.64 mAHD	
PROJECT No:	J21423	LOGGED BY	Sean Moran	DATUM	MGA Zone 56	



CLIENT	Shoalhaven City Council	COMPLETED	15/09/2017	EASTING	292219.787	Borehole No: MB403B Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6132449.549	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	8.44 mAHD	
PROJECT No:	J21423	LOGGED BY	Sean Moran	DATUM	MGA Zone 56	



CLIENT	Shoalhaven City Council	COMPLETED	14/09/2017	EASTING	292401.078	Borehole No: MB404 Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6131914.318	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	35.15 mAHD	
PROJECT No:	J21423	LOGGED BY	Sean Moran	DATUM	MGA Zone 56	

DRILLING		MATERIAL DESCRIPTION				BORE CONSTRUCTION		
Depth (m)	Drilling method	Geology	Graphic Log	Lithology Description	Water Observations	Water Level	Bore / Well Construction	
0	Auger 107 mm	Quaternary alluvium Soil		Brown topsoil	Moisture	09/10/2017		
34				light-grey clay				
2		Wandrawandian Formation		Grey-brown weathered siltstone				Airlift 0.3 L/s
32				Dark-grey-brown weathered siltstone				
4				Dark-grey-brown weathered siltstone with light grey clay				
6				Dark-grey-brown weathered siltstone				
8	Grey-brown weathered siltstone							
10	Dark-grey siltstone							
12	Dark-grey siltstone with angular quartz fragments							
14	Dark-grey siltstone; minor light grey siltstone							
16	Dark-grey siltstone; minor light grey clay							
18	Dark-grey siltstone							
20	Hammer 100 mm			Dark-grey siltstone; minor light grey siltstone				
22				Dark-grey siltstone				
24				Dark-grey siltstone				
26				Dark-grey siltstone; minor light grey siltstone				
28								
30								
32								
34								

CLIENT	Shoalhaven City Council	COMPLETED	13/09/2017	EASTING	294797.948	Borehole No: MB405A Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6131618.639	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	2.07 mAHD	
PROJECT No:	J21423	LOGGED BY	Sean Moran	DATUM	MGA Zone 56	

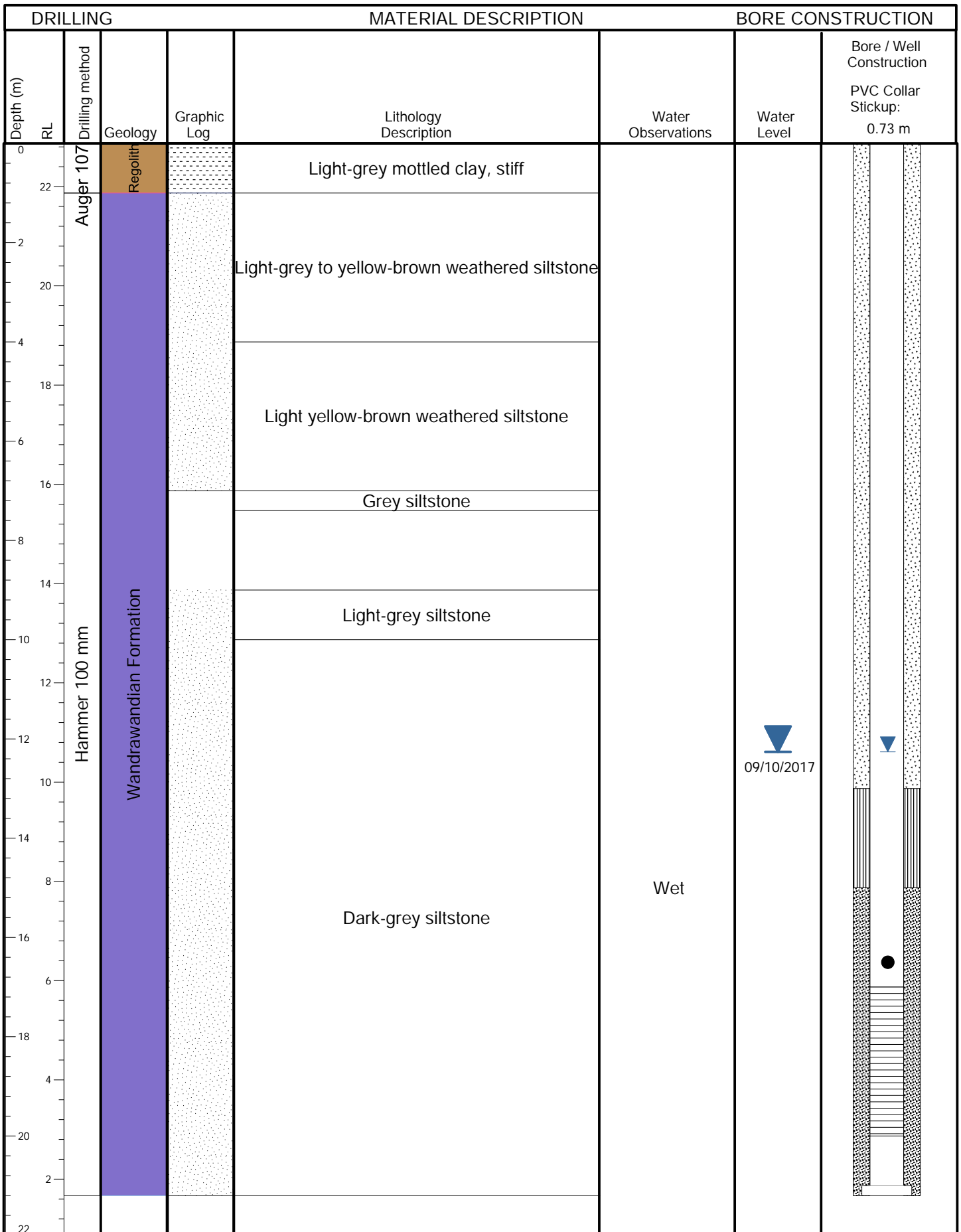
DRILLING		MATERIAL DESCRIPTION			BORE CONSTRUCTION		
Depth (m)	Drilling method	Geology	Graphic Log	Lithology Description	Water Observations	Water Level	Bore / Well Construction
0	Auger 107 mm	Soil		Dark-brown topsoil			
1		Quaternary alluvium		Grey to yellow-orange silty clay, stiff		▼ 10/10/2017	
2				Yellow-brown silty clay with fragments of weathered siltstone			
3				Grey-brown weathered siltstone			
4	MLC Core / Hammer 100 mm	Wandrawandian Formation		Dark-grey siltstone; Diffuse mm to cm-bedding with extensive bioturbation	Wet		
5				Fault zone			
6				Dark-grey siltstone			
7				Fault gauge, white clay			
8				Dark-grey siltstone; Crinoid fossils; mostly stem fragments			
9	Hammer 100 mm			Dark-grey siltstone			
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

CLIENT	Shoalhaven City Council	COMPLETED	13/09/2017	EASTING	294793.08	Borehole No: MB405B Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6131616.889	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	2.18 mAHD	
PROJECT No:	J21423	LOGGED BY	Sean Moran	DATUM	MGA Zone 56	

DRILLING		MATERIAL DESCRIPTION			BORE CONSTRUCTION		
Depth (m)	Drilling method	Geology	Graphic Log	Lithology Description	Water Observations	Water Level	Bore / Well Construction
0	Auger 107 mm	Soil		Dark-brown topsoil			
0.4							
1.2		Quaternary alluvium		Grey to yellow-orange silty clay, stiff		10/10/2017	
1.6							
2.0							
2.4							
2.8		Yellow-brown silty clay with fragments of weathered siltstone					
3.2							
3.6							
4.0							
4.4							
4.8							
5.2							
5.6							
6.0							
6.4							
6.8							
7.2							
7.6							
8.0							
8.4							
8.8							
9.2							
9.6							
10.0							

	HGEO Pty Ltd PO Box 312, Lindfield, NSW 2070. M: 0427 004 338	SWL	Filter sand	Cuttings	GROUNDWATER BOREHOLE LOG
		Sensor	Bentonite	Screen	

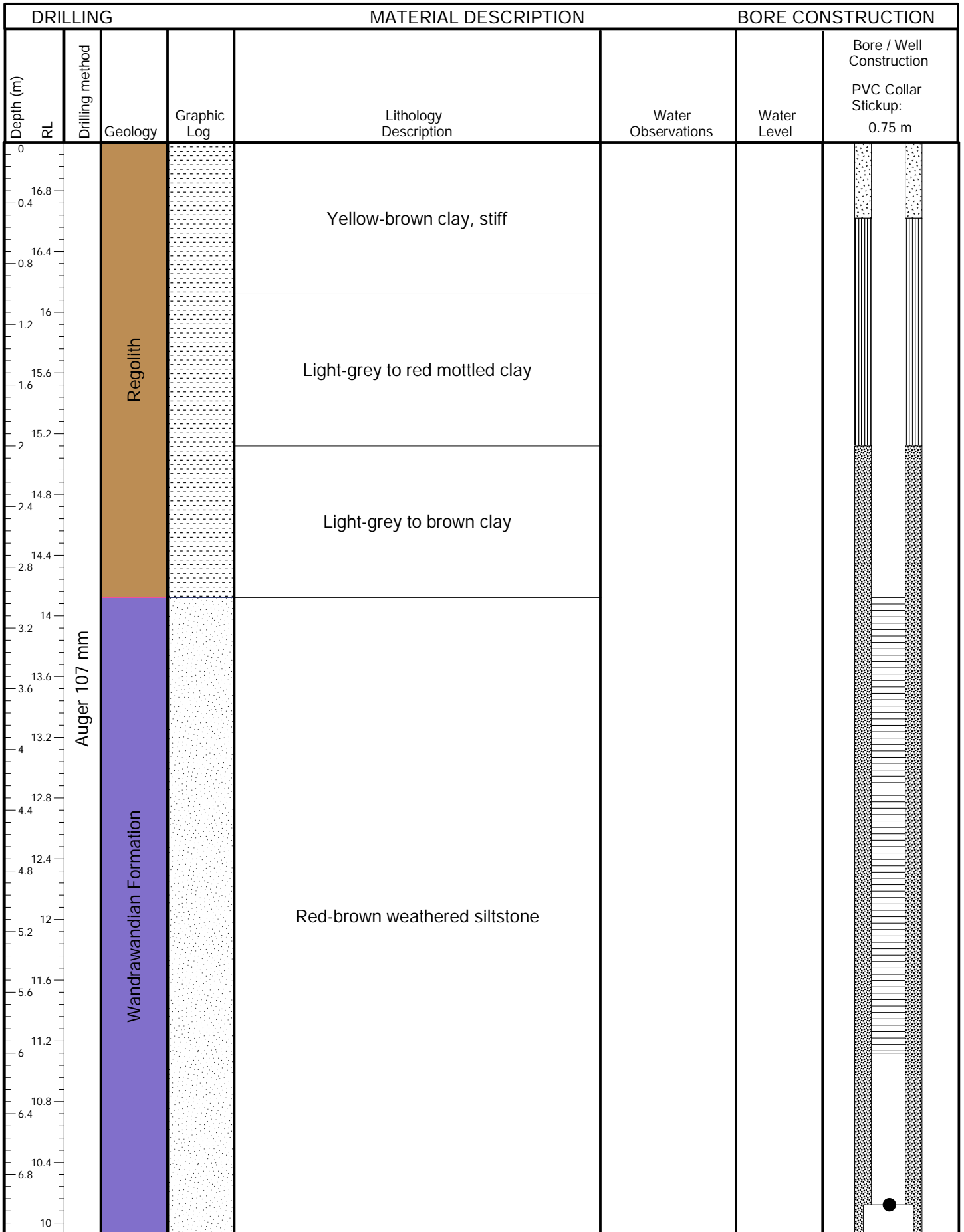
CLIENT	Shoalhaven City Council	COMPLETED	11/09/2017	EASTING	293964.524	Borehole No: MB406 Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6131638.411	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	22.87 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	



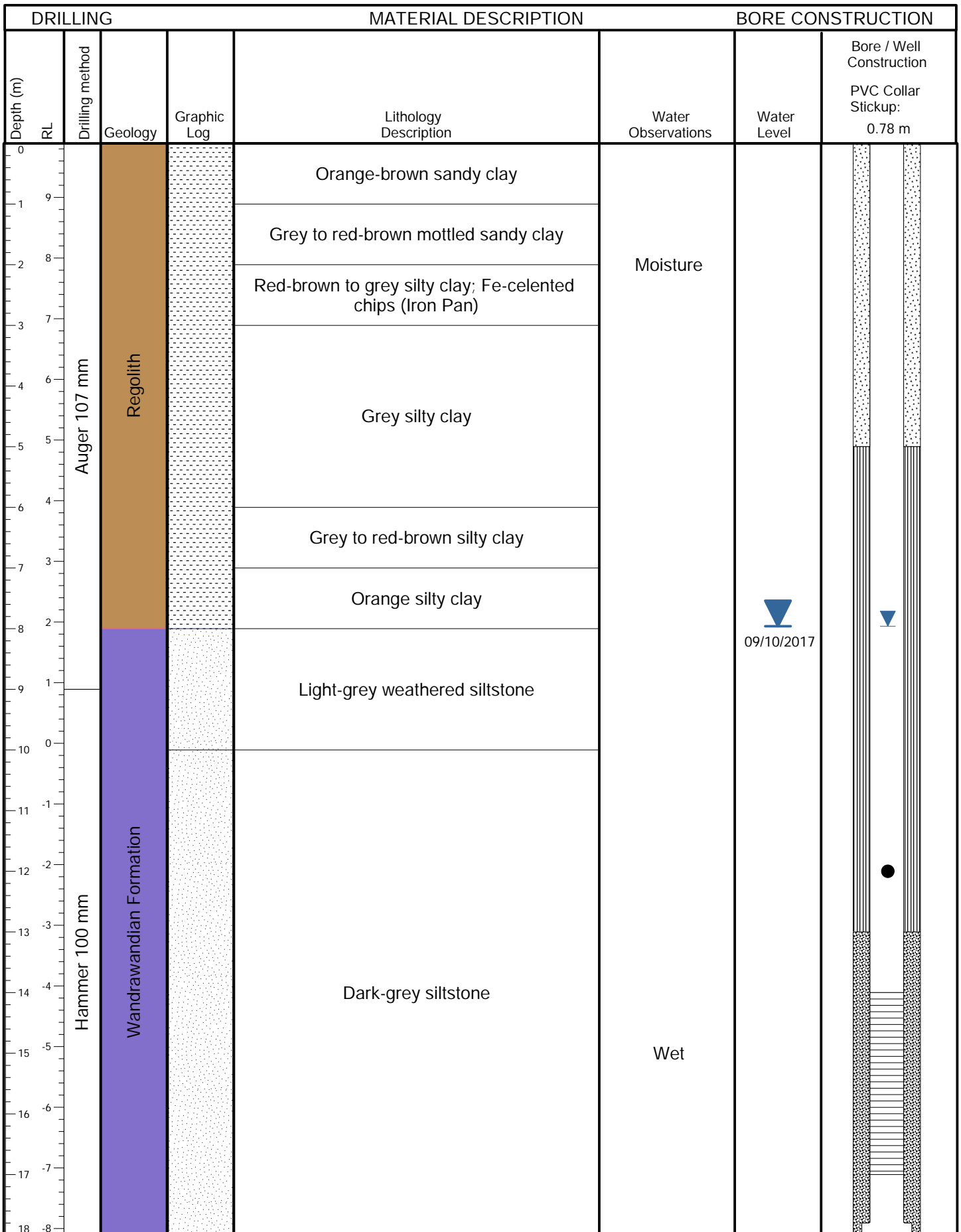
CLIENT	Shoalhaven City Council	COMPLETED	14/09/2017	EASTING	293867.317	Borehole No: MB407A Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6132201.957	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	17.25 mAHD	
PROJECT No:	J21423	LOGGED BY	Sean Moran	DATUM	MGA Zone 56	

DRILLING		MATERIAL DESCRIPTION			BORE CONSTRUCTION		
Depth (m)	Drilling method	Geology	Graphic Log	Lithology Description	Water Observations	Water Level	Bore / Well Construction
0	Auger 107 mm	Regolith		Yellow-brown clay, stiff			
1				Light-grey to red mottled clay			
2				Light-grey to brown clay			
3	Hammer 100 mm	Wandrawandian Formation		Red-brown weathered siltstone	Moisture	09/10/2017	
4				Dark-grey siltstone, slightly weathered			
5							Grey-brown weathered siltstone
6							Dark-grey siltstone
7							
8	Hammer 100 mm	Wandrawandian Formation		Dark-grey siltstone	Moisture	09/10/2017	
9							
10							
11							
12							
13							
14							
15	Hammer 100 mm	Wandrawandian Formation		Dark-grey siltstone	Moisture	09/10/2017	
16							
17							
18	Hammer 100 mm	Wandrawandian Formation		Dark-grey siltstone	Moisture	09/10/2017	
19							

CLIENT	Shoalhaven City Council	COMPLETED	14/09/2017	EASTING	293867.712	Borehole No: MB407B Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6132196.839	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	17.12 mAHD	
PROJECT No:	J21423	LOGGED BY	Sean Moran	DATUM	MGA Zone 56	



CLIENT	Shoalhaven City Council	COMPLETED	19/09/2017	EASTING	293644.181	Borehole No: MB408A Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6132748.991	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	9.89 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	



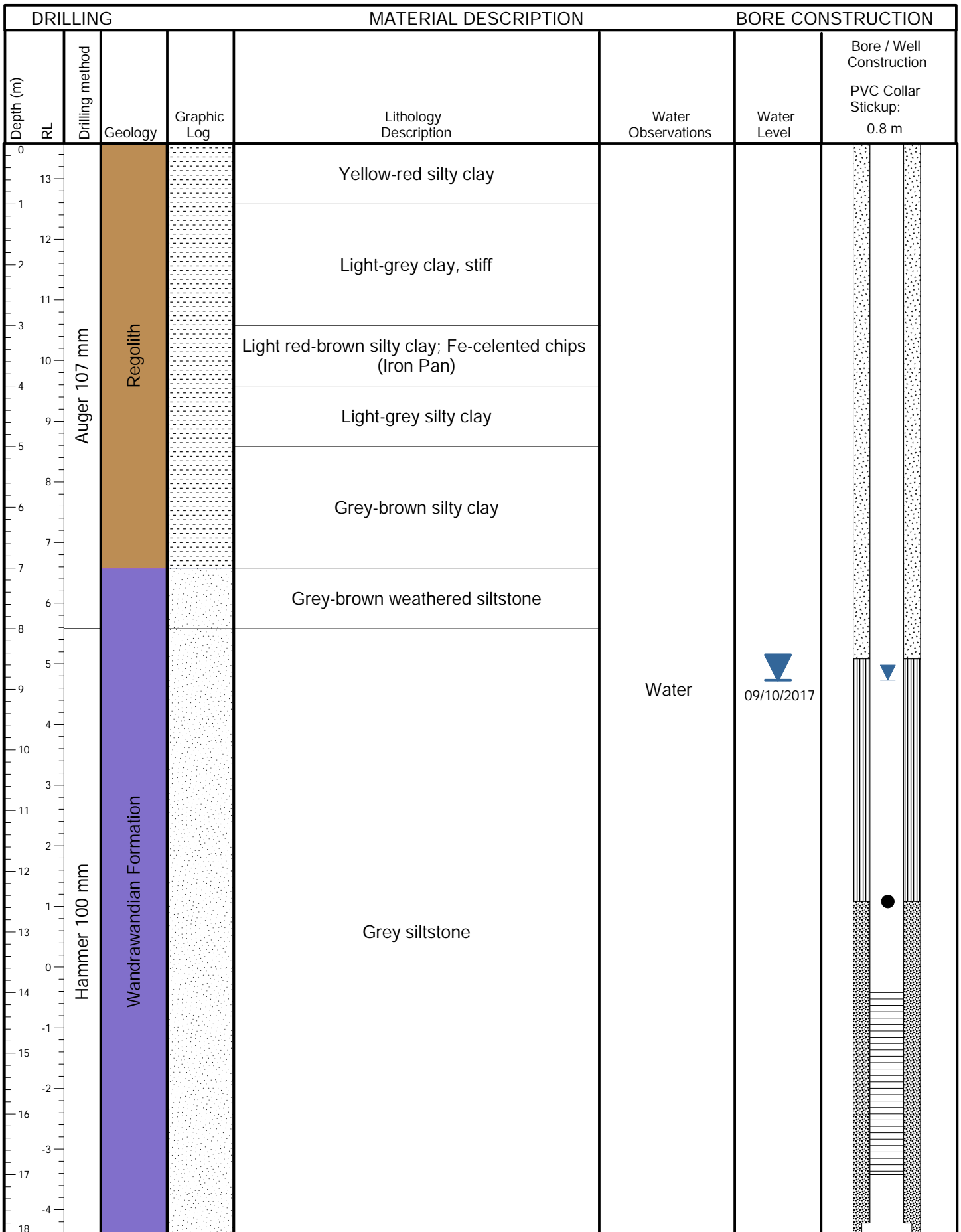
	HGEO Pty Ltd PO Box 312, Lindfield, NSW 2070. M: 0427 004 338	▼ SWL	Filter sand	Cuttings	GROUNDWATER BOREHOLE LOG
		● Sensor	Bentonite	Screen	

CLIENT	Shoalhaven City Council	COMPLETED	19/09/2017	EASTING	293641.124	Borehole No: MB408B Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6132749.516	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	9.78 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	

DRILLING		MATERIAL DESCRIPTION			BORE CONSTRUCTION		
Depth (m)	Drilling method	Geology	Graphic Log	Lithology Description	Water Observations	Water Level	Bore / Well Construction
0	Auger 107 mm	Regolith		Orange-brown sandy clay			
0.4							
0.8							
1.2							
1.6							
2.0							
2.4							
2.8							
3.2							
3.6							
4.0				Grey to red-brown mottled sandy clay			
4.4							
4.8							
5.2				Red-brown to grey silty clay; Fe-celented chips (Iron Pan)			
5.6							
6.0							
6.4							
6.8				Grey silty clay			
7.2							
7.6							
8.0							
8.4							
8.8							
9.2							
9.6							
10.0							
				Grey to red-brown silty clay			

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		Sensor	Bentonite	Screen	

CLIENT	Shoalhaven City Council	COMPLETED	18/09/2017	EASTING	293189.878	Borehole No: MB409 Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6131411.672	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	13.58 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	



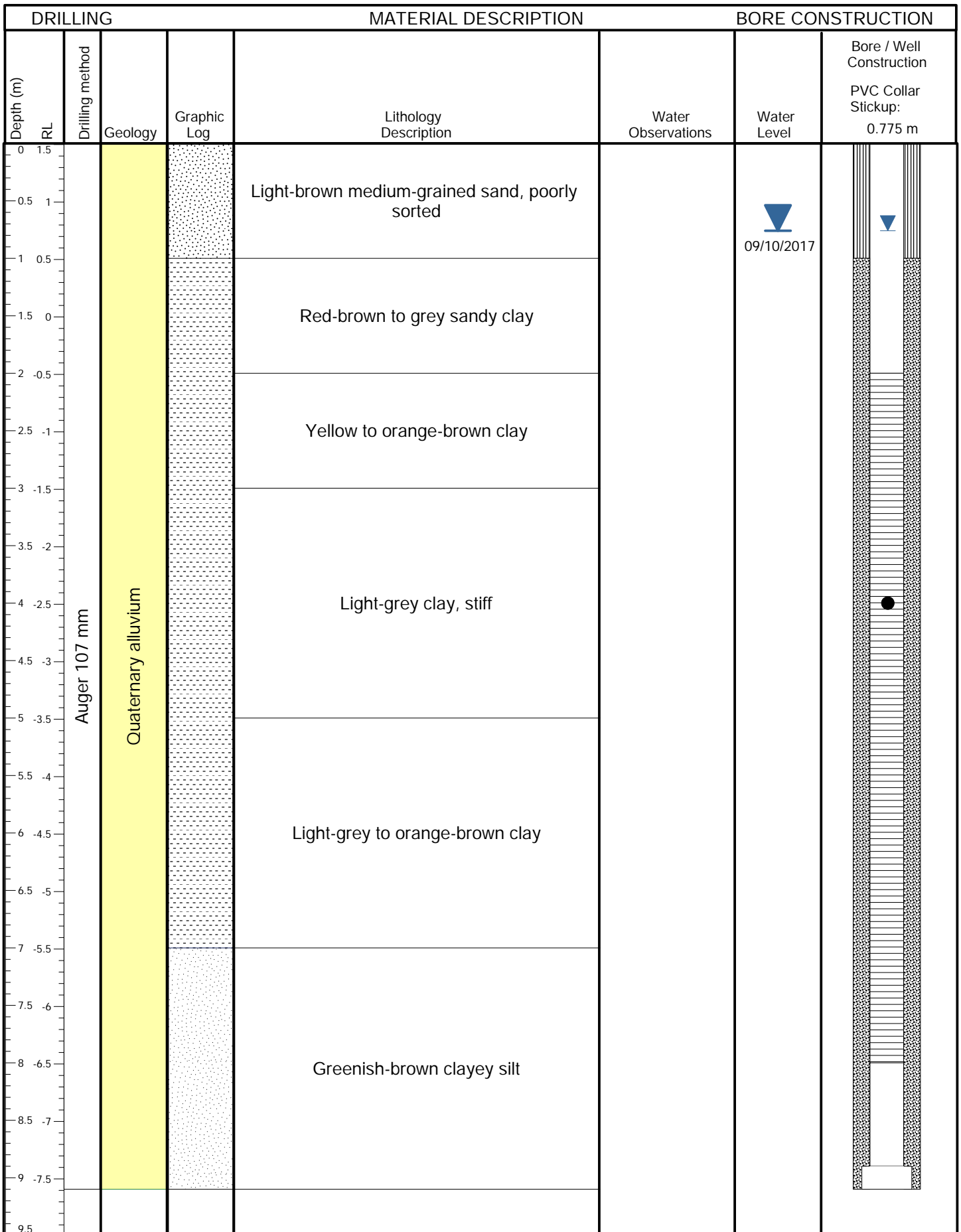
	HGeo Pty Ltd PO Box 312, Lindfield, NSW 2070. M: 0427 004 338	▼ SWL	Filter sand	Cuttings	GROUNDWATER BOREHOLE LOG
		● Sensor	Bentonite	Screen	

CLIENT	Shoalhaven City Council	COMPLETED	19/09/2017	EASTING	294877.932	Borehole No: MB410A Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6132562.696	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	1.45 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	

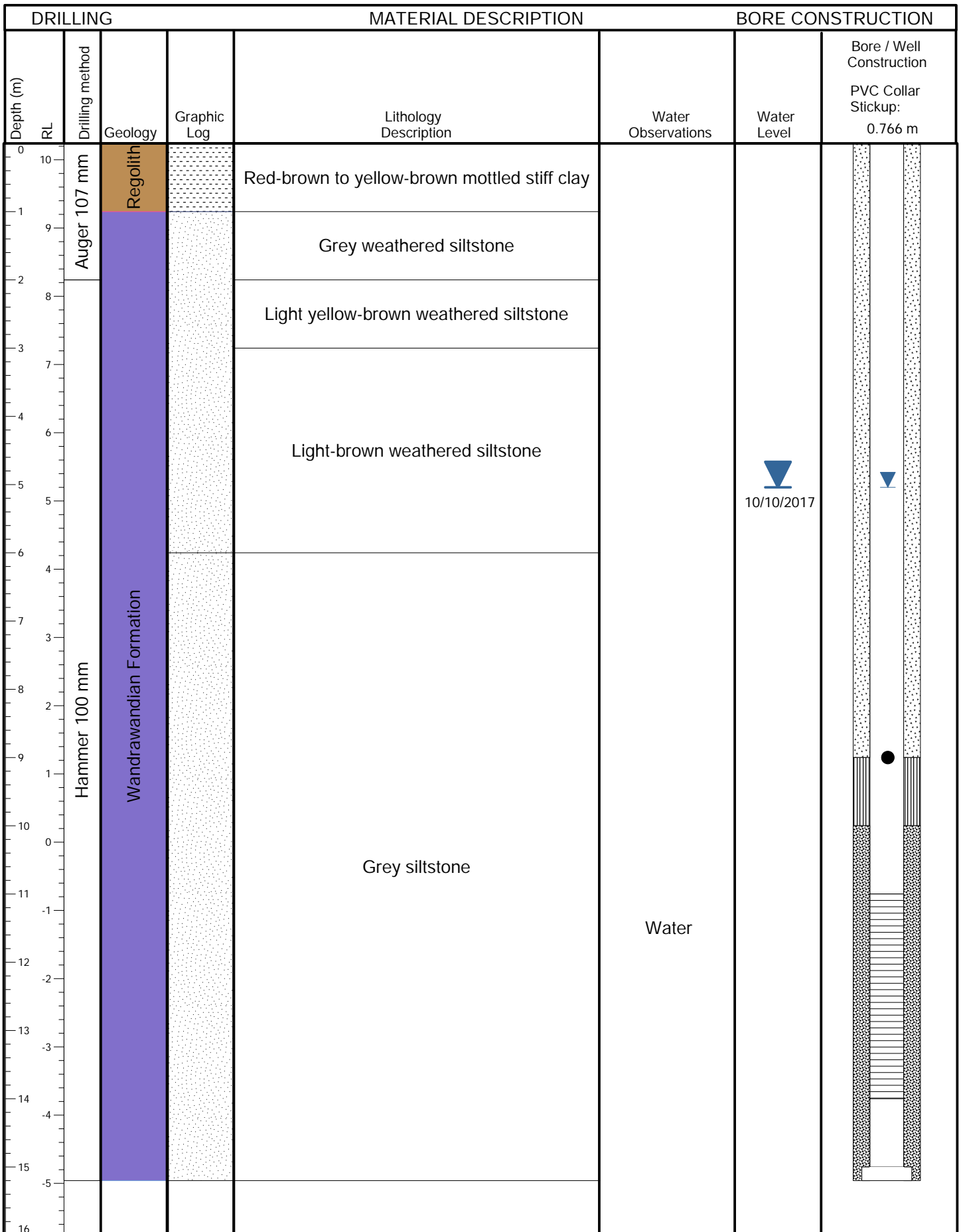
DRILLING		MATERIAL DESCRIPTION				BORE CONSTRUCTION	
Depth (m)	Drilling method	Geology	Graphic Log	Lithology Description	Water Observations	Water Level	Bore / Well Construction
0	Auger 107 mm	Quaternary alluvium		Light-brown medium-grained sand, poorly sorted		09/10/2017	
1				Red-brown to grey sandy clay			
2				Yellow to orange-brown clay			
3				Light-grey clay, stiff			
4							
5				Light-grey to orange-brown clay			
6	Hammer 100 mm	Wandrawandian Formation		Greenish-brown clayey silt	Moisture		
7				Grey weathered siltstone			
8							
9				Dark-grey siltstone			
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

	HCEO Pty Ltd PO Box 312, Lindfield, NSW 2070. M: 0427 004 338	▼ SWL	Filter sand	Cuttings	GROUNDWATER BOREHOLE LOG
		● Sensor	Bentonite	Screen	

CLIENT	Shoalhaven City Council	COMPLETED	19/09/2017	EASTING	294878.721	Borehole No: MB410B Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6132560.475	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	1.51 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	

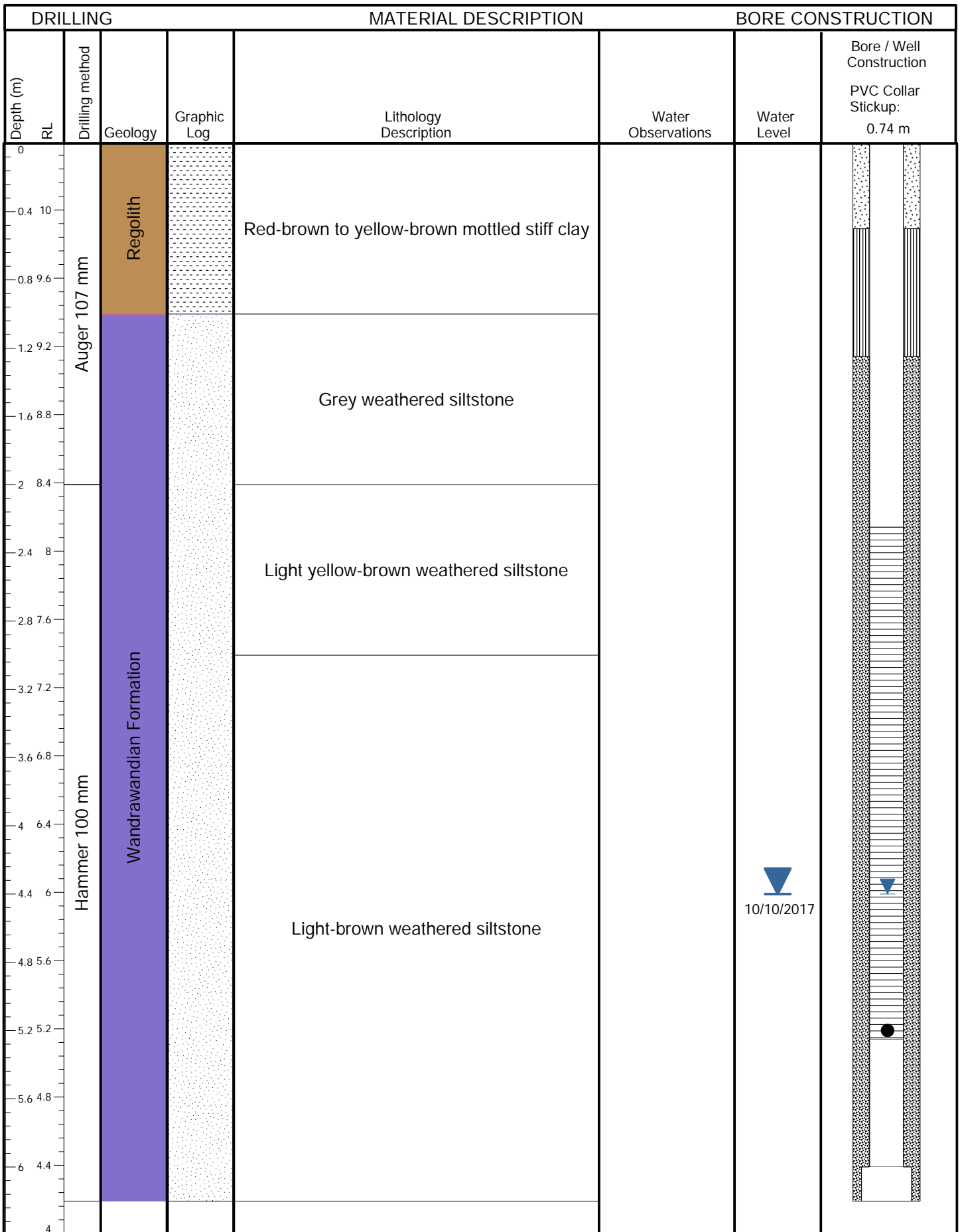


CLIENT	Shoalhaven City Council	COMPLETED	11/09/2017	EASTING	294644.294	Borehole No: MB411A Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6132097.83	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	10.24 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	



	HGEO Pty Ltd PO Box 312, Lindfield, NSW 2070. M: 0427 004 338	SWL	Filter sand	Cuttings	GROUNDWATER BOREHOLE LOG
		Sensor	Bentonite	Screen	

CLIENT	Shoalhaven City Council	COMPLETED	11/09/2017	EASTING	294647.574	Borehole No: MB411B Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6132101.671	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	10.39 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	

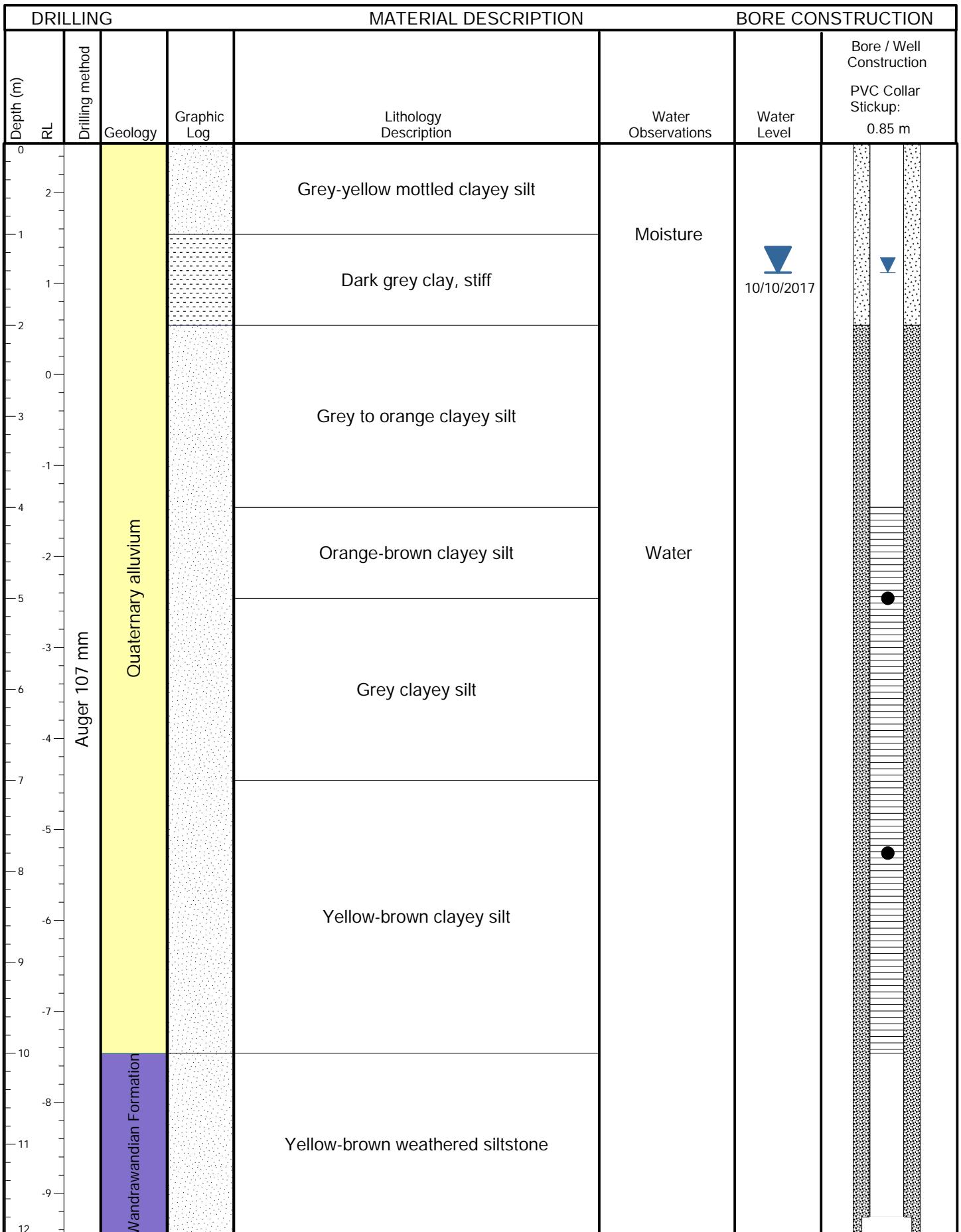


	HGEO Pty Ltd PO Box 312, Lindfield, NSW 2070. M: 0427 004 338	SWL	Filter sand	Cuttings	GROUNDWATER BOREHOLE LOG
		Sensor	Bentonite	Screen	

CLIENT	Shoalhaven City Council	COMPLETED	12/09/2017	EASTING	294573.847	Borehole No: MB412A Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6131776.954	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	2.58 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	

DRILLING		MATERIAL DESCRIPTION			BORE CONSTRUCTION		
Depth (m)	Drilling method	Geology	Graphic Log	Lithology Description	Water Observations	Water Level	Bore / Well Construction
0	Auger 107 mm	Quaternary alluvium		Grey-yellow mottled clayey silt	Moisture	▼ 10/10/2017	
2				Dark grey clay, stiff			
4				Grey to orange clayey silt	Water		
6				Orange-brown clayey silt			
8				Grey clayey silt			
10				Yellow-brown clayey silt			
12	Hammer 100 mm	Wandrawandian Formation		Yellow-brown weathered siltstone	Airlift 4 L/s		
14				Dark-grey carbonaceous siltstone			
16				Light-grey siltstone; Fracture at 25 m			
18							
20							
22							
24							
26							


CLIENT	Shoalhaven City Council	COMPLETED	12/09/2017	EASTING	294571.026	Borehole No: MB412B Sheet 1 of 1
PROJECT	West Culburra Groundwater	DRILLING Co	Highland Drilling	NORTHING	6131776.231	
LOCATION	West Culburra, NSW	RIG / METHOD	Hanjin D&B D8 TM	GRND RL	2.54 mAHD	
PROJECT No:	J21423	LOGGED BY	Stuart Brown	DATUM	MGA Zone 56	



 HGEO Pty Ltd PO Box 312, Lindfield, NSW 2070. M: 0427 004 338	 SWL	 Filter sand	 Cuttings	GROUNDWATER BOREHOLE LOG
	 Sensor	 Bentonite	 Screen	

16 Annexure F: Shoalhaven Council Irrigation Data

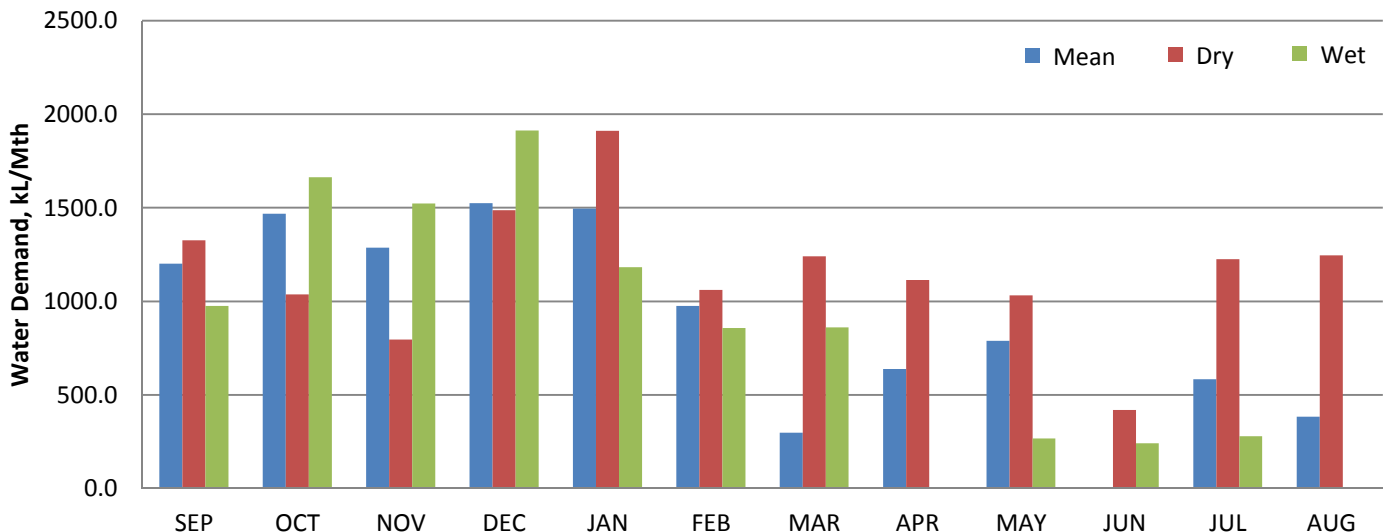
Irrigation Water Demand

 <b style="font-size: 1.2em;">Water Wise consulting Design - Management - Support	Project:	Ray Abood Oval								ID	4
	Plant Type	Irrigated Area, Ha	Scale Factors					Effective Rain Factors			
	Turf	1.250	Kv 0.90	Kd 1.00	Kmc 1.00	Ksm 1.00	Ksys 0.85	Sep-Nov 0.45	Dec-Feb 0.40	Mar-May 0.45	Jun-Aug 0.50
Weather Station: Norwa Ran Air Station											
Mean years: 10 Years (2010~2019); Dry year 2018; Wet Year 2015											

Kv=Species Factor; Kd=Density Factor; Kmc=Microclimate Factor; Ksm=Managed Stress Factor; Ksys=System Efficiency

Month		SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	Total	
Monthly Evapotranspiration (ET ₀), mm	Mean	113.4	137.7	140.1	155.3	152.2	115.4	105.9	85.9	79.3	54.8	74.8	89.9	1305	mm/yr
	Dry	113.8	116.9	147.6	151.7	175.2	135.4	119.8	102.9	88.8	58.2	96.3	107.4	1414	mm/yr
	Wet	97.1	143.8	142.7	165.5	146.9	77.0	104.9	72.4	79.6	49.3	63.5	80.1	1223	mm/yr
Monthly Rainfall, mm	Mean	45.3	53.6	85.8	90.1	88.3	94.0	166.7	75.3	39.3	148.6	55.2	109.8	1052	mm/yr
	Dry	27.2	77.2	175.0	88.6	69.2	124.2	52.2	37.4	21.8	47.6	6.8	24.0	751	mm/yr
	Wet	46.8	36.2	55.4	47.2	129.4	27.6	79.8	233.6	118.8	56.0	76.4	431.6	1339	mm/yr
Effective Rainfall, mm	Mean	20.4	24.1	38.6	36.0	35.3	37.6	75.0	33.9	17.7	74.3	27.6	54.9	475	mm/yr
	Dry	12.2	34.7	78.8	35.4	27.7	49.7	23.5	16.8	9.8	23.8	3.4	12.0	328	mm/yr
	Wet	21.1	16.3	24.9	18.9	51.8	11.0	35.9	105.1	53.5	28.0	38.2	215.8	620	mm/yr
Landscape Coefficient KL=Kv*Kd*Kmc*Ksm		0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90		
Target ET-L, mm	Mean	102.1	123.9	126.1	139.7	137.0	103.9	95.3	77.3	71.4	49.3	67.3	80.9	1174	mm/yr
	Dry	102.4	105.2	132.8	136.5	157.7	121.9	107.8	92.6	79.9	52.4	86.7	96.7	1273	mm/yr
	Wet	87.4	129.4	128.4	149.0	132.2	69.3	94.4	65.2	71.6	44.4	57.2	72.1	1101	mm/yr
Net Water Required, mm	Mean	81.7	99.8	87.5	103.7	101.7	66.3	20.3	43.4	53.7	0.0	39.7	26.0	724	mm/yr
	Dry	90.2	70.5	54.1	101.1	130.0	72.2	84.3	75.8	70.1	28.6	83.3	84.7	945	mm/yr
	Wet	66.3	113.1	103.5	130.1	80.5	58.3	58.5	0.0	18.2	16.4	19.0	0.0	664	mm/yr
Estimated Irrigation Water Required, mm	Mean	96.1	117.4	102.9	122.0	119.7	78.0	23.9	51.1	63.1	0.0	46.7	30.6	851	mm/yr
	Dry	106.1	82.9	63.6	118.9	152.9	84.9	99.2	89.2	82.5	33.6	98.0	99.6	1111	mm/yr
	Wet	78.0	133.1	121.8	153.0	94.6	68.5	68.8	0.0	21.4	19.3	22.3	0.0	781	mm/yr
Estimated Irrigation Water Required, kL/mth	Mean	1201.2	1467.9	1286.2	1525.1	1495.8	974.7	298.2	638.7	789.1	0.0	583.8	382.8	10.644	ML/yr
	Dry	1326.2	1036.3	795.4	1486.6	1911.8	1061.5	1240.1	1114.4	1031.0	420.3	1224.6	1245.0	13.893	ML/yr
	Wet	975.4	1663.7	1522.1	1912.8	1183.1	856.8	860.3	0.0	267.4	240.7	278.7	0.0	9.761	ML/yr
Seasonal Estimated Irrigation Water Required, ML/Season	Mean	3.955			3.996			1.726			0.967			10.644	ML/yr
	Dry	3.158			4.460			3.386			2.890			13.893	ML/yr
	Wet	4.161			3.953			1.128			0.519			9.761	ML/yr

Irrigation Water Monthly Demand



ID	Weather Station	ET0 mm/Month												Total, mm/yr
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1	Norwa Ran Air Station (2010~2019)	152.24	115.42	105.88	85.92	79.29	54.75	74.78	89.91	113.40	137.70	140.07	155.27	1304.63
2	Norwa Ran Air Station (Dry 2018)	175.20	135.40	119.80	102.90	88.80	58.20	96.30	107.40	113.80	116.90	147.60	151.70	1414.00
3	Norwa Ran Air Station (Wet 2015)	146.90	77.00	104.90	72.40	79.60	49.30	63.50	80.10	97.10	143.80	142.70	165.50	1222.80
0	Average of years 1961~1990 at the same location	107.00	82.00	73.00	37.00	23.00	23.00	21.00	21.00	36.00	69.00	90.00	102.00	684.00
		Rainfall mm/Month												
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1	Norwa Ran Air Station (2010~2019)	88.27	94.00	166.69	75.33	39.33	148.58	55.20	109.78	45.29	53.58	85.78	90.09	1051.91
2	Norwa Ran Air Station (Dry 2018)	69.20	124.20	52.20	37.40	21.80	47.60	6.80	24.00	27.20	77.20	175.00	88.60	751.20
3	Norwa Ran Air Station (Wet 2015)	129.40	27.60	79.80	233.60	118.80	56.00	76.40	431.60	46.80	36.20	55.40	47.20	1338.80
0	Average of years 1961~1990 at the same location	111.20	121.84	146.90	136.18	101.45	115.03	76.84	88.07	78.90	92.00	110.12	103.23	1281.76

17 Annexure G: MUSIC Model Data

Table G1: General treatment node inputs.

Element	Factor	Input	Source
Setup	Climate File	Nowra RAN AWS	eWater
Source Nodes	Rainfall Threshold	Based on surface type specified in Table 5-4	BMT WBM (2015)
	Base & Stormflow properties	As per Table 5-6 & 5-7	BMT WBM (2015)
	Estimation Method	Stochastically generated	BMT WBM (2015)
Rainwater Tanks	Low Flow By-Pass	0 m ³ /s	BMT WBM (2015)
	High Flow By-Pass	0.010 m ³ /s per dwelling	By Design
	Volume Below Overflow	5.0 kL per residential lot 15.0 kL per industrial lot	By Design
	Surface Area	2.5 m ² per tank for residential lots 7.5 m ² per tank for industrial lots	By Design
	Overflow Pipe Diameter	90 mm pipes for each tank	By Design
	Internal Re-use	1 ET = 0.265 kL/day/dwelling 1ET for dwellings and units 15 ET/ha for industrial	NSW DWE (2008) Shoalhaven Water (2012)
	External Re-use	55.115 kL/yr/single dwelling and industrial 32.12 kL/yr/multi-residential dwelling	BMT WBM (2015)
Gross Pollutant Traps	Low Flow By-Pass	0 m ³ /s	BMT WBM (2015)
	High Flow By-Pass	0.6 m ³ /s HumeGard (HG18) 1.43 m ³ /s HumeGard (HG24) 3.08 m ³ /s HumeGard (HG30)	Designed and specified by Holcim Australia
	Treatment Efficiency	As per manufacturer's specification	Holcim Australia
Biobasins	Low Flow By-Pass	0 m ³ /s	BMT WBM (2015)
	High Flow By-Pass	100 m ³ /s	Set to ensure all flows drain to bioretention basins
	Extended Detention Depth	0.30 m for primary, 0.70 m for secondary	By design, within AGFSBS (2015) standard range
	Surface Area	Varies (see Table G2)	By design
	Filter Area	Varies (see Table G2)	By design
	Unlined Filter Media Perimeter	0.01 m	By design
	Saturated Hydraulic Conductivity	100 mm/hr	BMT WBM (2015)

	Filter Depth	0.5 m	By design, within AGFSBS (2015) standard range
	TN Content of Filter Media	400 mg/kg	BMT WBM (2015) default
	Orthophosphate Content of Filer Media	40 mg/kg	BMT WBM (2015) default
	Exfiltration Rate	0.25 mm/hr	By design
	Lined Base	Yes for primary, No for secondary	By design
	Vegetation Properties	With effective nutrient removal plants	By design
	Overflow Weir Width	Varies (see Table G2)	By design
	Underdrain Present	Yes	By design
	Submerged Zone	Varies (see Table G2)	By design
Ponds	Low Flow By-Pass	0 m ³ /s	BMT WBM (2015)
	High Flow By-Pass	100 m ³ /s	Set to ensure all flows drain to ponds
	Surface Area	Varies (see Table G3)	By design
	Extended detention depth	2 m	By design
	Permanent Pool Volume	Varies (see Table G3)	By design
	Initial Volume	0 m ³	By design
	Exfiltration Rate	0.25 mm/hr	Infiltration testing
	Evaporation Loss	75%	By design
	Equivalent Pipe Diameter	Varies (see Table G3)	By design
	Overflow Weir Diameter	3 m	By design

Table G2: Individual bioretention basin inputs.

Treatment Structure	Surface Area (m ²)	Filter Area (m ²)	Overflow Weir Width (m)	Submerged Zone Depth (m)
1	250	250	5	0.05
2	300	300	5	0.05
3	250	250	5	0.05
6	500	500	5	0.05
7	840	840	110	0
A	6,000	6,000	300	0
B	3,000	3,000	300	0.05
C	2,000	2,000	140	0.05
D	250	250	60	0.05

Table G3: Individual pond inputs.

Treatment Structure	Surface Area (m ²)	Equivalent Pipe Diameter (mm)	Permanent Pool Volume (m ³)
Pond 1	3,500	300	10,500
Pond 2	2,500	180	7,500
Pond 3	1,000	120	3,000

18 Annexure H: Groundwater Slug Tests

Single Bore Slug Test (Rising or Falling)

Method SF-13 Revised 7.3.2007



PROJECT DETAILS

Project	P1002842 - Culburra
Project Ref	P1002842JS01V01
Borehole Ref	GMB1
Method	Hvorslev (1981)

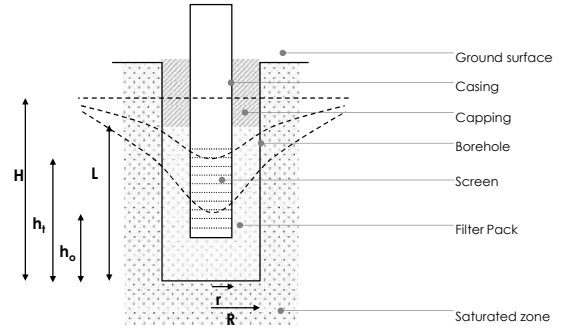
Test Date	23.11.2010
Field Testing	B.Rose and G.Taylor
Data Analysis	B.Rose
Reviewed	D.Marrens

FIELD TEST DATA

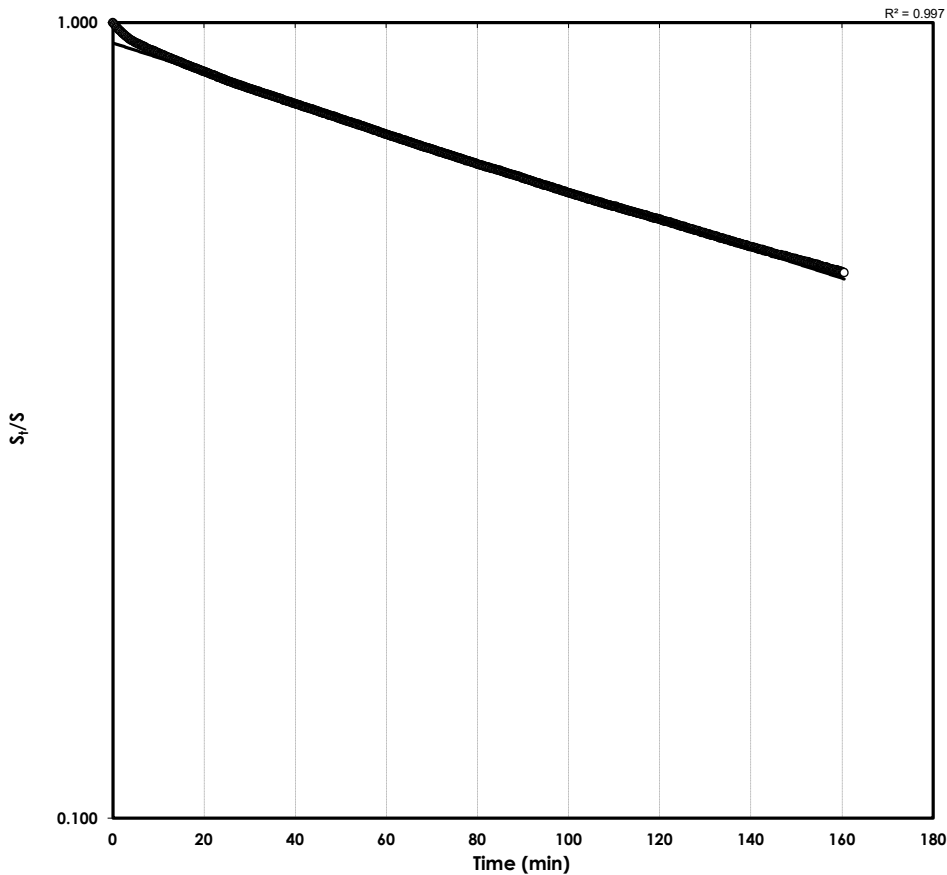
data used for analysis

FACTOR

FACTOR	Enter Data	Unit
H - Initial water level pressure (m H ₂ O)	14.29	m
h ₀ - Water level pressure at time = 0 (m H ₂ O)	11.30	m
r - Casing radius	0.025	m
R - Bore radius	0.025	m
L - Length of open screen	3.05	m
T ₀ - Length of characteristic time	219.74	minutes
K _{sat} - Saturated hydraulic conductivity	0.003	m/d



DATA PLOT



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Single Bore Slug Test (Rising or Falling)

Method SF-13 Revised 7.3.2007



PROJECT DETAILS

Project	P1002842 - Culburra
Project Ref	P1002842JS01V01
Borehole Ref	GMB1a
Method	Hvorslev (1981)

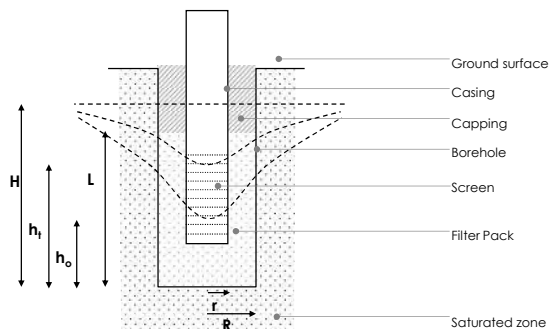
Test Date	23.11.2010
Field Testing	B.Rose and G.Taylor
Data Analysis	B.Rose
Reviewed	D.Martens

FIELD TEST DATA

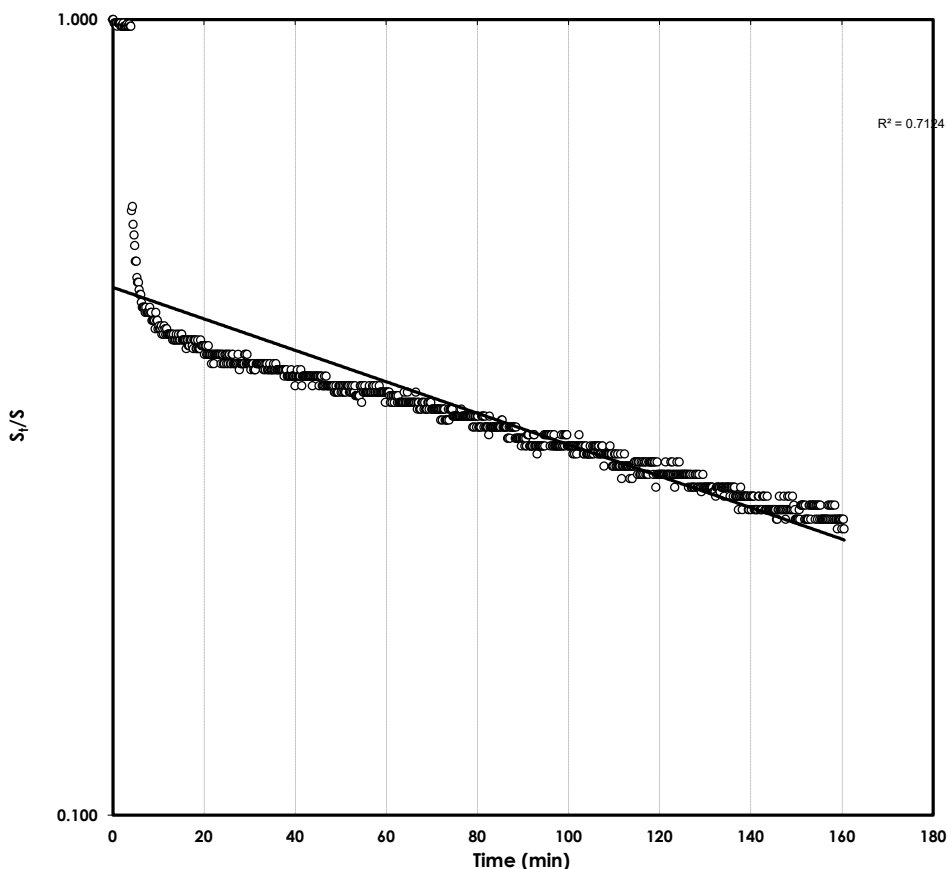
data used for analysis

FACTOR

FACTOR	Enter Data	Unit
H - Initial water level pressure (m H ₂ O)	10.63	m
h ₀ - Water level pressure at time = 0 (m H ₂ O)	10.32	m
r - Casing radius	0.025	m
R - Bore radius	0.025	m
L - Length of open screen	1.00	m
T ₀ - Length of characteristic time	48.08	minutes
K _{sat} - Saturated hydraulic conductivity	0.035	m/d



DATA PLOT



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Single Bore Slug Test (Rising or Falling)

Method SF-13 Revised 7.3.2007



PROJECT DETAILS

Project	P1002842 - Culburra
Project Ref	P1002842JS01V01
Borehole Ref	GMB2
Method	Hvorslev (1981)

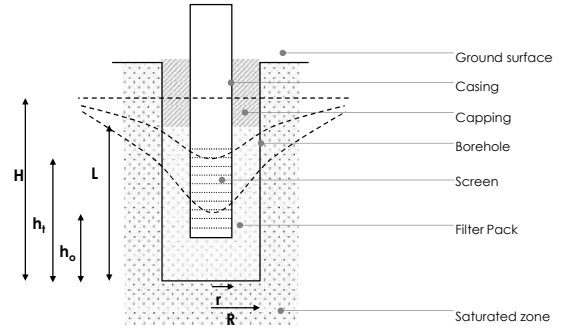
Test Date	22.11.2010
Field Testing	B.Rose and G.Taylor
Data Analysis	B.Rose
Reviewed	D.Martens

FIELD TEST DATA

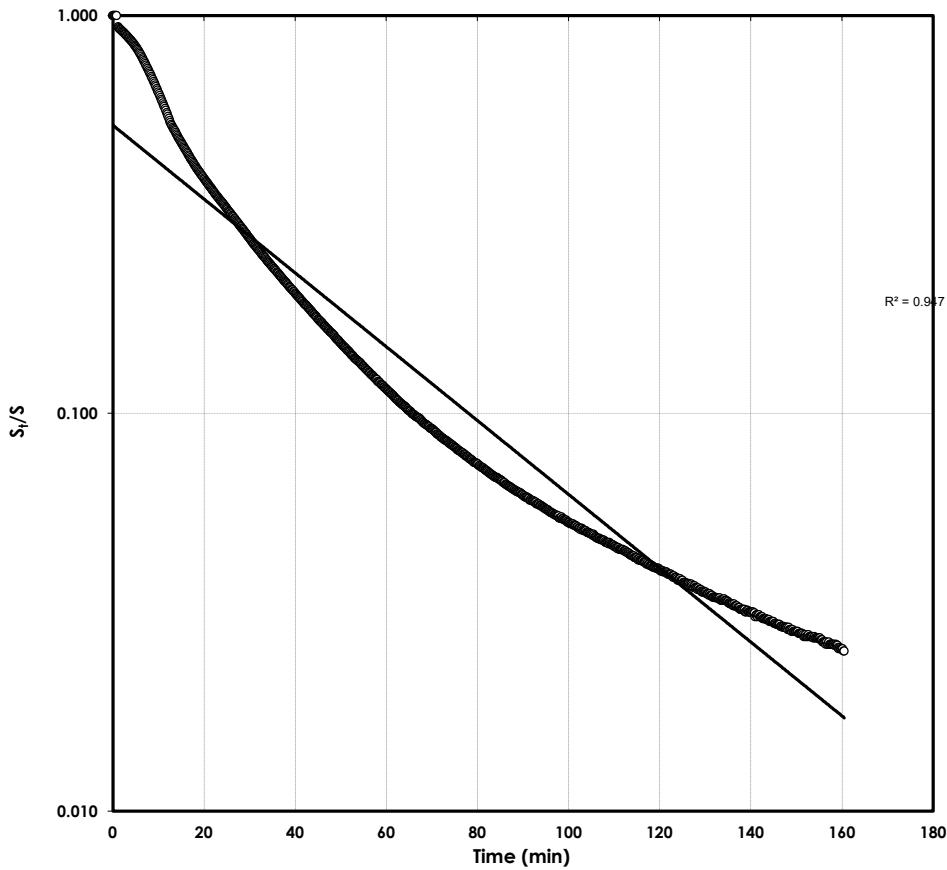
data used for analysis

FACTOR

FACTOR	Enter Data	Unit
H - Initial water level pressure (m H ₂ O)	16.36	m
h ₀ - Water level pressure at time = 0 (m H ₂ O)	10.41	m
r - Casing radius	0.025	m
R - Bore radius	0.025	m
L - Length of open screen	3.00	m
T ₀ - Length of characteristic time	16.84	minutes
K _{sat} - Saturated hydraulic conductivity	0.043	m/d



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Single Bore Slug Test (Rising or Falling)

Method SF-13 Revised 7.3.2007



PROJECT DETAILS

Project	P1002842 - Culburra
Project Ref	P1002842JS01V01
Borehole Ref	GMB6
Method	Hvorslev (1981)

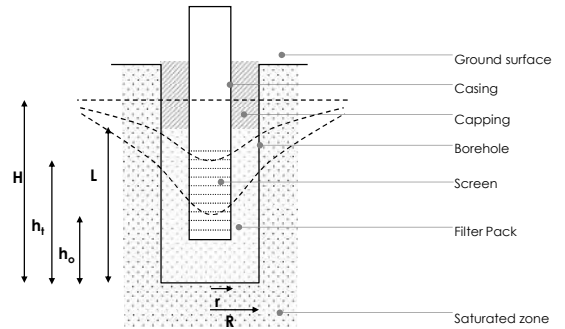
Test Date	23.11.2010
Field Testing	B.Rose and G.Taylor
Data Analysis	B.Rose
Reviewed	D.Martens

FIELD TEST DATA

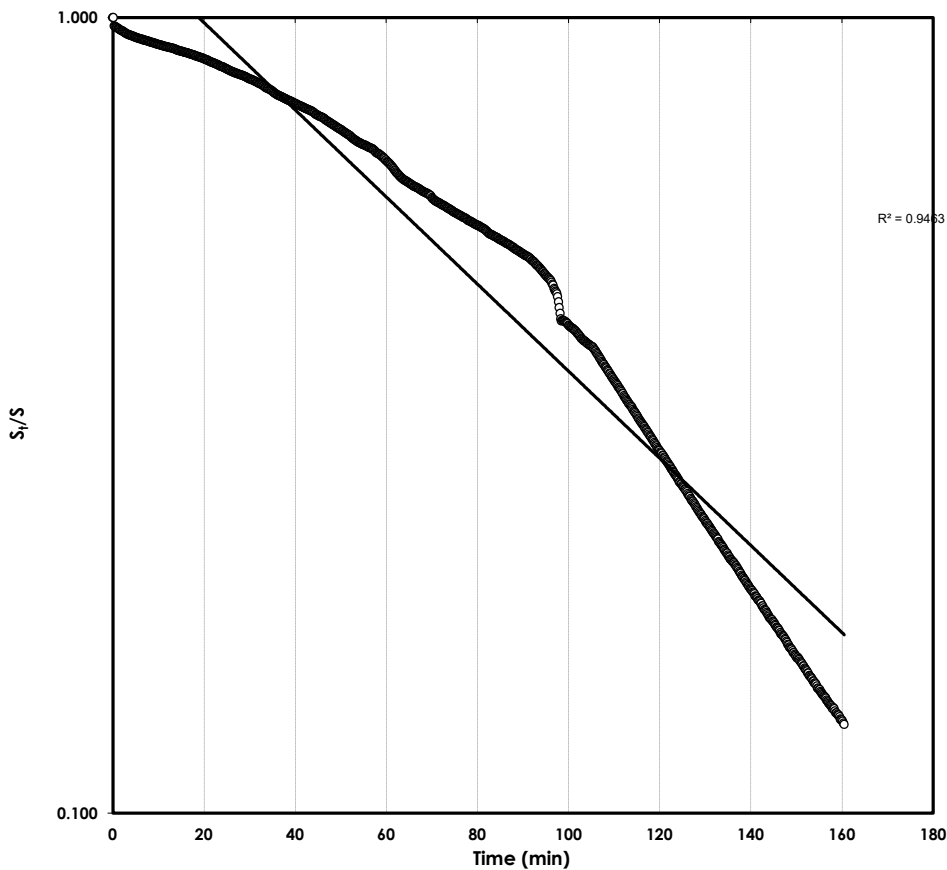
data used for analysis

FACTOR

FACTOR	Enter Data	Unit
H - Initial water level pressure (m H ₂ O)	15.39	m
h ₀ - Water level pressure at time = 0 (m H ₂ O)	10.50	m
r - Casing radius	0.025	m
R - Bore radius	0.025	m
L - Length of open screen	3.00	m
T ₀ - Length of characteristic time	97.69	minutes
K _{sat} - Saturated hydraulic conductivity	0.007	m/d



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19 Annexure I: Ksat Tests

Falling Head Soil Permeameter Field Data Analysis

Method based on AS 1547 (1994)
Method SI-15 Revised 20.3.2007



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PROJECT DETAILS

Project	WEST CULBURRA		Ref. No.	P1203365JS010-V1-BH302	
Author	MLK	Reviewed	AN	Date Created	19/06/2014

STEP 1 : ENTER TEST SITE DATA

FACTOR

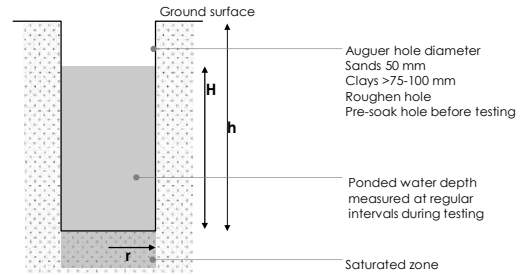
h - Hole depth
r - Radius

Enter Data

100.0
3.5

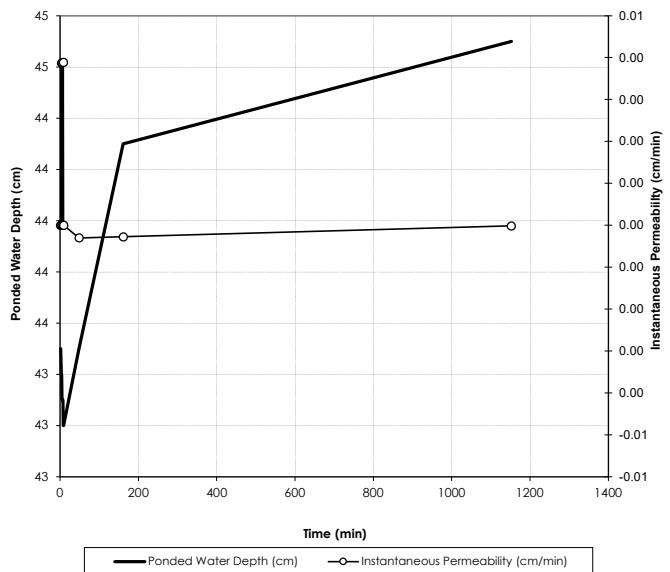
Unit

cm
cm



STEP 2 : ENTER TEST DATA

Time (min)	H. Ponded Depth (cm)	Permeability (cm/min)	
0.0	43.5		
0	1.0	43.5	0.000
0	2.0	43.5	0.000
	3.0	43.4	0.004
	4.0	43.4	0.000
	5.0	43.3	0.004
	6.0	43.3	0.000
	7.0	43.3	0.000
	8.0	43.2	0.004
	9.0	43.2	0.000
	48.0	43.5	0.000
	161.0	44.3	0.000
	1152.0	44.7	0.000
			-0.005
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!



STEP 3 : DETERMINE PERMEABILITY

FACTOR

Mean Outflow (Q)
Standard deviation in Q

Results

0.91
1.77

Unit

ml/min
ml/min

Saturated Hydraulic Conductivity (K_{sat})

1.33
0.55

+/-

2.57

cm/day
mm/hr

0.013

m/d

Falling Head Soil Permeameter Field Data Analysis

Method based on AS 1547 (1994)
Method SI-15 Revised 20.3.2007



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PROJECT DETAILS

Project	WEST CULBURRA		Ref. No.	P1203365JS010-V1-BH303	
Author	MLK	Reviewed	AN	Date Created	18.06.2014

STEP 1 : ENTER TEST SITE DATA

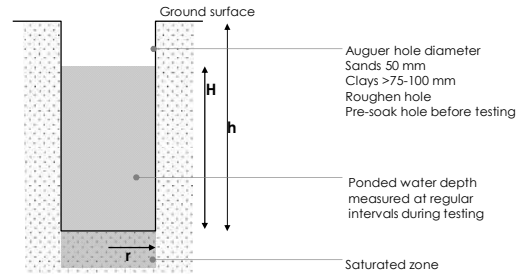
FACTOR

h - Hole depth
r - Radius

Enter Data

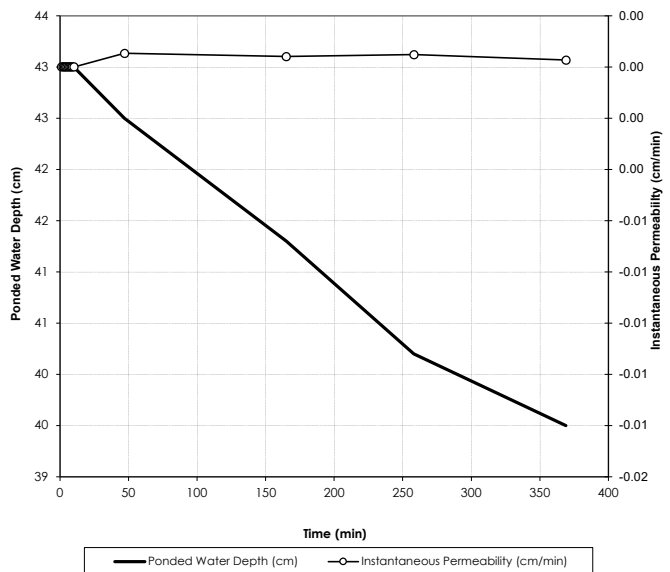
100.0
3.5

Unit
cm
cm



STEP 2 : ENTER TEST DATA

Time (min)	H, Pondered Depth (cm)	Permeability (cm/min)	
0.0	43.0		
0	1.0	43.0	0.000
0	2.0	43.0	0.000
	3.0	43.0	0.000
	4.0	43.0	0.000
	5.0	43.0	0.000
	6.0	43.0	0.000
	7.0	43.0	0.000
	8.0	43.0	0.000
	9.0	43.0	0.000
	10.0	43.0	0.000
	47.0	42.5	0.001
	165.0	41.3	0.000
	258.0	40.2	0.000
	369.0	39.5	0.000
			-0.015
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!



STEP 3 : DETERMINE PERMEABILITY

FACTOR

Mean Outflow (Q)
Standard deviation in Q

Results

0.11
0.20

Unit

ml/min
ml/min

Saturated Hydraulic Conductivity (K_{sat})

0.17
0.07

+/-

0.30

cm/day
mm/hr

0.002

m/d

Falling Head Soil Permeameter Field Data Analysis

Method based on AS 1547 (1994)
Method SI-15 Revised 20.3.2007



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PROJECT DETAILS

Project	WEST CULBURRA		Ref. No.	P1203365JS010-V1-BH304	
Author	MLK	Reviewed	AN	Date Created	19/06/2014

STEP 1 : ENTER TEST SITE DATA

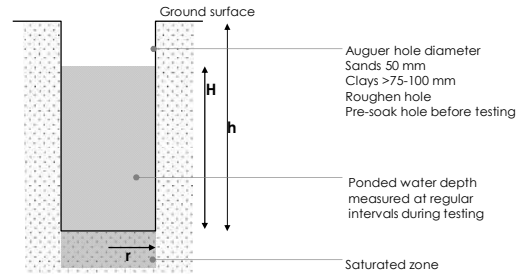
FACTOR

h - Hole depth
r - Radius

Enter Data

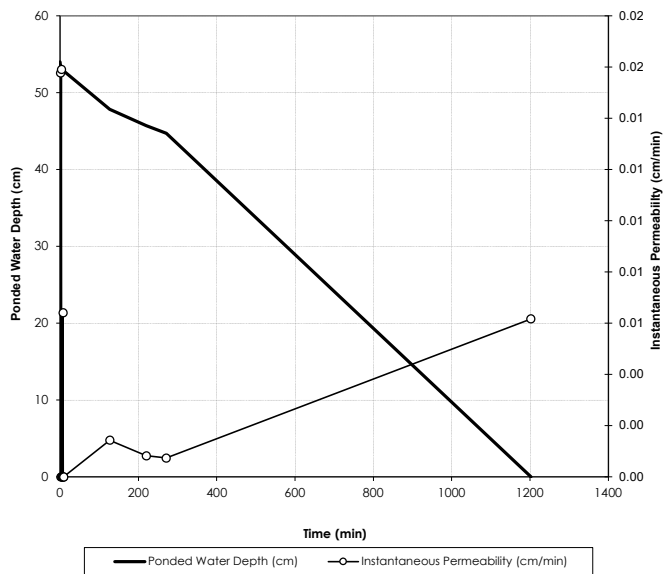
100.0
3.5

Unit
cm
cm



STEP 2 : ENTER TEST DATA

Time (min)	H. Pondered Depth (cm)	Permeability (cm/min)
0.0	54.0	
1.0	53.5	0.016
2.0	53.5	0.000
3.0	53.0	0.016
4.0	53.0	0.000
5.0	53.0	0.000
6.0	53.0	0.000
7.0	52.8	0.006
8.0	52.8	0.000
9.0	52.8	0.000
127.0	47.8	0.001
220.0	45.7	0.001
271.0	44.7	0.001
1202.0	0.0	0.006
		0.000
		#DIV/0!
		#DIV/0!
		#DIV/0!
		#DIV/0!
		#DIV/0!
		#DIV/0!
		#DIV/0!



STEP 3 : DETERMINE PERMEABILITY

FACTOR

Mean Outflow (Q)
Standard deviation in Q

Results

3.94
7.10

Unit
ml/min
ml/min

Saturated Hydraulic Conductivity (K_{sat})

5.23
2.18

+/-

8.44

cm/day
mm/hr

0.052

m/d

Falling Head Soil Permeameter Field Data Analysis

Method based on AS 1547 (1994)
Method SI-15 Revised 20.3.2007



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PROJECT DETAILS

Project	WEST CULBURRA		Ref. No.	P1203365JS010-V1-BH305	
Author	MLK	Reviewed	AN	Date Created	18.06.2014

STEP 1 : ENTER TEST SITE DATA

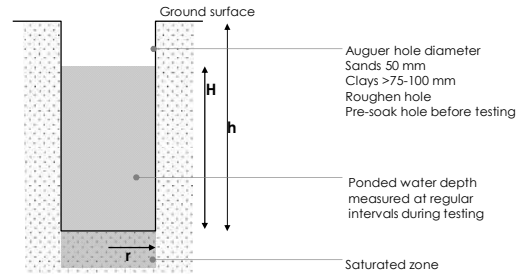
FACTOR

h - Hole depth
r - Radius

Enter Data

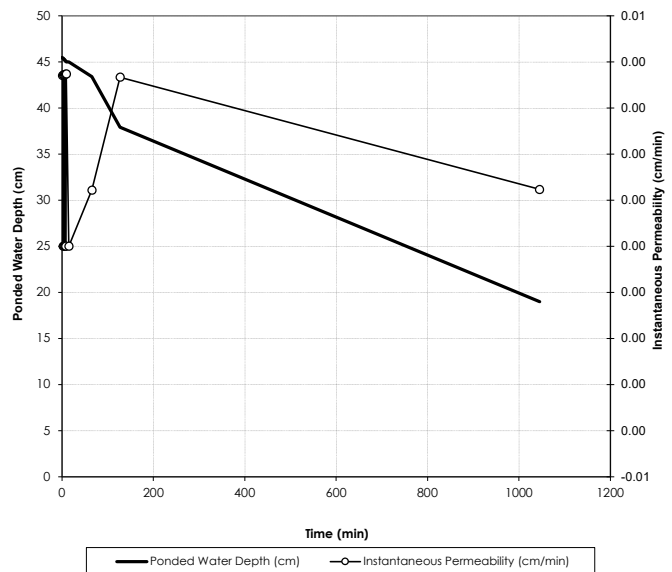
100.0
3.5

Unit
cm
cm



STEP 2 : ENTER TEST DATA

	Time (min)	H, Ponded Depth (cm)	Permeability (cm/min)
3.707628505 0	0.0	45.5	
	1.0	45.4	0.004
	2.0	45.4	0.000
	3.0	45.3	0.004
	4.0	45.3	0.000
	5.0	45.2	0.004
	6.0	45.2	0.000
	7.0	45.1	0.004
	8.0	45.1	0.000
	9.0	45.0	0.004
	15.0	45.0	0.000
	65.0	43.4	0.001
	127.0	37.9	0.004
	1045.0	19.0	0.001
			-0.004
		#DIV/0!	
		#DIV/0!	
		#DIV/0!	
		#DIV/0!	
		#DIV/0!	
		#DIV/0!	



STEP 3 : DETERMINE PERMEABILITY

FACTOR

Mean Outflow (Q)
Standard deviation in Q

Results

1.90
1.85

Unit

ml/min
ml/min

Saturated Hydraulic Conductivity (K_{sat})

2.74
1.14

+/-

2.59

cm/day
mm/hr

0.027

m/d

Falling Head Soil Permeameter Field Data Analysis

Method based on AS 1547 (1994)
Method SI-15 Revised 20.3.2007



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PROJECT DETAILS

Project	WEST CULBURRA	
Author	MLK	Reviewed AN

Ref. No.	P1203365JS010-V1-BH306
Date Created	18.06.2014

STEP 1 : ENTER TEST SITE DATA

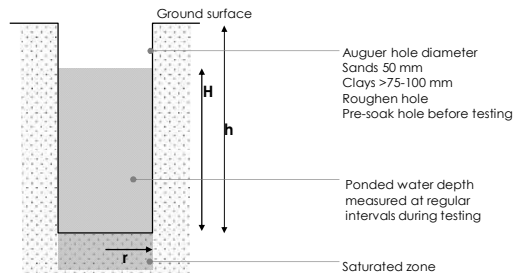
FACTOR

h - Hole depth
r - Radius

Enter Data

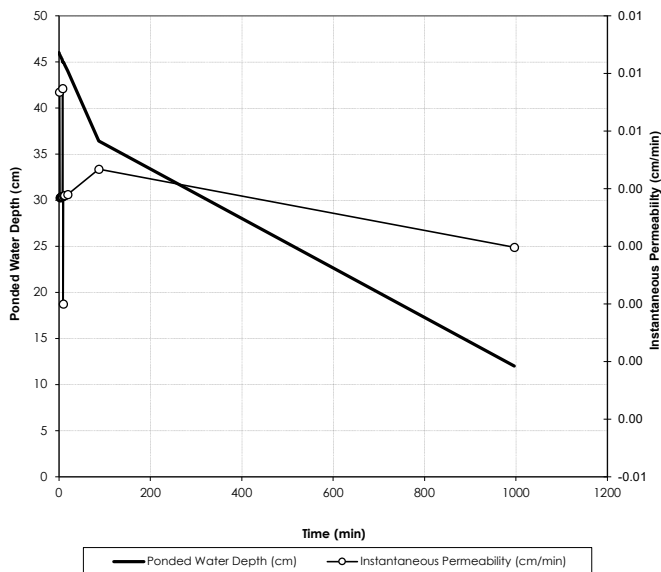
100.0
3.5

Unit
cm
cm



STEP 2 : ENTER TEST DATA

	Time (min)	H, Ponded Depth (cm)	Permeability (cm/min)
	0.0	46.0	
7.345236387	1.0	45.8	0.007
3.684211887	2.0	45.7	0.004
	3.0	45.6	0.004
	4.0	45.5	0.004
	5.0	45.4	0.004
	6.0	45.3	0.004
	7.0	45.2	0.004
	8.0	45.0	0.007
	9.0	45.0	0.000
	10.0	44.9	0.004
	11.0	44.8	0.004
	12.0	44.7	0.004
	19.0	44.0	0.004
	87.0	36.4	0.005
	996.0	12.0	0.002
			-0.004
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!



STEP 3 : DETERMINE PERMEABILITY

FACTOR

Mean Outflow (Q)
Standard deviation in Q

Results

3.95
1.93

Unit

ml/min
ml/min

Saturated Hydraulic Conductivity (K_{sat})

5.64
2.35

+/-

2.57

cm/day
mm/hr

0.056

m/d

Falling Head Soil Permeameter Field Data Analysis

Method based on AS 1547 (1994)
Method SI-15 Revised 20.3.2007



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PROJECT DETAILS

Project	WEST CULBURRA		Ref. No.	P1203365JS010-V1-BH307	
Author	MLK	Reviewed	AN	Date Created	18.06.2014

STEP 1 : ENTER TEST SITE DATA

FACTOR

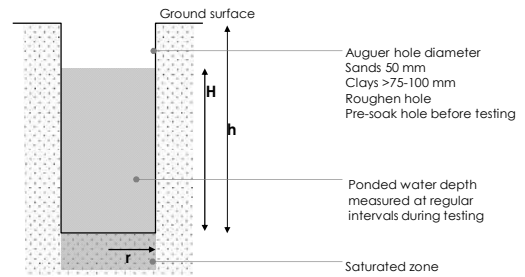
h - Hole depth
r - Radius

Enter Data

100.0
3.5

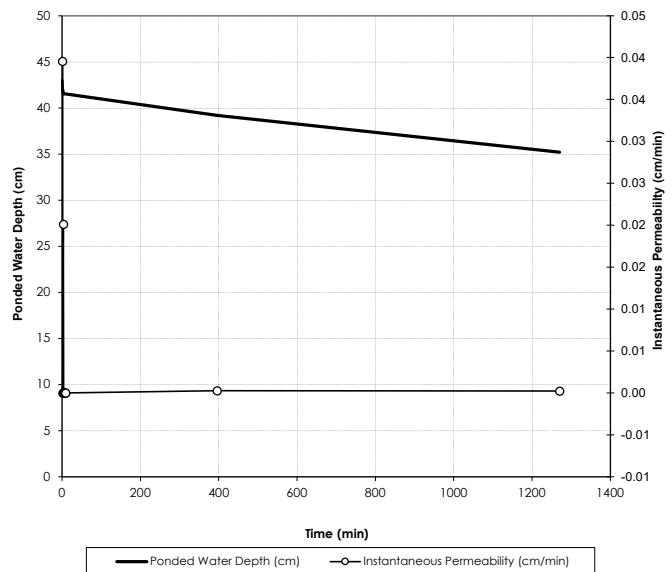
Unit

cm
cm



STEP 2 : ENTER TEST DATA

	Time (min)	H, Pondered Depth (cm)	Permeability (cm/min)
39.54970586 0	0.0	43.0	
	1.0	42.0	0.040
	2.0	42.0	0.000
	3.0	41.5	0.020
	4.0	41.5	0.000
	5.0	41.5	0.000
	6.0	41.5	0.000
	7.0	41.5	0.000
	8.0	41.5	0.000
	9.0	41.5	0.000
	396.0	39.2	0.000
	1270.0	35.2	0.000
			-0.004
		#DIV/0!	
		#DIV/0!	
		#DIV/0!	
		#DIV/0!	
		#DIV/0!	
		#DIV/0!	
		#DIV/0!	
		#DIV/0!	



STEP 3 : DETERMINE PERMEABILITY

FACTOR

Mean Outflow (Q)
Standard deviation in Q

Results

5.28
12.43

Unit

ml/min
ml/min

Saturated Hydraulic Conductivity (K_{sat})

7.87
3.28

+/-

18.44

cm/day
mm/hr

0.079

m/d

Falling Head Soil Permeameter Field Data Analysis

Method based on AS 1547 (1994)
Method SI-15 Revised 20.3.2007



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PROJECT DETAILS

Project	WEST CULBURRA		Ref. No.	P1203365JS010-V1-BH309	
Author	MLK	Reviewed	AN	Date Created	18.06.2014

STEP 1 : ENTER TEST SITE DATA

FACTOR

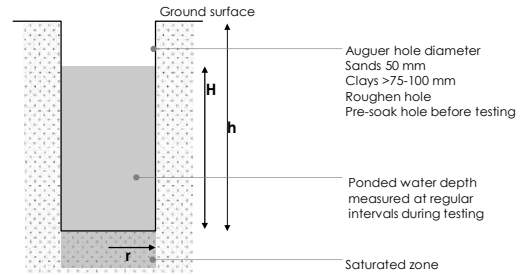
h - Hole depth
r - Radius

Enter Data

100.0
3.5

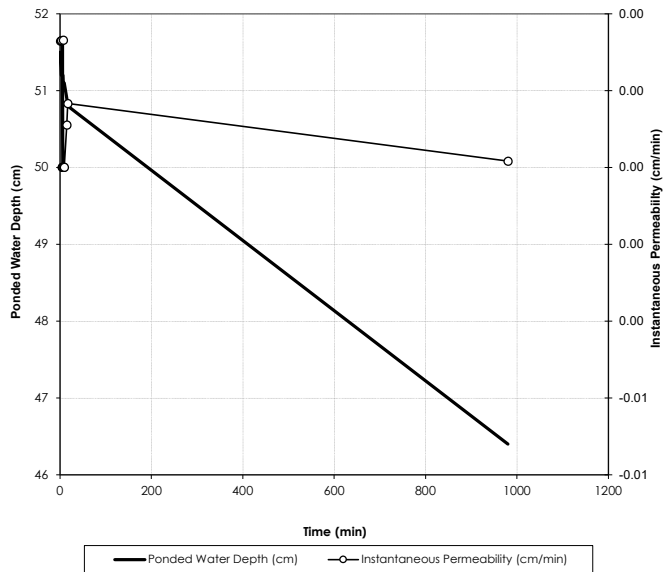
Unit

cm
cm



STEP 2 : ENTER TEST DATA

	Time (min)	H, Ponded Depth (cm)	Permeability (cm/min)
	0.0	51.5	
3.289474653	1.0	51.4	0.003
3.295669524	2.0	51.3	0.003
	3.0	51.2	0.003
	4.0	51.2	0.000
	5.0	51.2	0.000
	6.0	51.2	0.000
	7.0	51.1	0.003
	8.0	51.1	0.000
	9.0	51.1	0.000
	15.0	50.9	0.001
	17.0	50.8	0.002
	980.0	46.4	0.000
			-0.006
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!



STEP 3 : DETERMINE PERMEABILITY

FACTOR

Mean Outflow (Q)
Standard deviation in Q

Results

1.56
1.79

Unit

ml/min
ml/min

Saturated Hydraulic Conductivity (K_{sat})

1.93
0.81

+/-

2.21

cm/day
mm/hr

0.019

m/d

Constant Head Permeameter Field Data Analysis

Method based on Talsma & Holam (1980), AS1547:2012
Method SF-7 Revised 16.03.2017



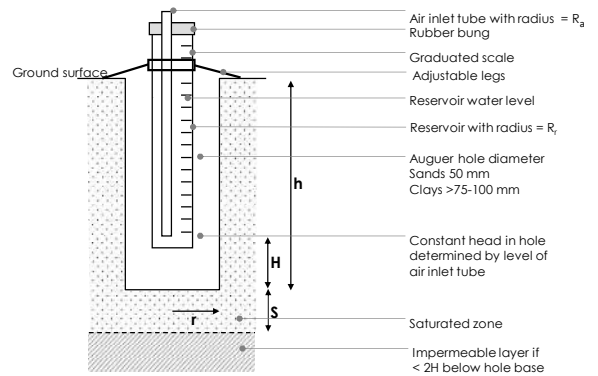
Suite 201, 20 George Street, Hornsby, NSW 2077, Ph: (02) 9476 9999 Fax: (02) 9476 8767, mail@martens.com.au, www.martens.com.au

PROJECT DETAILS

Project	P1203365 - West Culburra		Ref. No.	BH501	
Author	RJK/EZ	Reviewed	DM	Date Created	03.02.2020

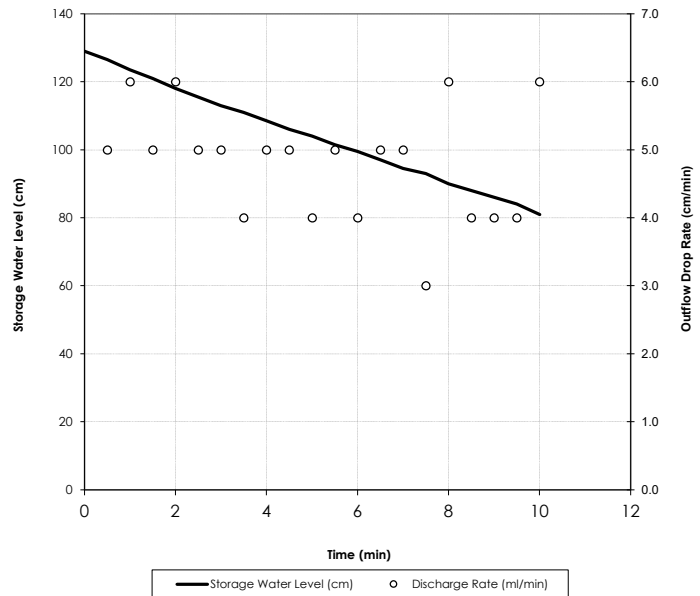
STEP 1 : ENTER BOREHOLE DATA

FACTOR	Enter Data	Unit
h - Hole depth	45.0	cm
H - Ponded depth	18.0	cm
r - Auger hole radius	4.5	cm
R_r - Reservoir radius	1.6	cm
R_a - Air inlet tube radius	0.5	cm
S - Depth to impermeable layer	355.0	cm
c - Permeameter constant	7.33	cm ³ /cm



STEP 2 : ENTER TEST DATA

Time (min)	Storage Level (cm)	Rate (cm/min)
0.0	129.0	
0.5	126.5	5.0
1.0	123.5	6.0
1.5	121.0	5.0
2.0	118.0	6.0
2.5	115.5	5.0
3.0	113.0	5.0
3.5	111.0	4.0
4.0	108.5	5.0
4.5	106.0	5.0
5.0	104.0	4.0
5.5	101.5	5.0
6.0	99.5	4.0
6.5	97.0	5.0
7.0	94.5	5.0
7.5	93.0	3.0
8.0	90.0	6.0
8.5	88.0	4.0
9.0	86.0	4.0
9.5	84.0	4.0
10.0	81.0	6.0



STEP 3: DETERMINE PERMEABILITY

FACTOR	Results	Unit
Mean Outflow (Q)	35.20	ml/min
Standard deviation in Q	6.11	ml/min
K_{sat} - no impermeable layer	45.23	cm/day
K_{sat} - with impermeable layer	4.88	cm/day
	+/- 7.85	cm/day
	+/- 4.73	cm/day

<-- Use This Value

Constant Head Permeameter Field Data Analysis

Method based on Talsma & Holam (1980), AS1547:2012
Method SF-7 Revised 16.03.2017



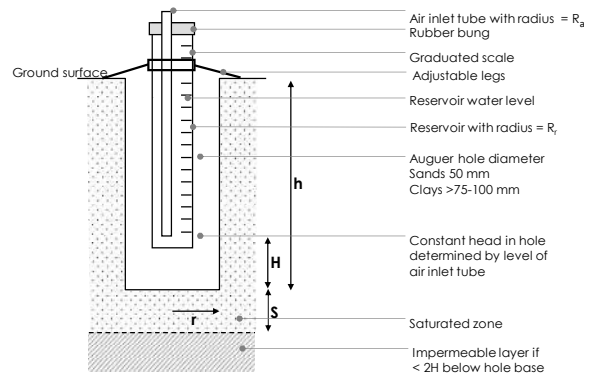
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PROJECT DETAILS

Project	P1203365 - West Culburra		Ref. No.	BH502B	
Author	RJK/EZ	Reviewed	DM	Date Created	03.02.2020

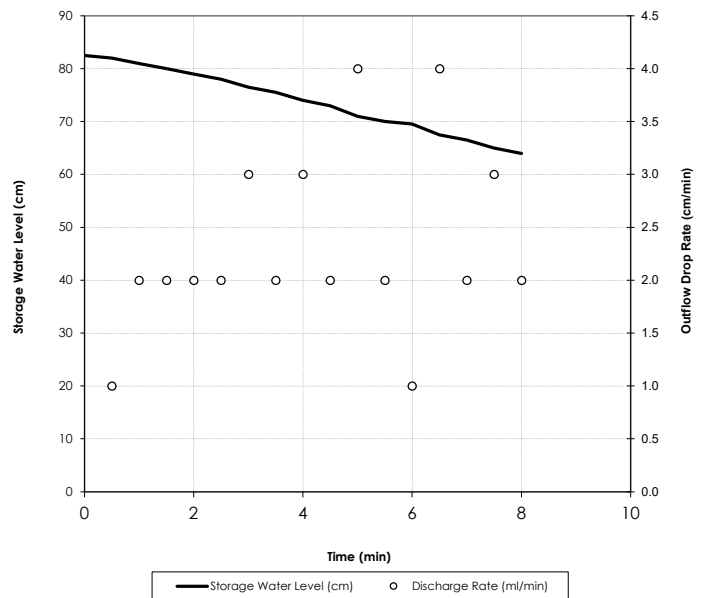
STEP 1 : ENTER BOREHOLE DATA

FACTOR	Enter Data	Unit
h - Hole depth	54.0	cm
H - Ponded depth	27.0	cm
r - Auger hole radius	4.5	cm
R_r - Reservoir radius	1.6	cm
R_a - Air inlet tube radius	0.5	cm
S - Depth to impermeable layer	146.0	cm
c - Permeameter constant	7.33	cm ³ /cm



STEP 2 : ENTER TEST DATA

Time (min)	Storage Level (cm)	Rate (cm/min)
0.0	82.5	
0.5	82.0	1.0
1.0	81.0	2.0
1.5	80.0	2.0
2.0	79.0	2.0
2.5	78.0	2.0
3.0	76.5	3.0
3.5	75.5	2.0
4.0	74.0	3.0
4.5	73.0	2.0
5.0	71.0	4.0
5.5	70.0	2.0
6.0	69.5	1.0
6.5	67.5	4.0
7.0	66.5	2.0
7.5	65.0	3.0
8.0	64.0	2.0



STEP 3: DETERMINE PERMEABILITY

FACTOR	Results	Unit
Mean Outflow (Q)	16.96	ml/min
Standard deviation in Q	6.40	ml/min
K_{sat} - no impermeable layer	12.88	cm/day
K_{sat} - with impermeable layer	4.15	cm/day
	+/- 4.86	cm/day
	+/- 3.00	cm/day

<-- Use This Value

Constant Head Permeameter Field Data Analysis

Method based on Talsma & Holam (1980), AS1547:2012
Method SF-7 Revised 16.03.2017



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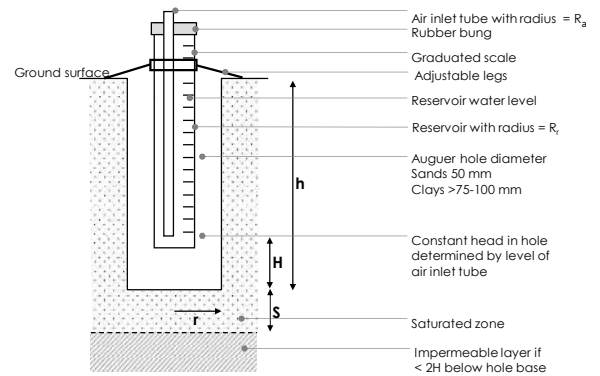
PROJECT DETAILS

Project	P1203365 - West Culburra		
Author	RJK/EZ	Reviewed	DM

Ref. No.	BH503B
Date Created	03.02.2020

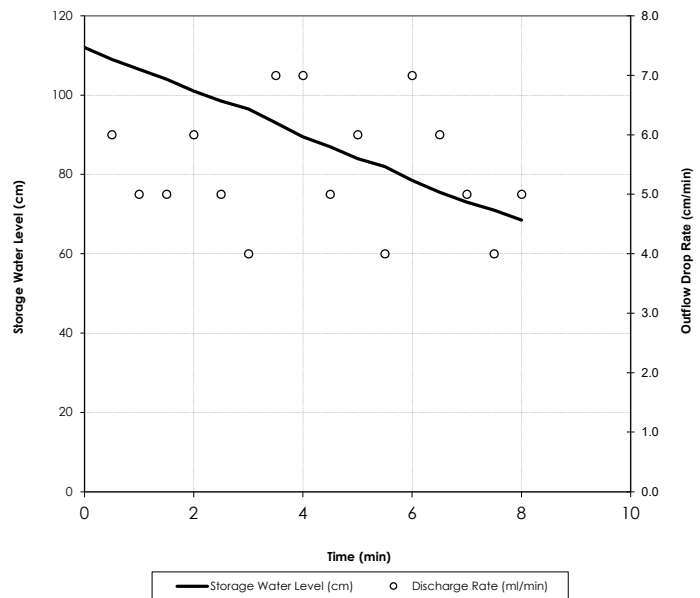
STEP 1 : ENTER BOREHOLE DATA

FACTOR	Enter Data	Unit
h - Hole depth	45.0	cm
H - Ponded depth	8.0	cm
r - Auger hole radius	4.5	cm
R_r - Reservoir radius	1.6	cm
R_a - Air inlet tube radius	0.5	cm
S - Depth to impermeable layer	255.0	cm
c - Permeameter constant	7.33	cm ³ /cm



STEP 2 : ENTER TEST DATA

Time (min)	Storage Level (cm)	Rate (cm/min)
0.0	112.0	
0.5	109.0	6.0
1.0	106.5	5.0
1.5	104.0	5.0
2.0	101.0	6.0
2.5	98.5	5.0
3.0	96.5	4.0
3.5	93.0	7.0
4.0	89.5	7.0
4.5	87.0	5.0
5.0	84.0	6.0
5.5	82.0	4.0
6.0	78.5	7.0
6.5	75.5	6.0
7.0	73.0	5.0
7.5	71.0	4.0
8.0	68.5	5.0



STEP 3: DETERMINE PERMEABILITY

FACTOR	Results	Unit
Mean Outflow (Q)	39.88	ml/min
Standard deviation in Q	7.56	ml/min
K_{sat} - no impermeable layer	132.07	cm/day
K_{sat} - with impermeable layer	7.39	cm/day
	+/- 25.04	cm/day
	+/- 9.19	cm/day

<-- Use This Value

Constant Head Permeameter Field Data Analysis

Method based on Talsma & Holam (1980), AS1547:2012
Method SF-7 Revised 16.03.2017



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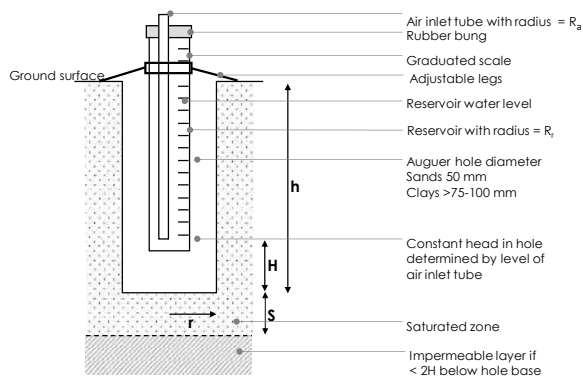
PROJECT DETAILS

Project	P1203365 - West Culburra		
Author	RJK/EZ	Reviewed	DM

Ref. No.	BH504
Date Created	03.02.2020

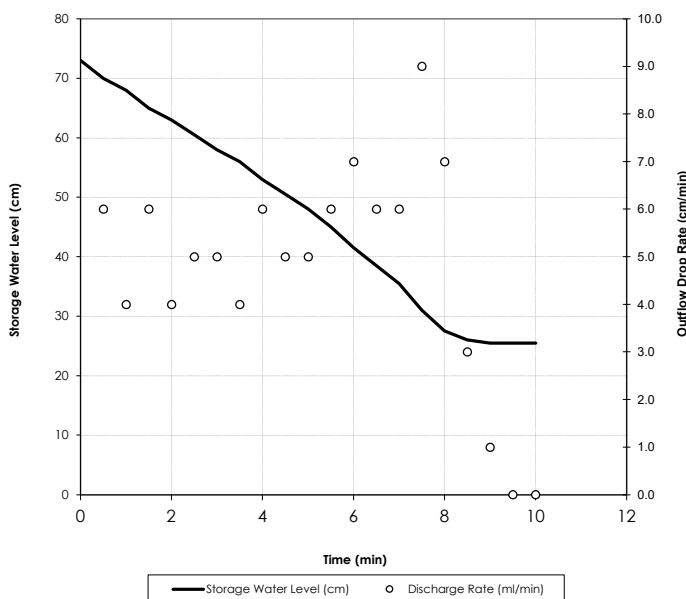
STEP 1 : ENTER BOREHOLE DATA

FACTOR	Enter Data	Unit
h - Hole depth	50.0	cm
H - Ponded depth	17.0	cm
r - Auger hole radius	4.5	cm
R_r - Reservoir radius	1.6	cm
R_a - Air inlet tube radius	0.5	cm
S - Depth to impermeable layer	450.0	cm
c - Permeameter constant	7.33	cm ³ /cm



STEP 2 : ENTER TEST DATA

Time (min)	Storage Level (cm)	Rate (cm/min)
0.0	73.0	
0.5	70.0	6.0
1.0	68.0	4.0
1.5	65.0	6.0
2.0	63.0	4.0
2.5	60.5	5.0
3.0	58.0	5.0
3.5	56.0	4.0
4.0	53.0	6.0
4.5	50.5	5.0
5.0	48.0	5.0
5.5	45.0	6.0
6.0	41.5	7.0
6.5	38.5	6.0
7.0	35.5	6.0
7.5	31.0	9.0
8.0	27.5	7.0
8.5	26.0	3.0
9.0	25.5	1.0
9.5	25.5	0.0
10.0	25.5	0.0



STEP 3: DETERMINE PERMEABILITY

FACTOR	Results	Unit
Mean Outflow (Q)	34.83	ml/min
Standard deviation in Q	12.78	ml/min
K_{sat} - no impermeable layer	48.06	cm/day
K_{sat} - with impermeable layer	3.94	cm/day
	+/- 17.63	cm/day
	+/- 10.53	cm/day

<-- Use This Value

Constant Head Permeameter Field Data Analysis

Method based on Talsma & Holam (1980), AS1547:2012
 Method SF-7 Revised 16.03.2017



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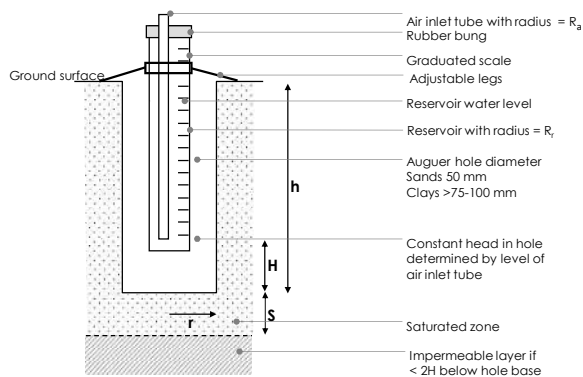
PROJECT DETAILS

Project	P1203365 - West Culburra		
Author	RJK/EZ	Reviewed	DM

Ref. No.	BH505
Date Created	03.02.2020

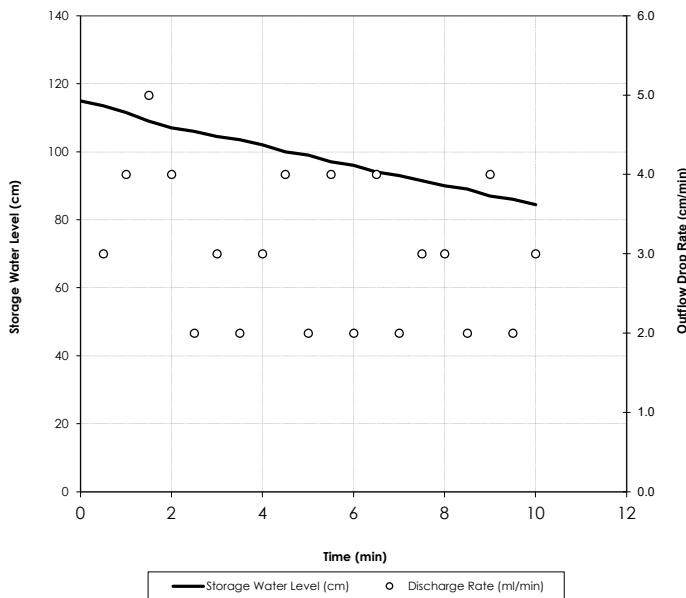
STEP 1 : ENTER BOREHOLE DATA

FACTOR	Enter Data	Unit
h - Hole depth	60.0	cm
H - Ponded depth	27.0	cm
r - Auger hole radius	4.5	cm
R _r - Reservoir radius	1.6	cm
R _a - Air inlet tube radius	0.5	cm
S - Depth to impermeable layer	440.0	cm
c - Permeameter constant	7.33	cm ³ /cm



STEP 2 : ENTER TEST DATA

Time (min)	Storage Level (cm)	Rate (cm/min)
0.0	115.0	
0.5	113.5	3.0
1.0	111.5	4.0
1.5	109.0	5.0
2.0	107.0	4.0
2.5	106.0	2.0
3.0	104.5	3.0
3.5	103.5	2.0
4.0	102.0	3.0
4.5	100.0	4.0
5.0	99.0	2.0
5.5	97.0	4.0
6.0	96.0	2.0
6.5	94.0	4.0
7.0	93.0	2.0
7.5	91.5	3.0
8.0	90.0	3.0
8.5	89.0	2.0
9.0	87.0	4.0
9.5	86.0	2.0
10.0	84.5	3.0



STEP 3: DETERMINE PERMEABILITY

FACTOR	Results	Unit
Mean Outflow (Q)	22.37	ml/min
Standard deviation in Q	6.93	ml/min
K _{sat} - no impermeable layer	16.98	cm/day
K _{sat} - with impermeable layer	2.12	cm/day

+/- **5.26** cm/day <-- Use This Value
 +/- **3.25** cm/day

20 Annexure J: Aquifer Interference Assessment

Table 61: Aquifer interference assessment.

Minimal Impact Consideration	Assessment ¹
Water Table	
<p>1. Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40m from any:</p> <p>a) high priority groundwater dependent ecosystem; or</p> <p>b) high priority culturally significant site;</p> <p>listed in the schedule of the relevant water sharing plan; or</p> <p>A maximum of a 2m decline cumulatively at any water supply work.</p>	<p>Complies –there are no GDEs on, or downstream of the proposed development and no groundwater supply works within the areas of drawdown as discussed in section 5.6.3.</p>
<p>2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40m from any:</p> <p>a) high priority groundwater dependent ecosystem; or</p> <p>b) high priority culturally significant site;</p> <p>listed in the schedule of the relevant water sharing plan then appropriate studies (including the hydrogeology, ecological condition and cultural function) will need to demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site.</p> <p>If more than 2m decline cumulatively at any water supply work then make good provisions should apply.</p>	<p>Condition 1 is met.</p>
Water Pressure	
<p>1. A cumulative pressure head decline of not more than a 2m decline, at any water supply work.</p>	<p>Complies – no groundwater supply works within the areas of drawdown as discussed in section 5.6.3.</p>
<p>2. If the predicted pressure head decline is greater than requirement 1. above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.</p>	<p>Condition 1 is met.</p>
Water Quality	
<p>1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity.</p>	<p>Complies – groundwater quality will not be materially impacted by the proposed development as discussed in section 5.6.5.</p>
<p>2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.</p>	<p>Condition 1 is met.</p>

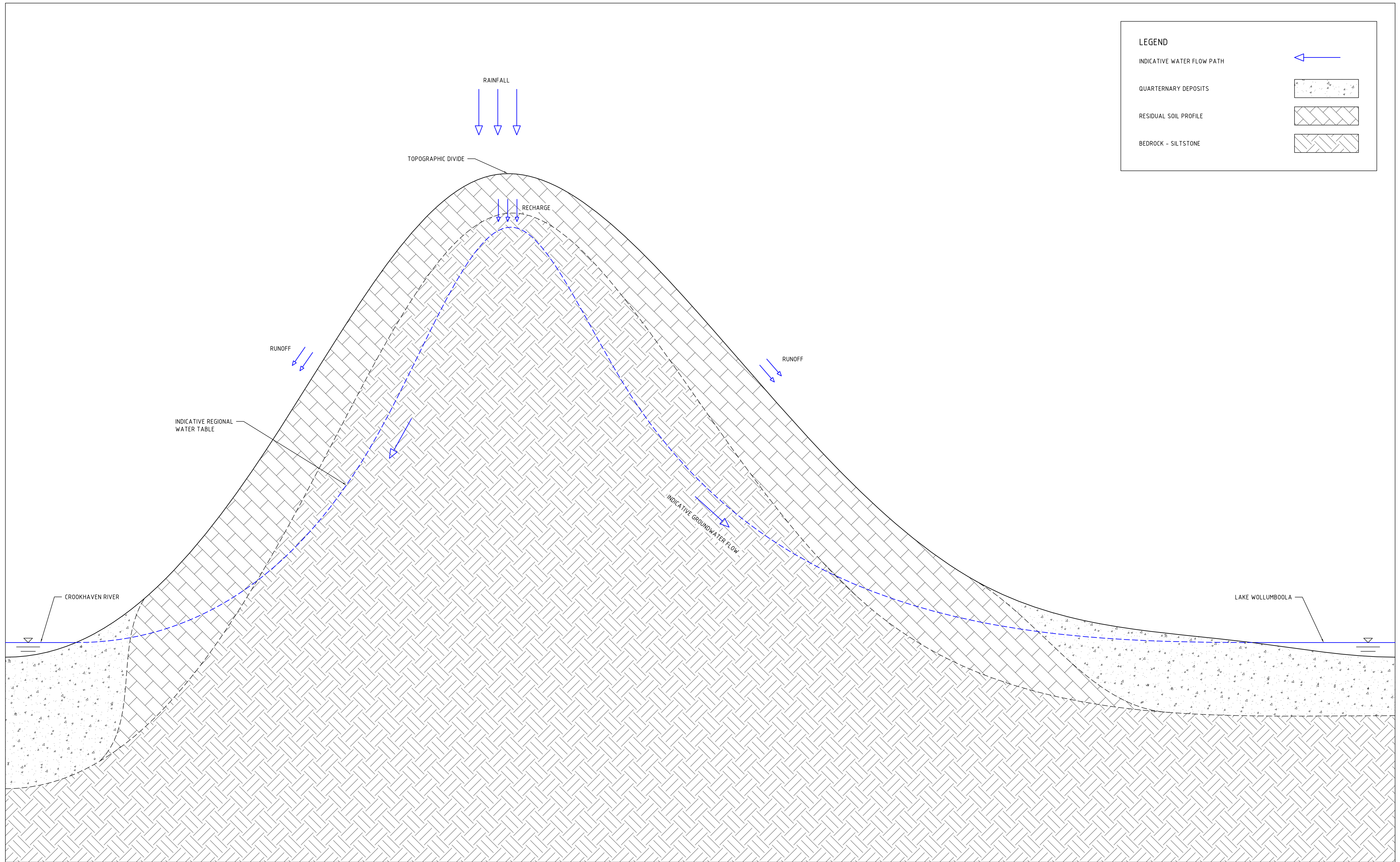
¹ For less productive porous and fractured rock water sources.

21 Annexure K: All Groundwater Quality Results

		pH	Electrical Conductivity	Total Dissolved Solids(grav)	NOx as N in water	Ammonia as N in water	Total Nitrogen in water	Phosphate as P in water	Nitrate as N in water	Nitrite as N in water	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hardness	Hydroxide Alkalinity (OH-) as CaCO3	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Ionic Balance	Phosphorus - Total	Aluminium-Dissolved	
		pH Units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mgCaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	%	mg/L	µg/L
PQL		N/A	1	5	0.005	0.005	0.1	0.005	0.005	0.005	0.5	0.5	0.5	0.5	3	5	5	5	5	1	1		0.05	10	
Sample	Date Sampled																								
BH01	19/09/2019	4.6	1000	580	0.3	0.056	0.9	<0.005	0.29	<0.005	3	<0.5	180	13	61	<5	<5	<5	<5	23	300	0	0.07	430	
BH01	23/10/2019	5.4	1300	800	0.006	0.048	0.3	<0.005	<0.005		2.9	0.7	240	12	56	<5	7	<5	7	29	330	7	0.1	80	
BH01	28/11/2019	5.4	2600	1600	0.01	0.15	0.4	0.014	0.01		5.4	2.3	700	37	160	<5	17	<5	17	210	750	13	0.1	230	
BH01	09/01/2020	5.1	3400	2100	0.007	0.18	1.7	0.008	0.006		6	2.6	590	40	180	<5	16	<5	16	270	950	-5	0.08	40	
BH01	19/02/2020	4.6	1200	670	0.7	0.028	1	0.009	0.7		4.7	0.7	210	17	82	<5	<5	<5	<5	60	350	-1	0.1	550	
BH01	20/03/2020	5	1300	930	0.2	0.034	0.6	<0.005	0.16		2.6	0.6	280	13	60	<5	<5	<5	<5	58	420	1	0.07	190	
BH02	19/09/2019	4.8	170	170	0.4	0.011	0.9	<0.005	0.39	<0.005	<0.5	<0.5	22	1.4	6	<5	<5	<5	<5	9	36	-5	0.05	80	
BH02	23/10/2019	5.9	190	220	0.08	0.007	0.2	<0.005	0.076		3.8	<0.5	37	1.3	15	<5	16	<5	16	14	34	10	0.08	20	
BH02	28/11/2019	4.8	190	270	0.1	0.024	0.3	<0.005	0.12		<0.5	<0.5	37	0.8	3.3	<5	29	<5	29	17	38	-9	0.2	30	
BH02	09/01/2020	4.9	210	280	0.08	0.084	6.7	<0.005	0.082		<0.5	<0.5	27	0.6	<3	<5	<5	<5	<5	19	44	-14	0.7	20	
BH02	19/02/2020	5	200	150	0.2	0.015	0.4	0.006	0.21		<0.5	0.7	33	1.8	7.3	<5	<5	<5	<5	18	43	0	<0.05	2300	
BH02	20/03/2020	5	190	210	0.3	0.064	0.6	<0.005	0.29		<0.5	<0.5	35	1.1	4.6	<5	<5	<5	<5	16	50	-3	0.2	20	
BH06	19/09/2019	6	18000	11000	<0.005	0.006	0.3	<0.005	<0.005	<0.005	130	5.3	2800	600	2800	<5	48	<5	48	730	6200	-3	<0.05	90	
BH06	23/10/2019	6.1	18000	11000	0.01	0.039	<0.1	0.006	0.007		140	6.6	2900	710	3300	<5	53	<5	53	710	6000	3	<0.05	70	
BH06	28/11/2019	6	17000	9400	0.01	0.043	<0.1	<0.005	0.01		150	6.6	3300	700	3300	<5	58	<5	58	730	5800	7	<0.05	60	
BH06	09/01/2020	5.8	17000	14000	0.02	0.067	1.9	0.009	0.02		140	7.2	2700	680	3100	<5	62	<5	62	790	6300	-4	0.2	<10	
BH06	19/02/2020	6.1	16000	12000	0.01	0.067	0.3	0.008	0.01		130	7	2800	610	2800	<5	53	<5	53	750	5700	0	0.2	550	
BH06	20/03/2020	6	16000	12000	0.007	0.051	0.2	<0.005	0.006		140	6.3	3000	680	3100	<5	59	<5	59	770	6000	3	<0.05	30	
BH403B	19/09/2019	6.6	2400	1400	<0.005	0.009	0.2	0.05	<0.005	<0.005	19	2.4	440	27	160	<5	200	<5	200	140	520	1	0.09	<10	
MB403B	23/10/2019	6.8	2300	1300	<0.005	0.027	<0.1	0.027	<0.005		21	2.6	460	31	180	<5	200	<5	200	130	490	8	0.2	<10	
MB403B	28/11/2019	6.6	2300	1300	0.02	0.038	0.1	0.04	0.01		22	2.8	530	32	190	<5	200	<5	200	160	590	6	0.4	<10	
MB403B	09/01/2020	6.4	2400	1400	<0.005	0.041	5.8	0.019	<0.005		20	2.5	400	30	170	<5	200	<5	200	150	560	-4	1.1	20	
MB404	23/10/2019	7.2	1900	1200	<0.005	0.36	0.4	<0.005	<0.005		49	4.7	330	33	260	<5	330	<5	330	140	300	4	0.1	<10	
MB404	28/11/2019	7.2	2100	1400	0.1	0.51	0.7	0.058	0.11		81	5.6	450	47	400	<5	480	<5	480	210	340	8	0.06	<10	
MB404	09/01/2020	6.9	2200	1500	<0.005	0.58	0.9	0.081	<0.005		79	5.3	370	48	390	<5	540	<5	540	240	370	-4	0.4	<10	
MB404	19/02/2020	7.3	2200	1200	<0.005	0.51	0.6	0.13	<0.005		68	5.7	410	43	350	<5	530	<5	530	230	310	1	0.4	<10	
MB404	20/03/2020	7.3	2100	1400	<0.005	0.52	0.8	0.066	<0.005		68	4.8	410	44	350	<5	520	<5	520	230	330	1	0.2	<10	
MB407A	20/03/2020	6.7	330	260	0.02	0.046	2	<0.005	0.02		7.5	2	53	5.2	40	<5	65	<5	65	27	51	-2	0.07	300	
MB408A	20/03/2020	6.3	3200	1900	0.01	0.18	0.9	0.12	0.01		42	4.6	560	80	430	<5	110	<5	110	120	1000	-1	0.4	<10	

		Arsenic-Dissolved	Boron-Dissolved	Barium-Dissolved	Beryllium-Dissolved	Cadmium-Dissolved	Cobalt-Dissolved	Chromium-Dissolved	Copper-Dissolved	Iron-Dissolved	Mercury-Dissolved	Manganese-Dissolved	Molybdenum-Dissolved	Nickel-Dissolved	Lead-Dissolved	Selenium-Dissolved	Strontium-Dissolved	Titanium-Dissolved	Vanadium-Dissolved	Zinc-Dissolved	Silicon* - Dissolved	Faecal Coliforms	E. coli
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	cfu/100mL	cfu/100mL
PQL		1	20	1	0.5	0.1	1	1	1	10	0.05	5	1	1	1	1	1	1	1	1	0.2	1	1
Sample	Date Sampled																						
BH01	19/09/2019	<1	90	120	<0.5	<0.1	2	<1	4	78	<0.05	14	<1	1	<1	<1	77	<1	<1	80	10		
BH01	23/10/2019	<1	100	67	<0.5	<0.1	4	<1	4	13	<0.05	52	<1	3	<1	<1	50	<1	<1	61	17	<10	
BH01	28/11/2019	<1	200	100	<0.5	<0.1	23	<1	5	1500	<0.05	470	<1	20	<1	<1	150	<1	2	81	26	<10	<10
BH01	09/01/2020	<1	210	59	<0.5	0.2	33	<1	5	<10	<0.05	630	<1	31	<1	<1	170	<1	1	130	28	<20	<20
BH01	19/02/2020	<1	100	120	0.7	<0.1	4	6	10	150	<0.05	36	<1	3	<1	<1	94	7.4	<1	260	6.7	<20	<20
BH01	20/03/2020	<1	100	76	<0.5	<0.1	6	2	6	64	<0.05	55	<1	6	<1	<1	65	<1	<1	120	17	<20	<20
BH02	19/09/2019	<1	50	26	<0.5	<0.1	<1	<1	2	160	<0.05	<5	<1	<1	<1	<1	4.9	4.2	<1	28	10		
BH02	23/10/2019	<1	70	12	<0.5	<0.1	<1	<1	2	13	<0.05	26	<1	<1	<1	<1	19	1.7	<1	12	27	<10	
BH02	28/11/2019	<1	80	9	<0.5	<0.1	<1	<1	<1	12	<0.05	<5	<1	<1	<1	<1	2.4	1.1	3	9	29	<20 MPN/100mL	<20 MPN/100mL
BH02	09/01/2020	<1	80	6	<0.5	<0.1	<1	<1	1	18	<0.05	<5	<1	<1	<1	<1	1.6	<1	<1	10	28	<20	<20
BH02	19/02/2020	2	70	43	<0.5	<0.1	<1	13	8	1300	<0.05	<5	<1	<1	2	<1	9.8	100	3	48	17	5400	5400
BH02	20/03/2020	<1	60	13	<0.5	<0.1	<1	<1	2	36	<0.05	<5	<1	<1	<1	<1	4.8	<1	<1	22	26	1700	1700
BH06	19/09/2019	<1	80	28	1	0.4	63	<1	3	<10	<0.05	1200	<1	66	<1	<1	1500	<1	<1	270	17		
BH06	23/10/2019	<1	90	29	1	0.7	77	<1	4	<10	<0.05	1300	<1	67	<1	<1	1500	<1	<1	290	18	<100	
BH06	28/11/2019	<1	100	27	2	0.5	110	<1	3	<10	<0.05	1700	<1	72	<1	<1	1600	<1	1	230	18	<1	<1
BH06	09/01/2020	<1	90	33	0.7	0.4	110	<1	4	<10	<0.05	1800	<1	76	<1	<1	1500	<1	<1	230	19	<20	<20
BH06	19/02/2020	<1	90	35	1	0.5	95	<1	4	550	<0.05	1600	<1	71	<1	<1	1500	32	<1	270	19	20	20
BH06	20/03/2020	<1	70	24	1	0.4	100	<1	1	450	<0.05	1900	<1	70	<1	<1	1600	<1	<1	160	19	<20	<20
BH403B	19/09/2019	<1	200	24	<0.5	<0.1	15	17	<1	130	<0.05	950	<1	10	<1	<1	180	<1	<1	23	20		
MB403B	23/10/2019	<1	200	23	<0.5	<0.1	13	<1	<1	21	<0.05	970	<1	11	<1	<1	180	2.1	2	18	20	<10	
MB403B	28/11/2019	<1	200	50	<0.5	<0.1	14	<1	<1	31	<0.05	1100	<1	9	<1	<1	180	1.6	2	27	21	<20 MPN/100mL	<20 MPN/100mL
MB403B	09/01/2020	<1	200	21	<0.5	0.1	7	<1	<1	59	<0.05	840	<1	5	<1	<1	180	2.5	3	3	20	<20	<20
MB404	23/10/2019	<1	200	21	<0.5	<0.1	2	<1	<1	14	<0.05	320	<1	5	<1	<1	2000	<1	1	8	16	<1	
MB404	28/11/2019	<1	200	30	<0.5	<0.1	2	<1	1	<10	<0.05	240	<1	4	<1	<1	2800	<1	2	18	15	<10	<10
MB404	09/01/2020	<1	200	23	<0.5	<0.1	<1	<1	<1	<10	<0.05	140	<1	<1	<1	<1	2700	<1	<1	3	13	<20	<20
MB404	19/02/2020	<1	200	21	<0.5	<0.1	<1	<1	<1	10	<0.05	120	<1	<1	<1	<1	2300	<1	<1	14	15	<20	<20
MB404	20/03/2020	<1	200	19	<0.5	<0.1	<1	<1	<1	11	<0.05	150	<1	1	<1	<1	2400	<1	<1	12	14	<100 CFU/100mL	<100 CFU/100mL
MB407A	20/03/2020	<1	30	13	<0.5	<0.1	1	<1	8	630	<0.05	120	<1	6	<1	<1	73	3.2	2	73	5.8	110	110
MB408A	20/03/2020	<1	100	42	0.6	<0.1	7	<1	<1	9100	<0.05	1600	<1	21	<1	<1	240	<1	<1	16	29	<100 CFU/100mL	<100 CFU/100mL

22 Annexure L: Hydrogeological Conceptual Section



SECTION 34

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE
A	INITIAL RELEASE	13/03/2020	JCF	JCF	DM	DM	

GRID	DATUM	PROJECT MANAGER	CLIENT
N/A	mAHD	AN	SEALARK PTY LTD

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PROJECT NAME/PLANSET TITLE
WEST CULBURRA MIXED USE SUBDIVISION
 HYDROLOGICAL CONCEPTUAL MODEL
 453 CULBURRA ROAD, CULBURRA BEACH
 PART LOT 5 & 6 DP 1065111

martens
 & Associates Pty Ltd
 Consulting Engineers
 Environment
 Water
 Geotechnical
 Civil
 Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8787
 Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE				
CONCEPTUAL HYDROGEOLOGICAL SECTION				
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1203365	PS07	R01	PS07-JZ01	A

PRINTED: 13/03/2020 USER: PRECISE

23 Annexure M: Surface Water Sampling Data

CERTIFICATE OF ANALYSIS

Work Order : EW1804961 Client : WOLLONGONG CASH CLIENTS Contact : James Harris Address : Telephone : ---- Project : P1203365- Stormwater Engineering: Mixed Use Subdivision West Culburra Order number : P1203365 C-O-C number : ---- Sampler : ---- Site : ---- Quote number : ---- No. of samples received : 7 No. of samples analysed : 5	Page : 1 of 3 Laboratory : Environmental Division NSW South Coast Contact : Glenn Davies Address : 1/19 Ralph Black Dr, North Wollongong 2500 4/13 Geary Pl, North Nowra 2541 Australia NSW Australia Telephone : 02 42253125 Date Samples Received : 29-Nov-2018 12:25 Date Analysis Commenced : 29-Nov-2018 Issue Date : 19-Dec-2018 10:30
---	--



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

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- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong, NSW



General Comments

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

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

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

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

When 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.

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

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

- EK061G: Poor spike recovery for TKN on sample 2 due to matrix interferences.
- pH data supplied by ALS Wollongong.
- pH tests completed on day of receipt.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID				
				A	B	C	D	G
Client sampling date / time				29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00
Compound	CAS Number	LOR	Unit	EW1804961-001	EW1804961-002	EW1804961-003	EW1804961-004	EW1804961-007
				Result	Result	Result	Result	Result
EA005FD: Field pH								
pH	----	0.1	pH Unit	2.7	2.3	2.0	4.3	4.0
EA010FD: Field Conductivity								
Conductivity @ 25oC	----	1	µS/cm	991	2150	5750	4300	2940
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	10	8	11	11	<5
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.37	0.22	0.09	0.01	0.10
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	0.98	0.44	0.44
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.98	0.44	0.44
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.7	1.1	0.6	0.6	0.9
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	1.7	1.1	1.6	1.0	1.3
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.01	0.01	0.02	0.04	0.02

CERTIFICATE OF ANALYSIS

Work Order : **EW1902455**
Client : **WOLLONGONG CASH CLIENTS**
Contact : James Harris
Address :

Telephone : ----
Project : West Culburra
Order number : ----
C-O-C number : ----
Sampler : Vic Walker
Site : ----
Quote number : ----
No. of samples received : 5
No. of samples analysed : 5

Page : 1 of 3
Laboratory : Environmental Division NSW South Coast
Contact : Glenn Davies
Address : 1/19 Ralph Black Dr, North Wollongong 2500
 4/13 Geary Pl, North Nowra 2541
 Australia NSW Australia
Telephone : 02 42253125
Date Samples Received : 06-Jun-2019 08:58
Date Analysis Commenced : 07-Jun-2019
Issue Date : 25-Jun-2019 16:33



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- General Comments
- Analytical Results

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Signatories

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<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



General Comments

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

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

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

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

When 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.

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

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

- EK057G: Poor spike recovery for Nitrite due to matrix interferences.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID				
				A	B	C	D	G
Client sampling date / time				05-Jun-2019 16:20	05-Jun-2019 16:14	05-Jun-2019 15:55	05-Jun-2019 15:45	05-Jun-2019 16:40
Compound	CAS Number	LOR	Unit	EW1902455-001	EW1902455-002	EW1902455-003	EW1902455-004	EW1902455-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	5.91	5.57	6.49	2.20	2.17
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	185	206	368	3060	3330
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	<5	<5	7	13	27
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.44	<0.01	0.84	<0.01	<0.01
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.06	<0.01	1.54	0.86	0.64
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.06	<0.01	1.54	0.86	0.64
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.6	1.0	1.6	0.8	1.3
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	1.7	1.0	3.1	1.7	1.9
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.07	0.08	0.04

CERTIFICATE OF ANALYSIS

Work Order : **EW1902698**
Client : **WOLLONGONG CASH CLIENTS**
Contact : James Harris
Address : Unit 4 13 Geary Place
 North Nowra 2541

Telephone : ----
Project : West Culburra
Order number :
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : EN/333
No. of samples received : 5
No. of samples analysed : 5

Page : 1 of 3
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500
 4/13 Geary Pl, North Nowra 2541
 Australia NSW Australia
Telephone : +61 2 4225 3125
Date Samples Received : 25-Jun-2019 15:52
Date Analysis Commenced : 26-Jun-2019
Issue Date : 02-Jul-2019 17:06



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<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



General Comments

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

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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.

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



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID				
				A	B	C	D	G
Client sampling date / time				24-Jun-2019 16:03	24-Jun-2019 15:56	24-Jun-2019 15:32	24-Jun-2019 15:24	24-Jun-2019 16:25
Compound	CAS Number	LOR	Unit	EW1902698-001	EW1902698-002	EW1902698-003	EW1902698-004	EW1902698-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	6.00	3.17	2.14	2.12	2.30
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	110	569	4330	4040	2820
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	11	17	20	18	19
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	<0.01	0.05	0.01	<0.01
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	1.71	0.72	0.30
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	1.71	0.72	0.30
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.8	1.6	1.0	0.9	1.2
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	1.8	1.6	2.7	1.6	1.5
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.03	0.04	0.07	0.07	0.03

CERTIFICATE OF ANALYSIS

Work Order : **EW2000641**

Client : **WOLLONGONG CASH CLIENTS**

Contact : James Harris

Address :

Telephone : ----

Project : N25405

Order number : ----

C-O-C number : ----

Sampler : ----

Site : ----

Quote number : EN/333

No. of samples received : 3

No. of samples analysed : 3

Page : 1 of 4

Laboratory : Environmental Division NSW South Coast

Contact : Aneta Prosaroski

Address : 1/19 Ralph Black Dr, North Wollongong 2500
4/13 Geary Pl, North Nowra 2541
Australia NSW Australia

Telephone : +61 2 4225 3125

Date Samples Received : 07-Feb-2020 16:06

Date Analysis Commenced : 07-Feb-2020

Issue Date : 17-Feb-2020 08:40



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

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Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Tony DeSouza	Senior Microbiologist	Sydney Microbiology, Smithfield, NSW



General Comments

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ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- **Analytical work for this work order will be conducted at ALS Sydney.**
- MF = membrane filtration
- CFU = colony forming unit
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- pH and conductivity data supplied by ALS Wollongong.
- Membrane filtration results for MW006 No. 3 are reported as an estimate (~) due to the presence of many non-target organism colonies that may have inhibited the growth of the target organisms on the filter membrane. It may be informative to record this fact.
- pH and conductivity tests completed on day of receipt.
- MW023 is ALS's internal code and is equivalent to AS4276.9.
- MW006 is ALS's internal code and is equivalent to AS4276.7.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		Callala Bay 3	Callala Bay 4	Culburra D	----	----	
Client sampling date / time		07-Feb-2020 12:00		07-Feb-2020 12:05		07-Feb-2020 13:20		----	----
Compound	CAS Number	LOR	Unit	EW2000641-001	EW2000641-002	EW2000641-003	-----	-----	
				Result	Result	Result	----	----	
EA005FD: Field pH									
pH	----	0.1	pH Unit	7.2	6.9	7.3	----	----	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	118	139	208	----	----	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	35	20	14	----	----	
ED093F: SAR and Hardness Calculations									
Total Hardness as CaCO3	----	1	mg/L	23	26	38	----	----	
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----	
Chromium	7440-47-3	0.001	mg/L	0.002	0.003	0.004	----	----	
Copper	7440-50-8	0.001	mg/L	0.005	0.005	0.008	----	----	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Lead	7439-92-1	0.001	mg/L	0.002	0.002	<0.001	----	----	
Zinc	7440-66-6	0.005	mg/L	0.023	0.040	0.084	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.02	0.62	----	----	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	----	----	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	0.20	0.24	0.24	----	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.20	0.24	0.24	----	----	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.4	0.3	1.3	----	----	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L	0.6	0.5	1.5	----	----	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.15	0.11	0.07	----	----	
EK071G: Reactive Phosphorus as P by discrete analyser									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	Callala Bay 3	Callala Bay 4	Culburra D	----	----
Client sampling date / time				07-Feb-2020 12:00	07-Feb-2020 12:05	07-Feb-2020 13:20	----	----	
Compound	CAS Number	LOR	Unit	EW2000641-001	EW2000641-002	EW2000641-003	-----	-----	
				Result	Result	Result	----	----	
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	0.07	0.10	0.06	----	----	
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL	24000	11000	~3800	----	----	
MW023: Enterococci by Membrane Filtration									
Enterococci	----	1	CFU/100mL	7000	7800	~12000	----	----	

CERTIFICATE OF ANALYSIS

Work Order : **EW2000648**
Client : **WOLLONGONG CASH CLIENTS**
Contact : James Harris
Address :

Telephone : ----
Project : Culburra Beach and Callala Bay
Order number : N25405
C-O-C number : ----
Sampler : James Harris, Vic
Site : ----
Quote number : EN/333
No. of samples received : 6
No. of samples analysed : 6

Page : 1 of 6
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500
 4/13 Geary Pl, North Nowra 2541
 Australia NSW Australia
Telephone : +61 2 4225 3125
Date Samples Received : 10-Feb-2020 11:06
Date Analysis Commenced : 09-Feb-2020
Issue Date : 18-Feb-2020 16:59



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Tony DeSouza	Senior Microbiologist	Sydney Microbiology, Smithfield, NSW



General Comments

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

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

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

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

When 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.

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

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

- **Analytical work for this work order will be conducted at ALS Sydney.**
- MF = membrane filtration
- CFU = colony forming unit
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- pH and electrical conductivity data supplied by ALS Wollongong.
- pH and electrical conductivity test completed on day of receipt.
- Sampling completed by client
- MW023 is ALS's internal code and is equivalent to AS4276.9.
- MW006 is ALS's internal code and is equivalent to AS4276.7.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID				
				A	B	C	D	G
Client sampling date / time				09-Feb-2020 18:05	09-Feb-2020 18:12	09-Feb-2020 18:25	09-Feb-2020 18:38	09-Feb-2020 17:30
Compound	CAS Number	LOR	Unit	EW2000648-001	EW2000648-002	EW2000648-003	EW2000648-004	EW2000648-005
				Result	Result	Result	Result	Result
EA005FD: Field pH								
pH	----	0.1	pH Unit	6.1	5.2	6.3	7.1	6.2
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	182	237	346	356	295
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	13	6	11	8	36
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	22	24	55	66	24
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.83	0.71	0.78	0.38	1.13
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.002	0.002	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	0.001	<0.001	0.003	0.002	0.002
Copper	7440-50-8	0.001	mg/L	0.006	0.002	0.008	0.009	0.003
Nickel	7440-02-0	0.001	mg/L	0.002	0.001	0.002	0.001	0.001
Lead	7439-92-1	0.001	mg/L	0.001	<0.001	<0.001	<0.001	0.001
Zinc	7440-66-6	0.005	mg/L	0.025	0.006	0.041	0.025	0.045
Iron	7439-89-6	0.05	mg/L	0.50	0.45	0.59	0.22	1.01
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.07	0.04	0.06	0.08	<0.01
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.18	<0.01	0.98	1.51	1.03
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.18	<0.01	0.98	1.51	1.03
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.9	0.8	0.7	1.4	1.3
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	1.1	0.8	1.7	2.9	2.3
EK067G: Total Phosphorus as P by Discrete Analyser								



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	A	B	C	D	G
Client sampling date / time				09-Feb-2020 18:05	09-Feb-2020 18:12	09-Feb-2020 18:25	09-Feb-2020 18:38	09-Feb-2020 17:30	
Compound	CAS Number	LOR	Unit	EW2000648-001	EW2000648-002	EW2000648-003	EW2000648-004	EW2000648-005	
				Result	Result	Result	Result	Result	
EK067G: Total Phosphorus as P by Discrete Analyser - Continued									
Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.09	0.15	<0.01	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.04	0.10	<0.01	
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL	3200	10000	8300	8500	3200	
MW023: Enterococci by Membrane Filtration									
Enterococci	----	1	CFU/100mL	2000	58	~24000	~26000	4200	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	H	----	----	----	----
Client sampling date / time			09-Feb-2020 18:50	----	----	----	----	
Compound	CAS Number	LOR	Unit	EW2000648-006	-----	-----	-----	-----
				Result	----	----	----	----
EA005FD: Field pH								
pH	----	0.1	pH Unit	7.1	----	----	----	----
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	296	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	8	----	----	----	----
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	54	----	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.37	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	0.002	----	----	----	----
Copper	7440-50-8	0.001	mg/L	0.015	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.024	----	----	----	----
Iron	7439-89-6	0.05	mg/L	0.32	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	0.0001	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	1.73	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	1.73	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.0	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	2.7	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			H	----	----	----	----
Client sampling date / time		09-Feb-2020 18:50			----	----	----	----	----
Compound	CAS Number	LOR	Unit	EW2000648-006	-----	-----	-----	-----	-----
				Result	----	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser - Continued									
Total Phosphorus as P	----	0.01	mg/L	0.12	----	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	0.06	----	----	----	----	----
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL	~14000	----	----	----	----	----
MW023: Enterococci by Membrane Filtration									
Enterococci	----	1	CFU/100mL	7100	----	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order : **EW2000673**
Client : **WOLLONGONG CASH CLIENTS**
Contact : James Harris
Address :

Telephone : ----
Project : Culburra Beach URA
Order number : N25405
C-O-C number : ----
Sampler : James Harris
Site : ----
Quote number : EN/333
No. of samples received : 2
No. of samples analysed : 2

Page : 1 of 4
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500
 4/13 Geary Pl, North Nowra 2541
 Australia NSW Australia
Telephone : +61 2 4225 3125
Date Samples Received : 10-Feb-2020 15:13
Date Analysis Commenced : 10-Feb-2020
Issue Date : 18-Feb-2020 10:28



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Tony DeSouza	Senior Microbiologist	Sydney Microbiology, Smithfield, NSW



General Comments

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

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

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

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

When 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.

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

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

- **Analytical work for this work order will be conducted at ALS Sydney.**
- MF = membrane filtration
- CFU = colony forming unit
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- pH and electrical conductivity data supplied by ALS Wollongong.
- pH and electrical conductivity test completed on day of receipt.
- Sampling completed by client
- MW023 is ALS's internal code and is equivalent to AS4276.9.
- MW006 is ALS's internal code and is equivalent to AS4276.7.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		Culburra I	Culburra J	----	----	----
Client sampling date / time		10-Feb-2020 12:30		10-Feb-2020 12:45		----	----	----
Compound	CAS Number	LOR	Unit	EW2000673-001	EW2000673-002	-----	-----	-----
				Result	Result	----	----	----
EA005FD: Field pH								
pH	----	0.1	pH Unit	5.2	4.6	----	----	----
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	78	153	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	10	11	----	----	----
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	4	13	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	1.06	0.88	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	0.011	----	----	----
Iron	7439-89-6	0.05	mg/L	0.53	0.61	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.02	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.08	0.02	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.08	0.02	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	1.0	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	0.6	1.0	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	Culburra I	Culburra J	----	----	----
Client sampling date / time				10-Feb-2020 12:30	10-Feb-2020 12:45	----	----	----	
Compound	CAS Number	LOR	Unit	EW2000673-001	EW2000673-002	-----	-----	-----	
				Result	Result	----	----	----	
EK067G: Total Phosphorus as P by Discrete Analyser - Continued									
Total Phosphorus as P	----	0.01	mg/L	0.02	0.02	----	----	----	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	----	----	----	
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL	1000	~200	----	----	----	
MW023: Enterococci by Membrane Filtration									
Enterococci	----	1	CFU/100mL	<2	~2	----	----	----	

CERTIFICATE OF ANALYSIS

Work Order : **EW2001216**
Client : **WOLLONGONG CASH CLIENTS**
Contact : James Harris
Address :

Telephone : ----
Project : Culburra Beach 25405
Order number : ----
C-O-C number : ----
Sampler : James Harris
Site : ----
Quote number : EN/333
No. of samples received : 8
No. of samples analysed : 8

Page : 1 of 6
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500
 4/13 Geary Pl, North Nowra 2541
 Australia NSW Australia
Telephone : +61 2 4225 3125
Date Samples Received : 05-Mar-2020 12:09
Date Analysis Commenced : 06-Mar-2020
Issue Date : 13-Mar-2020 10:27



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Tony DeSouza	Senior Microbiologist	Sydney Microbiology, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW



General Comments

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

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

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

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

When 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.

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

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

- **Analytical work for this work order will be conducted at ALS Sydney.**
- MF = membrane filtration
- CFU = colony forming unit
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported as approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- According to ALS work instruction for membrane filtration, the suggested volume for filtration of non treated / non-drinking water starts from 10mL or 50mL if the sample is turbid. A result of <10 or <2cfu/100mL is reported when there is no target organism growth from a volume of 10 or 50mL respectively.
- Membrane filtration results for MW006 Nos 1 7 and 8 are reported as an estimate (~) due to the presence of many non-target organism colonies that may have inhibited the growth of the target organisms on the filter membrane. It may be informative to record this fact.
- MW023 is ALS's internal code and is equivalent to AS4276.9.
- MW006 is ALS's internal code and is equivalent to AS4276.7.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	Culburra G	Culburra J	Culburra I	Culburra D	Culburra H
Client sampling date / time				05-Mar-2020 10:25	05-Mar-2020 09:45	05-Mar-2020 10:00	05-Mar-2020 09:13	05-Mar-2020 09:30	
Compound	CAS Number	LOR	Unit	EW2001216-001	EW2001216-002	EW2001216-003	EW2001216-004	EW2001216-005	
				Result	Result	Result	Result	Result	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	6.50	5.66	5.51	7.23	7.32	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	925	78	87	174	135	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	14	70	51	10	18	
ED093F: SAR and Hardness Calculations									
Total Hardness as CaCO3	----	1	mg/L	104	7	11	33	31	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.62	1.31	3.70	0.60	0.48	
Arsenic	7440-38-2	0.001	mg/L	0.003	<0.001	0.001	0.001	0.001	
Cadmium	7440-43-9	0.0001	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	0.004	0.001	0.006	0.001	0.002	
Copper	7440-50-8	0.001	mg/L	0.006	<0.001	0.002	0.006	0.005	
Nickel	7440-02-0	0.001	mg/L	0.006	<0.001	0.002	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	0.002	<0.001	0.002	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.108	0.024	0.027	0.018	0.044	
Iron	7439-89-6	0.05	mg/L	6.75	0.93	1.75	0.37	0.46	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.46	0.04	0.02	0.03	0.05	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	0.03	<0.01	<0.01	0.11	0.29	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.03	<0.01	<0.01	0.11	0.29	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.3	1.6	1.1	0.6	0.4	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L	2.3	1.6	1.1	0.7	0.7	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.06	0.07	0.06	0.05	0.10	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	Culburra G	Culburra J	Culburra I	Culburra D	Culburra H
Client sampling date / time				05-Mar-2020 10:25	05-Mar-2020 09:45	05-Mar-2020 10:00	05-Mar-2020 09:13	05-Mar-2020 09:30	
Compound	CAS Number	LOR	Unit	EW2001216-001	EW2001216-002	EW2001216-003	EW2001216-004	EW2001216-005	
				Result	Result	Result	Result	Result	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL	~60	5800	7800	8800	9000	
MW023: Enterococci by Membrane Filtration									
Enterococci	----	1	CFU/100mL	6000	<2	<2	5200	6500	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	Culburra C	Culburra B	Culburra A	----	----
Client sampling date / time				05-Mar-2020 09:00	05-Mar-2020 08:40	05-Mar-2020 08:35	----	----	
Compound	CAS Number	LOR	Unit	EW2001216-006	EW2001216-007	EW2001216-008	-----	-----	
				Result	Result	Result	----	----	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	7.11	5.64	5.91	----	----	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	392	325	144	----	----	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	21	11	13	----	----	
ED093F: SAR and Hardness Calculations									
Total Hardness as CaCO3	----	1	mg/L	114	32	13	----	----	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.74	1.26	0.62	----	----	
Arsenic	7440-38-2	0.001	mg/L	0.001	<0.001	<0.001	----	----	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----	
Chromium	7440-47-3	0.001	mg/L	0.002	0.003	0.001	----	----	
Copper	7440-50-8	0.001	mg/L	0.007	<0.001	0.001	----	----	
Nickel	7440-02-0	0.001	mg/L	0.003	0.002	<0.001	----	----	
Lead	7439-92-1	0.001	mg/L	<0.001	0.001	<0.001	----	----	
Zinc	7440-66-6	0.005	mg/L	0.026	0.012	0.012	----	----	
Iron	7439-89-6	0.05	mg/L	3.20	1.87	0.48	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.08	0.02	0.04	----	----	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	----	----	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	0.39	0.01	0.01	----	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.39	0.01	0.01	----	----	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.0	1.2	1.0	----	----	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L	1.4	1.2	1.0	----	----	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.06	0.06	0.05	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	Culburra C	Culburra B	Culburra A	----	----
Client sampling date / time				05-Mar-2020 09:00	05-Mar-2020 08:40	05-Mar-2020 08:35	----	----	
Compound	CAS Number	LOR	Unit	EW2001216-006	EW2001216-007	EW2001216-008	-----	-----	
				Result	Result	Result	----	----	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----	
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL	6300	~44	~23	----	----	
MW023: Enterococci by Membrane Filtration									
Enterococci	----	1	CFU/100mL	9600	~2	~800	----	----	

CERTIFICATE OF ANALYSIS

Work Order : **EW2003204**
Client : **WOLLONGONG CASH CLIENTS**
Contact : James Harris
Address :

Telephone : ----
Project : N25405
Order number : ----
C-O-C number : ----
Sampler : James Harris
Site : ----
Quote number : EN/333
No. of samples received : 7
No. of samples analysed : 7

Page : 1 of 6
Laboratory : Environmental Division NSW South Coast
Contact : Aneta Prosaroski
Address : 1/19 Ralph Black Dr, North Wollongong 2500
 4/13 Geary Pl, North Nowra 2541
 Australia NSW Australia
Telephone : +61 2 4225 3125
Date Samples Received : 14-Jul-2020 14:06
Date Analysis Commenced : 15-Jul-2020
Issue Date : 21-Jul-2020 14:17



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Somlok Chai	Microbiologist	Sydney Microbiology, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

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

- **Analytical work for this work order will be conducted at ALS Sydney.**
- MF = membrane filtration
- CFU = colony forming unit
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- EG035: Poor matrix spike recovery was obtained for Mercury on sample EW2003204 # 2. Confirmed by re-analysis.
- MW023 is ALS's internal code and is equivalent to AS4276.9.
- MW006 is ALS's internal code and is equivalent to AS4276.7.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID				
				G	I	D	H	C
Client sampling date / time				14-Jul-2020 10:15	14-Jul-2020 09:45	14-Jul-2020 09:15	14-Jul-2020 09:25	14-Jul-2020 08:55
Compound	CAS Number	LOR	Unit	EW2003204-001	EW2003204-002	EW2003204-003	EW2003204-004	EW2003204-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	6.14	5.74	7.23	7.48	7.02
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	811	54	346	287	305
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	60	74	10	15	11
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	73	<1	86	61	56
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	5.39	10.9	1.08	1.84	1.01
Arsenic	7440-38-2	0.001	mg/L	0.001	0.002	0.002	0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	0.007	0.010	0.002	0.003	0.002
Copper	7440-50-8	0.001	mg/L	0.005	0.010	0.011	0.030	0.004
Nickel	7440-02-0	0.001	mg/L	0.004	0.002	0.001	0.006	0.002
Lead	7439-92-1	0.001	mg/L	0.003	0.004	0.002	0.003	<0.001
Zinc	7440-66-6	0.005	mg/L	0.057	0.011	0.039	0.253	0.019
Iron	7439-89-6	0.05	mg/L	6.51	6.09	0.80	2.13	1.68
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.10	0.03	<0.01	0.04	0.04
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.50	0.12	1.55	0.38	0.35
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.50	0.12	1.55	0.38	0.35
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.6	1.0	1.1	1.0	0.6
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	2.1	1.1	2.6	1.4	1.0
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.19	0.22	0.14	0.20	0.09



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	G	I	D	H	C
Client sampling date / time				14-Jul-2020 10:15	14-Jul-2020 09:45	14-Jul-2020 09:15	14-Jul-2020 09:25	14-Jul-2020 08:55	
Compound	CAS Number	LOR	Unit	EW2003204-001	EW2003204-002	EW2003204-003	EW2003204-004	EW2003204-005	
				Result	Result	Result	Result	Result	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.01	0.02	<0.01	
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL	3500	2500	4000	4100	3700	
MW023: Enterococci by Membrane Filtration									
Enterococci	----	1	CFU/100mL	4500	570	9700	9200	9100	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID			B	A	----	----	----
Client sampling date / time				14-Jul-2020 08:40	14-Jul-2020 08:30	----	----	----	----	----	
Compound	CAS Number	LOR	Unit	EW2003204-006	EW2003204-007	-----	-----	-----	-----	-----	
				Result	Result	----	----	----	----	----	
EA005P: pH by PC Titrator											
pH Value	----	0.01	pH Unit	6.31	6.38	----	----	----	----	----	
EA010P: Conductivity by PC Titrator											
Electrical Conductivity @ 25°C	----	1	µS/cm	101	169	----	----	----	----	----	
EA025: Total Suspended Solids dried at 104 ± 2°C											
Suspended Solids (SS)	----	5	mg/L	12	19	----	----	----	----	----	
ED093F: SAR and Hardness Calculations											
Total Hardness as CaCO3	----	1	mg/L	11	11	----	----	----	----	----	
EG020T: Total Metals by ICP-MS											
Aluminium	7429-90-5	0.01	mg/L	2.52	2.81	----	----	----	----	----	
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	----	----	----	----	----	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----	----	----	
Chromium	7440-47-3	0.001	mg/L	0.003	0.004	----	----	----	----	----	
Copper	7440-50-8	0.001	mg/L	0.005	0.003	----	----	----	----	----	
Nickel	7440-02-0	0.001	mg/L	0.002	<0.001	----	----	----	----	----	
Lead	7439-92-1	0.001	mg/L	0.003	0.003	----	----	----	----	----	
Zinc	7440-66-6	0.005	mg/L	0.007	0.006	----	----	----	----	----	
Iron	7439-89-6	0.05	mg/L	1.74	1.61	----	----	----	----	----	
EG035T: Total Recoverable Mercury by FIMS											
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----	----	----	
EK055G: Ammonia as N by Discrete Analyser											
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	<0.01	----	----	----	----	----	
EK057G: Nitrite as N by Discrete Analyser											
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	----	----	----	----	----	
EK058G: Nitrate as N by Discrete Analyser											
Nitrate as N	14797-55-8	0.01	mg/L	0.23	0.06	----	----	----	----	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser											
Nitrite + Nitrate as N	----	0.01	mg/L	0.23	0.06	----	----	----	----	----	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser											
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.1	1.4	----	----	----	----	----	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser											
^ Total Nitrogen as N	----	0.1	mg/L	1.3	1.5	----	----	----	----	----	
EK067G: Total Phosphorus as P by Discrete Analyser											
Total Phosphorus as P	----	0.01	mg/L	0.09	0.06	----	----	----	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID		B	A	----	----	----
Client sampling date / time				14-Jul-2020 08:40	14-Jul-2020 08:30	----	----	----	----	----
Compound	CAS Number	LOR	Unit	EW2003204-006	EW2003204-007	-----	-----	-----	-----	-----
				Result	Result	----	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser										
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	----	----	----	----	----
MW006: Faecal Coliforms & E.coli by MF										
Faecal Coliforms	----	1	CFU/100mL	530	~18	----	----	----	----	----
MW023: Enterococci by Membrane Filtration										
Enterococci	----	1	CFU/100mL	530	730	----	----	----	----	----

24 Annexure N: Council Estuary Water Quality Data

Location		TN (mg/L)		TP (mg/L)		TSS (mg/L)		Faecal Coliforms (CFU/100mL)		Aluminium (mg/L)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Shoalhaven River Sites	E-148	0.313	0.275	0.038	0.041	43.4	34.3	86	216	na	na
	E-149	0.346	0.281	0.039	0.019	24.1	15.4	278	664	na	na
	E-158	0.285	0.075	0.019	0.001	na	na	96	110	na	na
	E-159	0.505	0.354	0.084	0.114	14.5	9.6	166	270	na	na
	E-275	0.455	0.352	0.305	0.911	41.9	19.6	122	509	na	na
	E-292	0.473	na	0.044	na	na	na	257	697	na	na
	E-294	0.329	0.305	0.051	0.082	44.5	35.7	90	379	na	na
	E-295	0.310	0.327	0.035	0.031	52.0	19.0	250	1733	0.2	na
	E-341	0.745	0.555	0.070	0.016	39.3	12.8	92	224	na	na
	E-345	0.220	na	0.037	na	100.0	na	175	231	na	na
	E-346	0.510	0.420	0.170	0.330	34.7	14.0	515	2015	na	na
	E-347	na	na	na	na	na	na	62	111	na	na
	E-548	0.274	0.288	0.034	0.033	42.9	23.4	43	185	na	na
	E-619	0.450	0.566	0.038	0.034	38.0	21.2	74	190	na	na
	E-7	1.899	1.574	0.822	1.187	22.0	11.5	205	500	na	na
	E-8	0.395	0.271	0.072	0.066	31.6	17.5	268	505	na	na
	E-9	0.395	0.283	0.050	0.034	29.8	16.5	139	404	na	na
	Overall	0.394	0.508	0.083	0.317	36.5	25.1	178	824	0.20	na
Crookhaven River Sites	E-452	2.10	na	0.210	na	na	na	119	120	0.47	na
	E-453	0.592	0.654	0.047	0.053	na	na	138	526	0.22	na
	E-454	0.326	0.291	0.034	0.025	na	na	14	40	0.43	na
	E-455	0.500	na	0.050	na	na	na	19	74	na	na
	E-456	0.600	na	0.050	na	na	na	52	225	4.08	na
	E-457	0.500	na	0.060	na	na	na	60	275	0.67	na
	E-777	na	na	na	Na	na	na	49	156	na	na
	Overall	0.568	0.626	0.047	0.051	na	na	64	265	1.17	1.46
Entire Estuary		0.422	0.531	0.077	0.292	36.5	25.1	150	731	1.01	1.38

25 Annexure O: Estuary Water Quality Laboratory Data



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CERTIFICATE OF ANALYSIS 227607

Client Details

Client	Martens & Associates Pty Ltd
Attention	D Dhiacou, R Kightley, Andrew Norris
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	P1203365: Culburra
Number of Samples	5 Water
Date samples received	03/10/2019
Date completed instructions received	03/10/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by 11/10/2019

Date of Issue 11/10/2019

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Results Approved By

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Miscellaneous Inorganics						
Our Reference		227607-1	227607-2	227607-3	227607-4	227607-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		02/10/2019	02/10/2019	02/10/2019	02/10/2019	02/10/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/10/2019	03/10/2019	03/10/2019	03/10/2019	03/10/2019
Date analysed	-	03/10/2019	03/10/2019	03/10/2019	03/10/2019	03/10/2019
pH	pH Units	7.7	7.9	7.9	8.0	8.0
Electrical Conductivity	µS/cm	50,000	47,000	47,000	48,000	46,000
Total Dissolved Solids (grav)	mg/L	39,000	40,000	39,000	40,000	40,000
NOx as N in water	mg/L	0.01	<0.005	<0.005	<0.005	0.01
Ammonia as N in water	mg/L	0.019	0.015	0.014	0.011	0.016
Total Nitrogen in water	mg/L	0.3	0.1	0.1	0.5	0.1
Phosphate as P in water	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrate as N in water	mg/L	0.006	<0.005	<0.005	<0.005	0.007

Ion Balance						
Our Reference		227607-1	227607-2	227607-3	227607-4	227607-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		02/10/2019	02/10/2019	02/10/2019	02/10/2019	02/10/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/10/2019	03/10/2019	03/10/2019	03/10/2019	03/10/2019
Date analysed	-	03/10/2019	03/10/2019	03/10/2019	03/10/2019	03/10/2019
Calcium - Dissolved	mg/L	360	370	370	380	380
Potassium - Dissolved	mg/L	410	410	390	410	410
Sodium - Dissolved	mg/L	11,000	12,000	11,000	12,000	12,000
Magnesium - Dissolved	mg/L	1,300	1,300	1,200	1,400	1,300
Hardness	mgCaCO ₃ /L	6,300	6,400	6,000	6,600	6,400
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	120	130	120	120	130
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	120	130	120	120	130
Sulphate, SO ₄	mg/L	2,500	2,500	2,400	2,500	2,500
Chloride, Cl	mg/L	18,000	19,000	18,000	19,000	19,000
Ionic Balance	%	5.0	5.0	4.0	6.0	6.0

Metals in Waters - Acid extractable						
Our Reference		227607-1	227607-2	227607-3	227607-4	227607-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		02/10/2019	02/10/2019	02/10/2019	02/10/2019	02/10/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	04/10/2019	04/10/2019	04/10/2019	04/10/2019	04/10/2019
Date analysed	-	04/10/2019	04/10/2019	04/10/2019	04/10/2019	04/10/2019
Phosphorus - Total	mg/L	0.05	<0.05	<0.05	<0.05	<0.05

All metals in water-dissolved						
Our Reference		227607-1	227607-2	227607-3	227607-4	227607-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		02/10/2019	02/10/2019	02/10/2019	02/10/2019	02/10/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	04/10/2019	04/10/2019	04/10/2019	04/10/2019	04/10/2019
Date analysed	-	04/10/2019	04/10/2019	04/10/2019	04/10/2019	04/10/2019
Aluminium-Dissolved	µg/L	10	<10	<10	<10	<10
Arsenic-Dissolved	µg/L	1	2	2	2	1
Boron-Dissolved	µg/L	4,600	4,600	4,700	4,700	4,700
Barium-Dissolved	µg/L	8	8	8	7	9
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt-Dissolved	µg/L	<1	<1	<1	<1	<1
Chromium-Dissolved	µg/L	<1	<1	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	<1	<1	<1
Iron-Dissolved	µg/L	<10	<10	<10	<10	<10
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese-Dissolved	µg/L	24	11	6	10	10
Molybdenum-Dissolved	µg/L	12	12	12	12	12
Nickel-Dissolved	µg/L	<1	<1	<1	<1	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1	<1
Strontium-Dissolved	µg/L	7,800	7,900	7,800	7,400	7,400
Titanium-Dissolved	µg/L	<1	<1	<1	<1	<1
Vanadium-Dissolved	µg/L	<1	<1	<1	<1	<1
Zinc-Dissolved	µg/L	1	<1	1	1	1

Metals in Water - Dissolved						
Our Reference		227607-1	227607-2	227607-3	227607-4	227607-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		02/10/2019	02/10/2019	02/10/2019	02/10/2019	02/10/2019
Type of sample		Water	Water	Water	Water	Water
Date digested	-	10/10/2019	10/10/2019	10/10/2019	10/10/2019	10/10/2019
Date analysed	-	10/10/2019	10/10/2019	10/10/2019	10/10/2019	10/10/2019
Silicon*- Dissolved	mg/L	0.6	0.4	0.3	0.3	0.4

Microbiological Testing						
Our Reference		227607-1	227607-2	227607-3	227607-4	227607-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		02/10/2019	02/10/2019	02/10/2019	02/10/2019	02/10/2019
Type of sample		Water	Water	Water	Water	Water
Date of testing	-	04/10/2019	04/10/2019	04/10/2019	04/10/2019	04/10/2019
E. coli	cfu/100mL	1 A	<1	1 A	<10	<1
Faecal Coliforms	cfu/100mL	1 A	<1	1 A	<10	<1

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.

Client Reference: P1203365: Culburra

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	227607-5
Date prepared	-			03/10/2019	1	03/10/2019	03/10/2019		03/10/2019	03/10/2019
Date analysed	-			03/10/2019	1	03/10/2019	03/10/2019		03/10/2019	03/10/2019
pH	pH Units		Inorg-001	[NT]	1	7.7	[NT]		102	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	50000	[NT]		93	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	39000	39000	0	103	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.01	[NT]		103	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.019	[NT]		104	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.3	[NT]		102	99
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	<0.005	[NT]		110	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.006	[NT]		107	[NT]

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	4	03/10/2019	03/10/2019		[NT]	[NT]
Date analysed	-			[NT]	4	03/10/2019	03/10/2019		[NT]	[NT]
pH	pH Units		Inorg-001	[NT]	4	8.0	[NT]		[NT]	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	[NT]	4	48000	[NT]		[NT]	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	[NT]	4	40000	[NT]		[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	[NT]	4	<0.005	[NT]		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	4	0.011	[NT]		[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	[NT]	4	0.5	0.5	0	[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	[NT]	4	<0.005	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	4	<0.005	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	5	03/10/2019	03/10/2019		[NT]	[NT]
Date analysed	-			[NT]	5	03/10/2019	03/10/2019		[NT]	[NT]
pH	pH Units		Inorg-001	[NT]	5	8.0	7.8	3	[NT]	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	[NT]	5	46000	47000	2	[NT]	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	[NT]	5	40000	[NT]		[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	[NT]	5	0.01	[NT]		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	5	0.016	[NT]		[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	[NT]	5	0.1	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	[NT]	5	<0.005	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	5	0.007	[NT]		[NT]	[NT]

Client Reference: P1203365: Culburra

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	227607-2
Date prepared	-			03/10/2019	1	03/10/2019	03/10/2019		03/10/2019	03/10/2019
Date analysed	-			03/10/2019	1	03/10/2019	03/10/2019		03/10/2019	03/10/2019
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	360	360	0	96	#
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	410	400	2	89	#
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	11000	11000	0	85	#
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	1300	1300	0	97	#
Hardness	mgCaCO ₃ /L	3		[NT]	1	6300	6400	2	[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	120	[NT]		[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	120	[NT]		111	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	1	2500	[NT]		87	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	18000	[NT]		84	[NT]
Ionic Balance	%		Inorg-040	[NT]	1	5.0	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	227607-5
Date prepared	-			[NT]	4	03/10/2019	03/10/2019		[NT]	03/10/2019
Date analysed	-			[NT]	4	03/10/2019	03/10/2019		[NT]	03/10/2019
Calcium - Dissolved	mg/L	0.5	Metals-020	[NT]	4	380	[NT]		[NT]	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	[NT]	4	410	[NT]		[NT]	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	[NT]	4	12000	[NT]		[NT]	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	[NT]	4	1400	[NT]		[NT]	[NT]
Hardness	mgCaCO ₃ /L	3		[NT]	4	6600	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	[NT]	4	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	4	120	[NT]		[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	4	<5	[NT]		[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	4	120	[NT]		[NT]	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	[NT]	4	2500	2500	0	[NT]	#
Chloride, Cl	mg/L	1	Inorg-081	[NT]	4	19000	19000	0	[NT]	#
Ionic Balance	%		Inorg-040	[NT]	4	6.0	[NT]		[NT]	[NT]

Client Reference: P1203365: Culburra

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	5	03/10/2019	03/10/2019		[NT]	[NT]
Date analysed	-			[NT]	5	03/10/2019	03/10/2019		[NT]	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	[NT]	5	380	[NT]		[NT]	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	[NT]	5	410	[NT]		[NT]	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	[NT]	5	12000	[NT]		[NT]	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	[NT]	5	1300	[NT]		[NT]	[NT]
Hardness	mgCaCO ₃ /L	3		[NT]	5	6400	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	[NT]	5	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	5	130	120	8	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	5	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	5	130	120	8	[NT]	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	[NT]	5	2500	[NT]		[NT]	[NT]
Chloride, Cl	mg/L	1	Inorg-081	[NT]	5	19000	[NT]		[NT]	[NT]
Ionic Balance	%		Inorg-040	[NT]	5	6.0	[NT]		[NT]	[NT]

Client Reference: P1203365: Culburra

QUALITY CONTROL: Metals in Waters - Acid extractable					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	227607-2
Date prepared	-			04/10/2019	1	04/10/2019	04/10/2019		04/10/2019	04/10/2019
Date analysed	-			04/10/2019	1	04/10/2019	04/10/2019		04/10/2019	04/10/2019
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	1	0.05	<0.05	0	104	115

Client Reference: P1203365: Culburra

QUALITY CONTROL: All metals in water-dissolved					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	227607-4
Date prepared	-			04/10/2019	3	04/10/2019	04/10/2019		04/10/2019	04/10/2019
Date analysed	-			04/10/2019	3	04/10/2019	04/10/2019		04/10/2019	04/10/2019
Aluminium-Dissolved	µg/L	10	Metals-022	<10	3	<10	<10	0	103	115
Arsenic-Dissolved	µg/L	1	Metals-022	<1	3	2	2	0	102	103
Boron-Dissolved	µg/L	20	Metals-022	<20	3	4700	4700	0	108	#
Barium-Dissolved	µg/L	1	Metals-022	<1	3	8	8	0	99	101
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	3	<0.5	<0.5	0	106	93
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	3	<0.1	<0.1	0	102	93
Cobalt-Dissolved	µg/L	1	Metals-022	<1	3	<1	<1	0	104	94
Chromium-Dissolved	µg/L	1	Metals-022	<1	3	<1	<1	0	100	98
Copper-Dissolved	µg/L	1	Metals-022	<1	3	<1	<1	0	102	83
Iron-Dissolved	µg/L	10	Metals-022	<10	3	<10	<10	0	108	104
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	3	<0.05	[NT]		101	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	3	6	6	0	100	105
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	3	12	12	0	101	116
Nickel-Dissolved	µg/L	1	Metals-022	<1	3	<1	<1	0	102	86
Lead-Dissolved	µg/L	1	Metals-022	<1	3	<1	<1	0	105	94
Selenium-Dissolved	µg/L	1	Metals-022	<1	3	<1	<1	0	100	94
Strontium-Dissolved	µg/L	1	Metals-022	<1	3	7800	7600	3	102	#
Titanium-Dissolved	µg/L	1	Metals-022	<1	3	<1	<1	0	104	114
Vanadium-Dissolved	µg/L	1	Metals-022	<1	3	<1	<1	0	98	102
Zinc-Dissolved	µg/L	1	Metals-022	<1	3	1	1	0	102	90

Client Reference: P1203365: Culburra

QUALITY CONTROL: All metals in water-dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	5	04/10/2019	04/10/2019		[NT]	[NT]
Date analysed	-			[NT]	5	04/10/2019	04/10/2019		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	5	<10	[NT]		[NT]	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	[NT]	5	1	[NT]		[NT]	[NT]
Boron-Dissolved	µg/L	20	Metals-022	[NT]	5	4700	[NT]		[NT]	[NT]
Barium-Dissolved	µg/L	1	Metals-022	[NT]	5	9	[NT]		[NT]	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	[NT]	5	<0.5	[NT]		[NT]	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	[NT]	5	<0.1	[NT]		[NT]	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	[NT]	5	<1	[NT]		[NT]	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	[NT]	5	<1	[NT]		[NT]	[NT]
Copper-Dissolved	µg/L	1	Metals-022	[NT]	5	<1	[NT]		[NT]	[NT]
Iron-Dissolved	µg/L	10	Metals-022	[NT]	5	<10	[NT]		[NT]	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	[NT]	5	<0.05	<0.05	0	[NT]	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	[NT]	5	10	[NT]		[NT]	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	[NT]	5	12	[NT]		[NT]	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	[NT]	5	<1	[NT]		[NT]	[NT]
Lead-Dissolved	µg/L	1	Metals-022	[NT]	5	<1	[NT]		[NT]	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	[NT]	5	<1	[NT]		[NT]	[NT]
Strontium-Dissolved	µg/L	1	Metals-022	[NT]	5	7400	[NT]		[NT]	[NT]
Titanium-Dissolved	µg/L	1	Metals-022	[NT]	5	<1	[NT]		[NT]	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	[NT]	5	<1	[NT]		[NT]	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	[NT]	5	1	[NT]		[NT]	[NT]

Client Reference: P1203365: Culburra

QUALITY CONTROL: Metals in Water - Dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	227607-4
Date digested	-			10/10/2019	3	10/10/2019	10/10/2019		10/10/2019	10/10/2019
Date analysed	-			10/10/2019	3	10/10/2019	10/10/2019		10/10/2019	10/10/2019
Silicon*- Dissolved	mg/L	0.2	Metals-020	<0.2	3	0.3	0.3	0	99	104

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
<p>Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.</p>	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Report Comments

All metals in water-dissolved - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

ION_BALANCE:# Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Faecal Coliform & E.Coli analysed by Sonic Food & Water Testing. Report No. W1921582

A: Approximate

Dissolved Metals: no filtered, preserved sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.

Note: there is a possibility some elements may be underestimated.



CERTIFICATE OF ANALYSIS 229288

Client Details

Client	Martens & Associates Pty Ltd
Attention	R Kightley
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	P1203365: Culburra
Number of Samples	5 Water
Date samples received	25/10/2019
Date completed instructions received	25/10/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	01/11/2019
Date of Issue	12/11/2019

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By

Jaimie Loa-Kum-Cheung, Metals Supervisor
Jeremy Faircloth, Operations Manager, Sydney
Loren Bardwell, Senior Chemist
Nick Sarlamis, Inorganics Supervisor
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		229288-1	229288-2	229288-3	229288-4	229288-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		24/10/2019	24/10/2019	24/10/2019	24/10/2019	24/10/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	25/10/2019	25/10/2019	25/10/2019	25/10/2019	25/10/2019
Date analysed	-	25/10/2019	25/10/2019	25/10/2019	25/10/2019	25/10/2019
pH	pH Units	7.8	7.8	7.8	8.1	7.8
Electrical Conductivity	µS/cm	52,000	52,000	51,000	51,000	52,000
Total Dissolved Solids (grav)	mg/L	38,000	38,000	37,000	37,000	37,000
NOx as N in water	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025
Ammonia as N in water	mg/L	0.042	0.038	0.034	0.081	0.074
Total Nitrogen in water	mg/L	0.3	0.5	0.3	0.4	0.3
Phosphate as P in water	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025
Nitrate as N in water	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025

Ion Balance						
Our Reference		229288-1	229288-2	229288-3	229288-4	229288-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		24/10/2019	24/10/2019	24/10/2019	24/10/2019	24/10/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	25/10/2019	25/10/2019	29/10/2019	25/10/2019	25/10/2019
Date analysed	-	25/10/2019	25/10/2019	29/10/2019	25/10/2019	25/10/2019
Calcium - Dissolved	mg/L	340	340	340	330	350
Potassium - Dissolved	mg/L	380	380	380	380	380
Sodium - Dissolved	mg/L	11,000	10,000	11,000	11,000	10,000
Magnesium - Dissolved	mg/L	1,200	1,200	1,200	1,200	1,200
Hardness	mgCaCO ₃ /L	5,900	5,700	6,000	5,800	5,700
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	120	120	190	120	120
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	120	120	190	120	120
Sulphate, SO ₄	mg/L	2,400	2,300	2,400	2,400	2,300
Chloride, Cl	mg/L	19,000	18,000	19,000	19,000	18,000
Ionic Balance	%	1.0	0	1.0	0	1.0

Metals in Waters - Acid extractable						
Our Reference		229288-1	229288-2	229288-3	229288-4	229288-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		24/10/2019	24/10/2019	24/10/2019	24/10/2019	24/10/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/10/2019	28/10/2019	28/10/2019	28/10/2019	28/10/2019
Date analysed	-	28/10/2019	28/10/2019	28/10/2019	28/10/2019	28/10/2019
Phosphorus - Total	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05

All metals in water-dissolved						
Our Reference		229288-1	229288-2	229288-3	229288-4	229288-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		24/10/2019	24/10/2019	24/10/2019	24/10/2019	24/10/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/10/2019	28/10/2019	28/10/2019	28/10/2019	28/10/2019
Date analysed	-	28/10/2019	28/10/2019	28/10/2019	28/10/2019	28/10/2019
Aluminium-Dissolved	µg/L	<10	<10	<10	<10	<10
Arsenic-Dissolved	µg/L	1	2	1	2	1
Boron-Dissolved	µg/L	4,400	4,300	4,400	4,300	4,300
Barium-Dissolved	µg/L	8	8	7	7	8
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt-Dissolved	µg/L	<1	<1	<1	<1	<1
Chromium-Dissolved	µg/L	<1	<1	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	<1	<1	<1
Iron-Dissolved	µg/L	<10	<10	<10	<10	<10
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese-Dissolved	µg/L	9	10	<5	7	<5
Molybdenum-Dissolved	µg/L	12	12	12	12	12
Nickel-Dissolved	µg/L	<1	<1	<1	<1	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1	<1
Strontium-Dissolved	µg/L	7,400	7,300	7,300	7,500	7,400
Titanium-Dissolved	µg/L	<1	<1	<1	<1	<1
Vanadium-Dissolved	µg/L	1	1	<1	2	<1
Zinc-Dissolved	µg/L	3	2	<1	1	1

Metals in Water - Dissolved						
Our Reference		229288-1	229288-2	229288-3	229288-4	229288-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		24/10/2019	24/10/2019	24/10/2019	24/10/2019	24/10/2019
Type of sample		Water	Water	Water	Water	Water
Date digested	-	28/10/2019	28/10/2019	28/10/2019	28/10/2019	28/10/2019
Date analysed	-	28/10/2019	28/10/2019	28/10/2019	28/10/2019	28/10/2019
Silicon*- Dissolved	mg/L	0.6	0.4	0.4	<0.2	0.4

Client Reference: P1203365: Culburra

Microbiological Testing						
Our Reference		229288-1	229288-2	229288-3	229288-4	229288-5
Your Reference	UNITS	3365/WQ201	3365/WQ202	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		24/10/2019	24/10/2019	24/10/2019	24/10/2019	24/10/2019
Type of sample		Water	Water	Water	Water	Water
Date of testing	-	26/10/2019	26/10/2019	26/10/2019	26/10/2019	26/10/2019
Faecal Coliforms	cfu/100mL	1A	10	<1	<1	6A

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.

Client Reference: P1203365: Culburra

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			25/10/2019	1	25/10/2019	25/10/2019		25/10/2019	[NT]
Date analysed	-			25/10/2019	1	25/10/2019	25/10/2019		25/10/2019	[NT]
pH	pH Units		Inorg-001	[NT]	1	7.8	[NT]		102	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	52000	[NT]		106	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	38000	38000	0	105	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.025	[NT]		98	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.042	[NT]		107	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.3	0.3	0	99	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	<0.025	[NT]		112	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.025	[NT]		97	[NT]

Client Reference: P1203365: Culburra

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	229288-2
Date prepared	-			25/10/2019	[NT]	[NT]	[NT]	[NT]	25/10/2019	25/10/2019
Date analysed	-			25/10/2019	[NT]	[NT]	[NT]	[NT]	25/10/2019	25/10/2019
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	91	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	88	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	86	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	90	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	98	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	88	#
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	83	#

Client Reference: P1203365: Culburra

QUALITY CONTROL: Metals in Waters - Acid extractable					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			28/10/2019	[NT]	[NT]	[NT]	[NT]	28/10/2019	[NT]
Date analysed	-			28/10/2019	[NT]	[NT]	[NT]	[NT]	28/10/2019	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	97	[NT]

Client Reference: P1203365: Culburra

QUALITY CONTROL: All metals in water-dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date prepared	-			28/10/2019	[NT]	[NT]	[NT]	[NT]	28/10/2019	[NT]
Date analysed	-			28/10/2019	[NT]	[NT]	[NT]	[NT]	28/10/2019	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	104	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	[NT]	[NT]	[NT]	[NT]	110	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	106	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	104	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	116	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	95	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Strontium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Titanium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	96	[NT]

Client Reference: P1203365: Culburra

QUALITY CONTROL: Metals in Water - Dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			28/10/2019	1	28/10/2019	28/10/2019		28/10/2019	[NT]
Date analysed	-			28/10/2019	1	28/10/2019	28/10/2019		28/10/2019	[NT]
Silicon*- Dissolved	mg/L	0.2	Metals-020	<0.2	1	0.6	0.6	0	97	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the same. When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Dissolved Metals: no filtered, preserved sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.

Note: there is a possibility some elements may be underestimated.

PQL raised for Nitrate,NOX,phosphate and ammonia due to high salinity of the samples requiring dilution.

Faecal coliforms analysed by Sonic, report W1923297

A = Approximate

CERTIFICATE OF ANALYSIS 231980

Client Details

Client	Martens & Associates Pty Ltd
Attention	R Kightley, Andrew Norris
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	P1203365: Culburra
Number of Samples	5 Water
Date samples received	29/11/2019
Date completed instructions received	29/11/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
 Samples were analysed as received from the client. Results relate specifically to the samples as received.
 Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

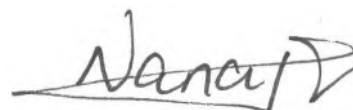
Report Details

Date results requested by	06/12/2019
Date of Issue	06/12/2019
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Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Jaimie Loa-Kum-Cheung, Metals Supervisor
 Ken Nguyen, Reporting Supervisor
 Nick Sarlamis, Inorganics Supervisor
 Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		231980-1	231980-2	231980-3	231980-4	231980-5
Your Reference	UNITS	3365/BH01	3365/MB403B	3365/BH02	3365/MB404	3365/BH06
Date Sampled		28/11/2019	28/11/2019	28/11/2019	28/11/2019	28/11/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	29/11/2019	29/11/2019	29/11/2019	29/11/2019	29/11/2019
Date analysed	-	29/11/2019	29/11/2019	29/11/2019	29/11/2019	29/11/2019
pH	pH Units	5.4	6.6	4.8	7.2	6.0
Electrical Conductivity	µS/cm	2,600	2,300	190	2,100	17,000
Total Dissolved Solids (grav)	mg/L	1,600	1,300	270	1,400	9,400
NOx as N in water	mg/L	0.01	0.02	0.1	0.1	0.01
Ammonia as N in water	mg/L	0.15	0.038	0.024	0.51	0.043
Total Nitrogen in water	mg/L	0.4	0.1	0.3	0.7	<0.1
Phosphate as P in water	mg/L	0.014	0.040	<0.005	0.058	<0.005
Nitrate as N in water	mg/L	0.01	0.01	0.12	0.11	0.01

Ion Balance						
Our Reference		231980-1	231980-2	231980-3	231980-4	231980-5
Your Reference	UNITS	3365/BH01	3365/MB403B	3365/BH02	3365/MB404	3365/BH06
Date Sampled		28/11/2019	28/11/2019	28/11/2019	28/11/2019	28/11/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	29/11/2019	29/11/2019	29/11/2019	29/11/2019	29/11/2019
Date analysed	-	29/11/2019	29/11/2019	29/11/2019	29/11/2019	29/11/2019
Calcium - Dissolved	mg/L	5.4	22	<0.5	81	150
Potassium - Dissolved	mg/L	2.3	2.8	<0.5	5.6	6.6
Sodium - Dissolved	mg/L	700	530	37	450	3,300
Magnesium - Dissolved	mg/L	37	32	0.8	47	700
Hardness	mgCaCO ₃ /L	160	190	3.3	400	3,300
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	17	200	29	480	58
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	17	200	29	480	58
Sulphate, SO ₄	mg/L	210	160	17	210	730
Chloride, Cl	mg/L	750	590	38	340	5,800
Ionic Balance	%	13	6.0	-9.0	8.0	7.0

Metals in Waters - Acid extractable						
Our Reference		231980-1	231980-2	231980-3	231980-4	231980-5
Your Reference	UNITS	3365/BH01	3365/MB403B	3365/BH02	3365/MB404	3365/BH06
Date Sampled		28/11/2019	28/11/2019	28/11/2019	28/11/2019	28/11/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/12/2019	03/12/2019	03/12/2019	03/12/2019	03/12/2019
Date analysed	-	03/12/2019	03/12/2019	03/12/2019	03/12/2019	03/12/2019
Phosphorus - Total	mg/L	0.1	0.4	0.2	0.06	<0.05

All metals in water-dissolved						
Our Reference		231980-1	231980-2	231980-3	231980-4	231980-5
Your Reference	UNITS	3365/BH01	3365/MB403B	3365/BH02	3365/MB404	3365/BH06
Date Sampled		28/11/2019	28/11/2019	28/11/2019	28/11/2019	28/11/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	02/12/2019	02/12/2019	02/12/2019	02/12/2019	02/12/2019
Date analysed	-	02/12/2019	02/12/2019	02/12/2019	02/12/2019	02/12/2019
Aluminium-Dissolved	µg/L	230	<10	30	<10	60
Arsenic-Dissolved	µg/L	<1	<1	<1	<1	<1
Boron-Dissolved	µg/L	200	200	80	200	100
Barium-Dissolved	µg/L	100	50	9	30	27
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	2
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1	0.5
Cobalt-Dissolved	µg/L	23	14	<1	2	110
Chromium-Dissolved	µg/L	<1	<1	<1	<1	<1
Copper-Dissolved	µg/L	5	<1	<1	1	3
Iron-Dissolved	µg/L	1,500	31	12	<10	<10
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese-Dissolved	µg/L	470	1,100	<5	240	1,700
Molybdenum-Dissolved	µg/L	<1	<1	<1	<1	<1
Nickel-Dissolved	µg/L	20	9	<1	4	72
Lead-Dissolved	µg/L	<1	<1	<1	<1	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1	<1
Strontium-Dissolved	µg/L	150	180	2.4	2,800	1,600
Titanium-Dissolved	µg/L	<1	1.6	1.1	<1	<1
Vanadium-Dissolved	µg/L	2	2	3	2	1
Zinc-Dissolved	µg/L	81	27	9	18	230

Metals in Water - Dissolved						
Our Reference		231980-1	231980-2	231980-3	231980-4	231980-5
Your Reference	UNITS	3365/BH01	3365/MB403B	3365/BH02	3365/MB404	3365/BH06
Date Sampled		28/11/2019	28/11/2019	28/11/2019	28/11/2019	28/11/2019
Type of sample		Water	Water	Water	Water	Water
Date digested	-	02/12/2019	02/12/2019	02/12/2019	02/12/2019	02/12/2019
Date analysed	-	02/12/2019	02/12/2019	02/12/2019	02/12/2019	02/12/2019
Silicon*- Dissolved	mg/L	26	21	29	15	18

Microbiological Testing						
Our Reference		231980-1	231980-2	231980-3	231980-4	231980-5
Your Reference	UNITS	3365/BH01	3365/MB403B	3365/BH02	3365/MB404	3365/BH06
Date Sampled		28/11/2019	28/11/2019	28/11/2019	28/11/2019	28/11/2019
Type of sample		Water	Water	Water	Water	Water
Date of testing	-	30/11/2019	30/11/2019	30/11/2019	30/11/2019	30/11/2019
Faecal Coliforms	cfu/100mL	<10	<20 MPN/100mL	<20 MPN/100mL	<10	<1
E. coli	cfu/100mL	<10	<20 MPN/100mL	<20 MPN/100mL	<10	<1

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.

Client Reference: P1203365: Culburra

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	231980-2
Date prepared	-			29/11/2019	1	29/11/2019	29/11/2019		29/11/2019	29/11/2019
Date analysed	-			29/11/2019	1	29/11/2019	29/11/2019		29/11/2019	29/11/2019
pH	pH Units		Inorg-001	[NT]	1	5.4	5.4	0	101	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	2600	2800	7	102	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	1600	[NT]		108	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.01	0.01	0	107	112
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.15	0.14	7	95	91
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.4	0.4	0	109	93
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	0.014	0.015	7	103	110
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.01	0.01	0	105	112

Client Reference: P1203365: Culburra

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	231980-2
Date prepared	-			29/11/2019	1	29/11/2019	29/11/2019		29/11/2019	29/11/2019
Date analysed	-			29/11/2019	1	29/11/2019	29/11/2019		29/11/2019	29/11/2019
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	5.4	[NT]		107	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	2.3	[NT]		101	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	700	[NT]		102	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	37	[NT]		108	[NT]
Hardness	mgCaCO ₃ /L	3		[NT]	1	160	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	17	17	0	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	17	17	0	98	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	1	210	210	0	119	#
Chloride, Cl	mg/L	1	Inorg-081	<1	1	750	750	0	117	#
Ionic Balance	%		Inorg-040	[NT]	1	13	[NT]		[NT]	[NT]

Client Reference: P1203365: Culburra

QUALITY CONTROL: Metals in Waters - Acid extractable					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			03/12/2019	[NT]	[NT]	[NT]	[NT]	03/12/2019	[NT]
Date analysed	-			03/12/2019	[NT]	[NT]	[NT]	[NT]	03/12/2019	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	108	[NT]

Client Reference: P1203365: Culburra

QUALITY CONTROL: All metals in water-dissolved				Duplicate			Spike Recovery %			
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	[NT]
Date prepared	-			02/12/2019	1	02/12/2019	02/12/2019		02/12/2019	[NT]
Date analysed	-			02/12/2019	1	02/12/2019	02/12/2019		02/12/2019	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	230	220	4	105	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	100	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	1	200	200	0	104	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	1	100	99	1	104	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	<0.5	<0.5	0	103	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	94	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	23	22	4	102	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	98	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	5	5	0	101	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	1	1500	1500	0	99	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	105	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	470	460	2	97	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	94	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	20	19	5	94	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	105	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	95	[NT]
Strontium-Dissolved	µg/L	1	Metals-022	<1	1	150	140	7	98	[NT]
Titanium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	100	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	<1	1	2	2	0	94	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	81	84	4	100	[NT]

Client Reference: P1203365: Culburra

QUALITY CONTROL: Metals in Water - Dissolved					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			02/12/2019	[NT]	[NT]	[NT]	[NT]	02/12/2019	[NT]
Date analysed	-			02/12/2019	[NT]	[NT]	[NT]	[NT]	02/12/2019	[NT]
Silicon*- Dissolved	mg/L	0.2	Metals-020	<0.2	[NT]	[NT]	[NT]	[NT]	93	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
<p>Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.</p>	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Dissolved Metals: no filtered, preserved sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.

Note: there is a possibility some elements may be underestimated.

Faecal Coliform & E.Coli analysed by Sonic Food & Water Testing. Report No's W1926351 & W1926350
Sample 2 and 3 reported as MPN/100mL

pH has exceeded the recommended technical holding times, Envirolab Group form 347 "Recommended Preservation and Holding Times" can be provided on request (available on the Envirolab website)

TDS value may be exaggerated for sample #3 due to colloidal matter passing through the filter.

INTERIM REPORT 234262

Client Details

Client	Martens & Associates Pty Ltd
Attention	R Kightley
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	<u>P1203365: West Culburra: Mixed Use Subdivision</u>
Number of Samples	5 Water
Date samples received	10/01/2020
Date completed instructions received	10/01/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
 Samples were analysed as received from the client. Results relate specifically to the samples as received.
 Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	17/01/2020
Interim Report Date	17/01/2020
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Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Miscellaneous Inorganics						
Our Reference		234262-1	234262-2	234262-3	234262-4	234262-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		09/01/2020	09/01/2020	09/01/2020	09/01/2020	09/01/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/01/2020	10/01/2020	10/01/2020	10/01/2020	10/01/2020
Date analysed	-	10/01/2020	10/01/2020	10/01/2020	10/01/2020	10/01/2020
pH	pH Units	7.7	7.9	8.0	8.1	7.9
Electrical Conductivity	µS/cm	53,000	52,000	51,000	51,000	52,000
Total Dissolved Solids (grav)	mg/L	42,000	41,000	40,000	41,000	42,000
NOx as N in water	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Ammonia as N in water	mg/L	0.009	0.006	0.018	0.013	0.005
Total Nitrogen in water	mg/L	0.8	0.5	0.2	0.4	0.2
Phosphate as P in water	mg/L	0.010	<0.005	0.01	0.008	<0.005
Nitrate as N in water	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Ion Balance						
Our Reference		234262-1	234262-2	234262-3	234262-4	234262-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		09/01/2020	09/01/2020	09/01/2020	09/01/2020	09/01/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/01/2020	10/01/2020	10/01/2020	10/01/2020	10/01/2020
Date analysed	-	10/01/2020	10/01/2020	10/01/2020	10/01/2020	10/01/2020
Calcium - Dissolved	mg/L	410	400	390	390	400
Potassium - Dissolved	mg/L	430	420	400	410	420
Sodium - Dissolved	mg/L	11,000	11,000	11,000	11,000	10,000
Magnesium - Dissolved	mg/L	1,400	1,400	1,300	1,300	1,300
Hardness	mgCaCO ₃ /L	6,900	6,800	6,500	6,400	6,500
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	130	120	120	120	120
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	130	120	120	120	120
Sulphate, SO ₄	mg/L	2,900	2,800	2,800	2,800	2,800
Chloride, Cl	mg/L	22,000	21,000	21,000	21,000	21,000
Ionic Balance	%	-2.0	-2.0	-3.0	-3.0	-6.0

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Metals in Waters - Acid extractable						
Our Reference		234262-1	234262-2	234262-3	234262-4	234262-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		09/01/2020	09/01/2020	09/01/2020	09/01/2020	09/01/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/01/2020	13/01/2020	13/01/2020	13/01/2020	13/01/2020
Date analysed	-	13/01/2020	13/01/2020	13/01/2020	13/01/2020	13/01/2020
Phosphorus - Total	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

All metals in water-dissolved						
Our Reference		234262-1	234262-2	234262-3	234262-4	234262-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		09/01/2020	09/01/2020	09/01/2020	09/01/2020	09/01/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/01/2020	13/01/2020	13/01/2020	13/01/2020	13/01/2020
Date analysed	-	13/01/2020	13/01/2020	13/01/2020	13/01/2020	13/01/2020
Aluminium-Dissolved	µg/L	<10	<10	<10	<10	<10
Arsenic-Dissolved	µg/L	2	2	2	2	1
Boron-Dissolved	µg/L	4,800	4,400	4,300	4,200	4,300
Barium-Dissolved	µg/L	13	11	7	7	12
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt-Dissolved	µg/L	<1	<1	<1	<1	<1
Chromium-Dissolved	µg/L	<1	<1	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	<1	<1	<1
Iron-Dissolved	µg/L	<10	<10	<10	<10	<10
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese-Dissolved	µg/L	7	<5	<5	<5	<5
Molybdenum-Dissolved	µg/L	13	13	13	13	13
Nickel-Dissolved	µg/L	<1	<1	<1	<1	<1
Lead-Dissolved	µg/L	<1	<1	2	<1	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1	<1
Strontium-Dissolved	µg/L	7,800	7,800	7,600	7,600	7,700
Titanium-Dissolved	µg/L	<1	<1	<1	<1	<1
Vanadium-Dissolved	µg/L	<1	<1	<1	<1	<1
Zinc-Dissolved	µg/L	<1	2	2	1	<1

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Metals in Water - Dissolved						
Our Reference		234262-1	234262-2	234262-3	234262-4	234262-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		09/01/2020	09/01/2020	09/01/2020	09/01/2020	09/01/2020
Type of sample		Water	Water	Water	Water	Water
Date digested	-	13/01/2020	13/01/2020	13/01/2020	13/01/2020	13/01/2020
Date analysed	-	13/01/2020	13/01/2020	13/01/2020	13/01/2020	13/01/2020
Silicon*- Dissolved	mg/L	0.5	<0.2	<0.2	<0.2	0.3

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Microbiological Testing						
Our Reference		234262-1	234262-2	234262-3	234262-4	234262-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		09/01/2020	09/01/2020	09/01/2020	09/01/2020	09/01/2020
Type of sample		Water	Water	Water	Water	Water
Date of testing	-					
E. coli	cfu/100mL					
Faecal Coliforms	cfu/100mL					

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	234262-1
Date prepared	-			10/01/2020	1	10/01/2020	10/01/2020		10/01/2020	10/01/2020
Date analysed	-			10/01/2020	1	10/01/2020	10/01/2020		10/01/2020	10/01/2020
pH	pH Units		Inorg-001	[NT]	1	7.7	7.7	0	102	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	53000	53000	0	105	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	42000	42000	0	100	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	<0.005	0	108	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.009	0.007	25	110	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.8	[NT]		86	77
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	0.010	0.01	0	117	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	<0.005	0	110	[NT]

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	234262-2
Date prepared	-			[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	10/01/2020
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	10/01/2020
NOx as N in water	mg/L	0.005	Inorg-055	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	83
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	128
Phosphate as P in water	mg/L	0.005	Inorg-060	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	103
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	77

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	234262-2
Date prepared	-			10/01/2020	1	10/01/2020	10/01/2020		10/01/2020	10/01/2020
Date analysed	-			10/01/2020	1	10/01/2020	10/01/2020		10/01/2020	10/01/2020
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	410	410	0	104	#
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	430	430	0	96	#
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	11000	11000	0	85	#
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	1400	1400	0	102	#
Hardness	mgCaCO ₃ /L	3		[NT]	1	6900	6700	3	[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	130	130	0	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	130	130	0	104	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	1	2900	2800	4	116	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	22000	21000	5	97	[NT]
Ionic Balance	%		Inorg-040	[NT]	1	-2.0	-3.0	-40	[NT]	[NT]

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Metals in Waters - Acid extractable				Duplicate			Spike Recovery %			
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			13/01/2020	1	13/01/2020	13/01/2020		13/01/2020	[NT]
Date analysed	-			13/01/2020	1	13/01/2020	13/01/2020		13/01/2020	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	1	<0.05	0.05	0	101	[NT]

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: All metals in water-dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	234262-2
Date prepared	-			13/01/2020	1	13/01/2020	13/01/2020		13/01/2020	13/01/2020
Date analysed	-			13/01/2020	1	13/01/2020	13/01/2020		13/01/2020	13/01/2020
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	<10	<10	0	106	106
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	2	1	67	104	105
Boron-Dissolved	µg/L	20	Metals-022	<20	1	4800	4500	6	107	#
Barium-Dissolved	µg/L	1	Metals-022	<1	1	13	13	0	102	110
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	<0.5	<0.5	0	99	84
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	98	105
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	110	100
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	109	109
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	114	93
Iron-Dissolved	µg/L	10	Metals-022	<10	1	<10	<10	0	107	110
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	105	106
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	7	7	0	108	111
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	13	13	0	94	119
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	107	92
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	104	88
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	107	102
Strontium-Dissolved	µg/L	1	Metals-022	<1	1	7800	7800	0	109	#
Titanium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	103	119
Vanadium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	101	101
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	106	93

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Metals in Water - Dissolved					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			13/01/2020	[NT]	[NT]	[NT]	[NT]	13/01/2020	[NT]
Date analysed	-			13/01/2020	[NT]	[NT]	[NT]	[NT]	13/01/2020	[NT]
Silicon*- Dissolved	mg/L	0.2	Metals-020	<0.2	[NT]	[NT]	[NT]	[NT]	109	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

All metals in water-dissolved - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Dissolved Metals: no filtered sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab. Note: there is a possibility some elements may be underestimated.

Ion Balance - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

CERTIFICATE OF ANALYSIS 237135

Client Details

Client	Martens & Associates Pty Ltd
Attention	D Dhiacou, R Kightley, Andrew Norris
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	<u>P1203365: West Culburra: Mixed Use Subdivision</u>
Number of Samples	5 Water
Date samples received	20/02/2020
Date completed instructions received	20/02/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
 Samples were analysed as received from the client. Results relate specifically to the samples as received.
 Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

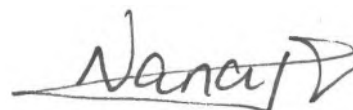
Report Details

Date results requested by	27/02/2020
Date of Issue	27/02/2020
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Jaimie Loa-Kum-Cheung, Metals Supervisor
 Ken Nguyen, Reporting Supervisor
 Nancy Zhang, Laboratory Manager, Sydney
 Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Miscellaneous Inorganics						
Our Reference		237135-1	237135-2	237135-3	237135-4	237135-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/02/2020	20/02/2020	20/02/2020	20/02/2020	20/02/2020
Date analysed	-	20/02/2020	20/02/2020	20/02/2020	20/02/2020	20/02/2020
pH	pH Units	6.9	7.1	7.5	7.2	7.5
Electrical Conductivity	µS/cm	3,600	8,300	15,000	10,000	14,000
Total Dissolved Solids (grav)	mg/L	1,900	5,500	11,000	7,300	9,700
NOx as N in water	mg/L	0.05	0.04	0.2	0.07	0.2
Ammonia as N in water	mg/L	0.78	0.77	0.40	0.72	0.43
Total Nitrogen in water	mg/L	3.6	2.4	1.2	2.1	1.2
Phosphate as P in water	mg/L	0.093	0.073	0.032	0.066	0.022
Nitrate as N in water	mg/L	0.050	0.04	0.21	0.062	0.16

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Ion Balance						
Our Reference		237135-1	237135-2	237135-3	237135-4	237135-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/02/2020	20/02/2020	20/02/2020	20/02/2020	20/02/2020
Date analysed	-	20/02/2020	20/02/2020	20/02/2020	20/02/2020	20/02/2020
Calcium - Dissolved	mg/L	42	67	120	84	100
Potassium - Dissolved	mg/L	30	56	130	62	120
Sodium - Dissolved	mg/L	650	1,800	3,500	2,000	3,100
Magnesium - Dissolved	mg/L	74	170	350	230	310
Hardness	mgCaCO ₃ /L	410	880	1,700	1,200	1,600
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	59	65	66	66	64
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	59	65	66	66	64
Sulphate, SO ₄	mg/L	180	410	790	520	710
Chloride, Cl	mg/L	1,100	2,800	5,600	3,600	5,100
Ionic Balance	%	3.0	3.0	4.0	-2.0	2.0

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Metals in Waters - Acid extractable						
Our Reference		237135-1	237135-2	237135-3	237135-4	237135-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/02/2020	24/02/2020	24/02/2020	24/02/2020	24/02/2020
Date analysed	-	24/02/2020	24/02/2020	24/02/2020	24/02/2020	24/02/2020
Phosphorus - Total	mg/L	0.7	0.3	0.1	0.3	0.09

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

All metals in water-dissolved						
Our Reference		237135-1	237135-2	237135-3	237135-4	237135-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	21/02/2020	21/02/2020	21/02/2020	21/02/2020	21/02/2020
Date analysed	-	21/02/2020	21/02/2020	21/02/2020	21/02/2020	21/02/2020
Aluminium-Dissolved	µg/L	180	80	70	80	60
Arsenic-Dissolved	µg/L	2	2	2	2	2
Boron-Dissolved	µg/L	310	780	1,500	970	1,500
Barium-Dissolved	µg/L	6	8	13	10	12
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt-Dissolved	µg/L	5	3	<1	2	<1
Chromium-Dissolved	µg/L	<1	<1	<1	<1	<1
Copper-Dissolved	µg/L	1	<1	<1	<1	<1
Iron-Dissolved	µg/L	1,300	610	170	530	160
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese-Dissolved	µg/L	560	410	94	370	88
Molybdenum-Dissolved	µg/L	1	3	4	3	4
Nickel-Dissolved	µg/L	5	3	<1	3	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1	<1
Strontium-Dissolved	µg/L	470	1,200	2,100	1,500	1,900
Titanium-Dissolved	µg/L	1.8	1.7	1.4	2.0	1.5
Vanadium-Dissolved	µg/L	<1	<1	<1	<1	<1
Zinc-Dissolved	µg/L	7	4	1	2	1

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Metals in Water - Dissolved						
Our Reference		237135-1	237135-2	237135-3	237135-4	237135-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
Type of sample		Water	Water	Water	Water	Water
Date digested	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Silicon*- Dissolved	mg/L	3.0	3.0	2.9	3.1	2.7

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Microbiological Testing						
Our Reference		237135-1	237135-2	237135-3	237135-4	237135-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
Type of sample		Water	Water	Water	Water	Water
Date of testing	-	21/02/2020	21/02/2020	21/02/2020	21/02/2020	21/02/2020
E. coli	cfu/100mL	2000 A NBO	100 A	<10 NBO	100 A	150 NBO
Faecal Coliforms	cfu/100mL	2000 A NBO	200 A	40 A NBO	100 A	150 NBO

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	237135-2
Date prepared	-			20/02/2020	1	20/02/2020	20/02/2020		20/02/2020	20/02/2020
Date analysed	-			20/02/2020	1	20/02/2020	20/02/2020		20/02/2020	20/02/2020
pH	pH Units		Inorg-001	[NT]	1	6.9	[NT]		101	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	3600	[NT]		102	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	1900	[NT]		93	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.05	0.05	0	96	85
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.78	0.78	0	96	118
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	3.6	3.6	0	102	104
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	0.093	0.089	4	113	86
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.050	0.052	4	97	81

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	5	20/02/2020	20/02/2020		[NT]	[NT]
Date analysed	-			[NT]	5	20/02/2020	20/02/2020		[NT]	[NT]
pH	pH Units		Inorg-001	[NT]	5	7.5	7.5	0	[NT]	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	[NT]	5	14000	14000	0	[NT]	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	[NT]	5	9700	9400	3	[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	[NT]	5	0.2	[NT]		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	5	0.43	[NT]		[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	[NT]	5	1.2	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	[NT]	5	0.022	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	5	0.16	[NT]		[NT]	[NT]

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	237135-2
Date prepared	-			20/02/2020	5	20/02/2020	20/02/2020		20/02/2020	20/02/2020
Date analysed	-			20/02/2020	5	20/02/2020	20/02/2020		20/02/2020	20/02/2020
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	100	[NT]		103	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	120	[NT]		101	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	3100	[NT]		91	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	5	310	[NT]		101	[NT]
Hardness	mgCaCO ₃ /L	3		[NT]	5	1600	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	5	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	5	64	67	5	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	5	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	5	64	67	5	103	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	5	710	[NT]		106	#
Chloride, Cl	mg/L	1	Inorg-081	<1	5	5100	[NT]		101	#
Ionic Balance	%		Inorg-040	[NT]	5	2.0	[NT]		[NT]	[NT]

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Metals in Waters - Acid extractable				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			24/02/2020	1	24/02/2020	24/02/2020		24/02/2020	[NT]
Date analysed	-			24/02/2020	1	24/02/2020	24/02/2020		24/02/2020	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	1	0.7	0.7	0	92	[NT]

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: All metals in water-dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			21/02/2020	[NT]	[NT]	[NT]	[NT]	21/02/2020	[NT]
Date analysed	-			21/02/2020	[NT]	[NT]	[NT]	[NT]	21/02/2020	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	109	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	[NT]	[NT]	[NT]	[NT]	99	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	95	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	106	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	93	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Strontium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Titanium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Metals in Water - Dissolved				Duplicate			Spike Recovery %			
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	237135-2
Date digested	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Date analysed	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Silicon*- Dissolved	mg/L	0.2	Metals-020	<0.2	1	3.0	3.2	6	105	109

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

pH

Samples were out of the recommended holding time for this analysis.

Dissolved Metals: no filtered, preserved sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.

Note: there is a possibility some elements may be underestimated.

Micro analysed by Sonic, report no W2003961.

A-Approximate

Micro note: The presence of competing background non-coliform organisms in the sample may have reduced the count obtained.

ION BALANCE

Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

CERTIFICATE OF ANALYSIS 239371

Client Details

Client	Martens & Associates Pty Ltd
Attention	R Kightley
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	P1203365: West Culburra: Mixed Used Subdivision
Number of Samples	5 Water
Date samples received	20/03/2020
Date completed instructions received	20/03/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
 Samples were analysed as received from the client. Results relate specifically to the samples as received.
 Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

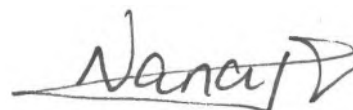
Report Details

Date results requested by	27/03/2020
Date of Issue	27/03/2020
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Jaimie Loa-Kum-Cheung, Metals Supervisor
 Ken Nguyen, Reporting Supervisor
 Nancy Zhang, Laboratory Manager, Sydney
 Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		239371-1	239371-2	239371-3	239371-4	239371-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/03/2020	20/03/2020	20/03/2020	20/03/2020	20/03/2020
Date analysed	-	20/03/2020	20/03/2020	20/03/2020	20/03/2020	20/03/2020
pH	pH Units	8.0	7.8	7.9	8.4	7.8
Electrical Conductivity	µS/cm	31,000	33,000	33,000	39,000	32,000
Total Dissolved Solids (grav)	mg/L	25,000	26,000	30,000	31,000	27,000
NOx as N in water	mg/L	<0.005	0.007	0.01	<0.005	0.02
Ammonia as N in water	mg/L	0.026	0.014	0.016	0.011	0.014
Total Nitrogen in water	mg/L	0.6	0.3	0.3	0.2	0.3
Phosphate as P in water	mg/L	0.015	0.008	<0.005	<0.005	<0.005
Nitrate as N in water	mg/L	<0.005	0.005	0.01	<0.005	0.01

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

Ion Balance						
Our Reference		239371-1	239371-2	239371-3	239371-4	239371-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	23/03/2020	23/03/2020	23/03/2020	23/03/2020	23/03/2020
Date analysed	-	23/03/2020	23/03/2020	23/03/2020	23/03/2020	23/03/2020
Calcium - Dissolved	mg/L	250	270	270	320	270
Potassium - Dissolved	mg/L	260	290	280	350	280
Sodium - Dissolved	mg/L	7,900	8,300	9,100	10,000	8,500
Magnesium - Dissolved	mg/L	830	930	910	1,100	920
Hardness	mgCaCO ₃ /L	4,100	4,500	4,400	5,200	4,400
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	110	100	97	96	99
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	15	<5
Total Alkalinity as CaCO ₃	mg/L	110	100	97	110	99
Sulphate, SO ₄	mg/L	1,700	1,900	2,000	2,400	1,900
Chloride, Cl	mg/L	13,000	14,000	15,000	18,000	15,000
Ionic Balance	%	4.0	2.0	4.0	0	2.0

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

Metals in Waters - Acid extractable						
Our Reference		239371-1	239371-2	239371-3	239371-4	239371-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/03/2020	24/03/2020	24/03/2020	24/03/2020	24/03/2020
Date analysed	-	24/03/2020	24/03/2020	24/03/2020	24/03/2020	24/03/2020
Phosphorus - Total	mg/L	0.06	<0.05	<0.05	<0.05	<0.05

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

All metals in water-dissolved						
Our Reference		239371-1	239371-2	239371-3	239371-4	239371-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/03/2020	24/03/2020	24/03/2020	24/03/2020	24/03/2020
Date analysed	-	24/03/2020	24/03/2020	24/03/2020	24/03/2020	24/03/2020
Aluminium-Dissolved	µg/L	<10	<10	10	10	10
Arsenic-Dissolved	µg/L	2	2	2	2	2
Boron-Dissolved	µg/L	2,900	3,200	3,200	3,900	3,300
Barium-Dissolved	µg/L	12	13	13	11	13
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium-Dissolved	µg/L	<0.1	0.1	<0.1	0.1	<0.1
Cobalt-Dissolved	µg/L	<1	<1	<1	<1	<1
Chromium-Dissolved	µg/L	<1	<1	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	<1	<1	<1
Iron-Dissolved	µg/L	<10	<10	<10	<10	<10
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese-Dissolved	µg/L	26	27	11	17	14
Molybdenum-Dissolved	µg/L	8	8	8	9	9
Nickel-Dissolved	µg/L	<1	<1	<1	<1	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1	<1
Strontium-Dissolved	µg/L	5,400	5,600	5,600	6,800	5,600
Titanium-Dissolved	µg/L	<1	<1	<1	<1	<1
Vanadium-Dissolved	µg/L	<1	<1	<1	<1	<1
Zinc-Dissolved	µg/L	<1	1	<1	1	2

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

Metals in Water - Dissolved						
Our Reference		239371-1	239371-2	239371-3	239371-4	239371-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Type of sample		Water	Water	Water	Water	Water
Date digested	-	26/03/2020	26/03/2020	26/03/2020	26/03/2020	26/03/2020
Date analysed	-	26/03/2020	26/03/2020	26/03/2020	26/03/2020	26/03/2020
Silicon*- Dissolved	mg/L	0.5	0.5	0.9	<0.2	0.8

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

Microbiological Testing						
Our Reference		239371-1	239371-2	239371-3	239371-4	239371-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Type of sample		Water	Water	Water	Water	Water
Date of testing	-	21/03/2020	21/03/2020	21/03/2020	21/03/2020	21/03/2020
E. coli	cfu/100mL	10 A NBO	20 A	12 NBO	4 A	5 A NBO
Faecal Coliforms	cfu/100mL	10 A NBO	20 A	12 NBO	4 A	5 A NBO

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	239371-2
Date prepared	-			20/03/2020	1	20/03/2020	20/03/2020		20/03/2020	20/03/2020
Date analysed	-			20/03/2020	1	20/03/2020	20/03/2020		20/03/2020	20/03/2020
pH	pH Units		Inorg-001	[NT]	1	8.0	8.0	0	102	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	31000	31000	0	93	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	25000	25000	0	98	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	[NT]		109	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.026	[NT]		96	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.6	0.5	18	88	103
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	0.015	[NT]		112	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	[NT]		110	[NT]

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/03/2020	1	23/03/2020	23/03/2020		23/03/2020	[NT]
Date analysed	-			23/03/2020	1	23/03/2020	23/03/2020		23/03/2020	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	250	260	4	97	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	260	270	4	92	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	7900	8100	2	95	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	830	880	6	99	[NT]
Hardness	mgCaCO ₃ /L	3		[NT]	1	4100	4300	5	[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	110	110	0	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	110	110	0	107	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	1	1700	1700	0	106	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	13000	13000	0	96	[NT]
Ionic Balance	%		Inorg-040	[NT]	1	4.0	5.0	22	[NT]	[NT]

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

QUALITY CONTROL: Metals in Waters - Acid extractable				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			24/03/2020	[NT]	[NT]	[NT]	[NT]	24/03/2020	[NT]
Date analysed	-			24/03/2020	[NT]	[NT]	[NT]	[NT]	24/03/2020	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	117	[NT]

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

QUALITY CONTROL: All metals in water-dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			24/03/2020	[NT]	[NT]	[NT]	[NT]	24/03/2020	[NT]
Date analysed	-			24/03/2020	[NT]	[NT]	[NT]	[NT]	24/03/2020	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	94	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	[NT]	[NT]	[NT]	[NT]	87	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	83	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	89	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	87	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	105	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	98	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	87	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	89	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Strontium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Titanium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]

Client Reference: P1203365: West Culburra: Mixed Used Subdivision

QUALITY CONTROL: Metals in Water - Dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date digested	-			26/03/2020	1	26/03/2020	26/03/2020		26/03/2020	[NT]
Date analysed	-			26/03/2020	1	26/03/2020	26/03/2020		26/03/2020	[NT]
Silicon*- Dissolved	mg/L	0.2	Metals-020	<0.2	1	0.5	0.5	0	107	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Faecal Coliform & E.Coli analysed by Sonic Food & Water Testing. Report No. W2006504

A: Approximate

NBO: The presence of competing background organisms in the sample may have reduced the count.

Dissolved Metals: no filtered, preserved sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.

Note: there is a possibility some elements may be underestimated.

CERTIFICATE OF ANALYSIS 242059

Client Details

Client	Martens & Associates Pty Ltd
Attention	D Dhiacou, R Kightley, Andrew Norris
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	<u>P1203365: West Culburra: Mixed Use Subdivision</u>
Number of Samples	5 Water
Date samples received	01/05/2020
Date completed instructions received	01/05/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
 Samples were analysed as received from the client. Results relate specifically to the samples as received.
 Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

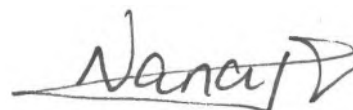
Report Details

Date results requested by	08/05/2020
Date of Issue	08/05/2020
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Hannah Nguyen, Senior Chemist
 Jaimie Loa-Kum-Cheung, Metals Supervisor
 Ken Nguyen, Reporting Supervisor
 Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Metals in Waters - Acid extractable						
Our Reference		242059-1	242059-2	242059-3	242059-4	242059-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		29/04/2020	29/04/2020	29/04/2020	29/04/2020	29/04/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	04/05/2020	04/05/2020	04/05/2020	04/05/2020	04/05/2020
Date analysed	-	07/05/2020	07/05/2020	07/05/2020	07/05/2020	07/05/2020
Phosphorus - Total	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

All metals in water-dissolved						
Our Reference		242059-1	242059-2	242059-3	242059-4	242059-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		29/04/2020	29/04/2020	29/04/2020	29/04/2020	29/04/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	04/05/2020	04/05/2020	04/05/2020	04/05/2020	04/05/2020
Date analysed	-	04/05/2020	04/05/2020	04/05/2020	04/05/2020	04/05/2020
Aluminium-Dissolved	µg/L	<10	<10	<10	<10	<10
Arsenic-Dissolved	µg/L	2	2	2	2	1
Boron-Dissolved	µg/L	3,500	3,200	3,300	3,300	3,000
Barium-Dissolved	µg/L	14	14	15	11	14
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt-Dissolved	µg/L	<1	<1	<1	<1	<1
Chromium-Dissolved	µg/L	<1	<1	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	<1	2	<1
Iron-Dissolved	µg/L	<10	<10	<10	<10	<10
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese-Dissolved	µg/L	25	21	10	8	<5
Molybdenum-Dissolved	µg/L	11	9	10	11	9
Nickel-Dissolved	µg/L	<1	<1	<1	<1	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1	<1
Vanadium-Dissolved	µg/L	<1	<1	<1	<1	1
Zinc-Dissolved	µg/L	1	<1	<1	<1	<1
Strontium-Dissolved	µg/L	6,400	6,400	6,400	6,300	6,500
Titanium-Dissolved	µg/L	<1	<1	<1	<1	<1

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Metals in Water - Dissolved						
Our Reference		242059-1	242059-2	242059-3	242059-4	242059-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		29/04/2020	29/04/2020	29/04/2020	29/04/2020	29/04/2020
Type of sample		Water	Water	Water	Water	Water
Date digested	-	08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Date analysed	-	08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Silicon*- Dissolved	mg/L	0.5	0.3	0.4	0.6	1.1

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Microbiological Testing						
Our Reference		242059-1	242059-2	242059-3	242059-4	242059-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		29/04/2020	29/04/2020	29/04/2020	29/04/2020	29/04/2020
Type of sample		Water	Water	Water	Water	Water
Date of testing	-	02/05/2020	02/05/2020	02/05/2020	02/05/2020	02/05/2020
E. coli	MPN/100mL	2 A	7 A	<1	1 A	<1
Faecal Coliforms	MPN/100mL	2 A	7 A	<1	1 A	<1

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Ion Balance						
Our Reference		242059-1	242059-2	242059-3	242059-4	242059-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		29/04/2020	29/04/2020	29/04/2020	29/04/2020	29/04/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	01/05/2020	01/05/2020	01/05/2020	01/05/2020	01/05/2020
Date analysed	-	01/05/2020	01/05/2020	01/05/2020	01/05/2020	01/05/2020
Calcium - Dissolved	mg/L	360	390	360	380	370
Potassium - Dissolved	mg/L	350	350	340	360	350
Sodium - Dissolved	mg/L	10,000	10,000	10,000	11,000	11,000
Magnesium - Dissolved	mg/L	1,200	1,200	1,200	1,200	1,200
Hardness	mgCaCO ₃ /L	5,900	6,000	5,700	6,100	5,900
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	120	110	110	110	110
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	120	110	110	110	110
Sulphate, SO ₄	mg/L	2,200	2,300	2,300	2,400	2,300
Chloride, Cl	mg/L	17,000	18,000	18,000	19,000	18,000
Ionic Balance	%	3.0	1.0	1.0	3.0	4.0

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Miscellaneous Inorganics						
Our Reference		242059-1	242059-2	242059-3	242059-4	242059-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		29/04/2020	29/04/2020	29/04/2020	29/04/2020	29/04/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	01/05/2020	01/05/2020	01/05/2020	01/05/2020	01/05/2020
Date analysed	-	01/05/2020	01/05/2020	01/05/2020	01/05/2020	01/05/2020
pH	pH Units	7.8	7.6	7.8	7.8	7.8
Electrical Conductivity	µS/cm	45,000	46,000	45,000	47,000	46,000
Temperature oC	°C	25	25	25	25	25
Total Nitrogen in water	mg/L	0.2	0.2	0.2	0.1	0.1
Nitrate as N in water	mg/L	<0.005	<0.005	0.02	<0.005	<0.005
Ammonia as N in water	mg/L	0.017	0.025	0.032	0.029	0.011
NOx as N in water	mg/L	<0.005	<0.005	0.02	<0.005	<0.005
Phosphate as P in water	mg/L	0.01	0.01	0.009	0.008	0.007
Total Dissolved Solids (grav)	mg/L	36,000	36,000	36,000	38,000	37,000

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Metals in Waters - Acid extractable				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	242059-2
Date prepared	-			04/05/2020	1	04/05/2020	04/05/2020		04/05/2020	04/05/2020
Date analysed	-			07/05/2020	1	07/05/2020	07/05/2020		07/05/2020	07/05/2020
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	1	<0.1	<0.1	0	98	#

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: All metals in water-dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	242059-2
Date prepared	-			04/05/2020	1	04/05/2020	04/05/2020		04/05/2020	04/05/2020
Date analysed	-			04/05/2020	1	04/05/2020	04/05/2020		04/05/2020	04/05/2020
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	<10	10	0	100	101
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	2	2	0	93	101
Boron-Dissolved	µg/L	20	Metals-022	<20	1	3500	3100	12	102	#
Barium-Dissolved	µg/L	1	Metals-022	<1	1	14	14	0	98	100
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	<0.5	<0.5	0	110	92
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	107	99
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	103	88
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	96	98
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	101	80
Iron-Dissolved	µg/L	10	Metals-022	<10	1	<10	<10	0	101	90
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	105	99
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	25	20	22	94	109
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	11	9	20	110	110
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	98	84
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	100	80
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	97	95
Vanadium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	96	109
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	1	<1	0	96	87
Strontium-Dissolved	µg/L	1	Metals-022	<1	1	6400	6300	2	102	#
Titanium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	95	112

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Metals in Water - Dissolved				Duplicate			Spike Recovery %			
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	242059-5
Date digested	-			08/05/2020	1	08/05/2020	04/05/2020		08/05/2020	04/05/2020
Date analysed	-			08/05/2020	1	08/05/2020	04/05/2020		08/05/2020	04/05/2020
Silicon*- Dissolved	mg/L	0.2	Metals-020	<0.2	1	0.5	0.5	0	108	115

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	242059-2
Date prepared	-			01/05/2020	1	01/05/2020	01/05/2020		01/05/2020	04/05/2020
Date analysed	-			01/05/2020	1	01/05/2020	01/05/2020		01/05/2020	04/05/2020
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	360	[NT]		102	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	350	[NT]		89	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	10000	[NT]		107	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	1200	[NT]		104	[NT]
Hardness	mgCaCO ₃ /L	3		[NT]	1	5900	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	120	120	0	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	120	120	0	105	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	1	2200	[NT]		98	#
Chloride, Cl	mg/L	1	Inorg-081	<1	1	17000	[NT]		93	#
Ionic Balance	%		Inorg-040	[NT]	1	3.0	[NT]		[NT]	[NT]

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	242059-2
Date prepared	-			01/05/2020	1	01/05/2020	01/05/2020		01/05/2020	01/05/2020
Date analysed	-			01/05/2020	1	01/05/2020	01/05/2020		01/05/2020	01/05/2020
pH	pH Units		Inorg-001	[NT]	1	7.8	7.8	0	100	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	45000	45000	0	104	[NT]
Temperature oC	°C			[NT]	1	25	[NT]		[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.2	0.2	0	83	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	<0.005	0	101	95
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.017	0.015	12	103	122
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	<0.005	0	100	97
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	0.01	0.01	0	110	118
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	36000	35000	3	101	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Holding time exceedance for pH.

Faecal Coliform & E.Coli analysed by Sonic Food & Water Testing. Report No. W2009365

A: Approximate and holding time exceedance for this analysis.

ION_BALANCE: Cl & SO4 # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

All metals in water-dissolved - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Dissolved Metals: no filtered, preserved sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab. Note: there is a possibility some elements may be underestimated.

8 Metals in Waters - total:

- # High spike recovery was obtained for this sample. Sample matrix interference is suspected. However, an acceptable recovery was obtained for the LCS.

-The PQL has been raised due to the sample matrix requiring dilution.

CERTIFICATE OF ANALYSIS 243860

Client Details

Client	Martens & Associates Pty Ltd
Attention	Andrew Norris
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	<u>P1203365: West Culburra: Mixed Use Subdivision</u>
Number of Samples	5 Water
Date samples received	29/05/2020
Date completed instructions received	29/05/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
 Samples were analysed as received from the client. Results relate specifically to the samples as received.
 Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

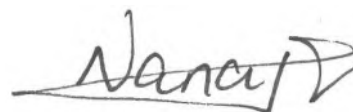
Report Details

Date results requested by	05/06/2020
Date of Issue	04/06/2020
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Hannah Nguyen, Senior Chemist
 Ken Nguyen, Reporting Supervisor
 Loren Bardwell, Senior Chemist
 Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

All metals in water-dissolved						
Our Reference		243860-1	243860-2	243860-3	243860-4	243860-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		27/05/2020	27/05/2020	27/05/2020	27/05/2020	27/05/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	01/06/2020	01/06/2020	01/06/2020	01/06/2020	01/06/2020
Date analysed	-	01/06/2020	01/06/2020	01/06/2020	01/06/2020	01/06/2020
Aluminium-Dissolved	µg/L	10	<10	<10	<10	<10
Arsenic-Dissolved	µg/L	1	1	1	<1	<1
Boron-Dissolved	µg/L	2,400	2,600	2,500	2,400	2,400
Barium-Dissolved	µg/L	13	14	13	14	13
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium-Dissolved	µg/L	<0.1	0.1	<0.1	<0.1	<0.1
Cobalt-Dissolved	µg/L	<1	<1	<1	<1	<1
Chromium-Dissolved	µg/L	<1	<1	<1	<1	<1
Copper-Dissolved	µg/L	2	2	<1	<1	1
Iron-Dissolved	µg/L	18	<10	<10	<10	<10
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese-Dissolved	µg/L	38	20	8	16	7
Molybdenum-Dissolved	µg/L	8	9	9	9	9
Nickel-Dissolved	µg/L	1	<1	<1	<1	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1	<1
Strontium-Dissolved	µg/L	6,000	6,600	6,700	6,600	6,700
Titanium-Dissolved	µg/L	<1	<1	<1	<1	<1
Vanadium-Dissolved	µg/L	<1	<1	<1	<1	<1
Zinc-Dissolved	µg/L	4	2	5	1	<1

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Metals in Waters - Acid extractable						
Our Reference		243860-1	243860-2	243860-3	243860-4	243860-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		27/05/2020	27/05/2020	27/05/2020	27/05/2020	27/05/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	01/06/2020	01/06/2020	01/06/2020	01/06/2020	01/06/2020
Date analysed	-	01/06/2020	01/06/2020	01/06/2020	01/06/2020	01/06/2020
Phosphorus - Total	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Metals in Water - Dissolved						
Our Reference		243860-1	243860-2	243860-3	243860-4	243860-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		27/05/2020	27/05/2020	27/05/2020	27/05/2020	27/05/2020
Type of sample		Water	Water	Water	Water	Water
Date digested	-	02/06/2020	02/06/2020	02/06/2020	02/06/2020	02/06/2020
Date analysed	-	02/06/2020	02/06/2020	02/06/2020	02/06/2020	02/06/2020
Silicon*- Dissolved	mg/L	0.4	0.4	0.4	0.4	0.5

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Microbiological Testing						
Our Reference		243860-1	243860-2	243860-3	243860-4	243860-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		27/05/2020	27/05/2020	27/05/2020	27/05/2020	27/05/2020
Type of sample		Water	Water	Water	Water	Water
Date of testing	-	30/05/2020	30/05/2020	30/05/2020	30/05/2020	30/05/2020
Faecal Coliforms	cfu/100mL	50	7 A	6 A	5 A	7 A
E. coli	cfu/100mL	50	7 A	6 A	5 A	7 A

Miscellaneous Inorganics						
Our Reference		243860-1	243860-2	243860-3	243860-4	243860-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		27/05/2020	27/05/2020	27/05/2020	27/05/2020	27/05/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	29/05/2020	29/05/2020	29/05/2020	29/05/2020	29/05/2020
Date analysed	-	29/05/2020	29/05/2020	29/05/2020	29/05/2020	29/05/2020
pH	pH Units	7.6	7.8	7.7	7.7	7.8
Electrical Conductivity	µS/cm	39,000	41,000	42,000	42,000	41,000
Temperature oC	°C	18.9	19.3	19	18.8	18.8
Total Dissolved Solids (grav)	mg/L	29,000	31,000	32,000	33,000	32,000
NOx as N in water	mg/L	0.04	0.02	0.02	0.03	<0.005
Ammonia as N in water	mg/L	0.37	0.20	0.15	0.16	0.13
Total Nitrogen in water	mg/L	0.6	0.3	0.2	0.2	0.1
Phosphate as P in water	mg/L	0.032	0.016	0.012	0.017	<0.005
Nitrate as N in water	mg/L	0.03	0.02	0.02	0.02	<0.005

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Ion Balance						
Our Reference		243860-1	243860-2	243860-3	243860-4	243860-5
Your Reference	UNITS	3365/WQ201	3365/WQ202B	3365/WQ203	3365/WQ204	3365/WQ205
Date Sampled		27/05/2020	27/05/2020	27/05/2020	27/05/2020	27/05/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	29/05/2020	29/05/2020	29/05/2020	29/05/2020	29/05/2020
Date analysed	-	29/05/2020	29/05/2020	29/05/2020	29/05/2020	29/05/2020
Calcium - Dissolved	mg/L	270	280	280	270	280
Potassium - Dissolved	mg/L	320	370	360	380	350
Sodium - Dissolved	mg/L	9,800	11,000	9,600	11,000	11,000
Magnesium - Dissolved	mg/L	810	860	880	860	850
Hardness	mgCaCO ₃ /L	4,000	4,200	4,300	4,200	4,200
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	100	100	100	110	100
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	100	100	100	110	100
Sulphate, SO ₄	mg/L	2,000	2,000	2,100	2,000	2,100
Chloride, Cl	mg/L	15,000	16,000	16,000	15,000	16,000
Ionic Balance	%	5.0	6.0	1.0	8.0	5.0

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: All metals in water-dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	243860-2
Date prepared	-			01/06/2020	1	01/06/2020	01/06/2020		01/06/2020	01/06/2020
Date analysed	-			01/06/2020	1	01/06/2020	01/06/2020		01/06/2020	01/06/2020
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	10	10	0	111	98
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	1	1	0	96	97
Boron-Dissolved	µg/L	20	Metals-022	<20	1	2400	2500	4	109	#
Barium-Dissolved	µg/L	1	Metals-022	<1	1	13	14	7	105	105
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	<0.5	<0.5	0	97	##
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	98	93
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	97	94
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	99	99
Copper-Dissolved	µg/L	1	Metals-022	<1	1	2	2	0	101	87
Iron-Dissolved	µg/L	10	Metals-022	<10	1	18	16	12	105	100
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	91	104
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	38	39	3	103	102
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	8	8	0	104	108
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	1	2	67	100	90
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	99	95
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	90	85
Strontium-Dissolved	µg/L	1	Metals-022	<1	1	6000	6200	3	99	#
Titanium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	107	118
Vanadium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	99	108
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	4	5	22	106	96

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Metals in Waters - Acid extractable				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	243860-2
Date prepared	-			01/06/2020	1	01/06/2020	01/06/2020		01/06/2020	01/06/2020
Date analysed	-			01/06/2020	1	01/06/2020	01/06/2020		01/06/2020	01/06/2020
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	1	<0.1	<0.1	0	101	109

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Metals in Water - Dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	243860-5
Date digested	-			02/06/2020	4	02/06/2020	02/06/2020		02/06/2020	02/06/2020
Date analysed	-			02/06/2020	4	02/06/2020	02/06/2020		02/06/2020	02/06/2020
Silicon*- Dissolved	mg/L	0.2	Metals-020	<0.2	4	0.4	0.4	0	100	116

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	243860-2
Date prepared	-			29/05/2020	1	29/05/2020	29/05/2020		29/05/2020	29/05/2020
Date analysed	-			29/05/2020	1	29/05/2020	29/05/2020		29/05/2020	29/05/2020
pH	pH Units		Inorg-001	[NT]	1	7.6	7.6	0	100	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	39000	39000	0	98	[NT]
Temperature oC	°C			[NT]	1	18.9	19.1	1	[NT]	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	29000	29000	0	92	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.04	0.03	29	105	95
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.37	0.37	0	102	124
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.6	0.6	0	98	74
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	0.032	0.032	0	93	105
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.03	0.03	0	106	91

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	4	29/05/2020	29/05/2020		[NT]	[NT]
Date analysed	-			[NT]	4	29/05/2020	29/05/2020		[NT]	[NT]
pH	pH Units		Inorg-001	[NT]	4	7.7	[NT]		[NT]	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	[NT]	4	42000	[NT]		[NT]	[NT]
Temperature oC	°C			[NT]	4	18.8	[NT]		[NT]	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	[NT]	4	33000	[NT]		[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	[NT]	4	0.03	[NT]		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	4	0.16	[NT]		[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	[NT]	4	0.2	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	[NT]	4	0.017	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	4	0.02	[NT]		[NT]	[NT]

Client Reference: P1203365: West Culburra: Mixed Use Subdivision

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			29/05/2020	1	29/05/2020	29/05/2020		29/05/2020	[NT]
Date analysed	-			29/05/2020	1	29/05/2020	29/05/2020		29/05/2020	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	270	[NT]		89	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	320	[NT]		87	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	9800	[NT]		92	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	810	[NT]		86	[NT]
Hardness	mgCaCO ₃ /L	3		[NT]	1	4000	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	100	100	0	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	100	100	0	108	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	1	2000	1900	5	113	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	15000	15000	0	89	[NT]
Ionic Balance	%		Inorg-040	[NT]	1	5.0	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	4	29/05/2020	29/05/2020		[NT]	[NT]
Date analysed	-			[NT]	4	29/05/2020	29/05/2020		[NT]	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	[NT]	4	270	[NT]		[NT]	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	[NT]	4	380	[NT]		[NT]	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	[NT]	4	11000	[NT]		[NT]	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	[NT]	4	860	[NT]		[NT]	[NT]
Hardness	mgCaCO ₃ /L	3		[NT]	4	4200	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	[NT]	4	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	4	110	[NT]		[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	4	<5	[NT]		[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	[NT]	4	110	[NT]		[NT]	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	[NT]	4	2000	2100	5	[NT]	[NT]
Chloride, Cl	mg/L	1	Inorg-081	[NT]	4	15000	16000	6	[NT]	[NT]
Ionic Balance	%		Inorg-040	[NT]	4	8.0	[NT]		[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Holding time exceedance - pH, micro

Microbiological testing analysed by Sonic food and water testing. Report no. W2011213

A: Approximate

8 Metals in Waters - total: The PQL has been raised 2 times due to suppression of the internal standard, which required the samples to be diluted. This is likely due to the high level of salts in the sample.

Dissolved Metals: no filtered, preserved sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.

Note: there is a possibility some elements may be underestimated.

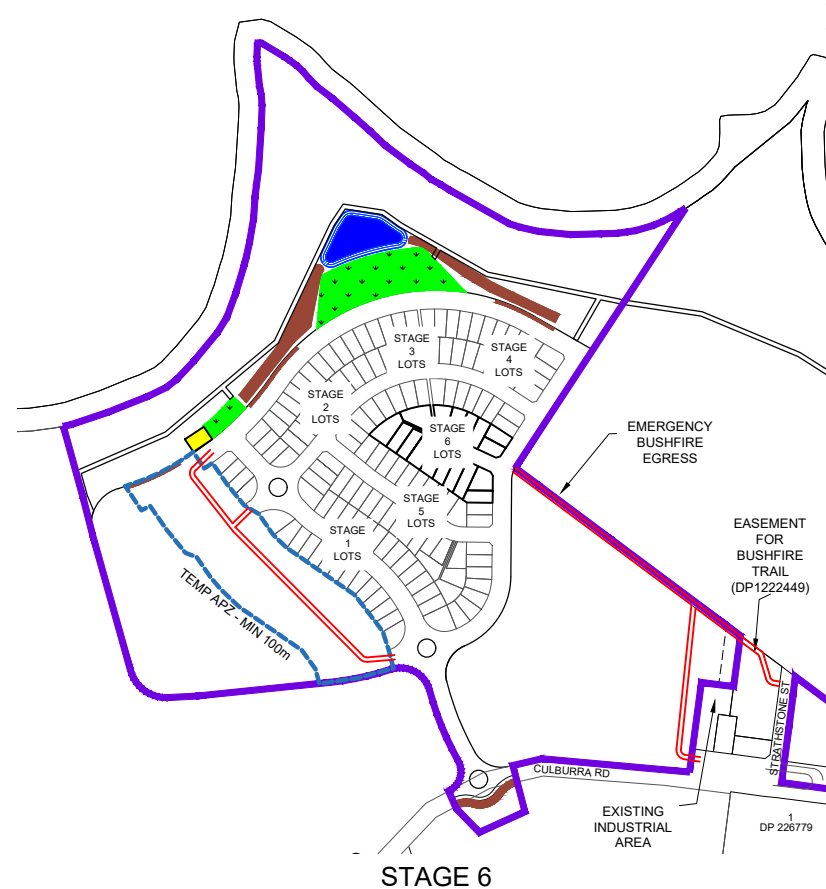
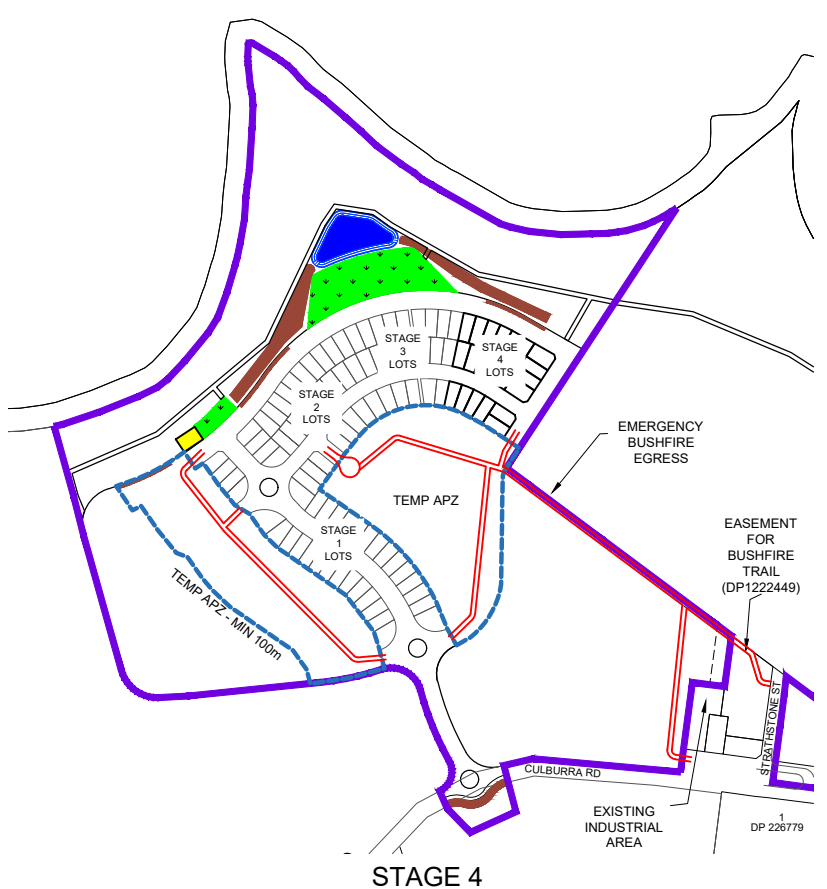
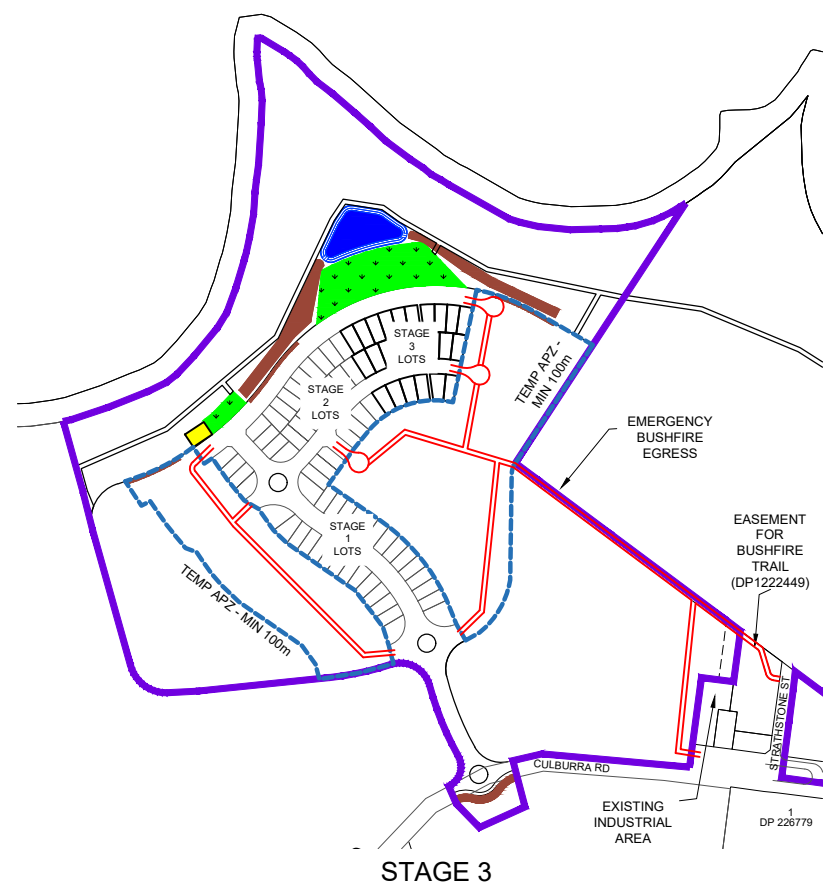
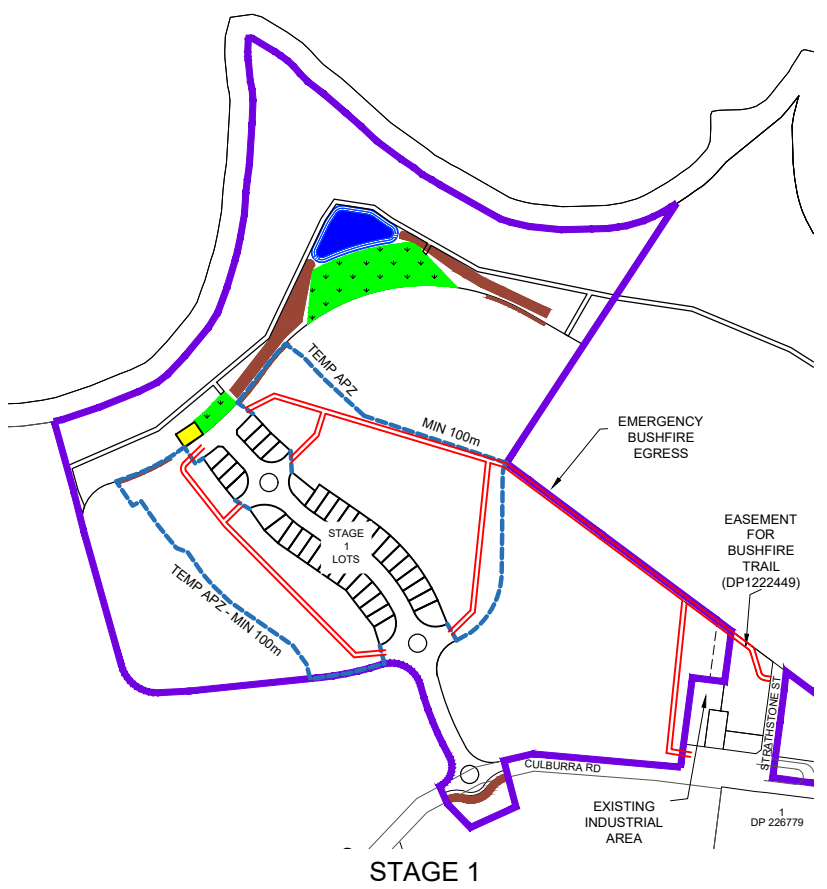
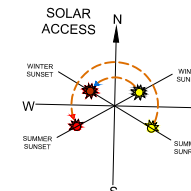
All metals in water-dissolved:

- # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

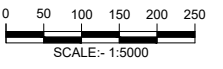
- ## Low spike recovery was obtained for this sample. Sample matrix interference is suspected. However, an acceptable recovery was obtained for the LCS

26 Annexure P: Construction Staging Plan

PROPOSED MIXED USE CONCEPT PLAN - STAGED DELIVERY PLANS



- DEVELOPMENT BOUNDARY
- TEMPORARY APZ - MINIMUM 100m
- TEMPORARY TURNING HEAD (RFS/PBP COMPLIANT)
- TEMPORARY FIRE TRAIL (RFS/PBP COMPLIANT)
- DENOTES BIOFILTRATION
- DENOTES WATER QUALITY PONDS
- DENOTES PUBLIC RESERVE



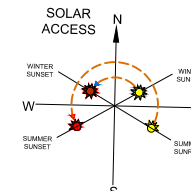
RESIDENTIAL AREA STAGE R1 - STAGE R6



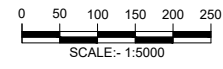
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RATIO: 1:5000 (AT A1 ORIGINAL) (1:10,000 AT A3)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY DESIGN DRAWN CHECK'D	AERIAL PHOTOGRAPHY MP DS MP	REV 01	DESCRIPTION LAYOUT AMENDED TO ALIGN WITH WATER QUALITY CHANGES	BY DS	DATE 08.10.2020	<p>allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone: (02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au</p>	PROPOSED MIXED USE CONCEPT PLAN STAGED DELIVERY OVER PART OF LOTS 5 & 6 DP1065111 AT WEST CULBURRA FOR SEALARK PTY LTD	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES	DRAWING NUMBER 25405-214	SHEET 1 OF 4	REVISION 01
	DATE OF PLAN: 18.02.2020												

PROPOSED MIXED USE CONCEPT PLAN - STAGED DELIVERY PLANS



- DEVELOPMENT BOUNDARY
- TEMPORARY APZ - MINIMUM 100m
- TEMPORARY TURNING HEAD (RFS/PBP COMPLIANT)
- TEMPORARY FIRE TRAIL (RFS/PBP COMPLIANT)
- DENOTES BIOFILTRATION
- DENOTES WATER QUALITY PONDS
- DENOTES PUBLIC RESERVE



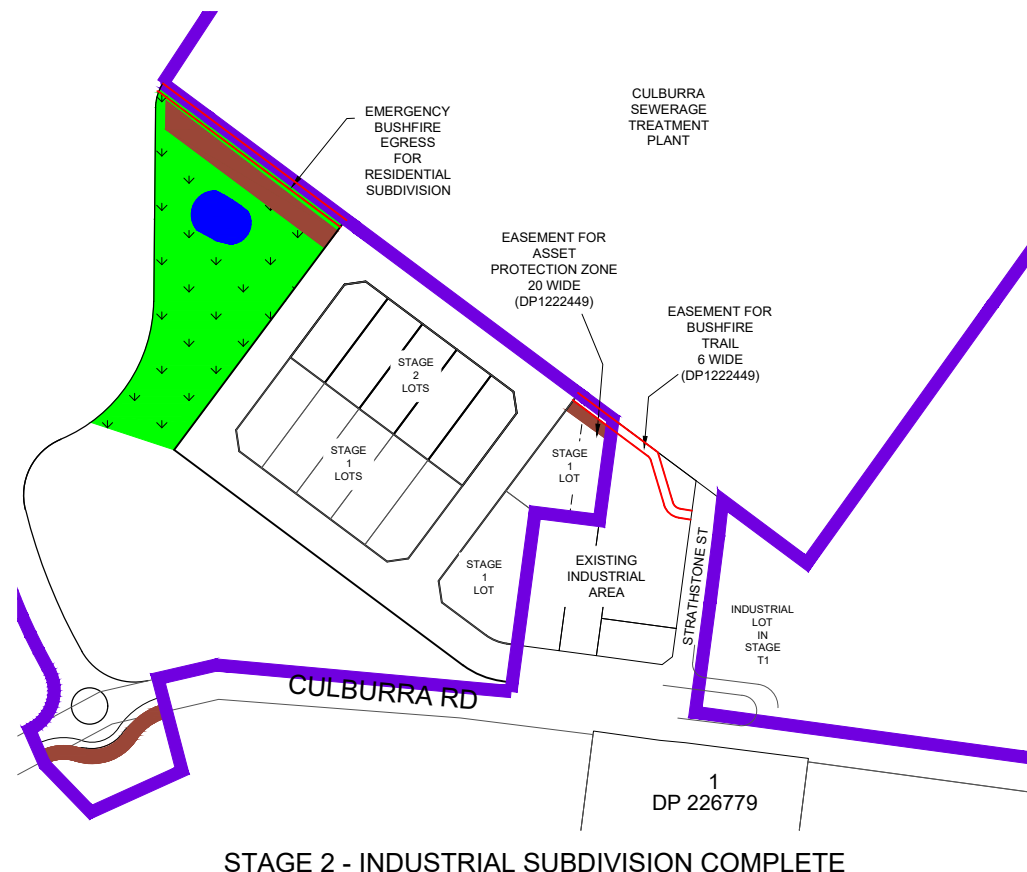
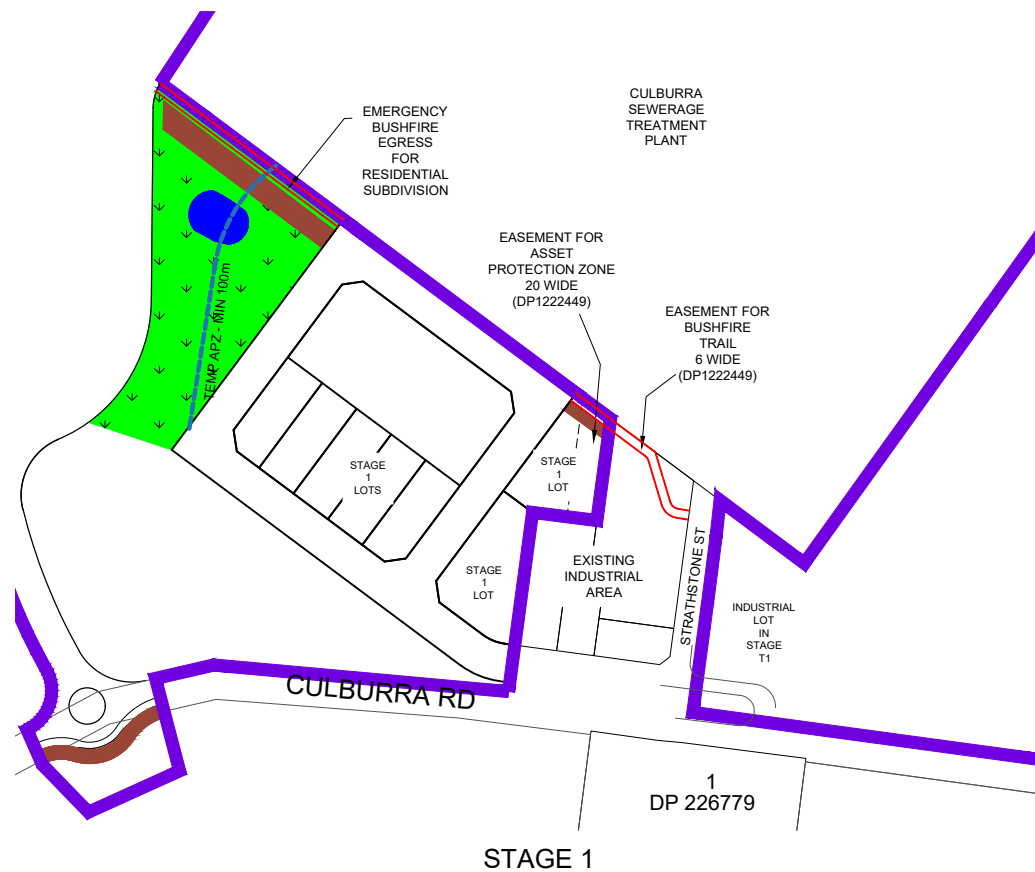
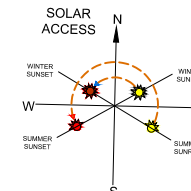
RESIDENTIAL AREA STAGE R7 - STAGE R9



RATIO: 1:5000 (AT A1 ORIGINAL) (1:10000 AT A3)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY DESIGN DRAWN CHECK'D	AERIAL PHOTOGRAPHY MP DS MP	REV 01	DESCRIPTION LAYOUT AMENDED TO ALIGN WITH WATER QUALITY CHANGES	BY DS	DATE 08.10.2020	allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone: (02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au	PROPOSED MIXED USE CONCEPT PLAN STAGED DELIVERY OVER PART OF LOTS 5 & 6 DP1065111 AT WEST CULBURRA FOR SEALARK PTY LTD	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
	DATE OF PLAN: 18.02.2020								DRAWING NUMBER 25405-215	SHEET 2 OF 4

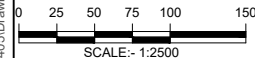
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PROPOSED MIXED USE CONCEPT PLAN - STAGED DELIVERY PLANS



- DEVELOPMENT BOUNDARY
- TEMPORARY APZ - MINIMUM 100m
- TEMPORARY TURNING HEAD (RFS/PBP COMPLIANT)
- TEMPORARY FIRE TRAIL (RFS/PBP COMPLIANT)
- DENOTES BIOFILTRATION
- DENOTES WATER QUALITY PONDS
- DENOTES PUBLIC RESERVE

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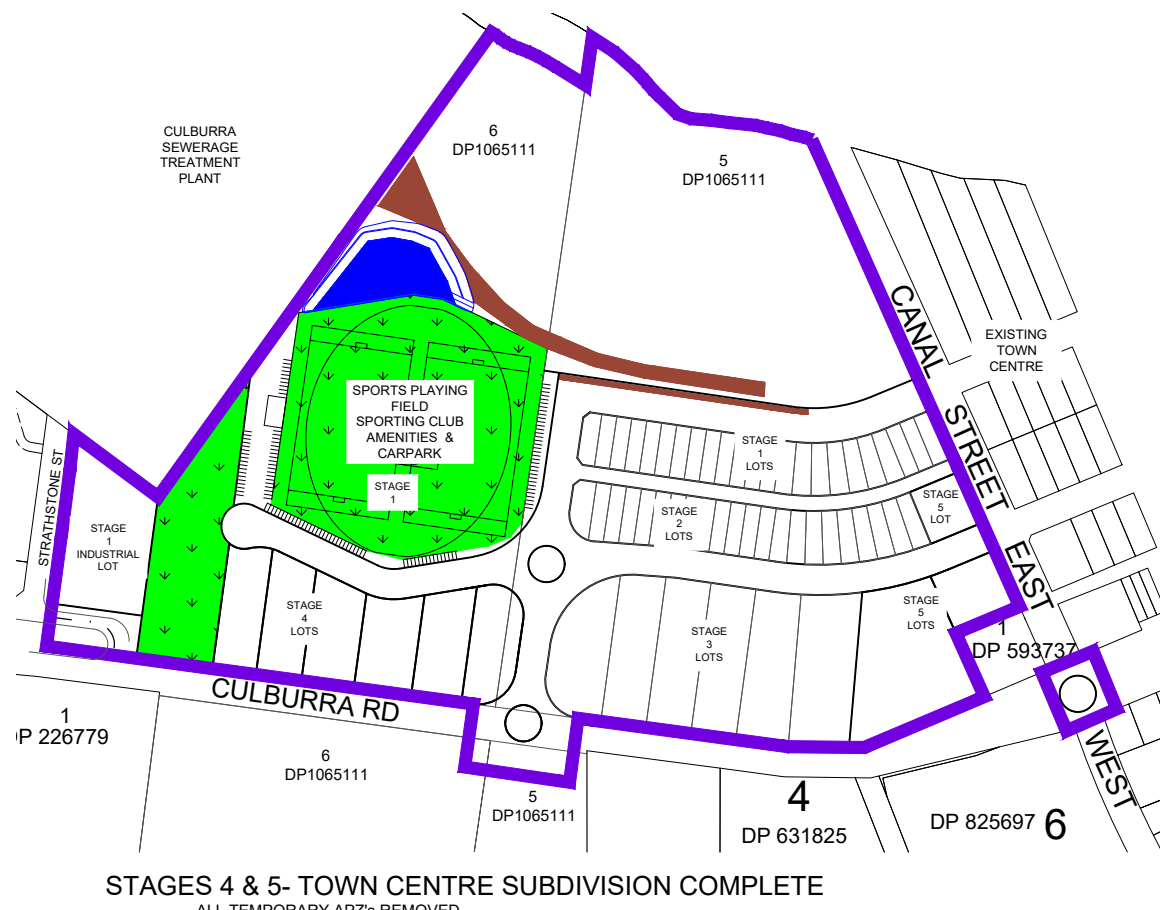
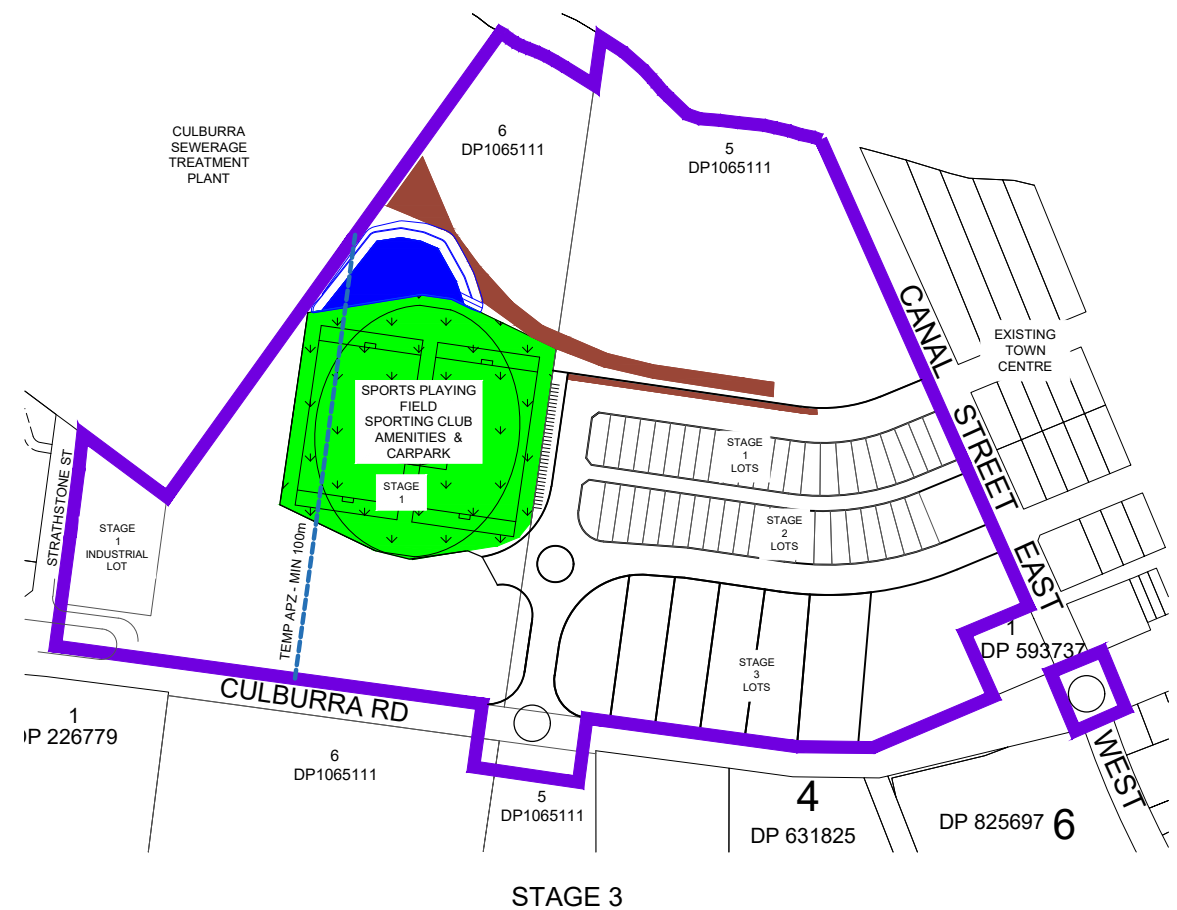
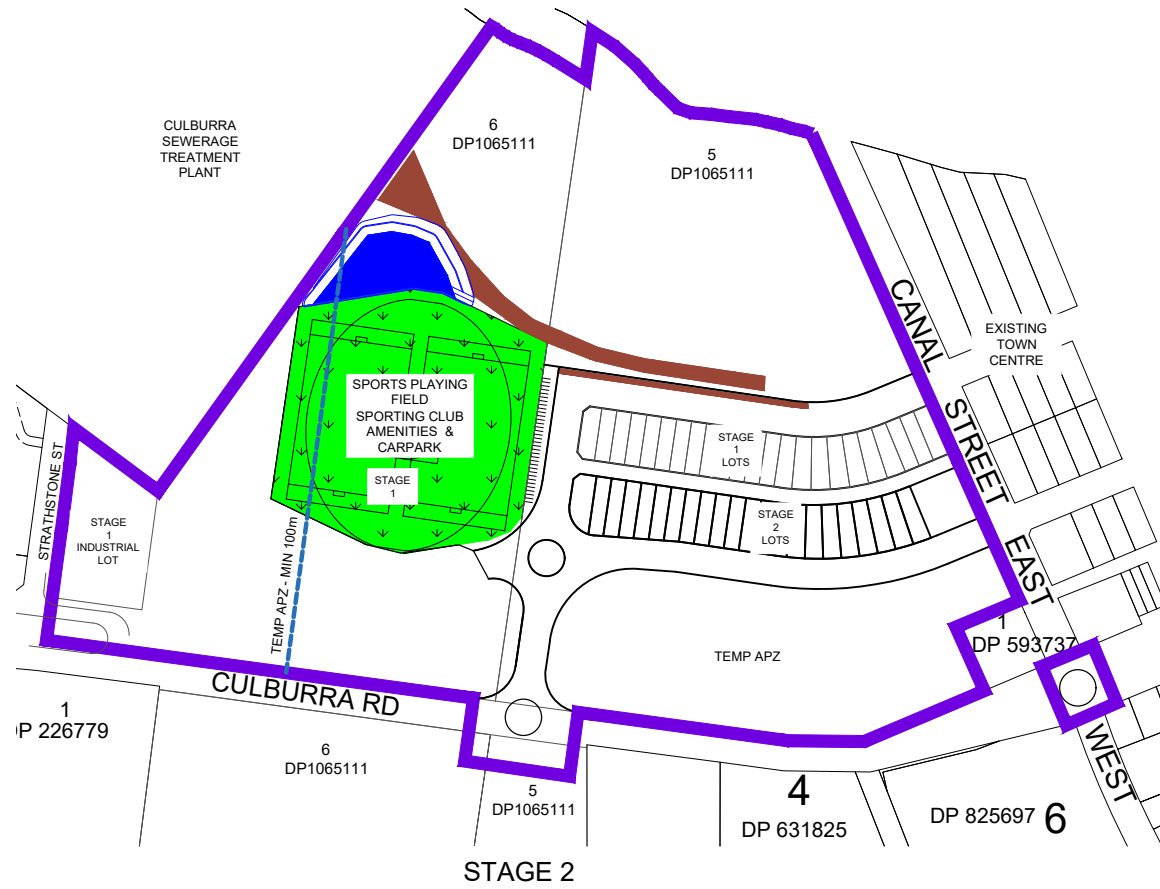
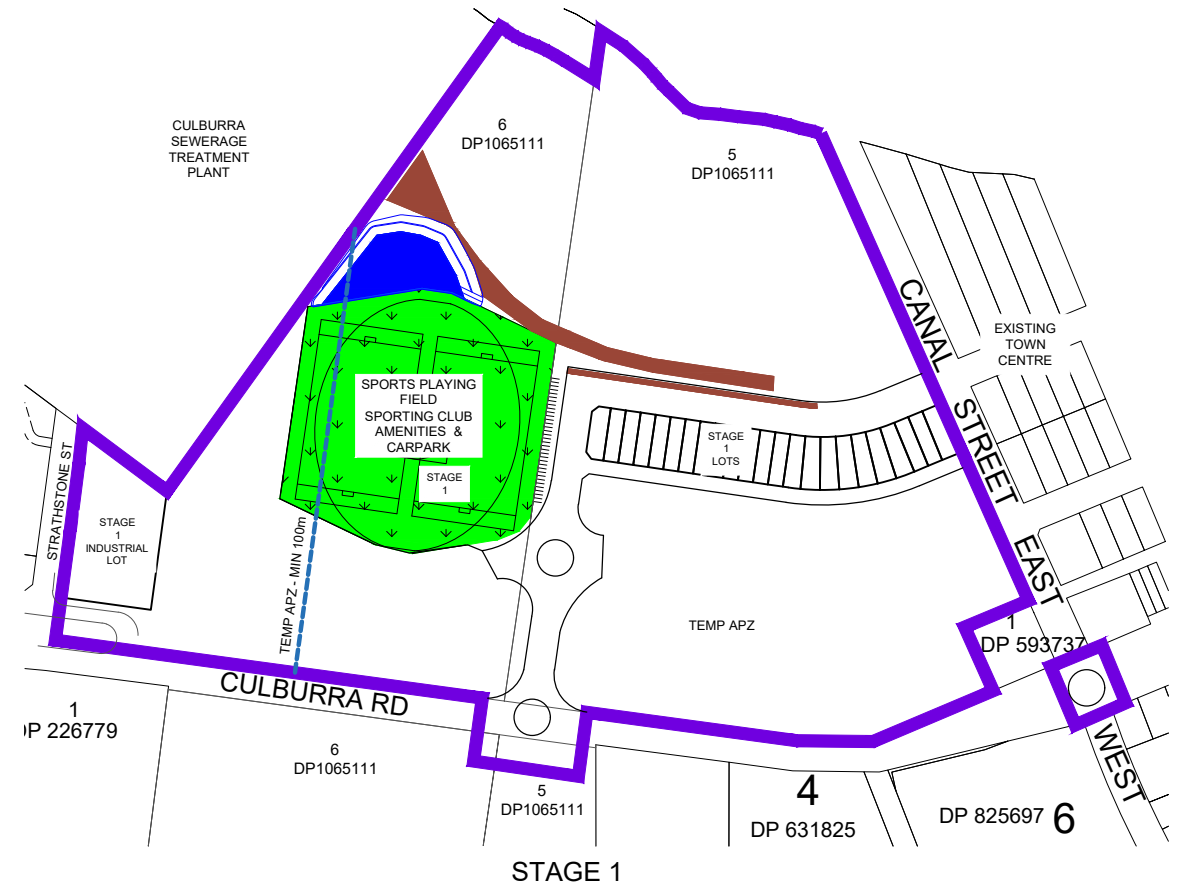
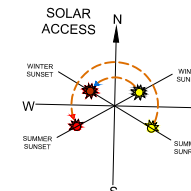


INDUSTRIAL AREA

STAGE I1 - STAGE I3

RATIO: 1:2500 (AT A1 ORIGINAL) (1:5000 AT A3)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY DESIGN DRAWN CHECK'D	AERIAL PHOTOGRAPHY MP DS MP	REV 01	DESCRIPTION LAYOUT AMENDED TO ALIGN WITH WATER QUALITY CHANGES	BY DS	DATE 08.10.2020	<p>allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone:(02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au</p>	PROPOSED MIXED USE CONCEPT PLAN STAGED DELIVERY OVER PART OF LOTS 5 & 6 DP1065111 AT WEST CULBURRA FOR SEALARK PTY LTD	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES	DRAWING NUMBER 25405-216	SHEET 3 OF 4	REVISION 01
	DATE OF PLAN: 18.02.2020												

PROPOSED MIXED USE CONCEPT PLAN - STAGED DELIVERY PLANS



- DEVELOPMENT BOUNDARY
- TEMPORARY APZ - MINIMUM 100m
- TEMPORARY TURNING HEAD (RFS/PBP COMPLIANT)
- TEMPORARY FIRE TRAIL (RFS/PBP COMPLIANT)
- DENOTES BIOFILTRATION
- DENOTES WATER QUALITY PONDS
- DENOTES PUBLIC RESERVE

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0 25 50 75 100 150
SCALE:- 1:2500

TOWN CENTRE

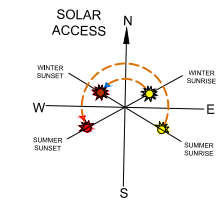
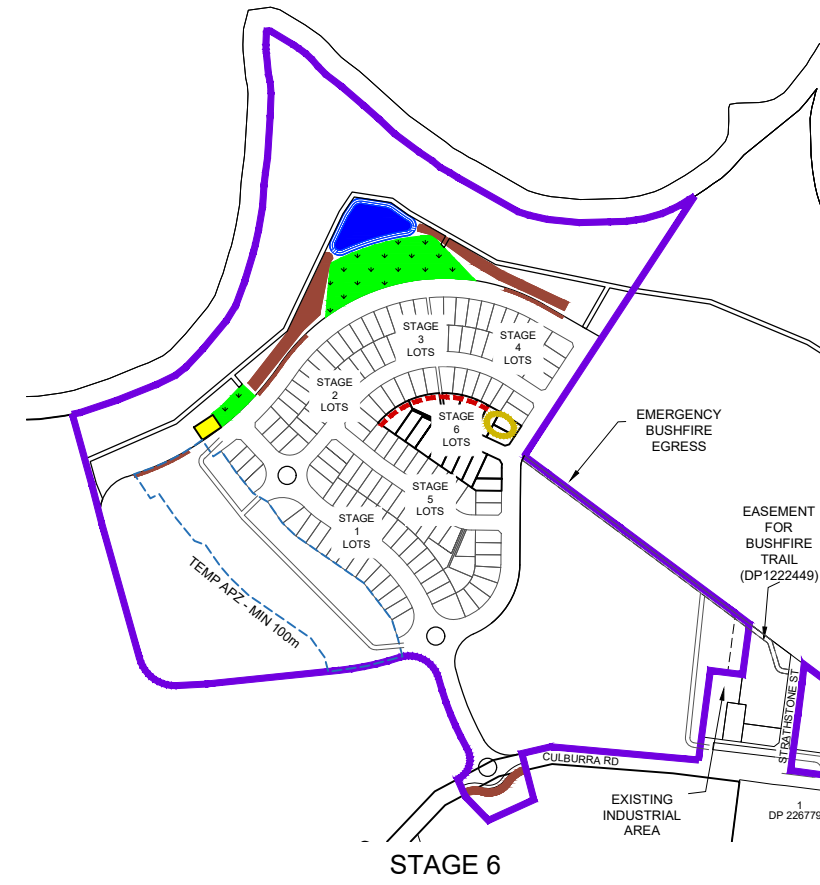
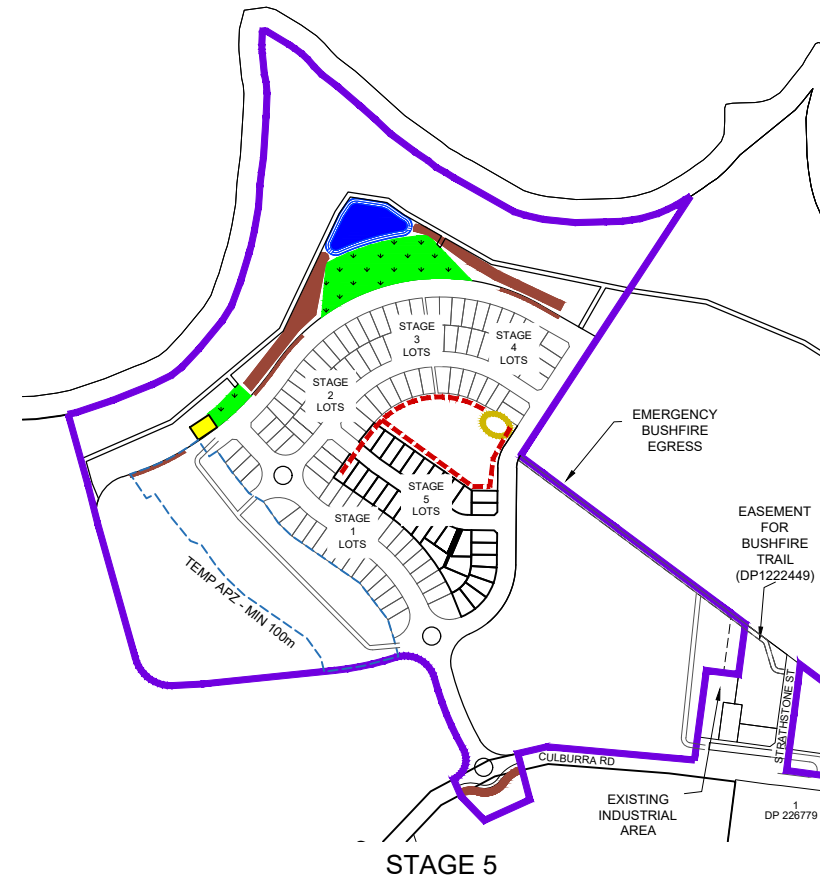
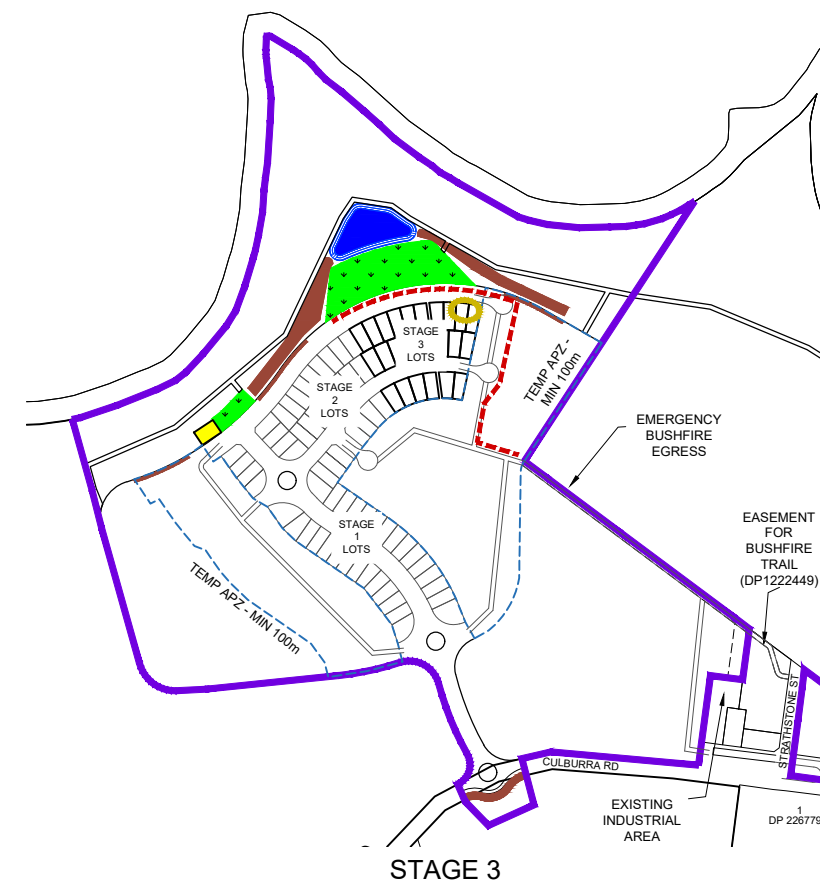
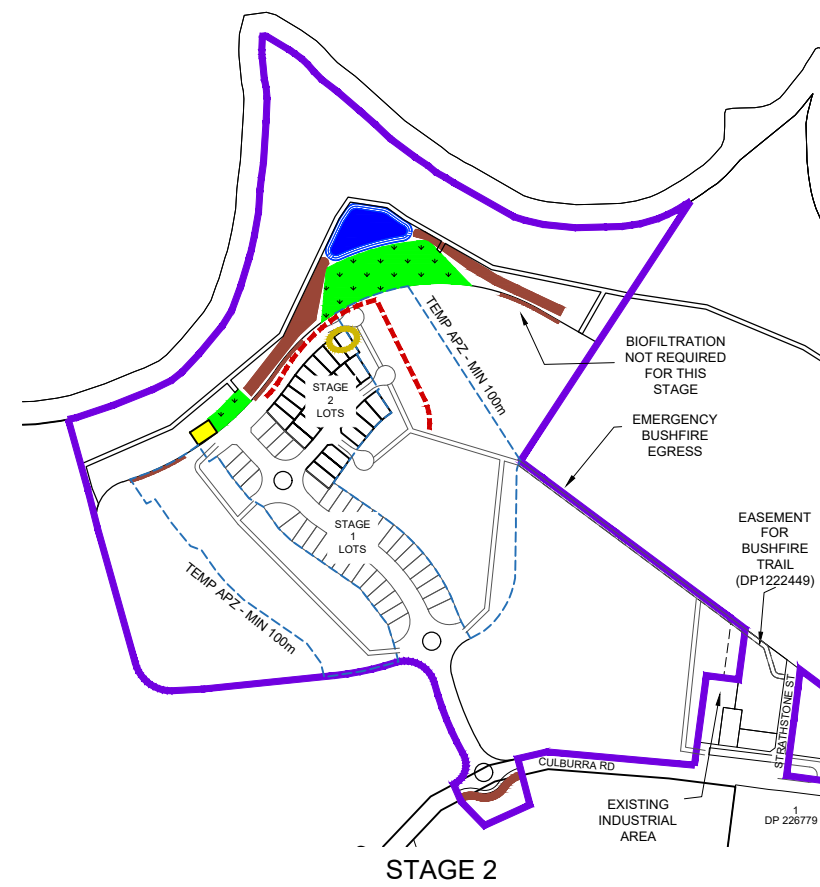
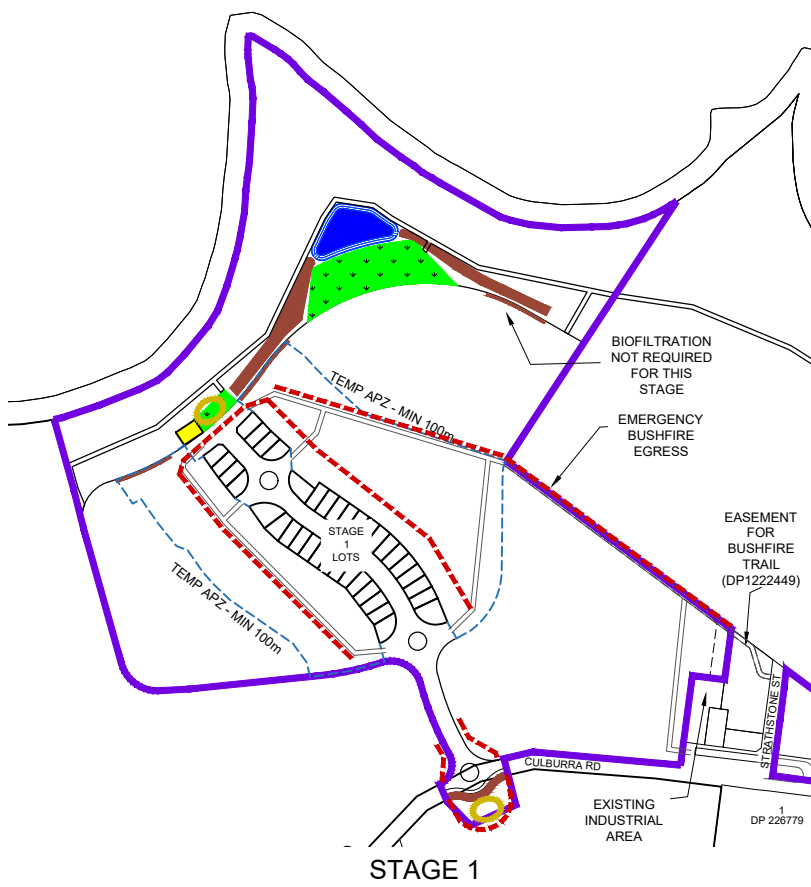
STAGE T1 - STAGE T4



RATIO: 1:2500 (AT A1 ORIGINAL) (1:5000 AT A3)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY DESIGN DRAWN CHECK'D	AERIAL PHOTOGRAPHY MP DS MP	REV 01	DESCRIPTION LAYOUT AMENDED TO ALIGN WITH WATER QUALITY CHANGES	BY DS	DATE 08.10.2020	<p>allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone:(02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au</p>	PROPOSED MIXED USE CONCEPT PLAN STAGED DELIVERY OVER PART OF LOTS 5 & 6 DP1065111 AT WEST CULBURRA FOR SEALARK PTY LTD	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
	DATE OF PLAN: 18.02.2020	DRAWING NUMBER 25405-217	SHEET 4 OF 4	REVISION 01						

27 Annexure Q: Sediment & Erosion Control Plan

PROPOSED MIXED USE CONCEPT PLAN - SEDIMENT & EROSION CONTROL STAGED DELIVERY PLANS



GENERAL NOTES

STREET DRAINAGE & ALL STORMWATER PITS TO BE PROTECTED DURING CONSTRUCTION WORKS.

TEMPORARY STOCKPILE LOCATION TO BE LOCATED WITHIN MANAGED AREA.

DETAILED UPDATED SEDIMENT & EROSION CONTROL PLAN TO BE PREPARED PRIOR TO EACH DEVELOPMENT STAGE.

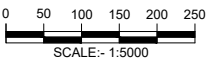
FILTER FENCING TO BE PLACED DOWNSLOPE OF TEMPORARY BUSHFIRE TRAILS.

BASIN SIZES ARE NOMINAL AND TO BE CONFIRMED AT DETAILED DESIGN STAGE.

CONFLICTS BETWEEN STORMWATER WATER QUALITY ELEMENTS AND SEDIMENT & EROSION CONTROL ARE TO BE MANAGED.

*"CLEAN" RUNOFF FROM UPSTREAM AREAS TO BE DIVERTED AROUND DISTURBED AREAS WHERE POSSIBLE.

- DEVELOPMENT BOUNDARY
- SEDIMENT FENCING
- TEMPORARY SEDIMENT POND
- TEMPORARY APZ - MINIMUM 100m
- TEMP. TURNING HEAD (RFS/PBP COMPLIANT)
- TEMP. FIRE TRAIL (RFS/PBP COMPLIANT)
- DENOTES BIOFILTRATION
- DENOTES WATER QUALITY PONDS
- DENOTES PUBLIC RESERVE

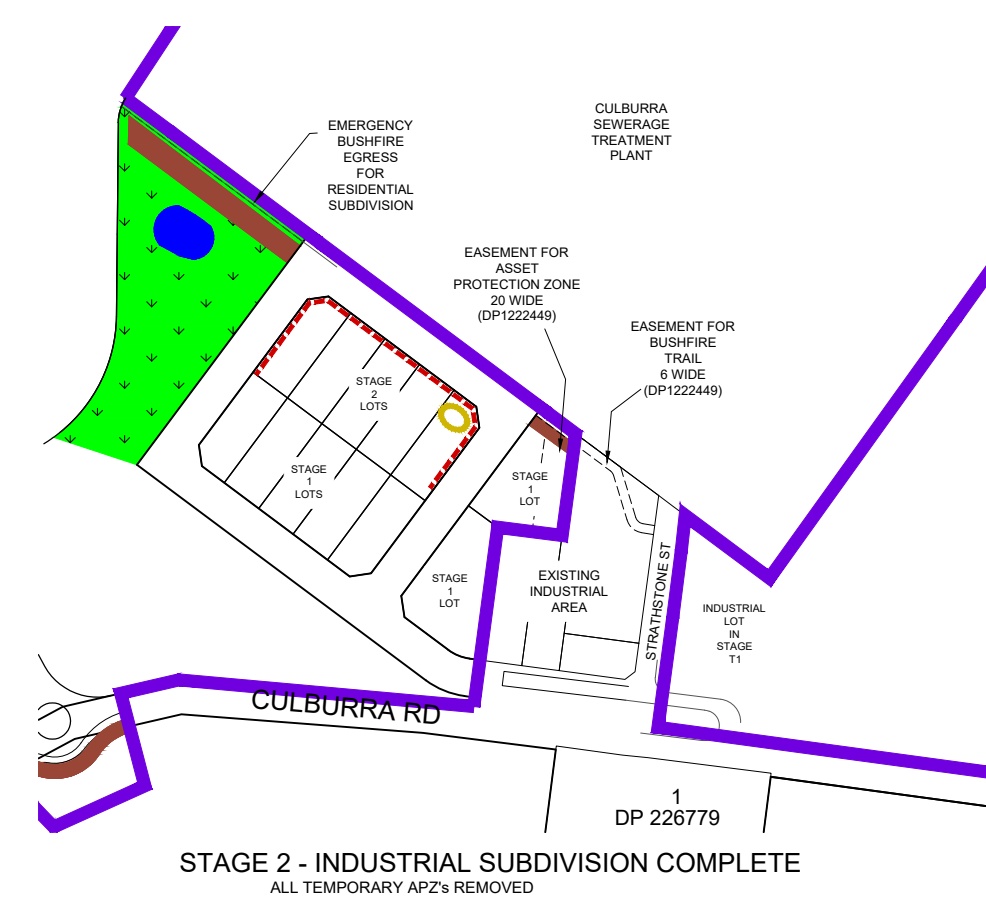
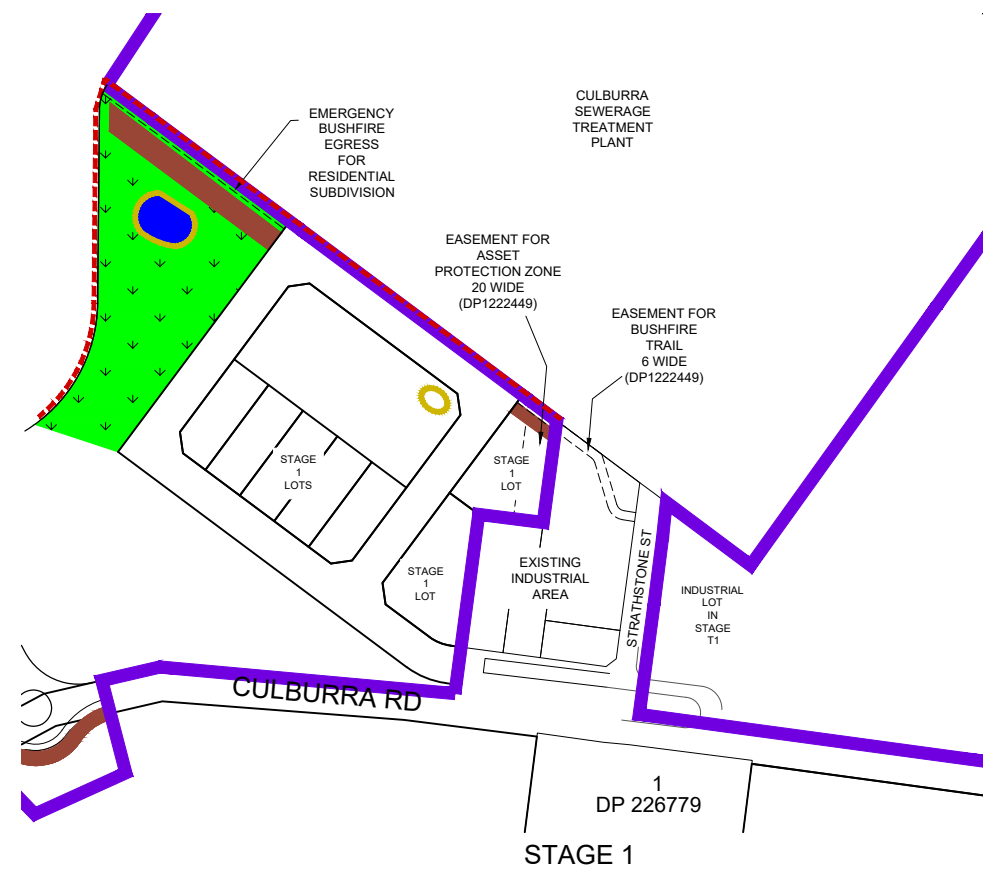
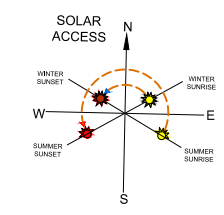


RESIDENTIAL AREA STAGE R1 - STAGE R6

RATIO: 1:5000 (AT A1 ORIGINAL) (1:10,000 AT A3)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY DESIGN	AERIAL PHOTOGRAPHY MP	REV 01	DESCRIPTION LAYOUT AMENDED TO ALIGN WITH WATER QUALITY CHANGES	BY DS	DATE 03.11.2020	<p>allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone:(02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au</p>	<p>PROPOSED MIXED USE CONCEPT PLAN SEDIMENT & EROSION CONTROL STAGED DELIVERY OVER PART OF LOTS 5 & 6 DP1065111 AT WEST CULBURRA FOR SEALARK PTY LTD</p>	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
	ORIGIN: SSM RL	DRAWN DS	CHECK'D MP	DATE OF PLAN: 26.03.2020	DRAWING NUMBER 25405-223	SHEET 1 OF 4	REVISION 01			

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PROPOSED MIXED USE CONCEPT PLAN - SEDIMENT & EROSION CONTROL STAGED DELIVERY PLANS



GENERAL NOTES

STREET DRAINAGE & ALL STORMWATER PITS TO BE PROTECTED DURING CONSTRUCTION WORKS.

TEMPORARY STOCKPILE LOCATION TO BE LOCATED WITHIN MANAGED AREA.

DETAILED UPDATED SEDIMENT & EROSION CONTROL PLAN TO BE PREPARED PRIOR TO EACH DEVELOPMENT STAGE.

FILTER FENCING TO BE PLACED DOWNSLOPE OF TEMPORARY BUSHFIRE TRAILS.

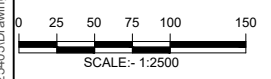
BASIN SIZES ARE NOMINAL AND TO BE CONFIRMED AT DETAILED DESIGN STAGE.

CONFLICTS BETWEEN STORMWATER WATER QUALITY ELEMENTS AND SEDIMENT & EROSION CONTROL ARE TO BE MANAGED.

"CLEAN" RUNOFF FROM UPSTREAM AREAS TO BE DIVERTED AROUND DISTURBED AREAS WHERE POSSIBLE.

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- TEMPORARY SEDIMENT POND
- TEMPORARY APZ - MINIMUM 100m
- TEMP. TURNING HEAD (RFS/PBP COMPLIANT)
- TEMP. FIRE TRAIL (RFS/PBP COMPLIANT)
- DENOTES BIOFILTRATION
- DENOTES WATER QUALITY PONDS
- DENOTES PUBLIC RESERVE

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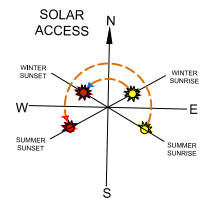
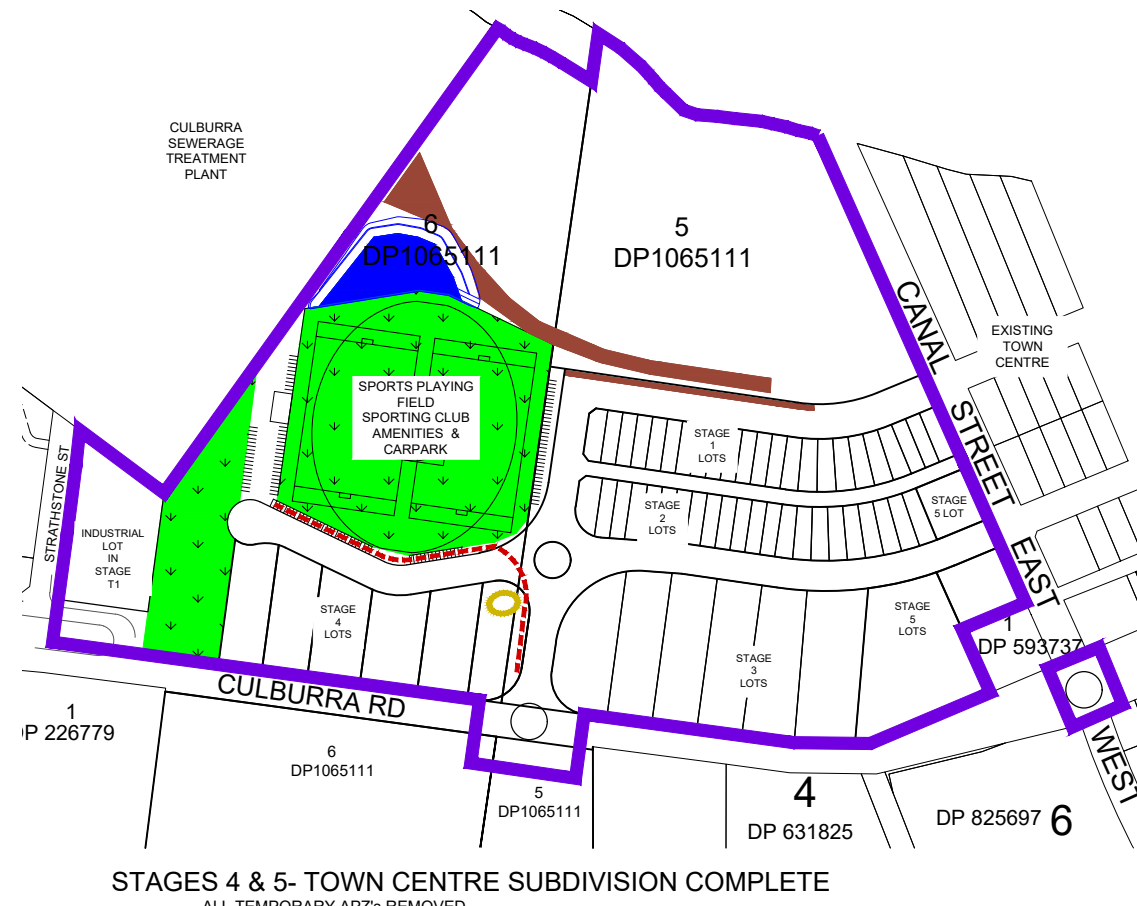
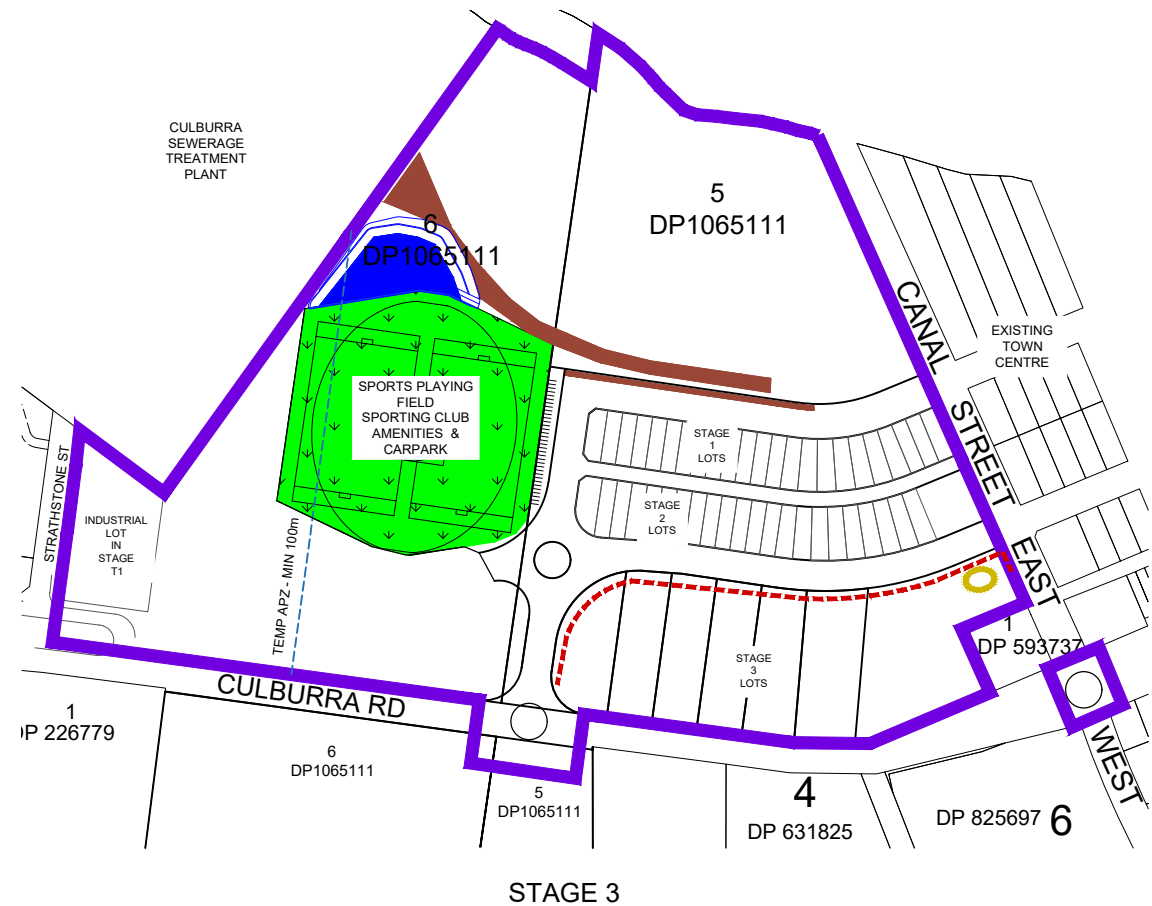
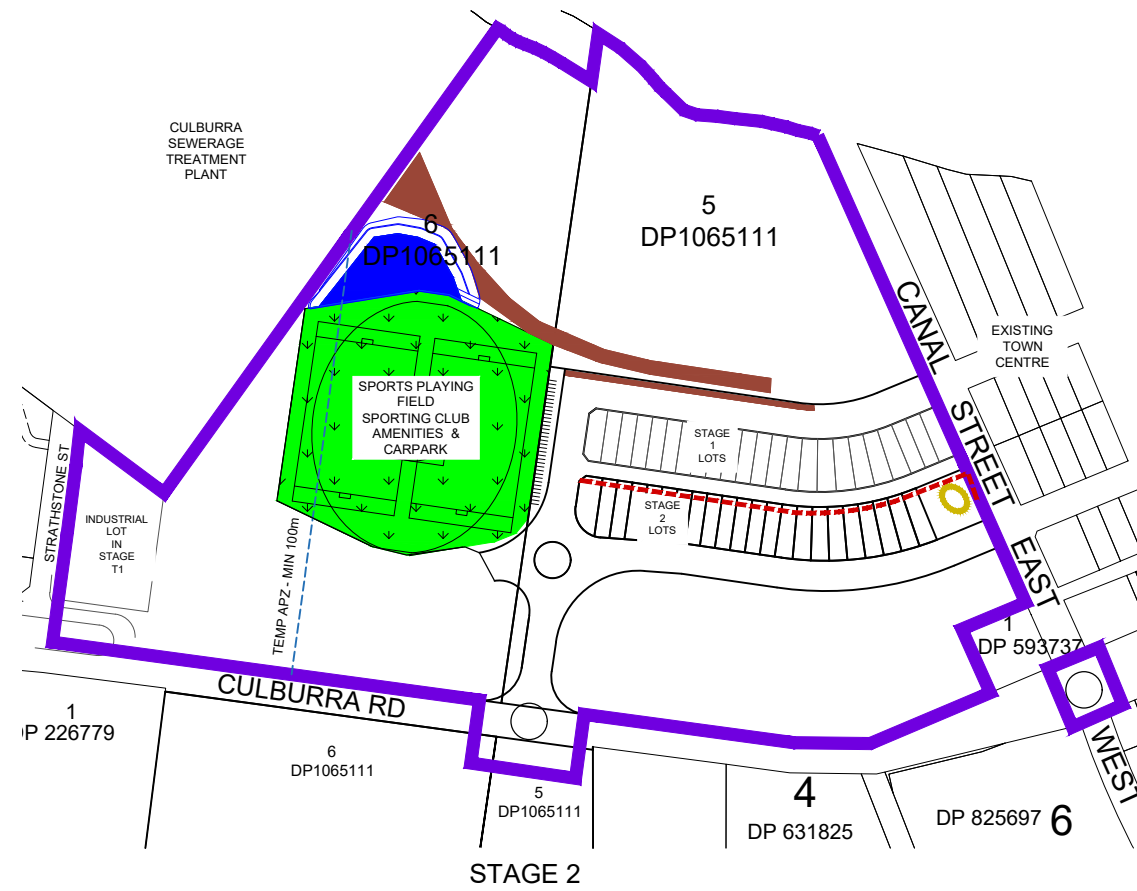
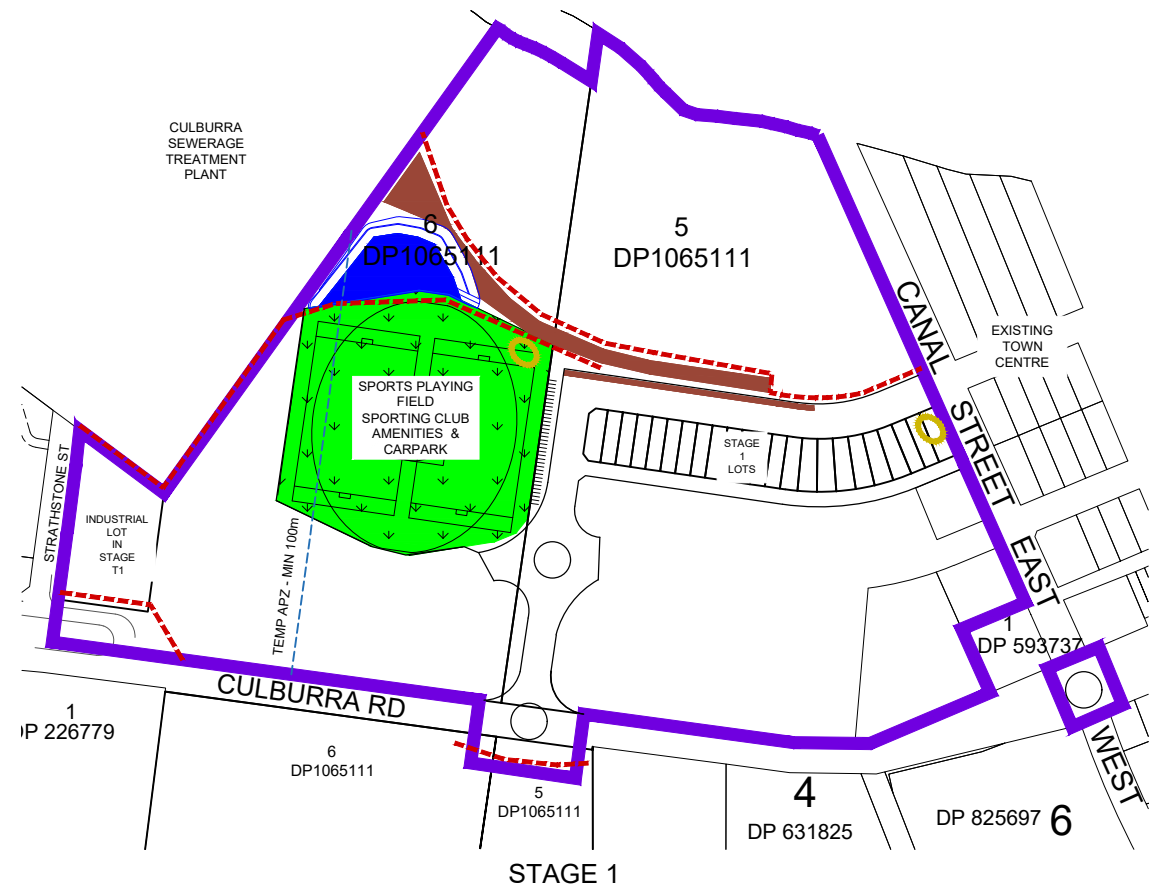
INDUSTRIAL AREA

STAGE I1 - STAGE I3



RATIO: 1:2500 (AT A1 ORIGINAL) (1:5000 AT A3)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY DESIGN DRAWN CHECK'D	AERIAL PHOTOGRAPHY MP DS MP	REV 01	DESCRIPTION LAYOUT AMENDED TO ALIGN WITH WATER QUALITY CHANGES	BY DS	DATE 03.11.2020	 allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone:(02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au	PROPOSED MIXED USE CONCEPT PLAN SEDIMENT & EROSION CONTROL STAGED DELIVERY OVER PART OF LOTS 5 & 6 DP1065111 AT WEST CULBURRA FOR SEALARK PTY LTD	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
	DATE OF PLAN: 26.03.2020								DRAWING NUMBER 25405-225	SHEET 3 OF 4

PROPOSED MIXED USE CONCEPT PLAN - SEDIMENT & EROSION CONTROL STAGED DELIVERY PLANS

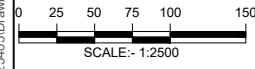


- GENERAL NOTES**
- STREET DRAINAGE & ALL STORMWATER PITS TO BE PROTECTED DURING CONSTRUCTION WORKS.
 - TEMPORARY STOCKPILE LOCATION TO BE LOCATED WITHIN MANAGED AREA.
 - DETAILED UPDATED SEDIMENT & EROSION CONTROL PLAN TO BE PREPARED PRIOR TO EACH DEVELOPMENT STAGE.
 - FILTER FENCING TO BE PLACED DOWNSLOPE OF TEMPORARY BUSHFIRE TRAILS.
 - BASIN SIZES ARE NOMINAL AND TO BE CONFIRMED AT DETAILED DESIGN STAGE.
 - CONFLICTS BETWEEN STORMWATER WATER QUALITY ELEMENTS AND SEDIMENT & EROSION CONTROL ARE TO BE MANAGED.
 - "CLEAN" RUNOFF FROM UPSTREAM AREAS TO BE DIVERTED AROUND DISTURBED AREAS WHERE POSSIBLE.

- DEVELOPMENT BOUNDARY
- SEDIMENT FENCING
- TEMPORARY SEDIMENT POND
- TEMPORARY APZ - MINIMUM 100m
- TEMP. TURNING HEAD (RFS/PBP COMPLIANT)
- TEMP. FIRE TRAIL (RFS/PBP COMPLIANT)
- DENOTES BIOFILTRATION
- DENOTES WATER QUALITY PONDS
- DENOTES PUBLIC RESERVE



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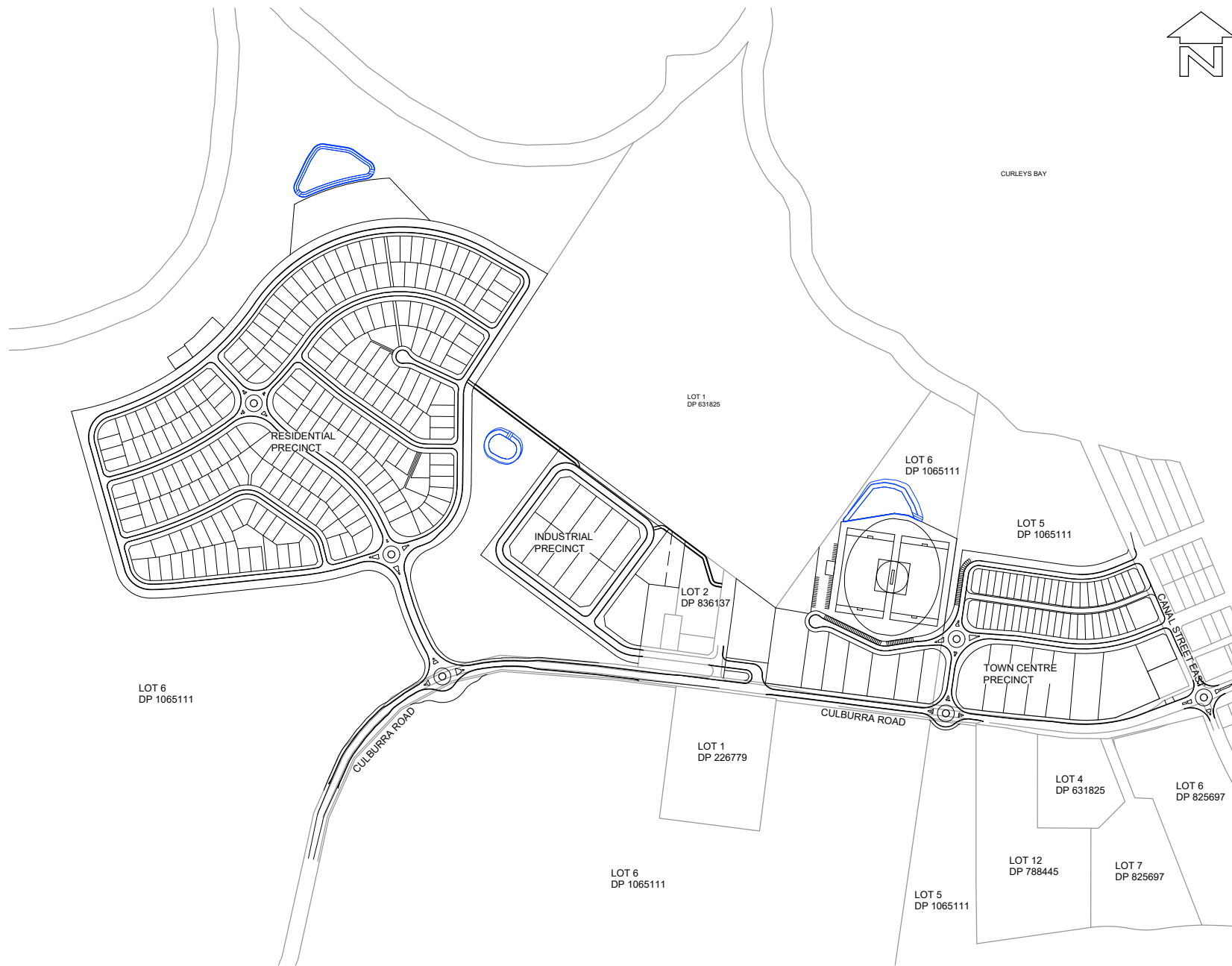
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	DATE OF PLAN: 26.03.2020											OF 4	

TOWN CENTRE

STAGE T1 - STAGE T4

28 Annexure R: Engineering Plans

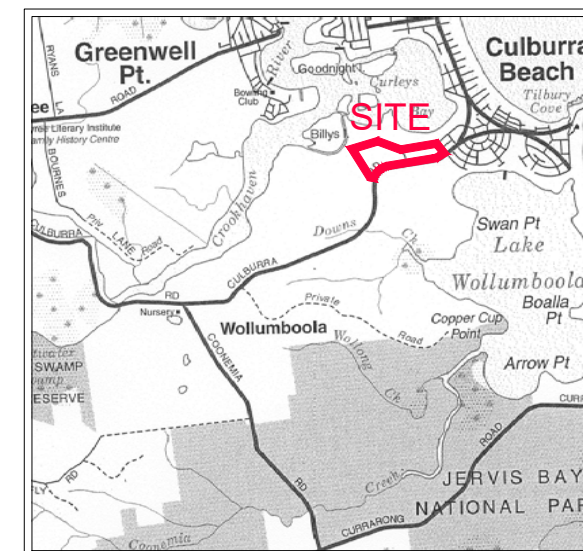
PRELIMINARY ENGINEERING DRAWINGS FOR PROPOSED MIXED-USE SUBDIVISION AT WEST CULBURRA



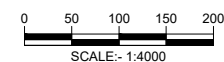
SITE LAYOUT PLAN
SCALE 1:4000

DRAWING SCHEDULE

25405-100	COVER SHEET AND INDEX PLAN
25405-101	PRELIMINARY RESIDENTIAL PRECINCT LAYOUT PLAN
25405-102	PRELIMINARY INDUSTRIAL PRECINCT LAYOUT PLAN
25405-103	PRELIMINARY TOWN CENTRE PRECINCT LAYOUT PLAN
25405-104	PRELIMINARY OVERALL CONCEPT ROUNDABOUT 01 DESIGN
25405-105	PRELIMINARY CONCEPT ROUNDABOUT 01 DESIGN
25405-106	ROUNDABOUT 01 VEHICLE MOVEMENT LAYOUT PLAN SHEET 01
25405-107	ROUNDABOUT 01 VEHICLE MOVEMENT LAYOUT PLAN SHEET 02
25405-108	PRELIMINARY ROUNDABOUT 01 SIGHT LINE LAYOUT PLAN
25405-109	PRELIMINARY CONCEPT INDUSTRIAL ENTRY AND EXIT LAYOUT PLAN
25405-110	PRELIMINARY CONCEPT INDUSTRIAL ENTRY AND EXIT VEHICLE MOVEMENTS AND SIGHT DISTANCE LAYOUT PLAN
25405-111	PRELIMINARY CONCEPT ROUNDABOUT 02 LAYOUT PLAN
25405-112	PRELIMINARY CONCEPT ROUNDABOUT 02 DESIGN
25405-113	ROUNDABOUT 02 VEHICLE MOVEMENT LAYOUT PLAN
25405-114	PRELIMINARY ROUNDABOUT 02 SIGHT LINE LAYOUT PLAN
25405-115	PRELIMINARY CONCEPT ROUNDABOUT 03 LAYOUT PLAN
25405-116	PRELIMINARY CONCEPT ROUNDABOUT 03 DESIGN
25405-117	ROUNDABOUT 03 VEHICLE MOVEMENT LAYOUT PLAN SHEET 01
25405-118	ROUNDABOUT 03 VEHICLE MOVEMENT LAYOUT PLAN SHEET 02
25405-119	PRELIMINARY ROUNDABOUT 03 SIGHT LINE LAYOUT PLAN
25405-120	PRELIMINARY TYPICAL ROAD CROSS SECTIONS PLAN SHEET 01
25405-121	PRELIMINARY TYPICAL ROAD CROSS SECTIONS PLAN SHEET 02
25405-122	PRELIMINARY TYPICAL ROAD CROSS SECTIONS PLAN SHEET 03
25405-123	PRELIMINARY TYPICAL ROAD CROSS SECTIONS PLAN SHEET 04
25405-124	PRELIMINARY TYPICAL ROAD CROSS SECTIONS PLAN SHEET 05
25405-125	WESTERN POND CONCEPT LAYOUT PLAN
25405-126	CENTRAL POND CONCEPT LAYOUT PLAN
25405-127	EASTERN POND CONCEPT LAYOUT PLAN
25405-128	TYPICAL WESTERN AND EASTERN POND CROSS SECTIONS PLAN



LOCALITY PLAN
MAP DRAWN & PUBLISHED BY
CARTODRAFT AUST P/L



PROFESSIONAL
STANDARDS SCHEME
Liability limited by a scheme
approved under Professional
Standards Legislation

BEWARE!

THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.

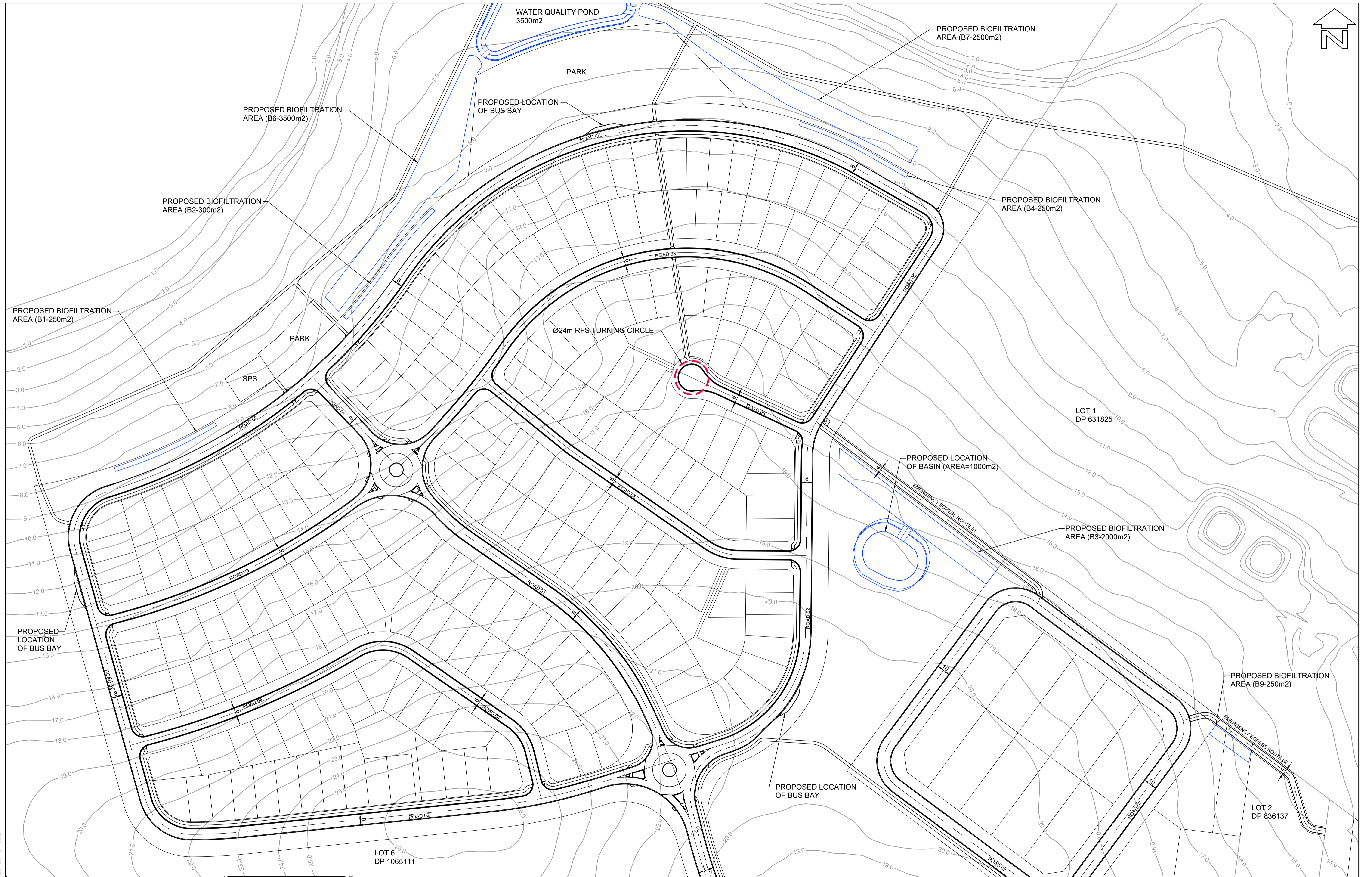


RATIO:	DATUM:	SURVEY	APS	REV	DESCRIPTION	BY	DATE
1:4000 (AT A1 ORIGINAL)	AUSTRALIAN HEIGHT DATUM ORIGIN: SSM RL DATE OF PLAN: MARCH 2020	DESIGN DRAWN CHECK'D	CJG CJG MJP	=			

aps allen price & scarratts pty ltd
land and development consultants
Nowra Office: 75 Plunkett Street, Nowra NSW 2541
Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533
phone: (02) 4421 6544
consultants@allenprice.com.au www.allenprice.com.au


COVER SHEET AND INDEX PLAN
OVER CULBURRA ROAD
AT CULBURRA BEACH
FOR SEALARK PTY LTD

DRAWING STATUS	PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
DRAWING NUMBER	25405-100
SHEET	1
REVISION	P6
OF	29



BEWARE!

THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.



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0 10 20 30 40 50
SCALE: 1:1250

PROFESSIONAL STANDARDS SCHEME
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RATIO:
1:1250
(AT A1 ORIGINAL)

DATUM:
AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM
RL
DATE OF PLAN: MARCH 2020

SURVEY	APS	REV	DESCRIPTION	BY	DATE
DESIGN	C/JG				
DRAWN	C/JG				
CHECK'D	MJP				

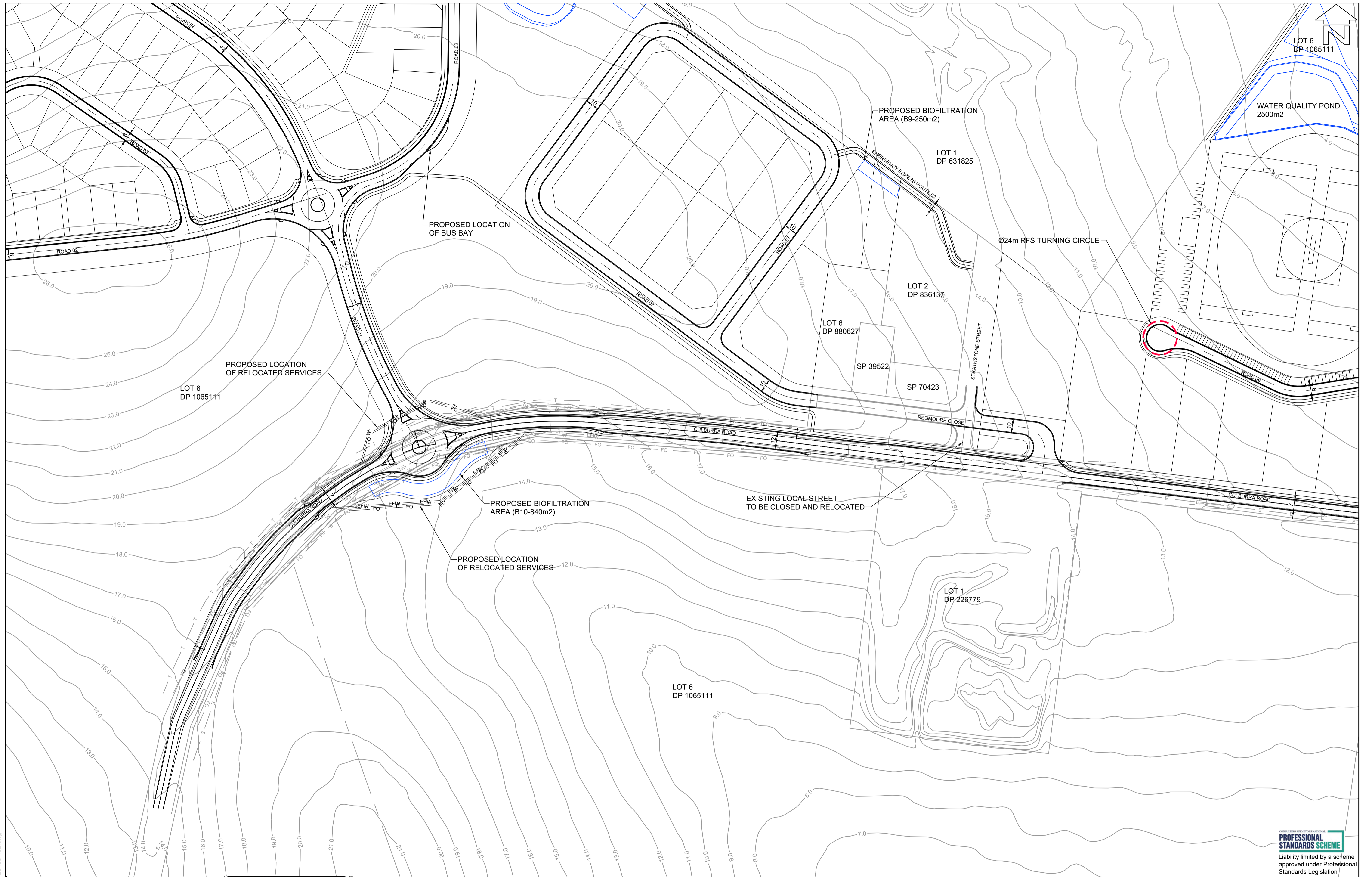
aps allen price & scarratts pty ltd
land and development consultants
Nowra Office: 75 Plunkett Street, Nowra NSW 2541
Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533
phone: (02) 4421 6544
consultants@allenprice.com.au www.allenprice.com.au

PRELIMINARY RESIDENTIAL PRECINCT LAYOUT PLAN
OVER CULBURRA ROAD
AT CULBURRA BEACH
FOR SEALARK PTY LTD

DRAWING STATUS
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER
25405-101

SHEET **2** REVISION
OF **29** P1



BEWARE!
 THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.



PROFESSIONAL STANDARDS SCHEME
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RATIO:
1:1250
 (AT A1 ORIGINAL)

DATUM:
 AUSTRALIAN HEIGHT DATUM
 ORIGIN: SSM
 RL
 DATE OF PLAN: MARCH 2020

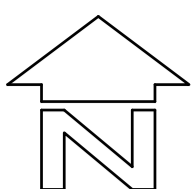
SURVEY	APS	REV	DESCRIPTION	BY	DATE
DESIGN	CJG				
DRAWN	CJG				
CHECK'D	MJP				

aps allen price & scarratts pty ltd
 land and development consultants
 Nowra Office: 75 Plunkett Street, Nowra NSW 2541
 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533
 phone: (02) 4421 6544
 consultants@allenprice.com.au www.allenprice.com.au

PRELIMINARY INDUSTRIAL PRECINCT LAYOUT PLAN
OVER CULBURRA ROAD AT CULBURRA BEACH FOR SEALARK PTY LTD

DRAWING STATUS: **PRELIMINARY**
 NOT TO BE USED FOR CONSTRUCTION PURPOSES
 DRAWING NUMBER: **25405-102**
 SHEET **3** OF **29** REVISION **P1**

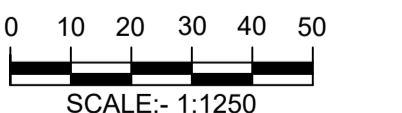
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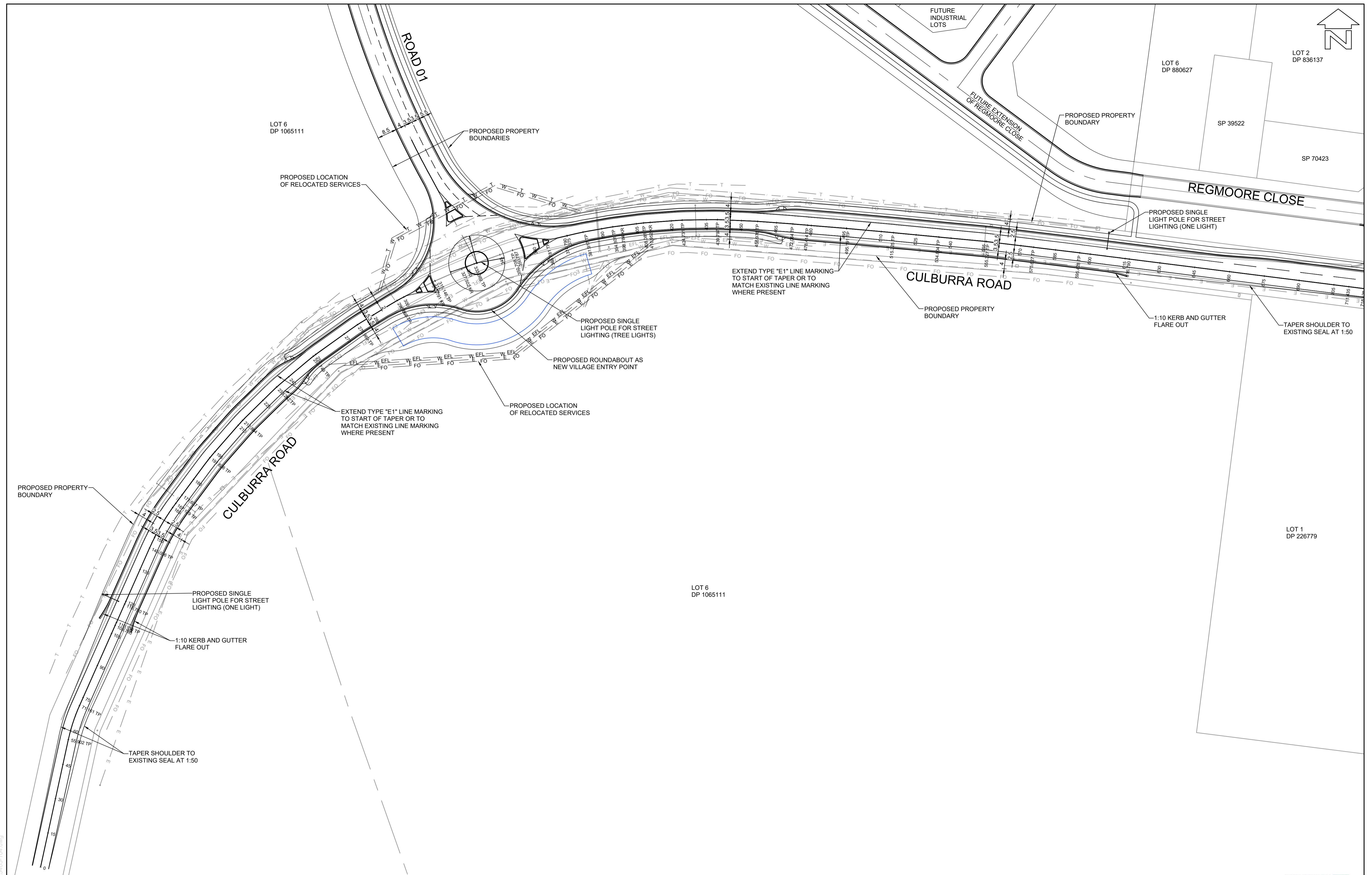
BEWARE!
 THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.



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RATIO: 1:1250 (AT A1 ORIGINAL)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY DESIGN DRAWN CHECK'D	APS CJG CJG MJP	REV =	DESCRIPTION	BY	DATE	 allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone:(02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au	PRELIMINARY TOWN CENTRE PRECINCT LAYOUT PLAN OVER CULBURRA ROAD AT CULBURRA BEACH FOR SEALARK PTY LTD	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
	DATE OF PLAN: MARCH 2020									DRAWING NUMBER 25405-103



LAYOUT PLAN
SCALE 1:750

CONSULTING ENGINEERS NATIONAL
PROFESSIONAL STANDARDS SCHEME
Liability limited by a scheme approved under Professional Standards Legislation

0 5 10 15 20 25
SCALE:- 1:750

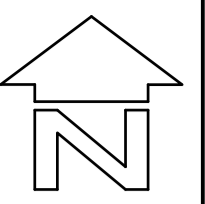
BEWARE!

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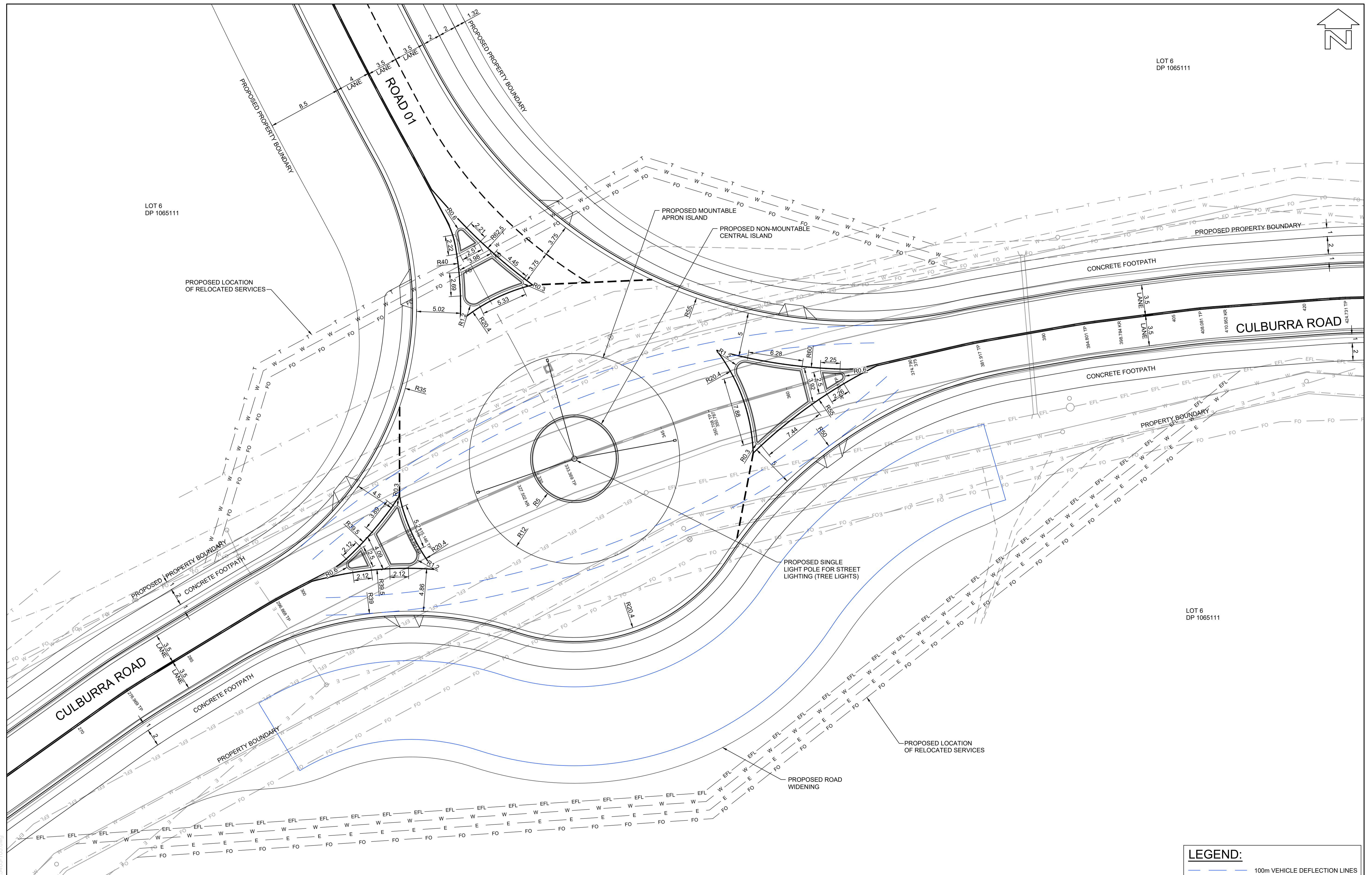
RATIO: 1:750 (AT A1 ORIGINAL)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY	APS	REV	DESCRIPTION	BY	DATE	allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone:(02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au	PRELIMINARY OVERALL CONCEPT ROUNDABOUT 01 DESIGN OVER CULBURRA ROAD AT CULBURRA BEACH FOR SEALARK PTY LTD	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
	ORIGIN: SSM RL	DESIGN CJG	DRAWN CJG	CHECK'D MJP						DRAWING NUMBER 25405-104
	DATE OF PLAN: MARCH 2020									

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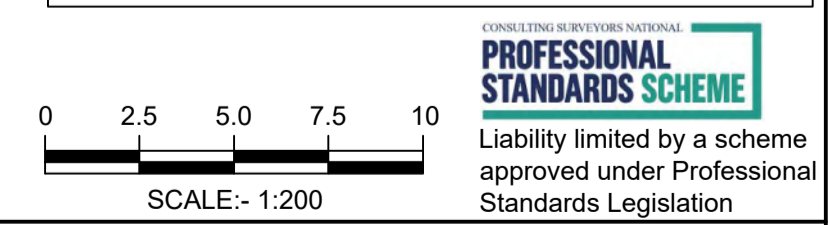


LOT 6
DP 1065111

LOT 6
DP 1065111



LEGEND:
 100m VEHICLE DEFLECTION LINES

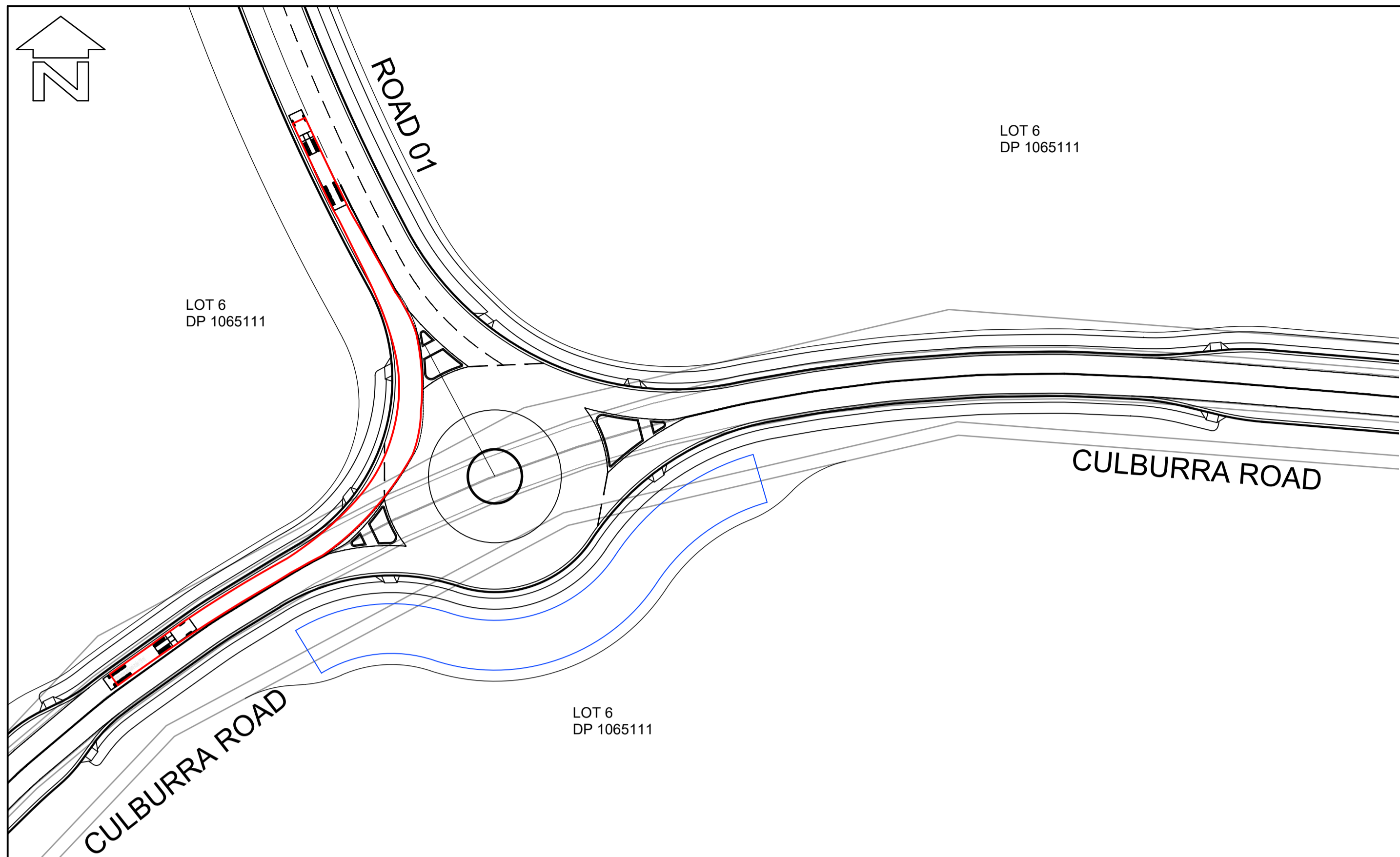


BEWARE!
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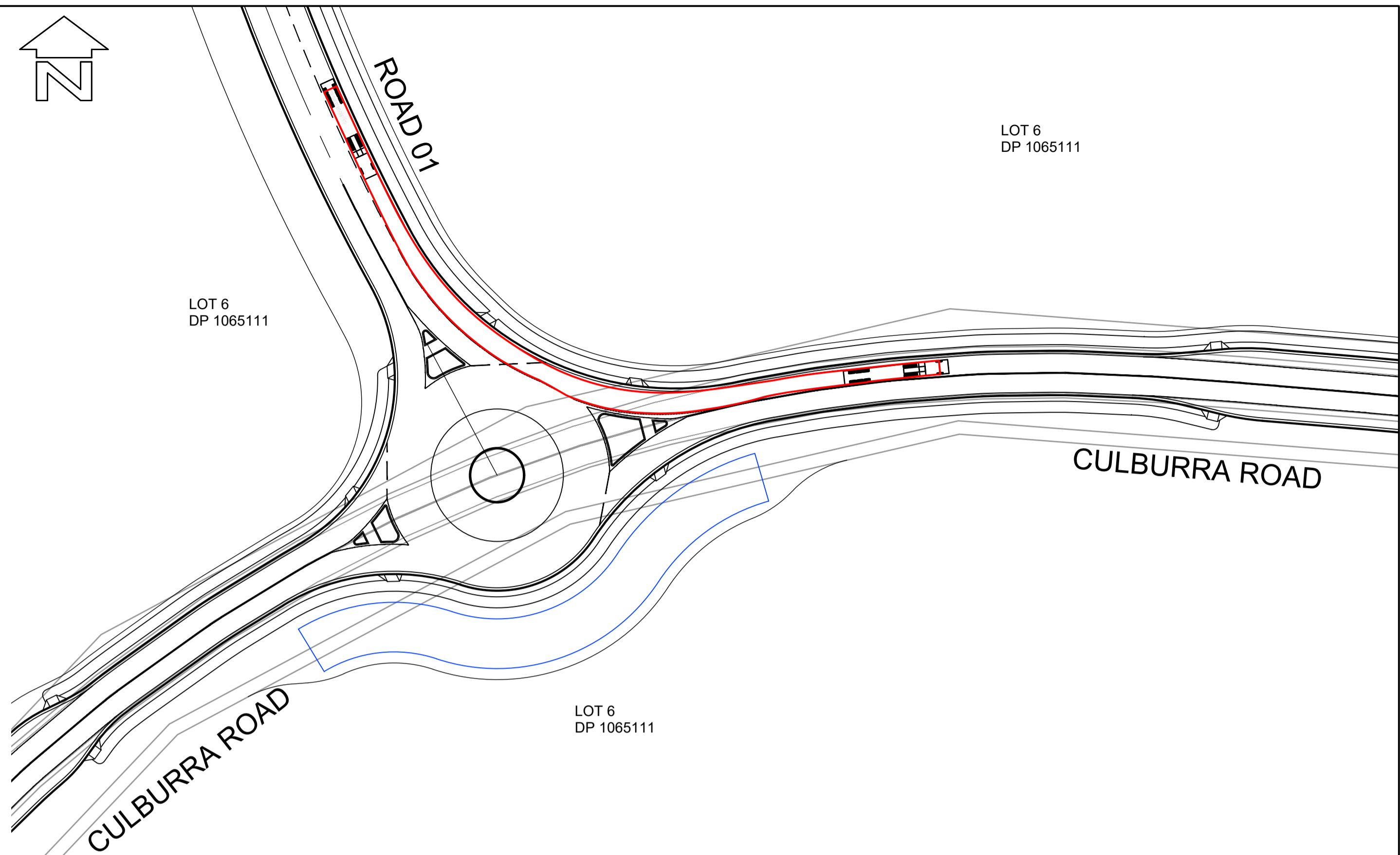
DIAL BEFORE YOU DIG
 www.1100.com.au

LAYOUT PLAN
 SCALE 1:200

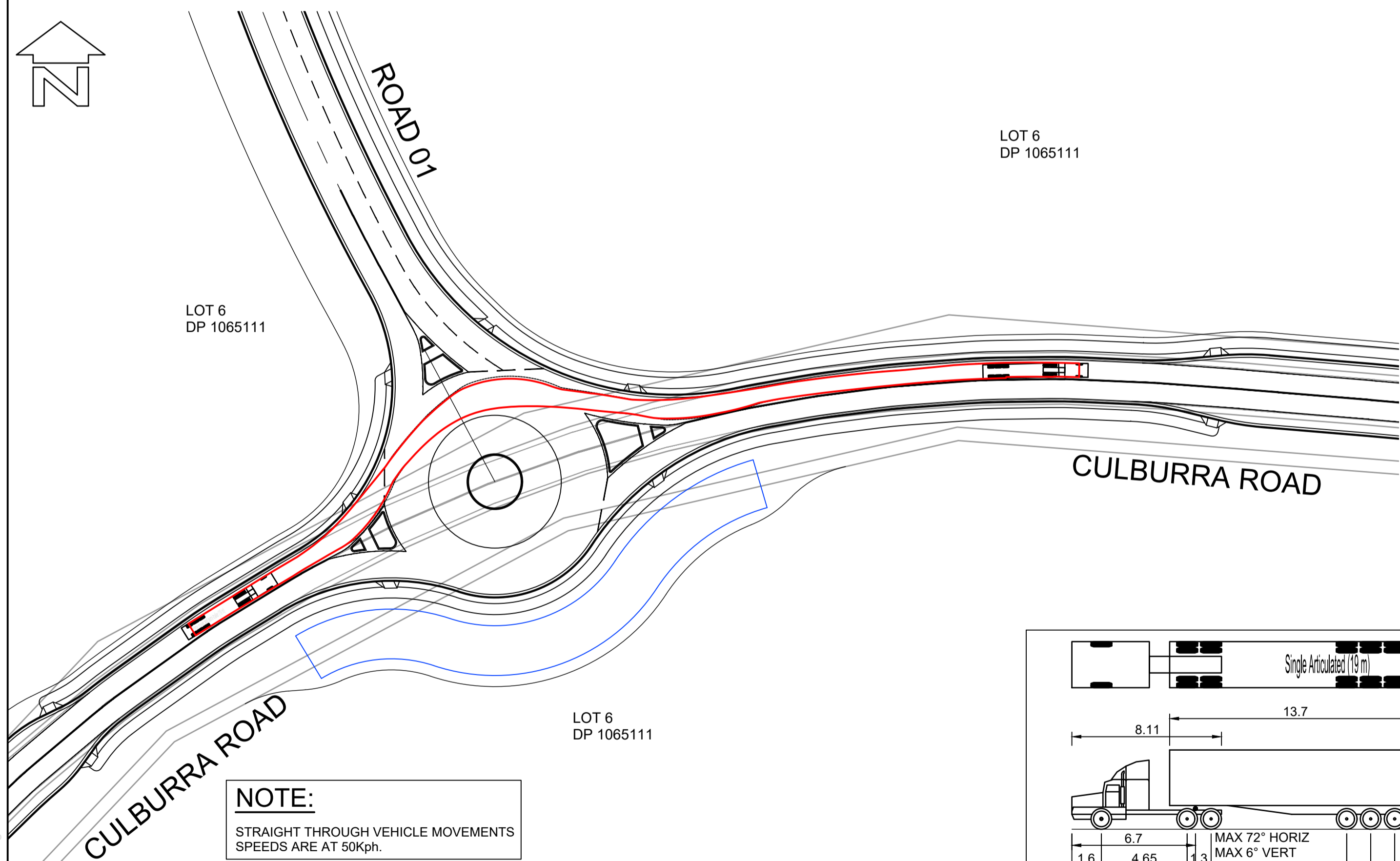
RATIO: 1:200 (AT A1 ORIGINAL)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY DESIGN	APS CJG	REV =	DESCRIPTION	BY	DATE		PRELIMINARY CONCEPT ROUNDABOUT 01 DESIGN OVER CULBURRA ROAD AT CULBURRA BEACH FOR SEALARK PTY LTD	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
	DATE OF PLAN: MARCH 2020	DRAWN CJG	CHECK'D MJP	DRAWING NUMBER 25405-105	SHEET 6 OF 29	REVISION P6				



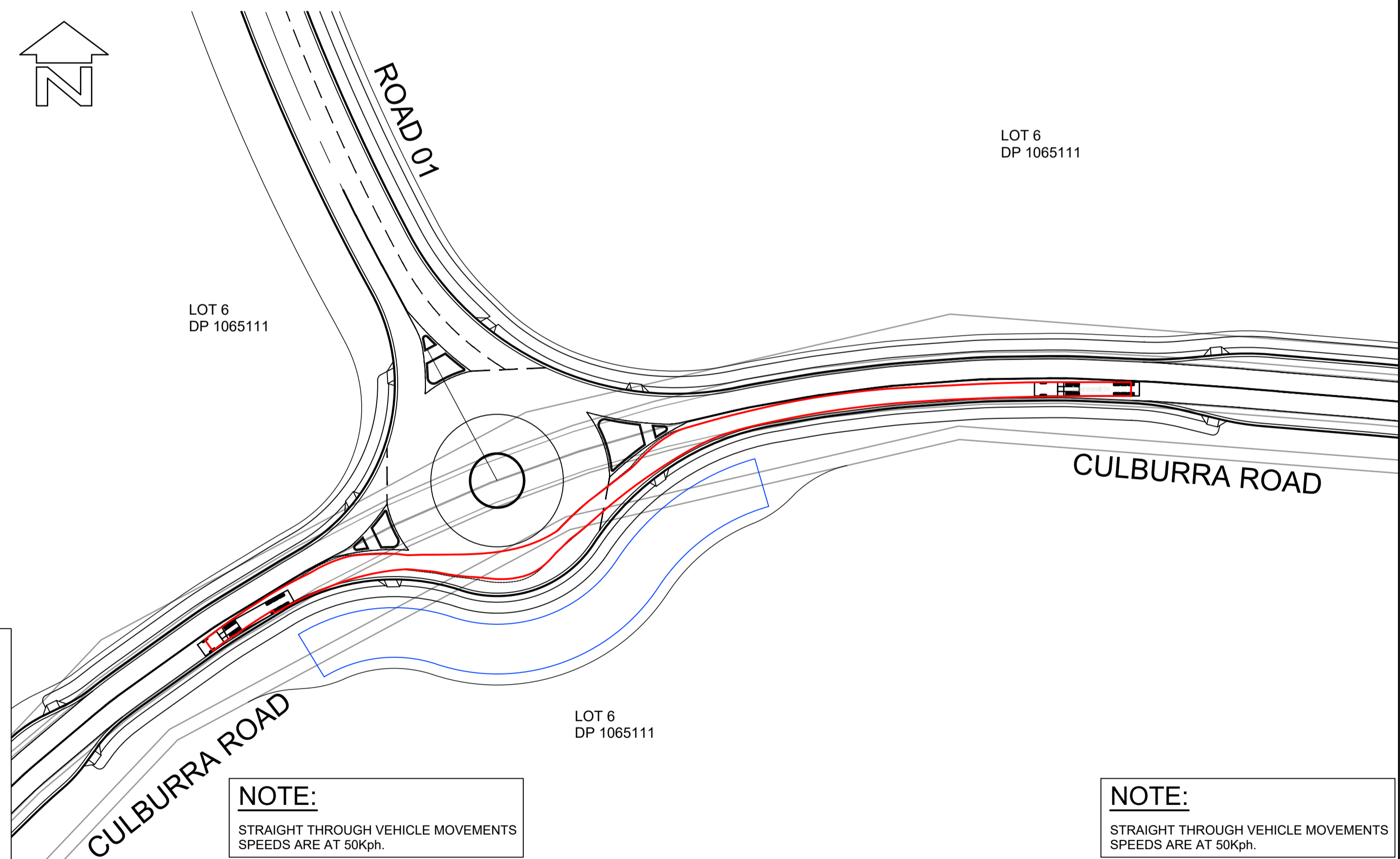
LAYOUT PLAN
SCALE 1:750



LAYOUT PLAN
SCALE 1:750



LAYOUT PLAN
SCALE 1:750

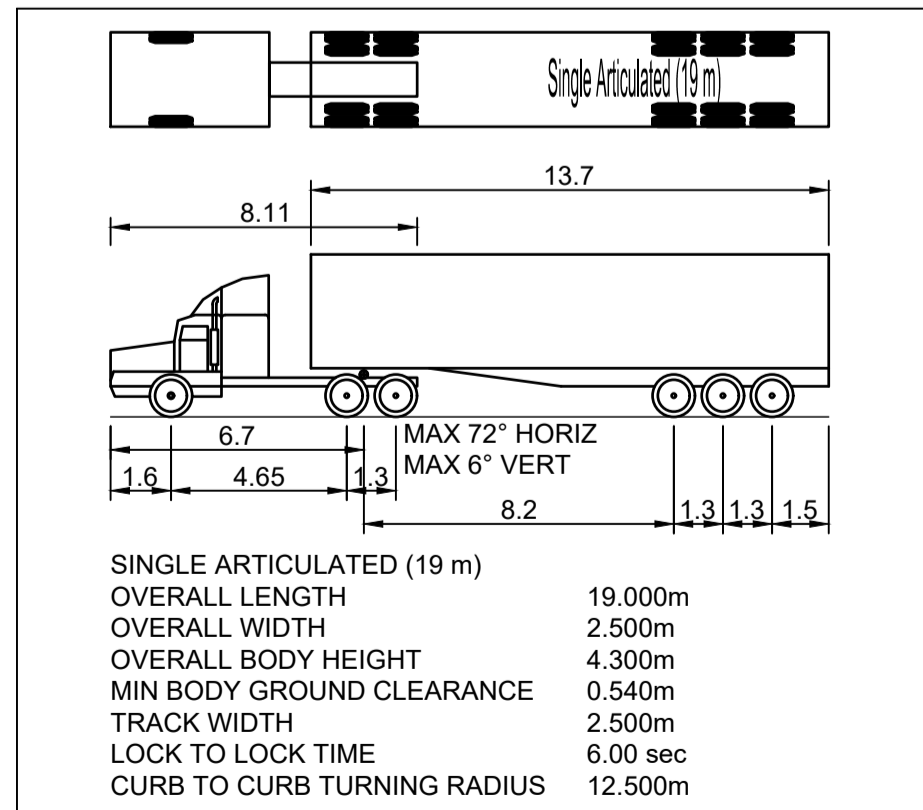


LAYOUT PLAN
SCALE 1:750

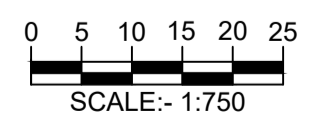
NOTE:
STRAIGHT THROUGH VEHICLE MOVEMENTS
SPEEDS ARE AT 50kph.

NOTE:
STRAIGHT THROUGH VEHICLE MOVEMENTS
SPEEDS ARE AT 50kph.

NOTE:
STRAIGHT THROUGH VEHICLE MOVEMENTS
SPEEDS ARE AT 50kph.



VEHICLE MANOEUVRE LEGEND:
 - - - - - PATH OF OUTER FRONT WHEEL (FORWARD MOVEMENT)
 - - - - - SWEEP PATH OF VEHICLE BODY (FORWARD MOVEMENT)
 THIS DRAWING HAS BEEN PREPARED USING MODELING COMPUTER SOFTWARE AUTODESK VEHICLE TRACKING 2016. THE VEHICLE USED IS BASED UPON DATA PROVIDED BY AUSTRROADS 2013 FOR A SINGLE ARTICULATED (19.0m) TRAVELING AT 20km/hr AND INCORPORATES A REASONABLE DEGREE OF TOLERANCE. HOWEVER IT IS NOT POSSIBLE TO ACCOUNT FOR ALL VEHICLE TYPES/ CHARACTERISTICS AND/OR DRIVER ABILITY.



PROFESSIONAL STANDARDS SCHEME
 Liability limited by a scheme approved under Professional Standards Legislation

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RATIO:
1:750
(AT A1 ORIGINAL)

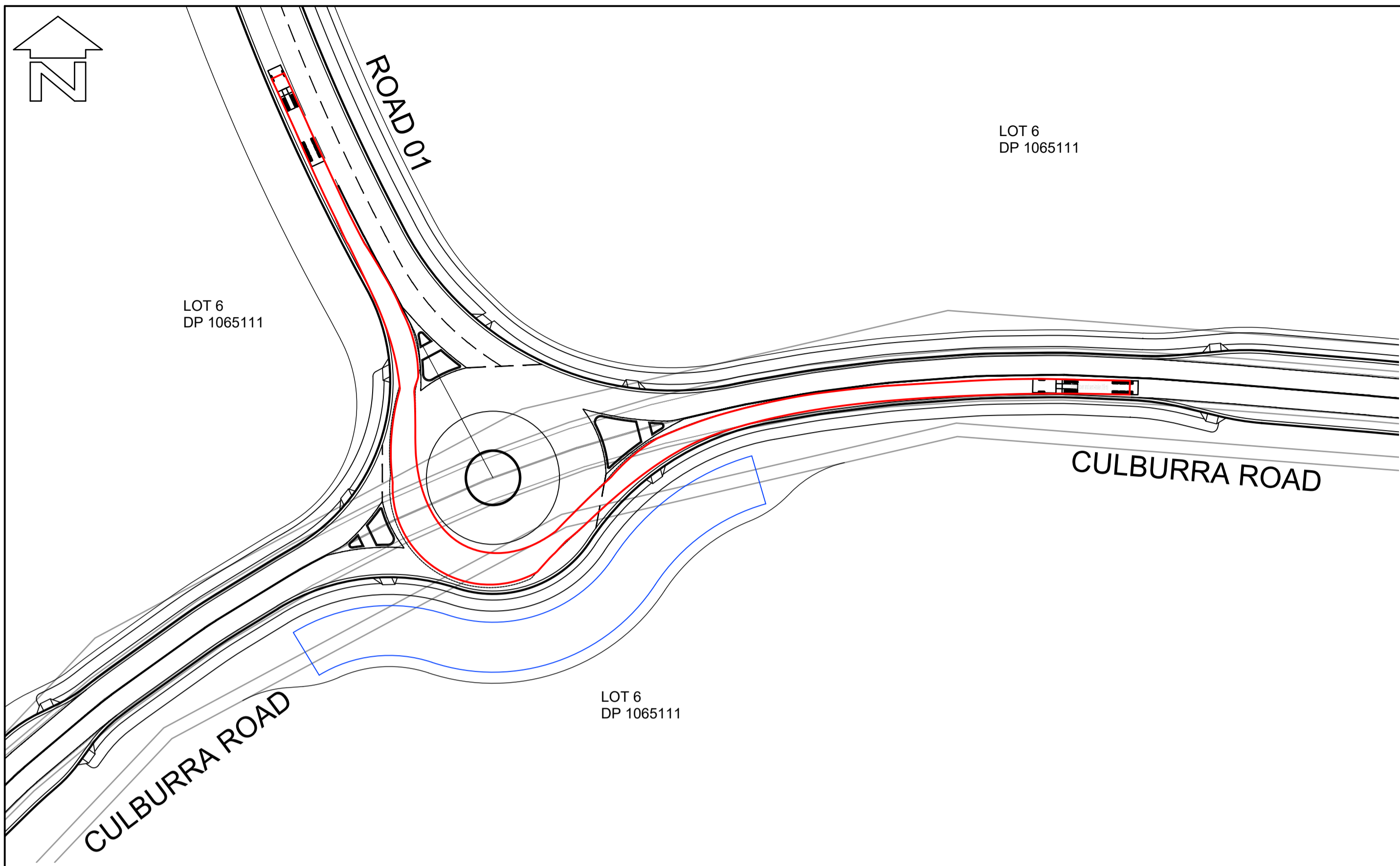
DATUM:
AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM
RL
DATE OF PLAN: MARCH 2020

SURVEY	APS	REV	DESCRIPTION	BY	DATE
DESIGN	CJG				
DRAWN	CJG				
CHECK'D	MJP				

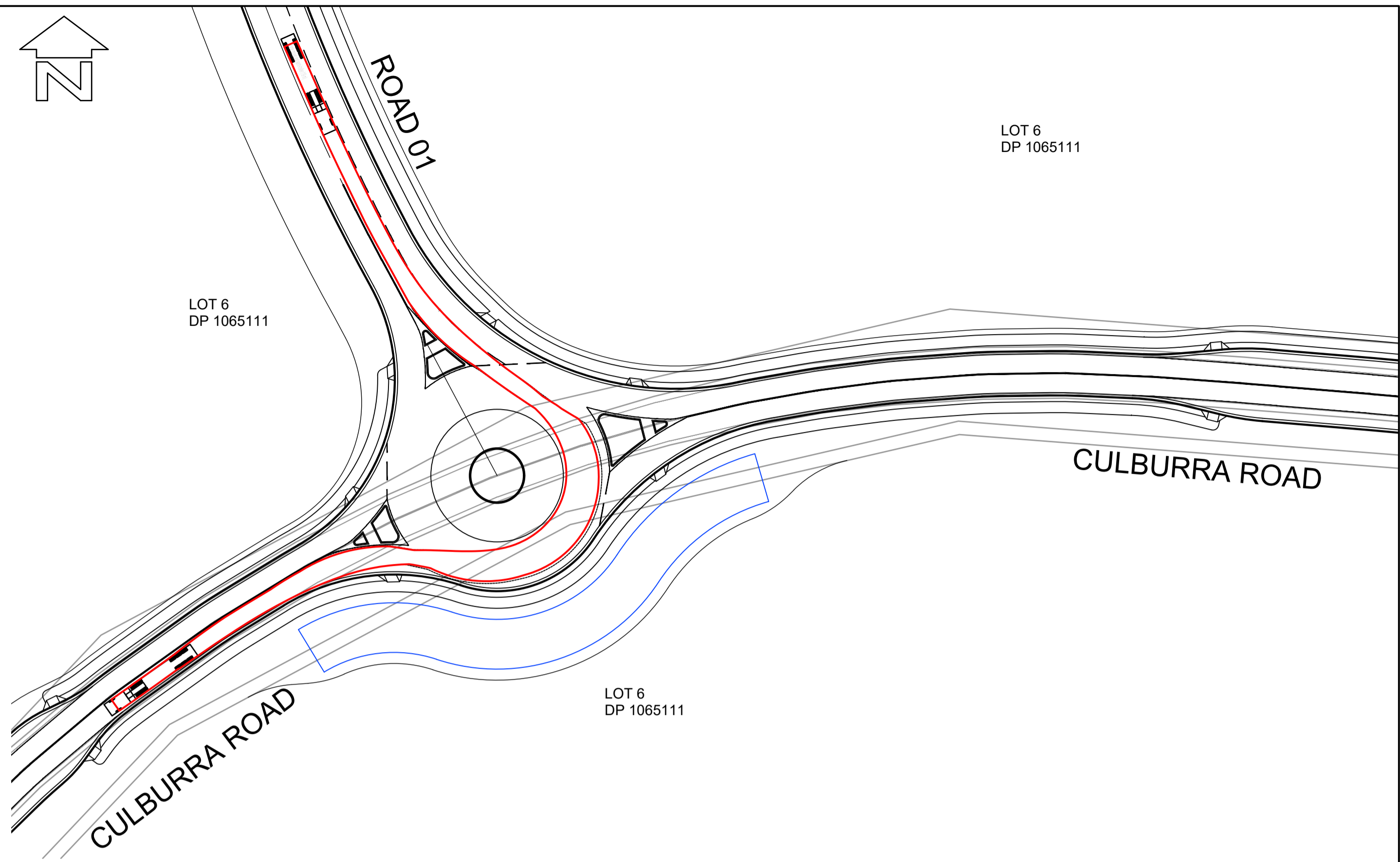
aps allen price & scarratts pty ltd
 land and development consultants
 Nowra Office: 75 Plunkett Street, Nowra NSW 2541
 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533
 phone: (02) 4421 6544
 consultants@allenprice.com.au www.allenprice.com.au

**ROUNDAABOUT 01 VEHICLE MOVEMENT LAYOUT PLAN
 SHEET 01
 OVER CULBURRA ROAD
 AT CULBURRA BEACH
 FOR SEALARK PTY LTD**

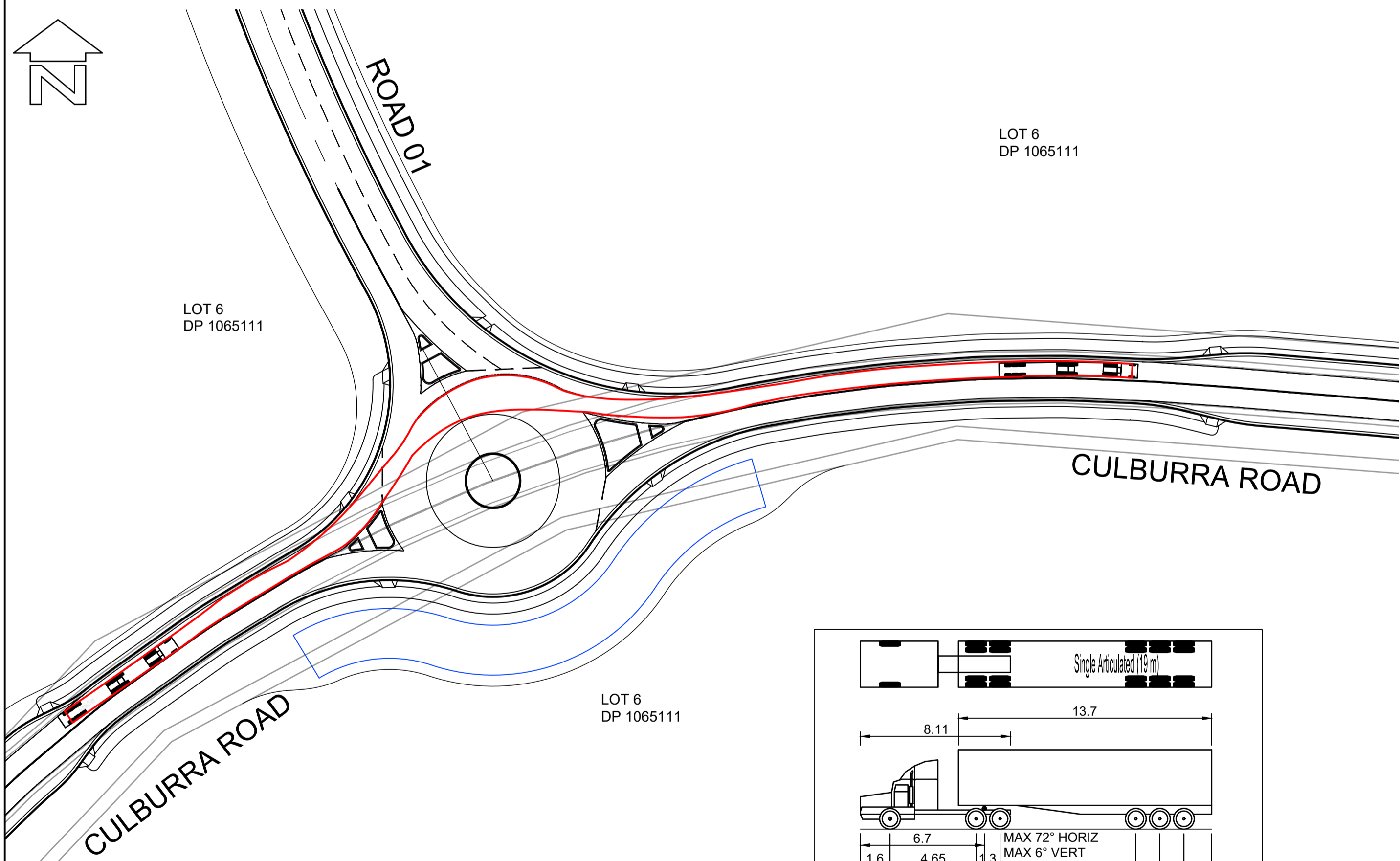
DRAWING STATUS
PRELIMINARY
 NOT TO BE USED FOR CONSTRUCTION PURPOSES
 DRAWING NUMBER
25405-106
 SHEET **7** OF **29** REVISION
P6



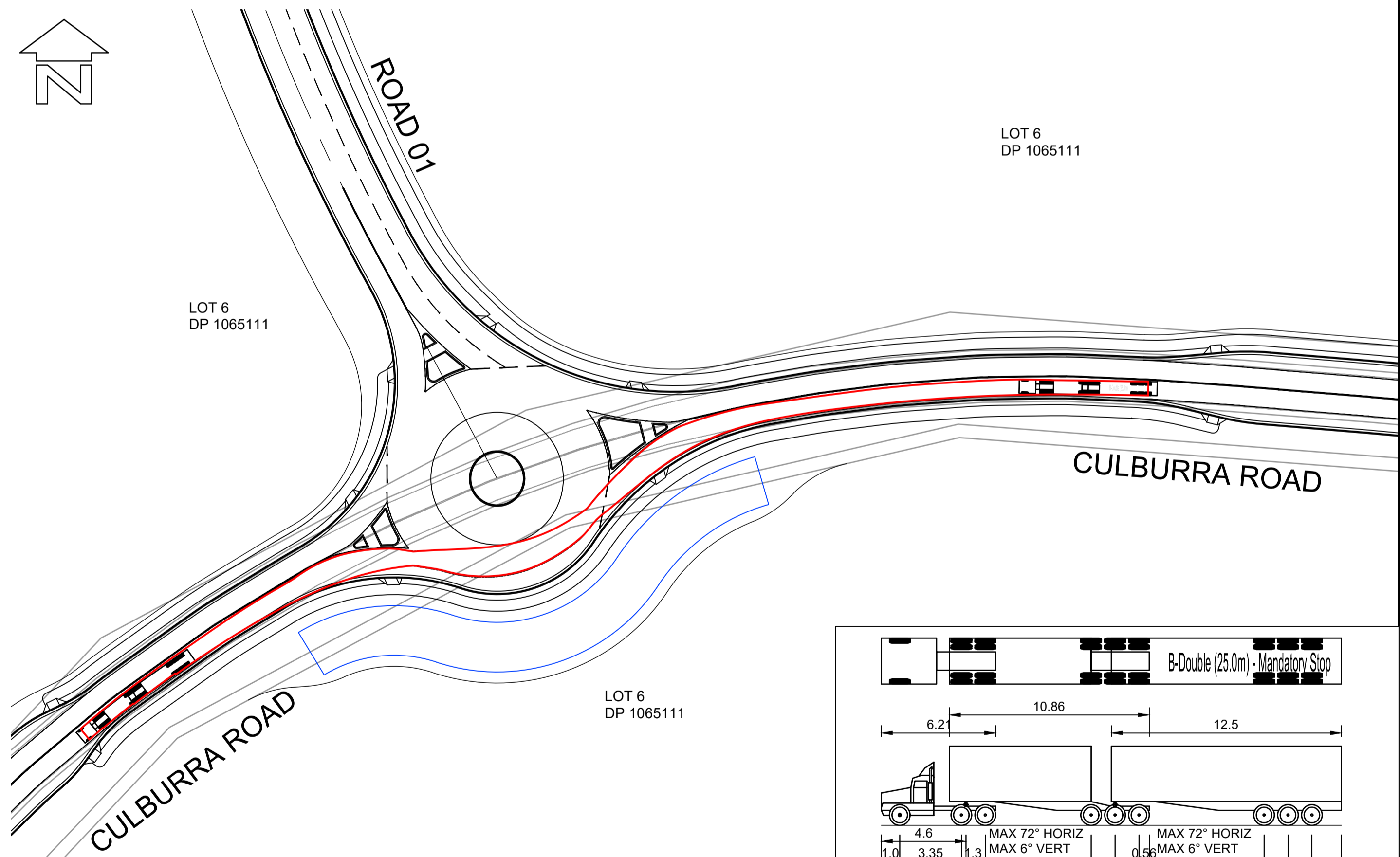
LAYOUT PLAN
SCALE 1:750



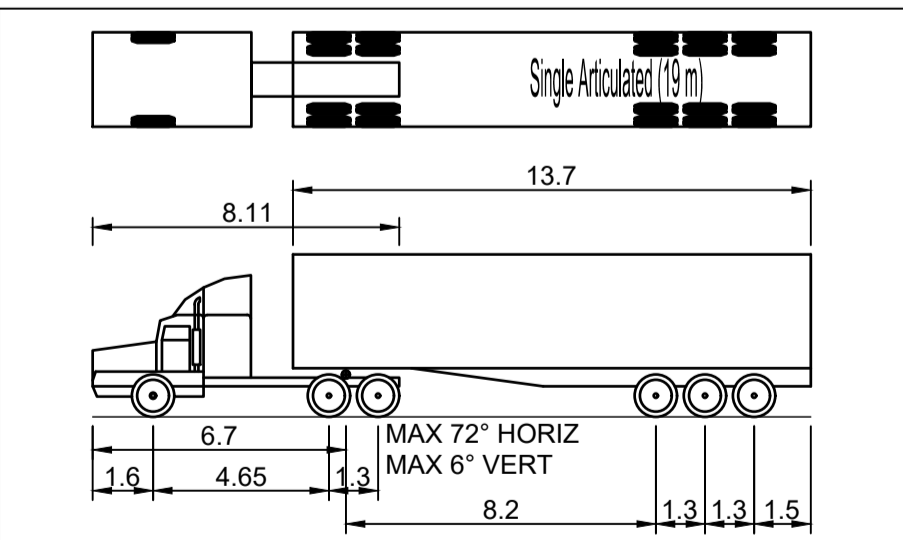
LAYOUT PLAN
SCALE 1:750



LAYOUT PLAN
SCALE 1:750



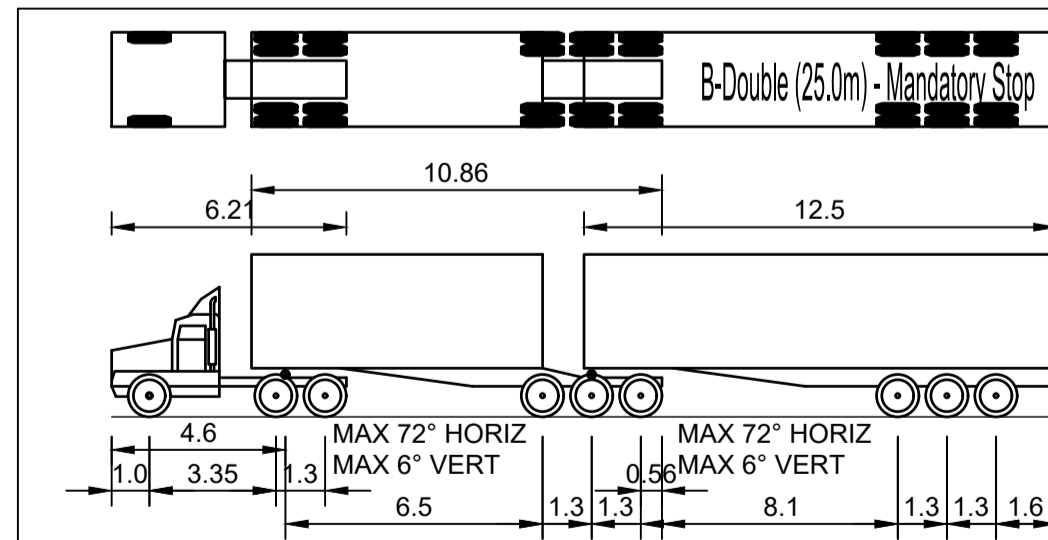
LAYOUT PLAN
SCALE 1:750



SINGLE ARTICULATED (19 m)	19.000m
OVERALL LENGTH	2.500m
OVERALL WIDTH	4.300m
OVERALL BODY HEIGHT	0.540m
MIN BODY GROUND CLEARANCE	2.500m
TRACK WIDTH	6.00 sec
LOCK TO LOCK TIME	12.500m
CURB TO CURB TURNING RADIUS	

VEHICLE MANOEUVRE LEGEND:

- - - - - PATH OF OUTER FRONT WHEEL (FORWARD MOVEMENT)
 - - - - - SWEEP PATH OF VEHICLE BODY (FORWARD MOVEMENT)
 THIS DRAWING HAS BEEN PREPARED USING MODELING COMPUTER SOFTWARE AUTODESK VEHICLE TRACKING 2016. THE VEHICLE USED IS BASED UPON DATA PROVIDED BY AUSTRROADS 2013 FOR A SINGLE ARTICULATED (19.0m) TRAVELING AT 20km/hr AND INCORPORATES A REASONABLE DEGREE OF TOLERANCE. HOWEVER IT IS NOT POSSIBLE TO ACCOUNT FOR ALL VEHICLE TYPES/ CHARACTERISTICS AND/OR DRIVER ABILITY.



B-DOUBLE (25.0m) - MANDATORY STOP	25.000m
OVERALL LENGTH	2.500m
OVERALL WIDTH	4.300m
OVERALL BODY HEIGHT	0.540m
MIN BODY GROUND CLEARANCE	2.500m
TRACK WIDTH	6.00 sec
LOCK TO LOCK TIME	12.500m
CURB TO CURB TURNING RADIUS	



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RATIO:	1:750 (AT A1 ORIGINAL)
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DATUM:	AUSTRALIAN HEIGHT DATUM
ORIGIN:	SSM RL
DATE OF PLAN:	MARCH 2020

SURVEY	APS	REV	DESCRIPTION	BY	DATE
DESIGN	CJG				
DRAWN	CJG				
CHECK'D	MJP				

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 consultants@allenprice.com.au www.allenprice.com.au

ROUNDAABOUT 01 VEHICLE MOVEMENT LAYOUT PLAN
SHEET 02
OVER CULBURRA ROAD
AT CULBURRA BEACH
FOR SEALARK PTY LTD

DRAWING STATUS	PRELIMINARY	
	NOT TO BE USED FOR CONSTRUCTION PURPOSES	
DRAWING NUMBER	SHEET 8	REVISION
25405-107	OF 29	P6