

Tripoli Way Extension,
Albion Park NSW

APPENDIX

C

GEOLOGICAL LOGS

Client: Shellharbour City Council		Hole No: BH001	
Project: Tripoli Way Upgrade and Extension		Job No: 8201612601	
Location: Albion Park, NSW		Sheet: 1 of 3	
Position: E294391.239 N6172365.255 56 MGA94		Angle from Horizontal: 90°	
Rig Type: Hydropower Scout		Surface Elevation: 11.266 m AHD	
Casing Diameter: HW		Mounting: Truck	
Data Started: 15/8/16		Driller: CM	
Date Completed: 15/8/16		Contractor: Total Drilling	
Logged By: CR		Checked By: DR	

Drilling			Water	Sampling & Testing	RL (m AHD)	Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test			Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
<div><div>AD/T</div><div>↑</div><div>↓</div></div>	E	<div><div>HW</div><div>↑</div><div>↓</div></div>	Not Observed	SPT 1.00 - 1.25 m 21, 25/100mm N*=R	11 1 10 9	<div><div><div></div></div></div>	0.20m	Clayey SAND: dark brown, low plasticity clay, with organics	M		TOPSOIL	
								Sandy CLAY: medium plasticity, mottled orange - brown and grey, with fine to medium gravel	w > PL	F - St	ALLUVIUM	
							Clayey Gravelly SAND: medium grained, orange, medium grained gravel, medium plasticity clay	M	D			
							Sandy GRAVEL: medium to coarse, brown, coarse grained sand	M	D			
							Continued as Cored Drill Hole					

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER Water Level on Date shown water inflow water outflow	FIELD TESTS SPT - Standard Penetration Test HP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photoionisation Detector VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube 'undisturbed' MOISTURE D - Dry M - Moist W - Wet PL - Plastic limit LL - Liquid limit w - Moisture content	SOIL CONSISTENCY VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense
--	--	--	---	---

Refer to explanatory notes for details of abbreviations and basis of descriptions

Client: Shellharbour City Council
 Project: Tripoli Way Upgrade and Extension
 Location: Albion Park, NSW

Job No: 8201612601

Sheet: 2 of 3

Position: E294391.239 N6172365.255 56 MGA94
 Angle from Horizontal: 90°
 Surface Elevation: 11.266 m AHD
 Rig Type: Hydropower Scout
 Mounting: Truck
 Driller: CM
 Casing Diameter: HW
 Bit Type: Impreg
 Bit Condition: Good
 Contractor: Total Drilling
 Data Started: 15/8/16
 Date Completed: 15/8/16
 Logged By: CR
 Checked By: DR

Coring				Depth (m)	Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)		Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength Is(50) MPa ● - Axial ○ - Diametral VL 0.1 L M H VH EH 1 3 5 10	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other	
				11								
				10								
				9								
				8		2.50m START CORING AT 2.50m						
				7		2.75m SILTSTONE, IF, pale grey, highly fractured, with FeO bands	HW					2.50 - 2.75 m: FZ
				6		2.95m Silty CLAY: medium plasticity, pale grey mottled orange-brown, with FeO and Siltstone gravel, (EXTREMELY WEATHERED)	XW					2.72 m: JT, FILLED, 5 mm
				5		3.50m SILTSTONE, IF, pale grey, highly fractured, with FeO bands	HW					3.05 m: SM, 15°, 10 mm
				4		3.75m Gravelly Silty CLAY: medium plasticity, pale grey mottled orange-brown, with FeO and Siltstone gravel, (EXTREMELY WEATHERED)	XW					3.20 m: JT, 75°, PR, RF, SN
				3		4.90m TUFFACEOUS SANDSTONE, fine grained, dark grey, with red iron oxidised bands	MW					3.28 - 3.35 m: SM
				2		5.15m CLAY: mottled grey and orange, (EXTREMELY WEATHERED)	XW					3.39 m: BP, 3°, UN, S, CN
				1		6.19m TUFFACEOUS SANDSTONE, fine grained, dark grey, plagioclase & biotite constituents	SW					3.44 m: JT, 3°, FILLED, 20 mm
				0		grey, elliptical inclusions up to 40mm						3.77 m: SM, FILLED, 5 mm

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer		WATER Water Level on date shown water inflow water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)		ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered		DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break		PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished		COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz	
--	--	---	--	---	--	---	--	--	--	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

Client:	Shellharbour City Council
Project:	Tripoli Way Upgrade and Extension
Location:	Albion Park, NSW

Job No: 8201612601

Sheet: 3 of 3

Position: E294391.239 N6172365.255 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 11.266 m AHD

Rig Type: Hydropower Scout

Mounting: Truck

Driller: CM

Casing Diameter: HW

Bit Type: Impreg

Bit Condition: Good

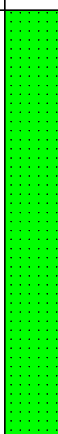
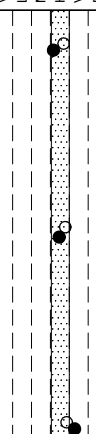
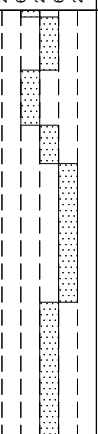

Contractor: Total Drilling




Data Started: 15/8/16

Date Completed: 15/8/16

Logged By: CR

Checked By: DR

Coring					Material Description					Defect Description				
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $I_{s(50)}$ MPa ● Axial ○ Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 100 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other		
NMLC	10% Water LOSS	100	83	3	9		TUFFACEOUS SANDSTONE, fine grained, dark grey, plagioclase & biotite constituents (continued) void, 20mm	F				7.61 m: BP, 20°, UN, RF, CN 7.72 m: BP, 20°, UN, RF, CN 7.89 m: BP, 20°, PR, RF, CN 8.04 m: BP, IR, VR, CN 8.36 m: BP, 10°, PR, VR, CN 8.48 m: JT, 75°, PR, S, SN 8.58 m: JT, ST, RF 8.69 m: BP, 5°, UN, RF, SN 8.92 m: BP, 5°, PR, RF, CN 9.75 m: BP, 10°, PR, RF, SN, possible jarosite 10.22 m: BP, 3°, PR, VR, SN		
		100	100									10	1	
					10.60m		TERMINATED AT 10.60 m							
					11									
					0									
					12									
					-1									
					13									
					-2									
					14									
					-3									
					15									
					-4									

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER  Water Level on date shown  water inflow  water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Slockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz
--	---	---	---	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Hole No: BH002

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 1 of 3

Position: E294390.855 N6172389.371 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 11.977 m AHD

Rig Type: Hydropower Scout

Mounting: Truck

Driller: CM

Casing Diameter: HW

Contractor: Total Drilling

Data Started: 15/8/16




Date Completed: 15/8/16

Logged By: CR

Checked By: DR

Drilling			Water	Sampling & Testing	RL (m AHD)	Depth (m)	Material Description							
Method	Resistance	Casing					Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations		
AD/T	E	HW	Not Observed									TOPSOIL		
							0.30m	Clayey SAND: dark brown, low plasticity clay, with fine to coarse gravel, with organics						
								CI	Sandy CLAY: medium plasticity, with fine gravel	w > PL	F to St	ALLUVIUM		
							1.00m							
					</									

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)
WATER
 Water Level on Date shown
 water inflow
 water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'
MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 2 of 3

Position: E294390.855 N6172389.371 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 11.977 m AHD

Rig Type: Hydropower Scout

Mounting: Truck

Driller: CM

Casing Diameter: HW

Bit Type: Impreg

Bit Condition: Good

Contractor: Total Drilling

Data Started: 15/8/16

Date Completed: 15/8/16

Logged By: CR

Checked By: DR

Coring				Depth (m)	Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)		Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $I_{s(50)}$ MPa	Average Natural Defect Spacing (mm)	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other	
								● - Axial ○ - Diametral VL 0.1 L M H T VH 10 EH	20 60 200 600 2000			
				11 1								
				10 2								
				9 3								
				8 4								
				7 5		4.60m START CORING AT 4.60m	MW				4.65 m: BP, 8°, PR, S, CT	
		100	24	6 6		TUFFACEOUS SANDSTONE, fine grained, dark grey	SW				4.77 m: DB	
				5 7		void up to 20mm	F				4.86 m: DB	
		100	93			infilled void up to 30mm					4.93 m: BP, 5°, PR, RF, FILLED, 30 mm	
											5.13 m: BP, 5°, CU, RF, SN	
											5.17 m: BP, 5°, PR, RF, SN	
											5.24 m: BP, 5°, PR, RF, SN	
											5.30 m: SM, 2°, UN, RF, FILLED	
											5.36 m: BP, 5°, CU, S, SN	
											5.36 - 5.41 m: CS, FILLED	
											5.47 m: BP, 5°, CU, RF, SN	
											5.56 m: BP, 5°, UN, RF, SN	
											5.60 m: DB	
											5.77 m: BP, 5°, UN, RF, SN	
											5.88 m: BP, 5°, UN, RF, SN	
											6.00 m: DB	
											6.20 m: JT, 85°, IR, RF, SN	
											6.36 - 6.42 m: FZ, FILLED, 55 mm	
											6.60 m: JT, 10°, UN, RF, SN	
											6.69 m: BP, 5°, PR, S, SN	
											6.88 m: HB	
											7.37 m: DB	
											7.81 m: BP, PR, S, SN	

DRILLING

AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller
PQ Rotary core (85mm)
HQ Rotary core (63.5mm)
NMLC Rotary core (51.94mm)
DT Diatube concrete coring
PT Push tube
PS Percussion sampling
SON Sonic drilling
AH Air hammer

WATER

Water Level on date shown
water inflow
water outflow

ROCK QUALITY DESCRIPTIONS

RQD Rock Quality Designation (%)
TCR Total Core Recovery (%)

ROCK STRENGTH

EH Extremely High
VH Very High
H High
M Medium
L Low
VL Very Low

ROCK WEATHERING

FR Fresh
SW Slightly Weathered
DW Distinctly Weathered
MW Moderately Weathered
HW Highly Weathered
XW Extremely Weathered

DEFECT TYPE

JT Joint
SZ Sheared zone
BP Bedding Parting
SM Seam
FL Foliation
VN Vein
CL Cleavage
CS Crushed Seam
FZ Fracture Zone
DL Drift Lift
HB Handing Break
DB Drilling Break

PLANARITY

CU Curved
DIS Discontinuous
IR Irregular
PR Planar
ST Stepped
UN Undulose

ROUGHNESS

VR Very Rough
RF Rough
S Smooth
SL Stockensided
POL Polished

COATING

CN Clean
SN Stained
VNR Veneer (thin or patchy)
CT Coating (up to 1mm)

INFILL MATERIALS




X Carbonaceous
MU Unidentified mineral
MS Secondary mineral
KT Chlorite
CA Calcite
Fe Iron Oxide
Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council	Job No: 8201612601	Sheet: 3 of 3
Project: Tripoli Way Upgrade and Extension		
Location: Albion Park, NSW		
Position: E294390.855 N6172389.371 56 MGA94	Angle from Horizontal: 90°	Surface Elevation: 11.977 m AHD
Rig Type: Hydropower Scout	Mounting: Truck	Driller: CM
Casing Diameter: HW	Bit Type: Impreg	Bit Condition: Good
Data Started: 15/8/16	Date Completed: 15/8/16	Logged By: CR
		Checked By: DR

Coring				Depth (m)	Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)		Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength Is ₍₅₀₎ MPa	Average Natural Defect Spacing (mm)	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other	
NMLC	10% LOSS	100	93	3.9		TUFFACEOUS SANDSTONE, fine grained, dark grey (continued)	F	VL 0.1 L M S T VH EH	20 60 200 600 2000		8.00 m: HB 8.13 m: BP, 5°, UN, RF, SN 8.50 m: HB 8.60 m: JT, PR, VR, SN 8.66 m: JT, 20°, PR, RF, SN 9.00 m: HB 9.10 m: HB 9.27 m: JT, 85°, PR, RF, SN 9.38 m: HB 9.42 m: HB 9.70 m: HB 10.00 m: HB 10.20 m: JT, 20°, UN, RF, SN 10.65 m: HB 11.00 m: HB 11.28 m: JT, 85°, PR, S, VNR	
		100	100	2.10								
				1.11								
						11.60m						
						TERMINATED AT 11.60 m						
				0.12								
				-1.13								
				-2.14								
				-3.15								

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER  Water Level on date shown  water inflow  water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Oz Quartz
--	---	---	---	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Hole No: BH003

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 1 of 3

Position: E294354.503 N6172372.405 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 11.139 m AHD

Rig Type: Hydropower Scout

Mounting: Truck

Driller: CM

Casing Diameter: HW





Contractor: Total Drilling

Data Started: 16/8/16




Date Completed: 16/8/16

Logged By: CR

Checked By: DR

Drilling			Sampling & Testing		Material Description									
Method	Resistance	Casing	Water	Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations		
AD/T	E	HW	17/08/16	SPT 1.00 - 1.45 m 2, 4, 5 N*=9	11	1		CH	Silty Clayey SAND: dark brown, with organics 0.30m	M		TOPSOIL		
				Sandy CLAY: high plasticity, mottled dark grey and brown						ALLUVIUM				
	VE	HW		SPT 2.50 - 2.95 m 0, 0, 3 N*=3	9	2		SM	Silty SAND: brown, with clay 2.10m	W	L			
				Silty CLAY: low plasticity, brown, with sand, with fine gravel 4.20m	w > PL				St					
	F	HW		SPT 4.00 - 4.45 m 3, 5, 10 N*=15	7	4		CL	Sandy CLAY: low plasticity, grey mottled orange 5.50m	w < PL	St	EXTREMELY WEATHERED		
				SILTSTONE, pale grey, highly weathered, low strength 5.80m						ROCK				
	H	HW		SPT 5.50 - 5.80 m 19, 25 N*=R	6	5			Continued as Cored Drill Hole					
							4	7						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)
WATER
 Water Level on Date shown
 water inflow
 water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'
MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council	Job No: 8201612601	Sheet: 2 of 3
Project: Tripoli Way Upgrade and Extension		
Location: Albion Park, NSW		
Position: E294354.503 N6172372.405 56 MGA94	Angle from Horizontal: 90°	Surface Elevation: 11.139 m AHD
Rig Type: Hydropower Scout	Mounting: Truck	Driller: CM
Casing Diameter: HW	Bit Type: Impreg	Bit Condition: Good
Data Started: 16/8/16	Date Completed: 16/8/16	Logged By: CR
		Checked By: DR

Coring				Depth (m)	Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)		Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $I_{s(50)}$ MPa	Average Natural Defect Spacing (mm)	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other	
				11								
				10								
				9								
				8								
				7								
				6								
				5								
				4								
				3								
				2								
				1								
				0								
				5.80m		START CORING AT 5.80m						
				5		SILTSTONE, pale grey	HW				6.10 m: SM, IR, RF, 20 mm	
		100	14	4							6.47 m: JT, 80°, PR, RF, CT	
				3							6.54 m: SM, CT, 50 mm	
				2							6.26 - 6.86 m: FZ, IR, S, CT, Multiple defects, part drill induced	
				1								
				0								
				7.00m		Gravelly CLAY: medium plasticity, orange and grey, (EXTREMELY WEATHERED)	XW				7.06 m: BP, PR, S, VNR	
				6							7.13 m: JT, 20°, PR, S, SN	
				5							7.24 m: BP, 3°, PR, S, CT	
				4							7.36 m: BP, 3°, PR, S, CT	
				3							7.45 m: DB, break on bedding plane	
				2							7.53 m: DB	
				1							7.58 - 7.78 m: FZ, PR, S, SN, Multiple defects, part drill induced	
				0							7.78 m: DB	
				7.80m		SANDSTONE, fine grained, dark grey	SW				7.80 m: JT, 20°, PR, S, SN, possible	

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER Water Level on date shown water inflow water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz
--	---	---	---	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

Client: Shellharbour City Council	Job No: 8201612601	Sheet: 3 of 3
Project: Tripoli Way Upgrade and Extension		
Location: Albion Park, NSW		
Position: E294354.503 N6172372.405 56 MGA94	Angle from Horizontal: 90°	Surface Elevation: 11.139 m AHD
Rig Type: Hydropower Scout	Mounting: Truck	Driller: CM
Casing Diameter: HW	Bit Type: Impreg	Bit Condition: Good
Data Started: 16/8/16	Date Completed: 16/8/16	Logged By: CR
		Checked By: DR

Coring				Depth (m)	Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)		Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength Is(50) MPa ● - Axial ○ - Diametral VL 0.1 L M H T VEH 10 20 60 200 600 2000	Average Natural Defect Spacing (mm)	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other	
NMLC	20% LOSS	100	35	3		TUFFACEOUS SANDSTONE, fine grained, dark grey, pyrite inclusions (continued)	SW				7.84 m: DB 8.03 m: JT, 80°, UN, S, SN, Subvertical joint 7.8-9.2m 8.00 - 9.28 m: FZ, SN, Multiple defects across subvertical joint, part drill induced 8.90 m: CS, 25 mm 9.38 m: JT, 30°, PR, S, SN, possible jarosite 9.45 m: JT, 25°, PR, S, VNR, possible jarosite 9.51 m: JT, 20°, PR, S, SN, possible jarosite 9.56 m: DB, drill break along weak plane 9.73 m: JT, 20°, UN, RF, VNR 10.00 m: JT, 20°, UN, RF, VNR 10.17 - 10.53 m: FZ, Multiple defects, spacing 50-60mm, likely drill breaks 10.70 m: JT, 30°, PR, RF, CN 10.80 m: JT, 80°, UN, S, CN 10.58 - 11.05 m: DB, Multiple drill breaks across subvertical joint and bedding 10.92 m: JT, 30°, UN, RF 11.20 m: JT, 75°, PR, S, SN 11.15 - 11.50 m: FZ, Multiple defects and drill breaks across subvertical joints and bedding 11.50 m: JT, 75°, PR, S, SN 11.68 m: JT, 85°, PR, PR 11.75 m: JT, 75°, PR, PR 11.68 - 11.84 m: DB, Multiple drill breaks across subvertical joints 11.95 m: JT, 20°, PR, S, CN 12.06 m: BP, 3°, PR, S 12.09 m: BP, 3°, PR, S 12.30 m: JT, 80°, PR, S, CN 12.12 - 12.52 m: FZ, Multiple bedding defects, spacing <50mm, drill breaks across subvertical joint 12.58 m: JT, 80°, PR, S, CN 12.75 - 12.97 m: FZ, Multiple sub-vertical joints, spacing 30-40mm 13.06 - 13.42 m: FZ, 70 - 80°, PR, RF, SN, Multiple sub-vertical joints, spacing 20-60mm 13.47 m: BP, 3°, PR, S, VNR 13.73 m: JT, 70°, PR, RF, SN 13.87 m: HB	
		100	45	9								
		100	55	10		SILTSTONE, pale grey	SW					
		100	18	11								
		100	23	12		TUFFACEOUS SANDSTONE, fine grained, dark grey	SW					
		88	34	13								
				14		TUFFACEOUS SANDSTONE, fine grained, grey	F					
				14		Sandy CLAY: low plasticity, grey, (EXTREMELY WEATHERED)	XW					
				14		CORE LOSS 0.06m (14.00-14.06)						
				14		TERMINATED AT 14.06 m						

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER Water Level on date shown water inflow water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz
--	---	---	---	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 1 of 3

Position: E294274.893 N6172310.549 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 12.172 m AHD

Rig Type: Hydropower Scout

Mounting: Truck

Driller: CM

Casing Diameter: HQ/HW

Contractor: Total Drilling

Data Started: 16/8/16

Date Completed: 17/8/16

Logged By: CR

Checked By: DR

Drilling			Water	Sampling & Testing		RL (m AHD)	Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	Graphic Log			Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations	
AD/T	E	HW			12			0.20m	Clayey SILT: low plasticity, dark brown, with sand, with organics	M		TOPSOIL	
												ALLUVIUM	
			SPT 1.00 - 1.45 m 2, 2, 2 N*=4	11	1	CL			w > PL	S - F			
							1.50m	Clayey SAND: fine to medium grained, low plasticity, brown	W	L			
			SPT 2.50 - 2.95 m 0, 0, 2 N*=2	10	2	SC			W	L			
							2.30m	Gravelly SAND: coarse grained, red-brown, fine to medium gravel	W	VL			
							3.50m	Silty CLAY: low plasticity, dark brown, with fine sand, trace fine gravel					
WB	F	HQA			8					w > PL	St		
			SPT 4.00 - 4.45 m 1, 4, 5 N*=9			CL							
							5.50m	Silty CLAY: as above but with fine gravel					
							5.80m	Silty Gravelly CLAY: low plasticity, dark brown, fine to medium gravel	M	St			
			SPT 5.80 - 6.25 m 8, 7, 6 N*=13	6	6	CL							
							7.00m	Silty CLAY: medium plasticity, dark brown, trace fine to medium gravel	M	St			
							7.50m	Silty CLAY: as above but dark brown mottled orange, absence of gravel	M	St			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)
WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'
MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

Hole No: BH004

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 2 of 3

Position: E294274.893 N6172310.549 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 12.172 m AHD

Rig Type: Hydropower Scout

Mounting: Truck

Driller: CM

Casing Diameter: HQ/HW

Contractor: Total Drilling

Data Started: 16/8/16

Date Completed: 17/8/16

Logged By: CR

Checked By: DR

Drilling				Sampling & Testing		Material Description						
Method	Resistance	Casing	Water	Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
WB	F-H	HQ	Water		4			8.10m		M	St	ALLUVIUM
				SPT 8.50 - 8.95 m 12, 15, 15 N*=30					Gravelly CLAY: medium plasticity, dark brown mottled orange, fine to coarse, sub-angular gravel			
					9			Cl		M	VSt	
				SPT 10.00 - 10.45 m 14, 13, 14 N*=27					Gravelly SAND: brown mottled orange, fine to coarse, sub-angular to sub-rounded gravel, with low plasticity clay			
H					10			SP		M	MD	EXTREMELY WEATHERED
				SPT 11.50 - 11.75 m 24, 25/100mm N*=R				GW	Sandy GRAVEL: fine to coarse, well graded, angular, brown, trace cobbles	M	VD	
					11							
					12				Continued as Cored Drill Hole			
					13							
					14							
					15							

METHOD

EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION

VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER

Water Level on Date shown
water inflow
water outflow

FIELD TESTS

SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES

B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE

D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY

VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY

VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 3 of 3

Position: E294274.893 N6172310.549 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 12.172 m AHD

Rig Type: Hydropower Scout

Mounting: Truck

Driller: CM

Casing Diameter: HQ/HW

Bit Type: Impreg

Bit Condition: Good

Contractor: Total Drilling




Data Started: 16/8/16

Date Completed: 17/8/16

Logged By: CR

Checked By: DR

Coring				Depth (m)	Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)		Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $I_{s(50)}$ MPa ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH 20	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other	
				4								
				9								
				3								
				10								
				2								
				11								
				1								
				12		12.00m START CORING AT 12.00m						
				0		TUFFACEOUS SANDSTONE, fine grained, dark grey	F					12.12 m: JT, 3°, UN, RF, CN, 3 mm 12.18 - 12.21 m: CS
				13								12.71 m: DB
				-1								13.15 m: DB 13.20 m: JT, 10°, UN, RF, CN
				14								13.60 m: DB
				-2								13.95 m: HB
				14.60m		14.60m						14.18 m: DB 14.29 m: JT, 60°, PR, VR, SN, 3 mm 14.37 m: DB
				15		TERMINATED AT 14.60 m						
				-3								

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer		WATER  Water Level on date shown  water inflow  water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)		ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered		DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break		PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished		COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Oz Quartz	
--	--	---	--	---	--	---	--	--	--	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Hole No: BH005

Job No: 8201612601

Sheet: 1 of 2

Position: E294724.849 N6172443.716 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 13.354 m AHD

Rig Type: Hydropower Scout

Mounting: Truck

Driller: CM

Casing Diameter: HW

Contractor: Total Drilling

Data Started: 18/8/16

Date Completed: 18/8/16




Logged By: CR

Checked By: DR

[illegible]

Client: Shellharbour City Council	Job No: 8201612601	Sheet: 2 of 2
Project: Tripoli Way Upgrade and Extension		
Location: Albion Park, NSW		
Position: E294724.849 N6172443.716 56 MGA94	Angle from Horizontal: 90°	Surface Elevation: 13.354 m AHD
Rig Type: Hydropower Scout	Mounting: Truck	Driller: CM
Casing Diameter: HW	Bit Type: Impreg	Bit Condition: Good
Data Started: 18/8/16	Date Completed: 18/8/16	Logged By: CR
		Checked By: DR

Coring					Material Description					Defect Description				
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $I_{s(50)}$ MPa ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH 20	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other		
					13									
					1									
					12									
					2									
					11									
					3									
					10									
					4									
					9									
					5									
					8									
							5.60m START CORING AT 5.60m							
					6		TUFFACEOUS SANDSTONE, fine grained, grey mottled orange brown	MW					5.63 m: JT, PR, VR, CT	
													5.70 m: JT, 3°, UN, RF, CN	
					7		6.30m Sandy CLAY: medium plasticity, pale grey mottled orange, (EXTREMELY WEATHERED)	XW					6.05 m: DB, break along bedding plane	
							6.53m						6.13 m: JT, 10°, PR, VR, in tact	
													6.18 m: JT, 10°, PR, VR, FILLED, 25 mm	
													6.28 m: JT, 3°, PR, VR, FILLED, 30 mm	
							6.90m TUFFACEOUS SANDSTONE, fine grained, orange brown mottled grey, undulating bedding, volcanic inclusions	MW					6.53 m: JT, 3°, PR, VR, FILLED, 20 mm	
													6.71 m: JT, 3°, PR, RF, FILLED, 20 mm	
					7		TUFFACEOUS SANDSTONE, as above but dark grey	SW					6.83 - 6.88 m: SM, PR, RF, FILLED	
													6.92 m: DB, break along bedding plane	
													7.14 m: DB	
													7.36 m: CS, PR, VR, FILLED, 25 mm	
													7.42 m: DB, break along bedding plane	
					6									
							8.00m BOREHOLE TERMINATED AT 8.00 m							

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer		WATER  Water Level on date shown  water inflow  water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)		ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered		DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break		PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished		COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz	
--	--	---	--	---	--	---	--	--	--	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 1 of 3

Position: E294194.603 N6172266.637 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 12.712 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HQ/HW

Contractor: Total Drilling

Data Started: 29/8/16

Date Completed: 29/8/16

Logged By: AC

Checked By: DR

Drilling			Sampling & Testing		Material Description							
Method	Resistance	Casing	Water	Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	E	HW	23/09/16						0.20m Clayey SILT: low plasticity, dark brown, with organics	M		TOPSOIL
				U75 0.75 - 1.00 m	12	1	CL	Silty CLAY: low plasticity, dark brown, with fine grained sand	w > PL	S	ALLUVIUM	
									W			
				SPT 1.50 - 1.95 m 0, 0, 2 N*=2	11		SC	Silty Clayey SAND: fine grained, dark brown				
				U75 2.00 - 2.35 m PP 30-50 kPa		2	SC	Silty Clayey SAND: as above but fine to medium grained sand, trace fine to medium rounded gravel	W	VL		
				VS 3.05 m P=48 kPa R=7kPa	10	3		CLAY: medium plasticity, mottled dark grey and orange, trace fine rounded gravel				
					9							
				SPT 4.00 - 4.45 m 2, 3, 4 N*=7	8	4	CI		w > PL	F		
					7							
WB	F	HQ	0% Polymer LOSS	SPT 5.50 - 5.95 m 5, 8, 12 N*=20	7	6	CI	Silty CLAY: medium plasticity, pale grey, with fine rounded to sub-angular gravel, with fine to coarse sand				
					6							
				SPT 7.00 - 7.45 m 8, 10, 17 N*=27		7	CI	Silty CLAY: as above but with pockets of clayey sand	w > PL	VSt		
H					5		CI	7.80m	w > PL	VSt		

METHOD

EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION

VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER

Water Level on Date shown
water inflow
water outflow

FIELD TESTS

SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES

B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE

D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY

VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY

VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Hole No: BH006

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 2 of 3

Position: E294194.603 N6172266.637 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 12.712 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HQ/HW

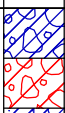
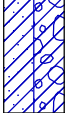


Contractor: Total Drilling

Data Started: 29/8/16




Date Completed: 29/8/16

Logged By: AC

Checked By: DR

Drilling			Sampling & Testing		Material Description							
Method	Resistance	Casing	Water	Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
NMLC	H	HQ	0% Polymer LOSS	C 8.05 - 10.10 m	9	4		CI	Gravelly CLAY: medium plasticity, pale grey, fine to medium rounded to sub-angular gravel, with fine grained sandstone cobbles (continued)	w > PL	VSt	ALLUVIUM
								GC		Clayey GRAVEL: fine to coarse, with silt, with clay	M	
RR	VH		60% Polymer LOSS		10	3		CI	Sandy Gravelly CLAY: medium plasticity, orange and brown, fine to coarse rounded to sub-angular gravel	w > PL	St	
								GP	GRAVEL: medium to coarse, rounded to sub-angular	M	D	
					11	2		SC	Gravelly Clayey SAND: fine to coarse grained, orange-brown	M	D	RESIDUAL SOIL
					12	1			TUFFACEOUS SANDSTONE, fine grained, dark grey Continued as Cored Drill Hole			BEDROCK

METHOD	
EX	Excavator bucket
R	Ripper
HA	Hand auger
PT	Push tube
SON	Sonic drilling
AH	Air hammer
PS	Percussion sampler
AS	Short spiral auger
AD/V	Solid flight auger: V-Bit
AD/T	Solid flight auger: TC-Bit
HFA	Hollow flight auger
WB	Washbore drilling
RR	Rock roller

PENETRATION	
VE	Very Easy (No Resistance)
E	Easy
F	Firm
H	Hard
VH	Very Hard (Refusal)
WATER	
	Water Level on Date shown
	water inflow
	water outflow

FIELD TESTS	
SPT	Standard Penetration Test
HP	Hand/Pocket Penetrometer
DCP	Dynamic Cone Penetrometer
PSP	Perth Sand Penetrometer
MC	Moisture Content
PBT	Plate Bearing Test
IMP	Borehole Impression Test
PID	Photoionisation Detector
VS	Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES	
B	Bulk disturbed sample
D	Disturbed sample
ES	Environmental sample
U	Thin wall tube 'undisturbed'
MOISTURE	
D	Dry
M	Moist
W	Wet
PL	Plastic limit
LL	Liquid limit
w	Moisture content




SOIL CONSISTENCY	
VS	Very Soft
S	Soft
F	Firm
St	Stiff
VSt	Very Stiff
H	Hard
RELATIVE DENSITY	
VL	Very Loose
L	Loose
MD	Medium Dense
D	Dense
VD	Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council	Job No: 8201612601	Sheet: 3 of 3
Project: Tripoli Way Upgrade and Extension		
Location: Albion Park, NSW		
Position: E294194.603 N6172266.637 56 MGA94	Angle from Horizontal: 90°	Surface Elevation: 12.712 m AHD
Rig Type: Hanjin D&B 8D	Mounting: Track	Driller: CM
Casing Diameter: HQ/HW	Bit Type: Impreg	Bit Condition: Good
Data Started: 29/8/16	Date Completed: 29/8/16	Logged By: AC
		Checked By: DR

Coring					Material Description					Defect Description				
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength	Average Natural Defect Spacing (mm)	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other		
									Is(50) MPa					
					4 9 3 10 2 11				VL 0.1 L 0.3 M 1 H 3 VH 10 EH 20	20 60 200 600 2000				
							11.50m START CORING AT 11.50m							
					1 12 0 13		TUFFACEOUS SANDSTONE, fine grained, dark grey	SW				11.77 m: DB 11.90 m: JT, 50°, PR, S 11.94 m: DB 12.13 m: DB 12.33 m: DB 12.49 m: DB 12.56 m: DB		
							13.10m					13.10 m: DB		
							TERMINATED AT 13.10 m							
					-1 14 -2 15 -3									

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER  Water Level on date shown  water inflow  water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz
--	---	---	---	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Hole No: BH007

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 1 of 4

Position: E293993.550 N6172145.710 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 14.374 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HQ/HW






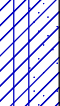
Contractor: Total Drilling

Data Started: 30/8/16

Date Completed: 30/8/16

Logged By: CR

Checked By: DR

Drilling			Sampling & Testing		Material Description							
Method	Resistance	Casing	Water	Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	E	HW	Water		14	14		ML	0.20m Clayey SILT: medium plasticity, dark brown, with organics	M		TOPSOIL
						Clayey SILT: low plasticity, brown, with sand			w > PL	S	ALLUVIUM	
				U75 0.75 - 1.15 m	1		1.00m	CI	Silty CLAY: medium plasticity, dark brown	w > PL		F
					13		1.20m		CLAY: medium plasticity, grey mottled orange-brown, with sand	w > PL		F
				SPT 1.50 - 1.95 m 0, 3, 3 N*=6	2		CI					
				U75 2.00 m No recovery	12							
				U75 2.75 - 3.15 m	3		CH					
					11							
				VS 3.60 m P>60 kPa	4		SC					
				SPT 4.00 - 4.45 m 5, 5, 6 N*=11	10							
U75 2.75 - 3.15 m	9		CI-CH									
	8											
SPT 5.50 - 5.95 m 7, 10, 12 N*=22	7		CI									
	7											

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)
WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'
MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Hole No: BH007

Job No: 8201612601

Sheet: 2 of 4

Position: E293993.550 N6172145.710 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 14.374 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HQ/HW

Contractor: Total Drilling

Data Started: 30/8/16

Date Completed: 30/8/16

Logged By: CR

Checked By: DR

[illegible]

Client: Shellharbour City Council	Job No: 8201612601	Sheet: 3 of 4
Project: Tripoli Way Upgrade and Extension		
Location: Albion Park, NSW		
Position: E293993.550 N6172145.710 56 MGA94	Angle from Horizontal: 90°	Surface Elevation: 14.374 m AHD
Rig Type: Hanjin D&B 8D	Mounting: Track	Driller: CM
Casing Diameter: HQ/HW	Bit Type: Impreg	Bit Condition: Good
Data Started: 30/8/16	Date Completed: 30/8/16	Logged By: CR
		Checked By: DR

Coring																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
--------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER Water Level on date shown water inflow water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz
--	---	---	---	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

Client: Shellharbour City Council		Job No: 8201612601		Sheet: 4 of 4	
Project: Tripoli Way Upgrade and Extension		Angle from Horizontal: 90°		Surface Elevation: 14.374 m AHD	
Location: Albion Park, NSW		Rig Type: Hanjin D&B 8D		Driller: CM	
Position: E293993.550 N6172145.710 56 MGA94		Mounting: Track		Contractor: Total Drilling	
Casing Diameter: HQ/HW		Bit Type: Impreg		Bit Condition: Good	
Data Started: 30/8/16		Date Completed: 30/8/16		Logged By: CR	
Checked By: DR					

Coring				Material Description				Defect Description				
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength Is(50) MPa	Average Natural Defect Spacing (mm)	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
NMLC	10% LOSS	100	71				TUFFACEOUS SANDSTONE, fine grained, dark grey (continued)	F	<div style="display: flex; justify-content: space-between;"> <div> VL 0.1 L 0.5 M 1 H 3 VH 10 EH 20 </div> <div> ● Axial ○ Diametral </div> </div>	20 60 200 600 2000		spacing 15-30mm, crushed core (part drill induced) 16.28 m: JT, 15°, PR, RF 16.75 m: JT, 15°, PR, RF 17.23 m: JT, 0°, PR, S 17.56 m: JT, 10°, PR, S 18.29 m: JT, 80°, PR, S 18.75 m: JT, 0°, PR, RF 18.79 m: JT, 10°, PR, S 18.97 m: JT, 10°, PR, RF
				19.00m			TERMINATED AT 19.00 m					
					-5							
					-6							
					-7							
					-8							
					-9							

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER Water Level on date shown water inflow water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz
--	---	---	---	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

Hole No: BH008

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 1 of 4

Position: E294019.940 N6172151.934 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 13.573 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HQ/HW

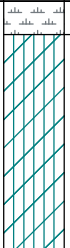

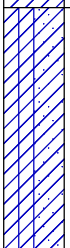
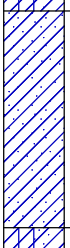
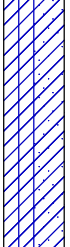
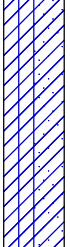
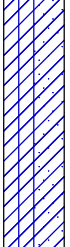
Contractor: Total Drilling

Data Started: 31/8/16

Date Completed: 31/8/16

Logged By: AC

Checked By: DR

Drilling			Water	Sampling & Testing	RL (m AHD)	Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test			Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	E	HW	Water		13	1		ML	0.20m Silty CLAY: low plasticity, dark brown, with organics	M	F	TOPSOIL
				Clayey SILT: low plasticity, dark brown, with fine grained sand, trace fine to medium angular to rounded gravel					w < PL	ALLUVIUM		
WB	F	HQ	Water	SPT 1.50 - 1.95 m 0, 0, 3 N*=3	12	2		Cl-CH	1.50m CLAY: medium to high plasticity, mottled pale grey and orange	w > PL		S - F
				U75 2.00 - 2.40 m PP 130-150 kPa								
WB	F	HQ	Water	SPT 3.00 - 3.45 m 3, 7, 9 N*=16	11	3		Cl-CH	3.00m Sandy Silty CLAY: medium to high plasticity, mottled dark grey and orange, fine to coarse sand, trace fine, rounded river gravel gravel	w > PL	St - VSt	
WB	F-H	HQ	Water	SPT 4.50 - 4.95 m 6, 9, 11 N*=20	9	5		Cl	4.50m Sandy CLAY: medium plasticity, dark brown, fine to coarse sand, trace fine to medium, rounded gravel	w > PL	VSt	
WB	F-H	HQ	Water	SPT 6.00 - 6.45 m 7, 12, 15 N*=27	7	6		Cl	thin gravelly layer			
WB	F-H	HQ	Water	SPT 6.00 - 6.45 m 7, 12, 15 N*=27	7	7		Cl	5.80m Sandy Silty CLAY: medium plasticity, mottled pale grey and orange, fine to medium sand	w > PL	VSt	
WB	F-H	HQ	Water	SPT 7.50 - 7.95 m 8, 12, 16 N*=28	6			Cl	7.50m Sandy Silty CLAY: as above but increased sand content, trace fine to medium rounded gravel			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)
WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'
MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Hole No: BH008

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 2 of 4

Position: E294019.940 N6172151.934 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 13.573 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HQ/HW

Contractor: Total Drilling

Data Started: 31/8/16

Date Completed: 31/8/16

Logged By: AC

Checked By: DR

Drilling				Sampling & Testing		Material Description						
Method	Resistance	Casing	Water	Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
WB						5		CI	Sandy Silty CLAY: as above but increased sand content, trace fine to medium rounded gravel (<i>continued</i>)	w > PL	VSt	ALLUVIUM
	F-H			SPT 9.00 - 9.45 m 12, 17, 29 N*=46	9	9.05m		SC	Clayey SAND: fine to medium grained, brown, trace medium gravel			
					4	9.25m		SC	Clayey SAND: as above but trace fine to coarse rounded to angular gravel, sand becoming coarser (fining up)	W	D	
					10	10.00m			Sandy CLAY: low to medium plasticity, pale grey and orange, fine to medium, rounded sand, trace fine, rounded gravel			
		HQ	Water	SPT 10.50 - 10.95 m 4, 5, 6 N*=11	3			CL-Cl		w > PL	St	RESIDUAL SOIL
	F				11							
				SPT 12.00 - 12.45 m 8, 23, 24 N*=47	12	12.00m		SC	Gravelly Clayey SAND: fine to coarse grained, grey, black, orange, and brown, fine to medium rounded gravel	W	D	EXTREMELY WEATHERED
					1	12.60m		SC	thin gravel Gravelly Clayey SAND: as above but extremely weathered	W	D	
	H				13	13.00m			Continued as Cored Drill Hole			
						0						
						14						
						-1						
						15						
						-2						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)
WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'
MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

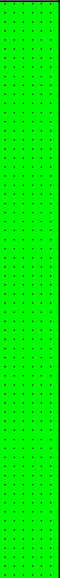
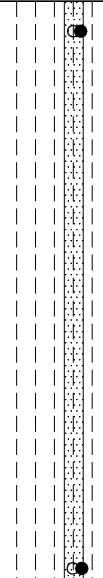
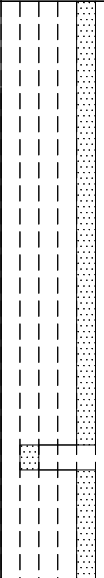
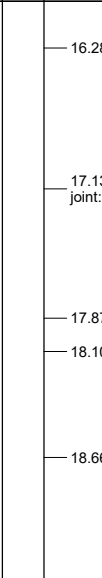
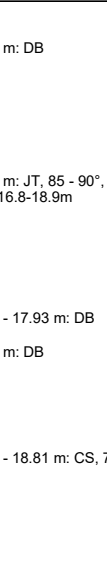
CARDNO (NSW/ACT) PTY LTD




Client: Shellharbour City Council
 Project: Tripoli Way Upgrade and Extension
 Location: Albion Park, NSW

Job No: 8201612601

Sheet: 4 of 4

Position: E294019.940 N6172151.934 56 MGA94
 Angle from Horizontal: 90°
 Surface Elevation: 13.573 m AHD
 Rig Type: Hanjin D&B 8D
 Mounting: Track
 Driller: CM
 Casing Diameter: HQ/HW
 Bit Type: Impreg
 Bit Condition: Fair
 Contractor: Total Drilling
 Data Started: 31/8/16
 Date Completed: 31/8/16
 Logged By: AC
 Checked By: DR

Coring				Depth (m)	Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)		RL (m AHD)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength Is ₍₅₀₎ MPa ● - Axial ○ - Diametral VL 0.1 L M H 1 3 5 10 20 L M H 1 3 5 10 20 VL L M H 1 3 5 10 20 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
NMLC	0% LOSS	100	100	-3		TUFFACEOUS SANDSTONE, fine grained, massive, dark grey, indistinct fabric, subvertical and vertical jointing (continued)	F					16.28 m: DB
	20% LOSS	100	92	-4								17.13 m: JT, 85 - 90°, UN, RF, vertical joint: 16.8-18.9m
				-5								17.87 - 17.93 m: DB
				-6		TERMINATED AT 19.50 m						18.10 m: DB
				-7								
				-8								
				-9								
				-10								
				-11								
				-12								
				-13								
				-14								
				-15								
				-16								
				-17								
				-18								
				-19								
				-20								
				-21								
				-22								
				-23								
				-24								
				-25								
				-26								
				-27								
				-28								
				-29								
				-30								

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer		WATER  Water Level on date shown  water inflow  water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)		ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered		DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break		PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished		COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz	
--	--	---	--	---	--	---	--	--	--	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

Hole No: BH009

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 1 of 4

Position: E294015.083 N6172115.890 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 13.601 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: RR

Casing Diameter: HQ/HW











Contractor: Cardno

Data Started: 22/9/16

Date Completed: 23/9/16

Logged By: AC

Checked By: DR

Drilling			Water	Sampling & Testing	RL (m AHD)	Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test			Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	E	HW	23/09/16			13		OL	0.20m Sandy Clayey SILT: low plasticity, brown, fine grained sand, with organics	M		TOPSOIL
						1			0.40m Sandy Clayey SILT: low plasticity, brown, trace fine to medium angular gravel	M	S to F	ALLUVIUM
								SC	Clayey SAND: fine grained, dark brown, with fine to medium angular gravel	W	L to MD	
						12			1.30m			
								CI	Silty CLAY: medium to high plasticity, mottled grey and orange, trace fine angular to rounded gravel	w > PL	St	
						2			1.70m			
								CI	Silty CLAY: as above but with fine to medium angular gravel			
									2.20m			
						11		CI	Sandy CLAY: medium plasticity, orange, brown, and grey, fine grained sand, with fine to medium gravel			
						3			3.00m			
						Sandy CLAY: as above but with pockets of pale grey silty sandy clay	w > PL	St				
		10		CI						RESIDUAL SOIL		
		4			4.00m							
			SPT 4.00 - 4.45 m 6, 12, 18 N*=30									
		9										
		5						w > PL	VSt - H			
		8										
		6										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										
		7										

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)
WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'
MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Hole No: BH009

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 2 of 4

Position: E294015.083 N6172115.890 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 13.601 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: RR

Casing Diameter: HQ/HW


Contractor: Cardno

Data Started: 22/9/16

Date Completed: 23/9/16

Logged By: AC

Checked By: DR

Drilling				Sampling & Testing		Material Description						
Method	Resistance	Casing	Water	Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
WB ↓	H	HQ ↓	Water	SPT 8.25 - 8.50 m 27, 57/100mm N*=R				8.50m	TUFFACEOUS SANDSTONE, fine grained, mottled pale grey and orange, highly weathered			ROCK
					5				Continued as Cored Drill Hole			
					9							
					4							
					10							
					3							
					11							
					2							
					12							
					1							
					13							
					0							
					14							
					-1							
					15							
					-2							




METHOD

EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION

VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER

 Water Level on Date shown
 water inflow
 water outflow

FIELD TESTS

SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES

B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE

D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY

VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY

VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council
 Project: Tripoli Way Upgrade and Extension
 Location: Albion Park, NSW

Job No: 8201612601

Sheet: 3 of 4

Position: E294015.083 N6172115.890 56 MGA94
 Angle from Horizontal: 90°
 Surface Elevation: 13.601 m AHD
 Rig Type: Hanjin D&B 8D
 Mounting: Track
 Driller: RR
 Casing Diameter: HQ/HW
 Bit Type: Impreg
 Bit Condition: Good
 Contractor: Cardno
 Data Started: 22/9/16
 Date Completed: 23/9/16
 Logged By: AC
 Checked By: DR

Coring				Depth (m)	Material Description				Defect Description																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
Method	Fluid	TCR (%)	RQD (%)		Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $I_{s(50)}$ MPa ● - Axial ○ - Diametral VL 0.1 L M H 1 3 5 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000	Average Natural Defect Spacing (mm) 20 60 100 200 300 600 1000 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
NMLC	0% LOSS	100	15	5	8.50m	START CORING AT 8.50m																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

DRILLING		WATER		ROCK STRENGTH		DEFECT TYPE		PLANARITY		COATING	
AD/V	Solid flight auger: V-Bit	Water Level	on date shown	EH	Extremely High	JT	Joint	CU	Curved	CN	Clean
AD/T	Solid flight auger: TC-Bit	Water inflow		VH	Very High	SZ	Sheared zone	DIS	Discontinuous	SN	Stained
HFA	Hollow flight auger	water inflow		H	High	BP	Bedding Parting	IR	Irregular	VNR	Veneer (thin or patchy)
WB	Washbore drilling			M	Medium	SM	Seam	PR	Planar	CT	Coating (up to 1mm)
RR	Rock roller			L	Low	FL	Foliation	ST	Stepped	INFILL MATERIALS	
PQ	Rotary core (85mm)			VL	Very Low	VN	Vein	UN	Undulose		
HQ	Rotary core (63.5mm)			ROCK WEATHERING		CL	Cleavage	ROUGHNESS		X	Carbonaceous
NMLC	Rotary core (51.94mm)			FR	Fresh	CS	Crushed Seam			MU	Unidentified mineral
DT	Diatube concrete coring			SW	Slightly Weathered	FZ	Fracture Zone	VR	Very Rough	MS	Secondary mineral
PT	Push tube			DW	Distinctly Weathered	DL	Drift Lift	RF	Rough	KT	Chlorite
PS	Percussion sampling			MW	Moderately Weathered	HB	Handing Break	S	Smooth	CA	Calcite
SON	Sonic drilling			HW	Highly Weathered	DB	Drilling Break	SL	Slockensided	Fe	Iron Oxide
AH	Air hammer			XW	Extremely Weathered			POL	Polished	Oz	Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council
 Project: Tripoli Way Upgrade and Extension
 Location: Albion Park, NSW
 Job No: 8201612601
 Sheet: 4 of 4

Position: E294015.083 N6172115.890 56 MGA94
 Angle from Horizontal: 90°
 Surface Elevation: 13.601 m AHD
 Rig Type: Hanjin D&B 8D
 Mounting: Track
 Driller: RR
 Casing Diameter: HQ/HW
 Bit Type: Impreg
 Bit Condition: Good
 Contractor: Cardno
 Data Started: 22/9/16
 Date Completed: 23/9/16
 Logged By: AC
 Checked By: DR

Coring				Depth (m)	Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)		Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $I_{s(50)}$ MPa	Average Natural Defect Spacing (mm)	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other	
NMLC	5% LOSS	99	95	-3		TUFFACEOUS SANDSTONE, fine grained, dark grey-black (continued)	SW	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000		16.00 m: DB 16.05 m: BP, IR, S, drill induced break along bedding 16.09 m: JT, 80°, PR, S, CT 16.14 m: BP, IR, S, drill induced break along bedding 16.30 m: DB 16.39 m: JT, CU, CN 16.66 m: JT, 0°, VNR 16.89 m: BP, 10°, PR, RF	
				-4							17.47 m: JT, 85° 17.68 m: JT, 0°, PR, RF, drill induced break along joint 17.91 m: DB	
				-5		CORE LOSS 0.04m (17.94-17.98) TERMINATED AT 17.98 m						
				-6								
				-7								
				-8								
				-9								
				-10								

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER Water Level on date shown water inflow water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz
--	---	---	---	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

Hole No: BH010

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 1 of 1

Position: E294065.617 N6172200.639 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 12.982 m AHD

Rig Type: Geoprobe 8140LS

Mounting: Track

Driller: RF

Casing Diameter:

Contractor: Numac Drilling

Data Started: 10/10/16

Date Completed: 10/10/16

Logged By: AC

Checked By: DR

Drilling			Water	Sampling & Testing	RL (m AHD)	Depth (m)	Material Description							
Method	Resistance	Casing		Sample or Field Test			Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations		
SONIC	E		Not Observed									TOPSOIL		
									0.20m	Sandy Clayey SILT: low plasticity, dark brown, fine to medium grained sand, with organics	M		ALLUVIUM	
									0.60m	Sandy Clayey SILT: low plasticity, dark brown, fine grained sand sand	M	S		

METHOD

EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION

VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER

Water Level on Date shown
water inflow
water outflow

FIELD TESTS

SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES

B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE

D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY

VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY

VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Hole No: BH101

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 1 of 3

Position: E295793.078 N6172634.156 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 6.245 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HW

Contractor: Total Drilling

Data Started: 11/9/17




Date Completed: 11/9/17

Logged By: GP

Checked By: DR

Drilling			Water	Sampling & Testing		RL (m AHD)	Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	Graphic Log			Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations	
AD/T	VE	HW	Water		6			Clayey SILT: brown, with fine grained sand	D		TOPSOIL		
						0.50m							
								CI	Sandy CLAY: medium plasticity, brown, fine-medium grained sand			ALLUVIUM	
						1.00m			Sandy CLAY: as above but orange brown mottled grey				
								CI		w > PL	F		
WB	E	HW	Water		3			CLAY: high plasticity, dark grey mottled brown orange, with fine grained sand, with silt					
WB	F	HW	Water		4			SPT 4.00 - 4.45 m 4, 8, 8 N*=16					
WB	F	HW	Water		5								
WB	F	HW	Water		6			SPT 5.50 - 5.95 m 9, 10, 10 N*=20					
WB	F	HW	Water		7			SPT 7.00 - 7.45 m 9, 9, 9 N*=18					
WB	H	HW	Water		8								
WB	H	HW	Water		9								
WB	H	HW	Water		10								
WB	H	HW	Water		11								
WB	H	HW	Water		12								
WB	H	HW	Water		13								
WB	H	HW	Water		14								
WB	H	HW	Water		15								
WB	H	HW	Water		16								
WB	H	HW	Water		17								
WB	H	HW	Water		18								
WB	H	HW	Water		19								
WB	H	HW	Water		20								
WB	H	HW	Water		21								
WB	H	HW	Water		22								
WB	H	HW	Water		23								
WB	H	HW	Water		24								
WB	H	HW	Water		25								
WB	H	HW	Water		26								

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)
WATER
 Water Level on Date shown
 water inflow
 water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'
MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Hole No: BH101

Client: Shellharbour City Council
 Project: Tripoli Way Upgrade and Extension
 Location: Albion Park, NSW

Job No: 8201612601

Sheet: 2 of 3

Position: E295793.078 N6172634.156 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 6.245 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HW






Contractor: Total Drilling

Data Started: 11/9/17

Date Completed: 11/9/17

Logged By: GP

Checked By: DR

Drilling			Sampling & Testing		Material Description							
Method	Resistance	Casing	Water	Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
WB	H		Water		-2		CL	8.50m	Silty CLAY: low plasticity, grey mottled orange, trace fine grained, ironstone gravel (continued)	w > PL	VSt	ALLUVIUM
				SPT 8.50 - 8.95 m 4, 7, 12 N*=19								
					-9		CI	10.00m	Silty CLAY: medium plasticity, grey mottled orange and green	w > PL	VSt	
	SPT 10.00 - 10.45 m 6, 10, 16 N*=26											
	VH			-11	CI		11.50m 11.60m	Sandy Silty CLAY: medium plasticity, orange mottled grey, fine-medium grained sand	w > PL	VSt		
				SPT 11.50 - 11.80 m 25, 50 N*=R	-12		GC		Sandy Clayey GRAVEL: medium plasticity, orange brown mottled green and grey, medium to coarse grained sand, with cobbles Continued as Cored Drill Hole		D	
					-6							
					-7							
					-8							
					-9							
METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller				PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER  Water Level on Date shown  water inflow  water outflow		FIELD TESTS SPT - Standard Penetration Test HP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photoionisation Detector VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)			SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube 'undisturbed' MOISTURE D - Dry M - Moist W - Wet PL - Plastic limit LL - Liquid limit w - Moisture content		SOIL CONSISTENCY VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense	
Refer to explanatory notes for details of abbreviations and basis of descriptions												
CARDNO (NSW/ACT) PTY LTD												

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council	Job No: 8201612601	Sheet: 3 of 4
Project: Tripoli Way Upgrade and Extension		
Location: Albion Park, NSW		
Position: E295793.078 N6172634.156 56 MGA94	Angle from Horizontal: 90°	Surface Elevation: 6.245 m AHD
Rig Type: Hanjin D&B 8D	Mounting: Track	Driller: CM
Casing Diameter: HW	Bit Type: SS	Bit Condition: Fair
Data Started: 11/9/17	Date Completed: 11/9/17	Logged By: GP
		Checked By: DR

Coring				Material Description						Defect Description			
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $I_{s(50)}$ MPa	Average Natural Defect Spacing (mm)	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other	
									<div>● - Axial ○ - Diametral</div> <div>VL 0.1 0.3 1 3 5 10 20 L M H V H EH</div>	<div>20 60 200 600 2000</div>			
					-2								
					-9								
					-3								
					-10								
					-4								
					-11								
					-5								
							11.60m START CORING AT 11.60m						

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER Water Level on date shown water inflow water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz
--	---	---	---	--	--




Refer to explanatory notes for details of abbreviations and basis of descriptions

Hole No: BH101

Client: Shellharbour City Council	Job No: 8201612601	Sheet: 4 of 4
Project: Tripoli Way Upgrade and Extension		
Location: Albion Park, NSW		

Position: E295793.078 N6172634.156 56 MGA94	Angle from Horizontal: 90°	Surface Elevation: 6.245 m AHD
Rig Type: Hanjin D&B 8D	Mounting: Track	Driller: CM
Casing Diameter: HW	Bit Type: SS	Bit Condition: Fair
Data Started: 11/9/17	Date Completed: 11/9/17	Logged By: GP
		Checked By: DR

Coring				RL (m AHD)	Depth (m)	Material Description				Defect Description											
Method	Fluid	TCR (%)	RQD (%)			Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength Is ₍₅₀₎ MPa ● - Axial ○ - Diametral VL 0.1 0.3 L 1 M 3 H 10 VH 30 EH 100	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other									
				-10																	15.05 m: JT, 45°, PR, RF, CT 15.10 m: DB 15.13 m: JT, 45°, PR, RF, CT 15.20 m: DB 15.34 m: DB 15.52 m: JT, 45°, PR, RF 15.60 m: DB 15.63 m: JT, 45°, PR, RF
				-17																	
				-11																	
				-18																	
				-12																	
				-19																	
				-13																	
				-20																	
				-14																	
				-21																	
				-15																	
				-22																	
				-16																	
				-23																	
				-17																	

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER  Water Level on date shown  water inflow  water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz
--	---	---	---	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Hole No: BH102

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 1 of 4

Position: E295760.045 N6172617.717 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 8.171 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HW

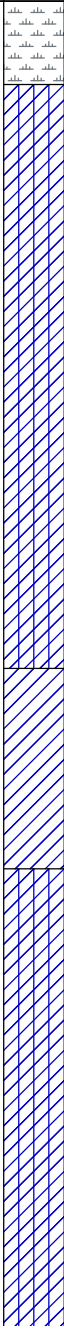
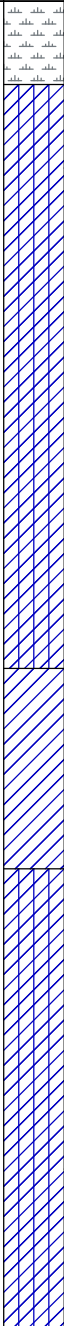
Contractor: Total Drilling

Data Started: 12/9/17

Date Completed: 12/9/17

Logged By: GP

Checked By: DR

Drilling			Water	Sampling & Testing		RL (m AHD)	Depth (m)	Material Description				
Method	Resistance	Casing		Sample or Field Test	Graphic Log			Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	VE	H	HW	Not Observed		8		Clayey SILT: low plasticity, brown, with sand	D		TOPSOIL	
						0.50m						
						1	CL	Silty CLAY: low to medium plasticity, dark brown mottled orange, with medium grained sand	w < PL	F	ALLUVIUM	
						7	CI	Silty CLAY: medium plasticity, grey mottled orange, with medium grained sand	w > PL	St		
						1.60m						
						2		Silty CLAY: medium plasticity, dark grey, with medium grained sand				
						3	CI		w > PL	VSt		
						4						
						4	CI-CH	CLAY: medium to high plasticity, pale grey, with silt, trace sand	w < PL	VSt		
						5						
						5.20m						
6	CI	Silty CLAY: medium plasticity, grey and orange mottled red, with fine grained sand	w < PL	VSt								
7												
WB	H					1		Silty CLAY: as above but with thin silt lenses	w > PL			
						7.00m						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)
WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'
MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Hole No: BH102

Client: Shellharbour City Council
Project: Tripoli Way Upgrade and Extension
Location: Albion Park, NSW

Job No: 8201612601

Sheet: 2 of 4

Position: E295760.045 N6172617.717 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 8.171 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HW





Contractor: Total Drilling

Data Started: 12/9/17




Date Completed: 12/9/17

Logged By: GP

Checked By: DR

Drilling			Sampling & Testing		Material Description								
Method	Resistance	Casing	Water	Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations	
WB	H	Not Observed	Not Observed		0			CI	Silty CLAY: as above but with thin silt lenses (continued)	w > PL	VSt	ALLUVIUM	
				SPT 8.50 - 8.95 m 8, 11, 14 N*=25				8.50m	Sandy CLAY: low to medium plasticity, grey mottled orange, with silt				
					-1			CL-CI					
				SPT 10.00 - 10.45 m 5, 8, 10 N*=18				10.00m	Sandy CLAY: as above but with trace coarse sand and gravel	w > PL	VSt		
					-2								
	F			SPT 11.50 - 11.95 m 7, 9, 12 N*=21				CL-CI				RESIDUAL SOIL	
					-3								
				SPT 13.00 - 13.45 m 6, 10, 12 N*=22				CL-CI	Sandy CLAY: low to medium plasticity, grey mottled orange, trace coarse grained sand	w > PL	VSt		
					-4								
					-5								
	H			SPT 14.50 - 14.80 m 14, 30 N*=R				CL-CI	Sandy Gravelly CLAY: low to medium plasticity, grey and orange mottled green, with fine grained sand, with gravel	w > PL	VSt		
					-6								
					-7				Continued as Cored Drill Hole				
METHOD				PENETRATION		FIELD TESTS			SAMPLES		SOIL CONSISTENCY		
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller				VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal)		SPT - Standard Penetration Test HP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photoionisation Detector VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)			B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube 'undisturbed'		VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard		
WATER									MOISTURE		RELATIVE DENSITY		
 Water Level on Date shown  water inflow  water outflow									D - Dry M - Moist W - Wet PL - Plastic limit LL - Liquid limit w - Moisture content		VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense		
Refer to explanatory notes for details of abbreviations and basis of descriptions													
CARDNO (NSW/ACT) PTY LTD													

METHOD
 EX Excavator bucket
 R Ripper
 HA Hand auger
 PT Push tube
 SON Sonic drilling
 AH Air hammer
 PS Percussion sampler
 AS Short spiral auger
 AD/V Solid flight auger: V-Bit
 AD/T Solid flight auger: TC-Bit
 HFA Hollow flight auger
 WB Washbore drilling
 RR Rock roller

PENETRATION
 VE Very Easy (No Resistance)
 E Easy
 F Firm
 H Hard
 VH Very Hard (Refusal)
WATER
 Water Level on Date shown
 water inflow
 water outflow

FIELD TESTS
 SPT - Standard Penetration Test
 HP - Hand/Pocket Penetrometer
 DCP - Dynamic Cone Penetrometer
 PSP - Perth Sand Penetrometer
 MC - Moisture Content
 PBT - Plate Bearing Test
 IMP - Borehole Impression Test
 PID - Photoionisation Detector
 VS - Vane Shear; P=Peak, R=Residual (uncorrected kPa)

SAMPLES
 B - Bulk disturbed sample
 D - Disturbed sample
 ES - Environmental sample
 U - Thin wall tube 'undisturbed'
MOISTURE
 D - Dry
 M - Moist
 W - Wet
 PL - Plastic limit
 LL - Liquid limit
 w - Moisture content

SOIL CONSISTENCY
 VS - Very Soft
 S - Soft
 F - Firm
 St - Stiff
 VSt - Very Stiff
 H - Hard
RELATIVE DENSITY
 VL - Very Loose
 L - Loose
 MD - Medium Dense
 D - Dense
 VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Client: Shellharbour City Council
 Project: Tripoli Way Upgrade and Extension
 Location: Albion Park, NSW

Job No: 8201612601

Sheet: 3 of 4

Position: E295760.045 N6172617.717 56 MGA94

Angle from Horizontal: 90°

Surface Elevation: 8.171 m AHD

Rig Type: Hanjin D&B 8D

Mounting: Track

Driller: CM

Casing Diameter: HW

Bit Type: SS

Bit Condition: Good




Contractor: Total Drilling

Data Started: 12/9/17

Date Completed: 12/9/17

Logged By: GP


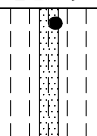
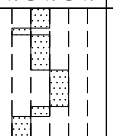
Checked By: DR




Coring				Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength Is(50) MPa	Average Natural Defect Spacing (mm)	Visual	Defect Description		
Method	Fluid	TCR (%)	RQD (%)										
				0									
				9									
				10									
				11									
				12									
				13									
				14									
				15		14.80m START CORING AT 14.80m SILTSTONE, indistinct fabric, dark grey	MW				14.80 - 15.15 m: BP, 3°, PR, RF, CT, Multiple bedding partings, average spacing 50mm 15.22 m: JT, 85°, CU, S, VNR, 15.15-15.55: Closed subvertical joint 15.32 m: BP, 2°, PR, RF, CT 15.28 - 15.64 m: FZ, IR, RF, SN, Closed 15.60 m: BP, 5°, PR, RF, CT 15.67 m: DB, Along joint 15.72 m: JT, 45°, IR, RF, Closed 15.78 m: DB		
DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer				WATER  Water Level on date shown  water inflow  water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)		ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered		DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break		PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished		COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz	

Refer to explanatory notes for details of abbreviations and basis of descriptions

Client: Shellharbour City Council Project: Tripoli Way Upgrade and Extension Location: Albion Park, NSW	Job No: 8201612601	Sheet: 4 of 4
--	---------------------------	----------------------

Position: E295760.045 N6172617.717 56 MGA94	Angle from Horizontal: 90°	Surface Elevation: 8.171 m AHD
Rig Type: Hanjin D&B 8D	Mounting: Track	Driller: CM
Casing Diameter: HW	Bit Type: SS	Bit Condition: Good
Data Started: 12/9/17	Date Completed: 12/9/17	Logged By: GP
Checked By: DR		

Coring				RL (m AHD)	Depth (m)	Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)			Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength IS ₍₅₀₎ MPa ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other	
NMLC ↓	10% LOSS	100	72	-8		SILTSTONE, indistinct fabric, dark grey <i>(continued)</i>	SW to F				<div><div></div><div>15.84 m: BP, 5°, PR, RF, VNR</div><div>16.00 m: JT, 60°, PR, VR, CN, Drill induced</div><div>16.12 m: BP, 10°, IR, RF, CT</div><div>16.16 m: JT, 50°, IR, VR, SN</div><div>16.30 m: BP, 2°, PR, RF, VNR, possible pyrite</div><div>16.37 m: JT, 20°, IR, RF, CN</div><div>16.47 m: DB, along bedding plane</div><div>16.59 m: JT, PR, CN, drill induced</div><div>16.65 - 16.80 m: FZ, IR, RF, CN, Drill induced along planes and joints</div></div>		
				-17		TERMINATED AT 16.80 m							
				-9									
				-10									
				-11									
				-12									
				-13									
				-14									
				-15									

DRILLING AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller PQ Rotary core (85mm) HQ Rotary core (63.5mm) NMLC Rotary core (51.94mm) DT Diatube concrete coring PT Push tube PS Percussion sampling SON Sonic drilling AH Air hammer	WATER  Water Level on date shown  water inflow  water outflow ROCK QUALITY DESCRIPTIONS RQD Rock Quality Designation (%) TCR Total Core Recovery (%)	ROCK STRENGTH EH Extremely High VH Very High H High M Medium L Low VL Very Low ROCK WEATHERING FR Fresh SW Slightly Weathered DW Distinctly Weathered MW Moderately Weathered HW Highly Weathered XW Extremely Weathered	DEFECT TYPE JT Joint SZ Sheared zone BP Bedding Parting SM Seam FL Foliation VN Vein CL Cleavage CS Crushed Seam FZ Fracture Zone DL Drift Lift HB Handing Break DB Drilling Break	PLANARITY CU Curved DIS Discontinuous IR Irregular PR Planar ST Stepped UN Undulose ROUGHNESS VR Very Rough RF Rough S Smooth SL Stockensided POL Polished	COATING CN Clean SN Stained VNR Veneer (thin or patchy) CT Coating (up to 1mm) INFILL MATERIALS X Carbonaceous MU Unidentified mineral MS Secondary mineral KT Chlorite CA Calcite Fe Iron Oxide Qz Quartz
--	---	---	---	--	--

Refer to explanatory notes for details of abbreviations and basis of descriptions

Tripoli Way Extension,
Albion Park NSW

APPENDIX

D






HISTORICAL AERIAL PHOTOGRAPHS



Aerial Imagery: 1948

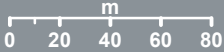
TRIPOLI WAY
EXTENSION PROJECT

Legend

-  Study Area (20.20 ha)
-  Proposed Road Alignment
-  Proposed Stormwater Network
-  Construction Footprint (14.47 ha)
-  Potential Ancillary Facility

Page 1

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-029-AerialImagery1948 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1948)



Aerial Imagery: 1948

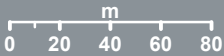
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 2

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-029-AerialImagery1948 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1948)



Aerial Imagery: 1948

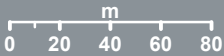
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 3

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-029-AerialImagery1948 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1948)



Aerial Imagery: 1961

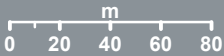
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 1

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-030-AerialImagery1961 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1961)



Aerial Imagery: 1961

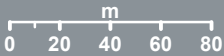
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 2

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-030-AerialImagery1961 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1961)



Aerial Imagery: 1961

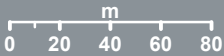
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 3

1:3,000 Scale at A3








Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-030-AerialImagery1961 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1961)

Aerial Imagery: 1973

TRIPOLI WAY EXTENSION PROJECT

Legend

-  Study Area (20.20 ha)
-  Proposed Road Alignment
-  Proposed Stormwater Network
-  Construction Footprint (14.47 ha)
-  Potential Ancillary Facility

TONGARRA ROAD

Page 1

1:3,000 Scale at A3

0 20 40 60 80
m



 Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-031-AerialImagery1973 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1973)



Aerial Imagery: 1973

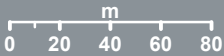
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 2

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-031-AerialImagery1973 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1973)



Aerial Imagery: 1973

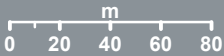
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 3

1:3,000 Scale at A3








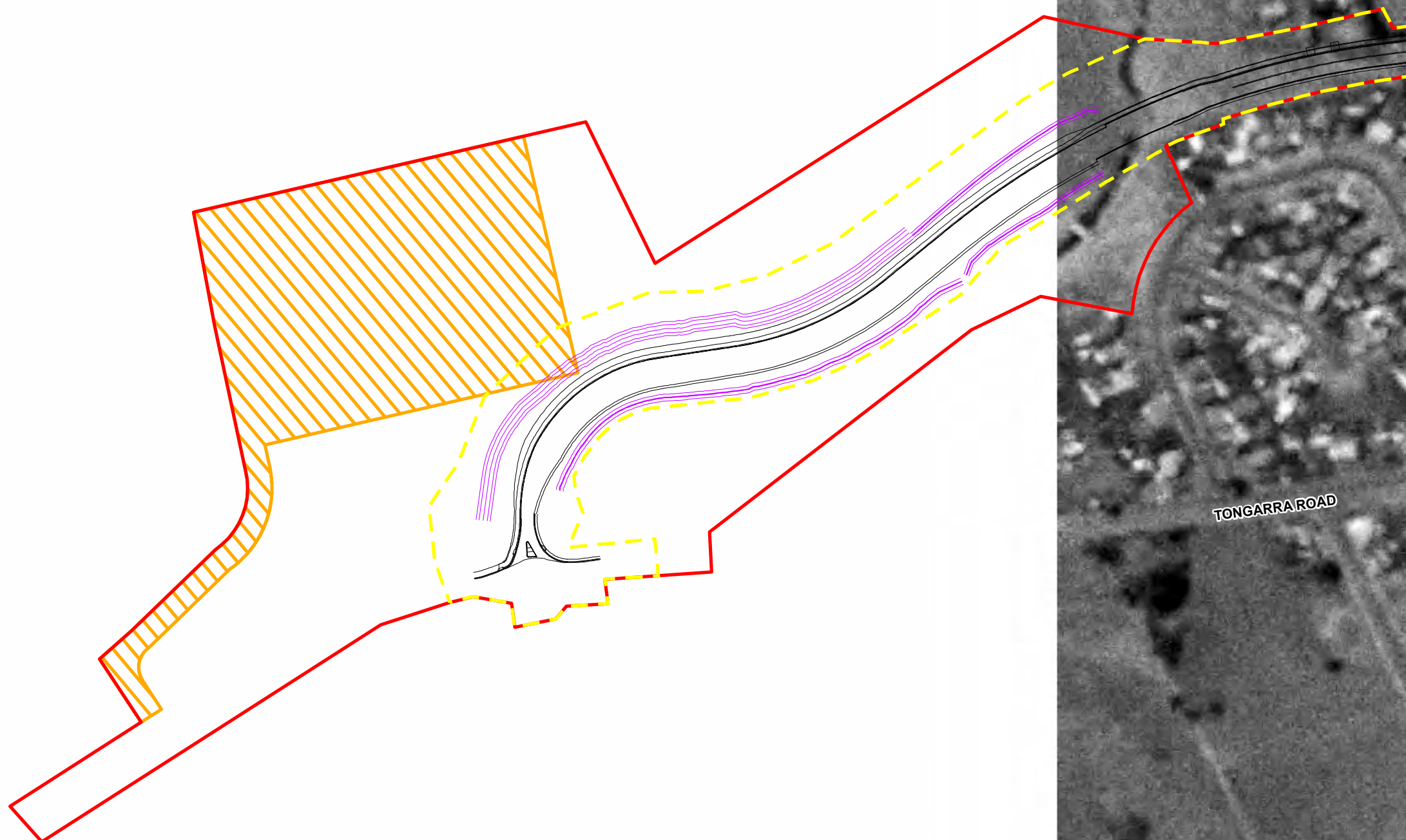
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-031-AerialImagery1973 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1973)

Aerial Imagery: 1980

TRIPOLI WAY EXTENSION PROJECT

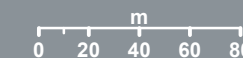
Legend

-  Study Area (20.20 ha)
-  Proposed Road Alignment
-  Proposed Stormwater Network
-  Construction Footprint (14.47 ha)
-  Potential Ancillary Facility



Page 1

1:3,000 Scale at A3








Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-032-AerialImagery1980 DDP.mxd_02
Aerial Imagery supplied by Shellharbour City Council (1980)

Aerial Imagery: 1980

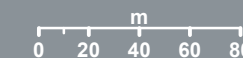
TRIPOLI WAY
EXTENSION PROJECT

Legend

-  Study Area (20.20 ha)
-  Proposed Road Alignment
-  Proposed Stormwater Network
-  Construction Footprint (14.47 ha)
-  Potential Ancillary Facility

Page 2

1:3,000 Scale at A3



 Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-032-AerialImagery1980 DDP.mxd_02
Aerial Imagery supplied by Shellharbour City Council (1980)

TONGARRA ROAD



Aerial Imagery: 1980

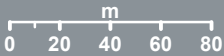
TRIPOLI WAY
EXTENSION PROJECT

Legend

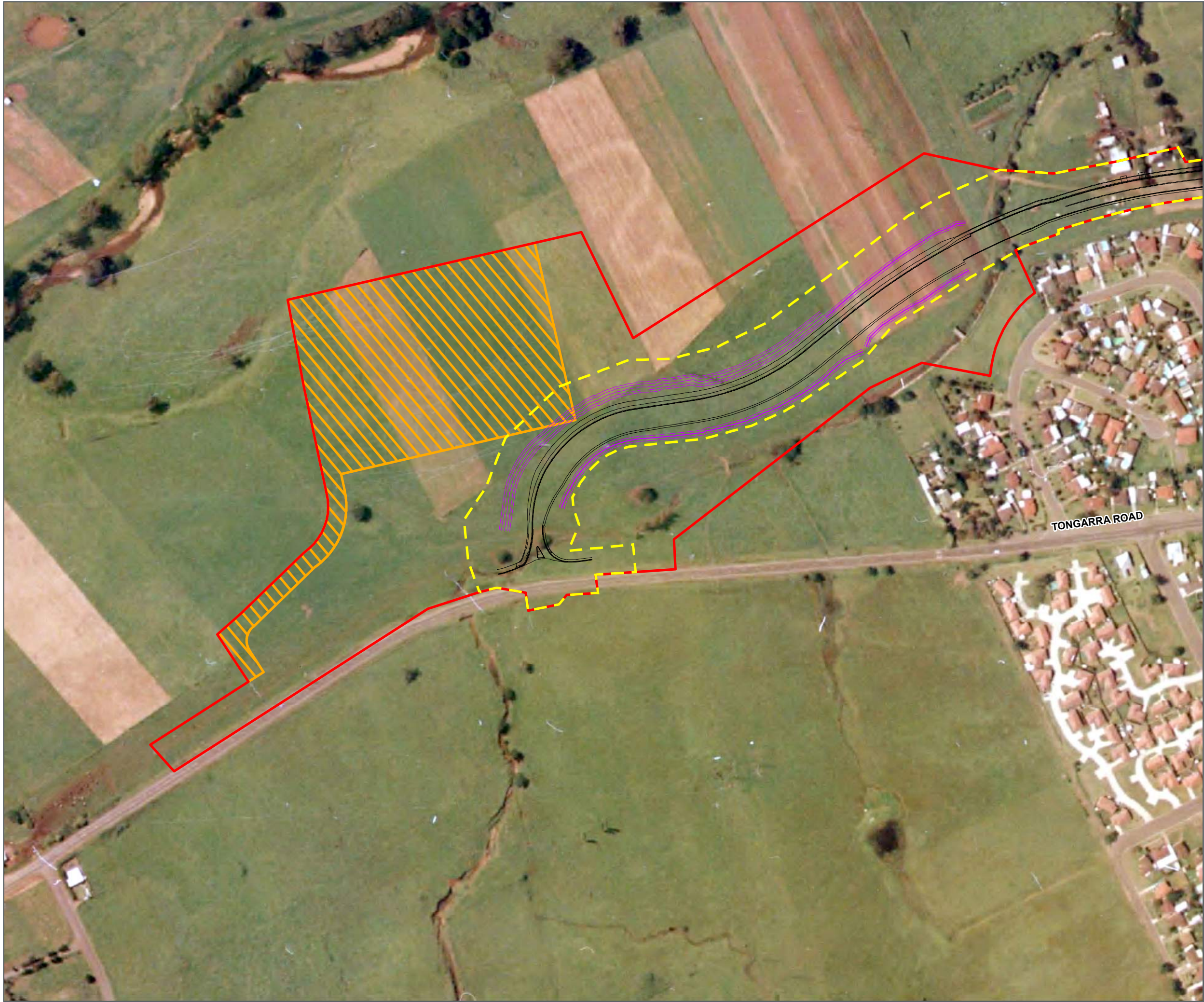
- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 3

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-032-AerialImagery1980 DDP.mxd_02
Aerial Imagery supplied by Shellharbour City Council (1980)



Aerial Imagery: 1993

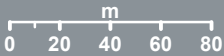
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 1

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-033-AerialImagery1993 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1993)



Aerial Imagery: 1993

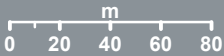
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 2

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-033-AerialImagery1993 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1993)



Aerial Imagery: 1993

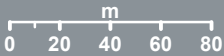
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 3

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-033-AerialImagery1993 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (1993)



Aerial Imagery: 2008

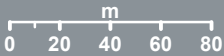
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 1

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-034-AerialImagery2008 DDP.mxd_02
Aerial Imagery supplied by Shellharbour City Council (2008)

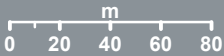


Aerial Imagery: 2008

TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility










Aerial Imagery: 2008

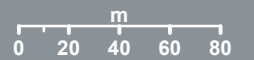
TRIPOLI WAY
EXTENSION PROJECT

Legend

-  Study Area (20.20 ha)
-  Proposed Road Alignment
-  Proposed Stormwater Network
-  Construction Footprint (14.47 ha)
-  Potential Ancillary Facility

Page 3

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-034-AerialImagery2008 DDP.mxd_02
Aerial Imagery supplied by Shellharbour City Council (2008)



Aerial Imagery: 2016

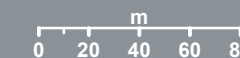
TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility

Page 1

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-035-AerialImagery2016 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (2016)

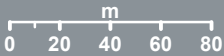


Aerial Imagery: 2016

TRIPOLI WAY
EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Proposed Stormwater Network
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility










Aerial Imagery: 2016

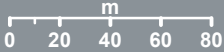
TRIPOLI WAY
EXTENSION PROJECT

Legend

-  Study Area (20.20 ha)
-  Proposed Road Alignment
-  Proposed Stormwater Network
-  Construction Footprint (14.47 ha)
-  Potential Ancillary Facility

Page 3

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2021-09-27 | Project: 82016126
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-035-AerialImagery2016 DDP.mxd 02
Aerial Imagery supplied by Shellharbour City Council (2016)