APPENDIX



Geotechnical Factual Report

Part 2 of 2

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT



The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

Appendix D Laboratory Test Result Summary and Reports

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT

Summary of Laboratory Results 1

		Ē		5	ontent	F	Plasticity					Gradin	9				Shrink	Swell		Aggressivi	ty	Emerson	Slake D	Durability	Uniaxial	Compressive S Deformation ²	trength &	Point	t Load	Test	nsity	Factor	hing Value
Borehole	Sample ID	Depth (nsc	Material Descript	Moisture Co	5 E	ᅯᆸ	rs	Clay Silt	Clay/Silt		Sand	Sand	Gravel		Gravel	Swell Shrinkage	Shrink Swell Index	Soluble Sulfate	Chloride	Ha	Class number	1st Cycle	2nd Cycle	ncs	roung's Modulus (Tangent)	Poisson Ratio (Tangent)	Axial Is(50)	Diametral Is(50)	Brazilian	Particle De	Degradation	Aggregate Crus
		From To			%	% >	%	%	2um 60um	%	fine	med coarse	%	fine med	coarse	%	%	* %	mg/kg	mg/kg	•		%	%	MPa	GPa		MPa	MPa	MPa	ťm³		%
330-01-BH2101	330-01-BH2101-C07000	70.00 71.00	· ·	SANDSTONE																					15.60	15.800	0.079			1.520			
330-01-BH2101 330-01-BH2101	330-01-BH2101-C07000 330-01-BH2101-C07000	70.20 70.33 70.33 70.47	-	SANDSTONE		_	_					_		_	+ +			_										1.15	1.04				
330-01-BH2101	330-01-BH2101-C07000	70.47 70.60	-	SANDSTONE																								0.94	0.95				
330-01-BH2101	330-01-BH2101-C07000	70.60 70.73	-	SANDSTONE																								1.34	0.84				
330-01-BH2101 330-01-BH2101	330-01-BH2101-C07000 330-01-BH2101-C07200	70.73 70.86	-	SANDSTONE		_	_					_		_	+ +			_										0.76	1.00	0 751			
330-01-BH2101	330-01-BH2101-C07200	72.03 72.15	-	SANDSTONE																								0.36	0.45	0.701			
330-01-BH2101	330-01-BH2101-C07200	72.20 72.36	-	SANDSTONE																					7.47	5.650	0.151						
330-01-BH2101	330-01-BH2101-C07200	72.36 72.49	-	SANDSTONE			_			+	_	_			+ +			_										0.46	0.36				
330-01-BH2101	330-01-BH2101-C07200	72.61 72.74	-	SANDSTONE											+ +													0.36	0.23				
330-01-BH2101	330-01-BH2101-C07200	72.74 72.81	-	SANDSTONE																								0.39	0.36				
330-01-BH2101	330-01-BH2101-C08100	81.00 82.00	-	SANDSTONE			_					_			+ +	_	_	_							12.00	E 400	0.063			1.030			
330-01-ВП2101 330-01-ВН2101	330-01-BH2101-C08100	81.43 81.53	-	SANDSTONE						+															13.00	5.400	0.003	0.79	0.80				
330-01-BH2101	330-01-BH2101-C08100	81.53 81.63	-	SANDSTONE																								0.7	0.84				
330-01-BH2101	330-01-BH2101-C08100	81.63 81.74	-	SANDSTONE			_			$ \rightarrow $		_			+ +			_										0.83	0.80				
330-01-BH2101 330-01-BH2101	330-01-BH2101-C08100	81.84 81.93	-	SANDSTONE											+ +													1.12	1.02				
330-01-BH2101	330-01-BH2101-C08610	86.10 86.18	-	SANDSTONE																								0.36	0.45				
330-01-BH2101	330-01-BH2101-C08610	86.18 86.34	-	SANDSTONE			_					_						_							2.37	2.120	0.036	0.47	0.47				
330-01-BH2101 330-01-BH2101	330-01-BH2101-C08610 330-01-BH2101-C08610	86.42 86.49	-	SANDSTONE			-					-		_														0.17	0.17				
330-01-BH2101	330-01-BH2101-C08610	86.49 86.57	-	SANDSTONE																								0.36	0.36				
330-01-BH2101	330-01-BH2101-C08610	86.57 86.66	-	SANDSTONE								_																0.08	0.11	0.447			
330-01-BH2101 330-01-BH2101	330-01-BH2101-C08700 330-01-BH2101-C08700	87.00 87.50 87.07 87.21	-	SANDSTONE			_			+															10.10	2.360	0.035			0.417			
330-01-BH2101	330-01-BH2101-C08700	87.21 87.28	-	SANDSTONE																								0.93	0.64				
330-01-BH2101	330-01-BH2101-C08700	87.28 87.35	-	SANDSTONE																								0.72	0.57				
330-01-BH2101 330-01-BH2101	330-01-BH2101-C08700 330-01-BH2101-C08700	87.35 87.42 87.42 87.50	-	SANDSTONE						+				_	+ +													0.54	0.21				
330-01-BH2101	330-01-BH2101-C09100	91.00 91.70	-	SILTSTONE																								1.00	0.01	0.262			
330-01-BH2101	330-01-BH2101-C09100	91.05 91.15	-	SILTSTONE																								0.29	0.01				
330-01-BH2101	330-01-BH2101-C09100 330-01-BH2101-C09100	91.21 91.27 91.32 91.42	-	SILTSTONE			_								+ +													0.09	-				
330-01-BH2101	330-01-BH2101-C09100	91.47 91.51	-	SILTSTONE																								0.10	-				
330-01-BH2101	330-01-BH2101-C09100	91.59 91.70	-	SILTSTONE								_																0.35	0.09				
330-01-BH2101	330-01-BH2101-C09500	95.00 95.70	-	SANDSTONE			_			+	_	_			+ +			_												1 200			
330-01-BH2101	330-01-BH2101-C09600	96.05 96.20	-	SANDSTONE																					6.78	1.460	0.043			1.230			
330-01-BH2101	330-01-BH2101-C09600	96.21 96.31	-	SANDSTONE																								1.10	0.69				
330-01-BH2101	330-01-BH2101-C09600	96.31 96.41	-	SANDSTONE			_			+	_	_			+ +			_										0.77	0.80				
330-01-BH2101	330-01-BH2101-C09600	96.52 96.63	-	SANDSTONE																								1.14	1.40				
330-01-BH2101	330-01-BH2101-C09600	96.63 96.73	-	SANDSTONE																								1.21	0.84				
330-01-BH2101	330-01-BH2101-C09970	99.70 99.90	-	SANDSTONE	\vdash	_		<u> </u>		+			\vdash		+										57 70	25 100	0.040			8.120			
330-01-ВП2101 330-01-ВН2101	330-01-BH2101-C10460	104.69 104.80		SANDSTONE SILTSTONE / MUDSTONE						+											<u> </u>				57.70	23.100	0.049	1.03	0.17				
330-01-BH2101	330-01-BH2101-C10460	104.80 104.90	-	SILTSTONE / MUDSTONE																								0.79	0.08				
330-01-BH2101	330-01-BH2101-C10820	108.20 109.00	-	SILTSTONE / SANDSTONE		_		-		┢─┦	-+	_	\vdash		+													0.62		0.207			
330-01-ВП2101 330-01-ВН2101	330-01-BH2101-C10820	108.58 108.63	-	SILTSTONE / SANDSTONE				<u> </u>		+											<u> </u>							0.03	-				
330-01-BH2101	330-01-BH2101-C10820	108.82 108.86	-	SILTSTONE / SANDSTONE																								0.48	-				
330-01-BH2101	330-01-BH2101-C10820	108.86 108.90	-	SILTSTONE / SANDSTONE			_				_	_						_										0.36	-				
330-01-ВН2101 330-01-ВН2101	330-01-BH2101-C10820 330-01-BH2101-C11400	114.00 115.00	-	SILISIONE / SANDSTONE SANDSTONE				-		+																		0.98	0.05	2.470			
330-01-BH2101	330-01-BH2101-C11400	114.00 114.17	-	SANDSTONE																					26.70	7.730	0.172						
330-01-BH2101	330-01-BH2101-C11400	114.16 114.25		SANDSTONE						+			\vdash		+													1.80	1.99				
330-01-ВН2101 330-01-ВН2101	330-01-BH2101-C11400	114.25 114.37 114.37 114.50	-	SANDSTONE				-		+																		2.62	1.20				
330-01-BH2101	330-01-BH2101-C11400	114.50 114.62	-	SANDSTONE																								2.13	1.13				
330-01-BH2101	330-01-BH2101-C11400	114.62 114.75	-	SANDSTONE	\vdash					$+ \overline{+}$			\square		+													2.08	1.88	0.640			
330-01-ВН2101 330-01-ВН2101	330-01-BH2101-C11700	117.00 117.90	-	SANDSTONE						+			+												32.90	19.000	0.035			2.040			
330-01-BH2101	330-01-BH2101-C12030	120.30 120.90	-	SILTSTONE / SANDSTONE																										1.940			
330-01-BH2101	330-01-BH2101-C12030	120.33 120.42	-	SILTSTONE / SANDSTONE		$-\Gamma$				$+ \neg$		_																1.01	0.55				
330-01-ВН2101 330-01-ВН2101	330-01-BH2101-C12030 330-01-BH2101-C12030	120.53 120.63	-	SILTSTONE / SANDSTONE						+			$\left \right $															0.92	0.25				
330-01-BH2101	330-01-BH2101-C12030	120.71 120.77	-	SILTSTONE / SANDSTONE																								0.98	0.56				
330-01-BH2101	330-01-BH2101-C12030	120.81 120.90	-	SILTSTONE / SANDSTONE																					7.0-	0.075	0.10-	0.67	0.18				
330-01-BH2102 330-01-BH2102	330-01-BH2102-C00365 330-01-BH2102-C00365	3.65 3.80 3.80 3.88	-	SANDSTONE			_	-		+			\vdash												7.67	2.670	0.107	0.18	0.28				
330-01-BH2102	330-01-BH2102-C00365	3.88 3.94	-	SANDSTONE																								0.53	0.31				
330-01-BH2102	330-01-BH2102-C00365	3.94 4.00	-	SANDSTONE																								0.43	0.38				
330-01-BH2102	330-01-BH2102-C00365	4.00 4.08		SANDSTONE			1	1		1 I		- I	1 I					- I	1	1	1	1		1	1			0.85	0.27				

Summary of Laboratory Results 1

			Ē	5	ontent		Plastici	ty					Grading	3				Shi	ink Swell		Ag	gressivity	,	Emerson	Slake Di	urability	Uniaxial	Compressive St Deformation ²	trength &	Point	Load	Test	nsity	Factor	hing Value
Borehole	Sample ID		Depth D	USC Material Descript	Moisture C	F	님	a s	Clay	Sit	Clay/Silt	Sand		Sand		Gravel	Gravel	Swell	Shrinkage	Shrink Swell Index	Soluble Sulfate	Chloride	Ħ	Class number	1st Cycle	2nd Cycle	ncs	Young's Modulus (Tangent)	Poisson Ratio (Tangent)	Axial Is(50)	Diametral Is(50)	Brazilian	Particle De	Degradation	Aggregate Crus
		From	То		%	%	%	% %	2um	60um	%	med	coarse	%	fine	med coarse	%	%	%	%	mg/kg	mg/kg			%	%	MPa	GPa	•	MPa	MPa	MPa	ťm³		%
330-01-BH2102	330-01-BH2102-C00365	4.08	4.14	- SANDSTONE																										0.01	0.00				
330-01-BH2102 330-01-BH2102	330-01-BH2102-C00420 330-01-BH2102-C01020	4.20	5.00 11.00	- MUDSTONE - SANDSTONE				_	+-+								-		_						68.5	15.5						7.430			
330-01-BH2102	330-01-BH2102-C01020	10.24	10.38	- SANDSTONE																							41.20	24.700	0.030						
330-01-BH2102	330-01-BH2102-C01020	10.38 10.45	10.45 10.52	- SANDSTONE			_	_			_	_				_	-			_										1.76	0.73				
330-01-BH2102	330-01-BH2102-C01020	10.52	10.60	- SANDSTONE																										1.37	0.69				
330-01-BH2102	330-01-BH2102-C01020	10.60	10.69	- SANDSTONE				_			_	_			_	_	-													1.41	1.36				
330-01-BH2102	330-01-BH2102-C02046	20.50	20.60	- MUDSTONE					+ +																					0.54	0.17				
330-01-BH2102	330-01-BH2102-C02046	20.60	20.68	- MUDSTONE																										0.50	0.03				
330-01-BH2102 330-01-BH2102	330-01-BH2102-C02046 330-01-BH2102-C02046	20.68	20.76	- MUDSTONE - MUDSTONE					+ +		-	-					-													0.21	0.15				
330-01-BH2102	330-01-BH2102-C02046	20.85	20.95	- MUDSTONE																										0.45	0.18				
330-01-BH2103 330-01-BH2103	330-01-BH2103-S00050 330-01-BH2103-S00350	0.50	0.95	CL Sandy CLAY	7.3 13.8	35 33	14 2 15 1	21 11. 18 9.	.5 5		54 21 36 14	2 17 5 25	7	46 56	0	0 0 7 0	0		_	-	20 20	<10 <10	7.7	6											
330-01-BH2103	330-01-BH2103-U00600	6.00	6.29	CI CLAY	23.8	50	20 3	30 13	.0		78 1	3 6	3	22	0	0 0	0				140	<10	5.4	4											
330-01-BH2103	330-01-BH2103-C01700	17.00 17.15	17.15 17.38	- SANDSTONE			_	_			_	_				_	-			_							6.89	0.389	0.105	0.35	0.12				
330-01-BH2103	330-01-BH2103-C01738	17.38	17.60	- SANDSTONE																										0.00	0.12				
330-01-BH2103	330-01-BH2103-C01800	18.00	18.13	- SANDSTONE							_					_														0.30	0.21				
330-01-BH2103	330-01-BH2103-C01920	19.42	19.33	- SANDSTONE					+ +																		3.53	0.321	0.098	0.17	0.10				
330-01-BH2103	330-01-BH2103-C02175	21.75	21.85	- SILTSTONE																							2.09	0.220	0.106	0.20	0.16				
330-01-BH2103 330-01-BH2103	330-01-BH2103-C02175	21.85	22.00	- SANDSTONE					+ +		-	-					-										3.98	0.329	0.106						
330-01-BH2103	330-01-BH2103-C02285	22.90	23.00	- SANDSTONE																										0.44	0.15				
330-01-BH2103 330-01-BH2103	330-01-BH2103-C02555 330-01-BH2103-C02555	27.12 27.30	27.30 27.40	- SANDSTONE - SANDSTONE				_	+ +		_	-								_							5.63	1.180	0.087	1.24	0.66				
330-01-BH2103	330-01-BH2103-C02800	28.00	28.10	- SANDSTONE																										0.40	0.44				
330-01-BH2103 330-01-BH2104	330-01-BH2103-C02800 330-01-BH2104-S00050	28.00 0.50	28.30 0.95	- SANDSTONE	93	32	16 1	16 6	5		17 2	2 25	6	53	0	0 0	0			_	<10	<10	69	6											
330-01-BH2104	330-01-BH2104-S00350	3.50	3.94	CL Sandy CLAY	11.6	35	16 1	19 10	.5		46 2 ⁻	1 24	7	52	2	0 0	2				10	30	8.2	Ŭ											
330-01-BH2104	330-01-BH2104-S00800	8.00	8.45 16.35	CH CLAY	20.1	58	23 3	35 16	.5	9	98 1	1	0	2	0	0 0	0				40	260	9				3.04	0.087	0.406						
330-01-BH2104	330-01-BH2104-C01600	16.00	16.11	- SANDSTONE																							5.04	0.007	0.400	0.26	0.20				
330-01-BH2104	330-01-BH2104-C01965	19.65	20.00	- SANDSTONE																							1.91	0.067	0.471	0.24	0.32				
330-01-BH2104	330-01-BH2104-C02000	20.00	20.15	- SANDSTONE					+ +																					0.34	0.32				
330-01-BH2104	330-01-BH2104-C02152	21.52	22.10	- SANDSTONE																							5.38	1.190	0.006						
330-01-BH2104	330-01-BH2104-C02152	21.86	21.96	- SANDSTONE / CONGLOMERATE																										0.22	0.11				
330-01-BH2104 330-01-BH2104	330-01-BH2104-C02346 330-01-BH2104-C02492	23.46 24.92	23.59 25.00	- SILTSTONE				_				_				_	-													0.24	0.28				
330-01-BH2104	330-01-BH2104-C02505	25.05	25.20	- SANDSTONE																							31.50	16.800	0.099						
330-01-BH2104 330-01-BH2104	330-01-BH2104-C02520	25.22 25.45	25.34 25.58	- SANDSTONE			_	_			_	_				_	-			_							17 70	18 900	0.062	0.33	1.42				
330-01-BH2104	330-01-BH2104-C02700	27.00	27.40	- SANDSTONE																							12.50	1.560	0.378						
330-01-BH2104	330-01-BH2104-C02700	27.15	27.29	- SANDSTONE		┝			+	-+				┝──┦				+									14 60	1 370	0 100	1.42	0.75				
330-01-BH2104	330-01-BH2104-C03000	30.15	30.25	- SILTSTONE																							14.00	1.070	0.100	0.77	0.42				
330-01-BH2203	330-01-BH2203-S00350	3.50	3.95	SC Clayey SAND	10.8	22	13	9 3.	0		19 13	3 39	27	79 51	2	0 0	2																		
330-01-ВН2203 330-01-ВН2203	330-01-BH2203-S00500	6.50	5.45 6.90	SW SAND	10.9	31	12	19 10.			+ <i>i</i> 13	5 21	Э	01	۷	U U	2				<10	10	6.8												
330-01-BH2203	330-01-BH2203-S00950	9.50	9.77	SW Gravelly SAND																	10	<10	6.5												
330-01-ВН2203 330-01-ВН2203	330-01-BH2203-S01100 330-01-BH2203-C01500	11.00	11.29 16.00	- Gravelly SAND					+				-				-	+			10	<10	5.9				9.65	1.300	0.083	0.28	0.18				
330-01-BH2203	330-01-BH2203-C01650	16.50	17.50	- CONGLOMERATE																							26.60	6.350	0.125	0.43	0.05				
330-01-BH2203 330-01-BH2203	330-01-BH2203-C01850 330-01-BH2203-C01950	18.50	19.00 20.00	- CONGLOMERATE - CONGLOMERATE													-										21.40	4.570	0.069	0.23	0.13				
330-01-BH2203	330-01-BH2203-C02000	20.00	20.50	- CONGLOMERATE																									0.551	2	2.24				
330-01-BH2203 330-01-BH2207	330-01-BH2203-C02200 330-01-BH2207-S00050	22.00 0.50	23.00 0.95	- SANDSTONE SC Clayey SAND	3.9	20	9 1	11 5.	5		30 10) 24	28	62	8	0 0	8				10	<10	5.8				6.66	0.726	U.093	0.29	0.19				
330-01-BH2207	330-01-BH2207-S00500	5.00	5.45	CL-CI Sandy CLAY	10.0	35	14 2	21 10	.0		38 20) 35	7	62	0	0 0	0																		
330-01-BH2207 330-01-BH2207	330-01-BH2207-S00650 330-01-BH2207-S00950	6.50 9.50	6.65 9.76	CL-CI Sandy CLAY CL-CI Sandy CLAY		\vdash		_	+	-+				\vdash		_	-	$\left \right $			40 20	220 440	9.6 8.8												
330-01-BH2207	330-01-BH2207-C01150	11.50	12.00	- SANDSTONE																			0.0							0.3	0.43				
330-01-BH2207 330-01-BH2207	330-01-BH2207-C01200 330-01-BH2207-C01350	12.00 13.50	12.50 14.00	- SANDSTONE					+	-+				┝──┦				+									4.04	1.340	0.061	0.15	0.06				
330-01-BH2207	330-01-BH2207-C01400	14.00	14.50	- SANDSTONE																							4.12	0.937	0.026	0.10	0.00				
330-01-BH2207	330-01-BH2207-C01550	15.50	16.00	- SANDSTONE							$-\Gamma$			\vdash						$-\Gamma$										1.76	1.36				
330-01-BH2207	330-01-BH2207-C01700	17.00	17.50	- SANDSTONE																							5.29	0.245	0.143	0.40	0.23				
330-01-BH2207	330-01-BH2207-C01950	19.50	20.00	- SANDSTONE																							47.0	1.00	0.066	1.56	0.73				
330-01-BH2212 330-01-BH2212	330-01-BH2212-S00050	0.50	20.50 0.95	CH CLAY					++				-				-				130	220	9.0				17.2	1.20	000.0						

Summary of Laboratory Results 1

		<u>(j</u>		Ę	content		Plasticity					Gra	ding				SI	nrink Swe	əll	Ą	ggressivity	y	Emerson	Slake D	urability	Uniaxial	Compressive S Deformation ²	strength &	Point	t Load	Test	ensity	1 Factor	shing Value
Borehole	Sample ID	Depth	nsc	Material Descrip	Moisture C	3	7 5	S	Clay	ont Clay/Silt		Sand	Sand		Gravel	Gravel	Swell	Shrinkage	Shrink Swell Index	Soluble Sulfate	Chloride	H	Class number	1st Cycle	2nd Cycle	ncs	Young's Modulus (Tangent)	Poisson Ratio (Tangent)	Axial Is(50)	Diametral Is(50)	Brazilian	Particle D	Degradatio	Aggregate Cru
		From To			%	%	% %	%	2um	w	fine	med	,0ai se	fine	med	coarse	%	%	%	mg/kg	mg/kg			%	%	MPa	GPa		MPa	MPa	МРа	ťm³		%
330-01-BH2212	330-01-BH2212-S00200	2.00 2.45	СН	CLAY	24.6	58	21 37	17.0		74	13	8	5 26	0	0	0 0				_	_													
330-01-BH2212	330-01-BH2212-S00500	5.00 5.45	СН	CLAY	38.2	95	23 72	21.5	;	97	1	1	1 3	0	0	0 0				20	920	0.2												
330-01-BH2212	330-01-BH2212-S01100	11.00 11.45	CH	CLAY	29.6	97	20 77	21.5	;	96	1	2	1 4	0	0	0 0				20	320	5.2												
330-01-BH2212	330-01-BH2212-S02300	23.00 23.21	SW	SAND																<10	70	9.7												
330-01-BH2212 330-01-BH2212	330-01-BH2212-C02460 330-01-BH2212-C02470	24.60 24.70 24.70 24.80	-	SANDSTONE			_	-					_													8.28	1.400	0.047	0.72	0.74				
330-01-BH2212	330-01-BH2212-C02520	25.20 25.30	-	SANDSTONE																									0.11	0.1				
330-01-BH2216	330-01-BH2216-S00200	2.00 2.45	CH	CLAY	34.1	101	22 79	25.5	;	97	1	1) 2	1	0	0 1	0.1	26	15	130	2870	8.8												
330-01-BH2216	330-01-BH2216-U00650	6.50 6.99	CH	Sandy CLAY													0.1	2.0	1.5													SEE REPORT		
330-01-BH2216	330-01-BH2216-S00800	8.00 8.45	CH	CLAY	31.4	106	21 85	19.5	5	97	1	2) 3	0	0	0 0)			10	100													
330-01-BH2216 330-01-BH2216	330-01-BH2216-S01100 330-01-BH2216-U01250	12.50 12.99	СН	Sandy CLAY Sandy CLAY			_	-												10	400	8.9										SEE REPORT		
330-01-BH2216	330-01-BH2216-S01400	14.00 14.45	CL	Sandy CLAY	19.9	24	13 11	5.0		35	32	32	1 65	0	0	0 0																		
330-01-BH2216	330-01-BH2216-S01700 330-01-BH2224-S00350	17.00 17.45 3.50 3.95	CI	Sandy CLAY			_	-					_							<10	540 10	8.6 8.7												
330-01-BH2224	330-01-BH2224-U00500	5.00 5.42	СН	CLAY	25.7	56	22 34	16.5	;	82	10	3	1 14	2	2	0 4						5												
330-01-BH2224	330-01-BH2224-S00650	6.50 6.95	CH	CLAY										\square						<10	10	8.7												
330-01-ВН2224 330-01-ВН2224	330-01-BH2224-S01950 330-01-BH2224-S01100	9.50 9.95 11.00 11.45	SC	Clayey SAND Clayey SAND	19.7	27	17 10	3.5	+	26	22	50	2 74	0	0	0 0	,			×10	10	1.9												
330-01-BH2224	330-01-BH2224-S01400	14.00 14.45	CI	Sandy CLAY	27.7	44	18 26	14.0)	58	20	20	2 42	0	0	0 0)																	
330-01-BH2224 330-01-BH2224	330-01-BH2224-S01550 330-01-BH2224-S01850	15.50 15.95 18.50 18.61	CL SC	Sandy CLAY Clavey SAND	25.4	29	15 14	6.5	+ $+$	65	20	12) 32	1	2	0 3	1			<10	20	8.3												
330-01-BH2224	330-01-BH2224-S02000	20.00 20.45	CI	CLAY	19	49	17 32	13.5	;	96	0	2	1 3	1	0	0 1					20	0.0												
330-01-BH2224	330-01-BH2224-C02150	21.50 22.00	-	SANDSTONE			_	-	+ $+$	_	_		_		_	_	_		_							6.05	0.492	0.169	0.44	0.31				
330-01-BH2224	330-01-BH2224-C02350	23.50 24.00	-	SANDSTONE				-																		0.00	0.432	0.103	6.41	4.27				
330-01-BH2224	330-01-BH2224-C02400	24.00 24.50	-	SANDSTONE																						5.01	3.290	0.026	0.00	0.44				
330-01-BH2224 330-01-BH2224	330-01-BH2224-C02550 330-01-BH2224-C02600	25.50 26.00 26.00 26.50	-	SANDSTONE									_		_											7.04	0.410	0.151	0.36	0.11				
330-01-BH2227	330-01-BH2227-S00050	0.50 0.95	СН	CLAY																40	320	8.4												
330-01-BH2227 330-01-BH2227	330-01-BH2227-S00200 330-01-BH2227-U00350	2.00 2.45	CH	CLAY CLAY	25.8 22.9	90 : 72 :	22 68 26 46	22.5		88	3	4	3 10) 8	2	0	0 2			_															
330-01-BH2227	330-01-BH2227-S00650	6.50 6.95	CH	CLAY	22.0		10 10	10.0		02	Ű	_	, ,	Ŭ	Ū	0				40	240	9.3												
330-01-BH2227	330-01-BH2227-S00800	8.00 8.45	CH	CLAY Sandy CLAY	19.5	52	18 34	14.0		73	20	6	1 27	0	0	0 0																		
330-01-BH2227 330-01-BH2227	330-01-BH2227-S01250	12.50 12.95	CL-CI	Sandy CLAY Sandy CLAY	23.5	52 .	20 32	14.5	,	69	19	12	5 31	0	U	0 0	'			10	80	8.7												
330-01-BH2227	330-01-BH2227-U01400	14.00 14.45	CL-CI	Sandy CLAY	22.6	35	15 20	11.0)	55	29	16) 45	0	0	0 0)																	
330-01-BH2227 330-01-BH2227	330-01-BH2227-S01700 330-01-BH2227-S01850	17.00 17.27 18.50 18.56	CI	Sandy CLAY Sandy CLAY	13.8	40	14 26	11.0)	49	25	23	3 51	0	0	0 0)			<10	60	8.9												
330-01-BH2301	330-01-BH2301-C00260	2.60 2.70	-	SANDSTONE																									0.24	0.23				
330-01-BH2301	330-01-BH2301-C00330	3.30 3.40	-	SANDSTONE			_	_	+ $+$		_		_						_							6 15	0.520	0.074	0.13	0.03				
330-01-BH2301	330-01-BH2301-C00440	4.40 4.50	-	SANDSTONE																						0.15	0.020	0.074	0.54	0.08				
330-01-BH2301	330-01-BH2301-C00500	5.00 6.00	-	SANDSTONE				_											_					88.9	80.2				4.04	0.70				
330-01-BH2301 330-01-BH2301	330-01-BH2301-C00560 330-01-BH2301-C00730	7.30 7.40	-	SANDSTONE				-					-						-							0.491	0.027	0.126	1.01	0.78				
330-01-BH2301	330-01-BH2301-C00760	7.60 7.70	-	SANDSTONE																									1.11	0.89				
330-01-BH2301 330-01-BH2301	330-01-BH2301-C00770 330-01-BH2301-C01000	7.70 7.80 10.00 11.00		SANDSTONE			_		+ $+$		+			+				+						96.4	93.7	14.70	2.950	0.127						
330-01-BH2301	330-01-BH2301-C01130	11.30 11.40	-	SANDSTONE																									1.01	1.08				
330-01-BH2301	330-01-BH2301-C01140	11.40 11.50	-	SANDSTONE					$+ \mp$					$+ \overline{+}$				┝╶Ҭ	T							13.00	1.350	0.058				2.63		
330-01-BH2301	330-01-BH2301-C01450	14.50 14.60		SANDSTONE																									1.05	1.07		2.05	2	
330-01-BH2301	330-01-BH2301-C01600	16.00 16.10	-	SANDSTONE																									0.83	1.35				
330-01-ВН2301 330-01-ВН2301	330-01-BH2301-C01780 330-01-BH2301-C01900	17.80 17.90 19.00 19.10	-	SANDSTONE										┢─┤				+											1.98 3.01	2.25				
330-01-BH2301	330-01-BH2301-C02130	21.30 21.40	-	CONGLOMERATE																									5.87	5.67				
330-01-BH2301 330-01-BH2301	330-01-BH2301-C02170 330-01-BH2301-C02550	21.66 21.81 25.50 25.60	-	SANDSTONE			_	-	+ +					┥┥				┝─┼								105.00	45.900	0.021	1.17	7.05				
330-01-BH2301	330-01-BH2301-C02930	29.30 29.40	-	CONGLOMERATE																									0.28	0.21				
330-01-BH2301	330-01-BH2301-C03030	30.30 30.40		SILTSTONE					+ $+$					┢─┦								—							0.89	0.68				
330-01-BH2303	330-01-BH2303-C00250	2.50 2.60	-	SANDSTONE																						45.30	24.900	0.073	0.03	4				
330-01-BH2303	330-01-BH2303-C00340	3.40 4.90	-	SANDSTONE																				00.0	07.6							2.66	2	
330-01-BH2303 330-01-BH2303	330-01-ВН2303-С00500 330-01-ВН2303-С00570	5.00 6.00 5.70 5.80		SANDSTONE				-	+ +		+			+										98.8	97.9				0.25	0.22				
330-01-BH2303	330-01-BH2303-C00710	7.10 7.20	-	SANDSTONE																									3.52	3.15				
330-01-BH2303	330-01-BH2303-C00720	7.20 7.30	-	SANDSTONE					+ $+$					┥┥				┝──┡						Q7 8	96.7	37.10	31.800	0.019						
330-01-BH2303	330-01-BH2303-C01040	10.40 10.50		SANDSTONE																				51.0	30.1				2.38	1.83				
330-01-BH2303	330-01-BH2303-C01050	10.50 10.60	-	SANDSTONE										\square												20.40	16.500	0.033	0.02	0.71				
330-01-ВН2303 330-01-ВН2303	330-01-BH2303-C01340 330-01-BH2303-C01470	13.50 14.70 14.80	-	SANDSTONE				-	+					┢┼┤				+											0.93 2.54	1.18				
330-01-BH2303	330-01-BH2303-C01480	14.80 14.90	-	SANDSTONE																						27.10	13.200	0.052						

Summary of Laboratory Results ¹

		Ē	Î		b Đ	Content		Plasticity	,					Gradin	g				s	Shrink Sv	well		Aggressivi	ty	Emerson	Slake D	urability	Uniaxial (Compressive S Deformation ²	trength &	Point	Load	Test	ensity	n Factor	shing Value
Borehole	Sample ID	tra C		nsc	Material Descrip	Moisture C	H	4 5	S	Clay	Silt	Clayour	Sand		Sand		Gravel	Gravel	Swell	Shrinkage	Shrink Swell Index	Soluble Sulfate	Chloride	Æ	Class number	1st Cycle	2nd Cycle	ncs	Young's Modulus (Tangent)	Poisson Ratio (Tangent)	Axial Is(50)	Diametral Is(50)	Brazilian	Particle D	Degradatio	Aggregate Cru
		From	То			%	%	%	%	2um	60um	% line	med	coarse	%	fine	med	coarse	%	%	%	mg/kg	mg/kg			%	%	MPa	GPa		MPa	MPa	МРа	t/m ³		%
330-01-BH2303 3′	30-01-BH2303-C01750	17.50	17.60	-	SANDSTONE																										0.39	0.36				
330-01-BH2303 3'	30-01-BH2303-C01870	18.70	18.80	-	SANDSTONE																										1.34	1.66				
330-01-BH2303 3'	30-01-BH2303-C02220	22.20	22.30	-	SANDSTONE																										0.31	0.11				
330-01-BH2303 3'	30-01-BH2303-C02230	22.30	22.40	-	SANDSTONE																							2.19	0.377	0.056						
330-01-BH2306 3'	30-01-BH2306-S00050	0.50	0.95	СН	CLAY	15.0	60	19 41	16.5	;									8.9	1.6	3.3				2											
330-01-BH2306 3.	30-01-BH2306-C00440	4.40	4.51	-	SANDSTONE																										0.34	0.29				
330-01-BH2306 3'	30-01-BH2306-C00440	4.51	4.67	-	SANDSTONE																							11.90	5.080	5.210						
330-01-BH2306 3.	30-01-BH2306-C00650	6.59	6.72	-	SANDSTONE / SILTSTONE																										0.15	0.82				
330-01-BH2306 3.	30-01-BH2306-C01250	11.00	17.00	-	SANDSTONE																													SEE REPORTS		41.2
330-01-BH2306 3'	30-01-BH2306-C01150	11.54	11.58	-	SANDSTONE																										1.51					
330-01-BH2306 3'	30-01-BH2306-C01150	11.58	11.64	-	SANDSTONE																											0.83				
330-01-BH2306 3'	30-01-BH2306-C01150	11.64	11.79	-	SANDSTONE																							22.40	8.280	8.490						
330-01-BH2306 3'	30-01-BH2306-C01250	12.50	13.00	-	SANDSTONE																					94.8	90.5									
330-01-BH2306 3'	30-01-BH2306-C01500	15.55	15.65	-	SANDSTONE																										0.91	1.28				
330-01-BH2306 3'	30-01-BH2306-C01500	15.65	15.79	-	SANDSTONE																							2.91	0.210	0.179						
330-01-BH2306 3'	30-01-BH2306-C01850	18.79	18.84	-	SANDSTONE																										0.47					
330-01-BH2306 3'	30-01-BH2306-C01850	18.89	18.97	-	SANDSTONE																											0.36				
330-01-BH2306 3'	30-01-BH2306-C01900	19.09	19.23	-	SANDSTONE																										0.13	0.27				
330-01-BH2306 3'	30-01-BH2306-C02100	21.00	21.50	-	SANDSTONE																					90.6	84.4									
330-01-BH2306 3'	30-01-BH2306-C02150	21.58	21.71	-	SANDSTONE																							8.39	2.94	1.86						
330-01-BH2306 3'	30-01-BH2306-C02150	21.71	21.87	-	SANDSTONE																										0.30	0.48				
330-01-BH2306 3'	30-01-BH2306-C02400	23.83	23.97	-	SANDSTONE																							1.67	0.236	0.278						
330-01-BH2306 3'	30-01-BH2306-C02400	24.39	24.51	-	SANDSTONE																										0.90	0.53				
330-01-DH2503 3'	30-01-DH2503-S00050	0.50	0.95	СН	Sandy CLAY	23.5	56	22 34	16.0		7	0 10	15	4	29	1	0	0 1							5											
330-01-DH2503 3'		2.00	2.45	CL	Sandy CLAY	15.6	36	17 10	8.0		6	2 22	15	1	38	0	0	0 0							3											
	30-01-DH2503-S00200	2.00		01	canay certi	10.0	00	1/ 13	0.0							-	-	0							0											
330-01-DH2503 3	30-01-DH2503-S00200 30-01-DH2503-S00350	3.50	3.95	CI	CLAY	22.9	37	19 18	8.5		7	1 21	8	0	29	0	0	0 0							5											
330-01-DH2503 3 330-01-DH2503 33	30-01-DH2503-S00200 30-01-DH2503-S00350 30-01-DH2503-U00650	3.50 6.50	3.95 6.89	CI	CLAY Sandy CLAY	22.9 15.2	37 41	19 18 19 18 14 27	8.5 13.5	;	7	1 21 1 1	8	0 10	29 49	0	0	0 0	1.7	3.1	2.2		<u> </u>		5											

Notes:

 Notes:

 1. The test results summarised here are quoted verbatim from the laboratory testing reports presented in Appendix D, without interpretation or bias. The Designer should make their own interpretation of the raw data presented on the test reports before deciding whether to accept the results for design purposes.

 2. For the UCS testing results, some particular issues that have been noted from observation of the laboratory test reports, which may affect the validity of some of the test results, include:

 a. Concave upwards profiles of the axial stress / strain curves for some of the tests;
 b. Divergence of the "Axial 1" and "Axial 2" stress / strain curves for some of the tests;
 c. Apparent influence of pre-existing plane(s) of weakness in some of the samples; and
 d. Poisson's Ratio results are considered to be generally lower, and in some cases higher, than expected based on our previous experience.

Grading



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

		PARTICLI	E SIZE DISTRI	BUTION -	TEST RE	PORT			
Client	Golder As	sociates Pty Limit	ed	1289 3.6.1 , 2.1.1	Report	No.	GA1014()3-G	
					Reque	st No	1893802_H	H2C_TR1	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test Da	ate	20/11/20	18	
					Report	Date	28/11/20	18	
Project	Inland Ra	il Package 13							
Project No	1893802		Client Sampl	e No	330-01-BI	H2203-S003	350		
Bore Hole	330-01-B	H2203	Depth From	(m) 3.5		Depth T	o(m) 3	8.95	
Description	SPT	1							
Sieve Size	Passing								
(mm)	%	-	Silt Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel C	obbles
150.0		100							
75.0		90							
63.0		-							
53.0		80 -							
37.5		70							
26.5									
19.0		60 -							
13.2		(%) Gu							
9.5		- 50 							
6.7		40							
4.75	100	-							
2.36	98	30 -							
1.18	91								
0.600	71	- 20 -							
0.425	57	10 -							
0.300	42								
0.150	25	0	0.1		1		10		100
0.075	19			Partic	ie Size (MM)				
NOTES/REMARKS:		-							
		Moisture Content 10.89 Sample/s supplied by the c	% client					Page 1 of 1	REP03903
Accredi The results of	ted for complia the tests, calibr	nce with ISO/IEC 1702 ations, and/or measur	25 - Testing. ements included in		AUNTHERIS	ed Signator	y		
this docun	nent are tracea Tested at Tri	pie to Australian/Natio	nai Standards. ry.		Cer G.Ha	mailton	-		
The	results of calibra	ations and tests performe	d apply only to the specific	instrument or sa	mple at the time	of test unless of	L therwise clearl	aboratory No y stated.	o. 9926



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		PARTICLE	E SIZE DISTRIB	UTION TE	ST REPOR	Т		
Client	Golder As	ssociates Pty Limite	ed	89 3.6.1 , 2.1.1	Report No.	GA10	1404-G	
					Request No	189380	2_H2C_TR1	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test Date	20/11	/2018	
					Report Date	28/11	/2018	
Project	Inland Ra	il Package 13						
Project No	1893802		Client Sample I	No	330-01-BH2203-	S00500		
Bore Hole	330-01-B	H2203	Depth From (m) 5	De	oth To (m)	5.45	
Description	SPT	1						
Sieve Size	Passing							
(mm)	%	-	Silt Fine Sand	Medium Sand	Coarse Fine Sand Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0		100 -						
75.0		90 -						
63.0		-						
53.0		80 -						
37.5		70 -						
26.5								
19.0		60 -	/					
13.2		(%) Bu						
9.5								
6.7	100	40 -						
4.75	99	-						
2.36	98	30 -						
1.18	96	-						
0.600	89	20 -						
0.425	81	10 -						
0.300	72							
0.150	55	0	0.1		1	10		100
0.075	47			Particle	Size (mm)			
NOTES/REMARKS:		-						
		Moisture Content 15.9% Sample/s supplied by the c	6 lient				Page 1 of 1	REP03903
Accredi The results of	ted for complia the tests, calibr	nce with ISO/IEC 1702 rations, and/or measure	25 - Testing. ements included in		A ANTHAR IS SIG	natory		
this docun	nent are tracea	ble to Australian/Nation	nal Standards. v.	6	Ge. Hauailton	7		
The	results of calibra	ations and tests performed	d apply only to the specific ins	strument or sampl	e at the time of test ur	less otherwise cl	Laboratory I early stated.	No. 9926



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		PARTICLE	E SIZE DISTRI		TEST REP	ORT		
Client	Golder As	sociates Pty Limite	ed	<u>1289 3.6.1 , 2.1.1</u>	Report N	l o . GA10	1419-G	
					Request	No 18938)2 H2C TR1	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test Date	e 20/11	/2018	
					Report D	ate 28/11	/2018	
Project	Inland Ra	il Package 13						
Project No	1893802		Client Sampl	e No	330-01-BH2	207-S00050		
Bore Hole	330-01-B	H2207	Depth From (m) 0.5		Depth To (m)	0.95	
Description	SPT							
Sieve Size	Passing							
(mm)	%	100	Silt Fine Sand	Medium Sand	Coarse I Sand G	Fine Medium ravel Gravel	Coarse Gravel C	obbles
150.0								
75.0		. 90 -						
63.0								
53.0		80 -						
37.5		70 -						
26.5		-						
19.0		60 -						
13.2		(%) Gui						
9.5		S 50						
6.7	100	40						
4.75	99							
2.36	94	30 -						
1.18	84							
0.600	64	20 -						
0.425	54	10						
0.300	47							
0.150	35	0	0.1			I0		100
0.075	30			Partic	ie Size (mm)			
NOTES/REMARKS:		-						
		Moisture Content 3.9% Sample/s supplied by the c	lient				Page 1 of 1	REP03903
Accredit The results of t	ted for complia the tests, calibr	nce with ISO/IEC 1702 ations, and/or measure	25 - Testing. ements included in		Adwitherises	Signatory	NATA	
this docum	nent are tracea Tested at Tri	ble to Australian/Nation lab Brisbane Laborator	nal Standards. ry.		Cer G. Hano	nilton		
The	results of calibra	tions and tests performe	d apply only to the specific	instrument or sa	mple at the time of	test unless otherwise c	Laboratory No early stated.	o. 9926



		PARTICLI	E SIZE [DISTRI	BUTION	TEST R	EPORT			
Client	Golder As	ssociates Pty Limit	rest N ed	wethod: AS	1289 3.6.1 , 2.1.	Repo	ort No.	GA10)1422-G	
						Requ	iest No	18938	02_H2C_TF	1
Address	PO Box 1	734 MILTON BC	QLD	4064		Test	Date	20/11	/2018	
						Repo	ort Date	28/11	/2018	
Project	Inland Ra	il Package 13								
Project No	1893802		Clier	nt Sample	e No	330-01-	BH2207-S	00500		
Bore Hole	330-01-B	H2207	Dept	th From (m) 5		Dept	h To (m)	5.45	
Description	SPT									
Sieve Size	Passing									
(mm)	%	- 100	Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0		-								
75.0		90								
63.0										
53.0		80 -								
37.5										
26.5		70 -								
19.0		60								
13.2		(%) 6								
9.5		Passin Passin								
6.7		40								
4.75		40								
2.36	100	30 -								
1.18	98									
0.600	93	20 -								
0.425	86	- 10 -								
0.300	74	-								
0.150	47	0.01		0.1		1		10		100
0.075	38				Partie	cle Size (mm)			
NOTES/REMARKS:		-								
		Moisture Content 10% Sample/s supplied by the o	lient						Page 1	of 1 REP039
Accredit The results of t this docum	ed for complia he tests, calibr nent are tracea	nce with ISO/IEC 1702 rations, and/or measur ble to Australian/Natio	25 - Testing. ements inclue nal Standard	ded in s.		ACHULA	rised Signa	tory		
	Tested at Tri	lab Brisbane Laborato	ry.			G .1	Hamilton		Laborato	ng No. 9926
The	results of calibra	itions and tests performe Reference should be ma	d apply only to de to Trilab's	the specific Standard Ter	instrument or sa	mple at the tir	ne of test unle s" for further d	ss otherwise c letails.	learly stated.	



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		PARTICL	E SIZE DISTRIE	BUTION TES	T REPORT			
Client	Golder As	ssociates Pty Limi	ted	289 3.6.1 , 2.1.1	Report No.	GA101	1437-G	
					Request No	189380	2_H2C_TR1	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test Date	20/11/	2018	
					Report Date	28/11/	2018	
Project	Inland Ra	il Package 13						
Project No	1893802		Client Sample	No 33	0-01-BH2212-S	00200		
Bore Hole	330-01-B	H2212	Depth From (m) 2	Dept	h To (m)	2.45	
Description	SPT							
Sieve Size	Passing							
(mm)	%		Silt Fine Sand	Medium Coar Sand San	se Fine d Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0		100						
75.0		90						
63.0								
53.0		80 -						
37.5		70						
26.5								
19.0		60						
13.2		ing (%)						
9.5		ss 50						
6.7		40						
4.75								
2.36	100	30 -						
1.18	98							
0.600	95	- 20 -						
0.425	94	10						
0.300	92							
0.150	83	0	0.1	1 D		10		100
0.075	74			Particle Size	e (mm)			
NOTES/REMARKS:		-						
		Moisture Content 24.6 Sample/s supplied by the	S% client				Page 1 of 1	REP03903
Accredit The results of	ted for complia the tests, calibr	nce with ISO/IEC 170 rations, and/or measu	025 - Testing. irements included in	٨Û	HUHPrised Signa	tory	NATA	
this docun	nent are tracea Tested at Tri	ble to Australian/Natio	onal Standards. ory.	\mathcal{L}	G. Hamilton	1		
The	results of calibra	ations and tests perform	ed apply only to the specific	nstrument or sample a	t the time of test unle	ss otherwise cle	Laboratory	No. 9926



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		PARTICL	E SIZE DIS	STRIBUTIO	N TEST I	REPORT			
Client	Golder As	ssociates Pty Limi	ted	UU. NO 1209 3.0.1 ,	Rep	ort No.	GA10	1443-G	
					Rec	uest No	189380)2_H2C_TR	1
Address	PO Box 1	734 MILTON BC	QLD	4064	Tes	t Date	20/11	/2018	
					Rep	ort Date	28/11	/2018	
Project	Inland Ra	il Package 13							
Project No	1893802		Client S	ample No	330-0	1-BH2212-S	01100		
Bore Hole	330-01-B	H2212	Depth F	From (m) 11		Dept	h To (m)	11.45	
Description	SPT								
Sieve Size	Passing			Fine Madium	0	Fine	Modium	Corro	
(mm)	%	100	Silt	Sand Sand	Coarse Sand	Gravel	Gravel	Gravel	Cobbles
150.0									
75.0									
10.0		90 -							
63.0									
53.0		80 -							
37.5									
26.5		70 -							
10.0		1 _							
19.0									
13.2		sing (%							
9.5		й 50 д							
6.7		40							
4.75									
2.36	100	30							
1.18	99								
0.600	99	20							
0 425	gq								
0.300	00	10							
0.300	90								
0.150	97	0 + 0.01		0.1	1 article Size (m		10	• • • •	100
0.075	96					,			
TO LONLINATIO.		Moisture Content 29.6	3%					D 4	
A 11	ad for ac	Sample/s supplied by the	client		1 . -			Page 1 o	t1 REP03903
Accredit The results of t this docum	the tests, calibring the tests and the tests are tracea	ations, and/or measu ble to Australian/National	rements included	in	Author	erises gigna	tory		À
	Tested at Tri	lab Brisbane Laborate	ory.		Ce G	Hamilton	1		DR L
The	results of calibra	ations and tests perform	ed apply only to the	specific instrument	or sample at the	time of test unle	ss otherwise c	Laborator early stated.	y No. 9926



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		PARTICL	E SIZE DISTRIE	SUTION TE	EST REPOR	Г		
Client	Golder As	ssociates Pty Limit	red	289 3.6.1 , 2.1.1	Report No.	GA10	1464-G	
					Request No	189380)2_H2C_TR1	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test Date	20/11	/2018	
					Report Date	28/11	/2018	
Project	Inland Ra	il Package 13	1					
Project No	1893802		Client Sample	No	330-01-BH2216-	S01400		
Bore Hole	330-01-BI	H2216	Depth From (m) 14	Dep	oth To (m)	14.45	
Description	SPT							
Sieve Size	Passing							
(mm)	%	- 100	Silt Fine Sand	Medium Sand	Coarse Fine Sand Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0								
75.0		90		/				
63.0								
53.0		80 -						
37.5								
26.5		70 -						
19.0		60						
13.2		(%) 6						
9.5		Passir 0-						
6.7		40						
4.75		40						
2.36		30 -						
1.18	100							
0.600	99	20 -						
0.425	96	10 -						
0.300	88							
0.150	53	0	0.1		1 I	10		100
0.075	35			Particle	Size (mm)			
NOTES/REMARKS:		- Moisture Content 19.9	%					
		Sample/s supplied by the	client				Page 1 of	1 REP03903
Accredi The results of	ted for complia the tests, calibr	nce with ISO/IEC 1702 rations, and/or measur	25 - Testing. rements included in		Adulturisedisign	atory	NATA	
this docum	nent are tracea Tested at Tri	ble to Australian/Natio	nal Standards. ry.	2	Ge. Hanvilton	1		
The	results of calibra	ations and tests performe	ed apply only to the specific i	instrument or samp	le at the time of test un	less otherwise cl	Laboratory early stated.	No. 9926



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		PARTICLI			EST REPOR	RT		
Client	Golder As	ssociates Pty Limit	ed	203 3.0.1 , 2.1.1	Report No.	GA10	1480-G	
					Request No	189380)2_H2C_TR1	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test Date	20/11	/2018	
					Report Date	28/11	/2018	
Project	Inland Ra	il Package 13						
Project No	1893802		Client Sample	No	330-01-BH2224	-S01400		
Bore Hole	330-01-B	H2224	Depth From (I	n) 14	De	pth To (m)	14.45	
Description	SP1 Bassing							
(mm)	Passing %		Fine	Medium	Coarse Fine	Medium	Coarse	
(1111)	70	100 -	Silt Sand	Sand	Sand Gravel	Gravel	Gravel	Cobbles
150.0	_	-						
75.0		90						
62.0								
03.0								
53.0		80 -						
37.5								
26.5		70 -						
19.0		60						
13.2		(%) E						
9.5		Passing Passing						
6.7								
4.75		40 -						
2.36	100	30						
1.18	99	-						
0.600	98	20 -						
0.425	95	10 -						
0.300	90							
0.150	70	0	0.1		1	10		100
0.075	58			Particle	Size (mm)			
NOTEO/DELLO								
NUTES/REMARKS:		- Moisture Content 27.7	%					
		Sample/s supplied by the o	client				Page 1 of 1	REP03903
Accredit The results of t this docum	ted for complia the tests, calibr tent are tracea	nce with ISO/IEC 1702 ations, and/or measur ble to Australian/Natio	25 - Testing. ements included in nal Standards.		Adhitherises Sig	natory		
	Tested at Tri	lab Brisbane Laborato	ry.	0	G. Hanailto	 n		No. 0026
The	results of calibra	ations and tests performe	d apply only to the specific i	nstrument or samp	ole at the time of test u	Inless otherwise cl	Laboratory early stated.	NO. 9926



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		PARTICL	E SIZE D		BUTION	TEST R	EPORT			
Client	Golder As	sociates Pty Limit	ed	-1100. AS	1209 5.0.1 , 2.1.	Rep	ort No.	GA10	1481-G	
						Req	uest No	189380)2_H2C_TF	R1
Address	PO Box 1	734 MILTON BC	QLD	4064		Test	Date	20/11	/2018	
						Rep	ort Date	28//1	1/18	
Project	Inland Ra	il Package 13								
Project No	1893802		Client	t Sample	e No	330-01	-BH2224-S	01550		
Bore Hole	330-01-B	H2224	Depth	From (m) 15.5		Dept	h To (m)	15.95	
Description	SPT									
Sieve Size	Passing									
(mm)	%	- 100	Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0		-								
75.0		90								
63.0										
53.0		80								
37.5		70 -								
26.5										
19.0	100	60								
13.2	99	sing (%)								
9.5	98	50								
6.7	98	40								
4.75	98									
2.36	97	30								
1.18	97	20 -								
0.600	97									
0.425	95	10								
0.300	87									
0.150	83	0		0.1	Darti	1 1	<u> </u>	10		100
0.075	65				rafu					
NOTES/REMARKS:		- Moisture Content 25.4 Sample/s supplied by the	% client						Page 1	of 1 REP0390
Accredit The results of t this docum	ted for complia the tests, calibr nent are tracea	nce with ISO/IEC 170 rations, and/or measu ble to Australian/Natio	25 - Testing. rements include mal Standards.	ed in			rises Signa	tory ~		FOR
	Tested at Tri	lab Brisbane Laborato	ory.			હિ.	Hamilton		Laborato	ory No. 9926
The	results of calibra	ations and tests performe Reference should be ma	ed apply only to th ade to Trilab's "St Trilab P	he specific tandard Ter Ptv Ltd AB	instrument or sa ms and Condition N 25 065 630 506	ample at the ti ons of Busine	me of test unle ss" for further o	ss otherwise cl letails.	early stated.	

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



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		PARTICL	E SIZE DIST			EPORT			
Client	Golder As	sociates Pty Limi	ted	AU 1207 0.0.1 , Z.	Repo	rt No.	GA10	1492-G	
					Requ	est No	189380)2_H2C_TR	.1
Address	PO Box 1	734 MILTON BC	QLD 40	64	Test	Date	20/11	/2018	
					Repo	rt Date	28/11	/2018	
Project	Inland Ra	il Package 13							
Project No	1893802		Client San	ple No	330-01-l	3H2227-S0	00200		
Bore Hole	330-01-B	H2227	Depth Fro	m (m) 2		Depth	n To (m)	2.45	
Description	SP1 Bassing								
(mm)	Passing %		Fin	e Medium	Coarse	Fine	Medium	Coarse	
(1111)	70	100	Silt	d Sand	Sand	Gravel	Gravel	Gravel	Cobbles
150.0		-							
75.0		90 -							
00.0									
63.0									
53.0		80 -							
37.5									
00.5		70 -							
26.5									
19.0		60 -							
13.2		(%) f							
0.5		ss 50 -							
9.0		<u> </u>							
6.7		40 -							
4.75	100	-							
2.36	98	30 -							
1.18	97	20 -							
0.600	95	-							
0.425	94	10							
0.300	93								
0.150	90	0 0.01	0.1		1		10		100
0.075	88			Par	ticle Size (mm)				
NOTES/REMARKS:		-							
		Moisture Content 25.8 Sample/s supplied by the	% client					Page 1	of 1 REP03903
Accredit	ed for complia	nce with ISO/IFC 170	25 - Testina.		Author	ised Signat	orv	. ugo 1	
The results of t	he tests, calibr	ations, and/or measu	rements included in		AUNIT	a signator	y* 2		A
	Tested at Tri	lah Brishana Laborat			<i>رو</i> ا ع	Lauvilton	~		FOR AL CE
The	results of calibra	ations and tests performe	و ہو. ed apply only to the spe	cific instrument or	sample at the tim	e of test unles	s otherwise c	Laborato early stated.	ry No. 9926



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		PARTICL	E SIZE DISTR		EST REPOR	Т		
Client	Golder As	ssociates Pty Limit	ed	1203 3.0.1 , 2.1.1	Report No.	GA10	1496-G	
					Request No	189380	2_H2C_TR1	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test Date	20/11/	/2018	
					Report Date	28/11/	/2018	
Project	Inland Ra	il Package 13						
Project No	1893802		Client Samp	le No	330-01-BH2227-	S00800		
Bore Hole	330-01-B	H2227	Depth From	(m) 8	De	oth To (m)	8.45	
Description	SP1 Bassing							
(mm)	rassing %		Fine	Medium	Coarse Fine	Medium	Coarse	
(1111)	70	100	Silt Sand	Sand	Sand Gravel	Gravel	Gravel	Cobbles
150.0								
75.0		90						
63.0								
00.0		80 -						
53.0								
37.5								
26.5		70 -						
19.0		60						
13.2		(%) E						
9.5		Dassing 20						
6.7								
4.75		40						
2.36		30		_				
1.18	100							
0.600	99	20 -						
0.425	99	10 -						
0.300	98							
0.150	89	0.01	0.1		1	10		100
0.075	73			Particle	Size (mm)			
NOTES/REMARKS:		- Moisture Content 19.5	%					
		Sample/s supplied by the	client				Page 1 of 1	REP03903
Accredit The results of t	ted for compliant the tests, calibr	nce with ISO/IEC 1702 rations, and/or measure	25 - Testing. rements included in		A ANTHARISES Sign	htory		
this docum	Tested at Tri	lab Brisbane Laborato	inai Stanuards. Ity.	0	G. Hamilton	1		
The	results of calibra	ations and tests performe	ed apply only to the specifi	c instrument or samp	le at the time of test ur	less otherwise cle	Laboratory N early stated.	lo. 9926



		PARTICL	E SIZE D		BUTION	TEST R	EPORT	I		
Client	Golder As	ssociates Pty Limit	ed	ethod: AS	209 3.0.1 , 2.1	Rep	ort No.	GA10	1713-G	
						Req	uest No	189380)2_H2C_TF	2
Address	PO Box 1	734 MILTON BC	QLD	4064		Test	Date	3/12/2	18-5/12/18	3
						Rep	ort Date	5/12/2	2018	
Project	Inland Ra	il Package 13								
Project No	1893802		Clien	t Sample	No	330-01	-BH2103-S	00050		
Bore Hole	330-01-B	H2103	Dept	h From (m) 0.5		Dept	h To (m)	0.95	
Description	SPT	1								
Sieve Size	Passing									
(mm)	%	-	Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0		100								
75.0		90 -								
63.0										
53.0		80 -								
37.5		70 -								
26.5		-								
19.0		60 -								
13.2		(%) Bu								
9.5		Bassi Bassi								
6.7		- 40								
4.75		-								
2.36	100	30								
1.18	98									
0.600	93									
0.425	90	10 -								
0.300	86									
0.150	69	0		0.1	Darti	1 cle Size (mn	<u></u> .	10		100
0.075	54				r al l	010 0120 (1111	",			
NOTEONEIMANNO.		Moisture Content 7.3% Sample/s supplied by the	client						Page 1	of 1 REP0390
Accredit The results of t this docum	ed for complia he tests, calibr ient are tracea	nce with ISO/IEC 1702 rations, and/or measur ble to Australian/Natio	25 - Testing. ements includ nal Standards	ed in	_	AUHUHA	rised Signa	tory		À
	Tested at Tri	lab Brisbane Laborato	ry.			ĊÈ.	Hamilton		Laborato	ry No. 9926
The	results of calibra	ations and tests performe Reference should be ma	d apply only to de to Trilab's "S _{Trilab}	the specific i Standard Ter Pty Ltd ABI	nstrument or s ms and Conditi N 25 065 630 506	ample at the ti ions of Busine 5	me of test unle ss" for further o	ess otherwise cl details.	early stated.	



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		PARTICLE	SIZE DISTRIBU	JTION TES	T REPORT			
Client	Golder As	sociates Pty Limite	ed	9 3.6.1 , 2.1.1	Report No.	GA10 ²	1715-G	
					Request No	189380	2_H2C_TR2	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test Date	3/12/1	8-5/12/18	
					Report Date	5/12/2	018	
Project	Inland Ra	il Package 13						
Project No	1893802		Client Sample N	l o 33	0-01-BH2103-S	00350		
Bore Hole	330-01-B	H2103	Depth From (m)	3.5	Dept	n To (m)	3.95	
Description	SPT							
Sieve Size	Passing							
(mm)	%	100 -	Silt Fine Sand	Medium Coa Sand Sa	rse Fine nd Gravel	Medium Gravel	Coarse Gravel C	obbles
150.0		100						
75.0		90						
63.0								
53.0		80 -						
37.5								
26.5		70 -						
19.0	100	60 -						
13.2	95	(%)						
9.5	94	assing						
6.7	93							
4.75	93	40						
2.36	92	30 -						
1.18	87							
0.600	76	20						
0.425	69							
0.300	62	10						
0.150	44							
0.075	36	0.01	U.1	1 Particle Siz	e (mm)	10		100
NOTES/REMARKS:		-						
		Moisture Content 13.7% Sample/s supplied by the cl	ient				Page 1 of 1	REP03903
Accredit	ted for complia	nce with ISO/IEC 1702	5 - Testing.	Ať	Mtherised Signa	tory		
this docum	nent are tracea	ble to Australian/Nation	al Standards.	C	e	~		
The	Tested at Tri	lab Brisbane Laborator	y. Lapply only to the specific inst	rument or sample a	で、戸細胞川での t the time of test unles	ss otherwise cle	Laboratory No	o. 9926



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		PARTICLE	SIZE DISTR	BUTION		PORT			
Client	Golder As	ssociates Pty Limite	ed	5 1209 3.0.1 , 2.1.	Repor	t No.	GA10	1717-G	
					Reque	st No	189380)2_H2C_TR	2
Address	PO Box 1	734 MILTON BC	QLD 4064		Test D	ate	3/12/1	18-5/12/18	}
					Repor	t Date	5/12/2	2018	
Project	Inland Ra	il Package 13							
Project No	1893802		Client Samp	le No	330-01-B	H2103-U	00600		
Bore Hole	330-01-BI	H2103	Depth From	(m) 6		Depth	ı To (m)	6.29	
Description	U	1							
Sieve Size	Passing								
(mm)	%	- 100	Silt Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0									
75.0		90 -							
63.0									
53.0		80 -							
37.5		70							
26.5									
19.0		60 -							
13.2		(%) Bu							
9.5									
6.7		40 -							
4.75									
2.36	100	30 -							
1.18	99								
0.600	97	20 -							
0.425	94	10							
0.300	93								
0.150	89	0	0.1		1		10		100
0.075	78			Partio	:le Size (mm)				
NOTES/REMARKS [.]		-							
		Moisture Content 23.8% Sample/s supplied by the cli	ient					Page 1	of 1 REP03903
Accredit The results of t this docum	ted for complia the tests, calibr	nce with ISO/IEC 1702 ations, and/or measure	5 - Testing. ments included in al Standards		Auntheri	sçel Şignat	ory		À
	Tested at Tri	lab Brisbane Laborator	y.		Cert G.H	amilton	ــــــ		
The	results of calibra	ations and tests performed	apply only to the specifi	c instrument or sa	mple at the time	e of test unles	s otherwise cl	Laborato early stated.	ry No. 9926



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		PARTICLE			TEST R	EPORT			
Client	Golder As	ssociates Pty Limite	ed	289 3.6.1 , 2.1.	Repo	rt No.	GA10	1740-G	
					Requ	est No	189380)2_H2C_TR	2
Address	PO Box 1	734 MILTON BC	QLD 4064		Test	Date	30/11	/18-4/12/1	8
					Repo	rt Date	4/12/2	2018	
Project	Inland Ra	il Package 13							
Project No	1893802		Client Sample	No	330-01-	BH2104-S	00050		
Bore Hole	330-01-BI	H2104	Depth From (m) 0.5		Dept	h To (m)	0.95	
Description	SPT								
Sieve Size	Passing								
(mm)	%	- 100	Silt Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0									
75.0		90 -							
63.0									
53.0		80 -							
37.5		70							
26.5									
19.0		60 -	/						
13.2		(%) 6							
9.5		- 05							
6.7									
4.75		40							
2.36	100	30 -							
1.18	98								
0.600	94	20 -							
0.425	89	10 -							
0.300	82								
0.150	61	0	0.1		1		10		100
0.075	47			Partic	le Size (mm)			
INUTES/REIVIARKS:		- Moisture Content 9.3%	iont					Dorod	
A "	had for comm'	Sample/s supplied by the cl	E Testing				·.	Page 1 o	DT1 REP03903
Accredit The results of t this docun	the tests, calibr nent are tracea	rice with ISO/IEC 1702 ations, and/or measure ble to Australian/Natior	o - resting. ements included in ial Standards.		ACHULAR	uses Signa	tory		À
	Tested at Tri	lab Brisbane Laborator	у.		رک (د.)	Inmilton	7		
The	results of calibra	ations and tests performed	apply only to the specific i	nstrument or sa	mple at the tin	ne of test unle	ss otherwise cl	early stated.	IY NO. 9920



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		PARTICLE		TION TEST R	EPORT	
Client	Golder As	sociates Pty Limite	ed	Repo	ort No. GA´	101742-G
				Requ	iest No 1893	802_H2C_TR2
Address	PO Box 1	734 MILTON BC	QLD 4064	Test	Date 30/1	12/18-4/12/18
				Repo	ort Date 4/12	2/2018
Project	Inland Ra	il Package 13		·		
Project No	1893802		Client Sample No	330-01-	BH2104-S00350	
Bore Hole	330-01-B	H2104	Depth From (m)	3.5	Depth To (m)	3.94
Description	SPT					
Sieve Size	Passing					
(mm)	%		Silt Fine N Sand	edium Coarse Sand Sand	Fine Medium Gravel Gravel	Coarse Gravel Cobbles
150.0		100				
75.0		90 -				
63.0						
53.0		80 -				
37.5		70 -				
26.5						
19.0		60 -				
13.2		sing (%)				
9.5		- ^{dc} - Ba				
6.7	100	40 -				
4.75	98					
2.36	98	30 -				
1.18	96	20 -				
0.600	91					
0.425	87	- 10 -				
0.300	80					
0.150	59	0 + 0.01	0.1	1 Particle Size (mm		
0.075	46					
NOTES/REMARKS:		-				
		Moisture Content 11.6% Sample/s supplied by the c	% client			Page 1 of 1 REP03903
Accredi The results of	ted for complia the tests, calibr	nce with ISO/IEC 1702 rations, and/or measure	25 - Testing. ements included in	AUNT	rises Signatory	NATA
this docun	nent are tracea Tested at Tri	ble to Australian/Nation lab Brisbane Laborator	nal Standards. ry.	Ce G.I	Hamilton	
The	results of calibra	ations and tests performe	d apply only to the specific instru	nent or sample at the tin	ne of test unless otherwise	Laboratory No. 9926 e clearly stated.



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		PARTICL	E SIZE D	ISTRI	BUTION	TEST R	EPORT			
Client	Golder As	sociates Pty Limi	ted	ethod: AS	1289 3.6.1 , 2.1	Repo	ort No.	GA10	1745-G	
						Real	iest No	189380)2 H2C TR	2
Address	PO Box 1	734 MILTON BC	QLD	4064		Test	Date	30/11	/18-4/12/1	8
						Repo	ort Date	4/12/2	2018	
Project	Inland Ra	il Package 13								
Project No	1893802		Clien	t Sample	e No	330-01-	BH2104-S	00800		
Bore Hole	330-01-B	H2104	Dept	h From (m) 8		Dept	h To (m)	8.45	
Description	SPT									
Sieve Size	Passing									
(mm)	%		Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0		100								
75.0		90								
63.0										
53.0		80 -								
37.5		70								
26.5										
19.0		60								
13.2		ing (%)								
9.5		ss 50								
6.7		40								
4.75										
2.36		30 -								
1.18										
0.600		- 20 -								
0.425	100	10								
0.300	99									
0.150	99	0		0.1		1 1		10		100
0.075	98				Part	icie Size (mm)			
NOTES/REMARKS:		-								
		Moisture Content 20.1 Sample/s supplied by the	% client						Page 1 c	f 1 REP03903
Accredi The results of this docum	ted for complia the tests, calibr	nce with ISO/IEC 170 ations, and/or measu ble to Australian/Natio	25 - Testing. rements includ	ed in		AUHTH	ised Signa	tory		À
	Tested at Tri	lab Brisbane Laborato	pry.			<i>رگ</i> (د.)	Hamilton	7		NO 9926
The	results of calibra	ations and tests perform	ed apply only to f	the specific	instrument or s	ample at the tir	ne of test unles	ss otherwise cl	early stated.	y 140. 3320



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		PARTICLE			BUTION	TEST R	EPORT			
Client	Golder As	sociates Pty Limite	ed	ietnoa: AS '	1209 3.0.1 , 2.1.	Rep	ort No.	GA10	1478-G	
						Req	uest No	189380)2_H2C_TR	1
Address	PO Box 1	734 MILTON BC	QLD	4064		Test	Date	20/11	/18-30/11	/18
						Rep	ort Date	30/11	/2018	
Project	Inland Ra	il Package 13								
Project No	1893802		Clier	nt Sample	e No	330-01	-BH2224-S	01100		
Bore Hole	330-01-B	H2224	Dept	h From (m) 11		Dept	h To (m)	11.45	
Description	SPT									
Sieve Size	Passing			-			-	Madium	0	
(mm)	%	100	Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Gravel	Gravel	Cobbles
150.0										
75.0		90 -								
63.0										
53.0		80 -								
37.5		70 -								
26.5										
19.0		60								
13.2		sing (%)								
9.5		86 50 - E								
6.7		40 -								
4.75										
2.36		30 -								
1.18	100									
0.600	98	20								
0.425	90	10 -								
0.300	70									
0.150	34	0		0.1		1		10		100
0.075	26				Partic	le Size (mn:	1)			
NOTES/REMARKS:		- Moisture Content 19.7%	6						n- 4	
Accredit The results of t this docum	ted for complia the tests, calibr nent are tracea	nce with ISO/IEC 1702 ations, and/or measure ble to Australian/Nation	ent 25 - Testing. ements incluc nal Standards	ded in S.			rised Signa	tory		
	Tested at Tri	lab Brisbane Laborato	у.			G.	Hamilton		Laborato	ଟ୍ଟ ry No. 9926
The	results of calibra	tions and tests performed Reference should be mad	d apply only to de to Trilab's "S Trilab	the specific Standard Ter Pty Ltd AB	instrument or sa ms and Condition N 25 065 630 506	mple at the ti ons of Busine	me of test unle ss" for further d	ss otherwise c etails.	early stated.	

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



		PARTICL	E SIZE D		BUTION	TEST R	EPORT			
Client	Golder As	ssociates Pty Limit	ed	letnod: AS	1289 3.6.1 , 2.1.	Repo	ort No.	GA10	1568-G	
						Requ	uest No	189380)2_H2C_TR	1
Address	PO Box 1	734 MILTON BC	QLD	4064		Test	Date	20/11	/18-30/11	/18
						Repo	ort Date	30/11	/2018	
Project	Inland Ra	il Package 13								
Project No	1893802		Clier	nt Sample	e No	330-01-	-DH2503-S	600050		
Bore Hole	330-01-D	H2503	Dept	h From (m) 0.5		Dept	h To (m)	0.95	
Description	SPT	1								
Sieve Size	Passing									
(mm)	%		Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0		100								
75.0		90 -								
63.0										
53.0		80 -								
37.5		70 -								
26.5										
19.0		60 -								
13.2		sing (%)								
9.5		- uc as								
6.7		40 -								
4.75	100									
2.36	99	30								
1.18	98	20								
0.600	95									
0.425	91	10								
0.300	87									
0.150	76	0		0.1	L	1 1	<u> </u>	10		<u>100</u>
0.075	70				Partic	516 5126 (IIIII	''			
NOTES/REMARKS		-								
		Moisture Content 23.5 Sample/s supplied by the	% client						Page 1	of 1 REP0390
Accredit The results of t this docum	ted for complia the tests, calibr nent are tracea	nce with ISO/IEC 170 ations, and/or measur ble to Australian/Natio	25 - Testing. ements incluc nal Standards	ded in s.		AUHUH	rised Signa	tory		À
	Tested at Tri	lab Brisbane Laborato	ry.			<u>رو</u> (ئ	Hamilton		Laborato	ry No. 9926
The	results of calibra	ations and tests performe Reference should be ma	d apply only to de to Trilab's "S Trilab	the specific Standard Ter Pty Ltd AB	instrument or sa ms and Condition N 25 065 630 506	imple at the tir ons of Busines	me of test unle ss" for further o	ess otherwise cl details.	early stated.	



Client Address	Golder As	sociates Pty Limite	iest M ed	eulou: A5 1	203 3.0.1 , 2.1.	1				
Address			<i></i>			Repo	ort No.	GA10	1569-G	
Address						Requ	uest No	189380	2_H2C_TR	1
	PO Box 1	734 MILTON BC	QLD	4064		Test	Date	20/11	/18-30/11	/18
						Repo	ort Date	30/11/	/2018	
Project	Inland Ra	il Package 13								
Project No	1893802		Clien	t Sample	No	330-01	-DH2503-S	00200		
Bore Hole	330-01-DI	H2503	Dept	h From (ı	n) 2		Dept	h To (m)	2.45	
Description	SPT									
Sieve Size	Passing									
(mm)	%		Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0		100								
75.0		90								
63.0										
53.0		80 -								
37.5		70								
26.5										
19.0		60 -								
13.2		ing (%)								
9.5		ss 50 -								
6.7		40								
4.75										
2.36		30 -								
1.18	100	20								
0.600	99	20								
0.425	98	10								
0.300	94									
0.150	77	0		0.1		1 1	<u> </u>	10		100
0.075	62				Partio	cië Size (mn	1)			
NUTES/REMARKS:		- Moisture Content 15.6% Sample/s supplied by the c	6 lient						Page 1	of 1 REP0390
Accredited The results of the this docume	d for compliar e tests, calibr nt are traceat	nce with ISO/IEC 1702 ations, and/or measure	5 - Testing. ements includ	led in		AUHUHR	ri કદ્વ ી ફાંદ્વાસ	tory		À
	Tested at Tril	ab Brisbane Laborator	y.			<u>رک</u> (6.	Hamilton	7	Laborato	ry No. 9926
The re	sults of calibra	tions and tests performed Reference should be mad	d apply only to de to Trilab's "S	the specific i Standard Terr	nstrument or sa	mple at the til	me of test unle ss" for further d	ss otherwise cl letails.	early stated.	.,



		PARTICLI	E SIZE D			TEST F	REPORT				
Client	Golder As	ssociates Pty Limit	ed	elliou. AS	1209 3.0.1 , 2.1	Rep	ort No.	GA10	1570-G		
						Req	uest No	18938	02_H2C_TF	1	
Address	PO Box 1	734 MILTON BC	QLD	4064		Test	Test Date 20/1			11/18-30/11/18	
						Rep	Report Date 30/11/2018				
Project	Inland Ra	il Package 13									
Project No	1893802		Client	t Sampl	e No	330-01	-DH2503-S	00350			
Bore Hole	330-01-D	H2503	Depth	n From (m) 3.5		Dept	h To (m)	3.95		
Description	SPT	1									
Sieve Size	Passing										
(mm)	%	100	Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles	
150.0											
75.0		90									
63.0		-									
53.0		80 -									
37.5		70 -		/							
26.5											
19.0		60 -									
13.2		sing (%)									
9.5		- ⁰⁰ - 33									
6.7		40 -									
4.75											
2.36		30 -									
1.18		- 20 -									
0.600	100	-									
0.425	99	10 -									
0.300	97										
0.150	89	0		0.1	Parti	1 cle Size (mr	n)	10		100	
0.075	71						,				
NOTES/REMARKS		-									
		Moisture Content 22.9 Sample/s supplied by the o	%						Page 1	of 1 REP0390	
Accredit The results of t this docum	ed for complia he tests, calibr ient are tracea	nce with ISO/IEC 1702 rations, and/or measur ble to Australian/Natio	25 - Testing. ements include nal Standards.	ed in			yises Signa	tory	NATA		
	Tested at Tri	lab Brisbane Laborato	ry.			Ge. Hanoilton					
The	results of calibra	ations and tests performe Reference should be ma	d apply only to t de to Trilab's "Si	he specific tandard Te	instrument or same and Conditi	ample at the t ions of Busine	ime of test unle ess" for further d	ss otherwise c letails.	learly stated.	,	



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		PARTICL	E SIZE DI	STRI	BUTION	TEST R	EPORT				
Client	Golder As	sociates Pty Lim	ited	tnod: AS	1289 3.6.1 , 2.1	Repo	ort No.	GA10	1439-G		
						Requ	uest No	18938	02_H2C_TR	1	
Address	PO Box 1	734 MILTON BC	QLD	4064		Test	Date	30/11	/2018		
						Repo	ort Date	3/12/2	2018		
Project	Inland Ra	il Package 13									
Project No	1893802		Client	Sampl	e No	330-01-	BH2212-S	00500			
Bore Hole	330-01-B	H2212	Depth	From (m) 5		Dept	h To (m)	5.45		
Description	SPT	1									
Sieve Size	Passing										
(mm)	%		Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles	
150.0		100									
75.0		90 -									
63.0		-									
53.0		- 80 -									
37.5		70 -									
26.5											
19.0		60 -									
13.2		- 00 - 00 - 00									
9.5		- Day									
6.7		40 -									
4.75											
2.36	100	30 -									
1.18	99	20 -									
0.600	99										
0.425	99	- 10 -									
0.300	98										
0.150	98	0.01		0.1	Part	1 icle Size (mm)	10	• · · · ·	100	
0.075	97	I									
NOTES/REMARKS:		-	0%								
		Sample/s supplied by the	∠% e client						Page 1	of 1 REP0390	
Accredit The results of t this docum	ted for complia the tests, calibr	nce with ISO/IEC 170 ations, and/or measuble to Australian/National	d in		ACHIMIC is a Signatory				NATA		
	Tested at Tri	lab Brisbane Laborat	tory.		Ce. Hamilton						
The	results of calibra	ations and tests perform	and apply only to th	e snecific	instrument or s	ample at the tir	ne of test unle	ss otherwise c	Laporato	y NO. 9926	



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		PARTICL	E SIZE DI		BUTION	TEST R	EPORT			
Client	Golder As	ssociates Pty Lim	ited	.nou: AS '	1203 J.O.1 , 2.1	Repo	ort No.	GA10	1456-G	
						Requ	uest No	18938	02_H2C_TR	.1
Address	PO Box 1	734 MILTON BC	QLD	4064		Test	Date	30/11	/2018	
						Repo	ort Date	3/12/2	2018	
Project	Inland Ra	il Package 13								
Project No	1893802		Client	lient Sample No 33			-BH2216-S	00200		
Bore Hole	330-01-B	H2216	Depth	From (m) 2		Dept	h To (m)	2.45	
Description	SPT									
Sieve Size	Passing									
(mm)	%		Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0		100	-							
75.0		90 -								
63.0		-								
53.0		- 80 -								
37.5		70 -								
26.5										
19.0		60 -								
13.2		%) 6uiss 50								
9.5		- La								
6.7		40 -								
4.75	100									
2.36	99	30 -								
1.18	99	20								
0.600	99									
0.425	99	10 -								
0.300	98									
0.150	98	0.01		0.1	Parti	1 icle Size (mm	· <u>·</u> ····	10		100
0.075	97	1								
NOTES/REMARKS:		-	40/							
		Moisture Content 34. Sample/s supplied by the	1% e client						Page 1 o	of 1 REP0390
Accredi The results of this docum	ted for complia the tests, calibr	nce with ISO/IEC 170 ations, and/or measuble to Australian/National Au		Adhttherised Signatory				NATA		
	Tested at Tri	lab Brisbane Laborat	ory.		Ge. Hampilton					
The	results of calibra	ations and tests perform	ed apply only to the	e specific	instrument or s	ample at the ti	me of test unle	ss otherwise c	learly stated	y 110. 3320



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		PARTICL	E SIZE DIS		N TEST F	REPORT					
Client	Golder As	ssociates Pty Limi	ted	uu. Mu 1209 J.O.T ,	Rep	ort No.	GA10	1460-G			
					Req	uest No	189380)2_H2C_TR	1		
Address	PO Box 1	734 MILTON BC	QLD	4064	Test	t Date	30/11	/2018			
					Rep	ort Date	3/12/2	2018			
Project	Inland Ra	il Package 13									
Project No	1893802		Client S	ample No	330-01	-BH2216-S	00800				
Bore Hole	330-01-B	H2216	Depth F	rom (m) 8		Dept	h To (m)	8.45			
Description	SPT										
Sieve Size	Passing										
(mm)	%	- 100	Silt	Fine Medium Sand Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles		
150.0		-	-								
75.0		90 -									
63.0											
53.0		80									
37.5		1									
06.5		70 -									
20.3		-									
19.0		- 60 - 									
13.2		sing (%									
9.5		- Las									
6.7		40									
4.75		-									
2.36		30 -									
1.18		-									
0.600		20 -									
0.425	100	10									
0.300	99										
0.150	98	0					10		100		
0.075	97	0.01		P	article Size (mr	n)	IV		100		
NOTES/REMARKS:		-									
		Moisture Content 31.4 Sample/s supplied by the	l% client					Page 1 o	f 1 REP03903		
Accredi The results of	ted for complia the tests, calibr	nce with ISO/IEC 170 rations, and/or measu	025 - Testing. Irements included i	in	AdHtherises Signatory						
	Tested at Tri	lab Brisbane Laborati	onal Stanualus. Dry.		Ge. Hamilton				or NL CE		
The	results of calibra	ations and tests perform	ed apply only to the	specific instrument	or sample at the t	ime of test unle	ss otherwise cl	Laborator early stated.	y No. 9926		



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		FARTICE			ESTRE	PORI				
Client	Golder As	sociates Pty Limi	ted	<u>289 3.6.1 , 2.1.1</u>	Repor	rt No. est No	GA10	1474-G	1	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test	Date	30/11	30/11/2018		
					Repor	rt Date	3/12/2	2018		
Project	Inland Ra	il Package 13								
Project No	1893802		Client Sample	No	330-01-E	3H2224-U	00500			
Bore Hole	330-01-BI	+2224	Depth From (n	n) 5		Dept	n To (m)	5.42		
Description	U	1								
Sieve Size	Passing									
(mm)	%		Silt Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles	
150.0		100								
75.0		90 -								
63.0										
53.0		80								
37.5		70								
26.5										
19.0		60								
13.2	100	sing (%)								
9.5	99	- 00 - 10 - 10								
6.7	98	40								
4.75	98									
2.36	96	30								
1.18	96	20								
0.600	95									
0.425	95	10								
0.300	94									
0.150	90	0.01	0.1	Particl	1 le Size (mm)		10		100	
0.075	82				()					
OTES/REMARKS:		-								
		Moisture Content 25.7 Sample/s supplied by the	% client					Page 1 c	f1 REP0390	
Accredite The results of th this docume	ed for compliant te tests, calibration tent are traceal	nce with ISO/IEC 170 ations, and/or measu ble to Australian/Natio	25 - Testing. rements included in onal Standards.		Adhitherister Signatory				NATA	
	Tested at Tril	ab Brisbane Laborato	pry.	Ge. Hanvilton				NO 9026		



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		PARTICL	E SIZE DIST		N TEST R	EPORT				
Client	Golder As	ssociates Pty Limi	ted	<u>. AJ 1209 3.0.1 , 2</u>	Repo	ort No.	GA10	1484-G		
					Requ	est No	189380	02_H2C_TR	1	
Address	PO Box 1	734 MILTON BC	QLD 40)64	Test	Date	30/11	/2018		
					Repo	ort Date	3/12/2	2018		
Project	Inland Ra	il Package 13								
Project No	1893802		Client Sa	mple No	330-01-	BH2224-S	02000			
Bore Hole	330-01-B	H2224	Depth Fro	om (m) 20		Dept	h To (m)	20.45		
Description	SPT	1								
Sieve Size	Passing									
(mm)	%		Silt F	ine Medium and Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles	
150.0		100								
75.0		90								
63.0		-								
53.0		80 -								
37.5		70								
26.5										
19.0		60								
13.2		%) 6uiss 50								
9.5		- Bas								
6.7		40 -								
4.75	100									
2.36	99	30 -								
1.18	98	20								
0.600	98									
0.425	97	10 -								
0.300	97									
0.150	96	0	0.1	Pa	1 rticle Size (mm)	10		100	
0.075	96									
NOTES/REMARKS:		-								
		Moisture Content 19% Sample/s supplied by the	6 client					Page 1 o	f 1 REP0390	
Accredi The results of this docum	ted for complia the tests, calibr	nce with ISO/IEC 170 ations, and/or measu)25 - Testing. Irements included in onal Standards		A thilling is a signatory				NATA	
	Tested at Tri	lab Brisbane Laborat	ory.		Ce. Hanvilton					
The	results of calibra	ations and tests perform	ed apply only to the sp	ecific instrument or	sample at the tin	ne of test unle	ss otherwise c	early stated	y NO. 3320	



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		PARTICL	E SIZE DIS		N TEST R	EPORT				
Client	Golder As	sociates Pty Limit	ted	u. NO 1203 3.0.1,	Repo	ort No.	GA10	1493-G		
					Requ	iest No	189380)2_H2C_TR	1	
Address	PO Box 1	734 MILTON BC	QLD 4	QLD 4064			30/11	1/2018		
					Repo	ort Date	3/12/2	2018		
Project	Inland Ra	il Package 13								
Project No	1893802		Client Sa	ample No	330-01-	BH2227-U	00350			
Bore Hole	330-01-B	H2227	Depth Fr	rom (m) 3.5		Dept	h To (m)	3.9		
Description	U									
Sieve Size	Passing									
(mm)	%		Silt	Fine Medium Sand Sand	Coarse Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles	
150.0		100								
75.0		90 -								
63.0										
53.0		80 -								
37.5		70								
26.5										
19.0		60								
13.2		ing (%)								
9.5		SS 50								
6.7		40								
4.75										
2.36		30								
1.18										
0.600		20 -								
0.425	100	10								
0.300	99									
0.150	98	0	0.	1	1 1		10		100	
0.075	92			Pi	arucie Size (mm)				
NOTES/REMARKS:		-								
		Moisture Content 22.9 Sample/s supplied by the	% client					Page 1 o	of 1 REP0390	
Accredi The results of this docum	ted for complia the tests, calibr	nce with ISO/IEC 170 ations, and/or measu ble to Australian/Natio	25 - Testing. rements included ir	1	Adht Herised Signatory					
	Tested at Tri	lab Brisbane Laborato	Dry.		Ce. Hampilton				AL CE	
The	results of calibra	ations and tests performe	ed apply only to the s	pecific instrument of	or sample at the tir	ne of test unle	ss otherwise c	early stated.	y NO. 9920	



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		PARTICL	E SIZE DISTRI	BUTION	TEST RE	EPORT			
Client	Golder As	ssociates Pty Limi	ted	1209 3.0.1 , 2.1.1	Repo	rt No.	GA10	1499-G	
Addross	PO Box 1				Requ	est No	189380	13802_H2C_TR1	
Audiess	I O DOX I				lest	Test Date 30		30/11/2018	
.					Repo	rt Date	3/12/2	2018	
Project	Inland Ra	Il Package 13			000.04		04450		
Project No	1893802	10007	Client Sampl		330-01-E	3H2227-U	01150	44.05	
Bore Hole	330-01-B	H2227	Depth From (m) 11.5		Depti	n Io (m)	11.95	
Description	Dession								
Sieve Size	Passing		-		_	-	Madhan	0	
(mm)	%	- 100	Silt Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Gravel	Gravel	Cobbles
150.0		-							
75.0		90							
63.0									
53.0		80 -							
37.5		70							
26.5									
19.0		60							
13.2		(%) Bu							
9.5		- 05 - 50 							
6.7		40							
4.75									
2.36		30							
1.18		-							
0.600	100	20							
0.425	99	10							
0.300	97								
0.150	82	0.01	0.1		1		10		100
0.075	69			Partic	le Size (mm)				
NOTES/REMARKS.		-							
<u></u>		Moisture Content 23.5 Sample/s supplied by the	% client					Page 1 c	of 1 REP03901
Accredi The results of	ted for complia the tests, calibr	nce with ISO/IEC 170 rations, and/or measu	25 - Testing. rements included in		AUNT	ised Signa	tory		
this docun	nent are tracea	ble to Australian/Natio	onal Standards.		G Hamilton				OR AL CE
The	results of calibra	ations and tests performe	ed apply only to the specific	instrument or sa	mple at the tim	e of test unles	ss otherwise cl	Laborato early stated.	ry No. 9926



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		PARTICLE		BUTION TE	ST REPOR	Т		
Client	Golder As	ssociates Pty Limite	ed	203 3.0.1 , 2.1.1	Report No.	GA10	1501-G	
					Request No	189380)2_H2C_TR1	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test Date	30/11	/2018	
					Report Date	3/12/2	2018	
Project	Inland Ra	il Package 13						
Project No	1893802		Client Sample	No	330-01-BH2227	-U01400		
Bore Hole	330-01-B	H2227	Depth From (r	n) 14	De	pth To (m)	14.45	
Description	U							
Sieve Size	Passing		_		_			
(mm)	%	-	Silt Fine Sand	Medium (Sand	Coarse Fine Sand Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0								
75.0								
75.0		90 -		/				
63.0		-						
53.0		80 -	/					
37.5		70						
26.5		-						
19.0		60 -						
13.2		(%) 6						
9.5		La 20 - Basin Pasin Pasi						
6.7								
4.75		40						
2.36		30						
1.18								
0.600	100	20 -						
0.425	99	10						
0.300	95							
0.150	76	0.01	0.1		1	10		100
0.075	55		-	Particle S	Size (mm)			
NOTES/REMARKS:		-						
		Moisture Content 22.6%	% lient				Page 1 of	1 REP03003
Δcoredit	ted for complia	nce with ISO/IEC 1700	25 - Testing		Authorized Cim	atory		
The results of t	the tests, calibr	ations, and/or measure	,		вногу	NATA		
	Tested at Tri	lab Brisbane Laborator	nai Stanualus. W	<	G. Hamilton			
The	results of calibra	ations and tests performe	d apply only to the specific in	nstrument or sample	e at the time of test u	nless otherwise cl	Laboratory early stated.	/ No. 9926


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		PARTICLE	E SIZE DISTRIBU	TION TEST	REPORT			
Client	Golder As	ssociates Pty Limite	ed	Re	eport No.	GA10	1503-G	
				Re	equest No	189380	2_H2C_TR1	
Address	PO Box 1	734 MILTON BC	QLD 4064	Te	st Date	30/11	/2018	
				Re	port Date	3/12/2	2018	
Project	Inland Ra	il Package 13						
Project No	1893802		Client Sample N	o 330-	01-BH2227-S	01700		
Bore Hole	330-01-B	H2227	Depth From (m)	17	Depth	n To (m)	17.27	
Description	SPT							
Sieve Size	Passing							
(mm)	%	-	Silt Fine Sand	Medium Coarse Sand Sand	Fine Gravel	Medium Gravel	Coarse Gravel	Cobbles
150.0		100						
75.0		90						
63.0		-						
53.0		80 -						
37.5		70						
26.5								
19.0		60 -						
13.2		(%) Bu						
9.5		-175 50 - Ba d						
6.7		40 -						
4.75								
2.36	100	30 -						
1.18	99	-						
0.600	97	20 -						
0.425	93	10 -						
0.300	87							
0.150	65	0.01	0.1	1		10		100
0.075	49			Particle Size (nm)			
NOTES/REMARKS:		-						
		Moisture Content 13.8% Sample/s supplied by the c	% lient				Page 1 of	1 REP03903
Accredi The results of	ted for complia the tests, calibr	nce with ISO/IEC 1702 rations, and/or measure	25 - Testing. ements included in	A	horised Signal	tory		
this docun	nent are tracea	ble to Australian/Nation	nal Standards.	C	E. Hamilton	*		
The	results of calibra	ations and tests performe	d apply only to the specific instr	ument or sample at th	e time of test unles	s otherwise cl	Laboratory early stated.	No. 9926

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		PARTICLI	E SIZE DISTRI	BUTION 1	TEST RE	PORT		
Client	Golder As	ssociates Pty Limit	ed	1209 3.0.1 , 2.1.1	Report	No. G/	A101572-G	
					Reques	st No 18	93802_H2C_TR1	
Address	PO Box 1	734 MILTON BC	QLD 4064		Test Da	ate 30	/11/2018	
					Report	Date 3/	12/2018	
Project	Inland Ra	il Package 13						
Project No	1893802		Client Sample	e No	330-01-Dł	H2503-U00650		
Bore Hole	330-01-D	H2503	Depth From (m) 6.5		Depth To (m	i) 6.89	
Description	U							
Sieve Size	Passing							
(mm)	%		Silt Fine Sand	Medium Sand	Coarse Sand	Fine Medium Gravel Gravel	Coarse Gravel	Cobbles
150.0		100						
75.0		90 -						
63.0		-						
53.0		80 -						
37.5		- 70 -						
26.5		-						
19.0		60						
13.2		(%) Bu						
9.5		ізз 50 - д						
6.7		40						
4.75		-						
2.36	100	30 -						
1.18	98							
0.600	90	20 -						
0.425	82	10						
0.300	72							
0.150	56	0	0.1			10		100
0.075	51			Partic	le Size (mm)			
NOTES/REMARKS:								
		Moisture Content 15.29 Sample/s supplied by the o	% client				Page 1 of 1	REP03903
Accredi The results of t this docum	ted for complia the tests, calibr	nce with ISO/IEC 1702 ations, and/or measur ble to Australian/Natio	25 - Testing. ements included in nal Standards.		Authoris	ed Signatory		
	Tested at Tri	lab Brisbane Laborato	ry.		G.Ha	milton		0026
The	results of calibra	ations and tests performe	d apply only to the specific	instrument or sar	mple at the time	of test unless otherwi	Laboratory N se clearly stated.	10. 9926

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Client Gold			Test Metho	od: AS 1289 2.1.1,	3.1.2, 3.2.1, 3.3	.1, 3.4.1					
	er Associates	Pty Limited					Report	No.	GA1014	103-AL	
Address PO B	ox 1734 MILT	ON BC C	LD 406	4			Reque	st No.	189380	2 H2C TR	1
							Test D	ate	27/11/2	<u></u> 018	
Project Inlan	d Rail Packao	e 13					Report	Date	30/11/2	018	
Project No. 1893	802			(Client Same	ole No.	330-01	-BH2203	-S00350		
Bore Hole 330-0)1-BH2203			Depth Fro	om (m) 3.	.5			Depth To	(m) 3.95	
Description SPT			I			-				()	
				RESULTS OF	TESTING						
		Liquid	Limit (%)	22							
		Plastic	Limit (%)	13							
		Plasticity I	ndex (%)	9							
		Linear Shrin	kage (%)	3.0	Curli	ing Ocur	red				
		Moisture Co	ntent (%)	10.8							
		Preparation	n Method	Dry Sieved and	l Oven Dried						
				Plast	icity Ch	art					
			A - Line [F	PI=0.73 x (LL-20)]	× Test	Result	CL	. & ML			
	80										
	70										
	60										
	00										
	50			СН							
Plasticity Index (%)	40				•						
	30		C								
		CL									
	20				-						
	10	×			мпе						
	CL&N		ML	&OL							
	0 1	0 20	30 4	0 50	60 7	70	80	90 ·	100 110	120	
				Liqu	uid Limit (%)						
Remarks:											
ample/s supplied by client									I	Page: 1 of 1	REP00102
Accredited for con	pliance with ISC)/IEC 17025 - Test	ing.		μ	Authoris	ed Signatoı	ry		/	
The results of the tests, cal document are trac	ibrations, and/or eable to Australia	measurements in an/National Standa	cluded in this ards.		(le	~	1			
Tested a	t Trilab Brisbane	Laboratory.				C. F	Park				D FOR CAL ENCE
	The results of colibr	ations and tests por	formed apply on	ly to the specific inc	strument or same	nle at the t	ime of test ur	less otherw	ise clearly stated	Laboratory N	lo. 9926



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Client Golder Associates Pty Limited Report No. GA101404-AL Address PO Box 1734 MILTON BC QLD 4064 Request No. 1893802_H2C_TR1 Test Date 27/11/2018 Test Date 30/11/2018 Project Inland Rail Package 13 Report Date 30/11/2018 Project No. 1893802 Client Sample No. 330-01-BH2203-S00500 Bore Hole 330-01-BH2203 Depth From (m) 5 Depth To (m) 5.45 Description SPT EESULTS OF TESTING Liquid Limit (%) 31 Plastic Limit (%) 12 Plasticity Index (%) 19 Linear Shrinkage (%) 10.0 Curling Ocurred Moisture Content (%) 15.9
Address PO Box 1734 MILTON BC QLD 4064 Request No. 1893802_H2C_TR1 Project Inland Rail Package 13 Test Date 27/11/2018 Project No. 1893802 Client Sample No. 330-01-BH2203-S00500 Bore Hole 330-01-BH2203 Depth From (m) 5 Depth To (m) 5.45 Description SPT Iniquid Limit (%) 31 Plastic Limit (%) 12 Plasticity Index (%) 19 Linear Shrinkage (%) 10.0 Curling Ocurred Moisture Content (%) 15.9
International Colspan="2">International Colspan="2">International Colspan="2" Project Inland Rail Package 13 Report Date 30/11/2018 Project No. 1893802 Client Sample No. 330-01-BH2203-S00500 Bore Hole 330-01-BH2203 Depth From (m) 5 Depth To (m) 5.45 Description SPT RESULTS OF TESTING Itiquid Limit (%) 31 Itiquid Limit (%) 12 Plastic Limit (%) 12 Plastic Limit (%) 19 Itique Shrinkage (%) 10.0 Curling Ocurred Moisture Content (%) 15.9 15.9 15.9 15.0
Project Inland Rail Package 13 Report Date 30/11/2018 Project No. 1893802 Client Sample No. 330-01-BH2203-S00500 Bore Hole 330-01-BH2203 Depth From (m) 5 Depth To (m) 5.45 Description SPT SPT ESULTS OF TESTING Liquid Limit (%) 31 Plastic Limit (%) 12 Plastic Limit (%) 19 Linear Shrinkage (%) 10.0 Curing Ocurred Moisture Content (%)
Project No. 1893802 Client Sample No. 330-01-BH2203-S00500 Bore Hole 330-01-BH2203 Depth From (m) 5 Depth To (m) 5.45 Description SPT RESULTS OF TESTING Depth To (m) 5.45 Liquid Limit (%) 31 Plastic Limit (%) 12 Plastic Limit (%) 12 Plasticity Index (%) 19 Linear Shrinkage (%) 10.0 Curling Ocurred Moisture Content (%) 15.9 15.9
Bore Hole 330-01-BH2203 Depth From (m) 5 Depth To (m) 5.45 Description SPT RESULTS OF TESTING Image: Content (m) 10 Image: Content (m) Image: Content (m) 10 Image: Content (m) Ima
Description SPT RESULTS OF TESTING Liquid Limit (%) 31 Plastic Limit (%) 12 Plastic Limit (%) 19 Linear Shrinkage (%) 10.0 Curling Ocurred Moisture Content (%) 15.9
RESULTS OF TESTING Liquid Limit (%) 31 Plastic Limit (%) 12 Plastic Limit (%) 19 Linear Shrinkage (%) 10.0 Curling Ocurred Moisture Content (%) 15.9
Liquid Limit (%)31Plastic Limit (%)12Plasticity Index (%)19Linear Shrinkage (%)10.0Curling OcurredMoisture Content (%)15.9
Plastic Limit (%) 12 Plasticity Index (%) 19 Linear Shrinkage (%) 10.0 Curling Ocurred Moisture Content (%) 15.9
Plasticity Index (%) 19 Linear Shrinkage (%) 10.0 Curling Ocurred Moisture Content (%) 15.9
Linear Shrinkage (%) 10.0 Curling Ocurred
Linear Shrinkage (%) 10.0 Curling Ocurred Moisture Content (%) 15.9
Moisture Content (%) 15.9
Preparation Method Dry Sieved and Oven Dried
Plasticity Index (%)
Remarks:
Sample/s supplied by client Page: 1 of 1 Accredited for compliance with ISO/IEC 17025 - Testing. The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards. Tested at Trilab Brisbane Laboratory. C. Park Page: 1 of 1



	ATTERE Test Me	ERG LIMITS TEST REPO thod: AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1	RT	
Client	Golder Associates Pty Limited		Report No. GA	101419-AL
Address	PO Box 1734 MILTON BC QLD 4	64	Request No. 189	03802_H2C_TR1
			Test Date 28/	11/2018
Project	Inland Rail Package 13		Report Date 30/	11/2018
Project No.	1893802	Client Sample No.	330-01-BH2207-S00050	
Bore Hole	330-01-BH2207	Depth From (m) 0.5	Depth	To (m) 0.95
Description	SPT		· · ·	
		RESULTS OF TESTING		
	Liquid Limit (%)	20		
	Plastic Limit (%)	9		
	Plasticity Index (%)	11		
	Linear Christers (//)	5.5 0	mad	
	Linear Shrinkage (%)	5.5 Curling Ocu	rrea	
	Moisture Content (%)	3.9		
	Preparation Method	Dry Sieved and Oven Dried		
Plasticity Index (%)		Prasticity Citant [PI=0.73 x (LL-20)] × Test Result CI CH CI MH&OH L&OL MH&OH L&OL FOL 40 50 60 70 Liquid Limit (%) FOL FOL FOL		
emarks:				
mple/s supplied by client				Page: 1 of 1 REP0010
Accredited The results of the t document	I for compliance with ISO/IEC 17025 - Testing. ests, calibrations, and/or measurements included in th are traceable to Australian/National Standards. Fested at Trilab Brisbane Laboratory.	S Authoris	ed Signatory Park	ACCEPTED FOR TECHNICAL COMMITTACE
	The results of calibrations and tests performed and	only to the specific instrument or complect the	time of test unloss otherwise algority	Laboratory No. 9926



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				AT	TER Test M	BERG	LIMITS	TEST	REPO 3.1, 3.4.1	RT					
Client	Golder A	ssociates	Pty Limite	ed						Repo	rt No.	GA	101422-/	AL.	
Address	PO Box	1734 MILT	ON BC	QL	.D 4	4064				Requ	est No.	18	93802 H	2C TR1	
										Test I	Date	28	/11/2018		
Proiect	Inland R	ail Packao	e 13							Repo	rt Date	30	/11/2018		
Project No.	1893802	2					С	lient Sam	ple No.	330-0	1-BH220	7-S0050)		
Bore Hole	330-01-E	3H2207					Depth Fro	m (m)	5			Dept	n To (m)	5.45	
Description	SPT	-							-						
						RES	JLTS OF T	ESTING							
			Li	quid Li	imit (%	6)	35								
			Pla	astic Li	imit (%	6)	14								
			Plast	icity In	dex (%	6)	21								
			Linear	Shrinka	age (%	6)	10.0	Cu	rling Ocu	rred					
			Moistu	re Cont	tent (%	6)	10.0								
			Prepa	ration I	Metho	d Dry	Sieved and	Oven Dried							
							Plasti	city Cl	hart						
				_	— A - L	ine [PI=0.73	x (LL-20)]	× Tes	st Result	(CL & ML				
	80														
	70														
	60														
	50						СН							-	
Plasticity Index (%)	40													_	
	20					CI									
	50			CL											
	20			VI	X									-	
	10					\square		MIN	хUП					_	
		CL&I	ИL	$\overline{}$		ML&O	L								
	0	0 1	0 20)	30	40	50	60	70	80	90	100	110	 120	
							Liqui	d Limit (%)							
lemarks:															
ample/s supplied by client													Page:	l of 1	REP00102
Accredite The results of the t document	d for complia ests, calibrat are traceabl	ance with ISC tions, and/or e to Australia	D/IEC 17025 measureme an/National	5 - Testino ents inclu Standard	g. uded in t ds.	this		4	Authoris	ed Signat	ory				
	Tested at Tri	ilab Brisbane	Laboratory	<i>ı</i> .					C. I	Park				TECHNICAL	000
	The re	esults of calibr	rations and te	ests perfor	med app	ly only to th	e specific instr	rument or sar	nple at the	time of test	unless other	vise clearly	stated.	oratory No.	9926



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				AT	TERE Test M	BERG ethod: AS 1	L IMITS 289 2.1.1, 3.	TEST F	REPOI 1, 3.4.1	RT					
Client	Golder A	ssociates	Ptv Limit	ted						Repor	rt No.	GA	101437-	AL	
Address	PO Box	1734 MIL	FON BC	QL	D 4	064				Reque	est No.	18	93802 H	2C TR1	
									-	Test [)ate	28	/11/2018	20_1111	
Project	Inland R	ail Packar	ıe 13							Renor	rt Date	30	/11/2018		
Project No	1893802	un r donag	0 10				CI	lient Samn	le No	330-0	1-BH221	2-50020)		
Bore Hole	330-01-F	RH2212				D	enth Fror	m (m) 2		000 0		Dentl	, To (m)	2 45	
Description	SPT	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					<u>eptilite</u>				l	Dopt	<u> ()</u>	2.10	
						RESU	LTS OF T	<u>Esting</u>							
			L	.iquid L	imit (%))	58								
			Р	lastic L	imit (%		21								
					dox (%)		27								
			Plas	sucity in	uex (%		51								
			Linear	r Shrink	age (%		17.0	Curli	ng Ocurr	red					
			Moistu	ure Con	tent (%)		24.6								
			Prep	aration	Method	Dry Si	ieved and C	Oven Dried							
						<u> </u>	Plastic	<u>city Ch</u>	<u>art</u>						
				_	A - Lin	e [PI=0.73 x	(LL-20)]	× Test F	Result	<u> </u>	L & ML				
	80														
	70													4	
	60														
	00														
	50						-							_	
Plasticity Index (%)	40						СП							_	
						CI	>	*							
	30													_	
	20			CL										_	
								MH&	он						
	10	CL&	ML			IL&OL									
	0					10			2			400	110		
		0	10 2	20	30	40	50 Liquid	60 7 I Limit (%)	0	80	90	100	110	120	
Remarks:															
ample/s supplied by client													Page:	1 of 1	REP00102
Accredite The results of the t document	l for complia ests, calibrat are traceabl	nce with IS0 ions, and/or e to Australi	D/IEC 1702 measuren an/Nationa	25 - Testin nents inclu I Standaro	ig. uded in th ds.	is		A	uthorise	ed Signato	ory				
	Tested at Tri	lab Brisbane	e Laborator	ry.					C. P	ark					
	The r			•									Lab	oratory No.	9926



	ATTERI Test M	BERG LIMITS TEST REPC thod: AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1	DRT	
Client	Golder Associates Pty Limited		Report No.	GA101439-AL
Address	PO Box 1734 MILTON BC QLD 4	064	Request No. 1	893802_H2C_TR1
			Test Date 2	8/11/2018
Project	Inland Rail Package 13		Report Date 3	0/11/2018
Project No.	1893802	Client Sample No	. 330-01-BH2212-S005	00
Bore Hole	330-01-BH2212	Depth From (m) 5	Dep	th To (m) 5.45
Description	SPT			
		RESULTS OF TESTING		
	Liquid Limit (%	95		
	Plastic Limit (%	23		
	Disticity Index /0/	72		
	Plasticity index (%	14		
	Linear Shrinkage (%)	21.5 Cracking &	Curling Ocurred	
	Moisture Content (%	38.2		
	Preparation Method	Dry Sieved and Oven Dried		
Plasticity Index (%)	A - Lin 80 70 60 50 40 30 20 10 CL&ML	Plasticity Chart (PI=0.73 x (LL-20)] × Test Result CH CH CH MH&OH IL&OL	CL & ML	
emarks:	0 10 20 30	40 50 60 70 Liquid Limit (%)	80 90 100	110 120
mple/s supplied by client				Page: 1 of 1 REP0010
Accredited The results of the t document	I for compliance with ISO/IEC 17025 - Testing. ests, calibrations, and/or measurements included in th are traceable to Australian/National Standards. Tested at Trilab Brisbane Laboratory.	s Authori C.	sed Signatory Park	
			the state of the s	Laboratory No. 9926



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				ΑT	TERE Test Me	BERG	LIMITS	TEST 1.2, 3.2.1, 3	REPO 3.3.1, 3.4.1	RT					
Client	Golder	Associates	Ptv Limit	ed						Repor	rt No.	GA	101443-4	AL.	
Address	PO Box	1734 MIL	TON BC	QL	D 4	064				Reque	est No.	189	3802 H		
										Test F)ate	28/	11/2018		
Project	Inland R	Rail Packar	1A 13							Renor	rt Date	20/ 30/*	11/2018		
Project No	189380	2	JO 10				CI	ient Sar	nnle No	330-01	1-RH2212	-S01100	11/2010		
Bore Hole	330-01-	EH2212				r I)enth From	n (m)	11	000 0		Denth	To (m)	11 45	
Description	SPT											Deptil	<u>10 (III)</u>	11.40	
						RESU	JLTS OF T	ESTING							
			L	.iguid L	imit (%)	1	97								
			P	lastic L	imit (%)	1	20								
			Plas	ticity In	dex (%)		77								
			Linoo	Chrink	aca (%)		21.5	C -	ookina 9 C	Surling Oo	urrod				
			Linea	SIITIIK	aye (/0)		21.5	CI	acking a c		liteu				
			Moisti	ire Con	tent (%)	_	29.0								
			Prep	aration	Method	Dry S	Sieved and C	Oven Drie	d						
							<u>Plastic</u>	city C	<u>hart</u>						
	8	0		_	A - Lin	e [PI=0.73	x (LL-20)]	× Te	est Result	C	L & ML			_	
											×				
	7	0				_				_					
	6	0				_								_	
	5	0					СН								
Plasticity Index (%)	4	0												-	
	3	0				CI									
				CL											
	2	0							204					-	
	1	0				1			avn					_	
			ML	\succ	N	IL&0I	-								
		0	10 2	20	30	40	50	60	70	80	90	100	110	120	
							Liquid	Limit (%)							
Remarks:															
ample/s supplied by client													Page: 1	l of 1	REP00102
Accredited The results of the t document	d for compli ests, calibra are traceab	ance with IS0 ations, and/or ole to Australi	O/IEC 1702 r measuren an/Nationa	25 - Testin nents inclu I Standard	g. uded in th ds.	is			Authoris	ed Signato	ory				
	Tested at T	rilab Brisbane	e Laborato	ту.					C. I	Park				TECHNICAL	
	The	results of calib	rations and	tests perfo	rmed apply	only to the	e specific instri	ument or sa	mole at the	time of test u	inless otherw	vise clearly s	Labo	oratory No. 9	9926



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				A	TTER Test M	BERG	LIMITS	TEST RE	EPO 3.4.1	RT					
Client	Golder A	Associates	Ptv Limi	ted						Repor	t No.	GA	101456-/	AL	
Address	PO Box	1734 MIL	TON BC	Q	LD ·	4064				Reque	est No.	189	3802 H	2C TR1	
									ŀ	Test D)ate	28/	11/2018		
Project	Inland R	Rail Packac	ne 13							Repor	t Date	30/	11/2018		
Project No.	1893802	2	<u>jo 10</u>				С	lient Sample	No.	330-01	I-BH2216	-S00200			
Bore Hole	330-01-	- BH2216				1	Depth Fro	m (m) 2		000 01		Denth	To (m)	2 45	
Description	SPT	BHZZIO					Septime					Dopti	10 (11)	2.10	
						DESI		ESTING							
						<u>NLSC</u>		Lonito							
			l	Liquid I	Limit (%	6)	101								
			F	Plastic L	Limit (%	6)	22								
			Plas	sticity lı	ndex (%	6)	79								
			Linoa	r Shrini	kago (%	-, ()	25 5	Cracki	na 8 C	urling Oou	urrod				
			Lillea		raye (/	0)	23.5	GIACKI	iiyαu		ineu				
			Moistu	ure Cor	ntent (%	6)	34.1								
			Prep	aration	Metho	d Dry	Sieved and	Oven Dried							
							Plasti	citv Cha	rt						
				-	— A - L	ine [PI=0.73	x (LL-20)]	× Test Re	sult	—— CI	L & ML				
	80	0										×			
	70	0													
	60	0												_	
	50	0			_									_	
Plasticity Index (%)	40	n					СН							_	
· ····································		- -				СІ									
	30	0												_	
	20	0		CL										_	
								MH&O	Н						
	10		ML			ML&OI	L							_	
	(0	40			40	-	0 70		00	00	100	140	100	
		0	10 .	20	30	40	50 Liquid	60 70 d Limit (%)		80	90	100	110	120	
Remarks [.]															
Sample/s supplied by client													Page:	1 of 1	REP00102
Accredite	d for complia	ance with IS	O/IEC 1702	25 - Testi	ng.	lhia		Au	thorise	ed Signato	ry				
i ne results of the t document	are traceab	le to Australi	ian/Nationa	al Standa	rds.	uns		\mathcal{C}	e	~	1				L .
	Tested at Tr	rilab Brisbane	e Laborato	ry.					C. P	'ark				TECHNICAL COMPETENCE	
	The r	results of calib	rations and	tests perfe	ormed app	ly only to th	e specific instr	rument or sample	at the t	ime of test u	nless other	/ise clearly s	Labo	oratory No.	9926
			Reference	e should b	e made to	Trilab's "Sta Trilab Pty I	andard Terms	and Conditions o 25 065 630 506	f Busine	ess" for furth	er details.				



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				A	TTERB Test Met	ERG L	LIMITS 289 2.1.1, 3.	TEST RI 1.2, 3.2.1, 3.3.1,	EPO 3.4.1	RT					
Client	Golder	Associate	s Ptv Lim	nited						Repor	t No.	GA	101460-/	AL	
Address	PO Box	1734 MIL	TON BC	; QI	LD 40)64				Reque	est No.	189	3802 H	2C TR1	
										Test D	ate	28/	<u>11/2018</u>		
Project	Inland F	Rail Packa	age 13							Repor	t Date	30/	11/2018		
Project No.	189380	2	igo io				CI	lient Sample	e No.	330-01	-BH2216	-S00800			
Bore Hole	330-01-	- BH2216				De	epth Fron	m (m) 8				Depth	To (m)	8.45	
Description	SPT												,		
						RESUL	TS OF T	ESTING							
				Liquid L	.imit (%)		106								
				Plastic L	_imit (%)		21								
			Pla	sticity Ir	ndex (%)		85								
			Line	ar Shrinl	kage (%)		19.5	Curling	q Ocuri	red					
			Mois	ture Con	tent (%)		31 4		J						
			Dre	norotion	Mothod	Dm/ Si	oved and (Duan Dried							
			FIC	paration	Methou	Diyor		Sven Dried							
	8 7 6 5			-	A - Line	[PI=0.73 x ((LL-20)]	× Test Re	isult		L & ML				
Plasticity Index (%)) 4	ło					СН							_	
	3	80				CI								_	
	2	20		CL											
	2							мн&с	Н						
	1										_	_		_	
					M	LOUL		_							
		0	10	20	30	40	50 Liquid	60 70 I Limit (%)		80	90	100	110	120	
Remarks:								/							
villarită.															
ample/s supplied by client													Page:	1 of 1	REP00102
Accredited The results of the t document	d for compli tests, calibra are traceat	iance with Is ations, and/ ole to Austra	SO/IEC 170 or measure alian/Nation	025 - Testir ements incl nal Standar	ng. Iuded in this rds.	S		Au	thorise	ed Signato	ry				
	Tested at T	rilab Brisba	ne Laborate	ory.					C. P	ark			l ah/	oratory No.	9926
	The	results of cal	ibrations and Referend	d tests perfo ce should be	ormed apply e made to Tr	only to the s ilab's "Stan Trilab Pty Ltd	specific instru dard Terms a 1 ABN 2	ument or sample and Conditions o 25 065 630 506	e at the ti of Busine	ime of test un ess" for furthe	nless otherw er details.	vise clearly s	stated.		



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				ΤA	TER Test	RBERG	LIMITS	TEST F .1.2, 3.2.1, 3.3	REPO .1, 3.4.1	RT					
Client	Golder	Associa	tes Ptv Lir	mited						Repo	rt No.	GA	101464-/	AL.	
Address	PO Bo	x 1734 N	ILTON B	C QL	D	4064				Requ	est No.	189	93802 H	2C TR1	
										Test [Date	27/	11/2018		
Project	Inland	Rail Pac	kage 13							Repo	rt Date	30/	11/2018		
Project No.	189380	02	<u>inage ie</u>				С	lient Sam	ole No.	330-0	1-BH2216	S-S01400)		
Bore Hole	330-01		 }				Depth From	m (m) 1	4			Depth	To (m)	14.45	
Description	SPT						<u> </u>								
						RESI	JLTS OF T	ESTING							
				Liquid L	imit (S	%)	24								
				Plastic L	imit (%)	13								
			ום	lacticity In	dov /0	, %)	11								
			гı 		uex (/0)									
			Line	ear Shrink	age (%)	5.0	Curl	ing Ocur	red					
			Mois	sture Con	tent (%)	19.9								
			Pro	eparation	Metho	od Dry	Sieved and (Oven Dried							
							Dlacti	city Ch	art						
				_	Δ.	l ine [PI=0 73	FIASU	Test	Result		1 & MI				
		80					x (LL 20)]							7	
		70													
		10													
		60												_	
		50													
							СН								
Plasticity Index (%)		40												-	
		30				GI								_	
				CL											
		20												-	
		10		×		\frown			iUn					_	
		CL	.&ML	$ \rightarrow$		ML&O	L								
		0 +	10	20	30	40	50	60	70	80	90	100	110	120	
							Liquid	d Limit (%)							
emarks:															
mple/s supplied by client													Page:	1 of 1	REP00102
Accredited The results of the t document	l for comp ests, calib are tracea	oliance with rations, an able to Aus	ı ISO/IEC 17 ıd/or measuı stralian/Natic	7025 - Testin irements inclu onal Standaru	ıg. uded in ds.	this			Authoris	ed Signato	ory				
	Tested at 1	Trilab Brisł	oane Labor:	atory					C. F	Park				ACCREDITED FOR TECHNICAL COMPETENCE	
													Lab	vratory No. (9926



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				AT	TERB Test Met	ERG I	LIMITS 289 2.1.1, 3.	TEST RI 1.2, 3.2.1, 3.3.1,	E PO 3.4.1	RT					
Client	Golder A	ssociates	Pty Limite	ed						Report	No.	GA1014	74-AL		
Address	PO Box	1734 MILT	ON BC	QLD) 40	64				Reques	st No.	189380	2 H2C T	R1	
										Test Da	ate	27/11/2			
Project	Inland Ra	ail Packao	e 13							Report	Date	30/11/2	018		
Project No.	1893802						CI	lient Sample	e No.	330-01-	-BH2224	-U00500			
Bore Hole	330-01-E	3H2224				De	epth Fror	m (m) 5				Depth To	m) 5.4	2	
Description	U						•					•			
						RESUL	TS OF T	ESTING							
			Li	iquid Lin	nit (%)		56								
			Pla	astic Lin	nit (%)		22								
			Plasti	icitv Ind	ex (%)		34								
			Lincor	Chrinka	en (%)		16.5	Curlin							
			Linear	Shrinka	ge (%)		10.5	Curling	g Ocuri	rea					
			Moistur	re Conte	ent (%)		25.7								
			Prepa	ration M	lethod	Dry Si	eved and C	Oven Dried							
Plasticity Index (%)	80 70 60 50 40 30 20 10		AL 0 20	CL	A - Line	[PI=0.73 x	2lastic [LL-20)] CH X 50 Liquid	City Cha × Test Re MH&C 60 70 d Limit (%)	DH	CL	& ML		120		
Remarks:															
Sample/s supplied by client Accredited The results of the t document	d for complia tests, calibrat are traceable	nce with ISC ions, and/or e to Australia	D/IEC 17025 measureme an/National	5 - Testing. ents includ Standards	ed in this	3		Au	thorise	ed Signator	у ц		Page: 1 of 1	REPO	<u>)0102</u>
	Tested at Tri	lab Brisbane	Laboratory	<i>ı</i> .					C. P	ark			TECH		
	The re	esults of calibr	ations and te Reference s	ests perform should be m	ed apply o nade to Tri	only to the lab's "Stan	specific instru dard Terms a	rument or sample and Conditions of	e at the ti of Busine	me of test un ess" for furthe	lless otherw r details.	vise clearly stated	Laboratory	' NO. 9926	



Client Golder Associates Pty Limited Report No. GA101478.AL Address PO Box 1734 MILTON BC QLD 4064 Reguest No. 1893802_H2C_TR1 Test Date 2/11/2018 Report No. 1893802_H2C_TR1 Test Date 2/11/2018 Project Inland Rail Package 13 Depth From (m) 11 Depth To (m) 11.45 Description SPT SPT RESULTS OF TESTING Liquid Limit (%) 27 Plastic Limit (%) 17 Plastic Limit (%) 10 Linear Shrinkage (%) 3.5 Curing Ocurred Moisture Content (%) 19.7 Preparation Method Dry Sloved and Oven Dried Plastic Limit (%) 17 Plasticity Index (%) 10 Linear Shrinkage (%) 3.5 Curing Ocurred Moisture Content (%) 19.7 Preparation Method Dry Sloved and Oven Dried Depth To (m) 10 10 Plasticity Index (%) 0 CH CH CH CH CH CH Plastic Limit (% 19.7 Plastic Limit (% 10		ATTERB Test Me	ERG LIMITS TEST REPO hod: AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1	RT	
Address PO Box 1734 MILTON BC OLD 4064 Important of the state of the s	Client	Golder Associates Ptv I imited		Report No.	GA101478-Al
Project Inland Rail Package 13 20701/2018 Project Inland Rail Package 13 Client Sample No. 330-01-BH2224-S01100 Bore Hole 330-01-BH2224 Depth From (m) 11 Bore Hole 330-01-BH2224-S01100 Depth To (m) 11.45 Bore Hole 330-01-BH2224-S01100 Depth To (m) 11.45 Bore Hole 330-01-BH2224-S01100 Depth To (m) 11.45 Description SPT SPT RESULTS OF TESTING Liquid Limit (%) 17 Plastic Limit (%) 17 Plastic Vinder (%) 19.7 Progration Method Dy Slewed and Oven Dried VERTICE Content (%) Moisture Content (%) 19.7 Preparation Method Dy Slewed and Oven Dried Vertice (%) Vertor	Address	PO Box 1734 MILTON BC QLD 40	64	Request No	1893802 H2C TR1
Project Inland Rail Package 13 Project 30/11/2018 Project No. 1893802 Client Sample No. 330-01-BH2224-S01100 Bore Hole 330-01-BH2224 Depth From (m) 11 Depth To (m) 11.45 Bescription SPT RESULTS OF TESTING Liquid Limit (%) 27 Plastic Limit (%) 17 Plastic Limit (%) 17 Plastic Limit (%) 10 Linear Shrinkage (%) 3.5 Curing Ocurred Moisture Content (%) 19.7 Preparation Method Dry Sived and Oven Dried				Test Date	27/11/2018
Project No. 1933602 Ulter Sample No. 330-01-BH2224 UDE NOT Bore Hole 330-01-BH2224 UDE pth From (m) 11 Depth To (m) 11.45 Description SPT	Project	Inland Rail Package 13		Report Date	30/11/2018
Depth Tor (m) Depth From (m) 11 Depth To (m) 11.45 Beer Hole 330-01-BH2224 Depth From (m) 11 Depth To (m) 11.45 Beer Hole Iliquid Limit (%) 27 Plastic Limit (%) 17 Plastic Limit (%) 17 Plastic Limit (%) 10 Linear Shrinkage (%) 3.5 Curting Ocurred Moisture Content (%) 19.7 Preparation Method Dry Sizeed and Oven Dried Plasticity Index (%) Pasticity Index (%) 0 Curting Ocurred Moisture Content (%) 19.7 Preparation Method Dry Sizeed and Oven Dried	Project No.	1893802	Client Sample No.	330-01-BH2224-S	501100
Description SPT EVENT OF THE SPT	Bore Hole	330-01-BH2224	Depth From (m) 11		Denth To (m) 11 45
<section-header><figure> Plastic Limit (%) 0 Plastic Limit (%) 0 District Imit (%) 0 Linear Shrinkage (%) 0.5 Construction Content (%) 0.7 Propriation Method District Content (%) Plasticity Index (%) Output Content (</figure></section-header>	Description	SPT			
<text><text><text></text></text></text>			RESULTS OF TESTING		
<text>Plastic Linit (%) 1, 1 Plasticity Index (%) 0, 1 Linear Shrinkage (%) 3, 5 curing Ocured Togate and Oven Dried Progration Method Togate and Oven Dried Plasticity Index (%) 0, 1 Togate of the optical Plant of</text>		Liquid Limit (%)	27		
		Plastic Limit (%)	17		
Please between service means report of the test scale base for service de la test scale base for service de		Disctisity Index (//)	10		
Linear Shrinkage (%) 3.5 Curling Ocurred Moisture Content (%) 19.7 Preparation Method Dry Sieved and Oven Dried Plasticity Chart Plasticity Index (%) Plasticity			10		
Moisture Content (%) 19.7 Preparation Metro To y Sleved and Oven Dried Plasticity index (%) Plasticity in		Linear Shrinkage (%)	3.5 Curling Ocu	rred	
Peregrad Degree degree de la de		Moisture Content (%)	19.7		
<figure><figure></figure></figure>		Preparation Method	Dry Sieved and Oven Dried		
emarks:	Plasticity Index (%		Plasticity Chart [PI=0.73 x (LL-20)] × Test Result Image: CH Image: CH Image:		
mple/s supplied by client Page: 1 of 1 Accredited for compliance with ISO/IEC 17025 - Testing. The results of the tasts, calibrations, and/or measurements included in this	emarks:				
Accredited for compliance with ISO/IEC 17025 - Testing. Authorised Signatory	mple/s supplied by client				Page: 1 of 1 REP0010
document are traceable to Australian/National Standards.	Accredite The results of the document	d for compliance with ISO/IEC 17025 - Testing. ests, calibrations, and/or measurements included in this are traceable to Australian/National Standards. Tested at Trilab Brisbane Laboratory.	Authoris C. I	ed Signatory	



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					A	TTEI	RBEF t Method	RG L 1: AS 128	IMITS 89 2.1.1, 3.	TEST 1.2, 3.2.1, 3.3	REPO 8.1, 3.4.1	RT					
Client	Golder	Asso	ciates F	² ty Lim ⁱ	ited							Repor	t No.	GA	101480-4	٩L	
Address	PO Bo	x 173	4 MILTO	ON BC	G	QLD	4064					Reque	est No.	189	3802 H2	2C TR1	
												Test D	ate	28/	11/2018		
Project	Inland	Rail F	ackage	13								Repor	t Date	30/	11/2018		
Project No.	189380	02	uonugo						CI	ient Sam	ple No.	330-01	I-BH2224	-S01400			
Bore Hole	330-01		224					Dei	oth Fror	n (m) 1	4			Depth	To (m)	14.45	
Description	SPT						1										
							<u>R</u>	ESUL	rs of t	<u>esting</u>							
				I	Liquid	Limit ((%)		44								
				F	Plastic	Limit ((%)		18								
				Pla	sticity I	ndex ((%)		26								
				Linea	r Shrin	ikage ((%)		14.0	Curl	ling Ocur	red					
				Moist	ure Co	ntent ((%)		27.7								
				Prep	paration	n Meth	od	Dry Sie	ved and C	Oven Dried							
								Р	lastic	city Ch	nart						
						— A -	- Line [PI=	=0.73 x (Ll	L-20)]	× Test	Result	<u> </u>	L & ML				
		80															
		70 -															
		60															
		00															
		50							СН							_	
Plasticity Index (%))	40														_	
		30					CI									_	
		20			CL			×									
		20								мна	ЮН						
		10	CI 9 M													-	
		0			\checkmark		MLG	×UL									
		0	10		20	30	40		50 Liquid	60 Limit (%)	70	80	90	100	110	120	
Remarks:																	
ample/s supplied by client															Page: 1	l of 1	REP00102
Accredited The results of the t document	d for comp tests, calib are tracea	oliance rations able to	with ISO/ , and/or n Australiar	IEC 170 neasure n/Nation	25 - Test ments ind al Standa	ing. cluded ir ards.	n this				Authoris	ed Signato	ory				
	Tested at	Trilab E	Brisbane l	Laboratc	ory.						C. F	Park			1 -1	TECHNICAL	0026
	The	e results	of calibra	itions and Referenc	l tests per e should b	formed ap be made	pply only to Trilab' Trilat	to the sp s "Standa b Pty Ltd	Decific instru ard Terms a ABN 2	ument or sam and Condition 25 065 630 506	ple at the is of Busin	time of test u ess" for furthe	nless otherw er details.	vise clearly s	Labo stated.	natory NO.	3320



				A	TTER Test N	BERC Nethod: A	5 LIMITS 5 1289 2.1.1, 3	TEST	REPO .3.1, 3.4.1	RT					
Client	Golder	Associates	Pty Limi	ited						Repo	rt No.	GA	101481-/	AL	
Address	PO Box	1734 MIL	TON BC	Q	LD 4	4064				Reau	est No.	18	93802 H	2C TR1	
										Test	Date	28	11/2018		
Proiect	Inland F	Rail Packad	ne 13							Repo	rt Date	30/	11/2018		
Project No.	189380	2	j e : e				С	lient Sar	nple No.	330-0	1-BH2224	4-S01550)		
Bore Hole	330-01-	BH2224					Depth Fro	m (m)	15.5			Depth	To (m)	15.95	
Description	SPT												- ()		
						RES	ULTS OF 1	ESTING							
				Liquid I	Limit (%	b)	29								
			F	Plastic I	Limit (%	b)	15								
			Plas	sticity I	ndex (%	b)	14								
			Linea	ar Shrin	kage (%	b)	6.5	Cı	rling Ocu	rred					
			Moist	ure Cor	ntent (%	5	25.4		-						
			Dree		Matha	~/ 	Cieved and	Over Drie	J						
			Fiel	Jaralion	Interno	u Diy	Sleveu allu	Oven Drie	J						
							<u>Plasti</u>	<u>city C</u>	<u>hart</u>						
	8	0		-	—— A - Li	ine [PI=0.73	3 x (LL-20)]	× Te	st Result		CL & ML			_	
	Ŭ														
	7	0													
	6	i0												_	
	_														
	5	0					СН								
Plasticity Index (%)	4	.0			_									_	
	3	0				CI									
				CI											
	2	0							• • • •					_	
	1	0			×	\frown			avn					_	
			ML	\succ	1 I	ML&O	L								
		0 -	10	20	30	40	50	60	70	80	90	100	110	120	
							Liqui	d Limit (%)							
Remarks:															
ample/s supplied by client													Page:	1 of 1	REP00102
Accredited	d for compli	iance with ISO	O/IEC 170	25 - Testi	ng. Juded in t	hie			Authoris	ed Signat	ory				
document	are traceat	ble to Australi	ian/Nationa	al Standa	rds.	6113			Ce	~	1				
	Tested at T	rilab Brisbane	e Laborato	ory.					C. I	Park				TECHNICAL	
	The	results of calib	prations and	l tests perfe	ormed app	lv onlv to t	ne specific inst	rument or sa	mple at the	time of test	unless other	wise clearly	Labo stated.	oratory No.	9926



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				AT	TERBI	ERG L	.IMITS 289 2.1.1, 3.	TEST 1.2, 3.2.1, 3.3	REPO 3.1, 3.4.1	RT					
Client	Golder A	ssociates	Ptv Limite	ed						Repo	rt No.	GA	101484-/	AL	
Address	PO Box '	1734 MILT	TON BC	QL	D 406	64				Requ	est No.	189)3802 H	2C TR1	
										Test	Date	28/	11/2018		
Proiect	Inland Ra	ail Packao	ie 13							Repo	rt Date	30/	11/2018		
Project No.	1893802						CI	lient Sam	ple No.	330-0	1-BH2224	1-S02000			
Bore Hole	330-01-B	3H2224				De	oth Fror	m (m) 2	20			Depth	To (m)	20.45	
Description	SPT								-						
						RESUL	TS OF T	ESTING							
			Li	quid Lii	mit (%)		49								
			Pl	astic Li	mit (%)		17								
			Place	icity Ind	lov (%)		32								
			- Fiasi				52 40 F	_							
			Linear	Shrinka	ige (%)		13.5	Cur	ling Ocur	red					
			Moistu	re Conte	ent (%)		19.0								
			Prepa	ration N	lethod	Dry Sie	eved and C	Oven Dried							
						<u>P</u>	Plastic	city Cł	<u>nart</u>						
					A - Line [[PI=0.73 x (L	_L-20)]	× Test	t Result	(CL & ML				
	80														
	70													1	
	60														
	50						CH							-	
Plasticity Index (%)	40													_	
					(×								
	30													-	
	20			CL										_	
	10							MH8	вон						
	10	CL&	ML	_	MI	L&OL									
	0	0 1			30	40	50	60	70	80	90	100	110	120	
		0 1	10 20	, .		-10	Liquid	l Limit (%)	10	00	50	100	110	120	
Remarks:															
ample/s supplied by client													Page: '	1 of 1	REP00102
Accredited The results of the t document	d for complia ests, calibrat are traceable	nce with ISC ions, and/or e to Australia	D/IEC 17025 measureme an/National	5 - Testing ents inclue Standards	ı. ded in this s.			<	Authoris	ed Signat	ory				
	Tested at Tril	lab Brisbane	e Laboratory	<i>ı</i> .					C. F	Park				TECHNICAL COMPETENCE	
	The re	oulto of colibr											Labo	oratory No. 9	9926



	ATTERB Test Me	ERG LIMITS TEST REPO hod: AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1	RT	
Client	Golder Associates Pty Limited		Report No. (GA101492-AL
Address	PO Box 1734 MILTON BC QLD 40	64	Request No. 1	893802_H2C_TR1
			Test Date 2	8/11/2018
Project	Inland Rail Package 13		Report Date 3	0/11/2018
Project No.	1893802	Client Sample No.	330-01-BH2227-S002	00
Bore Hole	330-01-BH2227	Depth From (m) 2	Dep	th To (m) 2.45
Description	SPT		· · ·	
		RESULTS OF TESTING		
	Liquid Limit (%)	90		
	Plastic Limit (%)	22		
	Plasticity Index (%)	68		
		00		
	Linear Shrinkage (%)	22.5 Cracking & C	Curling Ocurred	
	Moisture Content (%)	25.8		
	Preparation Method	Dry Sieved and Oven Dried		
Plasticity Index (%)		Plasticity Chart [PI=0.73 x (LL-20)] × Test Result Image: CH Image: CH Image: CH	CL & ML	110 120
emarks:				
mple/s supplied by client				Page: 1 of 1 REP0010
Accredited The results of the t document	I for compliance with ISO/IEC 17025 - Testing. ests, calibrations, and/or measurements included in this are traceable to Australian/National Standards. Fested at Trilab Brisbane Laboratory.	Authoris C.	ed Signatory Park	
	The results of calibrations and tests performed apply	nly to the specific instrument or sample at the	time of test unless otherwise along	Laboratory No. 9926



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				AT	TERB Test Met	ERG thod: AS 1	L IMITS 289 2.1.1, 3.4	TEST 1.2, 3.2.1, 3	REPO .3.1, 3.4.1	RT					
Client	Golder A	ssociates	Ptv I imite	ed						Repo	rt No.	G	101493-	41	
Address	PO Box	1734 MILT	ON BC	QLI	D 40	64				Requ	est No.	18	93802 H	2C TR1	
										Test	Date	27	/11/2018	20_1111	
Project	Inland R	ail Packao	e 13							Reno	rt Date	30	/11/2018		
Project No.	1893802	an r donag	0 10				CI	ient San	nple No.	330-0	1-BH222	7-U0035	n n		
Bore Hole	330-01-F	3H2227				D	enth Fron	n (m)	3.5			Dept	- 1 To (m)	39	
Description	U							,							
						RESU	TS OF T	<u>esting</u>							
			Li	iquid Li	mit (%)		72								
			PI	astic Li	mit (%)		26								
			Plast	icity Ind	dex (%)		46								
			Linear	Shrinks	age (%)		10 5	C.,	rling Ocu	rod					
			Linear		age (70)		00.0	- Uu		icu					
			Moistu	re Cont	ent (%)		22.9								
			Prepa	ration I	Method	Dry Si	eved and C	Oven Dried	1						
						<u> </u>	Plastic	city C	<u>hart</u>						
	80				A - Line	[PI=0.73 x	(LL-20)]	× Te	st Result	(CL & ML				
	70					_						_			
	60								_					_	
	50														
	50						СН		×						
Plasticity Index (%)	40													_	
	30					CI									
				CL											
	20			•-					о л ц					-	
	10	-							avn					_	
	0	CL&	/IL	$\overline{}$	M	L&OL									
	U	0 1	0 20	0 :	30	40	50	60	70	80	90	100	110	120	
							Liquid	Limit (%)							
Remarks:															
analo/o outabled by client													Danas	1 - 5 4	DED00102
ample/s supplied by client													Page:	1 of 1	REP00102
Accredite The results of the t document	d for complia ests, calibrat are traceable	ince with ISC tions, and/or e to Australia	measurem n/National	ents inclu Standard	g. ded in this s.	6			Authoris	ed Signat	ory				
	Tested at Tri	lab Brisbane	Laboratory	<i> </i> .					C.1	Park				TECHNICAL	
	The re	aulta of colibr											Lab	oratory No. 9	9926



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				AT	TERB Test Me	BERG I	LIMITS 289 2.1.1, 3.	TEST RE	EPO I 3.4.1	RT				
Client	Golder A	Associates	Pty Limit	ed						Report	No.	GA10149	6-AL	
Address	PO Box	1734 MIL	TON BC	QLI	D 40	064				Reques	st No.	1893802	H2C TR	1
									F	Test Da	ate	28/11/201	<u>8</u>	<u>.</u>
Project	Inland R	ail Packad	ne 13							Report	Date	30/11/201	8	
Project No.	1893802	7	<u>je : e</u>				C	lient Sample	No.	330-01-	BH2227	-S00800	•	
Bore Hole	330-01-	- BH2227				D	epth From	m (m) 8			<u> </u>	Depth To (m) 8.45	
Description	SPT							(, •					<u>,</u>	
						RESU	LTS OF T	ESTING						
			L	iquid Li	mit (%)		52							
			Ρ	lastic Li	mit (%)		18							
			Diac	ticity loc	10y (%)		34							
			- F 105											
			Linear	Shrinka	age (%)		14.0	Curling) Ocurr	ed				
			Moistu	ire Cont	ent (%)		19.5							
			Prepa	aration I	Nethod	Dry Si	ieved and (Oven Dried						
Plasticity Index (%)	80 70 60 50 40 30 20 10 0		10 2	CL	A - Line	[PI=0.73 x	Plastic (LL-20)] CH ×	City Cha × Test Res MH&O 60 70 d Limit (%)	PH		& ML	100 110	120	
Remarks:														
Sample/s supplied by client Accredited The results of the t document	d for complia tests, calibra are traceabl	ance with IS(ations, and/or le to Australi	D/IEC 1702 r measurem an/National	5 - Testing nents inclu I Standard	g. ded in this s.	s		Aut	c. P	d Signatory	y	Pag	e: 1 of 1	REP00102
	resieu at Tr			y.								L	aboratory N	o. 9926
The results of the t document	tests, calibra are traceabl Tested at Tr The r	ations, and/or le to Australi rilab Brisbane results of calib	r measurem an/National e Laborator rations and t Reference	ents inclu I Standard y. ests perforr should be r	ded in this s. med apply made to Tr	s only to the rilab's "Stan Trilab Pty Lto	specific instr idard Terms d ABN :	rument or sample and Conditions of 25 065 630 506	C. P at the til f Busine	ark me of test unl ss" for further	less otherw r details.	Lise clearly stated.	aboratory N	A Noce 0. 9926



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				AT	TERB Test Me	BERG	LIMITS	TEST	REPO 3.3.1, 3.4.1	RT					
Client	Golder A	ssociates	Pty Limite	ed						Repo	rt No.	G	A101499-J	AL	
Address	PO Box	1734 MILT	FON BC	QL	D 40)64				Regu	est No.	18	93802 H		
										Test	Date	27	/11/2018	20_11(1	
Project	Inland R	ail Packan	ie 13							Reno	rt Date	21	/11/2018		
Project No	1893802)					C	lient Sa	nnle No	330-0	1_BH222	7-110115	0		
Bore Hole	330-01-F	SH2227				п	enth Fro	m (m)	11 5	000 0		Dent	- - To (m)	11 95	
Description	U	5112221					epuirro		11.0			Dept	<u>110 (III)</u>	11.55	
						<u>RESU</u>	LTS OF T	ESTING	i						
			Т	iauid I i	mit (%)		52								
			- PI	astic Li	mit (%)		20								
			Plast	ticity Ind	dex (%)		32								
			Linear	Shrinka	age (%)		14.5	C	urling Ocu	rred					
			Moistu	re Cont	ent (%)		23.5		Ū						
			Prepa	aration I	Method	Dry S	ieved and (Oven Drie	d						
							Plasti	city C	hart						
				_	A - Line	e [PI=0.73 >	(LL-20)]	<u>х</u> т	est Result	(CL & ML				
	80														
	70														
	60													_	
	50													_	
							СН								
Plasticity Index (%)	40					СІ								_	
	30					-	×							_	
	20			CL											
	20							мн	&OH						
	10													_	
	0	CL&	ML	\checkmark	M	L&OL	•								
	0	0 1	10 21	0	30	40	50 Liquid	60 1 Limit (%)	70	80	90	100	110	120	
Remarks:								(/)							
ample/s supplied by client													Page:	1 of 1	REP00102
Accredited The results of the t document	d for complia ests, calibrat are traceabl	ance with ISC tions, and/or e to Australia	D/IEC 1702 measurem an/National	5 - Testino ents inclu Standard	g. Ided in thi Is.	s			Authoris	ed Signat	ory				
	Tested at Tri	ilab Brisbane	e Laboratory	y.					C.1	Park			11	TECHNICAL	0026
	The re	esults of calibr	rations and te	ests perfori	med apply	only to the	e specific instr	ument or s	ample at the	time of test	unless other	wise clearly	Labor stated.	oratory No.	9920



		ATTERI Test M	BERG LIMITS ethod: AS 1289 2.1.1, 3.1	TEST REPO .2, 3.2.1, 3.3.1, 3.4.1	RT		
Client	Golder Associate	es Pty Limited			Report No.	GA101501-AL	
Address	PO Box 1734 MI	LTON BC QLD 4	064		Request No.	1893802 H2C T	٦1
					Test Date	27/11/2018	
Proiect	Inland Rail Packa	age 13			Report Date	30/11/2018	
Project No.	1893802		Cli	ent Sample No.	330-01-BH222	7-U01400	
Bore Hole	330-01-BH2227		Depth From	n (m) 14		Denth To (m) 14	45
Description	U			<u>,</u>	I	(,	
			RESULTS OF T	<u>Esting</u>			
		Liquid Limit (%) 35				
		Plastic Limit (%) 15				
		Disctisity Index (%	,)				
		Plasticity index (%)) 20				
		Linear Shrinkage (%) 11.0	Curling Ocur	red		
		Moisture Content (%) 22.6				
		Preparation Method	Dry Sieved and O	ven Dried			
	80 70 60 50	A - Lir	Plastic	Test Result	CL & ML		
Plasticity Index (%)	40		CI				
	30						
	20	CL ×					
	10			MH&OH			
	CL8	RML	AL&OL				
	0	10 20 20	40 50	60 70	80 00	100 110 120	
	0	10 20 30	40 50 Liquid	Limit (%)	80 90	100 110 120	
Remarks:						Pane: 1 of 1	REP0010/
Approximation	for compliance with 1	SO/IEC 17025 Tasting		.			^
The results of the te	ests, calibrations, and/	for measurements included in the	is	Authorise	ed Signatory	NA	TÀ
accument		anan/mational Standards.			Park		
1	ested at Trilab Brisba	ine Laboratory.		U. P	wi fi	Some	



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				A	TTERE Test Me	BERG	LIMITS	TEST	REPO 3.1, 3.4.1	RT					
Client	Golder	Associates	s Ptv Lim	nited						Repor	t No.	GA1	01503-4	AL.	
Address	PO Box	< 1734 MIL	TON BC	; Q	LD 4	064				Reque	est No.	189	3802 H	PC TR1	
										Test D)ate	28/1	1/2018		
Project	Inland I	Rail Packa	ne 13							Renor	t Date	30/1	1/2018		
Project No.	189380	12	<u>jo io</u>				С	lient Sam	nle No.	330-01	1-BH2227	-S01700			
Bore Hole	330-01	-BH2227				П)epth Fro	m (m) 1	7	000 01		Depth	To (m)	17 27	
Description	SPT	DIILLEI					- optilitie	(,			I	Doptii	,		
						RESU	ILTS OF T	ESTING							
				Liquid L	_imit (%)	1	40								
			1	Plastic L	_imit (%)	1	14								
			Pla	sticity Ir	n dex (%)	1	26								
			Linea	ar Shrinl	kage (%)		11.0	Cur	ling Ocu	rred					
			Mois	ture Cor	ntent (%)		13.8								
			Pre	paration	Method	Drv S	Sieved and	Oven Dried							
							D I 11								
					۸ انه	- [DI=0 72 y	<u>Plasti</u>	<u>city Cr</u>	<u>nart</u>	0	0.04				
	8	30		-	A - Line	e [PI=0.73 x	((LL-20)]	× Tes	tResult						
		70													
	,														
	6	50								_				-	
	Ę	50												_	
Dia efficita in dass (0/)							СН								
Plasticity Index (%)) 2	10				CI								1	
	3	30	+	_										-	
	2	20		CL		<u> </u>									
								мна	sон						
	1		MI			u 201								-	
		0		\checkmark			•		_				-	_	
		0	10	20	30	40	50 Liqui	60 d Limit (%)	70	80	90	100 1	10	120	
Remarks:															
ample/s supplied by client													Page: 1	l of 1	REP00102
Accredited The results of the t	d for compl tests, calibr	iance with IS ations, and/o	O/IEC 170 r measure	025 - Testii ements incl val Standar	ng. Iuded in thi	is			Authoris	ed Signato	ory				
uocument								2	C. I	Park	~				
		THAD Brisban		ury.									Labo	oratory No. 9	9926
Plasticity Index (%) Remarks: Sample/s supplied by client Accrediter The results of the t document .) 2 d for compl tests, calibr are traceal Tested at T The	iance with IS iance with IS ations, and/o ble to Austral frilab Brisban results of calit	O/IEC 170 r measure ian/Nation le Laborations and Reference	CL 20 225 - Testi ements inc inal Standar ory. d tests perfo ce should bu	ng. luded in thirds.	CI × IL&OL 40 is only to the rilab's "Sta Triab Py L'	50 Liquid	60 d Limit (%)	Authoris C. I	ed Signato Park time of test u ess" for furth	90 90 Pry inless otherw er details.	100 f	Page: 1 Labo	of 1	REP00102



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				A	TTER	BERG	LIMITS	TEST .1.2, 3.2.1, 3.3	REPO 3.1, 3.4.1	RT					
Client	Golder	Associ	ates Ptv	Limited						Repor	t No.	GA10	01568-A	L	
Address	PO Box	x 1734	MILTON	BC C	، DL	4064				Reque	est No.	1893	802 H2	C TR1	
										Test D	ate	28/11	1/2018		
Proiect	Inland	Rail Pa	ckade 13	}						Repor	t Date	30/11	1/2018		
Project No.	189380)2					С	lient Sam	ple No.	330-01	I-DH2503	3-S00050			
Bore Hole	330-01	-DH250	03			C	Depth From	m (m) ().5			Depth T	'o (m)	0.95	
Description	SPT						-						- (,		
						DECU		FOTINO							
						<u>RE30</u>		ESTING							
				Liquid	Limit (%	6)	56								
				Plastic	Limit (%	6)	22								
				Plasticity	Index (%	6)	34								
			Li	near Shrir	nkage (%	6)	16.0	Cra	cking & C	Curling Ocu	irred				
			Me	oisture Co	ontent (%	6)	23.5								
			F	Preparatio	n Metho	d Dry S	Sieved and (Oven Dried							
							Plasti	city Cł	nart						
					—— A - L	ine [PI=0.73 >	x (LL-20)]	× Tes	t Result	<u> </u>	L & ML				
	8	80]	
	ī	70											/	-	
		60													
	,	00													
	ł	50					СН							-	
Plasticity Index (%)) 4	40												_	
	;	30				CI	×							_	
	2	20		CL	•									_	
								мна	вон						
			L&ML			ML&OL	_							-	
		0	10	20	20	40	- 	60	70	00	00	100 11	0 1	20	
		0	10	20	30	40	Liquic	d Limit (%)	70	00	90	100 11	0 1	20	
Remarks:															
Sample/s supplied by client													Page: 1	of 1	REP00102
Accredited The results of the t document	d for compl tests, calibr are tracea	liance wi rations, a ble to Au	th ISO/IEC and/or mea: ustralian/Na	17025 - Tes surements in ational Standa	ting. cluded in t ards.	this		2	Authoris	ed Signato	ery				
	Tested at 1	Frilab Bri	sbane Lab	oratory.					C. F	Park					
	The	e results o	of calibrations	s and tests per	formed app	ly only to the	e specific instr	ument or san	ple at the	time of test u	nless otherw	vise clearly sta	Labor ated.	ratory No. 9	926
			Refe	erence should	be made to	Trilab's "Sta Trilab Pty L	andard Terms	and Condition 25 065 630 506	ns of Busin	ess" for furthe	er details.				



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				A	TTER Test I	BERC	G LIMITS	5 TEST R 3.1.2, 3.2.1, 3.3.	REPO 1, 3.4.1	RT					
Client	Golder A	ssociates	Ptv Limit	ted						Repor	t No.	GA1	01569-/	AL	
Address	PO Box	1734 MILT	FON BC	Q	LD	4064				Reque	est No.	1893	3802 H	PC TR1	
										Test D)ate	29/1	1/2018		
Project	Inland R	ail Packag	ie 13							Repor	t Date	30/1	1/2018		
Project No.	1893802)					C	Client Samp	le No.	330-01	I-DH2503	-S00200			
Bore Hole	330-01-0	- 0H2503					Depth Fro	om (m) 2				Depth :	To (m)	2 45	
Description	SPT	5112000					Deptiline	, , , , , , , , , , , , , , , , , , ,				Doptii	10 (11)	2.10	
						RES		TESTING							
			L	.iquid L	_imit (%	%)	36								
			Р	lastic L	_imit (%	%)	17								
			Plas	ticity Ir	ndex (%	%)	19								
			Linear	r Shrinl	%kage	%)	8.0	Cracl	king & C	Curling Ocu	irred				
			Moistu	ure Cor	ntent (%	%)	15.6								
			Prepa	aration	Metho	od Dry	/ Sieved and	Oven Dried							
							Plasti	icity Ch	art						
				-	— A - L	_ine [PI=0.7	3 x (LL-20)]	× Test F	Result	<u> </u>	L & ML				
	80														
	70														
	60														
	00														
	50						СН							_	
Plasticity Index (%)) 40				_			·						_	
	30					CI								_	
				CL											
	20				;	× /		мня	он						
	10													_	
	0	CL&I	ML	\nearrow		ML&O)L								
	-	0 1	10 2	20	30	40	50 Liqu	60 7	0	80	90	100 1	10	120	
Remarks:															
Nemarka.															
Sample/s supplied by client													Page: '	1 of 1	REP00102
Accredited The results of the t document	d for complia tests, calibrat are traceabl	ance with ISC tions, and/or e to Australia	D/IEC 1702 measuren an/Nationa	25 - Testii nents incl I Standau	ng. luded in rds.	this		A	uthoris	ed Signato	ery				
	Tested at Tri	ilab Brisbane	e Laborator	ry.					C.F	Park					
	The m	esults of calib	rations and t	tests nerfo	ormed apr	oly only to t	the specific ins	trument or same	ole at the t	time of test u	nless otherw	ise clearly st	Labo tated	oratory No. 9	926
	Tested at Tri The re	ilab Brisbane	e Laborator rations and t Reference	ry. tests perfo should be	ormed app e made to	oly only to f Trilab's "S Trilab Pt	the specific ins Standard Terms y Ltd ABN	trument or samp s and Conditions v 25 065 630 506	C. F ble at the t s of Busine	Park time of test u ess" for furthe	nless otherw er details.	ise clearly st	Labo ated.	TECHNICAL COMPETENCE	1926



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		ATT	ERBER	RG LIMITS d: AS 1289 2.1.1, 3.1	TEST REPO .2, 3.2.1, 3.3.1, 3.4.1	RT			
Client	Golder Associate	es Pty Limited				Report No.	. GA10157	0-AL	
Address	PO Box 1734 MI	LTON BC QLD	4064			Request N	o. 1893802_	H2C_TR1	
						Test Date	28/11/20	8	
Project	Inland Rail Pack	age 13				Report Dat	te 30/11/20 ²	8	
Project No.	1893802			Cli	ent Sample No.	330-01-DH	2503-S00350		
Bore Hole	330-01-DH2503			Depth From	n (m) 3.5		Depth To (m	ı) 3.95	
Description	SPT								
			<u>R</u>	ESULTS OF TH	<u>esting</u>				
		Liquid Lim	it (%)	37					
		Plastic Lim	it (%)	19					
		Plasticity Inde	x (%)	18					
			~ (/0)		.				
		Linear Shrinkag	e (%)	8.5	Cracking & C	Surling Ocurred			
		Moisture Conten	nt (%)	22.9					
		Preparation Me	thod I	Dry Sieved and O	ven Dried				
Plasticity Index (%)	80 70 60 50 40 30 20 10 0 0 0	CL 10 20 30	A - Line [PI=	Plastic =0.73 × (LL-20)] CH CH kOL 50 Liquid	ity Chart × Test Result × Test Result ■<		100 110	120	
emarks:									
nple/s supplied by client							Pa	je: 1 of 1	REP0010
Accredited The results of the to document	I for compliance with ests, calibrations, and are traceable to Austr Tested at Trilab Brisba	ISO/IEC 17025 - Testing. //or measurements include ralian/National Standards. ane Laboratory.	d in this		Authoris C. F	ed Signatory 			
	TI 11 (, 	d analy'			lime of test		aboratory No. 9	9926



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	ATTERBI Test Meth	ERG LIMITS TEST REPC od: AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1	RT	
Client	Golder Associates Ptv Limited		Report No.	GA101572-AI
Address	PO Box 1734 MILTON BC QLD 406	4	Request No.	1893802 H2C TR1
			Test Date	29/11/2018
Proiect	Inland Rail Package 13		Report Date	30/11/2018
Project No.	1893802	Client Sample No.	330-01-DH2503-U	00650
Bore Hole	330-01-DH2503	Depth From (m) 6.5		Depth To (m) 6.89
Description	U	- · · · · · · · · · · · · · · · · · · ·	1	
		RESULTS OF TESTING		
	Liquid Limit (%)	41		
	Plastic Limit (%)	14		
	Diacticity Index (1/)	27		
	Linear Shrinkage (%)	13.5 Cracking & Cracki	Curling Ocurred	
	Moisture Content (%)	15.2		
	Preparation Method	Dry Sieved and Oven Dried		
Plasticity Index (%)		Place CH CH Image: CH CH Image: CH MH&OH MH&OH & Image: Ch Image: CH Image: CH Image: CH <	CL & ML	110 120
emarks:				
mple/s supplied by client				Page: 1 of 1 REP0010
Accredited The results of the t document	I for compliance with ISO/IEC 17025 - Testing. ests, calibrations, and/or measurements included in this are traceable to Australian/National Standards. Fested at Trilab Brisbane Laboratory.	Authoris	ed Signatory Park	ACCREMENT OF OR TECHNICAL COMPTENCE
		ly to the encoding instrument or second+ ++ -	time of test uplace athensis	Laboratory No. 9926



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					A	TTE Tes	RBEF	RG LIN	NITS 2.1.1, 3.1.	TEST RE	PO 3.4.1	RT					
Client	Golder	Assoc	iates Pr	ty Limit	ted							Repor	t No.	GA	101713-	AL	
Address	PO Bo	x 1734	MILTO	N BC	Q	LD	4064					Reque	st No	18	93802 H		
											-	Test D	ate	5/1	2/2018	20_1112	
Project	Inland	Rail Pa	ackage	13								Repor	t Date	10	12/2010		
Project No	18938	02	ionago	10					Cli	ent Sample	No	330-01	-BH2103	3-S00050)		
Bore Hole	330-01	-BH21	03					Dentł	From	(m) 0.5		000 01		Dent	, To (m)	0.95	
Description	SPT	01121	00					Dopti		(iii) 0.0				Dopti	<u>, , , , , , , , , , , , , , , , , , , </u>	0.00	
							<u>R</u>	ESULTS	OF TE	<u>STING</u>							
				L	.iquid L	_imit	(%)	3	5								
				Р	lastic L	_imit ((%)	1	4								
				Diac	ticity	ndev	(%)	2	1								
				- F105		IUEX	(/0)	-									
				Linear	r Shrinl	kage	(%)	11	.5	Curling	Ocuri	red					
				Moistu	ure Cor	ntent	(%)	7.	.3								
				Prep	aration	Meth	nod	Dry Sieved	d and O	ven Dried							
								DIa	actic	ity Cha	rt						
Plasticity Index (%)	1	80			CL		CI		СН								
		20								MH&O	н					1	
		10		-												-	
			:L&MI	L	\nearrow		ML8	LOL									
		0	10	2	20	30	40	50	Liquid L	60 70 Limit (%)		80	90	100	110	120	
Romarke:									•	. ,							
Sample/s supplied by client Accredited	d for comp	liance w	vith ISO/II	EC 1702	25 - Testii	ng.				Aut	horise	ed Signato	ry		Page:	1 of 1	REP00102
i ne results of the t document	ests, calib are tracea	able to A	ustralian/	easuren Nationa	l Standar	iuaea i rds.	n this			\mathcal{C}	e	~	1				
	Tested at	Trilab Br	risbane L	aborator	ry.						С. Р	ark			Lab	COMPETENCE COMPETENCE	. 9926
	Th	e results	of calibrati F	ons and Reference	tests perfo should be	ormed a e made	ipply only to Trilab Trilat	to the speci s "Standard	fic instrur Terms ar ABN 25	ment or sample and Conditions of 5065 630 506	at the ti Busine	me of test u ess" for furthe	nless othen er details.	vise clearly	stated.		



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				A	TTER Test I	BERG	LIMITS	TEST F	REPO .1, 3.4.1	RT					
Client	Golder A	Associates	Ptv Limi	ited						Report	t No.	GA1()1715-AI	L	
Address	PO Box	1734 MIL	TON BC	Q	LD	4064				Reque	st No.	1893	802 H20	C TR2	
										Test D	ate	5/12/	2018	0_1112	
Project	Inland R	ail Packar	ne 13							Renor	t Date	10/12	2/2018		
Project No.	1893802)	<u>jo 10</u>				С	lient Sam	ole No.	330-01	-BH2103	-\$00350			
Bore Hole	330-01-	- BH2103					Depth Fro	m (m) 3	5	000 01		Depth T	o (m)	3 95	
Description	SPT	5112100						<u></u>	.0			Deptil	<u> </u>	0.00	
						RESI	JLTS OF 1	<u>TESTING</u>							
				Liquid I	l imit (%	6)	33								
				Plastic I	Limit (%	6) (6)	15								
			Plas	sticity l	ndex (%	6) 6)	18								
			Linea	r Shrin	kage (%	6) 6)	9.5	Curl	ing Ocur	red					
			Moist	ure Cor	ntent (%	6)	13.8		•						
			Prer	paration	Metho	d Dry	Sieved and	Oven Dried							
							Dlasti	city Ch	art						
				-	— A - L	.ine [PI=0.73	x (LL-20)]	× Test	Result	CL	L & ML				
	80)]	
	70) — — — — — — — — — — — — — — — — — — —			_								/	-	
	60														
	50)					CH							-	
Plasticity Index (%)	40)												-	
	30	,				CI									
				CL											
	20)			×			мна	ЮН						
	10)												-	
	ſ		ML	\succ		ML&O	L								
	-	0	10	20	30	40	50 Liqui	60 d Limit (%)	70	80	90	100 11	0 1	20	
Remarks:															
Sample/s supplied by client													Page: 1 o	of 1	REP00102
Accredited The results of the t document	d for complia ests, calibra are traceabl	ance with IS0 itions, and/or le to Australi	D/IEC 1702 r measurer ian/Nationa	25 - Testi ments inc al Standa	ng. cluded in f rds.	this			Authoris	ed Signato	ry				
	Tested at Tr	ilab Brisbane	e Laborato	ory.					C. F	Park			-b		0.06
	The r	results of calib	rations and Referenc	l tests perfo e should b	ormed app e made to	bly only to th Trilab's "Stat Trilab Ptv	e specific insti andard Terms Ltd ABN	rument or sam and Condition 25 065 630 506	ple at the t s of Busin	time of test un ess" for furthe	nless otherw er details.	vise clearly sta	Lapor.	atory 140. 95	120



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				A	TTERE Test Me	BERG	LIMITS	TEST R	EPO	RT					
Client	Golder	Associates	S Ptv Lim	ited						Repor	t No.	GA	101717-/	AL	
Address	PO Box	1734 MIL	TON BC	Q	LD 40	064				Reque	est No.	189	3802 H	2C TR2	
									ľ	Test D	ate	5/12	2/2018		
Proiect	Inland F	Rail Packa	ae 13							Repor	t Date	10/1	2/2018		
Project No.	189380	2	<u> </u>				C	lient Sample	e No.	330-01	I-BH2103	B-U00600			
Bore Hole	330-01-	-BH2103				D	epth From	m (m) 6				Depth	To (m)	6.29	
Description	U						•				1	•			
						RESU	LTS OF T	ESTING							
				المتناط	imait (0/)		50								
			, I	Liquiu L	_IIIIIt (70)		20								
			r Dia		_IIIIIL (%)		20								
			Plas	sticity ir	naex (%)		30								
			Linea	r Shrinl	kage (%)		13.0	Curlin	g Ocuri	red					
			Moist	ure Cor	ntent (%)		23.8								
			Prep	paration	Method	Dry S	ieved and (Oven Dried							
							Plasti	city Cha	art						
				-	A - Line	e [PI=0.73 x	(LL-20)]	× Test Re	esult	—— CI	L & ML				
	8	10													
	7	0												4	
	6	60												_	
	5	60					СН							_	
Plasticity Index (%)) 4	0												_	
	3	10				CI									
	Ū			0											
	2	20												_	
	1	0						MIGO	JH					_	
		CL&	ML	>	M	IL&OL									
		0	10	20	30	40	50	60 70		80	90	100	110	120	
							Liquid	d Limit (%)							
Remarks:															
ample/s supplied by client													Page: '	1 of 1	REP00102
Accredited The results of the t	d for compli tests, calibra	iance with IS ations, and/c	O/IEC 170	25 - Testii ments inc	ng. luded in thi	s		Au	uthorise	ed Signato	iry				
document	are traceat	ole to Austral	ian/Nationa	al Standar	rds.			\mathcal{L}	R	~	1				
	Tested at T	rilab Brisban	e Laborato	ory.					C. P	'ark			l ahr	competence	9926
	The	results of calil	orations and Referenc	l tests perfo e should be	ormed apply e made to T	only to the rilab's "Star Trilab Pty Lt	specific instr ndard Terms d ABN	rument or sample and Conditions of 25 065 630 506	e at the t of Busine	ime of test u ess" for furth	nless otherw er details.	vise clearly s	tated.		



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				A	TTEF Test	RBER	G LIMITS AS 1289 2.1.1, 3	5 TEST 3.1.2, 3.2.1,	REPO 3.3.1, 3.4.1	RT					
Client	Golder	Associate	es Pty Lin	nited						Repo	rt No.	GA	101740-	AL.	
Address	PO Box	(1734 MI	LTON BC	C Q	LD	4064				Requ	est No.	18	93802 H	2C TR2	
										Test	Date	5/1	2/2018	-	
Proiect	Inland F	Rail Packa	age 13							Repo	rt Date	10	/12/2018		
Project No.	189380	2	<u> </u>				C	lient Sa	nple No.	330-0	1-BH2104	4-S0005)		
Bore Hole	330-01-	BH2104					Depth Fro	om (m)	0.5			Dept	n To (m)	0.95	
Description	SPT						•								
						RE	SULTS OF	TESTING	<u>ì</u>						
				Liquid I	Limit ((%)	32								
				Plastic I	Limit ((%)	16								
			Pla	asticity l	ndex ((%)	16								
			Line	ar Shrin	kage ((%)	6.5	с	urling Ocu	rred					
			Mois	ture Cor	ntent ((%)	9.3		-						
			Pre	paration	Meth	iod Di	y Sieved and	Oven Drie	d						
							Dlacti	city (bart						
				-	— A -	- Line [PI=0.	73 x (LL-20)]	<u>city t</u> × ⊺	est Result	(CL & ML				
	8	80													
	7	.0													
	6	60												-	
	5	i0												_	
Directicity Index (0()							СН								
Plasticity Index (%)	4	0				CI									
	3	0			_									_	
	2	20		CL										_	
					×			MF	HO&						
	1	CLS	2.ML			MIR								-	
		0													
		0	10	20	30	40	50 Liqu	60 id Limit (%)	70	80	90	100	110	120	
Remarks:															
ample/s supplied by client													Page:	l of 1	REP00102
Accredited The results of the t document	l for compli ests, calibra are traceat	iance with I ations, and/ ple to Austra	SO/IEC 17 /or measure alian/Natior	025 - Testi ements inc nal Standa	ng. Iuded ir rds.	n this			Authoris	ed Signat	ory				
	Tested at T	rilab Brisba	ine Laborat	tory.					C.	Park			_		
	The	results of ca	librations an	id tests nerfr	ormed ar	nnly only to							Lab	oratory No. 9	9926



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				AT	TERB Test Met	ERG	LIMITS	TEST R	EPO , 3.4.1	RT					
Client	Golder As	ssociates I	Pty Limite	d						Repor	t No.	GA10	1742-A	L	
Address	PO Box 1	1734 MILT	ON BC	QLD) 40	64				Reque	st No.	18938	302 H2	C TR2	
									-	Test D	ate	5/12/2	2018	<u></u>	
Project	Inland Ra	ail Package	- 13							Renor	t Date	10/12	/2018		
Project No	1893802	an r donage	, 10				C	lient Sampl	e No	330-01	-BH2104	L-S00350	2010		
Bore Hole	330-01-B	H2104				D	enth From	m (m) 35	5	000 01		Depth T	o (m)	3 94	
Description	SPT				I				, 			Doptin	• (,	0.01	
						RESU	LTS OF T	ESTING							
			Li	quid Lir	nit (%)		35								
			Pla	astic Lir	nit (%)		16								
			Diact	امما يدام	ox (0/)		10								
			Plasu		ex (%)		19								
			Linear	Shrinka	ge (%)		10.5	Curlin	ıg Ocuri	red					
			Moistur	e Conte	ent (%)		11.6								
			Prepa	ration N	lethod	Dry Si	ieved and (Oven Dried							
							Dlacti	aity Cha	- * +						
	80			_	— A - Line	[PI=0.73 x	(LL-20)]	× Test R	esult	CL	_ & ML			7	
	70												/	-	
	60													_	
	50														
	50						СН								
Plasticity Index (%)	40								/	1				_	
	30													-	
	20			CL											
								MH&	он						
	10						_							-	
	0	Lain				Laul		_						_	
		0 10) 20	3	0	40	50 Liquio	60 70 d Limit (%)		80	90	100 110)	120	
Domarke:															
veniarka.															
ample/s supplied by client													Page: 1	of 1	REP00102
Accredited t The results of the tes document a	for compliar sts, calibrati re traceable	nce with ISO ions, and/or e to Australia	/IEC 17025 measureme n/National !	- Testing ents includ Standards	led in this 3.	6			uthorise	ed Signato	ry				
Te	ested at Tril	ab Brisbane	Laboratory						C. P	ark				TECHNICAL COMPETENCE	
	The re	sults of calibra	ations and te	sts perform	ned apply of	only to the	specific instr	rument or sampl	e at the ti	me of test u	nless otherv	vise clearly stat	Labo	ratory No. 9	926



	ATTER Test M	BERG LIMITS TEST REPC ethod: AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1	DRT	
Client	Golder Associates Pty Limited		Report No. GA10	1745-AL
Address	PO Box 1734 MILTON BC QLD 4	064	Request No. 18938	02_H2C_TR2
			Test Date 5/12/2	018
Project	Inland Rail Package 13		Report Date 10/12	/2018
Project No.	1893802	Client Sample No	. 330-01-BH2104-S00800	
Bore Hole	330-01-BH2104	Depth From (m) 8	Depth To	o (m) 8.45
Description	SPT		· · ·	
		RESULTS OF TESTING		
	Liquid Limit (%	58		
	Plastic Limit (%	23		
	Diseticity Index (%	35		
	Linear Shrinkage (%	16.5 Curling Ocu	irred	
	Moisture Content (%	20.1		
	Preparation Method	Dry Sieved and Oven Dried		
Plasticity Index (%)		Plasticity Chart e [PI=0.73 x (LL-20)] × Test Result Cl CH Cl × MH&OH 40 50 60 70		120
temarks:		Liquid Limit (%)		Page: 1 of 1 REP0010:
Accredited The results of the t document	I for compliance with ISO/IEC 17025 - Testing. ests, calibrations, and/or measurements included in th are traceable to Australian/National Standards.	is Authori	sed Signatory	
-	Fested at Trilab Brisbane Laboratory.	C.	Fair	Laboratory No. 9926



					A	TTE Test	RBEF	RG LIMI : AS 1289 2.1	TS TE	ST REPO 2.1, 3.3.1, 3.4.1	RT				
Client	Golder	Asso	ciates P	ty Limi	ted						Report	No.	GA10183	6-AL	
Address	PO Bo	x 173	4 MILTC	DN BC	Q	LD	4064				Reques	st No.	1893802	H2C TR	3
											Test Da	ate	21/01/201	9	•
Project	Inland	Rail F	Package	13							Report	Date	23/01/201	9	
Project No.	18938	02							Client	Sample No.	330-01-B	H2306-S0	00050-ATT : 330-0	- I-BH2306-	S00050-MOI
Bore Hole	330-01	 1-BH2	306					Depth	From (m	0.5			Depth To (m) 0.95	
Description	SPT														
							R	ESULTS C	F TEST	NG					
				L	.iquid I	Limit ((%)	60							
				Р	lastic I	Limit ((%)	19							
				Dia-	ticite	ndov ((0/_)	14							
				Plas		nuex (70)	41							
				Linear	r Shrin	kage ((%)	16.5		Curling Ocu	rred				
				Moistı	ure Cor	ntent ((%)	15.0)						
				Prep	aration	Meth	od [Dry Sieved a	and Oven	Dried					
								Plas	sticity	Chart					
					-	— A -	- Line [PI=	0.73 x (LL-20)]	×	Test Result	CL	& ML			
		80													
		70													
		60													
		50 —									+				
Plasticity Index (%)		10							:н ×						
		30					CI								
		20			CL										
		20								ин&он					
		10													
		0	GL&M	L ,	\nearrow		MLð	OL							
		0	10	2	20	30	40	50	60 Liquid Limit	70 %)	80 9	90	100 110	120	
Remarks:															
													_		
bample/s supplied by client													Pag	e: 1 of 1	KEP00102
Accredited The results of the t	d for comp ests, calib	oliance orations	with ISO/I , and/or m	EC 1702 leasuren	25 - Testi nents inc	ng. Iuded ir	n this			Authorised Si	gnatory			NAT	TĂ
document	are tracea	able to	Australian	/Nationa	l Standa	rds.			C	- Ch		•		ACCREDITE	D FOR
	Tested at	Trilab I	Brisbane L	.aboratoı	ry.					C. Chann	on			COMPET	NCE
	Th	e result	s of calibrat F	ions and f Reference	tests perfo should b	ormed a e made	pply only to Trilab's Trilab	to the specific S "Standard Te Pty Ltd	instrument erms and Co	or sample at the nditions of Busir	time of test un ness" for furthe	less otherv r details.	Lise clearly stated.	iou alory N	10. 3320

Emerson Class


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			EMERSON	CLASS NU	JMBER TEST REPORT		
Client	Golder Assoc	ciates Pty Limite	d	Test Method:	AS 1289 3.8.1	Report No.	GA101836 - 101836-EM
Address	PO Box 1734	MILTON BC	QLD 406	4		Teet Data	1693002_1120_113
1001000	I O DOX II O					Test Date	15/01/2019
Duchast	la la a d Dail D					Report Date	17/01/2019
Project	Inland Rail Pa	ackage 13				Project No	1893802
	Oliont Comula			RESULTS	DF TESTING		
Sample No	No	Bore Hole	Depth From (m)	Depth To (m)	Description		Emerson Class Number
GA101836-EM	330-01-BH2306-S00050	330-01-BH2306	0.5	0.95	SILTY CLAY - brown / y	ellow	2
NOTES/REMARKS:							
Sample/s supplied	by the client			Tested with Distille	d water at 22°C		Page 1 of 1 REP00402
Ac The results doo	credited for complia of the tests, calibrat cument are traceable	ince with ISO/IEC 1 tions, and/or measu e to Australian/Nati	7025 - Testing. urements included in onal Standards.	this			

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		EMERS	SON CLASS	S NUMBER TEST REPO	RT		
Client	Golder Associates	Pty Limited	Test M	ethod: AS 1289 3.8.1	Report No	GA101713 - 10 ⁴	17/0_EM
					Request No	1893802 H2C	TR2
Address	PO Box 1734 MIL	FON BC QL	D 4064		Test Date	03/12/2018	
					Report Date	05/12/2018	
Project	Inland Rail Packad	ie 13			Project No	1893802	
Troject	iniana rain aciag	0 10	RESU	TS OF TESTING	Trojectivo	1000002	
Sample No.	Bore Hole	Depth From (m)	Denth To (m)	Description		Emerson Class	Number
			Deptil To (III)	Description		Ellicison oldas	Humber
GA101713-EM	330-01-BH2103	0.5	0.95	Sandy CLAY - brown		6	
GA101715-EM	330-01-BH2103	3.5	3.95	Gravelly Clayey SAND - b	rown	3	
GA101717-EM	330-01-BH2103	6	6.29	Sandy CLAY - grey / bro	own	4	
GA101740-EM	330-01-BH2104	0.5	0.95	Clayey SAND - browr	1	6	
NOTEO/DENA DICO							
Sample/s supplied	hy the client		Tested with Distilla	nd water at 21.5°C		Page 1 of 1	DED00402
Accredite The results of th this docume	ed for compliance with ISO te tests, calibrations, and/c ent are traceable to Austral	/IEC 17025 - Testing or measurements inc lian/National Standa	g. Juded in rds.				

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		EMER		S NUMBER TEST REPO	DRT		
Client	Golder Associate	es Pty Limited	rootn		Report No.	GA101568 - 10)1570-EM
Address	PO Box 1734 MI	TON BC C	D 4064		Teet Dete	01/11/19 20/11	_1111
					Test Date	21/11/10-30/11	/10
.		40			Report Date	03/12/2018	
Project	Inland Rail Packa	age 13			Project No	1893802	
		1	RESU				
Sample No	Bore Hole	Depth From (m)	Depth To (m)	Description		Emerson Clas	s Number
GA101568-EM	330-01-DH2503	0.5	0.95	Sandy CLAY - dark bro	wn	5	
GA101569-EM	330-01-DH2503	2	2.45	Sandy CLAY - brown	ı	3	
GA101570-EM	330-01-DH2503	3.5	3.95	Sandy CLAY - dark bro	wn	5	
NOTES/REMARKS:							
Sample/s supplied	by the client		Tested with Distille	ed water at 21.4°C		Page 1 of 1	REP00402
Accredited	d for compliance with IS	D/IEC 17025 - Testin	ig.				
The results of the in this docume	ne tests, calibrations, and ent are traceable to Aust	d/or measurements in tralian/National Stand	ncluded dards.				

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Shrink Swell Index



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

	SHRINK SWEL	LINDEX TES	ST REPORT	
Client	Golder Associates Pty Limited		Report No.	GA101457-ISS
			Request No.	1893802_H2C_TR1
Address	PO Box 1734 MILTON BC	QLD 4064	Test Date	27/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Description	U	1		
Sample No.			330-01-BH2216-	U00350
Client ID			330-01-BH2	216
Depth (m)			3.5-3.96	
	RESUL	TS OF TEST	ING	
	SWE		l	
Swell Press	sure (kPa) *		25	
Wet Densit	y (t/m³)		1.82	
Initial Mois	ture Content (%)		31.1	
Final Moist	ure Content (%)		36.7	
	Swell (%)		0.1	
		•		
	SHRIN	KAGE SPECIME	N	
Estimated I	nert Inclusions (%)		10-20	
Extent of C	rumbling		Nil	
Extent of C	racking		High	
Moisture (%	6)		27.6	
	Shrinkage (%)		2.6	
SHRINK	SWELL INDEX (Iss) (%)		1.5	
Notes/Remarks:		·		
Sample/s supplied b	* Swell pressure determination in accord by client Tested as	ance with test metho received	d AS4133.3.3	Page: 1 of 1 REP02304
Accredite The results of the t document	d for compliance with ISO/IEC 17025 - Testing. tests, calibrations, and/or measurements included in are traceable to Australian/National Standards.	this	Authorised Signator	NATA
	Tested at Trilab Brisbane Laboratory	V	J. Russell	Laboratory No. 9926



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	SHRINK SWELL	INDEX TE	ST REPORT	
Client	Test M	ethod AS 1289 7.1.1		
Client	Golder Associates Pty Limited		Report No.	GA101572-ISS
Address	PO Box 1734 MILTON BC OI	D 4064	Request No.	1893802_H2C_TR1
Address			Test Date	27/11/2018
Project	Inland Rail Package 13		Report Date	4/12/2018
Description	U			
-				
Sample No.			330-01-DH2503	-U00650
Client ID			330-01-DH2	2503
Depth (m)			6.5-6.89	
	RESULT	S OF TEST	ING	
	SWEI	L SPECIME	N	
Swell Pres	sure (kPa) *		75	
Wet Densit	y (t/m³)		2.03	
Initial Mois	ture Content (%)		15.2	
Final Moist	ure Content (%)		19.9	
	Swell (%)		1.7	
	• •			
	SHRIN	AGE SPECIME	EN	
Estimated	Inert Inclusions (%)		5-10	
Extent of C	rumbling		Nil	
Extent of C	racking		Slight	
Moisture (%	%)		14.6	
	Shrinkage (%)		3.1	
SHRINK	SWELL INDEX (Iss) (%)		2.2	
Notes/Remarks:				
	* Qual process determine the intervent		4 4 6 4 1 0 0 0 0	
Sample/s supplied b	Swell pressure determination in accorda	nce with test metho eceived	0a AS4133.3.3	Page: 1 of 1 REP02304
Accredite	d for compliance with ISO/IEC 17025 - Testing.		Authorised Signator	ry 🔨
The results of the	tests, calibrations, and/or measurements included in t	his	Authorised Signaforv	NATÀ
uoument	Tested at Trilab Drisbana Laboratory	[]	Jamin United	
	resteu at Triab Brisbarie Laboratory			Laboratory No. 9926



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		LL INDEX TE	ST REPORT	
Client	Golder Associates Pty Limited		Report No.	GA101836-ISS
			Request No.	1893802_H2C_TR3
Address	PO Box 1734 MILTON BC	QLD 4064	Test Date	15/01/2019
			Report Date	22/01/2019
Project	Inland Rail Package 13			
Description	SILTY CLAY-brown/yellow			
Sample No.			330-01-BH2306-	-S00050
Client ID			330-01-BH2	306
Depth (m)			0.5-0.95	
	RESU		ſING	
	sw		N	
Swell Pres	sure (kPa) *		-	
Wet Densit	y (t/m³)		1.86	
Initial Mois	ture Content (%)		15.0	
Final Moist	ure Content (%)		26.3	
	Swell (%)		8.9	
	SHR	INKAGE SPECIM	EN	
Estimated	Inert Inclusions (%)		5-10	
Extent of C	rumbling		Nil	
Extent of C	racking		Nil	
Moisture (%	%)		14.0	
	Shrinkage (%)		1.6	
SHRINK	SWELL INDEX (Iss) (%)		3.3	
Notes/Remarks:	Single Individual Specimen remoulded	to a target density of	Field Wet Density at Fi	ald Moisture Content (
	2.36mm material tested)	נס מ נמיקפי טפוואוני טו	TION WELDENSILY ALFIL	
Sample/s supplied b	by client			Page: 1 of 1 REP02304
Accredite The results of the document	d for compliance with ISO/IEC 17025 - Testing. tests, calibrations, and/or measurements included are traceable to Australian/National Standards.	l in this	Authorised Signatory	
	Tested at Trilab Brisbane Laboratory		C. Channon	

Triaxial Test Reports UU



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				TF		AL TES	REPOR	T			
Client		Golde	er Associates I	Pty Limited				Report	No. GA101459)- UU	
Ad	ldress	PO B	ox 1734 MILT	ON BC C	QLD	4064		Reques	t No. 1893802_	H2C_TR1	
								Test Da	te 26/11/201	8	
Projec	ct	Inland	l Rail Package	e 13				Report	Date 3/12/2018		
Projec	ct No.	18938	302				Client Sa	mple No.	330-01-BH2216-U0	0650	
Borel	lole	330-0	1-BH2216		Depth	From (m)	6.5		Depth To (m)	6.99	
Descr	iption	U					Sa	mple Type	Single Individual Undi	sturbed Spe	cimen
				<u></u>	Mohr	Circle Dia	agram				
200											
	-										
150											
	-										
kРа	-										
100 gt											
Shear \$	- - -										
50	-										
0	0	50) 1		200		250	300	350	400
						Normal St	ress kPa				
				Interpretat	ion bet	ween stage	3				
				Angle of Sh	Cohe	sion C (kPa)				
MOISTU	RE CONTENT	s	Initial	32.3 %	Fina	al 32.3 %) Failure Cri	teria	Maximum [Deviator Stres	ss
		SAN	IPLE & TEST	DETAILS					FAILURE DETAILS		
	Sample	Details 99.0	mm	Confin	ing Pres	ssure		Principa S ₁	Stresses S ₃	Deviator Stress	Strain
	Initial Diameter	47.7	mm		110 kPa		389	kPa	110 kPa	279 kPa	2.53 %
	Wet Density	1.91 1.44	t/m ³ t/m ³								
	Rate of Strain	0.505	% / min								
Graph not	to scale							Teste	ed as received	Page 1 of 3	REP2601
	Accrec The results of th docum	lited for o ne tests, o ent are tr	compliance with licalibrations, and/ aceable to Austra	SO/IEC 17025 - 1 or measurements alian/National Sta	Festing. s include ndards.	d in this		Authorise	ed Signatory		
	The	Teste	d at Trilab Brisba	ne Laboratory.				т. і	_ockhart	Laboratory No	o. 9926

st unless otherwise clearly stated. The results of c Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details. Trilab Pty Ltd ABN 25 065 630 506 the spe



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Laboratory No. 9926

Client Golder Associates Pty Limited Report No. GA101459-UU CLIENT: Golder Associates Pty Limited BEFORE TEST LAB SAMPLE No. 101459 DATE: 22/11/13 BOREHOLE: 330-01-BH2216 DEPTH: 6.5 CLIENT: Golder Associates Pty Limited PROJECT: Inland Rail Package 13 DEFORE TEST LAB SAMPLE No. 101459 DATE: 22/11/13 BOREHOLE: 330-01-BH2216 DEPTH: 6.5 CLIENT: Golder Associates Pty Limited PROJECT: Inland Rail Package 13 AFTER TEST DATE: 22/11/13 DEPTH: 6.5 BOREHOLE: 330-01-BH2216 DEPTH: 6.5 Emergenetics Prob not to scele 2000000000000000000000000000000000000			TRIAXIAL TEST RE		
CLIENT: Golder Associates Pty Limited PROJECT: Inland Rail Package 13 BEFORE TEST LAB SAMPLE No. 101459 DATE: 22-/11/18 BOREHOLE: 330-01-BH2216 DEPTH: 6.5 Image: Complex State St	Client	Golder Associates Pty	/ Limited	Report No. GA1014	459- UU
PROJECT: Inland Rail Package 13 BEFORE TEST LAB SAMPLE No. 101459 DATE: 22/10/16 BOREHOLE: 330-01-BH2216 DEPTH: 6.5 Image: Construction of the second		CLIENT:	Golder Associates Pty I	imited	
LAB SAMPLE No. 101459 DATE: 22/11/18 BOREHOLE: 330-01-BH2216 DEPTH: 6.5 Image: Construction of the set of		PROJECT:	Inland Rail Package 13	BEFORE TES	ST
BOREHOLE: 330-01-BH2216 DEPTH: 6.5 Image: Construction of the series of the		LAB SAMPLE No	· 101459	DATE: 22/11/18	
Extensity Product sets Presults of the tests, calibrations, and/or measurements included in this Product Sets		BOREHOLE:	330-01-BH2216	DEPTH: 6.5	
Image: Second					
Experiments: Photo not to scale photo to scale Tested as received Page 3 of 3		CLIENT: PROJECT:	Golder Associates Pty Li Inland Rail Package 13	mited	
LAB SAMPLE No. 101459 DATE: 26111/15 BOREHOLE: 330-01-BH2216 DEPTH: 6.5 Deptember Generation Deptember Photonot oscale raph not to scale Tested as received Pag 3 of 3 Accredited for compliance with ISO/IEC 17025 - Testing. Authorised Signatory Authorised Signatory Accredited for compliance with ISO/IEC 17025 - Testing. Tested as received Pag 3 of 3				AFTER TEST	
tes/Remarks: Photo not to scale aph not to scale Tested as received Pag 3 of 3 Accredited for compliance with ISO/IEC 17025 - Testing; Tested as received Pag 3 of 3		BOREHOLE:	330-01-BH2216	DATE: 26 11110 DEPTH: 6.5	
raph not to scale Tested as received Page 3 of 3 Accredited for compliance with ISO/IEC 17025 - Testing. The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards. Authorised Signatory Image: Compliance with ISO/IEC 17025 - Testing.	<u>otes/Rem</u> arks		Pho	to not to scale	
Accredited for compliance with ISO/IEC 17025 - Testing. Authorised Signatory The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.	raph not to sca	ale	Tesi	ted as received	Page 3 of 3 REI
	The re	Accredited for compliance with Is sults of the tests, calibrations, and/ document are traceable to Austra	SO/IEC 17025 - Testing. or measurements included in this alian/National Standards.	Authorised Signatory	

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



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				TR	Test Method: AS1		•			
Client		Golder	Associates I	Pty Limited			Report I	No. GA101463	- UU	
Ad	dress	PO Bo	x 1734 MILT	ON BCQ	LD 4064		Doguool	No 1203203 L	10C TD1	
						-	Teet Det	1095002_1	120_1K1	
D		Inland	Rail Package	13			Test Da)	
Projec							Report I	Jate 3/12/2018		
Projec	ct No.	189380)2			Client Sam	ple No.	330-01-BH2216-U0	1250	
BoreH	lole	330-01	-BH2216		Depth From (m)	12.5		Depth To (m)	12.99	
Descr	Iption	U				Sam	ріе Туре	Single Individual Undi	sturbed Spe	ecimen
				Δ	Iohr Circle Dia	agram				
400										
300	-									
Ра										
ss k										
Stre Stre										
hear										
S										
100				_/					+ -	
0	0	100	20) 3	00 400	5	00	600 7	/00	800
					Normal St	ress kPa				
				Interpretati	on between stages					
				interpretati	Cohesion C (kPa)				
				Angle of She	ar Resistance Φ (⁰)				
MOISTU	RE CONTENT	S	Initial	14.3 %	Final 14.3 %	Failure Crite	ria	Maximum D	eviator Stres	SS
	Sampla	SAMF Dotailo	PLE & TEST	DETAILS			Principal	FAILURE DETAILS	Doviator	Strain
	Initial Height	99.0	mm	Confini	ing Pressure	S ₁	Fincipal	Suesses S ₃	Stress	Suam
	Initial Diameter	47.6	mm	2	20 kPa	745 kl	Pa	220 kPa	525 kPa	11.70 %
	Wet Density	2.08 1.82	t/m³ t/m³							
	Rate of Strain	0.505	% / min							
Notes/Ren Graph pot	narks: to scale						Tosto	d as received	Page 1 of 2	DED3601
Jiapii IIUl							16260	a as 16061460	Fage 1 01 3	NEF2001
-	Accredi The results of th	tea for co e tests, ca	mpliance with la alibrations, and/	SU/IEC 17025 - T or measurements	esung. included in this		Authorise	d Signatory		
	docume	nt are tra	ceable to Austra	alian/National Star	idards.		1	. Office	V	
		Tested	at Trilab Brisba	ne Laboratory.			T. L	ockhart	TECHNICAL COMPETENCE	Ē
				· · · · · · · · ·					Laboratory No	o. 9926

o the spe fic instrument or sample s otherwise clearly stated. The results of c ormed a ations and tests performed apply only to the specific instrument or sample at the time of test unless othe Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details. Trilab Pty Ltd ABN 25 065 630 506



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Laboratory No. 9926

		TRIAXIAL TEST RE		
Client	Golder Associates Pty	Limited	Report No. GA101463- UU	
	CLIENT:	Golder Associates Pty L	imited	
	PROJECT:	Inland Rail Package 13	BEFORE TEST	
	LAB SAMPLE No.	101463	DATE: 22/11/18	
	BOREHOLE:	330-01-BH2216	DEPTH: 12.5	
2		and Martin Party		
			and the second	
			and the second	
	CLIENT:	Golder Associates Pty	Limited	
	PROJECT:	Inland Rail Package 13	AFTER TEST	
	LAR SAMPLE No.	101463	DATE 26/11/19	
	BOREHOLE:	330-01-BH2216	DEPTH: 12.5	
	DOREHOLE.	550-01-0114410		
otes/Remarks:		Pho	to not to scale	
raph not to scale	9	Tesi	ted as received Page 3 of 3	REP26
The resu	Accredited for compliance with IS ults of the tests, calibrations, and/o document are traceable to Australi	O/IEC 17025 - Testing. r measurements included in this an/National Standards.	Authorised Signatory	
	T () (T) D'		T. Lockbart Comparison	

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

Triaxial Compression Rock



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	STRENGTH	OF ROCK MA		. IN TF	RIAXIAL COM	PRESSION	
Sta	andard Test Methods for Compr	essive Strength and Elastic I	Moduli of Intact R	Cock Core Sp	ecimens under Varving Sta	ites of Stress and Temperatu	res
	Method B : Elastic Mo	duli of Undrained Rock Core	e Specimens in T	riaxial Comp	ression Without Pore Pres	sure Measurements	
Client	Golder Associates P	ty Limited		,	Report No.	GA101598-RTX	
					Request No.	330-01-BH2101	
Address	PO Box 1734 MILTO	ON BC QLD	4064		Test Date	24/01/2019	
					Report Date	25/01/2019	
Proiect	Inland Rail Package	13	Depth Fr	om (m)	81	Sample	
Bore Hole	330-01-BH2101	-	Depth	To (m)	82	No: 330-0	1-BH2101-C08100
Description	С					l	
Sample Type	Single Inc	lividual Rock Core	Specimen				
	· · · · ·	ę	Sample D	etails			
Average Sample	e Diameter (mm)	60	0.9	Moistu	re Content (%)		5.9
Sample Height (mm)	152	2.64	Wet De	ensity (t/m ³)		2.13
Duration of Test	(min)	20:5	52:00	Dry De	nsity (t/m³)		2.01
Rate of Strain (%	%/min)	0.	.05	Beddin	g (°)		10
Mode of Failure	,	She	ear	T (A			
Rupture Angle (°)	5	50	lest A	oparatus	RTR2500 Th	axial Machine
	,	Int	tact Test	Result	6		
	Value at Plastic Deformation	Value at Plastic Deformation	Value at F Deforma	Plastic ation	Value at Plastic Deformation	Value at Plastic Deformation	Peak Value
Confining Pressure MPa)	2.00	5.00	8.0	1	12.01	15.00	15.00
≿alc'd Deviator Stress MPa)	16.0	22.1	27.	7	32.8	-	-
Deviator Stress (MPa)	12.4	16.8	20.0	6	24.0	29.2	40.1
xial Strain (µe)	1894	2180	249	9	2768	3389	8116
liametral Strain (µe)	-223	-282	-38	1	-446	-656	-2214
angent Modulus (GPa)	6.24	7.63	8.6	1	9.13	9.56	-
'oisson's Ratio	0.161	0.189	0.18	36	0.176	0.191	-
		Res	idual Tes	st Resu	lts		
Confining Pressure (MPa	a)	14.99	13.1	5	7.94	4.92	1.94
esidual Deviator Stress	s (MPa)	35.8	32.0	0	26.0	19.6	11.4
xial Strain (µe)		13658	1490	03	16674	18530	20323
iametral Strain (µe)		-3640	-459	93	-6378	-9306	-15553
lotes/Remarks:							
ample/s supplied by	client		Tested as re	eceived			Page 1 of 8 REP16
Accredited fo The results of the te this document a	r compliance with ISO/IEs sts, calibrations, and/or m are traceable to Australian	S 17025 - Testing. leasurements included /National Standards.	in	А	uthorised Signatory		
	Tested at Trilab Brisbane Labo	oratory			C. Purvis		GUMPETENCE



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	STRENGT	H OF ROCK MATERIAL IN			1
	Standard Test Methods for Cor	ASIM D/012 mpressive Strength and Elastic Moduli of Intact Rock	Core Specimens unde	r Varying States of Stress and Tem	peratures
	Method B : Elastic	Moduli of Undrained Rock Core Specimens in Triaxia	al Compression Witho	ut Pore Pressure Measurements	
Client	Golder Associates	s Pty Limited	Repor	t No. GA101598-R1	ГХ
		Before and After Te	st Photos		
CL	IENT:	Golder Associates Ptx	Limited		1
PR	OJECT:	Inland Rail Package	13	BEFORE	ГЕЅТ
LAI	B SAMPLE No.	101598		DATE - 24 1 10	1
BO	REHOLE:	330-01-BH2101		DEPTH: 81	/
ВО	REHOLE:	330-01-BH2101	D	ЕРТН: 81	
ВО	REHOLE:	330-01-BH2101	D	EPTH: 81	
BO	DREHOLE:	330-01-BH2101	D	EPTH: 81	
BO	REHOLE	330-01-BH2101	D	EPTH: 81	
BO	PREHOLE:	330-01-BH2101		EPTH: 81	
BO es/Remarks: <u>nple/s supplie</u> Accred 'he results of this docur	PREHOLE:	Jago of the section o	D	EPTH: 81	Page 4 of 8 REP



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	STRENGTH	OF ROCK MA			RIAXIAL COM	IPRESSION		
C to	underd Test Methods for Compr	analyse Strength and Electical	<u>ASIM D</u> Maduli of Integt	7012 Dock Coro So	animona under Varian Sta	too of Stroop and Tamparatur		
518	Mothed R - Electic Mo	duli of Undroined Rock Core		Rock Core Sp	recimens under Varying Sta	nies of Stress and Temperatur	es	
Client	Golder Associates P	tv Limited	e opecimens in		Poport No	CA101632 DTY		
					Request No.	330-01-BH2101		
Address	PO Box 1734 MILTO	N BC QLD 4064		Tost Data	24/01/2019			
					Penort Date	25/01/2019		
Project	Inland Rail Package	13	Denth F	rom (m)	95	Sample 330.01 RH2101_C00500_TWP - 330		
Bore Hole	330-01-BH2101	10	Deptil	h To (m)	95.7	No: BH2101-C09500-MOI		
Description	C							
Sample Type	Single Ind	ividual Rock Core	Specimen					
			Sample I	Details				
					0 ((0))			
Average Sample Diameter (mm)		60	60.8 Moist		re Content (%)		3.8	
Sample Height (i	mm)	152	2.46	Wet De	ensity (t/m°)	2.18		
Duration of Test	(min)	16:5	16:59:00 Dry De		1sity (t/m ³) 2.10		2.10	
Rate of Strain (%	_b /min)	0.	0.05 Bedd		g (č) 10		10	
Mode of Failure		She	Shear Test A		oparatus	RTR2500 Triaxial Machine		
Rupture Angle (*	['])	6	50					
		Int	act Test	Result	S			
	Value at Plastic Deformation	Value at Plastic Deformation	Value at Deform	Plastic nation	Value at Plastic Deformation	Value at Plastic Deformation	Peak Value	
Confining Pressure (MPa)	1.99	5.01	8.0)1	12.00	15.01	15.01	
Calc'd Deviator Stress (MPa)	16.7	25.0	33.0		43.0	-	-	
Deviator Stress (MPa)	11.9	17.2	22.4		28.8	36.4	54.4	
Axial Strain (µe)	1688	1980	2274		2747	3382	8256	
Diametral Strain (µe)	-176	-249	-358		-478	-696	-2891	
Tangent Modulus (GPa)	6.80	8.21	9.81		10.6	11.1	-	
Poisson's Ratio	0.168	0.137	0.183		0.184	0.189	-	
		Res	idual Te	st Resu	lts			
Confining Pressure (MPa)	15.01	11.	98	7.94	4.97	1.96	
Residual Deviator Stress	(MPa)	39.5	32.7		24.4	17.4	9.09	
Axial Strain (µe)		13768	15047		16129	16541	16704	
Diametral Strain (µe)		-7377	-11(021	-16197	-20410	-25195	
Notes/Remarks:			_	_				
Sample/s supplied by	client		Tested as r	eceived			Page 1 of 8 REP16601	
Accredited fo The results of the tes this document a	r compliance with ISO/IES sts, calibrations, and/or m re traceable to Australian/	6 17025 - Testing. easurements included National Standards.	in	A	uthorised Signatory			
	Tested at Trilab Brisbane Labo	ratory			C. Purvis		competence	



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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



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





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	STRENGT	H OF ROCK MATERIAL IN T ASTM D7012	RIAXIA	L COMPRESSION	
	Standard Test Methods for Con	npressive Strength and Elastic Moduli of Intact Rock Core	Specimens und	ler Varying States of Stress and Temperat	ures
Clion	Method B : Elastic	Moduli of Undrained Rock Core Specimens in Triaxial Co	mpression With	out Pore Pressure Measurements	
Clien			Repo	rt No. GA101632-RTX	
		Before and After Test F	Photos		
E	CLIENT:	Golder Associates Pty I	imited		
	PROJECT:	Inland Rail Package 13	1.1	BEFORE TH	EST
	LAB SAMPLE No.	101632		DATE: 24 /1 /19	
	BOREHOLE:	330-01-BH2101		DEPTH: 95	
	processo in	All and the Party of the Party of the	-20		
	E.C.			111	
	Concerned and the second se				
	Service Card				
	BOREHOLE:	330-01-BH2101		DEPTH: 95	
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	BOREHOLE:	330-01-BH2101		DEPTH: 95	
	BOREHOLE:	330-01-BH2101		DEPTH: 95	
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	BOREHOLE:	330-01-BH2101		DEPTH: 95	
	BOREHOLE:	330-01-BH2101		DEPTH: 95	
	BOREHOLE	330-01-BH2101		DEPTH: 95	
es/Re	narks:	330-01-BH2101		DEPTH: 95	
es/Re	Norehole:			DEPTH: 95	
es/Re nple/s	BOREHOLE:	330-01-BH2101		DEPTH: 95	Page 4 of 8 REP16
es/Re pple/s	BOREHOLE: marks: supplied by client Accredited for compliance with ISO/ suits of the tests, calibrations, and/o	A30-01-BH2101	Autho	DEPTH: 95	Page 4 of 8 REP16



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	STRENGTH	OF ROCK MA	ATERIA	L IN TF	RIAXIAL COM	IPRESSION		
Sta	andard Test Methods for Compr	essive Strength and Elastic I	Moduli of Intact	Rock Core Sp	pecimens under Varying Sta	ates of Stress and Temperatur	res	
	Method B : Elastic Mo	oduli of Undrained Rock Core	Specimens in	Triaxial Comp	ression Without Pore Pres	sure Measurements		
Client	Golder Associates P	ty Limited			Report No.	GA101671-RTX		
					Request No.	330-01-BH2101		
Address	PO Box 1734 MILTO	ON BC QLD	BC QLD 4064		Test Date	24/01/2019		
					Report Date	25/01/2019		
Project	Inland Rail Package	13	Depth F	rom (m)	117	Sample 330-01-BH2101-C11700-TWR: 3		
Bore Hole	330-01-BH2101		Depth To (m) 117.9		117.9	No: 01-BH2101-C11700-MOI		
Description	С							
Sample Type	Single Inc	lividual Rock Core	Specimen					
		ę	Sample I	Details				
Average Sample	Diameter (mm)	60).9	Moistu	re Content (%)		2.1	
Sample Height (mm)	15	151.47 Wet		ensity (t/m^3) 2.15		2.15	
Duration of Test	(min)	17:0	00:80	Dry De	nsity (t/m ³) 2.10		2.10	
Rate of Strain (%	%/min)	0.	0.05 Beddir		(°) Nil		Nil	
Mode of Failure		She	Shear				avial Machina	
Rupture Angle (°)	5	50	Test A	pparatus	Daratus RIR2500 Triaxial Machine		
		Int	act Test	Result	S			
	Value at Plastic Deformation	Value at Plastic Deformation	Value at Deform	Plastic nation	Value at Plastic Deformation	Value at Plastic Deformation	Peak Value	
Confining Pressure (MPa)	1.97	5.00	8.0)1	12.01	15.00	15.01	
Calc'd Deviator Stress (MPa)	27.4	34.2	42	.6	49.8	-	-	
Deviator Stress (MPa)	24.1	29.7	36.9		42.8	50.7	59.1	
Axial Strain (µe)	1799	1842	210	69	2492	3047	4552	
Diametral Strain (µe)	-192	-224	-287		-368	-598	-1298	
Fangent Modulus (GPa)	14.1	15.6	17.5		17.8	18.3	-	
² oisson's Ratio	0.119	0.158	0.174		0.180	0.174	-	
		Res	idual Te	st Resu	lts			
Confining Pressure (MPa	a)	15.00	11.	95	7.91	4.92	1.92	
Residual Deviator Stress	(MPa)	53.1	47.4		38.4	29.9	19.7	
Axial Strain (µe)		8192	8877		10246	10738	11401	
Diametral Strain (µe)		-1980	-26	76	-5488	-8756	-14957	
Notes/Remarks:								
Sample/s supplied by	client		Tested as r	received			Page 1 of 8 REP1660	
Accredited fo The results of the te this document a	r compliance with ISO/IES sts, calibrations, and/or m re traceable to Australian	S 17025 - Testing. leasurements included /National Standards.	in	А	uthorised Signatory	,		
	Tested at Trilab Brisbane Labo	oratory			C. Purvis		Laboratory No. 9926	



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		TRIAXIAL COMPRESSION
Standard Test Methods for	r Compressive Strength and Elastic Moduli of Intact Rock Co	ore Specimens under Varying States of Stress and Temperatures
Method B : E	astic Moduli of Undrained Rock Core Specimens in Triaxial	Compression Without Pore Pressure Measurements
Client Golder Associ	ates Pty Limited	Report No. GA101671-RTX
	Before and After Test	t Photos
CLIENT:	Golder Associates Pty L	imited
PROJECT:	Inland Rail Package 13	BEFORE TEST
LAB SAMPLE No.	101671	DATE: 24/1/19
BOREHOLE:	330-01-BH2101	DEPTH: 117
DUREIIULE.	330-01-0114101	
-s/Remarks:		
es/Remarks: nple/s supplied by client	Photo not to scale Tested as received	



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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



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	STRENGTH	OF ROCK MA		IN TF		IPRESSION	
Sta	andard Test Methods for Compr	essive Strength and Elastic I	Moduli of Intact Ro	ock Core Sr	ecimens under Varvina Sta	ates of Stress and Temperatur	es
	Method B : Elastic Mo	duli of Undrained Rock Core	e Specimens in Tria	axial Comp	ression Without Pore Pres	sure Measurements	
Client	Golder Associates F	ty Limited			Report No.	GA101681-RTX	
					Request No.	330-01-BH2101	
Address	PO Box 1734 MILTO	ON BC QLD	4064		Test Date	24/01/2019	
					Report Date	25/01/2019	
Project	Inland Rail Package	13	Depth Fro	om (m)	120.3	Sample 330-01-BH2	2101-C12030-TWR : 33
Bore Hole	330-01-BH2101		Depth	To (m)	120.9	No: 01-BH	2101-C12030-MOI
Description	С						
Sample Type	Single Inc	lividual Rock Core	Specimen				
		Ş	Sample De	etails			
Average Sample	e Diameter (mm)	60	0.9	Moistu	re Content (%)		2.2
Sample Height (mm)	150	0.45	Wet De	ensity (t/m³)		2.46
Duration of Test	(min)	12:2	21:00	Dry De	nsity (t/m³)		2.41
Rate of Strain (%	%/min)	0.	.05	Beddin	g (°)		Nil
Mode of Failure		She	ear	Toot A	anaratua		wial Machina
Rupture Angle (Rupture Angle (°) 40						
Intact Test Results							
	Value at Plastic Deformation	Value at Plastic Deformation	Value at Pl Deformat	lastic tion	Value at Plastic Deformation	Value at Plastic Deformation	Peak Value
Confining Pressure MPa)	2.00	5.04	8.01		12.02	15.03	15.03
Calc'd Deviator Stress MPa)	26.2	32.8	37.4		43.5	-	-
Deviator Stress (MPa)	26.1	32.7	37.3		43.4	48.2	48.4
xial Strain (µe)	1059	1200	1339)	1538	1770	1814
Jiametral Strain (µe)	-125	-131	-182		-230	-280	-285
angent Modulus (GPa)	23.5	27.6	27.1		28.8	28.7	-
oisson's Ratio	0.173	0.176	0.197	7	0.216	0.207	-
		Res	idual Test	Resu	lts		
Confining Pressure (MPa	a)	15.02	11.96	6	7.90	4.91	1.93
esidual Deviator Stress	(MPa)	36.7	30.4		23.9	18.0	10.6
xial Strain (µe)		5702	7122	2	8582	9806	10824
iametral Strain (µe)		-693	-801		-1066	-1460	-2062
lotes/Remarks:							
ample/s supplied by	client		Tested as rec	ceived			Page 1 of 8 REP166
Accredited fo The results of the te this document a	r compliance with ISO/IE sts, calibrations, and/or m ire traceable to Australian	S 17025 - Testing. leasurements included /National Standards.	in	А	uthorised Signatory	/	NATA
	Tested at Trilah Drishans Lah	ratory			C. Purvis		COMPETENCE

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STREN	IGTH OF ROCK MAT	ERIAL IN TRI	AXIAL COMPRESSION				
<u>ASTM D7012</u>							
Standard Test Method	Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures						
Client Golder Asso	ciates Pty Limited		Report No. GA101681-RTX				
	,						
	Before a	nd After Test Phot	os				
CLIENT:	Golder Associate	es Pty Limite	d				
PROJECT:	Inland Rail Pack	tage 13	BEFORE TE:	ST			
LAB SAMPLE No.	101681	é	DATE: 24/1/19				
BOREHOLE:	330-01-BH2101		DEPTH: 120.3	·			
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BOREHULE:	330-01-BH210	1	DEPTH: 120.3	1			
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L I BERT BLOOM	4 11 1 20 19			and the second			
	and a second sec		A PARTY AND	AND DESCRIPTION OF THE OWNER.			
Notes/Remarks:	-						
Sample/s supplied by client	Р т	hoto not to scale		Page 4 of 8 REP16601			
Accredited for compliance wi	th ISO/IES 17025 - Testing						
The results of the tests, calibrations	, and/or measurements included in		Authorised Signatory				
this document are traceable to	Australian/Inational Standards.		the				
Tested at Trilab B	risbane Laboratory		C. Purvis	Laboratory No. 9926			

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Point Load Testing



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POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101410-101565-PL
			Request No	1893802_H2C_TR1
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	30/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
				1
Trilab Sample No.	101410	101412	101414	101416
Client Sample No	330-01-BH2203-C01500	330-01-BH2203-C01650	330-01-BH2203-C01850	330-01-BH2203-C02000
Bore Hole	330-01-BH2203	330-01-BH2203	330-01-BH2203	330-01-BH2203
Depth From/To (m)	15.00-16.00	16.50-17.50	18.50-19.00	20.00-20.50
Description	С	С	С	С
ls (MPa)	0.18	0.05	0.13	2.25
ls(50) (MPa)	0.18	0.05	0.13	2.24
Load Direction	Diametral	Diametral	Diametral	Diametral
Trilab Sample No.	101417	101427	101429	101431
Client Sample No	330-01-BH2203-C02200	330-01-BH2207-C01150	330-01-BH2207-C01350	330-01-BH2207-C01550
Bore Hole	330-01-BH2203	330-01-BH2207	330-01-BH2207	330-01-BH2207
Depth From/To (m)	22.00-23.00	11.50-12.00	13.50-14.00	15.50-16.00
Description	С	С	С	С
ls (MPa)	0.19	0.43	0.06	1.37

0.43

Diametral

NOTES/REMARKS:

Tested as received

0.19

Diametral

Sample/s supplied by the client

Is(50) (MPa)

Load Direction

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0.06

Diametral



Laboratory No. 9926

1.36

Diametral

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POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101410-101565-PL
			Request No	1893802_H2C_TR1
Address	PO Box 1734 MILTON E	BC QLD 4064	Test Date	30/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101432	101434	101453	101455
Client Sample No	330-01-BH2207-C01650	330-01-BH2207-C01950	330-01-BH2212-C02460	330-01-BH2212-C02520
Bore Hole	330-01-BH2207	330-01-BH2207	330-01-BH2212	330-01-BH2212
Depth From/To (m)	16.50-17.00	19.50-20.00	24.60-24.70	25.20-25.30
Description	С	С	С	С
ls (MPa)	0.23	0.73	0.75	0.10
ls(50) (MPa)	0.23	0.73	0.74	0.10
Load Direction	Diametral	Diametral	Diametral	Diametral
Trilab Sample No.	101485	101487	101489	101507
Client Sample No	330-01-BH2224-C02150	330-01-BH2224-C02350	330-01-BH2224-C02550	330-01-BH2301-C00260

330-01-BH2224

23.50-24.00

С

4.39

4.27

Diametral

330-01-BH2224

25.50-26.00

С

0.11

0.11

Diametral

Tested as received

330-01-BH2224

21.50-22.00

С

0.31

0.31

Diametral

NOTES/REMARKS:

Sample/s supplied by the client

Bore Hole

Description

Depth From/To (m)

ls (MPa)

Is(50) (MPa)

Load Direction

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330-01-BH2301

2.60-2.70

С

0.23

0.23

Diametral



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POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101410-101565-PL
			Request No	1893802 H2C TR1
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	30/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101508	101510	101512	101514
Client Sample No	330-01-BH2301-C00330	330-01-BH2301-C00440	330-01-BH2301-C00560	330-01-BH2301-C00760
Bore Hole	330-01-BH2301	330-01-BH2301	330-01-BH2301	330-01-BH2301
Depth From/To (m)	3.30-3.40	4.40-4.50	5.60-5.70	7.60-7.70
Description	С	С	С	С
ls (MPa)	0.03	0.08	0.79	0.90
ls(50) (MPa)	0.03	0.08	0.78	0.89
Load Direction	Diametral	Diametral	Diametral	Diametral
Trilab Sample No.	101517	101524	101530	101532
Client Sample No	330-01-BH2301-C01130	330-01-BH2301-C01450	330-01-BH2301-C01600	330-01-BH2301-C01780
Bore Hole	330-01-BH2301	330-01-BH2301	330-01-BH2301	330-01-BH2301
Depth From/To (m)	11.30-11.40	14.50-14.60	16.00-16.10	17.80-17.90

С

1.11

1.07

Diametral

С

1.36

1.35

Diametral

NOTES/REMARKS:

Tested as received

С

1.09

1.08

Diametral

Sample/s supplied by the client

Description

ls (MPa)

Is(50) (MPa)

Load Direction

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С

2.35

2.25

Diametral



 Laboratory No. 9926

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POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101410-101565-PL
			Request No	1893802_H2C_TR1
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	30/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101533	101534	101536	101537
Client Sample No	330-01-BH2301-C01900	330-01-BH2301-C02130	330-01-BH2301-C02550	330-01-BH2301-C02930
Bore Hole	330-01-BH2301	330-01-BH2301	330-01-BH2301	330-01-BH2301
Depth From/To (m)	19.00-19.10	21.30-21.40	25.50-25.60	29.30-29.40
Description	С	С	С	С
ls (MPa)	1.55	5.72	7.13	0.21
ls(50) (MPa)	1.55	5.67	7.05	0.21
Load Direction	Diametral	Diametral	Diametral	Diametral
Trilab Sample No.	101538	101540	101553	101554
Client Sample No	330-01-BH2301-C03030	330-01-BH2303-C00240	330-01-BH2303-C00570	330-01-BH2303-C00710
Bore Hole	330-01-BH2301	330-01-BH2303	330-01-BH2303	330-01-BH2303
Depth From/To (m)	30.30-30.40	2.40-2.50	5.70-5.80	7.10-7.20

С

4.05

4.00

Diametral

С

0.23

0.22

Diametral

NOTES/REMARKS:

Tested as received

С

0.68

0.68

Diametral

ls (MPa)

Is(50) (MPa)

Load Direction

Description

Sample/s supplied by the client

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С

3.18

3.15

Diametral



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	POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101410-101565-PL	
			Request No	1893802_H2C_TR1	
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	30/11/2018	
			Report Date	4/12/2018	
Project	Inland Rail Package 13				
Project No	1893802				
		•			
Trilab Sample No.	101556	101559	101560	101562	
Client Sample No	330-01-BH2303-C01040	330-01-BH2303-C01340	330-01-BH2303-C01470	330-01-BH2303-C01750	
Bore Hole	330-01-BH2303	330-01-BH2303	330-01-BH2303	330-01-BH2303	
Depth From/To (m)	10.40-10.50	13.40-13.50	14.70-14.80	17.50-17.60	
Description	С	С	С	С	
ls (MPa)	1.83	0.71	1.19	0.36	
ls(50) (MPa)	1.83	0.71	1.18	0.36	
Load Direction	Diametral	Diametral	Diametral	Diametral	
Trilab Sample No.	101564	101565	101410	101412	
Client Sample No	330-01-BH2303-C01870	330-01-BH2303-C02220	330-01-BH2203-C01500	330-01-BH2203-C01650	
Bore Hole	330-01-BH2303	330-01-BH2303	330-01-BH2203	330-01-BH2203	
Depth From/To (m)	18.70-18.80	22.20-22.30	15.00-16.00	16.50-17.50	

С

0.11

0.11

Diametral

С

0.28

0.28

Axial

NOTES/REMARKS:

Tested as received

С

1.72

1.66

Diametral

Sample/s supplied by the client

Description

ls (MPa)

Is(50) (MPa)

Load Direction

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С

0.45

0.43

Axial



 Laboratory No. 9926

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POINT LOAD TEST REPORT Test Method: AS 4133.4.1 Golder Associates Pty Limited Client **Report No.** GA101410-101565-PL 1893802 H2C TR1 **Request No** PO Box 1734 MILTON BC QLD 4064 Address **Test Date** 30/11/2018 4/12/2018 **Report Date** Project Inland Rail Package 13 **Project No** 1893802 101414 Trilab Sample No. 101416 101417 101427 ~... . .

Client Sample No	330-01-BH2203-C01850	330-01-BH2203-C02000	330-01-BH2203-C02200	330-01-BH2207-C01150
Bore Hole	330-01-BH2203	330-01-BH2203	330-01-BH2203	330-01-BH2207
Depth From/To (m)	18.50-19.00	20.00-20.50	22.00-23.00	11.50-12.00
Description	С	С	С	С
ls (MPa)	0.23	1.98	0.28	0.29
ls(50) (MPa)	0.23	2.00	0.29	0.30
Load Direction	Axial	Axial	Axial	Axial

Trilab Sample No.	101429	101431	101432	101434
Client Sample No	330-01-BH2207-C01350	330-01-BH2207-C01550	330-01-BH2207-C01650	330-01-BH2207-C01950
Bore Hole	330-01-BH2207	330-01-BH2207	330-01-BH2207	330-01-BH2207
Depth From/To (m)	13.50-14.00	15.50-16.00	16.50-17.00	19.50-20.00
Description	С	С	С	С
ls (MPa)	0.15	1.74	0.45	1.56
Is(50) (MPa)	0.15	1.76	0.45	1.56
Load Direction	Axial	Axial	Axial	Axial

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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Laboratory No. 9926

The results of calibrations and tests performed apply only to the specific instrument or sample at the time of test unless otherwise clearly stated.



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

POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101410-101565-PL
			Request No	1893802_H2C_TR1
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	30/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101453	101455	101485	101487
Client Sample No	330-01-BH2212-C02460	330-01-BH2212-C02520	330-01-BH2224-C02150	330-01-BH2224-C02350
Bore Hole	330-01-BH2212	330-01-BH2212	330-01-BH2224	330-01-BH2224
Depth From/To (m)	24.60-24.70	25.20-25.30	21.50-22.00	23.50-24.00
Description	С	С	С	С
ls (MPa)	0.73	0.11	0.43	6.40
ls(50) (MPa)	0.72	0.11	0.44	6.41
Load Direction	Axial	Axial	Axial	Axial
				•
Trilah Sample No	101/80	101507	101508	101510

Trilab Sample No.	101489	101507	101508	101510
Client Sample No	330-01-BH2224-C02550	330-01-BH2301-C00260	330-01-BH2301-C00330	330-01-BH2301-C00440
Bore Hole	330-01-BH2224	330-01-BH2301	330-01-BH2301	330-01-BH2301
Depth From/To (m)	25.50-26.00	2.60-2.70	3.30-3.40	4.40-4.50
Description	С	С	С	С
ls (MPa)	0.36	0.24	0.14	0.54
ls(50) (MPa)	0.36	0.24	0.13	0.54
Load Direction	Axial	Axial	Axial	Axial

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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Laboratory No. 9926 The results of calibrations and tests performed apply only to the specific instrument or sample at the time of test unless otherwise clearly stated.



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

POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101410-101565-PL
			Request No	1893802 H2C TR1
Address	PO Box 1734 MILTON E	BC QLD 4064	Test Date	30/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101512	101514	101517	101524
Client Sample No	330-01-BH2301-C00560	330-01-BH2301-C00760	330-01-BH2301-C01130	330-01-BH2301-C01450
Bore Hole	330-01-BH2301	330-01-BH2301	330-01-BH2301	330-01-BH2301
Depth From/To (m)	5.60-5.70	7.60-7.70	11.30-11.40	14.50-14.60
Description	С	С	С	С
ls (MPa)	1.00	1.13	0.96	1.05
ls(50) (MPa)	1.01	1.11	1.01	1.05
Load Direction	Axial	Axial	Axial	Axial
Trilab Sample No.	101530	101532	101533	101534
Client Sample No	330-01-BH2301-C01600	330-01-BH2301-C01780	330-01-BH2301-C01900	330-01-BH2301-C02130

Client Sample No	330-01-BH2301-C01600	330-01-BH2301-C01780	330-01-BH2301-C01900	330-01-BH2301-C021
Bore Hole	330-01-BH2301	330-01-BH2301	330-01-BH2301	330-01-BH2301
Depth From/To (m)	16.00-16.10	17.80-17.90	19.00-19.10	21.30-21.40
Description	С	С	С	С
ls (MPa)	0.83	1.91	3.01	5.77
ls(50) (MPa)	0.83	1.98	3.01	5.87
Load Direction	Axial	Axial	Axial	Axial

NOTES/REMARKS:

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Sample/s supplied by the client

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Laboratory No. 9926 The results of calibrations and tests performed apply only to the specific instrument or sample at the time of test unless otherwise clearly stated.



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

POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101410-101565-PL
			Request No	1893802 H2C TR1
Address	PO Box 1734 MILTON B	BC QLD 4064	Test Date	30/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
		ŀ		
Trilab Sample No.	101536	101537	101538	101540
Client Sample No	330-01-BH2301-C02550	330-01-BH2301-C02930	330-01-BH2301-C03030	330-01-BH2303-C00240
Bore Hole	330-01-BH2301	330-01-BH2301	330-01-BH2301	330-01-BH2303
Depth From/To (m)	25.50-25.60	29.30-29.40	30.30-30.40	2.40-2.50
Description	С	С	С	С
ls (MPa)	1.11	0.29	0.89	6.46
Is(50) (MPa)	1.17	0.28	0.89	6.05
Load Direction	Axial	Axial	Axial	Axial
Trilab Sample No.	101553	101554	101556	101559
Client Sample No	330-01-BH2303-C00570	330-01-BH2303-C00710	330-01-BH2303-C01040	330-01-BH2303-C01340

330-01-BH2303

7.10-7.20

С

3.53

3.52

Axial

330-01-BH2303

10.40-10.50

С

2.60

2.38

Axial

Tested as received

330-01-BH2303

5.70-5.80

С

0.25

0.25

Axial

NOTES/REMARKS:

Sample/s supplied by the client

Bore Hole

Description

Depth From/To (m)

ls (MPa)

Is(50) (MPa)

Load Direction

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330-01-BH2303

13.40-13.50

С

0.88

0.93

Axial

 Laboratory No. 9926

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POINT LOAD TEST REPORT					
Client	Golder Associates Pty L	imited	Report No. Request No	GA101410-101565-PL 1893802 H2C TR1	
Address	PO Box 1734 MILTON B	3C QLD 4064	Test Date Report Date	30/11/2018 4/12/2018	
Project	Inland Rail Package 13				
Project No	1893802				
	Γ	Γ	ſ	T	
Trilab Sample No.	101560	101562	101564	101565	
Client Sample No	330-01-BH2303-C01470	330-01-BH2303-C01750	330-01-BH2303-C01870	330-01-BH2303-C02220	
Bore Hole	330-01-BH2303	330-01-BH2303	330-01-BH2303	330-01-BH2303	
Depth From/To (m)	14.70-14.80	17.50-17.60	18.70-18.80	22.20-22.30	
Description	С	С	С	С	
İs (MPa)	2.52	0.38	1.30	0.31	
Is(50) (MPa)	2.54	0.39	1.34	0.31	
Load Direction	Axial	Axial	Axial	Axial	
Trileb Comple No.				1	
Trilab Sample No.					
Client Sample No					
Bore Hole					
Depth From/To (m)					
Description					
ls (MPa)					
Is(50) (MPa)					
Load Direction					
NOTES/REMARKS: Sample/s supplied by the This documer accreditation requ ISO/IEC 17025 - T and/or measurement to A	Tested as received e client tis issued in accordance with NAT, jirements. Accredited for complianc esting. The results of the tests, calil ents included in this document are tr ustralian/National Standards.	A's se with prations, aceable		Page 10 of 10 REP02102	



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

	POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL	
			Request No	1893802 H2C TR2	
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	29/11/2018	
			Report Date	4/12/2018	
Project	Inland Rail Package 13				
Project No	1893802				
Trilab Sample No.	101582	101583	101584	101585	
Client Sample No	330-01-BH2101-C07000	330-01-BH2101-C07000	330-01-BH2101-C07000	330-01-BH2101-C07000	
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101	
Depth From/To (m)	70.20-70.33	70.33-70.47	70.47-70.60	70.60-70.73	
Description	С	С	С	С	
ls (MPa)	1.07	1.11	0.89	1.29	
Is(50) (MPa)	1.15	1.16	0.94	1.34	
Load Direction	Axial	Axial	Axial	Axial	
Trilab Sample No.	101586	101590	101591	101592	
Client Sample No	330-01-BH2101-C07000	330-01-BH2101-C07200	330-01-BH2101-C07200	330-01-BH2101-C07200	
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101	

72.36-72.49

С

0.43

0.46

Axial

72.03-72.15

С

0.34

0.36

Axial

NOTES/REMARKS:

Tested as received

70.73-70.86

С

0.70

0.76

Axial

Depth From/To (m)

ls (MPa)

Is(50) (MPa)

Load Direction

Description

Sample/s supplied by the client

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72.49-72.61

С

0.29

0.30

Axial

 Laboratory No. 9926

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 Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details.

 Trilab Pty Ltd
 ABN 25 065 630 506



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

POINT LOAD TEST REPORT					
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL	
			Request No	1893802_H2C_TR2	
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	29/11/2018	
			Report Date	4/12/2018	
Project	Inland Rail Package 13				
Project No	1893802				
Trilab Sample No.	101593	101594	101602	101603	
Client Sample No	330-01-BH2101-C07200	330-01-BH2101-C07200	330-01-BH2101-C08100	330-01-BH2101-C08100	
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101	
Depth From/To (m)	72.61-72.74	72.74-72.81	81.43-81.53	81.53-81.63	
Description	С	С	С	С	
ls (MPa)	0.34	0.38	0.73	0.63	
ls(50) (MPa)	0.36	0.39	0.79	0.70	
Load Direction	Axial	Axial	Axial	Axial	
Trilab Sample No.	101604	101605	101606	101609	

Trilab Sample No.	101604	101605	101606	101609
Client Sample No	330-01-BH2101-C08100	330-01-BH2101-C08100	330-01-BH2101-C08100	330-01-BH2101-C08610
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101
Depth From/To (m)	81.63-81.74	81.74-81.84	81.84-81.93	86.10-86.18
Description	С	С	С	С
ls (MPa)	0.77	1.03	1.13	0.35
ls(50) (MPa)	0.83	1.12	1.23	0.36
Load Direction	Axial	Axial	Axial	Axial

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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 Laboratory No. 9926

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POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL
			Request No	1893802 H2C TR2
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	29/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101610	101611	101612	101613
Client Sample No	330-01-BH2101-C08610	330-01-BH2101-C08610	330-01-BH2101-C08610	330-01-BH2101-C08610
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101
Depth From/To (m)	86.34-86.42	86.42-86.49	86.49-86.57	86.57-86.66
Description	С	С	С	С
ls (MPa)	0.16	0.34	0.34	0.08
ls(50) (MPa)	0.17	0.36	0.36	0.08
Load Direction	Axial	Axial	Axial	Axial
Trilab Sample No.	101616	101617	101618	101619
Client Sample No	330-01-BH2101-C08700	330-01-BH2101-C08700	330-01-BH2101-C08700	330-01-BH2101-C08700
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101
Depth From/To (m)	87.21-87.28	87.28-87.35	87.35-87.42	87.42-87.50

С

0.70

0.72

Axial

С

0.53

0.54

Axial

NOTES/REMARKS:

Tested as received

С

0.92

0.93

Axial

Sample/s supplied by the client

Description

ls (MPa)

Is(50) (MPa)

Load Direction

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С

0.98

1.00

Axial



 Laboratory No. 9926

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> 96.31-96.41 С

> > 0.74

0.77

Axial

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POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL
			Request No	1893802_H2C_TR2
Address	PO Box 1734 MILTON E	BC QLD 4064	Test Date	29/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101625	101626	101627	101628
Client Sample No	330-01-BH2101-C09100	330-01-BH2101-C09100	330-01-BH2101-C09100	330-01-BH2101-C09100
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101
Depth From/To (m)	91.05-91.15	91.21-91.27	91.32-91.42	91.59-91.70
Description	С	С	С	С
ls (MPa)	0.34	0.09	0.18	0.36
ls(50) (MPa)	0.29	0.09	0.18	0.35
Load Direction	Axial	Axial	Axial	Axial
Trilab Sample No.	101629	101635	101636	101637
Client Sample No	330-01-BH2101-C09100	330-01-BH2101-C09600	330-01-BH2101-C09600	330-01-BH2101-C09600
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101
Depth From/To (m)	91.47-91.51	96 21-96 31	96 31-96 41	96 42-96 52

С

1.04

1.10

Axial

NOTES/REMARKS:

Tested as received

91.47-91.51

С

0.08

0.07

Axial

Sample/s supplied by the client

Depth From/To (m)

ls (MPa)

Is(50) (MPa)

Load Direction

Description

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С

1.35

1.45

Axial



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

	POINT LOAD TEST REPORT					
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL		
			Request No	1893802_H2C_TR2		
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	29/11/2018		
			Report Date	4/12/2018		
Project	Inland Rail Package 13					
Project No	1893802					
Trilab Sample No.	101638	101639	101647	101648		
Client Sample No	330-01-BH2101-C09600	330-01-BH2101-C09600	330-01-BH2101-C10460	330-01-BH2101-C10460		
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101		
Depth From/To (m)	96.52-96.63	96.63-96.73	104.69-104.80	104.80-104.90		
Description	С	С	С	С		
ls (MPa)	1.07	1.16	1.07	0.82		
ls(50) (MPa)	1.14	1.21	1.03	0.79		
Load Direction	Axial	Axial	Axial	Axial		
Trilab Sample No.	101651	101652	101653	101654		
Client Sample No	330-01-BH2101-C10820	330-01-BH2101-C10820	330-01-BH2101-C10820	330-01-BH2101-C10820		
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101		
Depth From/To (m)	108.90-109.0	108.86-108.90	108.82-108.86	108.58-108.63		
Description	С	С	С	С		

0.34

0.36

Axial

0.50

0.48

Axial

NOTES/REMARKS:

Tested as received

1.00

0.98

Axial

ls (MPa)

Is(50) (MPa)

Load Direction

Sample/s supplied by the client

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0.10

0.10

Axial



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POINT LOAD TEST REPORT Test Method: AS 4133.4.1 Golder Associates Pty Limited Client **Report No.** GA101582-101767-PL 1893802 H2C TR2 **Request No** PO Box 1734 MILTON BC QLD 4064 Address **Test Date** 29/11/2018 4/12/2018 **Report Date** Project Inland Rail Package 13 **Project No** 1893802 Trilab Sample No. 101655 101661 101662 101663

Client Sample No	330-01-BH2101-C10820	330-01-BH2101-C11400	330-01-BH2101-C11400	330-01-BH2101-C11400
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101
Depth From/To (m)	108.41-108.45	114.16-114.25	114.25-114.37	114.37-114.50
Description	С	С	С	С
ls (MPa)	0.63	1.81	1.48	2.52
ls(50) (MPa)	0.63	1.80	1.54	2.62
Load Direction	Axial	Axial	Axial	Axial

Trilab Sample No.	101664	101665	101674	101675
Client Sample No	330-01-BH2101-C11400	330-01-BH2101-C11400	330-01-BH2101-C12030	330-01-BH2101-C12030
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101
Depth From/To (m)	114.50-114.62	114.62-114.75	120.33-120.42	120.53-120.63
Description	С	С	С	С
ls (MPa)	2.15	1.97	0.96	1.03
ls(50) (MPa)	2.13	2.08	1.01	1.04
Load Direction	Axial	Axial	Axial	Axial

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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 Laboratory No. 9926

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

POINT LOAD TEST REPORT					
Client	Golder Associates Pty Limited		Report No.	GA101582-101767-PL	
			Request No	1893802 H2C TR2	
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	29/11/2018	
			Report Date	4/12/2018	
Project	Inland Rail Package 13				
Project No	1893802				
Trilab Sample No.	101676	101677	101678	101687	
Client Sample No	330-01-BH2101-C12030	330-01-BH2101-C12030	330-01-BH2101-C12030	330-01-BH2102-C00365	
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2102	
Depth From/To (m)	120.63-120.71	120.71-120.77	120.81-120.90	3.80-3.88	
Description	С	С	С	С	
ls (MPa)	0.88	0.96	0.64	0.18	
ls(50) (MPa)	0.92	0.98	0.67	0.18	
Load Direction	Axial	Axial	Axial	Axial	
Trilab Sample No.	101688	101689	101690	101691	
Client Sample No	330-01-BH2102-C00365	330-01-BH2102-C00365	330-01-BH2102-C00365	330-01-BH2102-C00365	
Bore Hole	330-01-BH2102	330-01-BH2102	330-01-BH2102	330-01-BH2102	

3.94-4.0

С

0.44

0.43

Axial

4.0-4.08

С

0.87

0.85

Axial

NOTES/REMARKS:

Tested as received

3.88-3.94

С

0.56

0.53

Axial

Sample/s supplied by the client

Depth From/To (m)

ls (MPa)

Is(50) (MPa)

Load Direction

Description

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4.08-4.14

С

0.01

0.01

Axial



 Laboratory No. 9926

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POINT LOAD TEST REPORT						
Client	Golder Associates Pty Limited		Report No.	GA101582-101767-PL		
Addross	PO Box 1734 MILTON F		Request No	1893802_H2C_TR2		
Address			Test Date	29/11/2018		
			Report Date	4/12/2018		
Project	Inland Rail Package 13					
Project No	1893802					
	I	I	Γ			
Trilab Sample No.	101696	101697	101698	101699		
Client Sample No	330-01-BH2102-C01020	330-01-BH2102-C01020	330-01-BH2102-C01020	330-01-BH2102-C01020		
Bore Hole	330-01-BH2102	330-01-BH2102	330-01-BH2102	330-01-BH2102		
Depth From/To (m)	10.38-10.45	10.45-10.52	10.52-10.60	10.60-10.69		
Description	С	С	С	С		
ls (MPa)	1.73	1.45	1.38	1.34		
ls(50) (MPa)	1.76 1.37		1.37	1.41		
Load Direction	Axial	Axial	Axial	Axial		
Trilab Sample No.	101700	101704	101705	101706		
Client Sample No	330-01-BH2102-C01020	330-01-BH2102-C02046	330-01-BH2102-C02046	330-01-BH2102-C02046		
Bore Hole	330-01-BH2102	330-01-BH2102	330-01-BH2102	330-01-BH2102		
Depth From/To (m)	10.69-10.78	20.50-20.60	20.60-20.68	20.68-20.76		
Description	С	С	С	С		

0.57

0.54

Axial

0.55

0.50

Axial

NOTES/REMARKS:

Tested as received

1.12

1.14

Axial

ls (MPa)

Is(50) (MPa)

Load Direction

Sample/s supplied by the client

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0.22

0.21

Axial



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POINT LOAD TEST REPORT					
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL	
			Request No	1893802_H2C_TR2	
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	29/11/2018	
			Report Date	4/12/2018	
Project	Inland Rail Package 13				
Project No	1893802				
Trilab Sample No.	101707	101708	101726	101728	
Client Sample No	330-01-BH2102-C02046	330-01-BH2102-C02046	330-01-BH2103-C01700	330-01-BH2103-C01800	
Bore Hole	330-01-BH2102	330-01-BH2102	330-01-BH2103	330-01-BH2103	
Depth From/To (m)	20.76-20.85	20.85-20.95	17.15-17.38	18.0-18.13	
Description	С	С	С	С	
ls (MPa)	0.43	0.47	0.35	0.29	
ls(50) (MPa)	0.40	0.45	0.35	0.30	
Load Direction	Axial	Axial	Axial	Axial	
Trilab Sample No.	101730	101732	101734	101736	
Client Sample No	330-01-BH2103-C01920	330-01-BH2103-C02175	330-01-BH2103-C02285	330-01-BH2103-C02555	
Bore Hole	330-01-BH2103	330-01-BH2103	330-01-BH2103	330-01-BH2103	
Depth From/To (m)	19.42-19.55	21.75-21.85	22.90-23.0	27.30-27.40	

С

0.21

0.20

Axial

С

0.46

0.44

Axial

NOTES/REMARKS:

Tested as received

С

0.17

0.17

Axial

Sample/s supplied by the client

Description

ls (MPa)

Is(50) (MPa)

Load Direction

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С

1.28

1.24

Axial



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POINT LOAD TEST REPORT					
Client	Golder Associates Pty Limited		Report No.	GA101582-101767-PL	
			Request No	1893802_H2C_TR2	
Address	PO Box 1734 MILTON E	BC QLD 4064	Test Date	29/11/2018	
			Report Date	4/12/2018	
Project	Inland Rail Package 13				
Project No	1893802				
Trilab Sample No.	101737	101753	101755	101758	
Client Sample No	330-01-BH2103-C02800	330-01-BH2104-C01600	330-01-BH2104-C01965	330-01-BH2104-C02152	
Bore Hole	330-01-BH2103	330-01-BH2104	330-01-BH2104	330-01-BH2104	
Depth From/To (m)	28.0-28.1	16.0-16.11	19.74-19.86	21.86-21.96	
Description	С	С	С	С	
ls (MPa)	0.40	0.26	0.34	0.23	
Is(50) (MPa)	0.40	0.26	0.34	0.22	
Load Direction	Axial	Axial	Axial	Axial	
Trilab Sample No.	101759	101761	101765	101767	
Client Sample No	330-01-BH2104-C02346	330-01-BH2104-C02520	330-01-BH2104-C02700	330-01-BH2104-C03000	
Bore Hole	330-01-BH2104	330-01-BH2104	330-01-BH2104	330-01-BH2104	

25.22-25.34

С

0.33

0.33

Axial

27.15-27.29

С

1.48

1.42

Axial

NOTES/REMARKS:

Tested as received

23.46-23.59

С

0.25

0.24

Axial

Sample/s supplied by the client

Depth From/To (m)

ls (MPa)

Is(50) (MPa)

Load Direction

Description

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30.15-30.25

#N/A

0.81

0.77

Axial



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POINT LOAD TEST REPORT					
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL	
			Request No	1893802_H2C_TR2	
Address	PO Box 1734 MILTON E	BC QLD 4064	Test Date	29/11/2018	
			Report Date	4/12/2018	
Project	Inland Rail Package 13				
Project No	1893802				
Trilab Sample No.	101582	101583	101584	101585	
Client Sample No	330-01-BH2101-C07000	330-01-BH2101-C07000	330-01-BH2101-C07000	330-01-BH2101-C07000	
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101	
Depth From/To (m)	70.20-70.33	70.33-70.47	70.47-70.60	70.60-70.73	
Description	С	С	С	С	
ls (MPa)	0.98	1.14	0.89	0.78	
ls(50) (MPa)	1.04	1.20	0.95	0.84	
Load Direction	Diametral	Diametral	Diametral	Diametral	
Trilab Sample No.	101586	101590	101586	101590	
Client Sample No	330-01-BH2101-C07000	330-01-BH2101-C07200	330-01-BH2101-C07200	330-01-BH2101-C07200	
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101	
Depth From/To (m)	70.73-70.86	72.36-72.49	72.03-72.15	72.49-72.61	

С

0.34

0.36

Diametral

С

0.42

0.45

Diametral

NOTES/REMARKS:

Tested as received

С

0.94

1.00

Diametral

Sample/s supplied by the client

Description

ls (MPa)

Is(50) (MPa)

Load Direction

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С

0.47

0.50

Diametral

 Laboratory No. 9926

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 Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details.

 Trilab Pty Ltd
 ABN 25 065 630 506



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POINT LOAD TEST REPORT						
Client	Golder Associates Pty Limited		Report No.	GA101582-101767-PL		
				Request No	1893802_H2C_TR2	
Address	PO Box 1734 MILTON E	BC QL	D 4064	Test Date	29/11/2018	
				Report Date	4/12/2018	
Project	Inland Rail Package 13					
Project No	1893802					
Trilab Sample No.	101593 101594		101602	101603		
Client Sample No	330-01-BH2101-C07200	330-01-BH2101-C07200		330-01-BH2101-C08100	330-01-BH2101-C08100	
Bore Hole	330-01-BH2101	330-01-BH2101		330-01-BH2101	330-01-BH2101	
Depth From/To (m)	72.61-72.74	72.74-72.81		81.43-81.53	81.53-81.63	
Description	С	сс		С	С	
ls (MPa)	0.21	0.34		0.75	0.79	
ls(50) (MPa)	0.23	0.36		0.80	0.84	
Load Direction	Diametral	Diametral		Diametral	Diametral	
Trilab Sample No.	101604	101	1605	101606	101609	
Client Sample No	330-01-BH2101-C08100	330-01-BH2	2101-C08100	330-01-BH2101-C08100	330-01-BH2101-C08610	

330-01-BH2101

81.74-81.84

С

0.95

1.02

Diametral

330-01-BH2101

81.84-81.93

С

1.03

1.10

Diametral

NOTES/REMARKS:

Tested as received

330-01-BH2101

81.63-81.74

С

0.76

0.80

Diametral

Sample/s supplied by the client

Bore Hole

Description

Depth From/To (m)

ls (MPa)

Is(50) (MPa)

Load Direction

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330-01-BH2101

86.10-86.18

С

0.42

0.45

Diametral



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POINT LOAD TEST REPORT					
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL	
			Request No	1893802 H2C TR2	
Address	PO Box 1734 MILTON E	BC QLD 4064	Test Date	29/11/2018	
			Report Date	4/12/2018	
Project	Inland Rail Package 13				
Project No	1893802				
Trilab Sample No.	101610	101611	101612	101613	
Client Sample No	330-01-BH2101-C08610	330-01-BH2101-C08610	330-01-BH2101-C08610	330-01-BH2101-C08610	
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101	
Depth From/To (m)	86.34-86.42	86.42-86.49	86.49-86.57	86.57-86.66	
Description	С	С	С	С	
ls (MPa)	0.16	0.31	0.34	0.11	
ls(50) (MPa)	0.17	0.33	0.36	0.11	
Load Direction	Diametral	Diametral	Diametral	Diametral	
Trilab Sample No.	101616	101617	101618	101619	
Client Sample No	330-01-BH2101-C08700	330-01-BH2101-C08700	330-01-BH2101-C08700	330-01-BH2101-C08700	
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101	
Depth From/To (m)	87.21-87.28	87.28-87.35	87.35-87.42	87.42-87.50	

С

0.53

0.57

Diametral

С

0.20

0.21

Diametral

NOTES/REMARKS:

Tested as received

С

0.59

0.64

Diametral

Sample/s supplied by the client

Description

ls (MPa)

Is(50) (MPa)

Load Direction

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С

0.48

0.51

Diametral



 Laboratory No. 9926

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POINT LOAD TEST REPORT						
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL		
			Request No	1893802_H2C_TR2		
Address	PO Box 1734 MILTON E	3C QLD 406	⁴ Test Date	29/11/2018		
			Report Date	4/12/2018		
Project	Inland Rail Package 13					
Project No	1893802					
Trilab Sample No.	101625	101627	101628	101635		
Client Sample No	330-01-BH2101-C09100	330-01-BH2101-C0910	330-01-BH2101-C09100	330-01-BH2101-C09600		
Bore Hole	330-01-BH2101 330-01-BH2101		330-01-BH2101	330-01-BH2101		
Depth From/To (m)	91.05-91.15	91.05-91.15 91.32-91.42		96.21-96.31		
Description	С	С	С	С		
ls (MPa)	0.01	0.02	0.09	0.65		
Is(50) (MPa)	0.01 0.03		0.09	0.69		
Load Direction	Diametral	Diametral	Diametral	Diametral		
Trilab Sample No.	101636	101637	101638	101639		
Client Sample No	330-01-BH2101-C09600	330-01-BH2101-C0960	330-01-BH2101-C09600	330-01-BH2101-C09600		
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101		
Depth From/To (m)	96.31-96.41	96.42-96.52	96.52-96.63	96.63-96.73		
Description	С	С	С	С		

1.43

1.48

Diametral

1.01

1.06

Diametral

NOTES/REMARKS:

Tested as received

0.74

0.80

Diametral

Sample/s supplied by the client

ls (MPa)

Is(50) (MPa)

Load Direction

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0.78

0.84

Diametral



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	POI	NT LOAD TEST R Test Method: AS 4133.4.1	EPORT	
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL
			Request No	1893802_H2C_TR2
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	29/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101647	101648	101651	101661
Client Sample No	330-01-BH2101-C10460	330-01-BH2101-C10460	330-01-BH2101-C10820	330-01-BH2101-C11400
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101
Depth From/To (m)	104.69-104.80	104.80-104.90	108.90-109	114.16-114.25
Description	С	С	С	С
ls (MPa)	0.16	0.07	0.05	1.89
ls(50) (MPa)	0.17	0.08	0.05	1.99
Load Direction	Diametral	Diametral	Diametral	Diametral
Trilab Sample No.	101662	101663	101664	101665
Client Sample No	330-01-BH2101-C11400	330-01-BH2101-C11400	330-01-BH2101-C11400	330-01-BH2101-C11400
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101
Depth From/To (m)	114.25-114.37	114.37-114.50	114.50-114.62	114.62-114.75
Description	С	С	С	С
ls (MPa)	1.12	1.33	1.05	1.76

NOTES/REMARKS:

Tested as received

1.20

Diametral

Is(50) (MPa)

Load Direction

Sample/s supplied by the client

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1.88

Diametral



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1.39

Diametral

1.13

Diametral



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POINT LOAD TEST REPORT Test Method: AS 4133.4.1 Golder Associates Pty Limited Client **Report No.** GA101582-101767-PL 1893802 H2C TR2 **Request No** PO Box 1734 MILTON BC QLD 4064 Address **Test Date** 29/11/2018 4/12/2018 **Report Date** Project Inland Rail Package 13 **Project No** 1893802 Trilab Sample No. 101674 101675 101676 101677

Client Sample No	330-01-BH2101-C12030	330-01-BH2101-C12030	330-01-BH2101-C12030	330-01-BH2101-C12030
Bore Hole	330-01-BH2101	330-01-BH2101	330-01-BH2101	330-01-BH2101
Depth From/To (m)	120.33-120.42	120.53-120.63	120.63-120.71	120.71-120.77
Description	С	С	С	С
ls (MPa)	0.51	0.52	0.23	0.52
Is(50) (MPa)	0.55	0.56	0.25	0.56
Load Direction	Diametral	Diametral	Diametral	Diametral

Trilab Sample No.	101678	101687	101688	101689
Client Sample No	330-01-BH2101-C12030	330-01-BH2102-C00365	330-01-BH2102-C00365	330-01-BH2102-C00365
Bore Hole	330-01-BH2101	330-01-BH2102	330-01-BH2102	330-01-BH2102
Depth From/To (m)	120.81-120.90	3.80-3.88	3.88-3.94	3.94-4.00
Description	С	С	С	С
ls (MPa)	0.17	0.28	0.31	0.38
Is(50) (MPa)	0.18	0.28	0.31	0.38
Load Direction	Diametral	Diametral	Diametral	Diametral

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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 Laboratory No. 9926

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POINT LOAD TEST REPORT Test Method: AS 4133.4.1				
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL
			Request No	1893802_H2C_TR2
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	29/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101690	101691	101696	101697
Client Sample No	330-01-BH2102-C00365	330-01-BH2102-C00365	330-01-BH2102-C01020	330-01-BH2102-C01020
Bore Hole	330-01-BH2102	330-01-BH2102	330-01-BH2102	330-01-BH2102
Depth From/To (m)	4.00-4.08	4.08-4.14	10.38-10.45	10.45-10.52
Description	С	С	С	С
ls (MPa)	0.28	0.00	0.73	1.95
ls(50) (MPa)	0.27	0.00	0.73	1.90
Load Direction	Diametral	Diametral	Diametral	Diametral
Trilab Sample No.	101698	101699	101700	101704
Client Sample No	330-01-BH2102-C01020	330-01-BH2102-C01020	330-01-BH2102-C01020	330-01-BH2102-C02046
Bore Hole	330-01-BH2102	330-01-BH2102	330-01-BH2102	330-01-BH2102
Depth From/To (m)	10.52-10.60	10.60-10.69	10.69-10.78	20.50-20.60
Description	С	С	С	С

1.37

1.36

Diametral

1.32

1.31

Diametral

NOTES/REMARKS:

Tested as received

0.69

0.69

Diametral

Sample/s supplied by the client

ls (MPa)

Is(50) (MPa)

Load Direction

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0.17

0.17

Diametral



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POINT LOAD TEST REPORT Test Method: AS 4133.4.1				
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL
			Request No	1893802_H2C_TR2
Address	PO Box 1734 MILTON E	BC QLD 4064	Test Date	29/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101705	101706	101707	101708
Client Sample No	330-01-BH2102-C02046	330-01-BH2102-C02046	330-01-BH2102-C02046	330-01-BH2102-C02046
Bore Hole	330-01-BH2102	330-01-BH2102	330-01-BH2102	330-01-BH2102
Depth From/To (m)	20.60-20.68	20.68-20.76	20.76-20.85	20.85-20.95
Description	С	С	С	С
ls (MPa)	0.03	0.15	0.05	0.18
Is(50) (MPa)	0.03	0.15	0.05	0.18
Load Direction	Diametral	Diametral	Diametral	Diametral
Trilab Sample No.	101726	101728	101730	101732
Client Sample No	330-01-BH2103-C01700	330-01-BH2103-C01800	330-01-BH2103-C01920	330-01-BH2103-C02175
Bore Hole	330-01-BH2103	330-01-BH2103	330-01-BH2103	330-01-BH2103
Depth From/To (m)	17.15-17.38	18.00-18.13	19.42-19.55	21.75-21.85
Description	С	С	С	С

0.22

0.21

Diametral

0.17

0.16

Diametral

NOTES/REMARKS:

Tested as received

0.12

0.12

Diametral

Sample/s supplied by the client

ls (MPa)

Is(50) (MPa)

Load Direction

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0.16

0.16

Diametral



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	POI	NT LOAD TEST R	REPORT	
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	29/11/2018
Project	Inland Rail Package 13		Report Date	4/12/2016
Project No	1893802			
Trilab Sample No.	101734	101736	101737	101753
Client Sample No	330-01-BH2103-C02285	330-01-BH2103-C02555	330-01-BH2103-C02800	330-01-BH2104-C01600
Bore Hole	330-01-BH2103	330-01-BH2103	330-01-BH2103	330-01-BH2104
Depth From/To (m)	22.90-23.00	27.30-27.40	28.00-28.10	16.00-16.11
Description	С	С	С	С
ls (MPa)	0.15	0.67	0.44	0.20
ls(50) (MPa)	0.15	0.66	0.44	0.20
Load Direction	Diametral	Diametral	Diametral	Diametral
Trilab Sample No.	101755	101758	101759	101761
Client Sample No	330-01-BH2104-C01965	330-01-BH2104-C02152	330-01-BH2104-C02346	330-01-BH2104-C02520
Bore Hole	330-01-BH2104	330-01-BH2104	330-01-BH2104	330-01-BH2104
Depth From/To (m)	19.74-19.86	21.86-21.96	23.46-23.59	25.22-25.34
Description	С	С	С	С

0.11

0.11

Diametral

0.28

0.28

Diametral

NOTES/REMARKS:

Tested as received

0.31

0.32

Diametral

Sample/s supplied by the client

ls (MPa)

Is(50) (MPa)

Load Direction

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1.44

1.42

Diametral



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	POI	NT LOAD TEST R	EPORT	
Client	Golder Associates Pty L	imited	Report No.	GA101582-101767-PL
			Request No	1893802 H2C TR2
Address	PO Box 1734 MILTON B	BC QLD 4064	Test Date	29/11/2018
			Report Date	4/12/2018
Project	Inland Rail Package 13			
Project No	1893802			
	1		1	
Trilab Sample No.	101765	101767		
Client Sample No	330-01-BH2104-C02700	330-01-BH2104-C03000		
Bore Hole	330-01-BH2104	330-01-BH2104		
Depth From/To (m)	27.15-27.29	30.15-30.25		
Description	С	С		
İs (MPa)	0.76	0.43		
Is(50) (MPa)	0.75	0.42		
Load Direction	Diametral	Diametral		
	Γ	Γ	Γ	1
Trilab Sample No.				
Client Sample No				
Bore Hole				
Depth From/To (m)				
Description				
Is (MPa)				
Is(50) (MPa)				
NOTES/REMARKS:	Tested as received			
Sample/s supplied by the	e client			Page 10 of 10 REP02102
This documen accreditation required ISO/IEC 17025 - To and/or measurement to A	nt is issued in accordance with NAT. uirements. Accredited for compliance esting. The results of the tests, calil ents included in this document are tr ustralian/National Standards. ations and tests performed apply	A's ce with brations, aceable only to the specific instrument or	sample at the time of test	TECHNICAL TECHNICAL Laboratory No. 9926 unless otherwise clearly stated.



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POINT LOAD TEST REPORT				
Client	Golder Associates Pty L	imited	Report No.	GA101839-101848-PL
			Request No	1893802_H2C_TR3
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	2/01/2019
			Report Date	7/01/2019
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101839	101840	101841	101843
Client Sample No	330-01-BH2306-C00440	330-01-BH2306-C00650	330-01-BH2306-C01150	330-01-BH2306-C01500
Bore Hole	330-01-BH2306	330-01-BH2306	330-01-BH2306	330-01-BH2306
Depth From/To (m)	4.44-4.51	6.64-6.72	11.58-11.64	15.59-15.65
Description	С	С	С	С
ls (MPa)	0.30	0.81	0.83	1.38
ls(50) (MPa)	0.29	0.82	0.83	1.28
Load Direction	Diametral	Diametral	Diametral	Diametral
Trilab Sample No.	101844	101845	101847	101848
Client Sample No	330-01-BH2306-C01850	330-01-BH2306-C01900	330-01-BH2306-C02150	330-01-BH2306-C02400
Bore Hole	330-01-BH2306	330-01-BH2306	330-01-BH2306	330-01-BH2306
Depth From/To (m)	18.89-18.97	19.14-19.23	21.71-21.81	24.43-24.51

С

0.27

0.27

Diametral

С

0.48

0.48

Diametral

NOTES/REMARKS:

Tested as received

С

0.38

0.36

Diametral

Sample/s supplied by the client

Description

ls (MPa)

Is(50) (MPa)

Load Direction

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С

0.52

0.53

Diametral

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	POI	NT LOAD TEST F		
Client	Golder Associates Pty L	imited	Report No.	GA101839-101848-PL
			Request No	1893802_H2C_TR3
Address	PO Box 1734 MILTON E	3C QLD 4064	Test Date	2/01/2019
			Report Date	7/01/2019
Project	Inland Rail Package 13			
Project No	1893802			
Trilab Sample No.	101839	101840	101841	101843
Client Sample No	330-01-BH2306-C00440	330-01-BH2306-C00650	330-01-BH2306-C01150	330-01-BH2306-C01500
Bore Hole	330-01-BH2306	330-01-BH2306	330-01-BH2306	330-01-BH2306
Depth From/To (m)	4.40-4.44	6.59-6.64	11.54-11.58	15.55-15.59
Description	С	С	С	С
ls (MPa)	0.35	0.15	1.51	0.89
Is(50) (MPa)	0.34	0.15	1.51	0.91
Load Direction	Axial	Axial	Axial	Axial

Trilab Sample No.	101844	101845	101847	101848
Client Sample No	330-01-BH2306-C01850	330-01-BH2306-C01900	330-01-BH2306-C02150	330-01-BH2306-C02400
Bore Hole	330-01-BH2306	330-01-BH2306	330-01-BH2306	330-01-BH2306
Depth From/To (m)	18.79-18.84	19.09-19.14	21.81-21.87	24.39-24.43
Description	С	С	С	С
ls (MPa)	0.44	0.12	0.29	0.87
ls(50) (MPa)	0.47	0.13	0.30	0.90
Load Direction	Axial	Axial	Axial	Axial

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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Uniaxial Compressive Strength



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Average Sample Di Sample Height (mm Duration of Test (m Rate of Displaceme Mode of Failure	iameter (mm) n) in) ent (mm/min) LIENT: ROJECT: AB SAMPLE No. OREHOLE:	51.7 141.7 25.23 0.10 Shear Golder Associates Pty Inland Rail Package 1 101411 330-01-BH2203	Moist Wet I Dry D Bedd Test	L ture Content (%) Density (t/m ³) Density (t/m ³) ding (°) Apparatus BEFORE TES DATE: 07/12/18 DEPTH: 15	4.2 2.38 2.28 Nil 100kN Compress Machine	ion
Sample Height (mm Duration of Test (m Rate of Displaceme Mode of Failure	n) in) ent (mm/min) LIENT: ROJECT: AB SAMPLE No. OREHOLE: LIENT:	141.7 25.23 0.10 Shear Golder Associates Pty Inland Rail Package 1 101411 330-01-BH2203	Wet I Dry D Bedd Test	Density (t/m ³) Density (t/m ³) Jing (°) Apparatus I BEFORE TES DATE: 07//c/18 DEPTH: 15	2.38 2.28 Nil 100kN Compress Machine	ion
Duration of Test (m Rate of Displaceme Mode of Failure	in) ent (mm/min) LIENT: ROJECT: AB SAMPLE No. OREHOLE:	25.23 0.10 Shear Golder Associates Pty Inland Rail Package 1 101411 330-01-BH2203	Dry E Bedd Test	Density (t/m ³) ling (°) Apparatus I BEFORE TES DATE: $07/12/18$ DEPTH: 15	2.28 Nil 100kN Compress Machine	ion
Rate of Displacement Mode of Failure	ent (mm/min) LIENT: ROJECT: AB SAMPLE No. OREHOLE: LIENT:	0.10 Shear	Bedd Test	ding (°) Apparatus BEFORE TES DATE: 07/12/18 DEPTH: 15	Nil 100kN Compress Machine	ion
Mode of Failure	LIENT: ROJECT: AB SAMPLE No. OREHOLE:	Shear Golder Associates Pty Inland Rail Package 1 101411 330-01-BH2203	Test.	Apparatus BEFORE TES DATE: 07/12/18 DEPTH: 15	100kN Compress Machine	ion
	LIENT: ROJECT: AB SAMPLE No. OREHOLE:	Golder Associates Pty Inland Rail Package 1 101411 330-01-BH2203	Limited 3	BEFORE TES DATE: 07/12/18 DEPTH: 15	ST	
	ROJECT: AB SAMPLE No. OREHOLE:	Inland Rail Package 1 101411 330-01-BH2203	3	BEFORE TES DATE: 07/12/18 DEPTH: 15	5T	
La B4 C P L B	AB SAMPLE No. OREHOLE:	101411 330-01-BH2203		DATE: 07/12/18 DEPTH: 15		
B C P L B	OREHOLE:	330-01-BH2203		DEPTH: 15		
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L. B	ROJECT:	Inland Rail Package 1	3	AFTER TES	T	
В	AB SAMPLE No.	101411		DATE: 07/12/18	8	
	OREHOLE:	330-01-BH2203		DEPTH: 15		
		Contractions .			1000	
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Client Golder A	ssociates	Pty Limited		Report No.	GA101415-MOD
Average Sample Diamet	er (mm)	51.8	Moist	L ure Content (%)	2.3
Sample Height (mm)		141.2	Wet [Density (t/m ³)	2.46
Duration of Test (min)		28.15	Dry D	ensity (t/m ³)	2.40
Rate of Displacement (m	m/min)	0.10	Bedd	ing (°)	30
Mode of Failure	,	Conical	Test	Apparatus	100kN Compression Machine
CLIEN	T:	Golder Associates P	ty Limited		
PROJE	ECT:	Inland Rail Package	13	BEFORE TH	CST
LAB SA	MPLE No.	101415		DATE: 06/12/18	
BORE	HOLE:	330-01-BH2203		DEPTH: 19.5	
CLIENT:		Golder Associates Pty	Limited		
CLIENT: PROJEC	T: I	Golder Associates Pty nland Rail Package 13	Limited	AFTER TEST	
CLIENT: PROJEC	T: I PLE No. 1	Golder Associates Pty nland Rail Package 13 01415	Limited	AFTER TEST	
CLIENT: PROJEC LAB SAM BOREHO	T: I PLE No. 1 DLE: 3	Golder Associates Pty nland Rail Package 13 01415 30-01-BH2203	Limited 3 D D	AFTER TEST ATE: ৩৬/১৫./18 EPTH: 19.5	
CLIENT: PROJEC LAB SAM BOREHC	T: I PLE No. 1 DLE: 3	Solder Associates Pty nland Rail Package 13 01415 30-01-BH2203	Limited 3 D D	AFTER TEST ATE: os/12/18 EPTH: 19.5	
CLIENT: PROJEC LAB SAM BOREHC	T: I PLE No. 1 DLE: 3	Golder Associates Pty nland Rail Package 13 01415 30-01-BH2203	Limited B D D	AFTER TEST ATE: ob/v2/18 EPTH: 19.5	
Otes/Remarks:	T: I PLE No. 1 DLE: 3 Output	Colder Associates Pty Inland Rail Package 13 01415 30-01-BH2203	Limited D D D Tested as	AFTER TEST ATE: os/v2/18 EPTH: 19.5	Page 2 of 2 REP134

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Client	Golder Associates	s Pty Limited		Report No.	GA101428-MOD	
Average Sample Diameter (mm)		51.6	Moist	ure Content (%)	9.4	
Sample Heigh	it (mm)	138.0	Wet [Density (t/m ³)	2.11	
Duration of Test (min)		18.33	Dry D	ensity (t/m³)	1.93	
Rate of Displacement (mm/min)		0.10 Bedding (°)		Nil		
Mode of Failure		Shear	Test	Apparatus	100kN Compression Machine	
	CLIENT:	Golder Associates Pt	v Limited	1		
	PROJECT:	Inland Rail Package	13	BEFORE T	FST	
	LAB SAMPLE No.	101428	C-R Print	DATE: OU /12 /	0	
	BOREHOLE:	330-01-BH2207		DEPTH: 12	3	
			2			
	CLIENT: PROJECT:	Golder Associates Pt Inland Rail Package	y Limiteo 13			
- 1	LADGAMDIEN	101.120		BEFORE I	EST	
- 1	BOREHOLE:	330-01-BH2207		DATE: 04/12/18 DEPTH: 12	3	
otes/Remarks:						
ample/s supplied by	client Pho	oto not to scale	Tested as	received.	Page 2 of 2 REP1340	
Accredited The results of the this docume	d for compliance with ISO/IEC e tests, calibrations, and/or m nt are traceable to Australian Tested at Trilab Brisbane Lat	C 17025 - Testing. leasurements included in /National Standards. poratory.			ACCREDITE FOR TECHNICAL COMPLETENCE	



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UNIAXIAL	COMPRESS	IVE STRENGTH Test Method: AS 4133.4.3.2	& DEI	FORMATION	TEST REPORT
Client	Golder Associates	s Pty Limited		Report No.	GA101430-MOD
Average Samp	le Diameter (mm)	52.1	Moistu	ure Content (%)	5.8
Sample Height (mm)		140.6	Wet D	Density (t/m ³)	2.36
Duration of Test (min)		24.87	Drv D	ensity (t/m ³)	2.23
Rate of Displacement (mm/min)		0.10	Beddi	ng (°)	Nil
Mode of Failure		Shear	Test Apparatus		100kN Compression Machine
	CLIENT.	Golder Associates Ptv I	imited		
	PROJECT:	Inland Rail Package 13		BEFORE TE	ST
-	AD CAMPLE No	101420		DATE: OK/12/18	
	BORFHOLE.	101430 330-01-BH2207		DEPTH: 14	
	BOREHOLE.	550-01-0112207			
	CLIENT	Golder Associates Pty I	imited		
	PROJECT:	Inland Rail Package 13		AFTER TES	r
10	LAB SAMPLE No.	101430	r	ATE: 04/12/18	·
	BOREHOLE:	330-01-BH2207	I	DEPTH: 14	
Notes/Remarks: Sample/s supplied by c Accredited The results of the	client Photogram	oto not to scale C 17025 - Testing. neasurements included in	Tested as	received.	Page 2 of 2 REP13402
this document	this document are traceable to Australian/National Standards. Tested at Trilab Brisbane Laboratory.				



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		Test Method: AS 4133.4.	3.2 & AS 41	33.1.1.1	
Client Golder A	Associates	Pty Limited		Report No.	GA101433-MOD
Average Sample Diameter (mm)		52.2	Moist	ure Content (%)	6.0
Sample Height (mm)	, , , , , , , , , , , , , , , , , , ,	139.8	Wet	Density (t/m ³)	2.40
Duration of Test (min)		53.48	Dry D	Density (t/m ³)	2.27
Rate of Displacement (mm/min)		0.10	Bedd	ing (°)	10
Mode of Failure		Conical	Test	Apparatus	100kN Compression Machine
CLIEN	T:	Golder Associates Pt	y Limited	1	
PROJE	CT:	Inland Rail Package	13	BEFORE TI	EST
LAB SA	MPLE No.	101433		DATE:5/12/18	
BOREH	HOLE:	330-01-BH2207	17.5	DEPTH: 17.00 -	17.14
CLIEN	T: ECT:	Golder Associates P	ty Limite	d	
11001		Imanu Kan I ackage	15	AFTER TE	ST
LAB SA BORFI	MPLE No.	101433 330 01 PH2207	-	DATE: 5/12/18	12.11
DORE		330-01-BH2207	· . · · · ·	DEPTH: 17.00 -	-17.14
lotes/Remarks:					
Sample/s supplied by client	Phot	to not to scale	Tested as	s received.	Page 2 of 2 REP1340
Accredited for complianc The results of the tests, calibrat this document are traceable Tested at Trilat	17025 - Testing. easurements included in National Standards. pratory.			KATA KATA KOMPETENCE	



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Client	Golder Associates	Pty Limited		Report No.	GA101435-MOD
Average Samp	le Diameter (mm)	51.7	Mois	sture Content (%)	3.6
Sample Height	: (mm)	143.8	Wet	Density (t/m ³)	2.40
Duration of Tes	st (min)	44.22	Dry	Density (t/m ³)	2.32
Rate of Displacement (mm/min)		0.10 Bedding (°)		20	
Mode of Failure		Conical	Test	Apparatus	100kN Compression Machine
	CLIENT	Colder Associatos Pt	u Limito	d	
	PROJECT:	Inland Rail Package	13	DEFODE	
	LADSAMDLEN	101/05		BEFORE TE	281
	BOREHOLE:	101435 330-01-BH2207		DATE: 04/12/1: DEPTH: 20	8.
	CLIENT: PROJECT:	Golder Associates Pty Inland Rail Package	Limited	1	
		101102		AFIERIES	
	BORFHOLE:	101435 330-01-BH2207	DATE: 04/12/18		
<u>otes/Remarks:</u>					
ample/s supplied by	client Pho	to not to scale	lested a	as received.	Page 2 of 2 REP134
Accredited The results of the	for compliance with ISO/IEC tests, calibrations, and/or m	3 17025 - Testing. easurements included in			NATA
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Т	ested at Trilab Brisbane Lab	oratory.			COMPETENCE

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Client	Golder Associates	Pty Limited		Report No.	GA101486-MOD	
Average Sample Diameter (mm)		51.7	Moist	ure Content (%)	6.6	
Sample Heigh	t (mm)	138.1	Wet [Density (t/m ³)	2.31	
Duration of Te	st (min)	32.13	Dry D	ensity (t/m ³)	2.17	
Rate of Displacement (mm/min)		0.10	Bedd	ing (°)	35	
Mode of Failure		Shear	Test	Test Apparatus 100kN C Machine		
	CLIENT	Colder Associates I	Pty Limitor			
	PROJECT:	Inland Rail Packag	e 13	PEEODE T	FST	
	LAD SAMDLE No.	101496	7.728	DATE: OV /C	LSI	
	BOREHOLE:	330-01-BH2224		DATE: 04/12/1 DEPTH: 22	8	
	CLIENT: PROJECT: LAB SAMPLE No.	Golder Associates F Inland Rail Packag	Pty Limited e 13	d AFTER T DATE: 0%////	EST	
	BOREHOLE:	330-01-BH2224	2	DEPTH: 22		
otes/Remarks:						
ample/s supplied by	client Pho	to not to scale	Tested as	received.	Page 2 of 2 REP13	
Accredited The results of the this docume	d for compliance with ISO/IEC e tests, calibrations, and/or m nt are traceable to Australian/	; 17025 - Testing. easurements included in National Standards.			NATA	

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UNIAXIAL	COMPRESS	IVE STRENGTH Test Method: AS 4133.4.3.1	& DEFC		N TEST REPORT
Client	Golder Associates	s Pty Limited		Report No.	GA101488-MOD
Average Sample Diameter (mm)		51.7	Moisture	Content (%)	5.9
Sample Height (mm)		140.2	Wet Der	nsity (t/m³)	2.35
Duration of Test (min)		19.88	Dry Den	sity (t/m³)	2.22
Rate of Displacement (mm/min)		0.10	Bedding	(°)	10
Mode of Failure		Axial Splitting Test		paratus	100kN Compression Machine
Γ	CLIENT:	Golder Associates Pty L	imited		
1	PROJECT:	Inland Rail Package 13		BEFORE TES	г
	LAB SAMPLE No.	101488	DAT	TE: 06/12/18	
	BOREHOLE:	330-01-BH2224	DEP	TH: 24	10 mg 200
ſ	CLIENT:	Golder Associates Pty L	imited		
	PROJECT:	Inland Rail Package 13		AFTER TEST	Г
	LAB SAMPLE No.	101488	DATE: 06/12/18		
L	BOREHOLE:	330-01-BH2224	DEP	TH: 24	
lotes/Remarks:					
ample/s supplied by cl	ient Pho	oto not to scale	Tested as rec	eived.	Page 2 of 2 REP1340
Accredited fo The results of the te this document a Te	or compliance with ISO/IE(ests, calibrations, and/or m are traceable to Australian sted at Trilab Brisbane Lal	C 17025 - Testing. neasurements included in /National Standards. poratory.			



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UNIAXIAL	COMPRESSI	VE STRENGTH	& DE	FORMATION	N TEST REPO	ORT
Client	Golder Associates	Pty Limited	2 & A3 41	Report No.	GA101490-MOI	C
Average Sample Diameter (mm)		51.5	Moist	ture Content (%)	7.9	
Sample Height (mm)	123.4	Wet	Density (t/m°)	2.29	
Duration of Test (min)		37.23	Dry D	Density (t/m³)	2.12	
Rate of Displacement (mm/min)		0.10	Bedd	ling (°)	20	
Mode of Failure		Conical	Test Apparatus 100kN Co Machine		100kN Compres Machine	ssion
Sec	CI IENT.	Colden Associates Ptr	Limitod			
	PROJECT:	Inland Rail Package 1	3	BEFORE TE	ST	
	LAP SAMPLE No.	101400		DATE: 07/12/13	R .	
	BOREHOLE:	330-01-BH2224		DEPTH: 26		
				Provide State	Same Service	
1.1		English and	•	1924	Contract of the local division of the local	
		No. Constanting				
		A CONTRACTOR OF THE OWNER				
	ALL DE LOT			i gefilmfil		
	CLIENT:	Golder Associates Pty	Limited			
1.1	PROJECT:	Inland Rail Package 1	3	AFTER TES	ST	
	LAB SAMPLE No.	101490		DATE: 07/12/18.		
	BOREHOLE:	330-01-BH2224		DEPTH: 26		
		and the second second				
			Contraction of the		San State Law	
		En la la la la la la la la la la la la la	San Sales			
				and the		
					Caller Land	
					1.	
		States and states of	- Watta	A Real Providence	1	
Notes/Remarks:						
The	e length to diameter ratio	falls outside the test method	limits of 2	2.5:1 to 3.0:1.		_
Sample/s supplied by cli	ent Phot	to not to scale	Tested as	s received.	Page 2 of	2 REP13402
Accredited fo	or compliance with ISO/IEC	17025 - Testing.				
this document a	are traceable to Australian/	National Standards.				•
Teo	sted at Trilab Brisbane Labo	oratory			ACCREDITED FOI TECHNICAL COMPETENCI	9 2
						ory No. 9926



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UNIAXIAL COMPRESS	SIVE STRENGTH	& DEI		N TEST REPORT
Client Golder Associate	es Pty Limited		Report No.	GA101509-MOD
Average Sample Diameter (mm)	51.8	Moistu	ure Content (%)	3.5
Sample Height (mm)	133.1	Wet D	ensity (t/m ³)	2.25
Duration of Test (min)	34.53	Dry D	ensity (t/m³)	2.18
Rate of Displacement (mm/min)	0.10	Beddi	ng (°)	5
Mode of Failure	Conical	Test Apparatus		100kN Compression Machine
CLIENT	Golder Associates Ptv	Limited		
PROJECT:	Inland Rail Package 1	3	BEFORE T	EST
LAD SAMDLE NO	101500		DATE: OU/12	lin
BOREHOLE:	330-01-BH2301	DATE: 04/12/18, DEPTH: 4.3		
CLIENT:	Golder Associates Pty	Limited		
PROJECT:	Inland Rail Package 1	3	AFTER TES	T
LAB SAMPLE No	101509	1	DATE: 04/12/18	-
BOREHOLE:	330-01-BH2301	1	DEPTH: 4.3	100 C
Notes/Remarks:				
Sample/s supplied by client Pr	noto not to scale	Tested as	received.	Page 2 of 2 REP13402
Accredited for compliance with ISO/IE The results of the tests, calibrations, and/or r this document are traceable to Australia Tested at Trilab Brisbane La	EC 17025 - Testing. measurements included in n/National Standards. aboratory.			TECHNICAL COMPETENCE

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UNIAXIA	L COMPRESS	IVE STRENGTH Test Method: AS 4133.4.3.	& DE	FORMATION 33.1.1.1	N TEST REPORT
Client	Golder Associates	Pty Limited		Report No.	GA101513-MOD
Average Sam	ple Diameter (mm)	51.7	Moist	ure Content (%)	8.3
Sample Heigh	it (mm)	116.2	Wet D	Density (t/m ³)	2.14
Duration of Te	est (min)	37.18	Dry D	ensity (t/m³)	1.97
Rate of Displa	icement (mm/min)	0.10	Beddi	ing (°)	Nil
Mode of Failu	re	Shear	Test A	Apparatus	100kN Compression Machine
	CLIENT:	Golder Associates Ptv	Limite	d	
	PROJECT:	Inland Rail Package	13	BEFORE T	TEST
	LAB SAMPLE No.	101513		DATE: 05/12/18	
	BOREHOLE:	330-01-BH2301		DEPTH: 7.3	
			ter		
	CLIENT:	Golder Associates Pty	Limited	1	
	PROJECT:	Inland Rail Package 1	13	AFTER TI	EST
	LAB SAMPLE No.	101513		DATE: 05 /12 /18	8
	BOREHOLE:	330-01-BH2301		DEPTH: 7.3	
otes/Remarks:	The length to diameter rati	o falls outside the test method	limits of 2.	.5:1 to 3.0:1.	
ample/s supplied by	client Pho	to not to scale	Tested as	received.	Page 2 of 2 REP134
Accredite The results of the this docume	d for compliance with ISO/IEC e tests, calibrations, and/or m int are traceable to Australian/	C 17025 - Testing. easurements included in National Standards.			
	Tested at Trilab Brisbane Lab	oratory.			TECHNICAL COMPETENCE Laboratory No. 992
he results of calibr	ations and tests performed Reference should be mad	apply only to the specific inst te to Trilab's "Standard Terms Trilab Ptv Ltd	rument or s and Condi	sample at the time of te tions of Business" for f	est unless otherwise clearly state urther details.

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Client	Golder Associates	s Pty Limited		Report No.	GA101515-MOD
Average Sampl	e Diameter (mm)	50.7	Mois	ture Content (%)	2.9
Sample Height	(mm)	131.6	Wet	Density (t/m ³)	2.26
Duration of Tes	t (min)	29.75	Dry I	Density (t/m ³)	2.19
Rate of Displac	splacement (mm/min) 0.10 Bedding (°)		ding (°)	Nil	
Mode of Failure	•	Shear	Test	Apparatus	100kN Compression Machine
	CLIENT:	Golder Associates Ptv	Limiter		
1	PROJECT:	Inland Rail Package 13	3	DEFODE TI	
	AR SAMPLE No	101515		DATE DATE	.51
	BOREHOLE:	330-01-BH2301		DEPTH: 77	
		550-01-0112501		DEI III. 7.7	
	CLIENT:	Golder Associates Pty	Limite	d	
	PROJECT:	Inland Rail Package 1	3	AFTER TE	ST
	LAB SAMPLE No.	101515		DATE: 05/12/18	
	BOREHOLE:	330-01-BH2301	167.T	DEPTH: 7.7	
otes/Remarks:					
ample/s supplied by c	lient Ph	oto not to scale	Tested a	s received.	Page 2 of 2 REP134
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Client Go	Ider Associates	s Pty Limited	/ \ 7 1	Report No.	GA101518-MOD
Average Sample D	iameter (mm)	51.5	Moist	ure Content (%)	2.8
Sample Height (mn	n)	132.4	Wet [Density (t/m ³)	2.35
Duration of Test (m	nin)	31.80	Dry D	ensity (t/m³)	2.29
Rate of Displaceme	ent (mm/min)	0.10 Bedding		ing (°)	30
Mode of Failure		Conical	Test	Apparatus	100kN Compression Machine
CLI	IENT:	Golder Associates Ptv	Limited		
PRO	OJECT:	Inland Rail Package 1	3	BEFORE TI	FST
LAB	SAMPLE No	101519		DATE: (/a/a	
BOI	REHOLE:	330-01-BH2301		DEPTH: 11.4	
		-			San State Con
CL	JENT:	Golder Associates Pty	Limite	d	
CL PR	LIENT: COJECT:	Golder Associates Pty Inland Rail Package	Limite	d AFTER T	EST
CL PR LA	JIENT: COJECT: B SAMPLE No.	Golder Associates Pty Inland Rail Package	Limite	d AFTER TI DATE: 06/12/18	EST
CL PR LA BO	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	Limite	d AFTER TI DATE: 06/12/18 DEPTH: 11.4	EST
CL PR LA BO	JIENT: ROJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	V Limite 13	d AFTER TI DATE: ٥٤/١٦ (١٤ DEPTH: 11.4	EST
CL PR LA BO	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	Limite	d AFTER TI DATE: ٥٢/١٢ (١٤ DEPTH: 11.4	EST
CL PR LA BO	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	v Limite 13	d AFTER TI DATE: 06/12 (18 DEPTH: 11.4	EST
CL PR LA BO	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	v Limite 13	d AFTER TI DATE: o6/12 [18 DEPTH: 11.4	EST
CL PR LA BO	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	Limite 13	d AFTER TI DATE: 06/12 (18 DEPTH: 11.4	EST
CL PR LA BO	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	v Limite 13	d AFTER TI DATE: o6/12/18 DEPTH: 11.4	EST
CL PR LA BO	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	v Limite 13	d AFTER TI DATE: o6/12 [18 DEPTH: 11.4	EST
CL PR LA BO	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	v Limite 13	d AFTER TI DATE: 06/12 (18 DEPTH: 11.4	EST
CL PR LA BO	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	v Limite 13	d AFTER TI DATE: o6/12/18 DEPTH: 11.4	EST
Votes/Remarks:	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	v Limite 13	d AFTER TI DATE: o6/12/18 DEPTH: 11.4	EST
Notes/Remarks: Sample/s supplied by client	JIENT: COJECT: B SAMPLE No. DREHOLE:	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	Y Limite 13	d AFTER TI DATE: o6/r2/18 DEPTH: 11.4	EST
Notes/Remarks: Sample/s supplied by client Accredited for co	DIENT: COJECT: B SAMPLE No. DREHOLE: DREHOLE: Photompliance with ISO/IEC	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	Y Limite 13 Tested as	d AFTER TI DATE: o6/12/18 DEPTH: 11.4	EST
Votes/Remarks: Sample/s supplied by client Accredited for co The results of the tests, this document are tr	JIENT: COJECT: B SAMPLE No. DREHOLE: DREHOLE: Pho propriations and/or m raceable to Australian	Golder Associates Pty Inland Rail Package 101518 330-01-BH2301	Tested as	d AFTER TI DATE: 06/12/18 DEPTH: 11.4	EST Page 2 of 2 REP13402

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UNI	AXIAL COMPRES	SSIVE STRENGTH	& DEFC	RMATION T	EST REPORT	
Client	Golder Associates Pty L	imited	100.4.0.1	Report No.	GA101535-MOD	
Average Sample Di	ameter (mm)	51.9	Moistur	e Content (%)	0.3	
Sample Height (mm)	141.5	Wet De	nsity (t/m ³)	2.34	
Duration of Test (mi	in)	9.17	Dry Density (t/m ³)		2.33	2.33
Rate of Loading (MI	Pa/min)	11.51	Beddin	a (°)	35	
Mode of Failure		Disintegration	Test Ap	paratus	Kelba 1000kN Load	Cell
				al in the left		
	CLIENT:	Golder Associates Pty	Limited			
100	PROJECT:	Iniand Kan Package I	3	BEFORE T	EST	
	LAB SAMPLE No. BOREHOLE:	101535 330-01-BH2301		DATE:	11/12/18	
	CLIENT:	Golder Associates Pty	Limited	-		
	PROJECT:	Inland Rail Package 1	3	AFTER TH	EST	
	LAB SAMPLE No.	101535]	DATE:	11/12/18	
	BOREHOLE:	330-01-BH2301	J	DEPTH: 21.7		
			2			
otes/Remarks:						
mple/s supplied by client	Graph	not to scale	Tested as re-	ceived.	Page 2 of 2	REP03
Accredited fo The results of the te this document	or compliance with ISO/IEC ests, calibrations, and/or mea are traceable to Australian/N	17025 - Testing. asurements included in lational Standards.		Authorised Signatory		
Te	sted at Trilab Brisbane Labo	ratory.		N. Maddison	ACCREDITED FOR TECHNICAL COMPETENCE	v No. 9926



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Client	Golder Associates	Pty Limited		Report No.	GA101541-MOD
Average Sample	e Diameter (mm)	51.6	Mois	ture Content (%)	2.2
Sample Height ((mm)	132.1	Wet	Density (t/m ³)	2.35
Duration of Test	t (min)	31.28 Dry Density (t/m ³)		Density (t/m ³)	2.30
Rate of Displacement (mm/min)		0.10 Bedding (°)		10	
Mode of Failure		Conical	Test	Apparatus	100kN Compression Machine
	CLIENT.	Caldar Associator Dtv I	imited		
	PROJECT:	Inland Rail Package 13		BEFORE TES	T
	LAB SAMPLE No.	101541		DATE: 04/12/18.	
	BOREHOLE:	330-01-BH2303		DEPTH: 2.5	
					and the second second
	CLIENT:	Golder Associates Pty L	imited		
	CLIENT: PROJECT:	Golder Associates Pty L Inland Rail Package 13	imited	AFTER TEST	
	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pty L Inland Rail Package 13 101541 330-01-BH2303	imited I I	AFTER TEST DATE: 04/12/18 DEPTH: 2.5	
	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pty L Inland Rail Package 13 101541 330-01-BH2303	imited I I	AFTER TEST DATE: 04/12/18 DEPTH: 2.5	
otes/Remarks:	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pty L Inland Rail Package 13 101541 330-01-BH2303	imited I I	AFTER TEST DATE: 04/12/18 DEPTH: 2.5	
otes/Remarks: ample/s supplied by cl	Ient Phot	Golder Associates Pty L Inland Rail Package 13 101541 330-01-BH2303	imited I I I Tested a	AFTER TEST DATE: 04/12/18 DEPTH: 2.5	Page 2 of 2 REP1340
otes/Remarks: ample/s supplied by cl Accredited fo The results of the to this document	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pty L Inland Rail Package 13 101541 330-01-BH2303	imited I I Tested a	AFTER TEST DATE: 04/12/18 DEPTH: 2.5	Page 2 of 2 REP1340

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UN	IAXIAL COMPRES	SSIVE STRENGTH	& DEF(ORMATION TEST RE	PORT	
Client	Golder Associates Pty	Limited	100.4.0.1	Report No. GA101	555-MOD	
Average Sample [Diameter (mm)	51.7	Moistu	I re Content (%)	3.9	
Sample Height (m	m)	134 0	Wet De	ensity (t/m ³)	2 26	
Duration of Test (r	min)	7 37	Dry De	(t/m^3)	2.20	
Data of Loading (/IPo/min)	5.04	Boddin		2.17	
Made of Eailure	vir a/11111)	5.04 Conicel	Deuuin	9()	50	
		Conical	Test A	pparatus Kelba ²	1000kN Load Cell	
	CLIENT:	Golder Associates Pty	Limited	1		
	PROJECT:	Inland Rail Package	13	BEFORE TEST		
	LAB SAMPLE No.	101555		DATE: 04/12/18		
	BOREHOLE:	330-01-BH2303	724	DEPTH: 7.2		
	CLIENT: PROJECT:	Golder Associates P Inland Rail Package	ty Limitee 13	d AFTER TEST		
	LAB SAMPLE N	0. 101555		DATE: 04/12/18	_	
	Interior Party in the second s					
Notes/Remarks:						
Sample/s supplied by client	Graph	not to scale	Tested as re	eceived.	Page 2 of 2 REPO	03603
Accredited The results of the this documer 1	for compliance with ISO/IEC tests, calibrations, and/or me at are traceable to Australian/N ested at Trilab Brisbane Labo	17025 - Testing. asurements included in lational Standards. ratory.		Authorised Signatory	TECHNICAL Laboratory No. 992	



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UNIAXIA	AL COMPRESS	IVE STRENGTH Test Method: AS 4133.4.3.	& DE	FORMATION	TEST REPORT
Client	Golder Associates	s Pty Limited		Report No.	GA101557-MOD
Average San	nple Diameter (mm)	52.0	Moist	ure Content (%)	3.6
Sample Heig	ht (mm)	113.1	Wet D	Density (t/m ³)	2.19
Duration of T	est (min)	22.00	Dry D	ensity (t/m³)	2.11
Rate of Displ	acement (mm/min)	0.10	Beddi	ing (°)	30
Mode of Failu	ure	Conical	Test /	Apparatus	100kN Compression Machine
	CLIENT	Colder Associates Ptv	Limited		
	PROJECT:	Inland Rail Package 1	3	BEFORE TE	ST
	LAD SAMPLE No	101557		DATE: Outration	
	BOREHOLE:	330-01-BH2303		DEPTH: 10.5	
	CLIENT: PROJECT:	Golder Associates Pty Inland Rail Package 1	Limited	AFTED TEC	
	LAD CAMPLE No.	101227		AFTER TEL	
	BOREHOLE:	330-01-BH2303		DEPTH: 10.5	<u>.</u>
Notes/Remarks:	The length to diameter rati	io falls outside the test method	limits of 2.	5:1 to 3.0:1.	
Sample/s supplied b	by client Pho	oto not to scale	Tested as	received.	Page 2 of 2 REP13402
Accredii The results of t this docum	ted for compliance with ISO/IE0 the tests, calibrations, and/or m nent are traceable to Australian	C 17025 - Testing. easurements included in /National Standards.			
_	Tested at Trilab Brisbane Lab	poratory.			COMPETENCE Laboratory No. 9926



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Client	Golder Associates	Pty Limited		Report No.	GA101561-M	
Average San	nple Diameter (mm)	51.7	Moist	ure Content (%)	6.6	
Sample Heig	Jht (mm)	132.0	Wet D	Density (t/m³)	2.21	
Duration of T	est (min)	25.50	Dry D	ensity (t/m ³)	2.07	
Rate of Displacement (mm/min) Mode of Failure		ment (mm/min) 0.10 Beddi		ing (°)	Nil	
Mode of Fail	ure	Disintegration	Test /	Apparatus	100kN Comp Machine	ression
	CLIENT:	Golder Associates Ptv	Limite	d		
	PROJECT:	Inland Rail Package	13	BEFORE	TEST	
	LAB SAMPLE No.	101561		DATE: 04/12/1	8	
	BOREHOLE:	330-01-BH2303	1 de la	DEPTH: 14.8		
	CLIENT:	Golder Associates Pty	Limited			
	PROJECT:	Inland Rail Package 1	3	AFTER TH	EST	
	LAB SAMPLE No.	101561		DATE: 04/12/18	t	
	BOREHOLE:	330-01-BH2303		DEPTH: 14.8		
					20.05	
	CE X	AL				
otes/Remarks:						
ample/s supplied l	by client Pho	oto not to scale	Tested as	received.	Page	2 of 2 REP134
Accredi The results of t this docun	ted for compliance with ISO/IEC the tests, calibrations, and/or m nent are traceable to Australian.	C 17025 - Testing. easurements included in /National Standards.			NA	
	Tested at Trilab Brisbane I at	oratory			TECH	NICAL

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UNIAXIAL	COMPRESS	IVE STRENGTH Test Method: AS 4133.4.3.1	& DE	FORMATION	I TEST REPORT
Client	Golder Associates	Pty Limited		Report No.	GA101589-MOD
Average Samp	le Diameter (mm)	60.7	Moist	ture Content (%)	7.7
Sample Height	(mm)	158.2	Wet I	Density (t/m³)	2.10
Duration of Tes	st (min)	17.33 Dr		Density (t/m ³)	1.95
Rate of Displac	ement (mm/min)	0.10 Be		ling (°)	Nil
Mode of Failure	2	Conical	Test	Apparatus	100kN Compression Machine
	CLIENT	Coldor Associatos Ptv	Limitod		
	PROJECT:	Inland Rail Package 13	3	DEFODE TE	07
	LAD CAMPLE N.	101500		BEFORE IE	51
- 1	BOREHOLE:	330-01-BH2101		DATE: 10/12/18. DEPTH: 72	
	CLIENT:	Golder Associates Ptv	imited		
	PROJECT:	Inland Rail Package 13	i l	A FTED TEC	
	LAR SAMPLE No.	101590	0	AFTER TES	1
	BOREHOLE:	330-01-BH2101	1	DATE: 10/12/18. DEPTH: 72	
Notes/Remarks:					
Sample/s supplied by o	client Pho	to not to scale	Tested as	s received.	Page 2 of 2 REP1340
Accredited The results of the this documen	for compliance with ISO/IEC tests, calibrations, and/or mu t are traceable to Australian/ ested at Trilab Brisbane Lab	: 17025 - Testing. easurements included in National Standards. oratory.			



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Client Gold	der Associates	Pty Limited		Report No.	GA101600-MOD
Average Sample Di	ameter (mm)	60.8	Mois	ture Content (%)	8.6
Sample Height (mm	ı)	162.7	Wet	Density (t/m ³)	2.23
Duration of Test (mi	, in)	21.43	Dry D	Density (t/m ³)	2.05
Rate of Displaceme	nt (mm/min)	0.10	Bedd	ling (°)	15
Mode of Failure	ζ ,	Shear	Test	Apparatus	100kN Compression Machine
			1		
	ROJECT:	Golder Associates Pty Inland Rail Package 1	3	DEFODE TECT	
				BEFORE TES	
	AB SAMPLE No.	330-01-BH2101		DATE: 10/12/18 DEPTH: 81	
CLI PRO	IENT: OJECT:	Golder Associates Pty 1 Inland Rail Package 13	Limited	AFTER TEST	<u> </u>
CLI PRO LAE BOI	IENT: OJECT: B SAMPLE No. REHOLE:	Golder Associates Pty Inland Rail Package 13 101600 330-01-BH2101	Limited 3 I 1	AFTER TEST DATE: 10/12/18. DEPTH: 81	
CLI PRO LAF BOI	IENT: OJECT: B SAMPLE No. REHOLE:	Golder Associates Pty I Inland Rail Package 13 101600 330-01-BH2101	Limited	AFTER TEST DATE: 10/12/18. DEPTH: 81	

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	ESSIVE STRENGTH	& DEFORMATION	N TEST REPORT
Client Golder Asso	ciates Pty Limited	Report No.	GA101608-MOD
Average Sample Diameter (nm) 60.3	Moisture Content (%)	7.3
Sample Height (mm)	149.6	Wet Density (t/m ³)	2.12
Duration of Test (min)	19.98	Dry Density (t/m ³)	1.98
Rate of Displacement (mm/n	nin) 0.10	Bedding (°)	Nil
Mode of Failure	Conical	Test Apparatus	100kN Compression Machine
CLIENT:	Golder Associates Ptv	Limited	
PROJECT:	Inland Rail Package 1	3 BEFORE TE	ST
LAB SAMPL	E No. 101608	DATE: 10/02/0	
BOREHOLI	C: 330-01-BH2101	DEPTH: 86.1	
CLIENT:	Golder Associates Pty	Limited	
PROJECT:	Inland Rail Package 13	AFTER TEST	
LAB SAMPI	LE No. 101608	DATE: 10/12/15	*
BOREHOL	E: 330-01-BH2101	DEPTH: 86.1	
Notes/Remarks:			
The length to diamonate Sample/s supplied by client	eter ratio falls outside the test method Photo not to scale	l limits of 2.5:1 to 3.0:1. Tested as received.	Page 2 of 2 REP13402
Accredited for compliance with The results of the tests, calibrations, a this document are traceable to Au Tested at Trilab Brisb	ISO/IEC 17025 - Testing. Ind/or measurements included in Istralian/National Standards.		ACCOUNTS ON TECHNICAL COMPETENCE Laboratory No. 9926



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UNIA	XIAL COMPRES	SIVE STRENGTH	& DEFC	ORMATION TEST R	REPORT	
Client	Golder Associates Pty L	imited	00.4.0.1	Report No. GA1	101642-MOD	
Average Sample Dia	ameter (mm)	60.9	Moistur	e Content (%)	2.5	
Sample Height (mm)		159.9	Wet De	ensity (t/m ³)	2.80	
Duration of Test (mir	, 1)	11.18	Dry Density (t/m ³) 2.7		2.73	
Rate of Loading (MP	?a/min)	5.16	Beddin	a (°)	5	
Mode of Failure		Conical	Test Ap	oparatus Kelb	ba 1000kN Load C	ell
			N 11.2			
100	CLIENT:	Golder Associates Pty	Limited			
	PROJECT:	Inland Rail Package 1	3	BEFORE TEST	100	
	LAB SAMPLE No. BOREHOLE:	101642 330-01-BH2101		DATE: 11/12/18 DEPTH: 99.7		
	CLIENT: PROJECT:	Golder Associates Pty	Limited			
100	TROJECT.	Tinanu Kan Tackage T	3	AFTER TEST		
	LAB SAMPLE No.	101642		DATE: 11/12/18.		
	BOREHOLE:	330-01-BH2101		DEPTH: 99.7		
lotes/Remarks:						
ample/s supplied by client	Graph	not to scale	Tested as re	ceived.	Page 2 of 2	REP0360
Accredited fo The results of the te this document a	r compliance with ISO/IEC 1 sts, calibrations, and/or mea re traceable to Australian/Na	7025 - Testing. surements included in ational Standards		Authorised Signatory	NATA	
Tes	ted at Trilab Brisbane Labor	atory.		 N. Maddison		No. 9926



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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT Test Method: AS 4133.4.3.1						
Client	Golder Associates Pty L	imited	Report No. GA1	01660-MOD		
Average Sample	Diameter (mm)	60.9	Moisture Content (%)	3.7		
Sample Height (mm)		160.9	Wet Density (t/m ³) 2.45			
Duration of Test (min)		6 75	Dry Density (t/m ³)	2.36		
Rate of Loading (MPa/min)		3.96	Bedding (°)	5		
Mode of Failure		Conical	Test Apparatus Kelb			
	CLIENT	Colder Associates Pty	Limited			
	PROJECT:	Inland Rail Package 1	3 DEPODE THE			
	LADCAMPLEN	101/20	BEFORE TEST			
	BORFHOLE:	101660 330-01-BH2101	DATE: 11/12/18			
	BOREHOLE:	330-01-BH2101	DEPTH: 114			
- 1	CLIENT:	Golder Associates Pty	Limited			
	TROJECT.	Infantu Kan I ackage I	AFTER TEST			
	LAB SAMPLE No.	101660	DATE: 11/12/18.			
	BOREHOLE:	330-01-BH2101	DEPTH: 114			
		-	AND DESCRIPTION			
Notes/Remarks:						
Notes/Remarks: Sample/s supplied by clie	nt Graph	not to scale	Tested as received.	Page 2 of 2 REP03603		
<u>Notes/Remarks:</u> Sample/s supplied by clie Accredite	nt Graph ed for compliance with ISO/IEC	not to scale 17025 - Testing.	Tested as received. Authorised Signatory	Page 2 of 2 REP03603		
Notes/Remarks: Sample/s supplied by clie Accredite The results of th	nt Graph ed for compliance with ISO/IEC reletests, calibrations, and/or mea	not to scale 17025 - Testing. asurements included in	Tested as received.	Page 2 of 2 REP03603		
<u>Notes/Remarks:</u> Sample/s supplied by clie Accredite The results of th this docume	nt Graph d for compliance with ISO/IEC e tests, calibrations, and/or mea ent are traceable to Australian/N	not to scale 17025 - Testing. asurements included in ational Standards.	Tested as received.	Page 2 of 2 REP03603		



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Client Golder Associa	ates Pty Limited	Report No.	GA101669-MOD
Average Sample Diameter (mn	n) 60.9	Moisture Content (%)	3.7
Sample Height (mm)	161.2	Wet Density (t/m ³)	2.41
Duration of Test (min)	34.45	Dry Density (t/m ³)	2.33
Rate of Displacement (mm/min	0.10	Bedding (°)	10
Mode of Failure	Conical	Test Apparatus	100kN Compression Machine
CLIENT: PROJECT:	Golder Associates	Pty Limited	
TROJECT:	inianu Ran Facka	BEFORE TI	EST
LAB SAMPLE	E No. 101669	DATE: 11/12/18	
BOREHOLE		DEFIN: 11/	
CLIENT:	Golder Associates	Pty Limited	
PROJECT:	Inland Rail Packa	ge 13 AFTER TH	CST
LAB SAMPLE	No. 101669	DATE: 11/12/18	3
BOREHOLE	: 330-01-BH2101	DEPTH: 117	
<u>otes/Remarks:</u>			
otes/Remarks:	Photo not to scale	Tested as received.	Page 2 of 2 REP134



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Client	Golder Associates	s Pty Limited		Report No.	GA101686-MOD
Average Sa	ample Diameter (mm)	50.8	Moist	ure Content (%)	8.6
Sample He	ight (mm)	142.7	Wet D	Density (t/m ³)	2.26
Duration of	Test (min)	17.77	Dry D	ensity (t/m ³)	2.08
Rate of Dis	placement (mm/min)	0.10	Beddi	ing (°)	20
Mode of Fa	ilure	Conical	Test A	Apparatus	100kN Compression Machine
	CLIENT:	Colder Associates Ptv	Limited		
	PROJECT:	Inland Rail Package 1	3	BEFORE TE	EST
	LAB SAMPLE No.	101686		DATE: 10/10/18	
	BOREHOLE:	330-01-BH2102		DEPTH: 3.65	
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	and the second second second				Contraction of the local division of the loc
	Net a Kate Const School				
	CLIENT:	Golder Associates Pty	Limited		
	PROJECT:	Inland Rail Package 1	.3	BEFORE TI	EST
	LAB SAMPLE No.	101686	1.200	DATE: 10/12/18	
	BOREHOLE:	330-01-BH2102		DEPTH: 3.65	
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otes/Remarks					
ample/s supplied	d by client Ph	oto not to scale	Tested as	received.	Page 2 of 2 REP134
Accre	dited for compliance with ISO/IE	C 17025 - Testing.			$\mathbf{\Lambda}$
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Client	Golder Associates	s Pty Limited		Report No.	GA101695-MOD
Average Sample	e Diameter (mm)	51.7	Moist	ure Content (%)	4.2
Sample Height (ímm)	141.6	Wet	Density (t/m ³)	2.44
Duration of Test	(min)	28.28	Dry D	Density (t/m ³)	2.34
Rate of Displace	ement (mm/min)	0.10	Bedd	ing (°)	30
Mode of Failure	, , , , , , , , , , , , , , , , , , ,	Conical	Test	Apparatus	100kN Compression Machine
Г	CLIENT:	Golder Associates Ptv	Limited		
	PROJECT:	Inland Rail Package 1	13	BEFORE TE	ST
	LAB SAMPLE No.	101695		DATE: 10/17/18	the second second second second second second second second second second second second second second second se
	BOREHOLE:	330-01-BH2102		DEPTH: 10.2	
	CLIENT: PROJECT:	Golder Associates Pty Inland Rail Package 13	Limited		
C F	CLIENT: PROJECT:	Golder Associates Pty Inland Rail Package 13	Limited	AFTER TES	r
	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pty Inland Rail Package 13 101695 330-01-BH2102	Limited 3 I I	AFTER TEST DATE: to/tt/18. DEPTH: 10.2	r
	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pty Inland Rail Package 13 101695 330-01-BH2102	Limited 3 I I	AFTER TES DATE: 10/12/18. DEPTH: 10.2	F
otes/Remarks:	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pty Inland Rail Package 13 101695 330-01-BH2102	Limited 3 I I	AFTER TES DATE: to/rz/ra. DEPTH: 10.2	F
Intes/Remarks: ample/s supplied by cli	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pty Inland Rail Package 13 101695 330-01-BH2102	Limited 3 I I I I I I I I I I I I I I I I I I	AFTER TEST DATE: to/tz/t8. DEPTH: 10.2	Page 2 of 2 REP134

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Client	Coldor Appendiates	Test Method: AS 4133.4.3.	.2 & AS 413	3.1.1.1		
Client	Golder Associates	Pty Limited		Report No.	GA101725	5-MOD
Average Sample	e Diameter (mm)	51.7	Moistu	Ire Content (%)	5.7	
Sample Height ((mm)	139.5	Wet D	ensity (t/m ³)	2.31	
Duration of Test	t (min)	32.85	Dry D	ensity (t/m³)	2.18	
Rate of Displace	ement (mm/min)	0.10	Beddi	na (°)	5	
Mode of Failure	· · · · ·	Conical	Test A	pparatus	100kN Co Machine	mpression
	CLIENT: PROJECT:	Golder Associates Pty	Limited			
	FROJECT:	inianu kan rackage i	13	BEFORE TE	ST	
	LAB SAMPLE No. BOREHOLE:	101725 330-01-BH2103		DATE: 11/12/18 DEPTH: 17		
	CLIENT: PROJECT:	Golder Associates Pty	Limited			
		initia initia i uchage i		AFTER TES	ST	
	LAB SAMPLE No.	101725		DATE: 11/12/18		
otes/Remarks: ample/s supplied by cl Accredited fo The results of the te	lient Photo or compliance with ISO/IEC ests, calibrations, and/or me	o not to scale 17025 - Testing. asurements included in	Tested as	received.	Pa	age 2 of 2 REP134
this document	are traceable to Australian/N sted at Trilab Brisbane Labo	lational Standards.			· ·	ACCREDITED FOR TECHNICAL COMPETENCE



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Client	Golder Associates	Pty Limited		Report No.	GA101729-MOD
Average Sample	e Diameter (mm)	51.7	Mois	sture Content (%)	10.2
Sample Height	(mm)	141.5	Wet	Density (t/m ³)	2.27
Duration of Test	(min)	33.45	Dry I	Density (t/m ³)	2.06
Rate of Displace	ement (mm/min)	0.10	Bedo	dina (°)	Nil
Mode of Failure		Conical	Test	Apparatus	100kN Compression Machine
	CLIENT.	Colden Associator P	tu Limita	J	
	PROJECT:	Inland Rail Package	13		070
				BEFORE TE	51
	BOREHOLE:	101729 330-01-BH2103		DATE: (1/12/18 DEPTH: 19.2	
	CLIENT:	Golder Associates Pr	y Limited	1	
63	PROJECT:	Inland Kall Package	15	AFTER TEST	
	LAB SAMPLE No.	101729	-	DATE: 11/12/18.	
- 1	BOREHOLE:	330-01-BH2103		DEPTH: 19.2	
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Client		Test Method: AS 4133.4.	3.2 & AS 4	133.1.1.1	
	Golder Associates	Pty Limited		Report No.	GA101735-MOD
Average Sample	Diameter (mm)	51.8	Mois	ture Content (%)	6.7
Sample Height (r	nm)	141.6	Wet	Density (t/m ³)	2.37
Duration of Test	(min)	23.53	Dry [Density (t/m ³)	2.22
Rate of Displace	ment (mm/min)	0.10	Bedo	ding (°)	10
Mode of Failure		Conical	Test	Apparatus	100kN Compression Machine
	CLIENT:	Colder Associates Pl	v Limiter	1	
1000	PROJECT:	Inland Rail Package	13	PEFODE TE	ST
	LADCAMBLE N.	101525		DATE: What he	51
	BOREHOLE:	330-01-BH2103		DATE: 11/12/18 DEPTH: 25.55	
		Contraction of	1		S TOTAL STREET, SALE
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	CLIENT.	Calden Associates D			
6 .	PROJECT:	Inland Rail Package	13	d	and the second second
				AFTER TES	T
	LAB SAMPLE No.	101735 330 01 BH2102	-	DATE: 11/12/18.	
	BOREHOLE:	330-01-BH2103		DEPTH: 25.55	Section 1
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otes/Remarks: ample/s supplied by clie Accredited for The results of the tes this document an	ent Phote r compliance with ISO/IEC ts, calibrations, and/or mear re traceable to Australian/N	o not to scale 17025 - Testing. asurements included in ational Standards.	Tested a	s received.	Page 2 of 2 REF



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UNIAXI	AL COMPRESS	SIVE STRENGTH	& DE		N TEST REPORT
Client	Golder Associate	es Pty Limited	2 a aj 41	Report No.	GA101752-MOD
					~ ~
Average Sar	mple Diameter (mm)	51.9	Moist	ure Content (%)	7.7
Sample Heig	ght (mm)	128.6	Wet D	Density (t/m [°])	2.34
Duration of T	Гest (min)	43.55	Dry D	ensity (t/m³)	2.17
Rate of Disp	lacement (mm/min)	0.10	Beddi	ing (°)	5
Mode of Fail	ure	Shear	Test /	Apparatus	100kN Compression Machine
	CLIENT:	Golder Associates Pty I	Limited		
	PROJECT:	Inland Rail Package 13		BEFORE TH	EST
	LAB SAMPLE No.	101752		DATE: 08/12/	18
	BOREHOLE:	330-01-BH2104		DEPTH: 16	
			20130		
		el version		The second second	Contract of the second s
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	Service of the				State of the
	Contraction of the second second	And the second s			
	CLIENT:	Golder Associates Pty]	Limited		
	PROJECT:	Inland Rail Package 13	;	AFTER TE	ST
	LAB SAMPLE No.	101752		DATE: 08/12/18	3.
	BOREHOLE:	330-01-BH2104		DEPTH: 16	1.1.1
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		Caller		1.00	
					and the second se
Notes/Remarks:					
THOLES/INCITIDINS.	The length to diameter ra	tio falls outside the test method	limits of 2.	.5:1 to 3.0:1.	
Sample/s supplied	by client Pr	noto not to scale	Tested as	received.	Page 2 of 2 REP13402
Accredi	ited for compliance with ISO/IE	EC 17025 - Testing.			
The results of this docur	the tests, calibrations, and/or in ment are traceable to Australia	measurements included in n/National Standards.			
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UNIAXIA	AL COMPRESS	IVE STRENGTH Test Method: AS 4133.4.3.	& DE	FORMATION 33.1.1.1	N TEST REPORT
Client	Golder Associate	s Pty Limited		Report No.	GA101757-MOD
Average San	nple Diameter (mm)	51.9	Moist	ure Content (%)	6.5
Sample Heig	iht (mm)	140.7	Wet I	Density (t/m ³)	2.30
Duration of T	est (min)	25.07	Dry D	Density (t/m ³)	2.16
Rate of Displ	lacement (mm/min)	0.10	Bedd	ing (°)	0
Mode of Fail	ure	Conical	Test	Apparatus	100kN Compression Machine
	CLIENT	Colder Associates Ptv	Limited		
	PROJECT:	Inland Rail Package 1	3	DEFODE T	EOT
				BEFORE I	ESI
	LAB SAMPLE No.	101757 330.01 PH2104		DATE: 08/12/1	8
	BOREHOLE:	330-01-BH2104		DEPTH: 21.52	
	CI IENT				
	PROJECT:	Golder Associates Pty Inland Rail Package 1	2		
	TROULETT	inianu Ran Fackage F	5	AFTER TH	EST
	LAB SAMPLE No.	101757		DATE: 08/12/18	8
	BOREHOLE:	330-01-BH2104		DEPTH: 21.52	
		(Alton			
		TP-			
	·				
Notes/Remarks:					
Sample/s supplied I	by client Ph	oto not to scale	Tested as	received.	Page 2 of 2 REP13402
Accredi The results of t this docum	ted for compliance with ISO/IE the tests, calibrations, and/or n nent are traceable to Australiar	C 17025 - Testing. neasurements included in /National Standards.			
	Tested at Trilab Brisbane La	boratory.			L aboratory No. 9926



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Client Gol	der Associates	Pty Limited		Report No.	GA101760-MC	D
Average Sample Di	ameter (mm)	51.7	Moist	ture Content (%)	3.8	
Sample Height (mr	ı)	141.1	Wet	Density (t/m ³)	2.39	
Duration of Test (m	, in)	26.63	Dry D	Density (t/m ³)	2.30	
Rate of Displaceme	ent (mm/min)	0.10	Bedd	ling (°)	30	
Mode of Failure	ζ ,	Conical	Test	Apparatus	100kN Compre Machine	ession
CL	IENT:	Golder Associates Pty	Limited			
PRO	OJECT:	Inland Rail Package 1	3	BEFORE TH	EST	
LAI	B SAMPLE No.	101760		DATE: 10/12/18		
BO	REHOLE:	330-01-BH2104		DEPTH: 25.05		
C P	LIENT: ROJECT:	Golder Associates P Inland Rail Package	ty Limit 2 13	ed AFTER T	EST	
L	AB SAMPLE No.	101760		DATE: 10/2/	8	
В	OREHOLE:	330-01-BH2104	2.50	DEPTH: 25.05	5	
	inter 1					
lotes/Remarks:					-2	
<u>Votes/Remarks:</u>	Phot	o not to scale	Tested as	s received.	Page 2 c	of 2 REP1340

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

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		Test Method: AS	4133.4.3.1	T		
Client	Golder Associates Pty	Limited		Report No.	GA101762-MOD	
Average Sam	nple Diameter (mm)	51.7	Moistur	e Content (%)	2.4	
Sample Heigl	ht (mm)	117.9	Wet De	nsity (t/m^3)	3.08	
Duration of T	est (min)	6.03	Dry Der	nsity (t/m ³)	3.01	
Rate of Loadi	ing (MPa/min)	2 93	Bedding	n (°)	5	
Mode of Failu	ure	Conical	Test Ap	paratus	Kelba 1000kN Load Cell	
				n ha na ka		
	CLIENT:	Golder Associates Pt	ty Limited			
	PROJECT:	Inland Rail Package	13	BEFORE TH	EST	
	LAB SAMPLE No.	101762		DATE: 11/12/18		
	BOREHOLE:	330-01-BH2104		DEPTH: 25.45		
	CLIENT: PROJECT:	Golder Associates Pt Inland Rail Package	y Limited	AFTED TE	ST	
	CLIENT: PROJECT: LAB SAMPLE No.	Golder Associates Pt Inland Rail Package 101762	y Limited	AFTER TE	ST	
	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pt Inland Rail Package 101762 330-01-BH2104	y Limited 13 1 1	AFTER TE: DATE: 11/12/18. DEPTH: 25.45	ST	
	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pt Inland Rail Package 101762 330-01-BH2104	y Limited 13 1	AFTER TE: DATE: 11/12/18. DEPTH: 25.45	ST	
tes/Remarks:	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pt Inland Rail Package 101762 330-01-BH2104	y Limited 13	AFTER TE DATE: 11/12/18. DEPTH: 25.45	ST	
tes/Remarks: nple/s supplied b	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pt Inland Rail Package 101762 330-01-BH2104	y Limited 13 1 1 1 1 1 1 1 1 1 1 1 1 1	AFTER TE: DATE: 11/12/18. DEPTH: 25.45	ST	EP0:
tes/Remarks: nple/s supplied b	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE:	Golder Associates Pr Inland Rail Package 101762 330-01-BH2104	y Limited 13 1 1 1 1 1 1 1 1 1 1 1 1 1	AFTER TE: DATE: 11/12/18. DEPTH: 25.45	ST	EP03
tes/Remarks: nple/s supplied by Accri The results	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE: Of the length to diameter ratio falls of y client Graph redited for compliance with ISO/IEC of the tests, calibrations, and/or me	Golder Associates Pr Inland Rail Package 101762 330-01-BH2104	y Limited 13 1 1 1 1 1 1 1 1 1 1 1 1 1	AFTER TE: DATE: 11/12/18. DEPTH: 25.45	ST	EP03
tes/Remarks: nple/s supplied by Accro The results this doo	CLIENT: PROJECT: LAB SAMPLE No. BOREHOLE: Of the length to diameter ratio fails of y client Graph redited for compliance with ISO/IEC of the tests, calibrations, and/or me cument are traceable to Australian/M	Golder Associates Pt Inland Rail Package 101762 330-01-BH2104	y Limited 13 1 1 1 1 1 1 1 1 1 1 1 1 1	AFTER TE DATE: 11/12/18. DEPTH: 25.45	ST Page 2 of 2 R	EP03

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UNIAXIAL	COMPRESSI	VE STRENGTH Test Method: AS 4133.4.3.	& DE 2 & AS 41	FORMATION 33.1.1.1	N TEST REPORT
Client	Golder Associates	Pty Limited		Report No.	GA101764-MOD
Average Sample	e Diameter (mm)	51.7	Moist	ure Content (%)	6.9
Sample Height (mm)	142.3	Wet [Density (t/m ³)	2.40
Duration of Test	(min)	30.22	Dry D	ensity (t/m ³)	2.25
Rate of Displace	ement (mm/min)	0.10	Bedd	ina (°)	10
Mode of Failure	(,	Axial Splitting	Test /	Apparatus	100kN Compression Machine
	CLIENT.	Colder Associates Pty	Limited		
	PROJECT:	Inland Rail Package 1	3	DEEODE TE	ST
	LAD CAMPLE No.	101764		DATE: 10/0	51
	BORFHOLE	101/04 330-01-BH2104		DATE: (0/12/18	
	CLIENT:	Golder Associates Ptr	Limiter		
100	PROJECT:	Inland Rail Package 1	13		C/2E
	LADSAMDIEN.	1017/4		AFIERIE	51
	BOREHOLE:	101/04 330-01-BH2104		DATE: 10/12/18-	
		550-01-0112104		DEI III. 27	
Notes/Remarks:					
Sample/s supplied by cli	ient Phot	o not to scale	Tested as	received.	Page 2 of 2 REP13402
Accredited fo The results of the te this document a	or compliance with ISO/IEC ests, calibrations, and/or me are traceable to Australian/N	17025 - Testing. asurements included in lational Standards.			
Tes	sted at Trilab Brisbane Labo	pratory.			Laboratory No. 9926



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UNIAXI	AL COMPRES	SIVE STRENGTH Test Method: AS 4133.4.3.	& DE 2 & AS 41	FORMATION	I TEST REPORT
Client	Golder Associate	es Pty Limited		Report No.	GA101766-MOD
Average San	nple Diameter (mm)	51.6	Moist	ture Content (%)	5.3
Sample Heig	Jht (mm)	140.8	Wet	Density (t/m³)	2.38
Duration of T	est (min)	32.95	Dry D	Density (t/m ³)	2.26
Rate of Displ	lacement (mm/min)	0.10	Bedd	ling (°)	5
Mode of Failu	ure	Conical	Test	Apparatus	100kN Compression Machine
	CLIENT	Golder Associates Ptv	Limiter		
	PROJECT:	Inland Rail Package 1.	3	PEEODE T	FOT
	LADSAMDLEN			DATE ANA	
	BOREHOLE:	101766 330.01 BH2104	-	DATE: 08/12/18	
	DOREHULE:	330-01-DH2104		DEFIN: 30	
	CLIENT: PROJECT:	Golder Associates Pty I Inland Rail Package 13	imited		
	PROJECT:	Inland Rail Package 13		AFTER TES	ST
	LAB SAMPLE No.	101766		DATE: 08/12/18	
	BOREHOLE:	330-01-BH2104		DEPTH: 30	
Notes/Remarks:					
Sample/s supplied ł	by client Pl	noto not to scale	Tested as	s received.	Page 2 of 2 REP13402
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UNIAXIAL (COMPRESS	IVE STRENGTH	& DEI		I TEST I	REPORT
Client G	older Associates	Pty Limited		Report No.	GA10183	9-MOD
Average Sample	Diameter (mm)	51.1	Moist	ure Content (%)	4.7	,
Sample Height (m	ım)	148.5	Wet D	Density (t/m ³)	2.4	2
Duration of Test (min)	21.28	Dry D	ensity (t/m ³)	2.3	1
Rate of Displacen	nent (mm/min)	0.10	Beddi	ng (°)	20	
Mode of Failure	, , , , , , , , , , , , , , , , , , ,	Conical	Test A	Apparatus	100kN Co Machine	ompression
	I DENTE	CHI I I I				
	ROIFCT:	Golder Associates Pty	Limited	1		
	ROJECT.	manu Kan Fackage	13	BEFORE T	TEST	
L	AB SAMPLE No.	101839		DATE:03/01/19		
В	OREHOLE:	330-01-BH2306		DEPTH: 4.4		
C	LIENT:	Golder Associates Pty	Limited	1		
P	ROJECT:	Inland Rail Package	13	AFTER T	EST	
L	AB SAMPLE No.	101839		DATE:03/01/19	1.111.2.1.1	
В	OREHOLE:	330-01-BH2306		DEPTH: 4.4	1.3.5	
			-The			
Notes/Remarks:						
Sample/s supplied by clier	nt Pho	to not to scale	Tested as	received.	I	Page 2 of 2 REP13402
Accredited for o The results of the test this document are Teste	compliance with ISO/IEC s, calibrations, and/or me e traceable to Australian/ ed at Trilab Brisbane Lab	17025 - Testing. easurements included in National Standards. oratory.				

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Client	Golder Associate	s Pty Limited		Report No.	GA101841-MOD	
Average Sa	ample Diameter (mm)	51.7	Mois	ture Content (%)	4.2	
Sample Height (mm)		134.5	Wet Density (t/m ³)		2.50	
Duration of Test (min)		26.42	Dry Density (t/m ³)		2.40	
Rate of Displacement (mm/min) Mode of Failure		0.10 Bedding (°)		ling (°)	10	
		Shear	Test	Apparatus	100kN Compression Machine	
	CLIENT	Colder Associates Ptv	Limiter			
	PROJECT:	Inland Rail Package	13	BEFORE T	EST	
	LAB SAMPLE No.	101841		DATE:03/01/19		
	BOREHOLE:	330-01-BH2306		DEPTH: 11.5 11.64 - 11.79		
	CLIENT: PROJECT:	Golder Associates Pty Inland Rail Package 1	Limited		eT.	
		101041		AFIER IE	51	
	BOREHOLE:	330-01-BH2306		DEPTH: 11.5 11.64-11.79		
otes/Remarks	<u>.</u>					
	d by alight Dh	oto not to scale	Tested as	s received.	Page 2 of 2 REP134	
ample/s supplie						



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		Test Method: AS 4133.4	.3.2 & AS 41	33.1.1.1		
Client	Golder Associate	es Pty Limited		Report No.	GA101843-MOD	
Average Sa	mple Diameter (mm)	51.7	Moist	ure Content (%)	8.1	
Sample Height (mm)		134.1	Wet D	Density (t/m ³)	2.34	
Duration of Test (min)		31.95	Dry D	ensity (t/m³)	2.17	
Rate of Displacement (mm/min)		0.10	Beddi	ng (°)	15	
Mode of Failure		Conical	Test A	Apparatus	100kN Compression Machine	
	CLIENT:	Golder Associates I	Ptv Limited	1		
	PROJECT:	Inland Rail Package 13		BEFORE 1	TEST	
	LAB SAMPLE No	. 101843		DATE:03/01/19		
	BOREHOLE:	330-01-BH2306		DEPTH: -15 15.65 - 15.79		
		The Protection			Contraction of the	
	CLIENT: PROJECT:	Golder Associates P Inland Rail Package	ty Limited	AFTED TE	2ST	
	LAB SAMPLE No.	101843		DATEIOZIOULO		
	BOREHOLE:	330-01-BH2306		DEPTH: 15		
otes/Remarks:						
ample/s supplied	l by client Pl	noto not to scale	Tested as	received.	Page 2 of 2 REP134	
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Client	Golder Associates	s Pty Limited		Report No.	GA101847	-MOD	
Average Sa	ample Diameter (mm)	51.6	Moist	ure Content (%)	6.8		
Sample Height (mm)		135.9	Wet D	Wet Density (t/m ³)		2.37	
Duration of Test (min)		19.17	Dry D	Dry Density (t/m ³)		2.22	
Rate of Displacement (mm/min)		0.10	Beddi	Bedding (°)		10	
Mode of Failure		Conical	Test A	Apparatus	100kN Cor Machine	mpression	
	CLIENT:	Coldar Associatos I	Dty Limitor	1			
	PROJECT:	Inland Rail Packag	e 13	BEFORE	TEST		
	LAB SAMPLE No.	101847		DATE:03/01/19			
	BOREHOLE:	330-01-BH2306		DEPTH: 21.5 21.58-21-5821.7	1		
	CLIENT: PROJECT:	Golder Associates Pty Lin Inland Rail Package 13		Limited AFTER TES			
	LAB SAMPLE No.	101847		DATE:03/01/19			
	BOREHOLE:	330-01-BH2306		DEPTH: 21.5 21.58-21.71	2728		
					4		
otes/Remarks							
mple/s supplied	d by client Pho	oto not to scale	Tested as	received.	Pa	ge 2 of 2 REP1	
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	Tested at Trilab Brisbane Lab	poratory.			Î		
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Client	Golder Associates	s Pty Limited		Report No.	GA101848-MOD
Average Sa	ample Diameter (mm)	51.8	Moist	ure Content (%)	17.8
Sample Height (mm)		137.1	Wet [Density (t/m ³)	2.17
Duration of	Test (min)	21.33	Dry D	ensity (t/m³)	1.84
Rate of Dis	placement (mm/min)	0.10	Bedd	ing (°)	Nil
Mode of Failure		Shear Test Apparatus		100kN Compression Machine	
	CLIENT	Colder Associates Pt	v I imitor		
	PROJECT:	Inland Rail Package	y Limited		
			15	BEFORE T	EST
	LAB SAMPLE No.	101848		DATE:03/01/18	
	BOREHOLE:	330-01-BH2306		DEPTH: 24 23.83-23.97	Constant in
	CLIENT: PROJECT:	Golder Associates Pr Inland Rail Package	ty Limite	d AFTER T	FST
	LAR SAMPLE No.	101949		DATE	EST
	BOREHOLE:	330-01-BH2306		DEPTH: 24	
				23.83-23.97	
	Br. P.				
			P	-	
otes/Remarks	<u>.</u>				
ample/s supplie	d by client Pho	oto not to scale	Tested as	received.	Page 2 of 2 REP
Accre The results o this doc	edited for compliance with ISO/IE0 of the tests, calibrations, and/or m ument are traceable to Australian	C 17025 - Testing. easurements included in /National Standards.			NATA
	Tested at Trilab Brisbane Lat	poratory.			ACCREDITED FOR TECHNICAL COMPETENCE
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Brazilian Test Indirect Tensile



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Client Golder Asso	ciates Pty Lim	ited		Report N	0.	GA101587-B
Address PO Box 1734	MILTON BC	QLD	4064	Test Date)	30/11/2018
				Report D	ate	04/12/2018
Project Inland Rail P	ackage 13					
Sample No.	101587	101595	101601	101621	101630	101640
Client ID	330-01-BH2101- C07000	330-01-BH2101- C07200	330-01-BH2101- C08100	330-01-BH2101- C08700	330-01-BH2101- C09100	330-01-BH2101- C09600
Depth (m)	70.00-71.00	72.00-72.90	81.00-82.00	87.00-87.50	91.00-91.70	96.00-96.90
Description	С	с	с	С	С	с
Wet Density (t/m ³)	2.11	2.05	2.17	2.17	2.20	2.28
Moisture Content (%)	8.4	8.1	9.3	6.8	9.2	7.8
Specimen Length (mm)	36.1	38.7	41.5	40.7	35	42.1
Specimen Diameter (mm)	60.9	60.8	60.8	60.3	60.9	60.7
Bedding Angle with Relation to Axial Plane (°)) Nil	Nil	15	10	5	15
Bedding Parallel or Perpendicular to Direction of Loading	N/A	N/A	Parallel	Parallel	Parallel	Parallel
Mode of Failure	Axial Splitting					
Test Duration (min:sec)	1:29	1:16	1:23	1:35	1:04	1:02
Average Load Rate (MPa/sec)	0.017	0.01	0.012	0.004	0.004	0.021
Load at Primary Failure (N)	5259	2779	4079	1610	878	5190
TENSILE STRENGTH (MPa) TS = 0.636 × (^{Load} / _{Diameter × Length}) MPa	1.52	0.751	1.03	0.417	0.262	1.29

NOTES/REMARKS:

Sample/s supplied by the client

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COMPETENCE



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lient	Golder Associa	ates Pty Lim	ited		Report N	0.	GA101643-B
ddress	PO Box 1734	MILTON BC	QLD	4064	Test Date)	30/11/2018
					Report Da	ate	04/12/2018
roject	Inland Rail Pa	ckage 13					
Sample No.		101643	101656	101666	101670	101679	101701
Client ID		330-01-BH2101- C09970	330-01-BH2101- C10820	330-01-BH2101- C11400	330-01-BH2101- C11700	330-01-BH2101- C12030	330-01-BH2102- C01020
Depth (m)		99.70-99.90	108.20-109.00	114.00-115.00	117.00-117.90	120.30-120.90	10.20-11.00
Description		С	С	с	С	С	С
Wet Density	(t/m ³)	2.66	2.05	2.30	2.31	2.34	2.46
Moisture Con	tent (%)	3.0	7.7	6.0	6.8	8.0	4.2
Specimen L	ength (mm)	34.5	36.3	40.3	45.6	38.4	31.1
Specimen D	iameter (mm)	60.7	60.7	60.9	60.9	60.6	51.7
Bedding Ang Axial Plane	gle with Relation to (°)	5	5	5	10	5	30
Bedding Para to Direction o	llel or Perpendicular f Loading	Parallel	Parallel	Parallel	Parallel	Parallel	Parallel
Mode of Fail	ure	Axial Splitting					
Test Duratio	n (min:sec)	1:37	0:43	1:08	1:12	1:10	3:02
Average Loa	ad Rate (MPa/sec)	0.084	0.005	0.036	0.037	0.028	0.041
Load at Prin	nary Failure (N)	26727	718	9526	11535	7106	18780
TENSILE S	TRENGTH (MPa)	8.12	0.207	2.47	2.64	1.94	7.43

NOTES/REMARKS:

Sample/s supplied by the client

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

REP07102 Page 1 of 1



Petrographic Reports



Geochempet Services

ABN 980 6945 3445 PETROLOGICAL and GEOCHEMICAL CONSULTANTS Principals: K.E. Spring B.Sc. (Hons), MAppSc and H.M. Spring B.Sc.



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Email: info@geochempet.com www.geochempet.com

PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101580) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order: Invoice Number: Client Ref: BNE 1912014 00008538 Chris Channon

Issued by

K. E. Spring BSc (Hons), MAppSc 10 January 2019

JANUARY, 2019 Tl190101 1 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Sample Number:	101580	Date Sampled :	Unknown
<u>Sample Type</u> :	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2101-C07000	<u>Depth</u> :	70.00– 71.00 m
Project ID:	1893802 Inland Rail Packag	e 13	
Work Requested	Petrographic analysis		
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Guid for Concrete and the engineering purposes	de for <i>Petrographic</i> 2 AS2758.1 – 2014 5 part 1; Concrete
Identification	Ferruginous quartz sandstone		

Description

The sample consisted of a drill core specimen of ferruginous, weathered, moderately robust, medium to coarse-grained dark reddish sandstone. The core can be unevenly scratched by a steel tool but a thin slab can be broken by hand pressure, fretted by a fingernail and is apparently water absorbent.



Plate 1: Photograph of supplied drill core.

JANUARY, 2019 Tl190101 2 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 33% quartz sand grains
- 17% feldspar sand grains
- <1% other resistate mineral grains (tourmaline)
- 6% quartzite clasts
- 2% chert clasts
- 2% vein quartz clasts
- 4% feldspar sand grains
- 1% acid tuffaceous/volcanic sand clasts
- 1% intermediate volcanic clasts

Soft, Weak &/Or Deleterious Components

- 1% free muscovite flakes
- <1% argillized and sericitized clasts of uncertain origin
- 3% kaolinite
- 27% earthy secondary iron oxide (hematite)
 - 3% pores

In thin section, the framework of the rock is seen to consist of conspicuous sub-rounded, moderately sorted quartz grains which range in size from about 0.02 to 1 mm cemented by dominantly by hematite and minor kaolinite.

This sample is a subtly graded, medium to coarse grained, matrix-supported sandstone dominated by sub-rounded grains of quartz with fine-grained deep red iron oxides aggregated along grain boundaries. The detrital quartz grains are almost all mildly to moderately-strained, sometimes occurring as polycrystalline grains and occasionally carry a few mica inclusions. A careful searched showed a few accessory bluish tournaline grains that support a granite/granite gneiss source. The presence of a few clouded microcline feldspar grains as well as lithic clasts of acid and intermediate volcanics are observed. Other framework grains include a few detrital mica flakes and some buff coloured extremely fine-grained siliceous lithic clasts of cherty, quartzite and heavily-strained vein quartz style along with occasional argillized/sericitized clasts.

The matrix cement between framework grains in this rock consists of volumetrically dominant earthy blebs, linings and fillings of a red iron oxide or hydroxide (probably hematite) along with some minor clots of kaolinite.

Irregular pores are also observed in the hematitic cement and may the result of thin section preparation washing out some of the clays.

JANUARY, 2019 Tl190101 3 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Comments and Interpretations

The supplied drill core sample (labelled 101580) from the Inland Rail Project is identified as coarse-grained, quartz sandstone ferruginized by a hematite cementing matrix.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- quartz sandstone (a sedimentary rock type)
- slightly porous (about 3% pores)
- moderately to heavily weathered
- hematite-cemented
- contains about 31% of soft, weak minerals mostly as an earthy hematitic cement
- essentially hard
- moderately strong

The rock is predicted to be **moderately durable**.

Free Silica Content

The free silica or quartz content is estimated to be about 60%.

Carbonate content

The carbonate content is estimated to be nil.



Plate 2: Low magnification, cross polarised light image of the sandstone, showing quartz and feldspar grains in a hematitic matrix.



Geochempet Services

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PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101599) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order: Invoice Number: Client Ref: BNE 1912014 00008538 Chris Channon

Issued by

C. A. Bruggemann BAppSc, MEngSC, MIEAust 10 January 2019 Reviewed by

K. E. Spring BSc (Hons), MAppSc 10 January 2019

JANUARY, 2019 Tl190102 1 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Sample Number:	101599	Date Sampled:	Unknown
<u>Sample Type</u> :	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2101-C08100	<u>Depth</u> :	81.00 – 82.00 m
Project ID:	1893802 Inland Rail Packag	e 13	
<u>Work Requested</u>	Petrographic analysis and content	determination of qu	artz and carbonate
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Guid for Concrete and the engineering purpose.	de for <i>Petrographic</i> e AS2758.1 – 2014 s part 1; Concrete
Identification	Carbonated quartzofeldspath	ic and lithic sandstone	

Description

The sample consisted of a drill core specimen which is very slightly weathered, grey sandstone with slight bedding evident. Weathering is expressed through weathered/argillized clasts scattered throughout the core. The core can be scratched by a steel tool. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is medium grained and is slowly hygroscopic.



Plate 1: Photograph of supplied drill core.

JANUARY, 2019 Tl190102 2 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 36% quartz sand grains
- 9% feldspar sand grains
- 2% other mineral grains (opaque oxide, leucoxene (1%), zircon, hornblende (1%))
- 5% quartzite clasts
- 4% acid tuffaceous/volcanic sand clasts (1% fine microcrystalline quartz)
- 4% intermediate volcanic clasts (largely argillized)
- <1% basalt clasts
- <1% meta-pelite clasts

Moderately Durable Components

25% carbonate

Soft, Weak &/Or Deleterious Components

- 2% muscovite
- <1% argillized and sericitized clasts of uncertain origin
- 4% interstitial sericite-smectite clays
- 8% zeolite
- <1% earthy secondary iron oxide
- <1% carbonaceous matter
 - 1% pores

In thin section, the rock is a medium grained, carbonated, quartzofeldspathic and lithic sandstone with an average grainsize of about 0.2 to 0.6 mm. It is relatively well sorted, and shows a weak bedding defined by grainsize grading.

The framework grains are dominated by sub-rounded to sub-angular lithic clasts, some of which are quite argillized, along with quartz and feldspar grains. Lithic clasts were very finegrained quartzo-feldspathic grains with strong pale brown sericite-smectite alteration. Due to their fine grainsize, it is difficult to be sure that these were derived from formerly glassy rhyolite/dacite lava fragments along with minor intermediate volcanics. Equant to sub-rounded detrital quartz and blocky sub-rounded to euhedral feldspar grains are relatively common suggesting derivation from phenocrysts in felsic volcanic or explosive volcaniclastic rocks. Occasionally, there are detrital muscovite flakes (about 0.1 mm long) with long axes sub-parallel to the bedding along with some opaque oxides and carbonaceous specks. Other lithic clasts comprise of quartzite, basalt and meta-pelite.

The matrix of this rock is now composed of largely fine quartz and extremely fine-grained sericite/smectite clays which have been partly altered to carbonate and zeolite.

JANUARY, 2019 Tl190102 3 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Comments and Interpretations

The supplied drill core sample (labelled 101599) from the Inland Rail Project is identified as medium grained, carbonated, quartzofeldspathic and lithic sandstone. The sandstone carries some argillized lithic clasts which indicate a felsic volcanic source. Alteration is largely diagenetic dewatering of the sediment but subsequent carbonation of the rock has replaced parts of the matrix cement and hardened the sandstone.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- carbonated, quartzofeldspathic and lithic sandstone (a sedimentary rock type)
- slightly porous (1% pores)
- very slightly weathered
- carbonated (25%)
- contains about 14% of soft, weak minerals as interstitial material and in altered lithic clasts
- essentially hard
- essentially strong

The rock is predicted to be **essentially durable**.

Free Silica Content

The free silica content is estimated to be about 42%.

Carbonate Content

The carbonate content is estimated to be about 25%.



Plate 2: Low magnification, cross polarised light image of the sandstone, showing quartz and lithic grains. Note the carbonate replacing part of the matrix.



Geochempet Services

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PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101614) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order: Invoice Number: Client Ref: BNE 1912014 00008538 Chris Channon

Issued by

C. A. Bruggemann BAppSc, MEngSC, MIEAust 10 January 2019 Reviewed by

K. E. Spring BSc (Hons), MAppSc 10 January 2019

JANUARY, 2019 Tl190103 1 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Sample Number:	101614	Date Sampled:	Unknown
Sample Type:	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2101-C08700	<u>Depth</u> :	87.00 – 87.50 m
Project ID:	1893802 Inland Rail Packag	e 13	
Work Requested	Petrographic analysis and content	determination of qu	uartz and carbonate
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Gui for Concrete and the engineering purpose	de for <i>Petrographic</i> e AS2758.1 – 2014 s part 1; Concrete
Identification	Clay-cemented quartz sandst	one	

Description

The sample consisted of a drill core specimen which slightly weathered, pale grey, claycemented quartz sandstone which is easily broken under finger pressure. The rock can be deeply gouged by a steel tool. The rock appears to be mostly composed of fine to medium quartz grains (becoming coarser grained towards the base) with some clays in the interstitial matrix and carbonaceous matter denoting bedding. When soaked in water, the rock rapidly disaggregated.



Plate 1: Photograph of the supplied drill core.

JANUARY, 2019 Tl190103 2 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Durable Minerals

- 55% quartz
- 3% feldspar
- 1% other mineral grains (leucoxene (1%) rutile and zircon)
- 6% quartzite clasts
- 1% chert clasts
- 1% acid tuffaceous/volcanic sand clasts (<1% fine microcrystalline quartz)

Moderately Durable Components

1% carbonate

Weak &/or Deleterious Components

- 1% muscovite
- 5% argillized and sericitized clasts
- 11% smectite clay cement
- 12% zeolite
- 1% earthy secondary iron oxide
- <1% carbonaceous matter
- 2% pores

In thin section, the sandstone displays textures of poorly sorted quartz grains in a fine to medium-grained sandstone (mainly 0.05 to 0.35 mm in size, with rare clasts up to 0.6 mm). Preferred orientation of quartz grains is observed, defining bedding within the sandstone.

Most of the rock consists of simple but strained quartz grains (angular to sub-rounded in shape), a few seem to be composite grains of quartzite style, and there are minor blocky grains of clouded feldspars, as well as small detrital heavy mineral grains (leucoxene, zircon and rutile). Minor lithic clasts observed included chert and acid tuffaceous/volcanic rock fragments. The sandstone also carries some argillized and sericitized clasts, most likely after feldspars. Occasionally, there are detrital muscovite flakes (about 0.2 mm long) with long axes sub-parallel to the bedding along with some carbonaceous specks.

The sandstone is cemented by a thin connected, interstitial network of a high birefringent smectitic style of clay, which has been partly altered to carbonate and zeolite. Washouts of the clay matrix during thin section preparation has induced some porosity.

Comments and Interpretations

The supplied drill core sample (labelled 101614) from the Inland Rail Project is considered to consist of slightly weathered, clay-cemented quartz sandstone, a sedimentary rock type probably derived from a metamorphic terrain, because of the straining evident in quartz grains.

For engineering purposes, the rock represented in the supplied drill core sample may be summarised as:

- quartz sandstone (sedimentary rock type)
- clay-cemented
- slightly porous (2% pores)
- slightly weathered
- carries about 1% of moderately durable carbonate
- carries about 30% of weak, soft minerals as interstitial material and in altered lithic clasts
- moderately hard
- moderately strong

The rock is predicted to be **moderately durable**; because it is anticipated that in exposed conditions, wetting and drying cycles will cause the rock to disintegrate.

Free Silica Content

The free silica content is estimated to be about 62%.

Carbonate Content

The carbonate content is estimated to be about 1%.



Plate 2: Low magnification, cross polarised light image of clay-cemented quartz sandstone. View is dominated by quartz grains with a thin interstitial clay cement and zeolite between grains, along with minor muscovite flakes.



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PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101623) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order: Invoice Number: Client Ref: BNE 1912014 00008538 Chris Channon

Issued by

K. E. Spring BSc (Hons), MAppSc 10 January 2019

JANUARY, 2019 Tl190104 Page 1 of 5 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services

Sample Number:	101623	Date Sampled:	Unknown
Sample Type:	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2101-C09100	<u>Depth</u> :	91.00– 91.70 m
Project ID:	1893802 Inland Rail Packag	e 13	
Work Requested	Petrographic analysis		
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Guid for Concrete and the engineering purpose.	de for <i>Petrographic</i> e AS2758.1 – 2014 s part 1; Concrete
Identification	Thinly laminated labile siltst	one	

Description

The sample consisted of a drill core specimen which is unweathered, dark grey siltstone with thin carbonaceous laminations. The core can be deeply scratched with a steel tool leaving a grey to brown streak. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is very fine grained and is soft and friable along laminations. The rock is slowly hygroscopic and will part very easily along its laminations.





JANUARY, 2019 Tl190104 Page 2 of 5 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 12% quartz grains
- 4% remnant feldspar grains
- 1% hematized, leucoxenized or finely rutilated clasts of former detrital opaque oxides
- 2% lithic clasts of acid tuffaceous clasts (<1% finely microcrystalline quartz)

Soft, Weak &/Or Deleterious Components

- 12% sericitized and argillized clasts
- 61% sericitic/illitic clay cement variably stained by secondary iron oxide
- 3% detrital mica (muscovite flakes)
- trace pyrite
 - 4% carbonaceous wisps
 - 1% open fractures

In thin section the rock displays primary textures of finely laminated, clayey to silty style. It consists of minor sub-rounded to angular sand clasts which are mainly 0.05 to 0.1 mm in size. Bedding is delineated by grainsize variations.

Very little of the rock persist as simple quartz and feldspar grains. Other robust mineral grains comprise hematized, leucoxenized or finely rutilated clasts of former detrital opaque oxides.

Detrital flakes of mica (up to about 0.1 mm long but most are smaller) comprise muscovite flakes. Most feldspars are now almost completely argillized. Some carbonaceous wisps occur as small wisps and blebs throughout the matrix. The carbonaceous flakes are mostly aligned to bedding but some randomly distributed deformed carbonaceous seams are observed.

The siltstone is cemented by a connected, interstitial network of a sericitic/illitic style of clay heavily stained brownish by very fine carbonaceous matter and overprinted by tiny diagenetic pyrite spheres.

Comments and Interpretations

The supplied drill core sample (labelled 101623) from the Inland Rail Project is identified as thinly laminated labile siltstone. The environment had to be of low current energy in order to deposit the matrix clays, micaceous flakes and the weak carbonaceous material and is probably marginal marine due to the presence of traces of diagenetic pyrite. Alteration is light, largely diagenetic dewatering of the sediment.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- thinly laminated labile siltstone (a sedimentary rock type)
- thinly fractured (about 1% open fractures)
- unweathered
- contains about 80% of soft, weak or otherwise non-durable components (sericite/illite and mica flakes as well as carbonaceous matter)
- carries a trace of pyrite, an oxidisable mineral
- moderately hard
- weak to moderately strong

The siltstone is predicted to be **non-durable to moderately durable.** The rock separated at laminations very easily (especially when wet). Its network of cementing clay will result in reduced wet strength which along with other mica flakes and oxidisable carbonaceous matter along bedding planes will lead to splitting, fretting and slow disaggregation of the siltstone upon cyclic wetting and drying.

Free silica content

The free silica or quartz content is estimated to be about 12%.

Carbonate content

The carbonate content is estimated to be nil.



Plate 2: Medium magnification, cross polarised light image of the siltstone showing mostly sericite/illite matrix clay with some silty grains of quartz and feldspar. Note the deformed carbonaceous seams.



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PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101633) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order: Invoice Number: Client Ref:

BNE 1912014 00008538 Chris Channon

Issued by

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JANUARY, 2019 Tl190105 1 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Sample Number:	101633	Date Sampled:	Unknown
<u>Sample Type</u> :	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2101-C09600	<u>Depth</u> :	96.00 – 96.90 m
Project ID:	1893802 Inland Rail Packag	e 13	
Work Requested	Petrographic analysis and content	determination of qu	artz and carbonate
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Guid for Concrete and the engineering purposes	de for <i>Petrographic</i> e AS2758.1 – 2014 s part 1; Concrete
Identification	Quartzofeldspathic and lithic	sandstone	

Description

The sample consisted of a drill core specimen which is apparently unweathered, grey finely laminated sandstone with bedding evident. The core can be deeply scratched by a steel tool and can be broken along bedding planes. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is fine to medium grained and is hygroscopic.



Plate 1: Photograph of supplied drill core.

JANUARY, 2019 Tl190105 2 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 43% quartz sand grains
- 7% feldspar sand grains
- 1% other mineral grains (opaque oxide, leucoxene (1%), zircon, garnet)
- 6% quartzite clasts
- 2% chert clasts
- 1% acid tuffaceous/volcanic sand clasts (<1% fine microcrystalline quartz)
- 2% intermediate volcanic clasts (largely argillized)

Moderately Durable Components

<1% carbonate

Soft, Weak &/Or Deleterious Components

- <1% muscovite
- 4% argillized and sericitized clasts of uncertain origin
- 22% interstitial sericite-smectite clays
- 9% zeolite
- <1% earthy secondary iron oxide
- <1% carbonaceous matter
 - 3% pores

In thin section, the rock is a fine to medium-grained, quartzofeldspathic and lithic sandstone with an average grainsize of about 0.1 to 0.5 mm, with minor clasts ranging up to 0.8 m. It is relatively well sorted, and shows a weak bedding defined by preferred orientation of grains.

The framework grains are dominated by sub-rounded to sub-angular lithic clasts which are quite argillized, along with quartz and feldspar grains. Lithic clasts were very fine-grained quartzo-feldspathic grains with strong pale brown sericite-smectite alteration. Due to their fine grainsize, it is difficult to be sure that these were derived from formerly glassy rhyolite/dacite lava fragments along with minor intermediate volcanics. Equant to sub-rounded detrital quartz and blocky sub-rounded to euhedral feldspar grains are relatively common suggesting derivation from phenocrysts in felsic volcanic or explosive volcaniclastic rocks. Occasionally, there are detrital muscovite flakes (about 0.3 mm long) with long axes sub-parallel to the bedding along with some opaque oxides and carbonaceous specks.

The matrix of this rock is now composed of largely fine quartz and extremely fine-grained sericite/smectite clays which have been partly altered to zeolite and minor carbonate.

JANUARY, 2019 Tl190105 3 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Comments and Interpretations

The supplied drill core sample (labelled 101633) from the Inland Rail Project is identified as fine to medium-grained, quartzofeldspathic and lithic sandstone. The sandstone carries an abundance of argillized lithic clasts which indicate a felsic volcanic source.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- **quartzofeldspathic and lithic sandstone** (a sedimentary rock type)
- slightly porous (3% pores)
- apparently unweathered
- finely laminated
- contains about 35% of soft, weak minerals as interstitial material and in altered lithic clasts
- moderately hard
- essentially strong

The rock is predicted to be **moderately durable to durable**.

Free Silica Content

The free silica content is estimated to be about 51%.

Carbonate Content

The carbonate content is estimated to be about <1%.



Plate 2: Low magnification, cross polarised light image of the sandstone, showing quartz and lithic grains with a thin interstitial clay cement and zeolite between grains.



Geochempet Services

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PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101644) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order: Invoice Number: Client Ref: BNE 1912014 00008538 Chris Channon

Issued by

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K. E. Spring BSc (Hons), MAppSc 10 January 2019

JANUARY, 2019 Tl190106 1 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Sample Number:	101644	Date Sampled:	Unknown
Sample Type:	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2101-C09970	<u>Depth</u> :	99.70 – 99.90 m
Project ID:	1893802 Inland Rail Packag	e 13	
Work Requested	Petrographic analysis and content	determination of qu	artz and carbonate
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Guid for Concrete and the engineering purpose.	de for <i>Petrographic</i> e AS2758.1 – 2014 s part 1; Concrete
Identification	Carbonated, quartzofeldspath	ic and lithic sandstone	

Description

The sample consisted of a drill core specimen which is very slightly weathered, light brownish-grey sandstone with slight bedding evident. Weathering is expressed through weathered/argillized clasts scattered throughout the core. The core can be lightly scratched by a steel tool. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is fine-grained and is slowly hygroscopic.





JANUARY, 2019 Tl190106 2 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 15% quartz sand grains
- 7% feldspar sand grains
- <1% other mineral grains (opaque oxide, leucoxene, zircon)
- 1% quartzite clasts
- 1% chert
- 3% acid tuffaceous/volcanic sand clasts (1% fine microcrystalline quartz)
- 1% intermediate volcanic clasts (largely argillized)
- 1% basalt clasts
- <1% meta-pelite clasts

Moderately Durable Components

51% carbonate

Soft, Weak &/Or Deleterious Components

- 2% muscovite
- 11% argillized and sericitized clasts of uncertain origin
- <1% interstitial sericite-smectite clays
 - 1% zeolite
- <1% earthy secondary iron oxide
 - 6% carbonaceous matter
- <1% pores

In thin section, the rock is a fine-grained, quartzofeldspathic and lithic sandstone with an average grainsize of about 0.1 to 0.2 mm. It is relatively well sorted, and shows a weak bedding defined by the alignment of grains.

The framework grains are dominated by sub-rounded to sub-angular lithic clasts which are quite argillized, along with quartz and feldspar grains. Lithic clasts were very fine-grained quartzo-feldspathic grains with strong pale brown sericite-smectite alteration. Due to their fine grainsize, it is difficult to be sure that these were derived from formerly glassy rhyolite/dacite lava fragments along with minor intermediate volcanics. Equant to sub-rounded detrital quartz and blocky sub-rounded to euhedral feldspar grains are relatively common suggesting derivation from phenocrysts in felsic volcanic or explosive volcaniclastic rocks. Occasionally, there are detrital muscovite flakes (about 0.2 mm long) with long axes sub-parallel to the bedding along with some opaque oxides and carbonaceous specks. Other lithic clasts comprise of quartzite, chert, basalt and meta-pelite.

The matrix of this rock is now composed of largely fine quartz and extremely fine-grained sericite/smectite clays which have now been almost completely altered to carbonate, with minor zeolite. A thin coal seam is observed in the sandstone.

JANUARY, 2019 Tl190106 3 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Comments and Interpretations

The supplied drill core sample (labelled 101644) from the Inland Rail Project is identified as fine-grained, carbonated, quartzofeldspathic and lithic sandstone. The sandstone carries an abundance of argillized lithic clasts which indicate a felsic volcanic source.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- carbonated, quartzofeldspathic and lithic sandstone (a sedimentary rock type)
- very slightly porous (<1% pores)
- very slightly weathered
- heavily carbonated
- contains about 20% of soft, weak minerals as interstitial material and in altered lithic clasts along including carbonaceous/plant matter (6%)
- essentially hard
- essentially strong

The rock is predicted to be **essentially durable**.

Free Silica Content

The free silica content is estimated to be about 18%.

Carbonate Content

The carbonate content is estimated to be about 51%.



Plate 2: Low magnification, cross polarised light image of the sandstone, showing quartz, feldspar, muscovite and lithic grains in a carbonated matrix with carbonaceous/plant matter to the left of the image.



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PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101659) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order: Invoice Number: Client Ref: BNE 1912014 00008538 Chris Channon

Issued by

C. A. Bruggemann BAppSc, MEngSC, MIEAust 10 January 2019 Reviewed by

K. E. Spring BSc (Hons), MAppSc 10 January 2019

JANUARY, 2019 Tl190107 l of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.
Sample Number:	101659	Date Sampled:	Unknown
<u>Sample Type</u> :	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2101-C11400	Depth:	114.00 – 115.00 m
Project ID:	1893802 Inland Rail Package	e 13	
<u>Work Requested</u>	Petrographic analysis and content	determination of qu	artz and carbonate
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Guid for Concrete and the engineering purposes	e for <i>Petrographic</i> AS2758.1 – 2014 <i>part 1; Concrete</i>
Identification	Quartzofeldspathic and lithic	sandstone	

Description

The sample consisted of a drill core specimen which is apparently unweathered, grey sandstone with slight bedding evident. The core can be scratched by a steel tool. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is fine to medium-grained and is slowly hygroscopic.



Plate 1: Photograph of supplied drill core.

JANUARY, 2019 Tl190107 2 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 44% quartz sand grains
- 7% feldspar sand grains
- 1% other mineral grains (opaque oxide, leucoxene (1%), zircon)
- 2% quartzite clasts
- 4% acid tuffaceous/volcanic sand clasts (1% fine microcrystalline quartz)
- 6% intermediate volcanic clasts (largely argillized)
- 2% basalt clasts
- 2% meta-pelite clasts

Moderately Durable Components

1% carbonate

Soft, Weak &/Or Deleterious Components

- 2% muscovite
- 6% argillized and sericitized clasts of uncertain origin
- 11% interstitial sericite-smectite clays
- 8% zeolite
- <1% earthy secondary iron oxide
- <1% carbonaceous matter
 - 4% pores

In thin section, the rock is a fine to medium-grained, quartzofeldspathic and lithic sandstone with an average grainsize of about 0.1 to 0.4 mm. It is relatively well sorted, and shows a weak bedding defined by grainsize grading.

The framework grains are dominated by sub-rounded to sub-angular lithic clasts which are quite argillized, along with quartz and feldspar grains. Lithic clasts were very fine-grained quartzo-feldspathic grains with strong pale brown sericite-smectite alteration. Due to their fine grainsize, it is difficult to be sure that these were derived from formerly glassy rhyolite/dacite lava fragments along with minor intermediate volcanics. Equant to sub-rounded detrital quartz and blocky sub-rounded to euhedral feldspar grains are relatively common suggesting derivation from phenocrysts in felsic volcanic or explosive volcaniclastic rocks. Occasionally, there are detrital muscovite flakes (about 0.2 mm long) with long axes sub-parallel to the bedding along with some opaque oxides and carbonaceous specks. Other lithic clasts comprise of quartzite, basalt and meta-pelite.

The matrix of this rock is now composed of largely fine quartz and extremely fine-grained sericite/smectite clays which have been partly altered to zeolite and minor carbonate.

JANUARY, 2019 Tl190107 3 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Comments and Interpretations

The supplied drill core sample (labelled 101659) from the Inland Rail Project is identified as fine to medium-grained, quartzofeldspathic and lithic sandstone. The sandstone carries an abundance of argillized lithic clasts which indicate a felsic volcanic source.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- quartzofeldspathic and lithic sandstone (a sedimentary rock type)
- slightly porous (4% pores)
- apparently unweathered
- contains about 27% of soft, weak minerals as interstitial material and in altered lithic clasts
- essentially hard
- essentially strong

The rock is predicted to be **essentially durable**.

Free Silica Content

The free silica content is estimated to be about 47%.

Carbonate Content

The carbonate content is estimated to be about 1%.



Plate 2: Low magnification, cross polarised light image of the sandstone, showing quartz and lithic grains in a clay matrix along with some porosity.



Geochempet Services

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PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101668) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order: Invoice Number: Client Ref: BNE 1912014 00008538 Chris Channon

Issued by

C. A. Bruggemann BAppSc, MEngSC, MIEAust 10 January 2019 Reviewed by

K. E. Spring BSc (Hons), MAppSc 10 January 2019

JANUARY, 2019 Tl190108 1 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Sample Number:	101668	Date Sampled:	Unknown
Sample Type:	Drill Core	Date Received:	14/12/2018
<u>Borehole</u> :	330-01-BH2101-C11700	<u>Depth</u> :	117.00 – 117.90 m
Project ID:	1893802 Inland Rail Packag	ge 13	
<u>Work Requested</u>	Petrographic analysis and content	determination of qu	artz and carbonate
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Guid for Concrete and the engineering purpose.	de for <i>Petrographic</i> e AS2758.1 – 2014 s part 1; Concrete
Identification	Quartzofeldspathic and lithic	sandstone	

Description

The sample consisted of a drill core specimen which is very slightly weathered, grey sandstone with slight bedding evident through variations in grain size. Weathering is expressed through weathered/argillized clasts scattered throughout the core. The core can be lightly scratched by a steel tool. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is medium to coarse-grained and is slowly hygroscopic.



Plate 1: Photograph of supplied drill core.

JANUARY, 2019 Tl190108 2 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 46% quartz sand grains
- 3% feldspar sand grains
- <1% other mineral grains (opaque oxide, leucoxene, zircon)
- 7% quartzite clasts
- 2% vein quartz
- 4% acid tuffaceous/volcanic sand clasts (1% fine microcrystalline quartz)
- 6% intermediate volcanic clasts (largely argillized)
- 1% basalt clasts
- 3% meta-pelite clasts

Moderately Durable Components

2% carbonate

Soft, Weak &/Or Deleterious Components

- 1% muscovite
- 5% argillized and sericitized clasts of uncertain origin
- 7% interstitial sericite-smectite clays
- 11% zeolite
- <1% earthy secondary iron oxide
- <1% carbonaceous matter
 - 2% pores

In thin section, the rock is a medium to coarse-grained, quartzofeldspathic and lithic sandstone with an average grainsize of about 0.25 to 1.5 mm. It is relatively well sorted, and shows a weak bedding defined by grainsize grading.

The framework grains are dominated by sub-rounded to sub-angular lithic clasts which are quite argillized, along with quartz and feldspar grains. Some quartz grains show overgrowths. Lithic clasts were very fine-grained quartzo-feldspathic grains with strong pale brown sericite-smectite alteration. Due to their fine grainsize, it is difficult to be sure that these were derived from formerly glassy rhyolite/dacite lava fragments along with minor intermediate volcanics. Equant to sub-rounded detrital quartz and blocky sub-rounded to euhedral feldspar grains are relatively common suggesting derivation from phenocrysts in felsic volcanic or explosive volcaniclastic rocks. Occasionally, there are detrital muscovite flakes (about 0.25 mm long) with long axes sub-parallel to the bedding along with some opaque oxides and carbonaceous specks. Other lithic clasts comprise of quartzite, vein quartz, basalt and meta-pelite.

The matrix of this rock is now composed of largely fine quartz and extremely fine-grained sericite/smectite clays which have been partly altered to carbonate and zeolite.

JANUARY, 2019 Tl190108 3 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Comments and Interpretations

The supplied drill core sample (labelled 101668) from the Inland Rail Project is identified as medium to coarse-grained, quartzofeldspathic and lithic sandstone. The sandstone carries an abundance of argillized lithic clasts which indicate a felsic volcanic source.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- quartzofeldspathic and lithic sandstone (a sedimentary rock type)
- slightly porous (2% pores)
- very slightly weathered
- contains about 24% of soft, weak minerals as interstitial material and in altered lithic clasts
- essentially hard
- essentially strong

The rock is predicted to be **essentially durable**. Although 24% of the rock contains soft, weak minerals, the quartz overgrowths observed have strengthened the rock.

Free Silica Content

The free silica content is estimated to be about 56%.

Carbonate Content

The carbonate content is estimated to be about 2%.



Plate 2: Low magnification, cross polarised light image of the sandstone, showing quartz, feldspar and lithic grains along with part of the matrix being slightly carbonated.



Geochempet Services

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PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101694) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order: Invoice Number: Client Ref: BNE 1912014 00008538 Chris Channon

Issued by

C. A. Bruggemann BAppSc, MEngSC, MIEAust 10 January 2019 Reviewed by

K. E. Spring BSc (Hons), MAppSc 10 January 2019

January 2019 Tl190109 1 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

<u>Sample Number</u> :	101694	Date Sampled:	Unknown
<u>Sample Type</u> :	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2102-C01020	<u>Depth</u> :	10.20 – 11.00 m
Project ID:	1893802 Inland Rail Packag	e 13	
Work Requested	Petrographic analysis and content	determination of qu	artz and carbonate
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Guid for Concrete and the engineering purposes	de for <i>Petrographic</i> e AS2758.1 – 2014 s part 1; Concrete
Identification	Quartzofeldspathic and lithic	sandstone	

Description

The sample consisted of a drill core specimen which is very slightly weathered, brownish-grey sandstone with slight bedding evident. Weathering is expressed through weathered/argillized clasts scattered throughout the core. The core can be lightly scratched by a steel tool. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is medium-grained and is slowly hygroscopic.





JANUARY, 2019 Tl190109 2 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 50% quartz sand grains
- 12% feldspar sand grains
- <1% other mineral grains (opaque oxide, leucoxene, zircon)
- 5% quartzite clasts
- 2% vein quartz
- 4% acid tuffaceous/volcanic sand clasts (1% fine microcrystalline quartz)
- 1% intermediate volcanic clasts (largely argillized)
- <1% basalt clasts
- 2% meta-pelite clasts

Moderately Durable Components

3% carbonate

Soft, Weak &/Or Deleterious Components

- 2% muscovite
- 9% argillized and sericitized clasts of uncertain origin
- 5% interstitial sericite-smectite clays
- 3% zeolite
- <1% earthy secondary iron oxide
- <1% carbonaceous matter
 - 2% pores

In thin section, the rock is a medium -grained, quartzofeldspathic and lithic sandstone with an average grainsize of about 0.1 to 0.5 mm, with some grains ranging up to 0.7 mm and rare grains up to 1 mm. It is relatively well sorted, and shows a weak bedding defined by grainsize grading.

The framework grains are dominated by sub-rounded to sub-angular lithic clasts which are quite argillized, along with quartz and feldspar grains. Lithic clasts were very fine-grained quartzo-feldspathic grains with strong pale brown sericite-smectite alteration. Due to their fine grainsize, it is difficult to be sure that these were derived from formerly glassy rhyolite/dacite lava fragments along with minor intermediate volcanics. Equant to sub-rounded detrital quartz and blocky sub-rounded to euhedral feldspar grains are relatively common suggesting derivation from phenocrysts in felsic volcanic or explosive volcaniclastic rocks. Occasionally, there are detrital muscovite flakes (about 0.1 mm long) with long axes sub-parallel to the bedding along with some opaque oxides and carbonaceous specks. Other lithic clasts comprise of quartzite, basalt and meta-pelite.

The matrix of this rock is now composed of largely fine quartz and extremely fine-grained sericite/smectite clays which have been partly altered to carbonate and zeolite.

JANUARY, 2019 Tl190109 3 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Comments and Interpretations

The supplied drill core sample (labelled 101694) from the Inland Rail Project is identified as medium-grained, quartzofeldspathic and lithic sandstone. The sandstone carries an abundance of argillized lithic clasts which indicate a felsic volcanic source.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- quartzofeldspathic and lithic sandstone (a sedimentary rock type)
- slightly porous (2% pores)
- very slightly weathered
- contains about 19% of soft, weak minerals as interstitial material and in altered lithic clasts
- essentially hard
- essentially strong

The rock is predicted to be **essentially durable**.

Free Silica Content

The free silica content is estimated to be about 58%.

Carbonate Content

The carbonate content is estimated to be about 3%.



Plate 2: Low magnification, cross polarised light image of the sandstone, showing quartz and lithic grains along with a single muscovite flake.



Geochempet Services

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lons), MAppSc

PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101727) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

BNE 1912014		
00008538		
Chris Channon	-	\bigcirc
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narphik	Reviewed by	Kent Optim
g BAppSc. MAppSc		K. E. Spring BSe (Hons)
19		10 January 2019
	BNE 1912014 00008538 Chris Channon	BNE 1912014 00008538 Chris Channon Mary Reviewed by BAppSc. MAppSc

JANUARY, 2019 Tl190110 1 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Sample Number:	101727	Date Sampled:	Unknown
Sample Type:	Drill Core	Date Received:	14/12/2018
<u>Borehole</u> :	330-01-BH2103-C01738	<u>Depth</u> :	17.38 – 17.60 m
Project ID:	1893802 Inland Rail Packag	e 13	
Work Requested	Petrographic analysis and content	determination of qu	uartz and carbonate
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Gui for Concrete and the engineering purpose	de for <i>Petrographic</i> e AS2758.1 – 2014 s part 1; Concrete
Identification	Quartzofeldspathic and lithic	sandstone	

Description

The sample consisted of a drill core specimen which is very slightly weathered, grey sandstone with bedding evident. Weathering is expressed through weathered/argillized clasts scattered throughout the core. The core can be deeply scratched by a steel tool and can be broken along bedding planes. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is fine to medium grained and is hygroscopic.



Plate 1: Photograph of supplied drill core.

JANUARY, 2019 T1190110 2 of 5 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 42% quartz sand grains
- 11% feldspar sand grains
- 2% other mineral grains (opaque oxide, leucoxene (1%), zircon, garnet)
- 4% quartzite clasts
- 1% chert clasts
- 3% acid tuffaceous/volcanic sand clasts (1% fine microcrystalline quartz)
- 8% intermediate volcanic clasts (largely argillized)
- 3% epidote

Moderately Durable Components

1% carbonate

Soft, Weak &/Or Deleterious Components

- 6% muscovite
- 5% argillized and sericitized clasts of uncertain origin
- 10% interstitial sericite-smectite clays
- 4% zeolite
- <1% earthy secondary iron oxide
- <1% carbonaceous matter
- <1% pores

In thin section, the rock is a fine to medium-grained, quartzofeldspathic and lithic sandstone with an average grainsize of about 0.05 to 0.2 mm, with minor clasts ranging up to 0.8 m. It is relatively well sorted, and shows a weak bedding defined by preferred orientation of grains.

The framework grains are dominated by sub-rounded to sub-angular lithic clasts which are quite argillized, along with quartz and feldspar grains. Lithic clasts were very fine-grained quartzo-feldspathic grains with strong pale brown sericite-smectite alteration. Due to their fine grainsize, it is difficult to be sure that these were derived from formerly glassy rhyolite/dacite lava fragments along with minor intermediate volcanics. Equant to sub-rounded detrital quartz and blocky sub-rounded to euhedral feldspar grains are relatively common suggesting derivation from phenocrysts in felsic volcanic or explosive volcaniclastic rocks. Occasionally, there are detrital muscovite flakes (about 0.3 mm long) with long axes sub-parallel to the bedding along with some opaque oxides and carbonaceous specks.

The matrix of this rock is now composed of largely fine quartz and extremely fine-grained sericite/smectite clays which have been partly altered to zeolite and minor carbonate.

JANUARY, 2019 Tl190110 3 of 5 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Comments and Interpretations

The supplied drill core sample (labelled 101727) from the Inland Rail Project is identified as fine to medium-grained, quartzofeldspathic and lithic sandstone. The sandstone carries an abundance of argillized lithic clasts which indicate a felsic volcanic source.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- quartzofeldspathic and lithic sandstone (a sedimentary rock type)
- very slightly porous (<1% pores)
- very slightly weathered
- contains 1% moderately durable carbonate
- contains about 25% of soft, weak minerals as interstitial material and in altered lithic clasts
- essentially hard
- essentially strong

The rock is predicted to be **essentially durable**.

Free Silica Content

The free silica content is estimated to be about 48%.

Carbonate Content

The carbonate content is estimated to be about 1%.



Plate 2: Micrograph taken at low magnification in transmitted cross polarised light of part of the sandstone, showing quartz and lithic grains with a thin interstitial clay cement and zeolite between grains.



Geochempet Services

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PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101738) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order: Invoice Number: Client Ref: BNE 1912014 00008538 Chris Channon

Issued by

K. E. Spring BSc (Hons), MAppSc 10 January 2019

JANUARY, 2019 Tl190111 Page 1 of 5 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services

Sample Number:	101738	Date Sampled:	Unknown
Sample Type:	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2103-C02800	<u>Depth</u> :	28.00–28.30 m
Project ID:	1893802 Inland Rail Packag	e 13	
Work Requested	Petrographic analysis		
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Guid for Concrete and the engineering purposes	de for Petrographic e AS2758.1 – 2014 s part 1; Concrete
Identification	Labile siltstone		

Description

The sample consisted of a drill core specimen which is unweathered, subtly laminated, dark grey siltstone. The core can be deeply scratched with a steel tool leaving a grey to brown streak. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is very fine grained and is moderately hard. The rock is slowly hygroscopic.





JANUARY, 2019 T1190111 Page 2 of 5 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 12% quartz grains
- 3% vein quartz
- 6% remnant feldspar grains
- 1% hematized, leucoxenized or finely rutilated clasts of former detrital opaque oxides
- 3% lithic clasts of acid tuffaceous clasts (about 1% finely microcrystalline quartz)

Moderately Durable Components

3% calcite and/or siderite

Soft, Weak &/Or Deleterious Components

- 12% sericitized and argillized clasts
- 56% sericitic/illitic clay cement variably stained by secondary iron oxide
- 2% detrital mica (muscovite flakes)
- trace pyrite
- 1% carbonaceous wisps
- 1% open fractures

In thin section the rock displays primary textures of finely laminated, clayey to silty style. It consists of minor sub-rounded to angular sand clasts which are mainly 0.05 to 0.1 mm in size. An oval-shaped dropstone (about 9 mm long) is composed of heavily-strained vein quartz is also observed. Bedding is delineated by grainsize variations.

Very little of the rock persist as simple quartz and feldspar grains. Other robust mineral grains comprise hematized, leucoxenized or finely rutilated clasts of former detrital opaque oxides.

Detrital flakes of mica (up to about 0.1 mm long but most are smaller) comprise muscovite flakes. Most feldspars are now almost completely argillized. Some carbonaceous wisps occur as small wisps and blebs throughout the matrix. The carbonaceous flakes are mostly aligned to bedding.

The siltstone is cemented by a connected, interstitial network of a sericitic/illitic style of clay heavily stained brownish by very fine carbonaceous matter and overprinted by a few scattered tiny diagenetic pyrite spheres. The matrix cement is spotted by later replacement carbonates.

Comments and Interpretations

The supplied drill core sample (labelled 101738) from the Inland Rail Project is identified as labile siltstone. The environment had to be of low current energy in order to deposit the matrix clays, micaceous flakes and the weak carbonaceous material and is probably marginal marine due to the presence of traces of diagenetic pyrite. Alteration is light, largely diagenetic dewatering of the sediment but subsequent light carbonation of the rock has replaced spots in the matrix cement and hardened the siltstone.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- **labile siltstone** (a sedimentary rock type)
- thinly fractured (about 1% open fractures)
- unweathered
- comprised of 3% moderately robust carbonates
- contains about 71% of soft, weak or otherwise non-durable components (sericite/illite and mica flakes as well as carbonaceous matter)
- carries a trace of pyrite, an oxidisable mineral
- moderately hard
- weak to moderately strong

The siltstone is predicted to be **non-durable to moderately durable.** The rock separated at laminations very easily (especially when wet). Its network of cementing clay will result in reduced wet strength which along with other mica flakes and oxidisable carbonaceous matter along bedding planes will lead to splitting, fretting and slow disaggregation of the siltstone upon cyclic wetting and drying.

Free silica content

The free silica or quartz content is estimated to be about 16%.

Carbonate content

The carbonate content is estimated to be about 3%.



Plate 2: Low magnification, cross polarised light image of the siltstone showing a dropstone of vein quartz in a mostly sericite/illite matrix clay with some silty grains of quartz and feldspar. Note the thin carbonate lining on the edge of the dropstone.



Geochempet Services

ABN 980 6945 3445 PETROLOGICAL and GEOCHEMICAL CONSULTANTS Principals: K.E. Spring B.Sc. (Hons), MAppSc and H.M. Spring B.Sc.



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AppSc

PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101756) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order:	BNE 1912014		
Invoice Number:	00008538		
Client Ref:	Chris Channon	-	6
Issued by T. F. D. Spring 10 January 201	BAppSc. MAppSc 9	Reviewed by	K. E. Spring BSe (Hor 10 January 20
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JANUARY, 2019 Tl190112 1 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Sample Number:	101756	Date Sampled:	Unknown
Sample Type:	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2104-C02000	Depth:	20.00 – 20.15 m
Project ID:	1893802 Inland Rail Packag	ge 13	
<u>Work Requested</u>	Petrographic analysis and content	determination of q	uartz and carbonate
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Gui for Concrete and th engineering purpose	de for <i>Petrographic</i> e AS2758.1 – 2014 s part 1; Concrete
Identification	Carbonated, quartzofeldspatl	nic and lithic sandstone	

Description

The sample consisted of a drill core specimen which is very slightly weathered, light brownish-grey sandstone with bedding evident. Weathering is expressed through weathered/argillized clasts scattered throughout the core. The core can be deeply scratched by a steel tool and can be broken along bedding planes. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is fine to medium grained and is hygroscopic.



Plate 1: Photograph of supplied drill core.

JANUARY, 2019 Tl190112 2 of 5 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 31% quartz sand grains
- 7% feldspar sand grains
- 1% other mineral grains (opaque oxide, leucoxene (1%), zircon, garnet)
- 6% quartzite clasts
- 3% chert clasts
- 2% acid tuffaceous/volcanic sand clasts (<1% fine microcrystalline quartz)
- 5% intermediate volcanic clasts (largely argillized)
- 2% basalt clasts
- 2% granite clasts (1% quartz)

Moderately Durable Components

17% carbonate

Soft, Weak &/Or Deleterious Components

- 1% muscovite
- 10% argillized and sericitized clasts of uncertain origin
- 6% interstitial sericite-smectite clays
- 7% zeolite
- <1% earthy secondary iron oxide
- <1% carbonaceous matter
- <1% pores

In thin section, the rock is a fine to medium-grained, quartzofeldspathic and lithic sandstone with an average grainsize of about 0.1 to 0.5 mm, with minor clasts ranging up to 0.8 m. It is relatively well sorted, and shows a weak bedding defined by preferred orientation of grains.

The framework grains are dominated by sub-rounded to sub-angular lithic clasts which are quite argillized, along with quartz and feldspar grains. Lithic clasts were very fine-grained quartzo-feldspathic grains with strong pale brown sericite-smectite alteration. Due to their fine grainsize, it is difficult to be sure that these were derived from formerly glassy rhyolite/dacite lava fragments along with minor intermediate volcanics. Equant to sub-rounded detrital quartz and blocky sub-rounded to euhedral feldspar grains are relatively common suggesting derivation from phenocrysts in felsic volcanic or explosive volcaniclastic rocks. Occasionally, there are detrital muscovite flakes (about 0.3 mm long) with long axes sub-parallel to the bedding along with some opaque oxides and carbonaceous specks.

The matrix of this rock is now composed of largely fine quartz and extremely fine-grained sericite/smectite clays which have been partly altered to zeolite and minor carbonate.

JANUARY, 2019 Tl190112 3 of 5 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

Comments and Interpretations

The supplied drill core sample (labelled 101756) from the Inland Rail Project is identified as fine to medium-grained, quartzofeldspathic and lithic sandstone. The sandstone carries an abundance of argillized lithic clasts which indicate a felsic volcanic source. Alteration is largely diagenetic dewatering of the sediment but subsequent carbonation of the rock has replaced parts of the matrix cement and hardened the sandstone.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- carbonated, quartzofeldspathic and lithic sandstone (a sedimentary rock type)
- very slightly porous (<1% pores)
- very slightly weathered
- contains 17% moderately durable carbonate
- contains about 24% of soft, weak minerals as interstitial material and in altered lithic clasts
- essentially hard
- essentially strong

The rock is predicted to be **essentially durable**.

Free Silica Content

The free silica content is estimated to be about 40%.

Carbonate Content

The carbonate content is estimated to be about 17%.



Plate 2: Micrograph taken at low magnification in transmitted cross polarised light of part of the sandstone, showing quartz and lithic grains with a thin interstitial clay cement and zeolite between grains.



Geochempet Services

ABN 980 6945 3445 PETROLOGICAL and GEOCHEMICAL CONSULTANTS Principals: K.E. Spring B.Sc. (Hons), MAppSc and H.M. Spring B.Sc.



5/14 Redcliffe Gardens Drive Clontarf, QLD 4019

Telephone: (07) 3284 0020

Email: info@geochempet.com www.geochempet.com

PETROGRAPHIC REPORT ON A DRILL CORE SAMPLE (101763) FROM INLAND RAIL PROJECT

prepared for

TRILAB PTY LTD BRISBANE OFFICE

Purchase Order:	BNE 1912014		
Invoice Number:	00008538		
Client Ref:	Chris Channon	Reviewed by	Kent Spring
T. F. D. Spring 10 January 201	BAppSc. MAppSc 9		K. E. Spring BSs (Hons), MAppSc 10 January 2019

JANUARY, 2019 Tl181113 1 of 4 The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services.

<u>Sample Number</u> :	101763	Date Sampled:	Unknown
<u>Sample Type</u> :	Drill Core	Date Received:	14/12/2018
Borehole:	330-01-BH2104-C02492	<u>Depth</u> :	24.92 – 25.00 m
Project ID:	1893802 Inland Rail Packag	e 13	
Work Requested	Petrographic analysis and content	determination of qu	artz and carbonate
<u>Methods</u>	Account taken of ASTM Assessment of Aggregates Aggregates and rock for aggregates (Appendix B)	C295 Standard Guid for Concrete and the engineering purposes	de for <i>Petrographic</i> e AS2758.1 – 2014 s part 1; Concrete
Identification	Carbonated, quartzofeldspath	ic and lithic sandstone	

Description

The sample consisted of a drill core specimen which is very slightly weathered, brownish-grey sandstone with slight bedding evident through variations in grain size. A deformed coal seam is noted in the core. Weathering is expressed through weathered/argillized clasts scattered throughout the core. The core can be lightly scratched by a steel tool. It seems to consist of a mixture of minerals, some as hard as quartz and others as soft as clay. The rock is medium to coarse-grained and is slowly hygroscopic.



Plate 1: Photograph of supplied drill core.

JANUARY, 2019Tl1901132 of 4The material contained within this report may not be quoted other than in full. Extracts may be used only with
expressed prior written approval of Geochempet Services.

A thin section was prepared from the drill core for detailed microscopic examination in transmitted polarized light. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points in thin section, is:

Hard, Durable Components

- 38% quartz sand grains
- 6% feldspar sand grains
- <1% other mineral grains (opaque oxide, leucoxene, zircon)
- 7% quartzite clasts
- 6% vein quartz
- 3% acid tuffaceous/volcanic sand clasts (1% fine microcrystalline quartz)
- 4% intermediate volcanic clasts (largely argillized)
- 2% basalt clasts
- 2% meta-pelite clasts
- 1% epidote

Moderately Durable Components

11% carbonate

Soft, Weak &/Or Deleterious Components

- 2% muscovite
- 6% argillized and sericitized clasts of uncertain origin
- 8% interstitial sericite-smectite clays
- 3% zeolite
- <1% earthy secondary iron oxide
- <1% carbonaceous matter
 - 1% pores

In thin section, the rock is a medium to coarse-grained, quartzofeldspathic and lithic sandstone with an average grainsize of about 0.25 to 1.5 mm. It is relatively well sorted, and shows a weak bedding defined by grainsize grading.

The framework grains are dominated by sub-rounded to sub-angular lithic clasts which are quite argillized, along with quartz and feldspar grains. Some quartz grains show overgrowths. Lithic clasts were very fine-grained quartzo-feldspathic grains with strong pale brown sericite-smectite alteration. Due to their fine grainsize, it is difficult to be sure that these were derived from formerly glassy rhyolite/dacite lava fragments along with minor intermediate volcanics. Equant to sub-rounded detrital quartz and blocky sub-rounded to euhedral feldspar grains are relatively common suggesting derivation from phenocrysts in felsic volcanic or explosive volcaniclastic rocks. Occasionally, there are detrital muscovite flakes (about 0.25 mm long) with long axes sub-parallel to the bedding along with some opaque oxides and carbonaceous specks. Other lithic clasts comprise of quartzite, vein quartz, basalt and meta-pelite.

The matrix of this rock is now composed of largely fine quartz and extremely fine-grained sericite/smectite clays which have been partly altered to carbonate and zeolite.

Comments and Interpretations

The supplied drill core sample (labelled 101763) from the Inland Rail Project is identified as medium to coarse-grained, quartzofeldspathic and lithic sandstone. The sandstone carries an abundance of argillized lithic clasts which indicate a felsic volcanic source.

For engineering purposes, the rock in the supplied drill core sample may be summarised as consisting of:

- carbonated, quartzofeldspathic and lithic sandstone (a sedimentary rock type)
- slightly porous (1% pores)
- very slightly weathered
- contains 11% moderately robust carbonate
- contains about 19% of soft, weak minerals as interstitial material and in altered lithic clasts
- essentially hard
- essentially strong

The rock is predicted to be **essentially durable**.

Free Silica Content

The free silica content is estimated to be about 52%.

Carbonate Content

The carbonate content is estimated to be about 11%.



Plate 2: Micrograph taken at low magnification in transmitted cross polarised light of part of the sandstone. Image shows quartz, feldspar and lithic grains along with part of the matrix being slightly carbonated.

Slake Durability Index



Brisbane 346A Bilsen Road, Geebung QLD 4034 Ph: +61 7 3265 5656 Perth 2 Kimmer Place, Queens Park WA 6107 Ph: +61 8 9258 8323

client Address		St Method. A5 4155.5.4		
ddress	Golder Associates Pty Limited		Report No.	GA101511-SD
	PO Box 1734 MILTON BC	QLD 4064	Request No.	1893802_H2C_TR1
			Test Date	26/11/2018
roject	Inland Rail Package 13		Report Date	04/12/2018
Project No	1893802	Client Sa	mple No.	330-01-BH2301-C00500
Sample No.			101511	
BoreHole		330-/	01-BH2301	
Depth From (m)			5.00	
Depth To (m)			6.00	
Description			С	
Slake Durability (1st cycle) (%)		88.9	
Slake Durability (2nd cycle) (%)		80.2	
Slake Durability (3rd cycle) (%)		-	
Slake Durability (4th cycle) (%)		-	
Water Used		Ta	ap Water	
Temperature (°C)	and the set of the difference of the set of	05.64	26.8	
Appearance of frag	gments retained in the drum	Slight		
Appearance of frag	gments passing through the drum	Fragm	ients & Fines	

Sample/s supplied by the client

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Tested at Trilab Brisbane Laboratory.

A Authorised Signatory

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Client	Golder Associates Pty Limited			Report No.	GA101516-SD
Address	PO Box 1734 MILTON BC	QLD	4064	Request No.	1893802_H2C_TR1
				Test Date	26/11/2018
Project	Inland Rail Package 13			Report Date	04/12/2018
Project No	1893802		Client Sa	mple No.	330-01-BH2301-C01000
Sample No.				101516	
BoreHole			330-	01-BH2301	
Depth From (r	m)			10	
Depth To (m)				11	
Description				С	
Slake Durabi	lity (1st cycle) (%)			96.4	
Slake Durabi	lity (2nd cycle) (%)			93.7	
Slake Durabi	lity (3rd cycle) (%)			-	
Slake Durabi	lity (4th cycle) (%)			-	
Water Used			Ta	ap Water	
Temperature	(°C)			26.8	
Appearance of	of fragments retained in the drum		Slight	Deterioration	
Appearance c	of fragments passing through the drum		Fragm	ents & Fines	

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Client	Golder Associates Pty Limited			Report No.	GA101552-SD
Address	PO Box 1734 MILTON BC	QLD	4064	Request No.	1893802_H2C_TR1
				Test Date	30/11/2018
Project	Inland Rail Package 13			Report Date	04/12/2018
Project No	1893802		Client Sa	ample No.	330-01-BH2303-C00500
			1		
Sample No.				101552	
BoreHole			330-	01-BH2303	
Depth From (m)			5	
Depth To (m)				6	
Description				С	
Slake Durabi	lity (1st cycle) (%)			98.8	
Slake Durabi	lity (2nd cycle) (%)			97.9	
Slake Durabi	lity (3rd cycle) (%)			-	
Slake Durabi	lity (4th cycle) (%)			-	
Water Used			Т	ap Water	
Temperature	(°C)			27.8	
Appearance of	of fragments retained in the drum		Ori	ginal Form	
Appearance of	of fragments passing through the drum			Fines	

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Client	Golder Associates Pty Limited			Report No.	GA101558-SD
Address	PO Box 1734 MILTON BC	QLD	4064	Request No.	1893802_H2C_TR1
				Test Date	29/11/2018
Project	Inland Rail Package 13			Report Date	04/12/2018
Project No	1893802		Client Sa	imple No.	330-01-BH2303-C01000
Sample No.				101558	
BoreHole			330-	01-BH2303	
Depth From ((m)			10	
Depth To (m)				11	
Description				С	
Slake Durab	ility (1st cycle) (%)			97.8	
Slake Durab	ility (2nd cycle) (%)			96.7	
Slake Durab	- ility (3rd cycle) (%)			-	
Slake Durab	- ility (4th cycle) (%)			-	
Water Used			Ta	ap Water	
Temperature	(°C)			26.1	
Appearance	of fragments retained in the drum		Ori	ginal Form	
Appearance (of fragments passing through the drum		Fragm	ients & Fines	

NOTES/REMARKS:

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Client	Golder Associates Pty Limited		Report No.	GA101692-SD
Address	PO Box 1734 MILTON BC	QLD 4064	Request No.	1893802_H2C_TR2
			Test Date	28/11/2018
Project	Inland Rail Package 13		Report Date	04/12/2018
Project No	1893802	Client S	ample No.	330-01-BH2102-C00420
Sample No.			101692	
BoreHole		330	-01-BH2102	
Depth From (m	n)		4.2	
Depth To (m)			5	
Description			С	
Slake Durabili	ity (1st cycle) (%)		68.5	
Slake Durabili	ity (2nd cycle) (%)		15.5	
Slake Durabili	ity (3rd cycle) (%)		-	
Slake Durabili	ity (4th cycle) (%)		-	
Water Used		T	ap Water	
Temperature (°C)		24.7	
Appearance of	fragments retained in the drum	High	Deterioration	
Appearance of	fragments passing through the drum	Fragr	ments & Fines	

NOTES/REMARKS:

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		TY INDEX T	EST REPORT	
Client	Golder Associates Pty Limited	ullou: A5 4155.5.4	Report No.	GA101842-SD
Address	PO Box 1734 MILTON BC QLD	4064	Request No.	1893802_H2C_TR3
			Test Date	15/01/2019
Project	Inland Rail Package 13		Report Date	17/01/2019
Project No	1893802	Client S	ample No.	330-01-BH2306-C01250
Sample No.			101842	
BoreHole		330)-01-BH2306	
Depth From (m	n)		12.5	
Depth To (m)			13	
Description			С	
Slake Durabili	ity (1st cycle) (%)		94.8	
Slake Durabili	ity (2nd cycle) (%)		90.5	
Slake Durabili	ity (3rd cycle) (%)		-	
Slake Durabili	ity (4th cycle) (%)		-	
Water Used			Tap Water	
Temperature (°C)		28.6	
Appearance of	fragments retained in the drum	Sligh	t Deterioration	
Appearance of	fragments passing through the drum		Fines	
Appearance of	fragments passing through the drum		Fines	
ITES/REMARKS:				

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Laboratory No. 9926

	SLAKE DURABILI	TY INDEX T	EST REPORT	
Client	Test M	ethod: AS 4133.3.4		0.1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0
	BOIDER ASSOCIATES PTY LIMITED) 4064	Report No.	GA101846-SD
Addicoo			Request No.	1893802_H2C_TR3
Project	Inland Pail Package 13		Penort Date	15/01/2019
Project No	1893802	Client S	ample No 33	0-01-BH2306-C02100
	1000001			
Sample No.			101846	
BoreHole		330	0-01-BH2306	
Depth From (n	n)		21	
Depth To (m)			21.5	
Description			С	
Slake Durabil	ity (1st cycle) (%)		90.6	
Slake Durabil	ity (2nd cycle) (%)		84.4	
Slake Durabil	ity (3rd cycle) (%)		-	
Slake Durabil	ity (4th cycle) (%)		-	
Water Used			Tap Water	
Temperature (°C)		28.6	
Appearance of	f fragments retained in the drum	Sligh	t Deterioration	
Appearance of	f fragments passing through the drum	Frag	ments & Fines	

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Soil Particle Density



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liont	Coldor Acc	lest M	<u>etnoa: AS 128</u> Sd	<u>39 3.5.1</u>	_			
Jiient	Goldel Asso		Report No.		GA101459-SG			
	<u> </u>			1001	Workord	er No.	0005107	
Address	PO Box 173	34 MILTON BC	QLD	4064	Report D	ate	06/12/2018	
Project	Inland Rail	Package 13						
Sample No.	101459	101463						1
Test Date	28/11/2018	28/11/2018						
Client ID	330-01- BH2216- U00650	330-01- BH2216- U01250						
Depth (m)	6.50-6.99	12.50-12.99						
Soil Particle Density (t/m³) (-2.36mm)	2.54	2.58						
Sample No.								
Test Date								
Client ID								
Depth (m)								
Soil Particle Density (t/m³) (-2.36mm)								
								I

Sample/s supplied by the client

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Aggregate - Particle Density Degradation Crushing Value



		AGGF	REGATE TEST F	REPORT			
Client	Golder Associates Ptv Limited				Report No.	GA101519-A	GG
Address	PO Box 1734 MILTON BC	QLD	4064		Request No	1893802	H2C TR1
					Test Date	17/12/18-7/1/	19
Project	Inland Rail Package 13				Report Date	7/01/2019	
Project No.	1893802			Client Sa	mple No. 330	-01-BH2301-C013	300
BoreHole	330-01-BH2301		Depth From (m)	13	De	epth To (m)	15.5
Description	C					, ,	
	-		TEST RESULTS	8			
AS 1141.5 F	Particle Density & Water Absorption		Apparent Particle Density	v		2.63 t/n	1 ³
			Particle Density - Dry Bas	, sis		2.44 t/n	1 ³
			Particle Density - Saturat	ted Surface		2.51 t/m	1 ³
			Water Absorption			2.9 %	
AS 1141 25.1 [Deg. Factor (Source Rock)		Degradation Factor			2	
	,		Water Clarity			Not Clear	
Remarks							
Sample/s supplied by	client					Page1 of	1 REP0760
Accredit The results of the te this document a	ed for compliance with ISO/IEC 17025. ests, calibrations, and/or measurements are traceable to Australian/National Star	included indards.	n	Authorise	ed Signatory		
Te	sted at Trilab Brisbane Laboratory.			0.1			COMPETENCE Laboratory No. 9920
	The results of calibrations and tests perform	ned apply or	nly to the specific instrument of	or sample at the	e time of test unless othe	erwise clearly stated	,



		AGGF	REGATE TEST F	REPORT	-		
Client	Golder Associates Ptv Limited				Report No.	GA101542-A	GG
Address	PO Box 1734 MILTON BC	QLD	4064		Poqueet No.	1803803 1	
					Tost Data	17/12/18 7/1/	120_IKI 10
Project	Inland Rail Package 13				Report Date	7/01/2010	19
Project No.	1803802			Client Sa	mole No 330	1/01/2013	40
BoreHole	330-01-BH2303		Depth From (m)	34		anth To (m)	40 1 Q
Description	С.		Deptil From (iii)	0.4	De	pui ro (iii)	т. о
Description	•		TEST RESULTS	;			
AS 1141.5	Particle Density & Water Absorption		Apparent Particle Density	,		2.66 t/m	3
			Particle Density - Dry Bas	sis		2.52 t/m	3
			Particle Density - Saturat	ed Surface		2.52 t/m	3
			Water Absorption			2.0 %	
AS 1141 25.1 !	Deg. Factor (Source Rock)		Degradation Factor			2	
	o (,		Water Clarity			Not Clear	
Remarks	-Ford						
sample/s supplied by	client					Page1 of 1	REP0760
Accredi The results of the te this document	ted for compliance with ISO/IEC 17025. ests, calibrations, and/or measurements i are traceable to Australian/National Star	ncluded i dards	n	Authoris	ed Signatory		NATA
Te	sted at Trilab Brisbane Laboratory.			C. F	Park	I	ACCREDITED FOR TECHNICAL COMPETENCE
	The results of calibrations and tests performe	ed apply of	nly to the specific instrument of	or sample at th	e time of test unless othe	erwise clearly stated	



	AGGI	REGATE TEST REPORT		
Client	Golder Associates Pty Limited		Report No.	GA101842-BPDC
Address	PO Box 1734 MILTON BC QLD	4064	Request No.	1893802_H2C_TR3
			Test Date	23/01/2019-31/01/2019
Project	Inland Rail Package 13	-	Report Date	1/02/2019
Project No.	1893802	Depth From (m) 11	Sample	330-01-BH2306-C01250-BDW : 330-
BoreHole	330-01-BH2306	Depth To (m) 17	No.	01-BH2306-C01250-MOI
		TEST RESULTS		
AS 1141.6.1 P	article Density & Water Absorption	Apparent Particle Density	2	.66 t/m ³
		Particle Density - Dry Basis	2	.18 t/m ³
		Particle Density - Saturated Surface	2	.36 t/m ³
		Water Absorption	8	3.2 %
Remarks Sample/s supplied by o Accredit The results of the te this document a Tes	client ed for compliance with ISO/IEC 17025. sts, calibrations, and/or measurements included re traceable to Australian/National Standards. ted at Trilab Brisbane Laboratory.	in Authoris C. I	ed Signatory	Page1 of 1 REP07601
	Reference should be made to Tril	ab's "Standard Terms and Conditions of Bus rilab Pty Ltd ABN 25 065 630 506	e unne on test unness otherwis iness" for further details.	e cleany stated.



	AG	GGR	EGATE TEST REPO	ORT				
Client	Golder Associates Pty Limited			Rep	oort No.		GA101842-BP	DF
Address	PO Box 1734 MILTON BC QI	LD	4064	Red	quest No.		1893802_H	2C_TR3
				Tes	t Date		23/1/19-29/1/1	9
Project	Inland Rail Package 13			Rep	oort Date		30/01/2019	
Project No.	1893802		Depth From (m) 11		Sam	ple	330-01-BH2306-C0	1250-BDW : 330-
BoreHole	330-01-BH2306		Depth To (m) 17		N) .	01-BH2306-C01250	I-MOI
Description	С							
			TEST RESULTS					
AS 1141.5 P	article Density & Water Absorption		Apparent Particle Density			2.5	59 t/m ³	
			Particle Density - Dry Basis			2.3	37 t/m ³	
			Particle Density - Saturated Surfa	ace		2.4	5 t/m ³	
			Water Absorption			3.	7 %	
Remarks								
Sample/s supplied by c	lient						Page1 of 1	REP07601
Accredit The results of the te this document a	ed for compliance with ISO/IEC 17025. sts, calibrations, and/or measurements inclu re traceable to Australian/National Standard	uded ir ds.	Auth	horised Sign	atory			
Tes	ted at Trilab Brisbane Laboratory.			C. Park			1.	TECHNICAL COMPETENCE
	The results of calibrations and tests performed ap Reference should be made t	pply on to Trila ^{Tril}	ly to the specific instrument or sample b's "Standard Terms and Conditions o ab Pty Ltd ABN 25 065 630 506	e at the time of of Business" for	test unless otl further detail:	nerwise S.	clearly stated.	Solutory No. 3320



		AGGF	REGATE TEST R	EPORT			
Client	Golder Associates Pty Limited				Report No.	GA101842-AC	V
Address	PO Box 1734 MILTON BC	QLD	4064		Request No.	1893802_H	2C_TR3
					Test Date	23/01/2019-30/	01/2019
Project	Inland Rail Package 13				Report Date	30/01/2019	
Project No.	1893802		Depth From (m)	11	Samp	330-01-BH2306-C0	1250-ACV ·
BoreHole	330-01-BH2306		Depth To (m)	17	No.	550-01-Di 12500-00	1200-701
Description	C						
			TEST RESULTS				
AS 1141.21 A	ggregate Crushing Value		Aggregate Crushing Value			41.2 %	
			Size Fraction			6.7 - 4.75 mm	
Sample/s supplied by c	slient					Page1 of 1	REP07601
Accredite The results of the te this document a	ed for compliance with ISO/IEC 17025 sts, calibrations, and/or measurements re traceable to Australian/National Sta	s included ir ndards.	ı	Authorise	ed Signatory		
Tes	ted at Trilab Brisbane Laboratory.			C. P	ark		
	The results of calibrations and tests perform	ned apply or	nly to the specific instrument or	sample at the	e time of test unless othe	La rwise clearly stated.	boratory No. 9926
	Reference should be r	made to Trila Tri	b's "Standard Terms and Conc lab Pty Ltd ABN 25 065 630	litions of Busi) 506	ness" for further details.		

Aggressivity



CERTIFICATE OF ANALYSIS

Work Order	EB1829170	Page	: 1 of 6	
Client	: TRILAB PTY LTD	Laboratory	Environmental Division Bri	sbane
Contact	: THE ADMIN RESULTS	Contact	: Customer Services EB	
Address	: 346A BILSEN RD	Address	: 2 Byth Street Stafford QLD	Australia 4053
	GEEBUNG QLD, AUSTRALIA 4031			
Telephone	: +61 07 3265 5656	Telephone	: +61-7-3243 7222	
Project	: 1893802 - Inland Rail Package 13	Date Samples Received	: 28-Nov-2018 13:45	ANUIUL.
Order number	: BNE 1911046	Date Analysis Commenced	: 29-Nov-2018	
C-O-C number	:	Issue Date	: 05-Dec-2018 09:48	NATA
Sampler	:			HACEMRA NATA
Site	:			
Quote number	: EN/333			Accreditation No. 825
No. of samples received	: 20			Accredited for compliance with
No. of samples analysed	: 20			ISO/IEC 17025 - Testing

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

• CORROSION ASSESSMENT: As per Australian Standard (AS2159-1995, section 6), the Exposure Classification for all samples is rated Non Aggressive. ALS is not NATA accredited for this comment.



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		101405 / 330-01-BH2203-S0065	101407 / 330-01-BH2203-S0095	101408 / 330-01-BH2203-S0110	101419 / 330-01-BH2207-S0005	101423 / 330-01-BH2207-S0065	
				0 / 6.50-6.90m	0 / 9.50-9.77m	0 / 11.00-11.29m	0 / 0.50-0.95m	0 / 6.50-6.65m
	Cl	ient sampli	ng date / time	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00
Compound	CAS Number	LOR	Unit	EB1829170-001	EB1829170-002	EB1829170-003	EB1829170-004	EB1829170-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value		0.1	pH Unit	6.8	6.5	5.9	5.8	9.6
EA055: Moisture Content (Dried @ 105-1	10°C)							
Moisture Content		1.0	%	10.7	6.0	10.9	3.3	10.8
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	10	10	10	40
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	10	<10	<10	<10	220



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		101425 / 330-01-BH2207-S0095 0 / 9 50-9 76m	101436 / 330-01-BH2212-S0005 0 / 0 50-0 95m	101440 / 330-01-BH2212-S0065 0 / 6 50-6 95m	101451 / 330-01-BH2212-S0230	101456 / 330-01-BH2216-S0020 0 / 2 00-2 45m	
	CI	ient sampli	na date / time	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00
Compound	CAS Number	LOR	Unit	EB1829170-006	EB1829170-007	EB1829170-008	EB1829170-009	EB1829170-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value		0.1	pH Unit	8.8	9.0	9.2	9.7	8.8
EA055: Moisture Content (Dried @ 105	-110°C)							
Moisture Content		1.0	%	13.0	20.5	27.3	13.6	25.8
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	20	130	20	<10	130
ED045G: Chloride by Discrete Analyse	r							
Chloride	16887-00-6	10	mg/kg	440	220	920	70	2870



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		101462 / 330-01-BH2216-S0110 0 / 11.00-11.45m	101466 / 330-01-BH2216-S0170 0 / 17.00-17.45m	101473 / 330-01-BH2224-S0035 0 / 3.50-3.95m	101475 / 330-01-BH2224-S0065 0 / 6.50-6.95m	101477 / 330-01-BH2224-S0095 0 / 9.50-9.95m	
	Cl	ient sampli	ng date / time	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00
Compound	CAS Number	LOR	Unit	EB1829170-011	EB1829170-012	EB1829170-013	EB1829170-014	EB1829170-015
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value		0.1	pH Unit	8.9	8.6	8.7	8.7	7.9
EA055: Moisture Content (Dried @ 105	-110°C)							
Moisture Content		1.0	%	15.5	14.1	21.1	16.0	18.0
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	10	<10	<10	<10	<10
ED045G: Chloride by Discrete Analyse	r							
Chloride	16887-00-6	10	mg/kg	400	540	10	10	10



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		101483 / 330-01-BH2224-S0185 0 / 18.50-18.605m	101491 / 330-01-BH2227-S0005 0 / 0.50-0.95m	101495 / 330-01-BH2227-S0065 0 / 6.50-6.95m	101500 / 330-01-BH2227-S0125 0 / 12.50-12.95m	101504 / 330-01-BH2227-S0185 0 / 18.50-18.56m	
	Cl	ient sampli	ng date / time	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00	29-Nov-2018 00:00
Compound	CAS Number	LOR	Unit	EB1829170-016	EB1829170-017	EB1829170-018	EB1829170-019	EB1829170-020
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value		0.1	pH Unit	8.3	8.4	9.3	8.7	8.9
EA055: Moisture Content (Dried @ 105-1	110°C)							
Moisture Content		1.0	%	10.7	15.8	19.0	25.4	16.7
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	40	40	10	<10
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	20	320	240	80	60



CERTIFICATE OF ANALYSIS

Work Order	EB1829495	Page	: 1 of 4
Client	: TRILAB PTY LTD	Laboratory	Environmental Division Brisbane
Contact	: MR CHRIS CHANNON	Contact	: Customer Services EB
Address	: 346A BILSEN RD	Address	: 2 Byth Street Stafford QLD Australia 4053
	GEEBUNG QLD, AUSTRALIA 4031		
Telephone	: +61 07 3265 5656	Telephone	: +61-7-3243 7222
Project	: 1893802 - Inland Rail Package 13	Date Samples Received	: 03-Dec-2018 15:50
Order number	: BNE 1911048	Date Analysis Commenced	: 03-Dec-2018
C-O-C number	:	Issue Date	: 06-Dec-2018 08:56
Sampler	:		Hac-MRA NATA
Site	:		
Quote number	: EN/333		The second
No. of samples received	: 6		Accreditation No. 825
No. of samples analysed	: 6		ISO/IEC 17025 - Testing

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

• CORROSION ASSESSMENT: As per Australian Standard (AS2159-1995, section 6), the Exposure Classification for all samples is rated Non Aggressive. ALS is not NATA accredited for this comment.



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		GA101713 / 330-01-BH2103-S0005 0 / 0 50-0 95m	GA101715 / 330-01-BH2103-S0035 0 / 3 50-3 95m	GA101717 / 330-01-BH2103-U0060 0 / 6 00-6 29m	GSA101740 / 330-01-BH2104-S0005	GA101742 / 330-01-BH2104-S0035 0 / 3 50-3 94m	
	Cl	ient sampli	ng date / time	03-Dec-2018 00:00	03-Dec-2018 00:00	03-Dec-2018 00:00	03-Dec-2018 00:00	03-Dec-2018 00:00
Compound	CAS Number	LOR	Unit	EB1829495-001	EB1829495-002	EB1829495-003	EB1829495-004	EB1829495-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value		0.1	pH Unit	7.7	8.4	5.4	6.9	8.2
EA055: Moisture Content (Dried @ 105-1	10°C)							
Moisture Content		1.0	%	8.8	12.0	21.2	7.8	16.5
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	20	20	140	<10	10
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	<10	<10	30



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID			GA101745 / 330-01-BH2104-S0080 0 / 8.00-8.45m	 	
	Cli	ent sampli	ng date / time	03-Dec-2018 00:00	 	
Compound	CAS Number	LOR	Unit	EB1829495-006	 	
				Result	 	
EA002: pH 1:5 (Soils)						
pH Value		0.1	pH Unit	9.0	 	
EA055: Moisture Content (Dried @ 105-11	0°C)					
Moisture Content		1.0	%	10.6	 	
ED040S : Soluble Sulfate by ICPAES						
Sulfate as SO4 2-	14808-79-8	10	mg/kg	40	 	
ED045G: Chloride by Discrete Analyser						
Chloride	16887-00-6	10	mg/kg	260	 	



QUALITY CONTROL REPORT

Work Order	: EB1829495	Page	: 1 of 3
Client		Laboratory	: Environmental Division Brisbane
Contact	: MR CHRIS CHANNON	Contact	: Customer Services EB
Address	346A BILSEN RD	Address	: 2 Byth Street Stafford QLD Australia 4053
	GEEBUNG QLD, AUSTRALIA 4031		
Telephone	: +61 07 3265 5656	Telephone	: +61-7-3243 7222
Project	: 1893802 - Inland Rail Package 13	Date Samples Received	: 03-Dec-2018
Order number	: BNE 1911048	Date Analysis Commenced	: 03-Dec-2018
C-O-C number	:	Issue Date	06-Dec-2018
Sampler	:		Hac-MRA NATA
Site	:		
Quote number	: EN/333		Accorditation No. 835
No. of samples received	: 6		Accredited for compliance with
No. of samples analysed	: 6		ISO/IEC 17025 - Testing

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

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

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

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

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

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

Key: Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: SOIL						Laboratory D	uplicate (DUP) Report		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA002: pH 1:5 (Soils)	(QC Lot: 2072059)								
EB1829456-001	Anonymous	EA002: pH Value		0.1	pH Unit	4.9	5.0	0.00	0% - 20%
EA055: Moisture Con	tent (Dried @ 105-110°C) (C	QC Lot: 2072068)							
EB1829045-020	Anonymous	EA055: Moisture Content		0.1	%	5.5	5.4	0.00	No Limit
EB1829495-004	GSA101740 / 330-01-BH2104-S00050 / 0.50-0.95m	EA055: Moisture Content		0.1	%	7.8	7.9	1.66	No Limit
ED040S: Soluble Maj	or Anions (QC Lot: 2072062	2)							
EB1829495-001	GA101713 / 330-01-BH2103-S00050 / 0.50-0.95m	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	20	20	0.00	No Limit
ED045G: Chloride by	Discrete Analyser (QC Lot:	2072063)							
EB1829495-001	GA101713 / 330-01-BH2103-S00050 / 0.50-0.95m	ED045G: Chloride	16887-00-6	10	mg/kg	<10	<10	0.00	No Limit



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

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

Sub-Matrix: SOIL		Method Blank (MB)	Laboratory Control Spike (LCS) Report					
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002: pH 1:5 (Soils) (QCLot: 2072059)								
EA002: pH Value			pH Unit		4 pH Unit	100	98	102
					7 pH Unit	100	98	102
ED040S: Soluble Major Anions (QCLot: 2072062)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	500 mg/kg	101	90	114
ED045G: Chloride by Discrete Analyser (QCLot: 2072063)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	50 mg/kg	108	83	119
				<10	5000 mg/kg	108	83	119

Matrix Spike (MS) Report

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

• No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.



	QA/QC Compliance Assessment to assist with Quality Review						
Work Order	: EB1829495	Page	: 1 of 4				
Client		Laboratory	: Environmental Division Brisbane				
Contact	: MR CHRIS CHANNON	Telephone	: +61-7-3243 7222				
Project	: 1893802 - Inland Rail Package 13	Date Samples Received	: 03-Dec-2018				
Site	:	Issue Date	: 06-Dec-2018				
Sampler	:	No. of samples received	: 6				
Order number	: BNE 1911048	No. of samples analysed	: 6				

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

• <u>NO</u> Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

• <u>NO</u> Quality Control Sample Frequency Outliers exist.



Analysis Holding Time Compliance

Matrix: SOIL

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

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

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

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

Evaluation:	×	= Holding	time	breach	. 🗸	· =	Within	holding	time
	~	- Holding	ume	DICAUL	, *	_		noiung	ume.

							,	
Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA002: pH 1:5 (Soils)								
Snap Lock Bag (EA002)								
GA101713 / 330-01-BH2103-S00050 / 0.50-0.95m,	GA101715 / 330-01-BH2103-S00350 / 3.50-3.95m,	03-Dec-2018	04-Dec-2018	10-Dec-2018	✓	04-Dec-2018	04-Dec-2018	✓
GA101717 / 330-01-BH2103-U00600 / 6.00-6.29m,	GSA101740 / 330-01-BH2104-S00050 / 0.50-0.95m,							
GA101742 / 330-01-BH2104-S00350 / 3.50-3.94m,	GA101745 / 330-01-BH2104-S00800 / 8.00-8.45m							
EA055: Moisture Content (Dried @ 105-110°C)								
Snap Lock Bag (EA055)								
GA101713 / 330-01-BH2103-S00050 / 0.50-0.95m,	GA101715 / 330-01-BH2103-S00350 / 3.50-3.95m,	03-Dec-2018				03-Dec-2018	17-Dec-2018	✓
GA101717 / 330-01-BH2103-U00600 / 6.00-6.29m,	GSA101740 / 330-01-BH2104-S00050 / 0.50-0.95m,							
GA101742 / 330-01-BH2104-S00350 / 3.50-3.94m,	GA101745 / 330-01-BH2104-S00800 / 8.00-8.45m							
ED040S : Soluble Sulfate by ICPAES								
Snap Lock Bag (ED040S)								
GA101713 / 330-01-BH2103-S00050 / 0.50-0.95m,	GA101715 / 330-01-BH2103-S00350 / 3.50-3.95m,	03-Dec-2018	04-Dec-2018	31-Dec-2018	\checkmark	04-Dec-2018	01-Jan-2019	✓
GA101717 / 330-01-BH2103-U00600 / 6.00-6.29m,	GSA101740 / 330-01-BH2104-S00050 / 0.50-0.95m,							
GA101742 / 330-01-BH2104-S00350 / 3.50-3.94m,	GA101745 / 330-01-BH2104-S00800 / 8.00-8.45m							
ED045G: Chloride by Discrete Analyser								
Snap Lock Bag (ED045G)								
GA101713 / 330-01-BH2103-S00050 / 0.50-0.95m,	GA101715 / 330-01-BH2103-S00350 / 3.50-3.95m,	03-Dec-2018	04-Dec-2018	31-Dec-2018	✓	04-Dec-2018	01-Jan-2019	✓
GA101717 / 330-01-BH2103-U00600 / 6.00-6.29m,	GSA101740 / 330-01-BH2104-S00050 / 0.50-0.95m,							
GA101742 / 330-01-BH2104-S00350 / 3.50-3.94m,	GA101745 / 330-01-BH2104-S00800 / 8.00-8.45m							



Quality Control Parameter Frequency Compliance

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

Matrix: SOIL				Evaluation	n: 🗴 = Quality Co	ntrol frequency	not within specification ; \checkmark = Quality Control frequency within specification.
Quality Control Sample Type		Co	ount		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	6	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	13	15.38	10.00	1	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	1	8	12.50	10.00	1	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chloride Soluble By Discrete Analyser	ED045G	2	6	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	8	25.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3)
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Major Anions - Soluble	ED040S	SOIL	In house: Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Chloride Soluble By Discrete Analyser	ED045G	SOIL	In house: Referenced to APHA 4500-CI- E. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm. Analysis is performed on a 1:5 soil / water leachate.
Preparation Methods	Method	Matrix	Method Descriptions
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Appendix E Hydraulic Testing Results

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT












Appendix F Slug Testing Results

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT
































































Appendix G Hydrographs

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT



CLIENT	FFJV			PROJECT	Inland Rail – H2	2C			
DRAWN	SK	DATE	19/03/19	TITLE	220 01 BH2101	LUvdroar	anh		
CHECKED	DB	DATE	19/03/19		330-01-DHZ101	г пушоді	арп		
SCALE	Not to Scale	;		PROJECT No	» 1893802	FIGURE No	G1.1	REV No 1	A4





CLIENT	FFJV			PROJECT	Inland Rail – H2	2C			
DRAWN	SK	DATE	19/03/19	TITLE	330 01 BH3103		anh		
CHECKED	DB	DATE	19/03/19		330-01-DHZ102		арп		
SCALE	Not to Scale	;		PROJECT N	1893802	FIGURE No	G1.2	REV No 1	A4





	CLIENT	FFJV			PROJECT	Inla	and Rail – H2	2C				
-	DRAWN	SK	DATE	19/03/19	TITLE	22			anh			
I	CHECKED	DB	DATE	19/03/19		33	0-01-002103	пушоді	арп			
I	SCALE	Not to Scale	;		PROJECT N	o	1893802	FIGURE No	G1.3	REV No	1	A4





CLIENT	FFJV			PROJECT	Inland Rail – H2	2C			
 DRAWN	SK	DATE	19/03/19	TITLE	220 01 00210/	LUvdroar	anh		
CHECKED	DB	DATE	19/03/19		330-01-DH2104	FHydrogr	арп		
SCALE	Not to Scale	;		PROJECT N	» 1893802	FIGURE No	G1.4	REV No 1	A4





CLIENT	FFJV			PROJECT	Inland Rail – H	2C			
 DRAWN	SK	DATE	19/03/19	TITLE	220 01 00200	2 Uvdroar	anh		
CHECKED	DB	DATE	19/03/19		330-01-DHZZU	5 Hydrogi	арп		
SCALE	Not to Scale	e		PROJECT N	• 1893802	FIGURE No	G1.5	REV No 1	A4





CLIENT	FFJV			PROJECT	Inland Rail – H2	2C			
DRAWN	SK	DATE	19/03/19	TITLE	220 01 BH2207	Uvdroar	anh		
CHECKED	DB	DATE	19/03/19		330-01-BHZZ07	пушоді	арп		
SCALE	Not to Scale	;		PROJECT No	» 1893802	FIGURE No	G1.6	REV No 1	A4





CLIENT	FFJV			PROJECT	Inland Rail – H2	2C			
DRAWN	SK	DATE	19/03/19	TITLE	220 01 BH2212		anh		
CHECKED	DB	DATE	19/03/19		330-01-BHZZ12		арп		
SCALE	Not to Scale	;		PROJECT N	» 1893802	FIGURE No	G1.7	REV No 1	A4





CLIENT	FFJV			PROJECT	Inland Rail – H2	2C				
DRAWN	SK	DATE	19/03/19	TITLE	220 01 BH2216	Lydroar	anh			
CHECKED	DB	DATE	19/03/19		330-01-DHZZ10	пушоді	арп			
SCALE	Not to Scale	;		PROJECT No	1893802	FIGURE No	G1.8	REV No	1	A4





CLIENT FFJV			PROJECT	Inland Rail – H2	2C			
drawn SK	DATE	19/03/19	TITLE	220 01 00222	LUvdroar	anh		
CHECKED DB	DATE	19/03/19		330-01-DHZZZ4	Finyurogi	арп		
scale Not to Scale	e		PROJECT N	• 1893802	FIGURE No	G1.9	REV No 1	A4





CLIENT	FFJV			PROJECT	Inland Rail – H2	2C				
DRAWN	SK	DATE	19/03/19	TITLE	220 01 BH2201	LUvdroar	anh			
CHECKED	DB	DATE	19/03/19		330-01-DH230	r riyurogi	арп			
SCALE	Not to Scale	;		PROJECT N	• 1893802	FIGURE No	G1.10	REV No	1	A4





CLIENT	FFJV			PROJECT	Inla	and Rail – H2	2C				
DRAWN	SK	DATE	19/03/19	TITLE	22			anh			
CHECKED	DB	DATE	19/03/19		33	0-01-062303	пушоді	арп			
SCALE	Not to Scale)		PROJECT No	D	1893802	FIGURE No	G1.11	REV No	1	A4





CLIENT	FFJV			PROJECT	Inland Rail – H2	2C				
DRAWN	SK	DATE	19/03/19	TITLE	330-01-DH2503	3 Hydrogr	aph			
CHECKED	DB	DATE	19/03/19			, ,				
SCALE	Not to Scale			PROJECT N	• 1893802	FIGURE No	G1.12	REV No	1	A4



Appendix H Groundwater Laboratory Reports

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT

CLIENT: Colder /	CHAIN OF CUSTODY ALS Laboratory: please tick ?	DADELAIDE 3/1 Burma Road I Ph: 08 8162 5130 E. adelaideg OBRISBANE: 2 Byth Street Staf Ph: 07 3243 7222 E: samples,b OGLADSTONE 48 Callemonda Ph: 07 4978 7944 E: gladstone(DADELAJDE 4/1 Burma Road Poorstas SA 5095 DMACKAY 78 Harbour Road Mackay CID 34740 DNEL Ph: 06 8162 5730 E. addalde@alsglobal.com Ph: 07 4944 0177 E. mackay@alsglobal.com Ph: 07 DBRISBANE 2 Byth Stroal Stafford QLD 4053 DMAELBOURNE 2-4 Westall Road Springvale VIC 3171 DNO. DBRISBANE 2 Byth Stroal Stafford QLD 4053 DMAELBOURNE 2-4 Westall Road Springvale VIC 3171 DNO. DGLADSTONE 48 Calimonation Drive Gladelsone QLD 4680 DMUDGEE 1/29 Sydney Road Mudgee NSW 2850 DPE Ph: 07 4976 7944 E: gladstane@alsglobal.com Ph: 02 69372 6735 E: mudgee.mat@alsglobal.com Ph: 11 TURNAROUND REQUIREMENTS : [Standard TAT may be longer for some tests Data and the colspan="2">Data data that the date):					DNEWC Ph: 02 4 DNOWR Ph: 02 44 OPERT Ph: 08 5	DNEWCASTLE 5/866 Maitland Road Maylield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@atsplobal.com DNOWRA 41/3 Geary Place. North Nowra NSW 2541 Ph: 02 4423 2083 E: nowra@atsglobal.com Ph: 03 49209 7655 E: samples.pertf@alsglobal.com Ph: 03 9209 7655 E: samples.pertf@alsglobal.com Ph: 03 49209 7655 E: samples.pertf@alsglobal.com Ph: 03 49209 7655 E: samples.pertf@alsglobal.com Ph: 04 4520 FOR LABORATC				USYDNEY 277-2 Ph: 02 8784 8555 DTOWNSVILLE Ph: 07 4795 0600 DW0LLONGON Ph: 02 4225 3125 LABORATORY	277-289 Woodpark Road Smithfield NSW 2164 B555 E: samples.syöney@alsglobal.com ILLE 14-15 Desam Court Bohle QLD 4318 0600 E: townsville environmental@alsglobal.com GONG 1/19-21 Ralph Bleck Drive. Nih Wolfongong NSW 2500 3125 E: wollangong@alsglobal.com		
PROJECT: T. J	- Pail (P12)	PPO JECT NO - (A #4 C + 1	e.g. Ultra T	race Organics)	Non St	andard or u	gent TAT (List o	due date):		•)•		Custo Free in	by Seal Intact?	ks present	Yes No N/A	
ORDER NUMBER:	PURCHAS	E ORDER NO.:	COUNTR	Y OF ORIGIN:			.				R (Circle)	receip	t? 	natura an E	Yes No N/A	
PROJECT MANAGER:	Mitch McGinnis	, CONTACT PI	H:				<u> </u>		1 2	3 4 3 4	5 6	7 Rando	comment:	rature on H	receipt: C	
SAMPLER: Rob	CIADDEN .	SAMPLER M		SAA8611/12	RELINQUIS	HED BY:		RECEIV	ED BAT:		5 8	RELINQUIS	SHED BY:	·	RECEIVED BY:	
COC Emailed to ALS?	(YES / NO)	EDD FORMA	T (or defa	<u>442011113</u> ult):	1			M	117							
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COMMENTS/SPECIAL	HANDLING/STORAGE OR DISPOSA	L:				**.			<u></u>	•	<u> </u>	I	····			
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<u>د</u>	UN 189	23/10/18 13:50	W	N, SP		4			~	V	i-	~				
	330-01-13#2216						<u> </u>									
<u> </u>	330-01-BH 2104	23/10/18 16:00	W	N, SP		4	V	2	~	v	V		~			
								U	R	GE	N				Environmental Division Brisbane Work Order Reference EB1825628	
Water Container Codes: V = VOA Vial HCI Preserve	P = Unpreserved Plastic; N = Nitric Preserv d; VB = VOA Vial Sodium Bisulohate Preser	sd Plastic; ORC = Nitric Preserved red; VS = VOA Vial Sulfuric Preserved	I ORC; SH	= Sodium Hydroxide/Cd Preserved; infreicht Unpreserved Vial SG = Su	TOTAL S = Sodium Hi Ifuric Preserved	16 ydroxide Pres	erved Plastic; AG	; ≠ Amber Glas	ss Unpreservi	ed; AP - Airfi	reight Unpres	served Plastic	Preserved Disetis			

Form Page 1 of 1

ENFN (204/13)

CLIENT: Golder A OFFICE: Golder	CHAIN OF CUSTODY ALS Laboratory: please tick ? Sseciatos Pty Ltd. Brisbane	DADELAIDE 3/1 Burma Road Ph: 06 8162 5130 E: adeloide¢ DBRISBANE 2 Byth Street Sla Ph: 07 3243 722 E: samples b DGLADSTONE 48 Callemond; Ph: 07 4978 7944 E: gladatone	Pooraka SA 50 palsglobal.com ford QLD 4053 risbana@alsglo b Drive Gladsk galsglobal.com TURNAR((Standard T/ e o Ultra Tr	es LIMACKA Ph: 07 49, Obtail com Ph: 03 88 one QLD 4680 LIMUDG 1 Ph: 02 68 DUND REQUIREMENTS : AT may be longer for some tests are Ornanics)	Y 78 Harbour Roa 14 0177 E: macka VURINE 2-4 Westz 149 9600 E: sampli EE 1/29 Sydney R 72 6735 E: mudge Standa	d Mackay QLD 4 y@alsglobal.com III Road Springva les.melbourne@a oad Mudgee NSI ae.mail@alsgloba rrd TAT (List andard or urg	740 e VIC 3171 Ilsglobal.com v 2850 it.com due date): ent TAT (List	DN(Ph: DNC Ph: C Ph: Ph: due date)	EWCASTLE 5/588 02 4014 2500 E: s 0WRA 4/13 Geary 02 4423 2063 E: n PERTH 10 Hod W 08 9209 7655 E:	i Mailland Roa Isamples.newca Place North N owra@alsglob ay Malaga WA samples.perith	d Mayfield West slle@alsglobal. owra NSW 2541 al.com 6090 @alsglobal.com	NSW 2304 com FOR I	DSYDNEY 2 Ph: 02 8784 I DTOWNSVII Ph: 07 4296	77-289 Woodpar 8555 E: samples LLE 14-15 Desm 0600 E- Iownsvir nvironm risbane Work O	k Road Smithfield NSW 2164 sydrey@alsgicbal.com a court Bohie QLD 4818 Dental Division rder Reference	500
PROJECT: Inlan	d Rail (PB	PROJECT NO. 1893 802	ALS QUO	TE NO.:		•			COC SEQUENCE NUMBER (Circle)			e i	FR.	1825910	N/A	
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Email Invoice to (will de	efault to PM if no other addresses are list	sted):			1			Q	5/10/18	- 9 <u>:</u> ($22 \cdot$		т	elephone	- 61-7-3243 7222	
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															:	
ALS USE ONLY	MATRIX: Sol	: DETAILS id(S) Water(W)		CONTAINER INF	ORMATION		ANALTSI	SREQUI	KED INCIDAIN	g SUITES	NB. Suite Co	des must be lis	ied to attract s	uite price)	Additional Inform	ation
			·				When W	etals are req	uired, specify Tot	al (untiliered be	ottle required) or	Distrived (field	liltered bottle re	quired).	Commonte on literity contaminat	t lovels
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Water Container Codes: V = VOA Vial HCI Preserve	P = Unpreserved Plastic; N = Nitric Preserv ed; VB = VOA Vial Sodium Bisulphate Preser	ed Plastic; ORC = Nitric Preserve ved; VS = VOA Vial Sulfuric Preserve	d ORC: SH rved; AV = Ai	= Sodium Hydroxide/Cd Preserved infreight Unpreserved Vial SG = S	; S = Sodium H ulfuric Preserve	lydroxide Pres d Amber Glas	erved Plastic: A s; H = HCl pre	G = Amber served Pla	Glass Unprese stic; HS = HCI	rved; AP - A preserved S	I infreight Unpre peciation bottle	. eserved Plastic e; SP = Sulfuric	Preserved Pl	lastic; F = Fon	naldehyde Preserved Glass;	

	CHAIN OF CUSTODY ALS Leboralory: please tick →	QADELAIDE 3/1 Surma Rop Ph: 08 3162 5130 E. adelaida CERISEANE 2 Byh Street SI Ph: 07 3243 7222 E: samples CLADSTONE 48 Callemon Ph: 07 4978 7544 E: gladston	d Pooraka SA 50 a@alsglobal.com afford QLD 4052 .brisbane@alsgli dah Drive Gladsi a@alsglobal.cor	995 DIMACRA 1 Ph: 0749 0bal.com Ph: 03 85 0ne CLD 4680 DIMUDG: n Ph: 02 63	978 Hapons Ho 9 017 AE: Mack SURNE 2- Wes 5 19 8 100 E sam EE 1/29 Sydney f 372 6735 E: mudg	ad Mackay QLD Y@atglesal Q all Paacspring Jes mel purne Road Mudgee N Jee.mai@alsglo	4740 Balsgibbalson SW 2850 bal.com	Ph: Ph: Ph: Ph Ph	EWCASTLE 5/ 02 4014 2500 E DWRA 4/13 Get 02 4423 2063 E PERTH 10 Hod 08 9209 7655	85 Mailland Roa : samples.newc ary Place North I : nowra@aisgloI Way Malaga W, E: samples.perl	ad Mayfield Wes astle@alsglobal Nowra NSW 254 bal.com A 6090 h@alsglobal.com	it NSW 2304 Loom 11	DSYDNEY 277-289 Ph: 02 8784 8555 E: DTOWNSVILLE 14- Ph: 07 4796 0600 E: CWOLLONGONG 1/ Ph: 02 4225 3125 E:	Voodpark Road Smithfield N samples sydne y@alsglobal. 5 Desma Court Bohle OLD 4 townsville.environmental@alsgl 19-21 Ralph Black Drive. Nith wollongong@alsglobal.com	SW 2164 om 1818 obal.com Wellongong NSW 2500
OFFICE:	OFH ASSOCIA	Tes	URNAR	OUND REQUIREMENTS :	Stand	ard TAT (Lis	t due date):		40	lance		F	OR LABORATORY US	EONLY (Circle)	
PROJECT: IA	ALD DAY (DID)	E JOAC	e.g., Ultra Tr	race Organics)	Non S	tandard or u	gent TAT (Lis	t due date): / 0	PIUCA	rs	C	ustody Seal Intact?	Yes	No N/
	AND RAIL(PIS)	PROJECT NO .: 1841	8 ALE CUO				<u> </u>		COC SEQU	IENCE NUME	SER (Circle)	Fr	ree Ice / frozen ice bricks p ceipt?	resent upon Yes	No Ni
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SAMPLER: Pog	CLODED	SANDIED SANDIED	-n:	1110100				OF:	1 2	3 4	5 6	7 01	ther comment:		· · · · · · · · ·
COC Emailed to ALS	21 YES / NO)			44861113		SHED BY:		REC	EIVED BY:	0		RELING	QUISHED BY:	RECEIVE	D BY:
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					<u> </u>						525		· · · · ·		
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ALS USE ONLY	SAMPL	E DETAILS					ANALY	S REQUI	RED includi	ng SUITES	(NB. Suite Cod	des hust b	e listed to attract suite price	e)	· · · ·
	MATRIX: So	olid(S) Water(W)			ORMATION		Winder	letals are req	lired, specify T	tal (unfiltered b	ottle required) or	Di Qives,	(field filtered bottle required).	Additic	onal Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVA (refer to codes belo	TIVE w)	TOTAL BOTTLES	Aniors (Cations (a, Mg Na, CI, F Sou, Alkalinity, 140	Ec, PH, TOS	Asi B. Ba. Br. Coll	0, (4, 144, Fr, W.	Nuthrich ts Nitrateo, Nitrite,	LEACTIC PHOSON	Scalium Scalium	Comments on like dilutions, or sampl analysis etc.	iy contaminant levels, es requiring specific QC
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· ·					TOTAL	4						[
Water Container Codes:	P = Unpreserved Plastic; N = Nitric Preserv	ed Plastic; ORC = Nitric Preserve	d ORC: SH =	Sodium Hydroxide/Cd Preserved;	S = Sodium H	ydroxide Pres	erved Plastic; A	G = Amber	L Glass Unpres	erved; AP - Ai	freight Unpres	served Plas	stic		

*

ALS	CHAIN OF CUSTODY ALS Laboratory: please tick →	QADELAIDE 3/1 Burma Roa Ph: 08 8162 5133 E: adelpaid QBRISBANE 2 Byth Street S Ph: 07 3243 7222 E: samples QGLADSTONE 49 Callemon Ph: 07 4978 7944 E: gladstor	d Pooraka SA 5095 :@alsglobal.com lafford QLD 4053 .brisbane@alsglobal dah Drive Gladstone ie@alsglobal.com	LIMACKAY 76 Harbo Ph: 07 494 0177 E. OMELBOURNE 2-4 Ph: 03 8549 9600 QLD 4660 OMUDGEE 1/29 Sy Ph: 02 6372 6735 E:	ur Road Mackay OLD 4740 mackay@alsglobal.com Weslall Road Springvale VIC 3171 sampies.melbourne@alsglobal.com Inay Road Mudgee NSW 2850 mudgee.mail@alsglobal.com	DNEWCASTLE 5/585 Mailtand R Ph: 02 4014 2500 E: samples.new DNOWRA 4/13 Geary Place Not Ph: 02 4423 2063 E: nowra@alag DPERTH 10 Hod Way Malaga Ph: 08 9209 7655 E: samples.pr	oad Mayfield West NSW 23 wcastle@alsglobal.com h Nowra NSW 2541 lobal.com WA 6090 rrth@alsglobal.com	2304 DSYDNEY 277-289 Woodp Ph: 02 8784 8555 E: sampl DTOWNSVILLE 14-15 Des Ph: 07 4786 6800 E: towney QWOLLONGONG 1/19-21 Ph: 02 4225 3125 E: wollon	ark Road Smithfield NSW 2154 is,sydney@alsglobal.com ma Court Bohle QLD 4818 ils environmenta@alsglobal.com Ralph Black Drive, Nth Wollongong NSW 2500 igong@alsglobal.com
IENT: GOLD	ER ASSOCIATES ER-BRISBANE ND RAIL (PI3)	PROJECT NO.: 181380	TURNAROU (Standard TAT e.g Ultra Trace 2 ALS QUOTE	IND REQUIREMENTS : S may be longer for some tests c Organics) E NO.:	tandard TAT (List due date): Ion Standard or urgent TAT (List	due date): 48 h r	S IBER (Circle)	FOR LABORATORY USE O Custody Seal Intact? Free Ice / frozen Ice bricks preser receipt?	NLY (Circle) Yes No N/ ntuppon Yes No N/
OJECT MANAGER:	Mitch McCinnis		PH:				1567 1567	Random Sample Temperature or	Receipt C
MPLER: SusA	NTHA HUMARADE/I	SAMPLER		10073467 RELIN	IQUISHED BY:	RECEIVED BY:	REL	INQUISHED BY:	RECEIVED BY:
C Emailed to ALS?	(YES / NO)	EDD FORM	AT (or default): C.	VINCENT	KYLIE			
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nail Invoice to (will d	efault to PM if no other addresses are lis	sted);	r - J	2	2/11/18	22/11/18	8:35 1	•	
MMENTS/SPECIAL	HANDLING/STORAGE OR DISPOSA	L:							
ALS USE ONLY	SAMPLE MATRIX: Sol	DETAILS id(S) Water(W)		CONTAINER INFORMA	S REQUIRED including SUITE	Additional Information			
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	Anions/cations Ca, Mg, No, K, Cl, F Soy, Alkalines, Hard	EE, PH, TDS Total Discolued As. B. B. B. Le, Cd, Cr Le, Cu, Mn, Fr, N Pb, Ze, V, Zn, Hg	Nutrients Nitrate, Nitrite, Ammonia Reachive Phosphoru	Tetan BSN, TKN Sodium Adsorption Ratio	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
)	330-01-BH2103	20/u/18	W	N, SP	4 1	- Jo			
					Environ Brisbar Work	Imental Division Order Reference 31828572			
					Telephon	a : + 61-7-3243 7222		URGE	
·					TOTAL L				

LLENT: GOLDER ASSOCIATE OFFICE: GOLDER - BRISBAN PROJECT: INLAND RAIL(PI3) ORDER NUMBER: PL PROJECT MANAGER: MITCH McGIN SAMPLER: HANNAH GROVES COC Emailed to ALS? (YES / GO Email Reports to (will default to PM if no other address Email Invoice to (will default to PM if no other address COMMENTS/SPECIAL HANDLING/STORAGE OR D ALS USE ONLY MA LAB ID SAMPLE ID	PROJECT NO.: 18 PROJECT NO.: 18 JRCHASE ORDER NO.: N/S . CON SAM EDD SSES are listed): DISPOSAL: SAMPLE DETAILS TRIX: Solid(S) Water(W)	TURNAROU (Standard TAT e.g., Ultra Trac 23802 ALS QUOT COUNTRY (ITACT PH: IPLER MOBILE: 0.4 FORMAT (or default 1 A P.A P.E.L.)	UND REQUIREMENTS: Dy Stand T may be longer for some tests □ Non s E NO.: OF ORIGIN: 405 046 250 RELINQU 405 046 250 RELINQU 10: COM • A U 7 1	Ished BY: GROV f	iue date): 44 ent TAT (List du	B LUNS He date): COC: 1 OF: 1 RECEIVED BY DATE/TIME: T7/1	$\frac{1}{2} \frac{1}{2} \frac{1}$	ER (Circle) 5 6 5 6	FOI Cusi Free 7 Ran 7 Othe RELINQU	R LABOF tody Seal I a Ice / froze ipi? dom Samj er commen JISHED I	E	k Order Reference B1830098
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ALS USE ONLY MA LAB ID SAMPLE ID	SAMPLE DETAILS TRIX: Solid(S) Water(W)			r								
LAB ID SAMPLE ID			CONTAINER INFORMATION	N	ANALYSIS F	REQUIRED Inclu	ding SUITES	(NB. Suite Cod	les must be i Dissolved (fie	listed to attract	suite price) required).	Additional Information
330-01-BH	DATE / TIM	E MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	ANIONS/CATIONS Ca,Mg, Na, Ci, F, Dy, AILalininy, Hand	EC, pH, TDS TOTAL / NESCOLVED 45,8, 60, 66, 60, 67,	0,00,00,00,00,00,00,00,00,00,00,00,00,0	Nitrouds Withate Withte Annabhid	EERCAVE Phosphorus	SODIUM ADSORPTION		Comments on likely conterninant levels, ditutions, or samples requiring specific Q analysis etc.
	1210 7/12/18	W	N, SP	4			YV	2	L	10		······································
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CERTIFICATE OF ANALYSIS : EB1825628 Work Order Page : 1 of 5 Laboratory GOLDER ASSOCIATES : Environmental Division Brisbane : MR MITCH McGINNIS Contact : Andrew Epps Address : 2 Byth Street Stafford QLD Australia 4053 : 32 SHAND STREET BRISBANE QLD, AUSTRALIA 4053 : +61 07 3721 5400 Telephone : +61 7 3552 8639 Date Samples Received : 1893802 Inland Rail (P13) : 24-Oct-2018 09:17 Order number Date Analysis Commenced : 24-Oct-2018 C-O-C number Issue Date : 26-Oct-2018 15:59 : ROBERT CUPPER ----

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

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

This Certificate of Analysis contains the following information:

: 4

: 4

: EN/002/18 National BQ

- General Comments
- Analytical Results

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

Signatories

Client

Contact

Address

Telephone

Project

Sampler

Quote number

No. of samples received

No. of samples analysed

Site

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

• Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Page	: 3 of 5
Work Order	: EB1825628
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	330-01-BH2212	330-01-BH2216	GW 789	330-01-BH22104	
	Cl	lient sampli	ng date / time	22-Oct-2018 15:20	23-Oct-2018 13:40	23-Oct-2018 13:50	23-Oct-2018 16:00	
Compound	CAS Number	LOR	Unit	EB1825628-001	EB1825628-002	EB1825628-003	EB1825628-004	
				Result	Result	Result	Result	
EA005P: pH by PC Titrator								
pH Value		0.01	pH Unit	8.16	10.5	10.6	8.33	
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Adsorption Ratio		0.01	-	29.5	17.6	17.5	21.7	
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C		1	µS/cm	5500	2530	2390	4260	
EA015: Total Dissolved Solids dried at 18	0 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	2940	1180	1210	2390	
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	24	24	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	194	166	7	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	601	<1	<1	549	
Total Alkalinity as CaCO3		1	mg/L	601	218	190	556	
ED041G: Sulfate (Turbidimetric) as SO4 2	- by DA							
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	77	41	39	98	
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	1340	646	614	980	
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	38	25	26	48	
Magnesium	7439-95-4	1	mg/L	42	15	15	36	
Sodium	7440-23-5	1	mg/L	1110	451	453	817	
Potassium	7440-09-7	1	mg/L	7	12	12	8	
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3		1	mg/L	268	124	127	268	
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	0.008	
Boron	7440-42-8	0.05	mg/L	0.06	0.06	0.06	0.10	
Barium	7440-39-3	0.001	mg/L	0.096	0.279	0.283	0.199	
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	
Cobalt	7440-48-4	0.001	mg/L	0.001	<0.001	<0.001	0.005	
Chromium	7440-47-3	0.001	mg/L	<0.001	0.004	0.004	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	0.002	0.002	0.001	
Manganese	7439-96-5	0.001	mg/L	0.096	<0.001	<0.001	0.072	
Nickel	7440-02-0	0.001	mg/L	0.003	0.001	<0.001	0.008	

Page	: 4 of 5
Work Order	EB1825628
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	330-01-BH2212	330-01-BH2216	GW 789	330-01-BH22104	
	Cl	ient samplir	ng date / time	22-Oct-2018 15:20	23-Oct-2018 13:40	23-Oct-2018 13:50	23-Oct-2018 16:00	
Compound	CAS Number	LOR	Unit	EB1825628-001	EB1825628-002	EB1825628-003	EB1825628-004	
			- T	Result	Result	Result	Result	
EG020F: Dissolved Metals by ICP-MS - Con	tinued							
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	0.007	
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	<0.001	0.015	
Boron	7440-42-8	0.05	mg/L	0.06	0.08	0.08	0.12	
Barium	7440-39-3	0.001	mg/L	0.125	0.440	0.504	0.379	
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	0.002	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	0.0003	
Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.001	0.026	
Chromium	7440-47-3	0.001	mg/L	0.003	0.005	0.005	0.012	
Copper	7440-50-8	0.001	mg/L	0.002	0.004	0.004	0.045	
Manganese	7439-96-5	0.001	mg/L	0.154	0.157	0.107	0.333	
Nickel	7440-02-0	0.001	mg/L	0.006	0.002	0.002	0.027	
Lead	7439-92-1	0.001	mg/L	0.002	<0.001	<0.001	0.039	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	
Vanadium	7440-62-2	0.01	mg/L	0.01	<0.01	<0.01	0.03	
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	0.145	
Iron	7439-89-6	0.05	mg/L	1.55	0.87	0.48	25.6	
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	
EG035T: Total Recoverable Mercury by FI	MS							
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.5	0.7	0.7	0.7	
EK055G: Ammonia as N by Discrete Analy	ser							
Ammonia as N	7664-41-7	0.01	mg/L	0.11	0.16	0.15	0.66	
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.01	0.01	0.01	
EK058G: Nitrate as N by Discrete Analyse	r							
Nitrate as N	14797-55-8	0.01	mg/L	0.48	0.26	0.27	0.01	
EK059G: Nitrito plus Nitrato as N (NOx) bi	v Discrete Ape	lyeor						
EROSSG. Milline plus Millale as N (NOX) by	y Discrete Ana	nyser						

Page	5 of 5
Work Order	: EB1825628
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER (Matrix: WATER)		Cli	ent sample ID	330-01-BH2212	330-01-BH2216	GW 789	330-01-BH22104	
	Cli	ent sampli	ing date / time	22-Oct-2018 15:20	23-Oct-2018 13:40	23-Oct-2018 13:50	23-Oct-2018 16:00	
Compound	CAS Number	LOR	Unit	EB1825628-001	EB1825628-002	EB1825628-003	EB1825628-004	
				Result	Result	Result	Result	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Anal	lyser - Co	ntinued					
Nitrite + Nitrate as N		0.01	mg/L	0.48	0.27	0.28	0.02	
EK061G: Total Kjeldahl Nitrogen By Dis	screte Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	0.6	0.8	0.8	1.5	
EK062G: Total Nitrogen as N (TKN + N	Ox) by Discrete An	alyser						
^ Total Nitrogen as N		0.1	mg/L	1.1	1.1	1.1	1.5	
EK067G: Total Phosphorus as P by Dis	crete Analyser							
Total Phosphorus as P		0.01	mg/L	0.08	0.04	0.03	0.12	
EK071G: Reactive Phosphorus as P by	discrete analyser							
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	
EN055: Ionic Balance								
Total Anions		0.01	meq/L	51.4	23.4	21.9	40.8	
Total Cations		0.01	meq/L	53.8	22.4	22.5	41.1	
Ionic Balance		0.01	%	2.28	2.24	1.38	0.37	



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		CERTIFICATE OF ANALYSIS		
Work Order	EB1825910	Page	: 1 of 5	
Client	GOLDER ASSOCIATES	Laboratory	Environmental Division E	Brisbane
Contact	: MR MITCH McGINNIS	Contact	: Andrew Epps	
Address	: P O BOX 1734	Address	: 2 Byth Street Stafford QL	D Australia 4053
	MILTON QLD, AUSTRALIA 4064			
Telephone	: +61 07 3721 5400	Telephone	: +61 7 3552 8639	
Project	: 1893802	Date Samples Received	: 26-Oct-2018 09:05	SWIIIIIII.
Order number	: 1893802	Date Analysis Commenced	: 26-Oct-2018	
C-O-C number	:	Issue Date	: 31-Oct-2018 08:13	NATA
Sampler	: ROBERT CUPPER			Hac-MRA NAIA
Site	:			
Quote number	: EN/002/18 National BQ			Accreditation No. 825
No. of samples received	: 3			Accredited for compliance with
No. of samples analysed	: 3			ISO/IEC 17025 - Testing

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

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^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- It is recognised that EG020-T (Total Metals by ICP-MS) is less than EG020-F (Dissolved Metals by ICP-MS) for some samples. However, the difference is within experimental variation of the methods.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Page	: 3 of 5
Work Order	: EB1825910
Client	: GOLDER ASSOCIATES
Project	: 1893802



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			330-01-BH2102	330-01-BH2303	330-01-BH2207	
	Cl	lient sampli	ng date / time	24-Oct-2018 12:00	25-Oct-2018 07:30	25-Oct-2018 09:45	
Compound	CAS Number	LOR	Unit	EB1825910-001	EB1825910-002	EB1825910-003	
				Result	Result	Result	
EA005P: pH by PC Titrator							
pH Value		0.01	pH Unit	7.95	7.22	8.53	
EA010P: Conductivity by PC Titrator							
Electrical Conductivity @ 25°C		1	μS/cm	4260	1720	1730	
EA015: Total Dissolved Solids dried at 18	30 ± 5 °C						
Total Dissolved Solids @180°C		10	mg/L	2340	999	955	
ED037P: Alkalinity by PC Titrator							
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	12	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	457	385	116	
Total Alkalinity as CaCO3		1	mg/L	457	385	128	
ED041G: Sulfate (Turbidimetric) as SO4 2	2- by DA						
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	97	20	50	
ED045G: Chloride by Discrete Analyser							
Chloride	16887-00-6	1	mg/L	1000	322	438	
ED093F: Dissolved Major Cations							
Calcium	7440-70-2	1	mg/L	40	118	33	
Magnesium	7439-95-4	1	mg/L	24	60	33	
Sodium	7440-23-5	1	mg/L	833	138	246	
Potassium	7440-09-7	1	mg/L	8	10	28	
ED093F: SAR and Hardness Calculations							
Total Hardness as CaCO3		1	mg/L	199	542	218	
^ Sodium Adsorption Ratio		0.01	-	25.7	2.58	7.24	
EG020F: Dissolved Metals by ICP-MS							
Arsenic	7440-38-2	0.001	mg/L	0.008	0.005	0.002	
Boron	7440-42-8	0.05	mg/L	0.18	0.07	0.28	
Barium	7440-39-3	0.001	mg/L	0.214	0.500	0.098	
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.022	0.003	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.010	
Copper	7440-50-8	0.001	mg/L	<0.001	0.001	0.008	
Manganese	7439-96-5	0.001	mg/L	0.086	0.790	0.461	
Nickel	7440-02-0	0.001	mg/L	0.001	0.022	0.013	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.004	

Page	: 4 of 5
Work Order	: EB1825910
Client	: GOLDER ASSOCIATES
Project	: 1893802



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID		330-01-BH2102	330-01-BH2303	330-01-BH2207	 	
	Cli	ient samplii	ng date / time	24-Oct-2018 12:00	25-Oct-2018 07:30	25-Oct-2018 09:45	
Compound	CAS Number	LOR	Unit	EB1825910-001	EB1825910-002	EB1825910-003	
				Result	Result	Result	
EG020F: Dissolved Metals by ICP-MS	Continued						
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	
Zinc	7440-66-6	0.005	mg/L	0.006	0.014	0.008	
Iron	7439-89-6	0.05	mg/L	<0.05	0.15	0.10	
EG020T: Total Metals by ICP-MS							
Arsenic	7440-38-2	0.001	mg/L	0.011	0.005	0.002	
Boron	7440-42-8	0.05	mg/L	0.18	0.05	0.26	
Barium	7440-39-3	0.001	mg/L	0.275	0.468	0.136	
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	
Cobalt	7440-48-4	0.001	mg/L	0.008	0.021	0.004	
Chromium	7440-47-3	0.001	mg/L	0.008	<0.001	0.021	
Copper	7440-50-8	0.001	mg/L	0.015	<0.001	0.013	
Manganese	7439-96-5	0.001	mg/L	0.296	0.693	0.482	
Nickel	7440-02-0	0.001	mg/L	0.010	0.037	0.020	
Lead	7439-92-1	0.001	mg/L	0.013	<0.001	0.026	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	
Vanadium	7440-62-2	0.01	mg/L	0.02	<0.01	<0.01	
Zinc	7440-66-6	0.005	mg/L	0.046	0.014	0.046	
Iron	7439-89-6	0.05	mg/L	13.0	1.66	2.93	
EG035F: Dissolved Mercury by FIMS							
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	
EG035T: Total Recoverable Mercury b	y FIMS						
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator							
Fluoride	16984-48-8	0.1	mg/L	0.4	0.2	0.6	
EK055G: Ammonia as N by Discrete A	nalyser						
Ammonia as N	7664-41-7	0.01	mg/L	0.89	0.15	0.25	
EK057G: Nitrite as N by Discrete Anal	vser						
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.20	
EK058G: Nitrate as N by Discrete Ana	lvser						
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	0.22	
FK059G: Nitrite plus Nitrate as N (NO)	x) by Discrete Ana	lvser	-				
Nitrite + Nitrate as N		0.01	mg/L	<0.01	<0.01	0.42	

Page	5 of 5
Work Order	: EB1825910
Client	: GOLDER ASSOCIATES
Project	: 1893802



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	330-01-BH2102	330-01-BH2303	330-01-BH2207	
	Cli	ent sampli	ng date / time	24-Oct-2018 12:00	25-Oct-2018 07:30	25-Oct-2018 09:45	
Compound	CAS Number	LOR	Unit	EB1825910-001	EB1825910-002	EB1825910-003	
				Result	Result	Result	
EK061G: Total Kjeldahl Nitrogen By I)iscrete Analyser						
Total Kjeldahl Nitrogen as N		0.1	mg/L	2.3	0.4	1.4	
EK062G: Total Nitrogen as N (TKN + I	NOx) by Discrete An	alyser					
^ Total Nitrogen as N		0.1	mg/L	2.3	0.4	1.8	
EK067G: Total Phosphorus as P by D	iscrete Analyser						
Total Phosphorus as P		0.01	mg/L	0.22	0.04	0.09	
EK071G: Reactive Phosphorus as P t	y discrete analyser						
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	<0.01	
EN055: Ionic Balance							
Total Anions		0.01	meq/L	39.4	17.2	16.0	
Total Cations		0.01	meq/L	40.4	17.1	15.8	
Ionic Balance		0.01	%	1.32	0.31	0.55	



CERTIFICATE OF ANALYSIS					
Work Order	EB1825981	Page	: 1 of 5		
Client		Laboratory	: Environmental Division E	Brisbane	
Contact	: MR SUSANTHA KUMARAPELI	Contact	: Andrew Epps		
Address	: P O BOX 1734	Address	2 Byth Street Stafford QI	LD Australia 4053	
Telephone	MILTON QLD, AUSTRALIA 4064 : +61 07 3721 5400	Telephone	: +61 7 3552 8639		
Project	: 1893802 Inland Rail (P13)	Date Samples Received	26-Oct-2018 16:25		
Order number	: 1893802	Date Analysis Commenced	: 27-Oct-2018		
C-O-C number	:	Issue Date	: 31-Oct-2018 09:13		
Sampler	: ROB CUPPER			HALA NALA	
Site	:				
Quote number	: EN/002/18 National BQ			Accorditation No. 825	
No. of samples received	: 1			Accredited for compliance with	
No. of samples analysed	: 1			ISO/IEC 17025 - Testing	

True

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

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This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

• Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Page	: 3 of 5
Work Order	: EB1825981
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			330-01-BH2224	 	
	Client sampling date / time			26-Oct-2018 10:00	 	
Compound	CAS Number	LOR	Unit	EB1825981-001	 	
				Result	 	
EA005P: pH by PC Titrator						
pH Value		0.01	pH Unit	9.66	 	
EA010P: Conductivity by PC Titrator						
Electrical Conductivity @ 25°C		1	μS/cm	459	 	
EA015: Total Dissolved Solids dried at 18	30 ± 5 °C					
Total Dissolved Solids @180°C		10	mg/L	258	 	
ED037P: Alkalinity by PC Titrator						
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	 	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	28	 	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	31	 	
Total Alkalinity as CaCO3		1	mg/L	59	 	
ED041G: Sulfate (Turbidimetric) as SO4 2	2- by DA					
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	46	 	
ED045G: Chloride by Discrete Analyser						
Chloride	16887-00-6	1	mg/L	73	 	
ED093F: Dissolved Major Cations						
Calcium	7440-70-2	1	mg/L	11	 	
Magnesium	7439-95-4	1	mg/L	2	 	
Sodium	7440-23-5	1	mg/L	68	 	
Potassium	7440-09-7	1	mg/L	16	 	
ED093F: SAR and Hardness Calculations						
Total Hardness as CaCO3		1	mg/L	36	 	
^ Sodium Adsorption Ratio		0.01	-	4.95	 	
EG020F: Dissolved Metals by ICP-MS						
Arsenic	7440-38-2	0.001	mg/L	0.001	 	
Beryllium	7440-41-7	0.001	mg/L	<0.001	 	
Barium	7440-39-3	0.001	mg/L	0.029	 	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	 	
Chromium	7440-47-3	0.001	mg/L	0.008	 	
Cobalt	7440-48-4	0.001	mg/L	<0.001	 	
Copper	7440-50-8	0.001	mg/L	0.003	 	
Lead	7439-92-1	0.001	mg/L	<0.001	 	
Manganese	7439-96-5	0.001	mg/L	0.006	 	
Nickel	7440-02-0	0.001	mg/L	0.002	 	
Selenium	7782-49-2	0.01	mg/L	<0.01	 	

Page	: 4 of 5
Work Order	: EB1825981
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			330-01-BH2224				
	Client sampling date / time			26-Oct-2018 10:00				
Compound	CAS Number	LOR	Unit	EB1825981-001				
				Result				
EG020F: Dissolved Metals by ICP-MS - Co	ontinued							
Vanadium	7440-62-2	0.01	mg/L	<0.01				
Zinc	7440-66-6	0.005	mg/L	<0.005				
Boron	7440-42-8	0.05	mg/L	0.06				
Iron	7439-89-6	0.05	mg/L	<0.05				
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.002				
Beryllium	7440-41-7	0.001	mg/L	<0.001				
Barium	7440-39-3	0.001	mg/L	0.047				
Cadmium	7440-43-9	0.0001	mg/L	<0.0001				
Chromium	7440-47-3	0.001	mg/L	0.010				
Cobalt	7440-48-4	0.001	mg/L	0.001				
Copper	7440-50-8	0.001	mg/L	0.003				
Lead	7439-92-1	0.001	mg/L	0.003				
Manganese	7439-96-5	0.001	mg/L	0.047				
Nickel	7440-02-0	0.001	mg/L	0.003				
Selenium	7782-49-2	0.01	mg/L	<0.01				
Vanadium	7440-62-2	0.01	mg/L	<0.01				
Zinc	7440-66-6	0.005	mg/L	0.012				
Boron	7440-42-8	0.05	mg/L	0.07				
Iron	7439-89-6	0.05	mg/L	0.96				
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001				
EG035T: Total Recoverable Mercury by F	FIMS							
Mercury	7439-97-6	0.0001	mg/L	<0.0001				
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.8				
EK055G: Ammonia as N by Discrete Anal	lyser							
Ammonia as N	7664-41-7	0.01	mg/L	0.18				
EK057G: Nitrite as N by Discrete Analyse	er							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01				
EK058G: Nitrate as N by Discrete Analys	ser							
Nitrate as N	14797-55-8	0.01	mg/L	0.14				
EK059G: Nitrite plus Nitrate as N (NOx)	by Discrete Ana	lvser						
Nitrite + Nitrate as N		0.01	mg/L	0.14				
			5	-			ļ	

Page	5 of 5
Work Order	: EB1825981
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	330-01-BH2224				
	Clie	ent samplii	ng date / time	26-Oct-2018 10:00				
Compound	CAS Number	LOR	Unit	EB1825981-001				
				Result				
EK061G: Total Kjeldahl Nitrogen By D								
Total Kjeldahl Nitrogen as N		0.1	mg/L	0.9				
EK062G: Total Nitrogen as N (TKN + N	lOx) by Discrete Ana	alyser						
^ Total Nitrogen as N		0.1	mg/L	1.0				
EK067G: Total Phosphorus as P by Di	screte Analyser							
Total Phosphorus as P		0.01	mg/L	0.02				
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01				
EN055: Ionic Balance								
Total Anions		0.01	meq/L	4.20				
Total Cations		0.01	meq/L	4.08				
Ionic Balance		0.01	%	1.39				



CERTIFICATE OF ANALYSIS : EB1828572 Page : 1 of 5 Laboratory GOLDER ASSOCIATES : Environmental Division Brisbane : MR SUSANTHA KUMARAPELI Contact : Andrew Epps Address : 2 Byth Street Stafford QLD Australia 4053 : P O BOX 1734 MILTON QLD, AUSTRALIA 4064 : +61 07 3721 5400 Telephone : +61 7 3552 8639

Date Samples Received

Issue Date

Date Analysis Commenced

22-Nov-2018 08:35

: 26-Nov-2018 14:42

Accreditation No. 825

Accredited for compliance with ISO/IEC 17025 - Testing

: 22-Nov-2018

his report supersedes any previous report(s) w	ith this reference. Results apply to th	ne sample(s) as submitted. This document	shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

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: 1893802 INLAND RAIL (P13)

: SUSANTHA KUMARAPELI

: EN/002/18 National BQ

- General Comments
- Analytical Results

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

Signatories

Work Order

Client

Contact

Address

Telephone

Order number

C-O-C number

Quote number

No. of samples received

No. of samples analysed

Project

Sampler

Site

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

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

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

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

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

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

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

Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society. LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

 \sim = Indicates an estimated value.

- It is recognised that EG020-T (Total Metals by ICP-MS) is less than EG020-F (Dissolved Metals by ICP-MS) for sample EB1828572-001(330-01-BH2103). However, the difference is within experimental variation of the methods.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
| Page | : 3 of 5 |
|------------|-----------------------------|
| Work Order | : EB1828572 |
| Client | : GOLDER ASSOCIATES |
| Project | : 1893802 INLAND RAIL (P13) |



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			330-01-BH2103				
	Cl	ient samplii	ng date / time	20-Nov-2018 00:00				
Compound	CAS Number	LOR	Unit	EB1828572-001				
				Result				
EA005P: pH by PC Titrator								
pH Value		0.01	pH Unit	8.18				
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C		1	μS/cm	3810				
EA015: Total Dissolved Solids dried at 18	30 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	2170				
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1				
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1				
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	875				
Total Alkalinity as CaCO3		1	mg/L	875				
ED041G: Sulfate (Turbidimetric) as SO4 2	2- by DA							
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	169				
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	709				
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	50				
Magnesium	7439-95-4	1	mg/L	51				
Sodium	7440-23-5	1	mg/L	662				
Potassium	7440-09-7	1	mg/L	8				
ED093F: SAR and Hardness Calculations	;							
Total Hardness as CaCO3		1	mg/L	335				
^ Sodium Adsorption Ratio		0.01	-	15.7				
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.002				
Boron	7440-42-8	0.05	mg/L	0.12				
Barium	7440-39-3	0.001	mg/L	0.080				
Beryllium	7440-41-7	0.001	mg/L	<0.001				
Cadmium	7440-43-9	0.0001	mg/L	<0.0001				
Cobalt	7440-48-4	0.001	mg/L	0.002				
Chromium	7440-47-3	0.001	mg/L	<0.001				
Copper	7440-50-8	0.001	mg/L	0.003				
Manganese	7439-96-5	0.001	mg/L	0.082				
Nickel	7440-02-0	0.001	mg/L	0.003				
Lead	7439-92-1	0.001	mg/L	<0.001				

Page	: 4 of 5
Work Order	: EB1828572
Client	: GOLDER ASSOCIATES
Project	: 1893802 INLAND RAIL (P13)



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			330-01-BH2103			
	Cli	ient samplir	ng date / time	20-Nov-2018 00:00			
Compound	CAS Number	LOR	Unit	EB1828572-001			
				Result			
EG020F: Dissolved Metals by ICP-MS - C	ontinued						
Selenium	7782-49-2	0.01	mg/L	<0.01			
Vanadium	7440-62-2	0.01	mg/L	<0.01			
Zinc	7440-66-6	0.005	mg/L	0.040			
EG020T: Total Metals by ICP-MS							
Arsenic	7440-38-2	0.001	mg/L	0.003			
Boron	7440-42-8	0.05	mg/L	0.12			
Barium	7440-39-3	0.001	mg/L	0.105			
Beryllium	7440-41-7	0.001	mg/L	<0.001			
Cadmium	7440-43-9	0.0001	mg/L	0.0002			
Cobalt	7440-48-4	0.001	mg/L	0.005			
Chromium	7440-47-3	0.001	mg/L	0.003			
Copper	7440-50-8	0.001	mg/L	0.016			
Manganese	7439-96-5	0.001	mg/L	0.178			
Nickel	7440-02-0	0.001	mg/L	0.006			
Lead	7439-92-1	0.001	mg/L	0.007			
Selenium	7782-49-2	0.01	mg/L	<0.01			
Vanadium	7440-62-2	0.01	mg/L	0.01			
Zinc	7440-66-6	0.005	mg/L	0.029			
EG035F: Dissolved Mercury by FIMS							
Mercury	7439-97-6	0.0001	mg/L	<0.0001			
EG035T: Total Recoverable Mercury by	FIMS						
Mercury	7439-97-6	0.0001	mg/L	<0.0001			
EK040P: Fluoride by PC Titrator							
Fluoride	16984-48-8	0.1	mg/L	0.2			
EK055G: Ammonia as N by Discrete Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	0.23			
EK057G: Nitrite as N by Discrete Analys	ser						
Nitrite as N	14797-65-0	0.01	mg/L	<0.01			
EK058G: Nitrate as N by Discrete Analys	ser						
Nitrate as N	14797-55-8	0.01	mg/L	0.03			
EK059G: Nitrite plus Nitrate as N.(NOx)	by Discrete Ana	lvser					
Nitrite + Nitrate as N		0.01	mg/L	0.03			
EK061G: Total Kieldahl Nitrogen By Disc	crete Analyser		-				
Total Kieldahl Nitrogen as N		0.1	ma/L	12.0			
,,				-=			

Page	5 of 5
Work Order	: EB1828572
Client	: GOLDER ASSOCIATES
Project	: 1893802 INLAND RAIL (P13)



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			330-01-BH2103		 	
	Cli	ient sampli	ng date / time	20-Nov-2018 00:00		 	
Compound	CAS Number	LOR	Unit	EB1828572-001		 	
				Result		 	
EK062G: Total Nitrogen as N (TKN + N	alyser						
^ Total Nitrogen as N		0.1	mg/L	12.0		 	
EK067G: Total Phosphorus as P by Dis							
Total Phosphorus as P		0.01	mg/L	0.12		 	
EK071G: Reactive Phosphorus as P by discrete analyser							
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01		 	
EN055: Ionic Balance							
Total Anions		0.01	meq/L	41.0		 	
Total Cations		0.01	meq/L	35.7		 	
Ionic Balance		0.01	%	6.92		 	



CERTIFICATE OF ANALYSIS : EB1830098 Work Order Page : 1 of 5 Laboratory GOLDER ASSOCIATES : Environmental Division Brisbane : MR SUSANTHA KUMARAPELI Contact Contact : Andrew Epps Address Address : 2 Byth Street Stafford QLD Australia 4053 : P O BOX 1734 MILTON QLD. AUSTRALIA 4064 Telephone : +61 07 3721 5400 Telephone : +61 7 3552 8639 Date Samples Received : 1893802 INLAND RAIL (P13) : 07-Dec-2018 19:20 Order number Date Analysis Commenced : 08-Dec-2018 C-O-C number Issue Date : 11-Dec-2018 16:35 Sampler : HANNAH GROVES ·

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

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

This Certificate of Analysis contains the following information:

: 1

: 1

: EN/002/18 National BQ

- General Comments
- Analytical Results

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

Signatories

Client

Project

Site

Quote number

No. of samples received

No. of samples analysed

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



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

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

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

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

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

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

Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society. LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

 \sim = Indicates an estimated value.

- It is recognised that EG020-T (Total Metals by ICP-MS) is less than EG020-F (Dissolved Metals by ICP-MS) for sample EB1830098-001(330-01-BH2101). However, the difference is within experimental variation of the methods.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Page	: 3 of 5
Work Order	: EB1830098
Client	: GOLDER ASSOCIATES
Project	: 1893802 INLAND RAIL (P13)



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			330-01-BH2101				
	Cl	ient samplii	ng date / time	07-Dec-2018 00:00				
Compound	CAS Number	LOR	Unit	EB1830098-001				
				Result				
EA005P: pH by PC Titrator								
pH Value		0.01	pH Unit	8.80				
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C		1	μS/cm	2190				
EA015: Total Dissolved Solids dried at 18	80 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	1280				
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1				
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	104				
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	670				
Total Alkalinity as CaCO3		1	mg/L	774				
ED041G: Sulfate (Turbidimetric) as SO4 2	2- by DA							
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	51				
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	209				
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	9				
Magnesium	7439-95-4	1	mg/L	5				
Sodium	7440-23-5	1	mg/L	506				
Potassium	7440-09-7	1	mg/L	3				
ED093F: SAR and Hardness Calculations	5							
^ Sodium Adsorption Ratio		0.01	-	33.5				
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.002				
Beryllium	7440-41-7	0.001	mg/L	<0.001				
Barium	7440-39-3	0.001	mg/L	0.196				
Cadmium	7440-43-9	0.0001	mg/L	<0.0001				
Chromium	7440-47-3	0.001	mg/L	<0.001				
Cobalt	7440-48-4	0.001	mg/L	<0.001				
Copper	7440-50-8	0.001	mg/L	<0.001				
Lead	7439-92-1	0.001	mg/L	<0.001				
Manganese	7439-96-5	0.001	mg/L	0.069				
Nickel	7440-02-0	0.001	mg/L	<0.001				
Selenium	7782-49-2	0.01	mg/L	<0.01				
Vanadium	7440-62-2	0.01	mg/L	<0.01				

Page	: 4 of 5
Work Order	: EB1830098
Client	: GOLDER ASSOCIATES
Project	: 1893802 INLAND RAIL (P13)



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			330-01-BH2101				
	Cl	ient samplir	g date / time	07-Dec-2018 00:00				
Compound	CAS Number	LOR	Unit	EB1830098-001				
				Result				
EG020F: Dissolved Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	<0.005				
Boron	7440-42-8	0.05	mg/L	0.13				
Iron	7439-89-6	0.05	mg/L	2.28				
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.004				
Beryllium	7440-41-7	0.001	mg/L	<0.001				
Barium	7440-39-3	0.001	mg/L	0.166				
Cadmium	7440-43-9	0.0001	mg/L	<0.0001				
Chromium	7440-47-3	0.001	mg/L	0.002				
Cobalt	7440-48-4	0.001	mg/L	<0.001				
Copper	7440-50-8	0.001	mg/L	0.002				
Lead	7439-92-1	0.001	mg/L	<0.001				
Manganese	7439-96-5	0.001	mg/L	0.078				
Nickel	7440-02-0	0.001	mg/L	0.002				
Selenium	7782-49-2	0.01	mg/L	<0.01				
Vanadium	7440-62-2	0.01	mg/L	<0.01				
Zinc	7440-66-6	0.005	mg/L	0.014				
Boron	7440-42-8	0.05	mg/L	0.20				
Iron	7439-89-6	0.05	mg/L	3.31				
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001				
EG035T: Total Recoverable Mercury by F	FIMS							
Mercury	7439-97-6	0.0001	mg/L	<0.0001				
EK055G: Ammonia as N by Discrete Anal	lyser							
Ammonia as N	7664-41-7	0.01	mg/L	0.97				
EK057G: Nitrite as N by Discrete Analyse	er							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01				
EK058G: Nitrate as N by Discrete Analys	ser							
Nitrate as N	14797-55-8	0.01	mg/L	0.03				
EK059G: Nitrite plus Nitrate as N (NOx)	by Discrete Ana	lvser						
Nitrite + Nitrate as N		0.01	mg/L	0.03				
EK061G: Total Kieldahl Nitrogen By Disc	rete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	1.6				
EK062G: Total Nitrogen as N (TKN + NOx	() by Discrete Ar	alvser						
ERODEO. TOtal Nillogen as N (TRN + NOX	y bisciete Al	aryser						

Page	5 of 5
Work Order	: EB1830098
Client	: GOLDER ASSOCIATES
Project	: 1893802 INLAND RAIL (P13)



Sub-Matrix: WATER (Matrix: WATER)		Cli	ent sample ID	330-01-BH2101	 	
	Cli	ent sampli	ing date / time	07-Dec-2018 00:00	 	
Compound	CAS Number	LOR	Unit	EB1830098-001	 	
				Result	 	
EK062G: Total Nitrogen as N (TKN + NO	0x) by Discrete An	alyser - C	Continued			
^ Total Nitrogen as N		0.1	mg/L	1.6	 	
EK067G: Total Phosphorus as P by Disc	crete Analyser					
Total Phosphorus as P		0.01	mg/L	0.03	 	
EK071G: Reactive Phosphorus as P by	discrete analyser					
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	 	
EN055: Ionic Balance						
Total Anions		0.01	meq/L	22.4	 	
Total Cations		0.01	meq/L	22.9	 	
Ionic Balance		0.01	%	1.16	 	



QUALITY CONTROL REPORT

Work Order	EB1825628	Page	: 1 of 9
Client	GOLDER ASSOCIATES	Laboratory	: Environmental Division Brisbane
Contact	: MR MITCH McGINNIS	Contact	: Andrew Epps
Address	: 32 SHAND STREET	Address	: 2 Byth Street Stafford QLD Australia 4053
	BRISBANE QLD, AUSTRALIA 4053		
Telephone	: +61 07 3721 5400	Telephone	: +61 7 3552 8639
Project	: 1893802 Inland Rail (P13)	Date Samples Received	: 24-Oct-2018
Order number	:	Date Analysis Commenced	: 24-Oct-2018
C-O-C number	:	Issue Date	26-Oct-2018
Sampler	: ROBERT CUPPER		Hac-MRA NATA
Site	:		
Quote number	: EN/002/18 National BQ		Accreditation No. 825
No. of samples received	: 4		Accredited for compliance with
No. of samples analysed	: 4		ISO/IEC 17025 - Testing

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

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

Signatories

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

- CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
- LOR = Limit of reporting
- RPD = Relative Percentage Difference
- # = Indicates failed QC

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005P: pH by PC Ti	trator (QC Lot: 1998976)								
EB1825421-001	Anonymous	EA005-P: pH Value		0.01	pH Unit	8.25	8.31	0.725	0% - 20%
EB1825628-001	330-01-BH2212	EA005-P: pH Value		0.01	pH Unit	8.16	8.19	0.367	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 1998975)									
EB1825421-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C		1	μS/cm	3310	3300	0.307	0% - 20%
EB1825628-001	330-01-BH2212	EA010-P: Electrical Conductivity @ 25°C		1	μS/cm	5500	5480	0.369	0% - 20%
EA015: Total Dissolv	ed Solids dried at 180 ± 5 °C	; (QC Lot: 1999654)							
EB1825537-001	Anonymous	EA015H: Total Dissolved Solids @180°C		10	mg/L	16	14	14.6	No Limit
EB1825568-007	Anonymous	EA015H: Total Dissolved Solids @180°C		10	mg/L	435	433	0.461	0% - 20%
EA015: Total Dissolv	ed Solids dried at 180 ± 5 °C	; (QC Lot: 1999656)							
EB1825628-004	330-01-BH22104	EA015H: Total Dissolved Solids @180°C		10	mg/L	2390	2340	1.80	0% - 20%
ED037P: Alkalinity by	PC Titrator (QC Lot: 1998	974)							
EB1825421-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	4	115	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	203	194	4.08	0% - 20%
		ED037-P: Total Alkalinity as CaCO3		1	mg/L	203	198	2.19	0% - 20%
EB1825628-001	330-01-BH2212	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	601	609	1.44	0% - 20%
		ED037-P: Total Alkalinity as CaCO3		1	mg/L	601	609	1.44	0% - 20%
ED041G: Sulfate (Tur	bidimetric) as SO4 2- by DA	(QC Lot: 1999114)							
EB1825628-001	330-01-BH2212	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	77	77	0.00	0% - 20%
ED045G: Chloride by	Discrete Analyser (QC Lot	: 1999115)							
EB1825628-001	330-01-BH2212	ED045G: Chloride	16887-00-6	1	mg/L	1340	1360	0.843	0% - 20%

Page	: 3 of 9
Work Order	: EB1825628
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER	Matrix: WATER					Laboratory Duplicate (DUP) Report				
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)	
ED093F: Dissolved	Major Cations (QC Lo	ot: 2000478)								
EB1825699-003	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	37	37	0.00	0% - 20%	
		ED093F: Magnesium	7439-95-4	1	mg/L	1	1	0.00	No Limit	
		ED093F: Sodium	7440-23-5	1	mg/L	14	14	0.00	0% - 50%	
		ED093F: Potassium	7440-09-7	1	mg/L	3	2	0.00	No Limit	
EB1825618-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	36	36	0.00	0% - 20%	
		ED093F: Magnesium	7439-95-4	1	mg/L	13	14	0.00	0% - 50%	
		ED093F: Sodium	7440-23-5	1	mg/L	94	95	1.84	0% - 20%	
		ED093F: Potassium	7440-09-7	1	mg/L	4	4	0.00	No Limit	
EG020F: Dissolved	Metals by ICP-MS (Q	C Lot: 2000480)								
EB1825699-003	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit	
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.001	0.001	0.00	No Limit	
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.048	0.048	0.00	0% - 20%	
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.009	0.010	11.9	0% - 50%	
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.00	No Limit	
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.001	<0.001	0.00	No Limit	
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.287	0.283	1.32	0% - 20%	
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.006	0.006	0.00	No Limit	
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	11.2	11.0	1.48	0% - 20%	
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit	
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit	
		EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.00	No Limit	
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.10	0.10	0.00	No Limit	
EB1825618-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit	
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.153	0.154	0.00	0% - 20%	
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.001	0.001	0.00	No Limit	
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.029	0.029	0.00	0% - 20%	
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.003	0.003	0.00	No Limit	
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.108	0.110	1.56	0% - 20%	
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.010	0.010	0.00	0% - 50%	
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.041	0.040	0.00	No Limit	
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit	
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit	
		EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.00	No Limit	
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit	
EG020T: Total Meta	Is by ICP-MS (QC Lot	t: 2000492)								



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals	by ICP-MS (QC Lot: 20004	92) - continued							
EB1825618-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.172	0.181	4.75	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.040	0.041	0.00	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.145	0.148	2.19	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.014	0.015	8.05	0% - 50%
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.053	0.052	0.00	0% - 50%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	0.05	<0.05	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	1.14	1.14	0.00	0% - 20%
EB1825675-002	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0005	<0.0005	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.060	0.063	5.49	0% - 50%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.009	0.009	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	10.0	10.4	3.24	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.007	0.008	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.287	0.296	3.26	0% - 50%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	1.43	1.49	4.57	0% - 20%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.69	0.72	4.20	0% - 50%
EG035F: Dissolved N	lercury by FIMS (QC Lot: 20	000479)							
EB1825675-004	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EB1825618-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recov	verable Mercury by F <u>IMS(</u> C	QC Lot: 2000491)							
EB1825618-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK040P: Fluoride by	PC Titrator (QC Lot: 19989)	73)							
EB1825421-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit
EB1825628-001	330-01-BH2212	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.5	0.4	0.00	No Limit
EK055G: Ammonia a	s N by Discrete Analyser(C	QC Lot: 1999768)			-				

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Work Order	: EB1825628
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK055G: Ammonia as	s N by Discrete Analyser (Q	C Lot: 1999768) - continued							
EB1825283-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.02	<0.01	80.7	No Limit
EB1825628-001	330-01-BH2212	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.11	0.10	15.1	0% - 50%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 1999113)									
EB1825530-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EB1825628-001	330-01-BH2212	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK059G: Nitrite plus	Nitrate as N (NOx) by Discr	rete Analyser (QC Lot: 1999769)							
EB1825283-001	Anonymous	EK059G: Nitrite + Nitrate as N		0.01	mg/L	<0.01	<0.01	0.00	No Limit
EB1825628-001	330-01-BH2212	EK059G: Nitrite + Nitrate as N		0.01	mg/L	0.48	0.49	3.08	0% - 20%
EK061G: Total Kjelda	hl Nitrogen By Discrete Ana	ılyser (QC Lot: 1999751)							
EB1825424-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	9.8	8.5	14.5	No Limit
EB1825602-005	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	8.6	8.4	2.23	0% - 20%
EK067G: Total Phosp	horus as P by Discrete Ana	lyser (QC Lot: 1999750)							
EB1825424-001	Anonymous	EK067G: Total Phosphorus as P		0.01	mg/L	2.10	1.85	12.6	0% - 20%
EB1825602-005	Anonymous	EK067G: Total Phosphorus as P		0.01	mg/L	0.80	0.80	0.00	0% - 20%
EK071G: Reactive Ph	osphorus as P by discrete a	analyser (QC Lot: 1999116)							
EB1825628-001	330-01-BH2212	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit



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

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

Sub-Matrix: WATER				Method Blank (MB)	Laboratory Control Spike (LCS) Report			
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 1998976)								
EA005-P: pH Value			pH Unit		4 pH Unit	100	98	102
					7 pH Unit	101	98	102
EA010P: Conductivity by PC Titrator (QCLot: 1998975)								
EA010-P: Electrical Conductivity @ 25°C		1	μS/cm	<1	220 µS/cm	103	91	107
				<1	12890 µS/cm	99.3	91	107
EA015: Total Dissolved Solids dried at 180 ± 5 °C(QCLo	t: 1999654)							
EA015H: Total Dissolved Solids @180°C		10	mg/L	<10	293 mg/L	101	88	112
				<10	2000 mg/L	100	88	112
EA015: Total Dissolved Solids dried at 180 \pm 5 °C (QCLo	t: 1999656)							
EA015H: Total Dissolved Solids @180°C		10	mg/L	<10	293 mg/L	103	88	112
_				<10	2000 mg/L	99.3	88	112
ED037P: Alkalinity by PC Titrator (QCLot: 1998974)								
ED037-P: Total Alkalinity as CaCO3			mg/L		50 mg/L	107	80	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLo	t: 1999114)							
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	102	85	118
			J. J. J. J. J. J. J. J. J. J. J. J. J. J	<1	100 mg/L	96.4	85	118
ED045G: Chloride by Discrete Analyser (QCLot: 199911	5)							
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	95.4	90	115
			, , , , , , , , , , , , , , , , , , ,	<1	1000 mg/L	97.3	90	115
ED093F: Dissolved Maior Cations (QCLot: 2000478)								
ED093F: Calcium	7440-70-2	1	mg/L	<1				
ED093F: Magnesium	7439-95-4	1	mg/L	<1				
ED093F: Sodium	7440-23-5	1	mg/L	<1				
ED093F: Potassium	7440-09-7	1	mg/L	<1				
EG020F: Dissolved Metals by ICP-MS (QCLot: 2000480)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	100	88	116
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	96.9	81	117
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.5 mg/L	94.3	70	130
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	96.0	88	108
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	104	87	113
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	103	86	112
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.2 mg/L	104	88	114
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	101	89	110
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	102	89	120

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Sub-Matrix: WATER				Method Blank (MB)	Laboratory Control Spike (LCS) Report			
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2000	480) - continued							
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	102	89	113
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	101	83	112
EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	109	88	114
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	101	87	113
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	107	81	125
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	99.9	82	114
EG020T: Total Metals by ICP-MS (QCLot: 2000492)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	99.8	88	112
EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	98.4	81	119
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.5 mg/L	102	70	130
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	97.6	88	111
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	103	89	115
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	102	89	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.2 mg/L	104	88	116
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	97.8	89	112
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	102	88	114
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	105	88	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	97.0	79	111
EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	108	87	114
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	97.2	84	114
EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	121	82	128
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	102	82	118
EG035F: Dissolved Mercury by FIMS (QCLot: 20004	179)							
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	88.2	84	118
EG035T: Total Recoverable Mercury by FIMS (QCL	ot: 2000491)							
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	104	84	118
EK040P: Fluoride by PC Titrator (QCLot: 1998973)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	102	80	117
EK055G: Ammonia as N by Discrete Analyser(QCL	.ot: 1999768)							
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	102	86	112
EK057G: Nitrite as N by Discrete Analyser (QCLot:	1999113)							
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	96.8	90	110
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete	Analyser (QCI of: 199	99769)						
EK059G: Nitrite + Nitrate as N		0.01	mg/L	<0.01	0.5 mg/L	101	89	115
EK064C: Total Kieldahl Nitrogan By Discrete Analys	or (OCI of 1000 751)		3. –		.			
EK061G: Total Kieldahl Nitrogen as N	<u></u>	0 1	ma/l	<0.1	1 mg/l	93.6	70	111
		0.1	iiig/L	-0.1	i nig/L	00.0	,0	
EK067G: Total Phosphorus as P by Discrete Analys	er (QCLot: 1999750)							



с				Mathad Blank (MB)	Laboratory Control Spike (LCS) Penert				
Sub-Matrix: WATER					Laboratory Control Spike (LCS) Report				
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High	
EK067G: Total Phosphorus as P by Discrete A	EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1999750) - continued								
EK067G: Total Phosphorus as P		0.01	mg/L	<0.01	0.442 mg/L	92.3	77	109	
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 1999116)									
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	95.4	88	115	

Matrix Spike (MS) Report

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

Sub-Matrix: WATER					atrix Spike (MS) Report		
				Spike	SpikeRecovery(%)	Recovery L	imits (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (1	urbidimetric) as SO4 2- by DA (QCLot: 1999114)						
EB1825618-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	70.3	70	130
ED045G: Chloride	by Discrete Analyser (QCLot: 1999115)						
EB1825618-002	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	94.3	70	130
EG020F: Dissolved	I Metals by ICP-MS (QCLot: 2000480)						
EB1825628-001	330-01-BH2212	EG020A-F: Arsenic	7440-38-2	0.1 mg/L	107	70	130
		EG020A-F: Beryllium	7440-41-7	0.1 mg/L	99.1	70	130
		EG020A-F: Barium	7440-39-3	0.5 mg/L	99.0	70	130
		EG020A-F: Cadmium	7440-43-9	0.1 mg/L	98.7	70	130
		EG020A-F: Chromium	7440-47-3	0.1 mg/L	98.7	70	130
		EG020A-F: Cobalt	7440-48-4	0.1 mg/L	97.3	70	130
		EG020A-F: Copper	7440-50-8	0.2 mg/L	96.0	70	130
		EG020A-F: Lead	7439-92-1	0.1 mg/L	98.6	70	130
		EG020A-F: Manganese	7439-96-5	0.1 mg/L	95.7	70	130
		EG020A-F: Nickel	7440-02-0	0.1 mg/L	94.6	70	130
		EG020A-F: Selenium	7782-49-2	0.1 mg/L	105	70	130
		EG020A-F: Vanadium	7440-62-2	0.1 mg/L	105	70	130
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	99.5	70	130
		EG020A-F: Boron	7440-42-8	0.5 mg/L	97.2	70	130
EG020T: Total Met	als by ICP-MS (QCLot: 2000492)						
EB1825618-002	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	91.4	70	130
		EG020A-T: Beryllium	7440-41-7	0.1 mg/L	90.9	70	130
		EG020A-T: Barium	7440-39-3	1 mg/L	99.7	70	130
		EG020A-T: Cadmium	7440-43-9	0.5 mg/L	99.3	70	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	92.6	70	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	92.2	70	130
		EG020A-T: Copper	7440-50-8	1 mg/L	88.8	70	130

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Sub-Matrix: WATER				Ма	trix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Li	mits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High	
EG020T: Total Meta	als by ICP-MS (QCLot: 2000492) - continued							
EB1825618-002	Anonymous	EG020A-T: Lead	7439-92-1	1 mg/L	94.0	70	130	
		EG020A-T: Manganese	7439-96-5	1 mg/L	87.3	70	130	
		EG020A-T: Nickel	7440-02-0	1 mg/L	93.6	70	130	
		EG020A-T: Vanadium	7440-62-2	1 mg/L	94.7	70	130	
		EG020A-T: Zinc	7440-66-6	1 mg/L	89.8	70	130	
EG035F: Dissolved	EG035F: Dissolved Mercury by FIMS (QCLot: 2000479)							
EB1825618-003	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	82.2	70	130	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2000491)								
EB1825618-002	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	92.5	70	130	
EK040P: Fluoride b	y PC Titrator (QCLot: 1998973)							
EB1825421-002	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	92.6	70	130	
EK055G: Ammonia	as N by Discrete Analyser (QCLot: 1999768)							
EB1825319-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	96.4	70	130	
EK057G: Nitrite as	N by Discrete Analyser (QCLot: 1999113)							
EB1825618-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.4 mg/L	95.6	70	130	
EK059G: Nitrite pl	us Nitrate as N (NOx) by Discrete Analyser (QCLot: 199	9769)						
EB1825319-001	Anonymous	EK059G: Nitrite + Nitrate as N		0.4 mg/L	93.8	70	130	
EK061G: Total Kjel	dahl Nitrogen By Discrete Analyser (QCLot: 1999751)							
EB1825425-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		100 mg/L	109	70	130	
EK067G: Total Pho	sphorus as P by Discrete Analyser (QCLot: 1999750)							
EB1825425-001	Anonymous	EK067G: Total Phosphorus as P		20 mg/L	81.9	70	130	
EK071G: Reactive	Phosphorus as P by discrete analyser (QCLot: 1999116							
EB1825618-002	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.4 mg/L	97.2	70	130	



QUALITY CONTROL REPORT

Work Order	: EB1825910	Page	: 1 of 9	
Client		Laboratory	: Environmental Division	Brisbane
Contact	: MR MITCH McGINNIS	Contact	: Andrew Epps	
Address	: P O BOX 1734 MILTON QLD, AUSTRALIA 4064	Address	: 2 Byth Street Stafford G	QLD Australia 4053
Telephone	: +61 07 3721 5400	Telephone	: +61 7 3552 8639	
Project	: 1893802	Date Samples Received	: 26-Oct-2018	- MIIIII.
Order number	: 1893802	Date Analysis Commenced	: 26-Oct-2018	
C-O-C number	:	Issue Date	: 31-Oct-2018	NATA
Sampler	: ROBERT CUPPER			Hac-MRA NATA
Site	:			
Quote number	: EN/002/18 National BQ			Accreditation No. 935
No. of samples received	: 3			Accredited for compliance with
No. of samples analysed	: 3			ISO/IEC 17025 - Testing

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

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

Signatories

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: WATER			Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005P: pH by PC 1	itrator (QC Lot: 2004137)								
EB1825819-002	Anonymous	EA005-P: pH Value		0.01	pH Unit	7.54	7.41	1.74	0% - 20%
EB1825910-003	330-01-BH2307	EA005-P: pH Value		0.01	pH Unit	8.53	8.60	0.817	0% - 20%
EA010P: Conductivi	ty by PC Titrator (QC Lot: 2	004136)							
EB1825819-002	Anonymous	EA010-P: Electrical Conductivity @ 25°C		1	μS/cm	3210	3180	0.974	0% - 20%
EB1825910-003	330-01-BH2307	EA010-P: Electrical Conductivity @ 25°C		1	μS/cm	1730	1730	0.240	0% - 20%
EA015: Total Dissol	ved Solids dried at 180 ± 5 °C	C (QC Lot: 2004052)							
EB1825828-002	Anonymous	EA015H: Total Dissolved Solids @180°C		10	mg/L	5370	5240	2.49	0% - 20%
EB1825828-011	Anonymous	EA015H: Total Dissolved Solids @180°C		10	mg/L	13900	14000	0.687	0% - 20%
ED037P: Alkalinity b	y PC Titrator (QC Lot: 2004	138)							
EB1825819-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	40	47	14.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3		1	mg/L	40	47	14.9	0% - 20%
EB1825910-003	330-01-BH2307	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	12	14	17.9	0% - 50%
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	116	112	3.56	0% - 20%
		ED037-P: Total Alkalinity as CaCO3		1	mg/L	128	126	1.36	0% - 20%
ED041G: Sulfate (Tu	rbidimetric) as SO4 2- by DA	(QC Lot: 2004179)							
EB1825915-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10	10	0.00	No Limit
EB1825875-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	45	45	0.00	0% - 20%
ED045G: Chloride b	y Discrete Analyser (QC Lot	: 2004180)							
EB1825875-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	115	115	0.00	0% - 20%
ED093F: Dissolved	Major Cations (QC Lot: 2005	582)							
EB1825908-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	22	21	0.00	0% - 20%

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Sub-Matrix: WATER	ub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)	
ED093F: Dissolved I	Major Cations (QC Lot: 2	2005582) - continued								
EB1825908-002	Anonymous	ED093F: Magnesium	7439-95-4	1	mg/L	14	13	0.00	0% - 50%	
	-	ED093F: Sodium	7440-23-5	1	mg/L	422	405	4.17	0% - 20%	
		ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.00	No Limit	
EG020F: Dissolved I	Metals by ICP-MS (QC Lo	ot: 2005581)								
EB1825492-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0024	0.0024	0.00	0% - 20%	
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	0.004	0.004	0.00	No Limit	
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.010	0.009	10.8	0% - 50%	
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.072	0.069	4.19	0% - 20%	
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.001	0.002	65.2	No Limit	
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	3.55	3.52	0.891	0% - 20%	
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.168	0.165	1.30	0% - 20%	
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.708	0.700	1.21	0% - 20%	
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit	
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit	
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.96	0.95	0.00	0% - 50%	
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit	
EB1825908-002	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit	
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.007	0.007	0.00	No Limit	
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.045	0.043	4.36	0% - 20%	
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.003	0.003	0.00	No Limit	
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.005	0.004	0.00	No Limit	
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.069	0.067	3.58	0% - 20%	
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.004	0.003	0.00	No Limit	
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.009	0.008	12.2	No Limit	
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit	
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit	
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.13	0.12	0.00	No Limit	
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit	
EG020T: Total Metal	s by ICP-MS (QC Lot: 20	005742)								
EB1825778-031	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit	
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit	
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit	

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Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals	by ICP-MS (QC Lot: 20057	42) - continued							
EB1825778-031	Anonymous	EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EB1825822-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.009	0.009	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.009	0.009	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.291	0.292	0.00	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EG035F: Dissolved M	lercury by FIMS (QC Lot: 20	005575)							
EB1825908-004	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EB1824322-003	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recov	verable Mercury by FIMS(C	QC Lot: 2005740)							
EB1825778-031	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EB1825910-002	330-01-BH2303	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK040P: Fluoride by	PC Titrator (QC Lot: 20041:	39)							
EB1825819-002	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.7	0.7	0.00	No Limit
EB1825910-003	330-01-BH2307	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.6	0.6	0.00	No Limit
EK055G: Ammonia as	s N by Discrete Analyser(C	QC Lot: 2004188)							
EB1825908-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.06	0.00	No Limit
EK057G: Nitrite as N	by Discrete Analyser (QC	Lot: 2004177)							
EB1825917-003	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EB1825875-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit

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Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)	
EK059G: Nitrite plus	Nitrate as N (NOx) by Discr	rete Analyser (QC Lot: 2004189)								
EB1825915-005	Anonymous	EK059G: Nitrite + Nitrate as N		0.01	mg/L	0.13	0.13	0.00	0% - 50%	
EB1825908-001	Anonymous	EK059G: Nitrite + Nitrate as N		0.01	mg/L	<0.01	<0.01	0.00	No Limit	
EK061G: Total Kjelda	hl Nitrogen By Discrete Ana	llyser (QC Lot: 2004477)								
EB1825611-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	117	114	2.52	0% - 20%	
EB1825908-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	0.2	0.1	0.00	No Limit	
EK067G: Total Phosp	horus as P by Discrete Ana	lyser (QC Lot: 2004478)								
EB1825611-001	Anonymous	EK067G: Total Phosphorus as P		0.01	mg/L	14.8	14.4	2.98	0% - 20%	
EB1825908-004	Anonymous	EK067G: Total Phosphorus as P		0.01	mg/L	0.18	0.18	0.00	0% - 50%	
EK071G: Reactive Ph	osphorus as P by discrete a	nalyser (QC Lot: 2004178)								
EB1825852-002	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit	
EB1825917-003	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	0.03	0.02	0.00	No Limit	



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

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

Sub-Matrix: WATER			Method Blank (MB)		Laboratory Control Spike (LC	S) Report	
			Report	Spike	Spike Recovery (%)	Recovery	Limits (%)
Method: Compound CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 2004137)							
EA005-P: pH Value		pH Unit		4 pH Unit	100	98	102
				7 pH Unit	101	98	102
EA010P: Conductivity by PC Titrator (QCLot: 2004136)							
EA010-P: Electrical Conductivity @ 25°C	1	μS/cm	<1	2100 µS/cm	102	91	107
			<1	12890 µS/cm	101	91	107
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 2004052)							
EA015H: Total Dissolved Solids @180°C	10	mg/L	<10	293 mg/L	95.4	88	112
_			<10	2000 mg/L	100	88	112
ED037P: Alkalinity by PC Titrator (QCLot: 2004138)							
ED037-P: Total Alkalinity as CaCO3		mg/L		50 mg/L	102	80	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2004179)							
ED041G: Sulfate as SO4 - Turbidimetric 14808-79-8	1	mg/L	<1	25 mg/L	102	85	118
			<1	100 mg/L	87.3	85	118
ED045G: Chloride by Discrete Analyser (QCLot: 2004180)							
ED045G: Chloride 16887-00-6	1	mg/L	<1	10 mg/L	107	90	115
			<1	1000 mg/L	102	90	115
ED093F: Dissolved Maior Cations (QCLot: 2005582)							
ED093F: Calcium 7440-70-2	1	mg/L	<1				
ED093F: Magnesium 7439-95-4	1	mg/L	<1				
ED093F: Sodium 7440-23-5	1	mg/L	# 2				
ED093F: Potassium 7440-09-7	1	mg/L	<1				
EG020F: Dissolved Metals by ICP-MS (QCLot: 2005581)							
EG020A-F: Arsenic 7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.7	88	116
EG020A-F: Beryllium 7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	90.8	81	117
EG020A-F: Barium 7440-39-3	0.001	mg/L	<0.001	0.5 mg/L	97.9	70	130
EG020A-F: Cadmium 7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	96.2	88	108
EG020A-F: Chromium 7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	101	87	113
EG020A-F: Cobalt 7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	98.5	86	112
EG020A-F: Copper 7440-50-8	0.001	mg/L	<0.001	0.2 mg/L	98.0	88	114
EG020A-F: Lead 7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	106	89	110
EG020A-F: Manganese 7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	101	89	120
EG020A-F: Nickel 7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	94.7	89	113
EG020A-F: Selenium 7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	98.0	83	112
EG020A-F: Vanadium 7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	112	88	114

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Sub-Matrix: WATER			Method Blank (MB)		Laboratory Control Spike (LC	S) Report		
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 200	5581) - continued							
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	98.1	87	113
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	97.8	81	125
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	95.0	82	114
EG020T: Total Metals by ICP-MS (QCLot: 2005742)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	100.0	88	112
EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	103	81	119
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.5 mg/L	90.4	70	130
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	95.9	88	111
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	108	89	115
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	102	89	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.2 mg/L	101	88	116
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	106	89	112
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	105	88	114
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.2	88	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	95.7	79	111
EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	107	87	114
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	95.1	84	114
EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	111	82	128
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	100	82	118
EG035F: Dissolved Mercury by FIMS (QCLot: 2005	575)							
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	87.2	84	118
EG035T: Total Recoverable Mercury by FIMS (QC	Lot: 2005740)							
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	86.6	84	118
EK040P: Fluoride by PC Titrator (QCLot: 2004139)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	93.8	80	117
EK055G: Ammonia as N by Discrete Analyser(QC	Lot: 2004188)							
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	107	86	112
EK057G: Nitrite as N by Discrete Analyser (OCLot	: 2004177)							
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	97.0	90	110
EK059G: Nitrite plus Nitrate as N (NOx), by Discret	te Analyser (QCI of: 200	04189)						
EK059G: Nitrite + Nitrate as N		0.01	mg/L	<0.01	0.5 mg/L	100	89	115
EK061G: Total Kieldahl Nitrogen By Discrete Analy	/ser (QCLot: 2004477)							
EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	<0.1	1 mg/L	79.7	70	111
EK067G: Total Phosphorus as P by Discrete Analy	ser (QCLot: 2004478)							
EK067G: Total Phosphorus as P		0.01	mg/L	<0.01	0.442 mg/L	93.4	77	109
EK071G: Reactive Phosphorus as P by discrete an	alvser (QCLot: 2004178	3)						
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	90.5	88	115
				1	, <u> </u>	1		



Matrix Spike (MS) Report

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

Sub-Matrix: WATER			Matrix Spike (MS) Report					
				Spike	SpikeRecovery(%)	Recovery L	imits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High	
ED041G: Sulfate (*	Turbidimetric) as SO4 2- by DA (QCLot: 2004179)							
EB1825908-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	72.6	70	130	
ED045G: Chloride	by Discrete Analyser (QCLot: 2004180)				1			
EB1825908-001	Anonymous	ED045G: Chloride	16887-00-6	400 ma/L	91.3	70	130	
EG020E: Dissolvo	d Motals by ICB-MS (OCI at: 2005581)			3				
EB1825402.002			7440.29.2	0.5 mg/l	00.0	70	120	
EB1825492-002	Anonymous	EG020A-F: Arsenic	7440-38-2	0.5 mg/L	99.9	70	130	
		EG020A-F: Beryllium	7440-41-7	0.5 mg/L	91.0	70	130	
		EG020A-F: Barium	7440-39-3	2.5 mg/L	96.4	70	130	
		EG020A-F: Cadmium	7440-43-9	0.5 mg/L	94.4	70	130	
		EG020A-F: Chromium	7440-47-3	0.5 mg/L	95.1	70	130	
		EG020A-F: Cobalt	7440-48-4	0.5 mg/L	95.0	70	130	
		EG020A-F: Copper	7440-50-8	1 mg/L	92.6	70	130	
		EG020A-F: Lead	7439-92-1	0.5 mg/L	96.4	70	130	
		EG020A-F: Manganese	7439-96-5	0.5 mg/L	85.2	70	130	
		EG020A-F: Nickel	7440-02-0	0.5 mg/L	90.9	70	130	
		EG020A-F: Selenium	7782-49-2	0.5 mg/L	96.6	70	130	
		EG020A-F: Vanadium	7440-62-2	0.5 mg/L	98.1	70	130	
		EG020A-F: Zinc	7440-66-6	1 mg/L	96.5	70	130	
		EG020A-F: Boron	7440-42-8	2.5 mg/L	87.7	70	130	
EG020T: Total Met	als by ICP-MS (QCLot: 2005742)							
EB1825778-032	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	103	70	130	
		EG020A-T: Beryllium	7440-41-7	0.1 mg/L	102	70	130	
		EG020A-T: Barium	7440-39-3	1 mg/L	92.7	70	130	
		EG020A-T: Cadmium	7440-43-9	0.5 mg/L	98.8	70	130	
		EG020A-T: Chromium	7440-47-3	1 mg/L	96.8	70	130	
		EG020A-T: Cobalt	7440-48-4	1 mg/L	88.9	70	130	
		EG020A-T: Copper	7440-50-8	1 mg/L	86.8	70	130	
		EG020A-T: Lead	7439-92-1	1 mg/L	92.9	70	130	
		EG020A-T: Manganese	7439-96-5	1 mg/L	90.5	70	130	
		EG020A-T: Nickel	7440-02-0	- 1 mg/L	92.9	70	130	
		EG020A-T: Vanadium	7440-62-2	- 1 mg/L	93.9	70	130	
		EG020A-T: Zinc	7440-66-6	1 mg/L	96.1	70	130	
EG035F: Dissolve	d Mercury by FIMS (QCLot: 2005575)							
EB1824322-004	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	72.0	70	130	
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Work Order	: EB1825910
Client	: GOLDER ASSOCIATES
Project	: 1893802



Sub-Matrix: WATER	Sub-Matrix: WATER					Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Li	mits (%)		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High		
EG035T: Total Rec	overable Mercury by FIMS (QCLot: 2005740)								
EB1825778-032	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	91.3	70	130		
EK040P: Fluoride b	y PC Titrator (QCLot: 2004139)								
EB1825819-004	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	83.4	70	130		
EK055G: Ammonia	as N by Discrete Analyser (QCLot: 2004188)								
EB1825908-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	82.4	70	130		
EK057G: Nitrite as	N by Discrete Analyser (QCLot: 2004177)								
EB1825908-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.4 mg/L	104	70	130		
EK059G: Nitrite plu	us Nitrate as N (NOx) by Discrete Analyser (QCLot: 200	4189)							
EB1825908-002	Anonymous	EK059G: Nitrite + Nitrate as N		0.4 mg/L	95.2	70	130		
EK061G: Total Kjel	dahl Nitrogen By Discrete Analyser (QCLot: 2004477)								
EB1825763-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		5 mg/L	77.0	70	130		
EK067G: Total Pho	sphorus as P by Discrete Analyser (QCLot: 2004478)								
EB1825763-001	Anonymous	EK067G: Total Phosphorus as P		1 mg/L	# Not Determined	70	130		
EK071G: Reactive F	Phosphorus as P by discrete analyser (QCLot: 2004178								
EB1825908-001	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.4 mg/L	103	70	130		



QUALITY CONTROL REPORT

Work Order	: EB1825981	Page	: 1 of 8	
Client		Laboratory	: Environmental Division	Brisbane
Contact	: MR SUSANTHA KUMARAPELI	Contact	: Andrew Epps	
Address	: P O BOX 1734 MILTON QLD. AUSTRALIA 4064	Address	: 2 Byth Street Stafford Q	LD Australia 4053
Telephone	+61 07 3721 5400	Telephone	: +61 7 3552 8639	
Project	: 1893802 Inland Rail (P13)	Date Samples Received	: 26-Oct-2018	
Order number	: 1893802	Date Analysis Commenced	: 27-Oct-2018	
C-O-C number	:	Issue Date	31-Oct-2018	
Sampler	: ROB CUPPER			Hac-MRA NAIA
Site	:			
Quote number	: EN/002/18 National BQ			Accreditation No. 925
No. of samples received	: 1			Accredited for compliance with
No. of samples analysed	: 1			ISO/IEC 17025 - Testing

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

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

Signatories

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

- CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
- LOR = Limit of reporting
- RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)	
EA005P: pH by PC	Titrator (QC Lot: 20	05091)								
EB1825979-001	Anonymous	EA005-P: pH Value		0.01	pH Unit	7.89	7.91	0.253	0% - 20%	
EA010P: Conductiv	vity by PC Titrator (C	QC Lot: 2005092)								
EB1825979-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C		1	μS/cm	782	780	0.256	0% - 20%	
EA015: Total Disso	lved Solids dried at	180 ± 5 °C (QC Lot: 2005707)								
EB1825905-001	Anonymous	EA015H: Total Dissolved Solids @180°C		10	mg/L	15700	15800	0.697	0% - 20%	
EB1825997-015	Anonymous	EA015H: Total Dissolved Solids @180°C		10	mg/L	207	211	1.59	0% - 20%	
ED037P: Alkalinity	by PC Titrator (QC I	Lot: 2005090)								
EB1825979-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit	
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit	
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	180	187	3.55	0% - 20%	
		ED037-P: Total Alkalinity as CaCO3		1	mg/L	180	187	3.55	0% - 20%	
ED041G: Sulfate (T	urbidimetric) as SO4	4 2- by DA (QC Lot: 2005225)								
EB1825977-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	15	14	7.85	No Limit	
EB1825979-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	40	40	0.00	0% - 20%	
ED045G: Chloride b	by Discrete Analyser	r (QC Lot: 2005224)								
EB1825977-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	95	95	0.00	No Limit	
EB1825979-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	110	109	1.54	0% - 20%	
ED093F: Dissolved	Major Cations (QC	Lot: 2005582)								
EB1825908-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	22	21	0.00	0% - 20%	
		ED093F: Magnesium	7439-95-4	1	mg/L	14	13	0.00	0% - 50%	
		ED093F: Sodium	7440-23-5	1	mg/L	422	405	4.17	0% - 20%	
		ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.00	No Limit	
EG020F: Dissolved	Metals by ICP-MS (QC Lot: 2005583)								

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Work Order	: EB1825981
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020F: Dissolved N	letals by ICP-MS(QC Lot: 2	005583) - continued							
EB1825911-002	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.010	0.010	0.00	0% - 50%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.002	0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.007	0.006	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EG020T: Total Metals	by ICP-MS (QC Lot: 20057	43)							
EB1825914-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.026	0.026	0.00	0% - 20%
		EG020A-T: Bervllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.009	0.009	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.009	0.009	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.010	0.010	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.001	0.002	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.404	0.401	0.821	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.06	<0.05	0.00	No Limit
EB1825932-004	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.011	0.011	0.00	0% - 50%
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.403	0.406	0.724	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.012	0.012	0.00	0% - 50%
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.008	0.008	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.438	0.436	0.377	0% - 20%

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Work Order	: EB1825981
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals	by ICP-MS (QC Lot: 20057	43) - continued							
EB1825932-004	Anonymous	EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.049	0.050	0.00	0% - 20%
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.012	0.020	49.0	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	1.27	1.23	2.64	0% - 20%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	1.96	1.96	0.00	0% - 20%
EG035F: Dissolved M	ercury by FIMS (QC Lot: 20	05584)							
EB1825979-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recov	verable Mercury by FIMS (Q	C Lot: 2005741)							
EB1825932-006	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK040P: Fluoride by	PC Titrator (QC Lot: 200508	39)							
EB1825979-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.3	0.3	0.00	No Limit
EK055G: Ammonia as	N by Discrete Analyser (Q	C Lot: 2008325)							
EB1825979-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.07	0.06	0.00	No Limit
EK057G: Nitrite as N	by Discrete Analyser (QC I	_ot: 2005226)							
EB1825979-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK059G: Nitrite plus	Nitrate as N (NOx) by Disci	rete Analyser (QC Lot: 2008326)							
EB1825979-001	Anonymous	EK059G: Nitrite + Nitrate as N		0.01	mg/L	0.03	0.03	0.00	No Limit
EK061G: Total Kjelda	hl Nitrogen By Discrete Ana	alyser (QC Lot: 2005437)							
EB1825827-003	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	0.7	0.7	0.00	No Limit
EB1825623-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	6.1	6.0	0.00	0% - 20%
EK067G: Total Phosp	horus as P by Discrete Ana	lyser (QC Lot: 2005439)							
EB1825827-008	Anonymous	EK067G: Total Phosphorus as P		0.01	mg/L	0.10	0.08	17.8	No Limit
EB1825827-003	Anonymous	EK067G: Total Phosphorus as P		0.01	mg/L	0.05	0.05	0.00	No Limit
EK071G: Reactive Ph	osphorus as P by discrete a	analyser (QC Lot: 2005227)							
EB1825979-001	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit



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

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

Sub-Matrix: WATER			Method Blank (MB)	Laboratory Control Spike (LCS) Report				
			Report	Spike	Spike Recovery (%)	Recovery	Limits (%)	
Method: Compound CAS Numb	er LOR	Unit	Result	Concentration	LCS	Low	High	
EA005P: pH by PC Titrator (QCLot: 2005091)								
EA005-P: pH Value		pH Unit		4 pH Unit	100	98	102	
				7 pH Unit	100	98	102	
EA010P: Conductivity by PC Titrator (QCLot: 2005092)								
EA010-P: Electrical Conductivity @ 25°C	- 1	µS/cm	<1	4000 µS/cm	101	91	107	
			<1	12890 µS/cm	96.2	91	107	
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 2005707)								
EA015H: Total Dissolved Solids @180°C	- 10	mg/L	<10	293 mg/L	102	88	112	
			<10	2000 mg/L	100	88	112	
ED037P: Alkalinity by PC Titrator (QCLot: 2005090)								
ED037-P: Total Alkalinity as CaCO3		mg/L		200 mg/L	95.2	80	120	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2005225)								
ED041G: Sulfate as SO4 - Turbidimetric 14808-79-	3 1	mg/L	<1	25 mg/L	102	85	118	
		-	<1	100 mg/L	106	85	118	
ED045G: Chloride by Discrete Analyser (QCLot: 2005224)								
ED045G: Chloride 16887-00-	3 1	mg/L	<1	10 mg/L	102	90	115	
			<1	1000 mg/L	102	90	115	
ED093F: Dissolved Major Cations (QCLot: 2005582)								
ED093F: Calcium 7440-70-	2 1	mg/L	<1					
ED093F: Magnesium 7439-95-	1 1	mg/L	<1					
ED093F: Sodium 7440-23-	5 1	mg/L	# 2					
ED093F: Potassium 7440-09-	7 1	mg/L	<1					
EG020F: Dissolved Metals by ICP-MS (QCLot: 2005583)								
EG020A-F: Arsenic 7440-38-	2 0.001	mg/L	<0.001	0.1 mg/L	98.5	88	116	
EG020A-F: Beryllium 7440-41-	7 0.001	mg/L	<0.001	0.1 mg/L	82.4	81	117	
EG020A-F: Barium 7440-39-	3 0.001	mg/L	<0.001	0.5 mg/L	98.5	70	130	
EG020A-F: Cadmium 7440-43-	9 0.0001	mg/L	<0.0001	0.1 mg/L	96.2	88	108	
EG020A-F: Chromium 7440-47-	3 0.001	mg/L	<0.001	0.1 mg/L	103	87	113	
EG020A-F: Cobalt 7440-48-	4 0.001	mg/L	<0.001	0.1 mg/L	99.9	86	112	
EG020A-F: Copper 7440-50-	3 0.001	mg/L	<0.001	0.2 mg/L	99.8	88	114	
EG020A-F: Lead 7439-92-	1 0.001	mg/L	<0.001	0.1 mg/L	99.6	89	110	
EG020A-F: Manganese 7439-96-	5 0.001	mg/L	<0.001	0.1 mg/L	102	89	120	
EG020A-F: Nickel 7440-02-	0.001	mg/L	<0.001	0.1 mg/L	95.8	89	113	
EG020A-F: Selenium 7782-49-	2 0.01	mg/L	<0.01	0.1 mg/L	97.8	83	112	
EG020A-F: Vanadium 7440-62-	2 0.01	mg/L	<0.01	0.1 mg/L	111	88	114	

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Work Order	: EB1825981
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER				Method Blank (MB)	Laboratory Control Spike (LCS) Report				
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High	
EG020F: Dissolved Metals by ICP-MS (QCLot: 200	5583) - continued								
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	98.0	87	113	
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	91.1	81	125	
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	99.0	82	114	
EG020T: Total Metals by ICP-MS (QCLot: 2005743))								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	98.8	88	112	
EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	100	81	119	
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.5 mg/L	92.9	70	130	
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	95.6	88	111	
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	106	89	115	
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	100	89	115	
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.2 mg/L	99.2	88	116	
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	109	89	112	
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	102	88	114	
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	96.8	88	116	
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	97.0	79	111	
EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	104	87	114	
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	93.4	84	114	
EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	107	82	128	
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	99.0	82	118	
EG035F: Dissolved Mercury by FIMS (QCLot: 2005	584)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	92.9	84	118	
EG035T: Total Recoverable Mercury by FIMS (QC	Lot: 2005741)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	92.3	84	118	
EK040P: Fluoride by PC Titrator (QCLot: 2005089)									
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	10 mg/L	105	80	117	
EK055G: Ammonia as N by Discrete Analyser(QC	Lot: 2008325)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	98.6	86	112	
EK057G: Nitrite as N by Discrete Analyser (QCI of	· 2005226)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	94.9	90	110	
EK059G: Nitrite plus Nitrate as N (NOx), by Discret	te Analyser (OCI of: 20)	08326)							
EK059G: Nitrite + Nitrate as N		0.01	mg/L	<0.01	0.5 mg/L	101	89	115	
EK061G: Total Kieldahl Nitrogen By Discrete Analy	(ser (OCI of: 2005437)								
EK061G: Total Kieldahl Nitrogen as N		0.1	mg/L	<0.1	10 mg/L	86.0	70	111	
FK067G' Total Phosphorus as P by Discrete Analy	ser (QCI ot: 2005439)								
EK067G: Total Phosphorus as P		0.01	mg/L	<0.01	0.442 mg/L	94.7	77	109	
EK071G: Reactive Phosphorus as P by discrete an	alvser (QCLot: 2005222	7)							
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	92.1	88	115	
· ·	I		-	1	-	1	1		



Matrix Spike (MS) Report

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

Sub-Matrix: WATER			Matrix Spike (MS) Report				
				Spike	SpikeRecovery(%)	Recovery L	imits (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (T	urbidimetric) as SO4 2- by DA (QCLot: 2005225)						
EB1825981-001	330-01-BH2222	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	97.9	70	130
ED045G: Chloride	by Discrete Analyser (OCL of: 2005224)				1		
EB1825081 001	330.01 BH2222		16887 00 6	400 mg/l	06.8	70	130
EB1023901-001	330-01-01/2222	ED045G: Chloride	10007-00-0	400 mg/L	90.0	70	130
EG020F: Dissolved	Metals by ICP-MS (QCLot: 2005583)						
EB1825979-001	Anonymous	EG020A-F: Arsenic	7440-38-2	0.1 mg/L	104	70	130
		EG020A-F: Beryllium	7440-41-7	0.1 mg/L	91.3	70	130
		EG020A-F: Barium	7440-39-3	0.5 mg/L	102	70	130
		EG020A-F: Cadmium	7440-43-9	0.1 mg/L	100.0	70	130
		EG020A-F: Chromium	7440-47-3	0.1 mg/L	99.7	70	130
		EG020A-F: Cobalt	7440-48-4	0.1 mg/L	97.5	70	130
		EG020A-F: Copper	7440-50-8	0.2 mg/L	96.9	70	130
		EG020A-F: Lead	7439-92-1	0.1 mg/L	102	70	130
		EG020A-F: Manganese	7439-96-5	0.1 mg/L	95.7	70	130
		EG020A-F: Nickel	7440-02-0	0.1 mg/L	92.7	70	130
		EG020A-F: Selenium	7782-49-2	0.1 mg/L	101	70	130
		EG020A-F: Vanadium	7440-62-2	0.1 mg/L	102	70	130
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	104	70	130
		EG020A-F: Boron	7440-42-8	0.5 mg/L	92.7	70	130
EG020T: Total Meta	als by ICP-MS (QCLot: 2005743)						
EB1825914-002	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	102	70	130
		EG020A-T: Beryllium	7440-41-7	0.1 mg/L	101	70	130
		EG020A-T: Barium	7440-39-3	1 mg/L	92.1	70	130
		EG020A-T: Cadmium	7440-43-9	0.5 mg/L	98.8	70	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	92.9	70	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	83.8	70	130
		EG020A-T: Copper	7440-50-8	1 mg/L	80.8	70	130
		EG020A-T: Lead	7439-92-1	1 mg/L	88.1	70	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	87.2	70	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	80.5	70	130
		EG020A-T: Vanadium	7440-62-2	1 mg/L	91.0	70	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	78.9	70	130
EG035F: Dissolved	I Mercury by FIMS (QCLot: 2005584)						
EB1825981-001	330-01-BH2222	EG035F: Mercury	7439-97-6	0.01 mg/L	88.1	70	130

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Work Order	: EB1825981
Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery L	imits (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035T: Total Rec	overable Mercury by FIMS (QCLot: 2005741)						
EB1825932-007	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	87.9	70	130
EK040P: Fluoride b	y PC Titrator (QCLot: 2005089)						
EB1825981-001	330-01-BH2222	EK040P: Fluoride	16984-48-8	5 mg/L	88.0	70	130
EK055G: Ammonia	as N by Discrete Analyser (QCLot: 2008325)						
EB1825981-001	330-01-BH2222	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	114	70	130
EK057G: Nitrite as	N by Discrete Analyser (QCLot: 2005226)						
EB1825981-001	330-01-BH2222	EK057G: Nitrite as N	14797-65-0	0.4 mg/L	106	70	130
EK059G: Nitrite plu	us Nitrate as N (NOx) by Discrete Analyser (QCLot: 200	8326)					
EB1825981-001	330-01-BH2222	EK059G: Nitrite + Nitrate as N		0.4 mg/L	99.8	70	130
EK061G: Total Kjel	dahl Nitrogen By Discrete Analyser (QCLot: 2005437)						
EB1824322-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		5 mg/L	110	70	130
EK067G: Total Pho	sphorus as P by Discrete Analyser (QCLot: 2005439)						
EB1825824-011	Anonymous	EK067G: Total Phosphorus as P		1 mg/L	112	70	130
EK071G: Reactive	Phosphorus as P by discrete analyser (QCLot: 2005227)						
EB1825981-001	330-01-BH2222	EK071G: Reactive Phosphorus as P	14265-44-2	0.4 mg/L	105	70	130



QUALITY CONTROL REPORT

Work Order	: EB1828572	Page	: 1 of 8	
Client	: GOLDER ASSOCIATES	Laboratory	: Environmental Division	Brisbane
Contact	: MR SUSANTHA KUMARAPELI	Contact	: Andrew Epps	
Address	: P O BOX 1734 MILTON OLD, AUSTRALIA 4064	Address	: 2 Byth Street Stafford C	2LD Australia 4053
Telephone	: +61 07 3721 5400	Telephone	: +61 7 3552 8639	
Project	: 1893802 INLAND RAIL (P13)	Date Samples Received	: 22-Nov-2018	
Order number	:	Date Analysis Commenced	: 22-Nov-2018	
C-O-C number	:	Issue Date	: 26-Nov-2018	
Sampler	: SUSANTHA KUMARAPELI			Hac-MRA NAIA
Site	:			
Quote number	: EN/002/18 National BQ			Accorditation No. 935
No. of samples received	: 1			Accredited for compliance with
No. of samples analysed	: 1			ISO/IEC 17025 - Testing

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

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

Signatories

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



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

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

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

Key: Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: WATER				Laboratory Duplicate (D				OUP) Report		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)	
EA005P: pH by PC Ti	trator (QC Lot: 2051941)									
EB1828142-003	Anonymous	EA005-P: pH Value		0.01	pH Unit	7.68	7.74	0.778	0% - 20%	
EB1828180-003	Anonymous	EA005-P: pH Value		0.01	pH Unit	7.57	7.64	0.920	0% - 20%	
EA010P: Conductivit	y by PC Titrator (QC Lot: 20	51943)								
EB1828142-003	Anonymous	EA010-P: Electrical Conductivity @ 25°C		1	μS/cm	404	404	0.00	0% - 20%	
EB1828180-003	Anonymous	EA010-P: Electrical Conductivity @ 25°C		1	μS/cm	16800	16800	0.482	0% - 20%	
EA015: Total Dissolv	ed Solids dried at 180 ± 5 °C	(QC Lot: 2052371)								
EB1828018-001	Anonymous	EA015H: Total Dissolved Solids @180°C		10	mg/L	1590	1580	0.883	0% - 20%	
ED037P: Alkalinity by	PC Titrator (QC Lot: 20519	942)								
EB1828142-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit	
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit	
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	87	86	0.00	0% - 20%	
		ED037-P: Total Alkalinity as CaCO3		1	mg/L	87	86	0.00	0% - 20%	
EB1828180-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit	
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit	
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	637	642	0.699	0% - 20%	
		ED037-P: Total Alkalinity as CaCO3		1	mg/L	637	642	0.699	0% - 20%	
ED041G: Sulfate (Tur	bidimetric) as SO4 2- by DA	(QC Lot: 2051983)								
EB1828573-004	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3	3	0.00	No Limit	
EB1828285-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	108	109	1.44	No Limit	
ED045G: Chloride by	Discrete Analyser (QC Lot	2051984)								
EB1828573-004	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	7	9	21.9	No Limit	
EB1828285-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	76200	75800	0.476	0% - 20%	
ED093F: Dissolved N	ajor Cations (QC Lot: 2053	078)								
EB1828548-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	6	6	0.00	No Limit	
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Work Order	: EB1828572									
Client	: GOLDER ASSOCIATES									
Project	: 1893802 INLAND RAIL (P13)									



Sub-Matrix: WATER						Laboratory L	Duplicate (DUP) Report		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved M	ajor Cations (QC Lot: 2053	078) - continued							
EB1828548-001	Anonymous	ED093F: Magnesium	7439-95-4	1	mg/L	3	3	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	257	259	0.827	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	12	12	0.00	0% - 50%
EG020F: Dissolved M	etals by ICP-MS (QC Lot: 2	053080)							
EB1828548-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	0.002	0.001	0.00	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.182	0.191	4.88	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.008	0.007	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.005	0.006	18.1	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.004	0.003	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.007	0.007	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.040	0.040	0.00	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.008	0.006	26.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.054	0.050	7.93	0% - 50%
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	0.02	0.02	0.00	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.40	0.40	0.00	No Limit
EG020T: Total Metals	by ICP-MS (QC Lot: 20530	85)							
EB1828168-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.113	0.114	1.47	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.385	0.384	0.00	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.007	0.006	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	0.14	0.14	0.00	No Limit
EG035F: Dissolved M	ercury by FIMS (QC Lot: 20)53079)							
EB1828548-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recov	verable Mercury by FIMS(Q	C Lot: 2053088)							
EB1828168-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK040P: Fluoride by	PC Titrator (QC Lot: 205194	14)							
EB1828142-003	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.1	0.1	0.00	No Limit

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Work Order	: EB1828572
Client	: GOLDER ASSOCIATES
Project	: 1893802 INLAND RAIL (P13)



Sub-Matrix: WATER						Laboratory D	Duplicate (DUP) Report		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK040P: Fluoride by	PC Titrator (QC Lot: 20519	44) - continued							
EB1828180-003	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.00	No Limit
EK055G: Ammonia as	s N by Discrete Analyser(QC Lot: 2052027)							
EB1828540-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.02	0.05	81.1	No Limit
EK057G: Nitrite as N	by Discrete Analyser (QC	Lot: 2051982)							
EB1828573-004	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EB1828285-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.10	<0.10	0.00	No Limit
EK059G: Nitrite plus	Nitrate as N (NOx) by Disc	rete Analyser (QC Lot: 2052026)							
EB1828540-001	Anonymous	EK059G: Nitrite + Nitrate as N		0.01	mg/L	0.06	0.07	0.00	No Limit
EK061G: Total Kjelda	hl Nitrogen By Discrete An	alyser (QC Lot: 2052364)							
EB1828147-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	2.6	2.7	4.48	0% - 20%
EB1828540-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	0.6	0.5	0.00	No Limit
EK067G: Total Phosp	horus as P by Discrete Ana	alyser (QC Lot: 2052363)							
EB1828147-001	Anonymous	EK067G: Total Phosphorus as P		0.01	mg/L	0.38	0.37	0.00	0% - 20%
EB1828540-001	Anonymous	EK067G: Total Phosphorus as P		0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK071G: Reactive Ph	osphorus as P by discrete	analyser (QC Lot: 2051985)							
EB1827882-001	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit



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

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

Sub-Matrix: WATER			Method Blank (MB)	Laboratory Control Spike (LCS) Report				
			Report	Spike	Spike Recovery (%)	Recovery	Limits (%)	
Method: Compound CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High	
EA005P: pH by PC Titrator (QCLot: 2051941)								
EA005-P: pH Value		pH Unit		4 pH Unit	101	98	102	
				7 pH Unit	100	98	102	
EA010P: Conductivity by PC Titrator (QCLot: 2051943)								
EA010-P: Electrical Conductivity @ 25°C	1	μS/cm	<1	2100 µS/cm	96.6	91	107	
			<1	24800 µS/cm	99.5	91	107	
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 2052371)								
EA015H: Total Dissolved Solids @180°C	10	mg/L	<10	293 mg/L	99.6	88	112	
_			<10	2000 mg/L	99.8	88	112	
ED037P: Alkalinity by PC Titrator (QCLot: 2051942)								
ED037-P: Total Alkalinity as CaCO3		mg/L		50 mg/L	103	80	120	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2051983)								
ED041G: Sulfate as SO4 - Turbidimetric 14808-79-8	1	mg/L	<1	25 mg/L	103	85	118	
		, , , , , , , , , , , , , , , , , , ,	<1	100 mg/L	114	85	118	
ED045G: Chloride by Discrete Analyser (QCLot: 2051984)								
ED045G: Chloride 16887-00-6	1	mg/L	<1	10 mg/L	102	90	115	
			<1	1000 mg/L	106	90	115	
ED093F: Dissolved Major Cations (QCLot: 2053078)								
ED093F: Calcium 7440-70-2	1	mg/L	<1					
ED093F: Magnesium 7439-95-4	1	mg/L	<1					
ED093F: Sodium 7440-23-5	1	mg/L	<1					
ED093F: Potassium 7440-09-7	1	mg/L	<1					
EG020F: Dissolved Metals by ICP-MS (QCLot: 2053080)								
EG020A-F: Arsenic 7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.1	88	116	
EG020A-F: Beryllium 7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	101	81	117	
EG020A-F: Barium 7440-39-3	0.001	mg/L	<0.001	0.5 mg/L	95.1	70	130	
EG020A-F: Cadmium 7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	91.0	88	108	
EG020A-F: Chromium 7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	91.8	87	113	
EG020A-F: Cobalt 7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	92.5	86	112	
EG020A-F: Copper 7440-50-8	0.001	mg/L	<0.001	0.2 mg/L	96.9	88	114	
EG020A-F: Lead 7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	97.7	89	110	
EG020A-F: Manganese 7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	92.7	89	120	
EG020A-F: Nickel 7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	95.6	89	113	
EG020A-F: Selenium 7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	94.3	83	112	
EG020A-F: Vanadium 7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	95.7	88	114	

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Work Order	: EB1828572
Client	: GOLDER ASSOCIATES
Project	: 1893802 INLAND RAIL (P13)



Sub-Matrix: WATER				Method Blank (MB)	Laboratory Control Spike (LCS) Report				
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High	
EG020F: Dissolved Metals by ICP-MS (QCLot: 20	53080) - continued								
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	96.7	87	113	
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	99.4	81	125	
EG020T: Total Metals by ICP-MS (QCLot: 205308	5)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.8	88	112	
EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	92.7	81	119	
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.5 mg/L	93.8	70	130	
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	90.6	88	111	
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	97.5	89	115	
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	98.3	89	115	
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.2 mg/L	102	88	116	
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	97.4	89	112	
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	104	88	114	
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	98.1	88	116	
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	94.4	79	111	
EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	110	87	114	
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	94.2	84	114	
EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	96.6	82	128	
EG035F: Dissolved Mercury by FIMS (QCLot: 205	3079)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	90.3	84	118	
EG035T: Total Recoverable Mercury by FIMS (Q0	CLot: 2053088)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	89.5	84	118	
EK040P: Fluoride by PC Titrator (QCLot: 2051944)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	93.6	80	117	
EK055G: Ammonia as N by Discrete Analyser (O	CL of: 2052027)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	95.7	86	112	
EK057CL Nitrite on N by Disperate Applyant (OCL	4. 2054092)		<u>J</u>						
EK057G: Nitrite as N by Discrete Analyser (QCLC	14797-65-0	0.01	ma/l	<0.01	0.5 mg/l	100	90	110	
EKOFOCI Nitrite as N		20000)	ing/2	.0.01	0.0 mg/2	100		110	
EK059G: Nitrite plus Nitrate as N (NOX) by Discre	ete Analyser (QCLOT: 205	0.01	mg/l	<0.01	0.5 mg/l	102	80	115	
		0.01	ing/L	40.01	0.0 mg/L	102	09	115	
EK061G: Total Kjeldahl Nitrogen By Discrete Anal	yser (QCLot: 2052364)	0.4		10.4	4 mm m/l	02.0	70	100	
EKU61G: Total Kjeldahl Nitrogen as N		0.1	mg/L	<u.1< td=""><td>i mg/L</td><td>83.8</td><td>70</td><td>108</td></u.1<>	i mg/L	83.8	70	108	
EK067G: Total Phosphorus as P by Discrete Anal	yser (QCLot: 2052363)				0.446			167	
EK067G: Total Phosphorus as P		0.01	mg/L	<0.01	0.442 mg/L	93.4	79	105	
EK071G: Reactive Phosphorus as P by discrete a	nalyser (QCLot: 2051985)							
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	97.9	88	115	



Matrix Spike (MS) Report

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

Sub-Matrix: WATER				Matrix Spike (MS) Report					
				Spike	SpikeRecovery(%)	Recovery L	imits (%)		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High		
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2051	983)							
EB1828285-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	400 mg/L	93.8	70	130		
ED045G: Chlorida	by Discrete Analyser (OCI et: 2051984)								
ED0430. Chionue			16997 00 6	400 mg/l		70	120		
ED1020200-001	Anonymous	ED045G: Chloride	10007-00-0	400 mg/L	# Not	70	130		
					Determined		L		
EG020F: Dissolve	d Metals by ICP-MS (QCLot: 2053080)								
EB1828572-001	330-01-BH2103	EG020A-F: Arsenic	7440-38-2	0.1 mg/L	99.1	70	130		
		EG020A-F: Beryllium	7440-41-7	0.1 mg/L	94.5	70	130		
		EG020A-F: Barium	7440-39-3	0.5 mg/L	100	70	130		
		EG020A-F: Cadmium	7440-43-9	0.1 mg/L	91.1	70	130		
		EG020A-F: Chromium	7440-47-3	0.1 mg/L	85.8	70	130		
		EG020A-F: Cobalt	7440-48-4	0.1 mg/L	88.8	70	130		
	EG020A-F: Copper	7440-50-8	0.2 mg/L	90.3	70	130			
	EG020A-F: Lead	7439-92-1	0.1 mg/L	86.4	70	130			
	EG020A-F: Manganese	7439-96-5	0.1 mg/L	87.3	70	130			
	EG020A-F: Nickel	7440-02-0	0.1 mg/L	88.2	70	130			
		EG020A-F: Selenium	7782-49-2	0.1 mg/L	98.9	70	130		
		EG020A-F: Vanadium	7440-62-2	0.1 mg/L	94.2	70	130		
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	89.5	70	130		
		EG020A-F: Boron	7440-42-8	0.5 mg/L	89.2	70	130		
EG020T: Total Me	tals by ICP-MS (QCLot: 2053085)								
EB1828168-002	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	88.2	70	130		
		EG020A-T: Bervllium	7440-41-7	0.1 mg/L	90.8	70	130		
		EG020A-T: Barium	7440-39-3	1 mg/L	90.4	70	130		
		EG020A-T: Cadmium	7440-43-9	0.5 mg/L	93.3	70	130		
		EG020A-T: Chromium	7440-47-3	1 mg/L	90.9	70	130		
		EG020A-T: Cobalt	7440-48-4	1 mg/L	88.1	70	130		
		EG020A-T: Copper	7440-50-8	1 mg/L	93.9	70	130		
		EG020A-T: Lead	7439-92-1	1 mg/L	88.3	70	130		
		EG020A-T: Manganese	7439-96-5	1 mg/L	89.9	70	130		
		EG020A-T: Nickel	7440-02-0	1 mg/L	90.9	70	130		
		EG020A-T: Vanadium	7440-62-2	1 mg/L	86.2	70	130		
		EG020A-T: Zinc	7440-66-6	1 mg/L	88.0	70	130		
EG035F: Dissolve	d Mercurv by FIMS (QCLot: 2053079)				· · · · · · · · · · · · · · · · · · ·				
EB1828572-001	330-01-BH2103		7439-97-6	0.01 mg/l	80.2	70	130		
201020012-001			1403-31-0	0.01 mg/L	00.2	10	100		

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Work Order	: EB1828572
Client	: GOLDER ASSOCIATES
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Sub-Matrix: WATER			Γ	Ма	trix Spike (MS) Report	1	
				Spike	SpikeRecovery(%)	Recovery L	imits (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035T: Total Red	coverable Mercury by FIMS (QCLot: 2053088)						
EB1828168-002	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	81.7	70	130
EK040P: Fluoride I	by PC Titrator (QCLot: 2051944)						
EB1828142-004	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	90.4	70	130
EK055G: Ammonia	a as N by Discrete Analyser (QCLot: 2052027)						
EB1828548-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	86.8	70	130
EK057G: Nitrite as	N by Discrete Analyser (QCLot: 2051982)						
EB1828285-001	Anonymous	EK057G: Nitrite as N	14797-65-0	4 mg/L	94.4	70	130
EK059G: Nitrite pl	us Nitrate as N (NOx) by Discrete Analyser (QCLot: 205	2026)					
EB1828548-001	Anonymous	EK059G: Nitrite + Nitrate as N		0.4 mg/L	94.9	70	130
EK061G: Total Kjel	ldahl Nitrogen By Discrete Analyser (QCLot: 2052364)						
EB1828148-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		5 mg/L	96.1	70	130
EK067G: Total Pho	osphorus as P by Discrete Analyser (QCLot: 2052363)						
EB1828148-001	Anonymous	EK067G: Total Phosphorus as P		1 mg/L	94.5	70	130
EK071G: Reactive	Phosphorus as P by discrete analyser (QCLot: 2051985)						
EB1828285-001	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	4 mg/L	98.1	70	130



QUALITY CONTROL REPORT

Work Order	EB1830098	Page	: 1 of 9	
Client		Laboratory	: Environmental Division E	Brisbane
Contact	: MR SUSANTHA KUMARAPELI	Contact	: Andrew Epps	
Address	P O BOX 1734	Address	: 2 Byth Street Stafford QL	LD Australia 4053
Telephone	: +61 07 3721 5400	Telephone	: +61 7 3552 8639	
Project	: 1893802 INLAND RAIL (P13)	Date Samples Received	: 07-Dec-2018	SWIIII.
Order number	:	Date Analysis Commenced	: 08-Dec-2018	
C-O-C number	:	Issue Date	: 11-Dec-2018	
Sampler	: HANNAH GROVES			HAC-MRA NAIA
Site	:			
Quote number	: EN/002/18 National BQ			Accreditation No. 825
No. of samples received	: 1			Accredited for compliance with
No. of samples analysed	: 1			ISO/IEC 17025 - Testing

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

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

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

- CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
- LOR = Limit of reporting
- RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: WATER					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)		
EA005P: pH by PC Ti	trator (QC Lot: 2082923)										
EB1829787-001	Anonymous	EA005-P: pH Value		0.01	pH Unit	8.84	8.92	0.901	0% - 20%		
EA010P: Conductivity by PC Titrator (QC Lot: 2082922)											
EB1829787-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C		1	μS/cm	5280	5250	0.575	0% - 20%		
EA015: Total Dissolv	ed Solids dried at 180 ± 5 °C	(QC Lot: 2083184)									
EB1830080-004	Anonymous	EA015H: Total Dissolved Solids @180°C		10	mg/L	5140	5220	1.54	0% - 20%		
ED037P: Alkalinity by	PC Titrator (QC Lot: 20829	25)									
EB1830028-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit		
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit		
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	161	167	3.96	0% - 20%		
		ED037-P: Total Alkalinity as CaCO3		1	mg/L	161	167	3.96	0% - 20%		
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2083109)											
EB1830063-007	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	8	8	0.00	No Limit		
EB1830002-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	100	100	0.00	0% - 20%		
ED045G: Chloride by	Discrete Analyser (QC Lot:	2083112)									
EB1830063-007	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	95	97	1.49	0% - 20%		
EB1830002-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	900	901	0.00	0% - 20%		
ED093F: Dissolved N	lajor Cations (QC Lot: 2083	337)									
EB1830099-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	83	84	0.00	0% - 20%		
		ED093F: Magnesium	7439-95-4	1	mg/L	27	28	0.00	0% - 20%		
		ED093F: Sodium	7440-23-5	1	mg/L	974	972	0.165	0% - 20%		
		ED093F: Potassium	7440-09-7	1	mg/L	12	12	0.00	0% - 50%		
EB1829556-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	87	86	1.52	0% - 20%		
		ED093F: Magnesium	7439-95-4	1	mg/L	65	64	0.00	0% - 20%		
		ED093F: Sodium	7440-23-5	1	mg/L	356	350	1.55	0% - 20%		

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Work Order	EB1830098
Client	GOLDER ASSOCIATES
Project	1893802 INLAND RAIL (P13)



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved M	lajor Cations (QC Lot: 2083	837) - continued							
EB1829556-001	Anonymous	ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.00	No Limit
EG020F: Dissolved N	letals by ICP-MS (QC Lot: 2	2083839)							
EB1829787-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0002	0.0002	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.260	0.265	1.92	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.027	0.028	0.00	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.057	0.057	0.00	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.008	0.009	0.00	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	1.81	1.84	1.40	0% - 20%
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.15	0.16	9.41	No Limit
EB1829556-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.045	0.045	0.00	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.26	0.26	0.00	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EG020T: Total Metals	by ICP-MS (QC Lot: 20839	97)							
EB1830098-001	330-01-BH2101	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.166	0.162	2.30	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.002	0.001	0.00	No Limit

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Sub-Matrix: WATER Laboratory Duplicate (DUP) Report									
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals	by ICP-MS (QC Lot: 208399	97) - continued							
EB1830098-001	330-01-BH2101	EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.078	0.076	2.83	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.014	0.014	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	0.20	0.13	42.2	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	3.31	3.15	5.05	0% - 20%
EB1829787-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0001	0.0002	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.287	0.292	1.56	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.038	0.038	0.00	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.060	0.063	4.50	0% - 20%
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.037	0.037	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	1.54	1.83	17.3	0% - 20%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	2.62	2.68	2.08	0% - 20%
EG035F: Dissolved M	ercury by FIMS (QC Lot: 20	83838)							
EB1830022-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EB1829556-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recov	verable Mercury by FIMS (Q	C Lot: 2083995)							
EB1830028-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	0.0705	0.0745	5.52	0% - 20%
EK055G: Ammonia as	N by Discrete Analyser (Q	C Lot: 2083445)							
EB1830002-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	2.04	1.98	2.79	0% - 20%
EK057G: Nitrite as N	by Discrete Analyser (QC L	ot: 2083111)							
EB1830063-007	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EB1830002-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK059G: Nitrite plus	Nitrate as N (NOx) by Discr	ete Analyser (QC Lot: 2083446)							
EB1830002-001	Anonymous	EK059G: Nitrite + Nitrate as N		0.01	mg/L	0.03	0.05	50.2	No Limit
EK061G: Total Kjelda	hl Nitrogen By Discrete Ana	llyser (QC Lot: 2084226)							
EB1829364-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	2.7	2.8	0.00	0% - 20%
EB1830099-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	49.3	55.1	11.1	No Limit
EK067G: Total Phosp	horus as P by Discrete Ana	lvser (QC Lot: 2084225)							



								/	
Sub-Matrix: WATER			Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2084225) - continued									
EB1829364-001	Anonymous	EK067G: Total Phosphorus as P		0.01	mg/L	0.39	0.38	3.38	0% - 20%
EB1830099-001	Anonymous	EK067G: Total Phosphorus as P		0.01	mg/L	127	125	2.10	0% - 20%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 2083110)									
EB1830002-001	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	0.05	0.05	0.00	No Limit



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

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

Sub-Matrix: WATER				Laboratory Control Spike (LCS) Report			
			Report	Spike	Spike Recovery (%)	Spike Recovery (%) Recovery Limi	
Method: Compound CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 2082923)							
EA005-P: pH Value		pH Unit		4 pH Unit	101	98	102
				7 pH Unit	100	98	102
EA010P: Conductivity by PC Titrator (QCLot: 2082922)							
EA010-P: Electrical Conductivity @ 25°C	1	μS/cm	<1	220 µS/cm	103	91	107
			<1	12890 µS/cm	98.9	91	107
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 2083184)							
EA015H: Total Dissolved Solids @180°C	10	mg/L	<10	293 mg/L	102	88	112
			<10	2000 mg/L	98.0	88	112
ED037P: Alkalinity by PC Titrator (QCLot: 2082925)							
ED037-P: Total Alkalinity as CaCO3		mg/L		50 mg/L	107	80	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2083109)							
ED041G: Sulfate as SO4 - Turbidimetric 14808-79-8	1	mg/L	<1	25 mg/L	101	85	118
		-	<1	100 mg/L	95.5	85	118
ED045G: Chloride by Discrete Analyser (QCLot: 2083112)							
ED045G: Chloride 16887-00-6	1	mg/L	<1	10 mg/L	103	90	115
			<1	1000 mg/L	102	90	115
ED093F: Dissolved Major Cations (QCLot: 2083837)							
ED093F: Calcium 7440-70-2	1	mg/L	<1				
ED093F: Magnesium 7439-95-4	1	mg/L	<1				
ED093F: Sodium 7440-23-5	1	mg/L	<1				
ED093F: Potassium 7440-09-7	1	mg/L	<1				
EG020F: Dissolved Metals by ICP-MS (QCLot: 2083839)							
EG020A-F: Arsenic 7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	94.3	88	116
EG020A-F: Beryllium 7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	96.1	81	117
EG020A-F: Barium 7440-39-3	0.001	mg/L	<0.001	0.5 mg/L	100	70	130
EG020A-F: Cadmium 7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	95.3	88	108
EG020A-F: Chromium 7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	90.7	87	113
EG020A-F: Cobalt 7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	95.5	86	112
EG020A-F: Copper 7440-50-8	0.001	mg/L	<0.001	0.2 mg/L	94.4	88	114
EG020A-F: Lead 7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	93.4	89	110
EG020A-F: Manganese 7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	93.1	89	120
EG020A-F: Nickel 7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	93.5	89	113
EG020A-F: Selenium 7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	87.1	83	112
EG020A-F: Vanadium 7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	102	88	114

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Sub-Matrix: WATER				Method Blank (MB)	Laboratory Control Spike (LCS) Report			
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 20)83839) - continued							
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	92.3	87	113
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	100	81	125
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	95.3	82	114
EG020T: Total Metals by ICP-MS(QCLot: 208399	07)							
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	99.8	88	112
EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	87.4	81	119
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.5 mg/L	93.4	70	130
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	91.0	88	111
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	99.9	89	115
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	104	89	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.2 mg/L	106	88	116
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	95.6	89	112
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	97.7	88	114
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	100	88	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	98.2	79	111
EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	102	87	114
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.2 mg/L	104	84	114
EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	93.8	82	128
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	96.3	82	118
EG035F: Dissolved Mercury by FIMS (QCLot: 20	83838)							
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	99.3	84	118
EG035T: Total Recoverable Mercury by FIMS(Q	CLot: 2083995)							
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	97.6	84	118
EK055G: Ammonia as N by Discrete Analyser(Q	CLot: 2083445)							
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	97.4	86	112
EK057G: Nitrite as N by Discrete Analyser (QCL	.ot: 2083111)							
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	101	90	110
EK059G: Nitrite plus Nitrate as N (NOx) by Disci	rete Analvser (QCLot: 208	3446)						
EK059G: Nitrite + Nitrate as N		0.01	mg/L	<0.01	0.5 mg/L	108	89	115
EK061G: Total Kieldahl Nitrogen By Discrete Ana	alvser (QCLot: 2084226)							
EK061G: Total Kjeldahl Nitrogen as N		0.1	mg/L	<0.1	10 mg/L	95.1	70	108
EK067G: Total Phosphorus as P by Discrete Ana	lvser (QCLot: 2084225)							
EK067G: Total Phosphorus as P		0.01	mg/L	<0.01	4.42 mg/L	89.9	79	105
EK071G: Reactive Phosphorus as P <u>by discrete</u> a	analyser (QCLot: 2083110)						
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	96.3	88	115

Matrix Spike (MS) Report



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

Sub-Matrix: WATER				Ma	Matrix Spike (MS) Report			
					SpikeRecovery(%)	Recovery L	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High	
ED041G: Sulfate (1	urbidimetric) as SO4 2- by DA (QCLot: 2083109)							
EB1830002-004	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	112	70	130	
ED045G: Chloride	hy Discrete Analyser (OCI of: 2083112)				1			
EB1830002-004		ED045C: Chlorido	16887-00-6	400 mg/l	98.1	70	130	
ED1030002-004		ED045G. Chloride	10007-00-0	400 mg/L	30.1	10	150	
EG020F: Dissolved	Metals by ICP-MS (QCLot: 2083839)							
EB1829556-003	Anonymous	EG020A-F: Arsenic	7440-38-2	0.1 mg/L	112	70	130	
		EG020A-F: Beryllium	7440-41-7	0.1 mg/L	111	70	130	
		EG020A-F: Barium	7440-39-3	0.5 mg/L	109	70	130	
		EG020A-F: Cadmium	7440-43-9	0.1 mg/L	103	70	130	
		EG020A-F: Chromium	7440-47-3	0.1 mg/L	93.7	70	130	
		EG020A-F: Cobalt	7440-48-4	0.1 mg/L	95.0	70	130	
		EG020A-F: Copper	7440-50-8	0.2 mg/L	90.3	70	130	
		EG020A-F: Lead	7439-92-1	0.1 mg/L	102	70	130	
		EG020A-F: Manganese	7439-96-5	0.1 mg/L	# Not	70	130	
					Determined			
		EG020A-F: Nickel	7440-02-0	0.1 mg/L	89.4	70	130	
		EG020A-F: Selenium	7782-49-2	0.1 mg/L	116	70	130	
		EG020A-F: Vanadium	7440-62-2	0.1 mg/L	100	70	130	
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	103	70	130	
		EG020A-F: Boron	7440-42-8	0.5 mg/L	104	70	130	
EG020T: Total Met	als by ICP-MS (QCLot: 2083997)							
EB1829787-002	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	98.6	70	130	
		EG020A-T: Bervilium	7440-41-7	0.1 mg/L	83.5	70	130	
		EG020A-T: Barium	7440-39-3	1 ma/L	98.3	70	130	
		EG020A-T: Cadmium	7440-43-9	0.5 mg/l	89.8	70	130	
		EG020A-T: Chromium	7440-47-3	1 ma/L	94.6	70	130	
		EG020A-T: Cobalt	7440-48-4	1 mg/l	94.2	70	130	
		EG020A-T: Copper	7440-50-8	1 mg/L	90.3	70	130	
		EG020A-T: Lead	7439-92-1	1 mg/L	88.2	70	130	
		EC020A T: Mangapasa	7439-96-5	1 mg/L	88.0	70	130	
		EC020A-T: Niakal	7440-02-0	1 mg/L	90.6	70	130	
			7440-62-2	1 mg/L	95.8	70	130	
			7440-66-6	1 mg/L	96.5	70	130	
				i iiig/L	00.0	10	100	
EG035F: Dissolved	Mercury by FIMS (QCLot: 2083838)							
EB1829556-002	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	87.2	70	130	
EG035T: Total Red	coverable Mercury by FIMS (QCLot: 2083995)							
EB1830098-001	330-01-BH2101	EG035T: Mercury	7439-97-6	0.01 mg/L	83.0	70	130	

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Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Lin	nits (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK055G: Ammonia	as N by Discrete Analyser (QCLot: 2083445)						
EB1830002-004	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	94.0	70	130
EK057G: Nitrite as	N by Discrete Analyser (QCLot: 2083111)						
EB1830002-004	Anonymous	EK057G: Nitrite as N	14797-65-0	0.4 mg/L	107	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2083446)							
EB1830002-004	Anonymous	EK059G: Nitrite + Nitrate as N		0.4 mg/L	99.8	70	130
EK061G: Total Kje	dahl Nitrogen By Discrete Analyser (QCLot: 2084226)						
EB1829364-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N		5 mg/L	108	70	130
EK067G: Total Pho	osphorus as P by Discrete Analyser (QCLot: 2084225)						
EB1829364-002	Anonymous	EK067G: Total Phosphorus as P		1 mg/L	107	70	130
EK071G: Reactive	Phosphorus as P by discrete analyser (QCLot: 2083110						
EB1830002-004	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.4 mg/L	101	70	130



QA/QC Compliance Assessment to assist with Quality Review								
Work Order	EB1825628	Page	: 1 of 10					
Client		Laboratory	: Environmental Division Brisbane					
Contact	: MR MITCH McGINNIS	Telephone	: +61 7 3552 8639					
Project	: 1893802 Inland Rail (P13)	Date Samples Received	: 24-Oct-2018					
Site	:	Issue Date	: 26-Oct-2018					
Sampler		No. of samples received	: 4					
Order number	:	No. of samples analysed	: 4					

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

• Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

• <u>NO</u> Quality Control Sample Frequency Outliers exist.



Outliers : Analysis Holding Time Compliance

Matrix: WATER

Method	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days	Date analysed	Due for analysis	Days	
			overdue			overdue	
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
330-01-BH2212				24-Oct-2018	22-Oct-2018	2	
Clear Plastic Bottle - Natural							
330-01-BH2216, GW 789,				24-Oct-2018	23-Oct-2018	1	
330-01-BH22104							

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

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

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

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

Matrix: WATER					Evaluation	i: × = Holding time	breach ; 🗸 = Withi	n holding time.	
Method		Sample Date Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA005P: pH by PC Titrator									
Clear Plastic Bottle - Natural (EA005-P)									
330-01-BH2212		22-Oct-2018				24-Oct-2018	22-Oct-2018	*	
Clear Plastic Bottle - Natural (EA005-P)									
330-01-BH2216,	GW 789,	23-Oct-2018				24-Oct-2018	23-Oct-2018	×	
330-01-BH22104									
EA010P: Conductivity by PC Titrator									
Clear Plastic Bottle - Natural (EA010-P)									
330-01-BH2212		22-Oct-2018				24-Oct-2018	19-Nov-2018	✓	
Clear Plastic Bottle - Natural (EA010-P)									
330-01-BH2216,	GW 789,	23-Oct-2018				24-Oct-2018	20-Nov-2018	 ✓ 	
330-01-BH22104									
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Clear Plastic Bottle - Natural (EA015H)									
330-01-BH2212		22-Oct-2018				24-Oct-2018	29-Oct-2018	✓	
Clear Plastic Bottle - Natural (EA015H)									
330-01-BH2216,	GW 789,	23-Oct-2018				24-Oct-2018	30-Oct-2018	 ✓ 	
330-01-BH22104									

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Project	: 1893802 Inland Rail (P13)



Matrix: WATER	Evaluation: × = Holding time breach ; ✓ = Within holding time							
Method			Ex	traction / Preparation		Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P) 330-01-BH2212		22-Oct-2018				24-Oct-2018	05-Nov-2018	✓
Clear Plastic Bottle - Natural (ED037-P) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct-2018				24-Oct-2018	06-Nov-2018	~
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) 330-01-BH2212		22-Oct-2018				24-Oct-2018	19-Nov-2018	✓
Clear Plastic Bottle - Natural (ED041G) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct-2018				24-Oct-2018	20-Nov-2018	~
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) 330-01-BH2212		22-Oct-2018				24-Oct-2018	19-Nov-2018	✓
Clear Plastic Bottle - Natural (ED045G) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct-2018				24-Oct-2018	20-Nov-2018	~
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2212		22-Oct-2018				25-Oct-2018	19-Nov-2018	✓
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct-2018				25-Oct-2018	20-Nov-2018	~
ED093F: SAR and Hardness Calculations								
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2212		22-Oct-2018				25-Oct-2018	19-Nov-2018	1
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct-2018				25-Oct-2018	20-Nov-2018	~
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) 330-01-BH2212		22-Oct-2018				25-Oct-2018	20-Apr-2019	1
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct-2018				25-Oct-2018	21-Apr-2019	~
EG020T: Total Metals by ICP- <u>MS</u>								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) 330-01-BH2212		22-Oct-2018	25-Oct-2018	20-Apr-2019	1	25-Oct-2018	20-Apr-2019	1
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct-2018	25-Oct-2018	21-Apr-2019	✓	25-Oct-2018	21-Apr-2019	~

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Matrix: WATER					Evaluation: × = Holding time breach ; ✓ = Within holding time							
Method			Date	Ex	traction / Preparation		Analysis					
Container / Client Sample ID(s)				Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation			
EG035F: Dissolved Mercury by FIMS												
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) 330-01-BH2212		22-Oct	2018				25-Oct-2018	19-Nov-2018	1			
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct	-2018				25-Oct-2018	20-Nov-2018	~			
EG035T: Total Recoverable Mercury by FIMS												
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) 330-01-BH2212		22-Oct	2018				26-Oct-2018	19-Nov-2018	1			
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct	-2018				26-Oct-2018	20-Nov-2018	~			
EK040P: Fluoride by PC Titrator												
Clear Plastic Bottle - Natural (EK040P) 330-01-BH2212		22-Oct	-2018				24-Oct-2018	19-Nov-2018	~			
Clear Plastic Bottle - Natural (EK040P) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct	-2018				24-Oct-2018	20-Nov-2018	~			
EK055G: Ammonia as N by Discrete Analyser												
Clear Plastic Bottle - Sulfuric Acid (EK055G) 330-01-BH2212		22-Oct	2018				25-Oct-2018	19-Nov-2018	1			
Clear Plastic Bottle - Sulfuric Acid (EK055G) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct	-2018				25-Oct-2018	20-Nov-2018	~			
EK057G: Nitrite as N by Discrete Analyser												
Clear Plastic Bottle - Natural (EK057G) 330-01-BH2212		22-Oct	2018				24-Oct-2018	24-Oct-2018	1			
Clear Plastic Bottle - Natural (EK057G) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct	2018				24-Oct-2018	25-Oct-2018	~			
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete	Analyser											
Clear Plastic Bottle - Sulfuric Acid (EK059G) 330-01-BH2212		22-Oct	2018				25-Oct-2018	19-Nov-2018	1			
Clear Plastic Bottle - Sulfuric Acid (EK059G) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct	2018				25-Oct-2018	20-Nov-2018	~			
EK061G: Total Kjeldahl Nitrogen By Discrete Analyse	er											
Clear Plastic Bottle - Sulfuric Acid (EK061G) 330-01-BH2212		22-Oct	2018	25-Oct-2018	19-Nov-2018	1	25-Oct-2018	19-Nov-2018	1			
Clear Plastic Bottle - Sulfuric Acid (EK061G) 330-01-BH2216, 330-01-BH22104	GW 789,	23-Oct	2018	25-Oct-2018	20-Nov-2018	\checkmark	25-Oct-2018	20-Nov-2018	~			

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Matrix: WATER				Evaluation	n: × = Holding time	breach ; ✓ = With	in holding time	
Method	Sample Date	E>	traction / Preparation		Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G) 330-01-BH2212	22-Oct-2018	25-Oct-2018	19-Nov-2018	~	25-Oct-2018	19-Nov-2018	✓	
Clear Plastic Bottle - Sulfuric Acid (EK067G) 330-01-BH2216, GW 789, 330-01-BH22104 GW 789,	23-Oct-2018	25-Oct-2018	20-Nov-2018	~	25-Oct-2018	20-Nov-2018	~	
EK071G: Reactive Phosphorus as P by discrete analyser								
Clear Plastic Bottle - Natural (EK071G) 330-01-BH2212	22-Oct-2018				24-Oct-2018	24-Oct-2018	✓	
Clear Plastic Bottle - Natural (EK071G) 330-01-BH2216, GW 789, 330-01-BH22104 GW 789,	23-Oct-2018				24-Oct-2018	25-Oct-2018	~	



Quality Control Parameter Frequency Compliance

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

Matrix: WATER	WATER Evaluation: × = Quality Control frequency not within specification; ✓ = Qua								
Quality Control Sample Type		C	ount		Rate (%)		Quality Control Specification		
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation			
Laboratory Duplicates (DUP)									
Alkalinity by PC Titrator	ED037-P	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Ammonia as N by Discrete analyser	EK055G	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Chloride by Discrete Analyser	ED045G	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Conductivity by PC Titrator	EA010-P	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Dissolved Mercury by FIMS	EG035F	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Fluoride by PC Titrator	EK040P	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Major Cations - Dissolved	ED093F	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Nitrite as N by Discrete Analyser	EK057G	2	16	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
pH by PC Titrator	EA005-P	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Total Dissolved Solids (High Level)	EA015H	3	21	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Total Mercury by FIMS	EG035T	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Total Metals by ICP-MS - Suite A	EG020A-T	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Laboratory Control Samples (LCS)									
Alkalinity by PC Titrator	ED037-P	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Ammonia as N by Discrete analyser	EK055G	1	13	7.69	5.00	1	NEPM 2013 B3 & ALS QC Standard		
Chloride by Discrete Analyser	ED045G	2	8	25.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Conductivity by PC Titrator	EA010-P	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Dissolved Mercury by FIMS	EG035F	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Fluoride by PC Titrator	EK040P	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Nitrite as N by Discrete Analyser	EK057G	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
pH by PC Titrator	EA005-P	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	8	25.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Total Dissolved Solids (High Level)	EA015H	4	21	19.05	10.00	1	NEPM 2013 B3 & ALS QC Standard		
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Total Mercury by FIMS	EG035T	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Total Metals by ICP-MS - Suite A	EG020A-T	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard		

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Matrix: WATER	Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specific							
Quality Control Sample Type		Count			Rate (%)		Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation		
Method Blanks (MB)								
Ammonia as N by Discrete analyser	EK055G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Chloride by Discrete Analyser	ED045G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Conductivity by PC Titrator	EA010-P	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Dissolved Mercury by FIMS	EG035F	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Fluoride by PC Titrator	EK040P	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Major Cations - Dissolved	ED093F	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Nitrite as N by Discrete Analyser	EK057G	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Total Dissolved Solids (High Level)	EA015H	2	21	9.52	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Total Mercury by FIMS	EG035T	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Total Metals by ICP-MS - Suite A	EG020A-T	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Matrix Spikes (MS)								
Ammonia as N by Discrete analyser	EK055G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Chloride by Discrete Analyser	ED045G	1	8	12.50	5.00	√	NEPM 2013 B3 & ALS QC Standard	
Dissolved Mercury by FIMS	EG035F	1	11	9.09	5.00	1	NEPM 2013 B3 & ALS QC Standard	
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	5.56	5.00	1	NEPM 2013 B3 & ALS QC Standard	
Fluoride by PC Titrator	EK040P	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Nitrite as N by Discrete Analyser	EK057G	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Total Mercury by FIMS	EG035T	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Total Metals by ICP-MS - Suite A	EG020A-T	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard	
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	1	NEPM 2013 B3 & ALS QC Standard	



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE.
			This method is compliant with NEPM (2013) Schedule B(3)
Sodium Adsorption Ratio	EA006	WATER	In house: Referenced to APHA 3120 Ca, Mg, Na. This method is compliant with NEPM (2013) Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method
			is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue
			in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is
			evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013)
			Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC
			I itrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013)
Outfate (Truckiding state) as OOA 0, but	ED0440		Schedule B(3)
Sullate (Turbidimetric) as SO4 2- by	ED041G	WATER	in house: Referenced to APHA 4500-504. Dissolved suitate is determined in a 0.450m intered sample. Suitate
Discrete Analysei			ons are converted to a banum surface suspension in an accuc acid medium with banum chloride. Light
			by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 CL - G The thiocyanate ion is liberated from mercuric thiocyanate through
	220100		sequestration of mercury by the chloride ion to form non-ionised mercuric chloride in the presence of ferric ions
			the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition
			seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by
			either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3)
			Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method
			QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3)
			Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013)
Disselved Metals by ICD MS - Suite A	50000A 5		Schedule B(3)
Dissolved Metals by ICP-INS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered
			prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements, ions
			mass to charge ratios prior to their measurement by a discrete dynade ion detector
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125: USEPA SW846 - 6020 ALS OWI-EN/EG020 The ICPMS technique utilizes
	20020,11		a highly efficient argon plasma to jonize selected elements. Jons are then passed into a high vacuum mass
			spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their
			measurement by a discrete dynode ion detector.
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Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3 This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions

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Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013)
			Schedule B(3)
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure
			used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant
			with NEPM (2013) Schedule B(3)



	QA/QC Compliance Assessment to assist with Quality Review							
Work Order	: EB1825910	Page	: 1 of 10					
Client		Laboratory	: Environmental Division Brisbane					
Contact	: MR MITCH McGINNIS	Telephone	: +61 7 3552 8639					
Project	: 1893802	Date Samples Received	: 26-Oct-2018					
Site	:	Issue Date	: 31-Oct-2018					
Sampler		No. of samples received	: 3					
Order number	: 1893802	No. of samples analysed	: 3					

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- <u>NO</u> Duplicate outliers occur.
- <u>NO</u> Laboratory Control outliers occur.
- Method Blank value outliers exist please see following pages for full details.
- Matrix Spike outliers exist please see following pages for full details.
- For all regular sample matrices, NO surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

• Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

• NO Quality Control Sample Frequency Outliers exist.



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: WATER

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Method Blank (MB) Values							
ED093F: Dissolved Major Cations	QC-MRG3-20055840	0-2	Sodium	7440-23-5	2 mg/L	1 mg/L	Blank result exceeds permitted value
Matrix Spike (MS) Recoveries							
EK067G: Total Phosphorus as P by Discrete Analyser	EB1825763001	Anonymous	Total Phosphorus as P		Not		MS recovery not determined,
					Determined		background level greater than or
							equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: WATER						
Method	Extraction / Preparation Analysis					
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days	Date analysed	Due for analysis	Days
			overdue			overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
330-01-BH2102				26-Oct-2018	24-Oct-2018	2
Clear Plastic Bottle - Natural						
330-01-BH2303, 330-01-BH2307				26-Oct-2018	25-Oct-2018	1

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

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

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

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

Matrix: WATER					Evaluation	n: 🗴 = Holding time	breach ; ✓ = With	in holding time
Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P)								
330-01-BH2102		24-Oct-2018				26-Oct-2018	24-Oct-2018	*
Clear Plastic Bottle - Natural (EA005-P)								
330-01-BH2303,	330-01-BH2307	25-Oct-2018				26-Oct-2018	25-Oct-2018	*
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P)								
330-01-BH2102		24-Oct-2018				26-Oct-2018	21-Nov-2018	✓
Clear Plastic Bottle - Natural (EA010-P)								
330-01-BH2303,	330-01-BH2307	25-Oct-2018				26-Oct-2018	22-Nov-2018	 ✓

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Matrix: WATER			Evaluation: \star = Holding time breach ; \checkmark = Within holding time						
Method	Sample Date	Ex	traction / Preparation		Analysis				
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Clear Plastic Bottle - Natural (EA015H) 330-01-BH2102		24-Oct-2018				29-Oct-2018	31-Oct-2018	✓	
Clear Plastic Bottle - Natural (EA015H) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				29-Oct-2018	01-Nov-2018	~	
ED037P: Alkalinity by PC Titrator									
Clear Plastic Bottle - Natural (ED037-P) 330-01-BH2102		24-Oct-2018				26-Oct-2018	07-Nov-2018	✓	
Clear Plastic Bottle - Natural (ED037-P) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				26-Oct-2018	08-Nov-2018	~	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Clear Plastic Bottle - Natural (ED041G) 330-01-BH2102		24-Oct-2018				26-Oct-2018	21-Nov-2018	✓	
Clear Plastic Bottle - Natural (ED041G) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				26-Oct-2018	22-Nov-2018	~	
ED045G: Chloride by Discrete Analyser									
Clear Plastic Bottle - Natural (ED045G) 330-01-BH2102		24-Oct-2018				26-Oct-2018	21-Nov-2018	✓	
Clear Plastic Bottle - Natural (ED045G) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				26-Oct-2018	22-Nov-2018	1	
ED093F: Dissolved Major Cations									
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2102		24-Oct-2018				29-Oct-2018	21-Nov-2018	~	
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				29-Oct-2018	22-Nov-2018	~	
ED093F: SAR and Hardness Calculations									
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2102		24-Oct-2018				29-Oct-2018	21-Nov-2018	~	
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				29-Oct-2018	22-Nov-2018	~	
EG020F: Dissolved Metals by ICP-MS									
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) 330-01-BH2102		24-Oct-2018				29-Oct-2018	22-Apr-2019	✓	
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				29-Oct-2018	23-Apr-2019	~	
EG020T: Total Metals by ICP-MS									
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) 330-01-BH2102		24-Oct-2018	29-Oct-2018	22-Apr-2019	1	29-Oct-2018	22-Apr-2019	1	
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) 330-01-BH2303.	330-01-BH2307	25-Oct-2018	29-Oct-2018	23-Apr-2019	1	29-Oct-2018	23-Apr-2019	1	



Matrix: WATER					Evaluation	: × = Holding time	breach ; ✓ = With	in holding time.
Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) 330-01-BH2102		24-Oct-2018				29-Oct-2018	21-Nov-2018	✓
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				29-Oct-2018	22-Nov-2018	1
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) 330-01-BH2102		24-Oct-2018				29-Oct-2018	21-Nov-2018	✓
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				29-Oct-2018	22-Nov-2018	✓
EK040P: Fluoride by PC Titrator								
Clear Plastic Bottle - Natural (EK040P) 330-01-BH2102		24-Oct-2018				26-Oct-2018	21-Nov-2018	✓
Clear Plastic Bottle - Natural (EK040P) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				26-Oct-2018	22-Nov-2018	~
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) 330-01-BH2102		24-Oct-2018				26-Oct-2018	21-Nov-2018	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				26-Oct-2018	22-Nov-2018	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) 330-01-BH2102		24-Oct-2018				26-Oct-2018	26-Oct-2018	✓
Clear Plastic Bottle - Natural (EK057G) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				26-Oct-2018	27-Oct-2018	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete A	nalyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G) 330-01-BH2102		24-Oct-2018				26-Oct-2018	21-Nov-2018	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				26-Oct-2018	22-Nov-2018	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyse	r i i i i i i i i i i i i i i i i i i i							
Clear Plastic Bottle - Sulfuric Acid (EK061G) 330-01-BH2102		24-Oct-2018	28-Oct-2018	21-Nov-2018	~	28-Oct-2018	21-Nov-2018	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) 330-01-BH2303,	330-01-BH2307	25-Oct-2018	28-Oct-2018	22-Nov-2018	~	28-Oct-2018	22-Nov-2018	✓
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G) 330-01-BH2102		24-Oct-2018	28-Oct-2018	21-Nov-2018	~	28-Oct-2018	21-Nov-2018	√
Clear Plastic Bottle - Sulfuric Acid (EK067G) 330-01-BH2303,	330-01-BH2307	25-Oct-2018	28-Oct-2018	22-Nov-2018	~	28-Oct-2018	22-Nov-2018	√



Matrix: WATER					Evaluation	n: × = Holding time	e breach ; ✓ = Withi	n holding time
Method			Extraction / Preparation		Analysis			
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK071G: Reactive Phosphorus as P by discrete analys	ser							
Clear Plastic Bottle - Natural (EK071G) 330-01-BH2102		24-Oct-2018				26-Oct-2018	26-Oct-2018	1
Clear Plastic Bottle - Natural (EK071G) 330-01-BH2303,	330-01-BH2307	25-Oct-2018				26-Oct-2018	27-Oct-2018	~



Quality Control Parameter Frequency Compliance

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

Matrix: WATER				Evaluatio	n: × = Quality Co	ntrol frequency i	not within specification ; \checkmark = Quality Control frequency within specification.
Quality Control Sample Type		С	ount		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	10	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	13	15.38	10.00	1	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	10.00	10.00	1	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	20	10.00	10.00	1	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	10	10.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	9	22.22	10.00	1	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	2	17	11.76	10.00	1	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	5.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	11	9.09	5.00	1	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	10	10.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	12	8.33	5.00	1	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	1	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	11	9.09	5.00	1	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	13	15.38	10.00	1	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	19	5.26	5.00	√	NEPM 2013 B3 & ALS QC Standard

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Work Order	: EB1825910
Client	: GOLDER ASSOCIATES
Project	: 1893802



Matrix: WATER				Evaluatio	n: × = Quality Co	ontrol frequency	not within specification ; ✓ = Quality Control frequency within specification.			
Quality Control Sample Type		С	ount		Rate (%)		Quality Control Specification			
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation				
Method Blanks (MB)										
Ammonia as N by Discrete analyser	EK055G	1	10	10.00	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard			
Chloride by Discrete Analyser	ED045G	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Conductivity by PC Titrator	EA010-P	1	17	5.88	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard			
Dissolved Mercury by FIMS	EG035F	1	20	5.00	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard			
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard			
Fluoride by PC Titrator	EK040P	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Major Cations - Dissolved	ED093F	1	8	12.50	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard			
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	10	10.00	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard			
Nitrite as N by Discrete Analyser	EK057G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Total Dissolved Solids (High Level)	EA015H	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard			
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Total Phosphorus as P By Discrete Analyser	EK067G	1	19	5.26	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard			
Matrix Spikes (MS)										
Ammonia as N by Discrete analyser	EK055G	1	10	10.00	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard			
Chloride by Discrete Analyser	ED045G	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Dissolved Mercury by FIMS	EG035F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Fluoride by PC Titrator	EK040P	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Nitrite as N by Discrete Analyser	EK057G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard			
Total Phosphorus as P By Discrete Analyser	EK067G	1	19	5.26	5.00	1	NEPM 2013 B3 & ALS QC Standard			



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 CI - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

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Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS)
			Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique.
			A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic
			mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell.
			Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM
			(2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS)
			FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise
			any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic
			mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing
			absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength
			background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or
			automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser.
			This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser.
			This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed
			by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate
			calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by
Analyser			Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013)
			Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high
Analyser			temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined
			colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3 This method is compliant with NEPM (2013) Schedule
Discrete Analyser			B(3)
Total Phosphorus as P By Discrete	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves
Analyser			sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate
			reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and
			its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013)
			Schedule B(3)
Reactive Phosphorus as P-By Discrete	EK071G	WATER	In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid
Analyser			medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely
			coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant
			with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
DA			
Preparation Methods	Method	Matrix	Method Descriptions

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Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)



QA/QC Compliance Assessment to assist with Quality Review							
Work Order	EB1825981	Page	: 1 of 9				
Client		Laboratory	: Environmental Division Brisbane				
Contact	: MR SUSANTHA KUMARAPELI	Telephone	: +61 7 3552 8639				
Project	: 1893802 Inland Rail (P13)	Date Samples Received	: 26-Oct-2018				
Site	:	Issue Date	: 31-Oct-2018				
Sampler	: ROB CUPPER	No. of samples received	: 1				
Order number	: 1893802	No. of samples analysed	: 1				

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- <u>NO</u> Duplicate outliers occur.
- <u>NO</u> Laboratory Control outliers occur.
- <u>NO</u> Matrix Spike outliers occur.
- Method Blank value outliers exist please see following pages for full details.
- For all regular sample matrices, <u>NO</u> surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

• Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

• <u>NO</u> Quality Control Sample Frequency Outliers exist.


Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: WATER

Compound Group Name	Laboratory Sample ID Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Method Blank (MB) Values						
ED093F: Dissolved Major Cations	QC-MRG3-2005584002	Sodium	7440-23-5	2 mg/L	1 mg/L	Blank result exceeds permitted value

Outliers : Analysis Holding Time Compliance

Matrix: WATER

Matrix: WATER

Method	Ex	traction / Preparation			Analysis	
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days	Date analysed	Due for analysis	Days
			overdue			overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
330-01-BH2222				27-Oct-2018	26-Oct-2018	1

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

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

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

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

Evaluation: \mathbf{x} = Holding time breach ; \mathbf{v} = Within holding time.

				0		0
Sample Date	Ex	traction / Preparation				
	Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
26-Oct-2018				27-Oct-2018	26-Oct-2018	*
26-Oct-2018				27-Oct-2018	23-Nov-2018	✓
26-Oct-2018				29-Oct-2018	02-Nov-2018	✓
26-Oct-2018				27-Oct-2018	09-Nov-2018	✓
26-Oct-2018				27-Oct-2018	23-Nov-2018	✓
	Sample Date 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018	Sample Date Ex Date extracted Date extracted 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018	Sample Date Extraction / Preparation Date extracted Due for extraction 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018	Sample Date Extraction / Preparation Date extracted Due for extraction Evaluation 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018 26-Oct-2018	Sample Date Extraction / Preparation Date extracted Due for extraction Evaluation Date analysed 26-Oct-2018 27-Oct-2018 26-Oct-2018 27-Oct-2018 26-Oct-2018 27-Oct-2018 26-Oct-2018 29-Oct-2018 26-Oct-2018 29-Oct-2018 26-Oct-2018 29-Oct-2018 26-Oct-2018 27-Oct-2018 26-Oct-2018 27-Oct-2018 26-Oct-2018 27-Oct-2018 26-Oct-2018 27-Oct-2018	Sample Date Extraction / Preparation Analysis Date extracted Due for extraction Evaluation Date analysed Due for analysis 26-Oct-2018 27-Oct-2018 26-Oct-2018 26-Oct-2018 27-Oct-2018 26-Oct-2018 26-Oct-2018 27-Oct-2018 23-Nov-2018 26-Oct-2018 29-Oct-2018 02-Nov-2018 26-Oct-2018 29-Oct-2018 02-Nov-2018 26-Oct-2018 27-Oct-2018 09-Nov-2018 26-Oct-2018 27-Oct-2018 09-Nov-2018 26-Oct-2018 27-Oct-2018 09-Nov-2018

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Matrix: WATER				Evaluation	: × = Holding time	breach ; 🗸 = Withi	in holding time.
Method	Sample Date	Ex	traction / Preparation		Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) 330-01-BH2222	26-Oct-2018				27-Oct-2018	23-Nov-2018	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2222	26-Oct-2018				29-Oct-2018	23-Nov-2018	✓
ED093F: SAR and Hardness Calculations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2222	26-Oct-2018				29-Oct-2018	23-Nov-2018	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) 330-01-BH2222	26-Oct-2018				29-Oct-2018	24-Apr-2019	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) 330-01-BH2222	26-Oct-2018	29-Oct-2018	24-Apr-2019	✓	29-Oct-2018	24-Apr-2019	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) 330-01-BH2222	26-Oct-2018				29-Oct-2018	23-Nov-2018	~
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) 330-01-BH2222	26-Oct-2018				29-Oct-2018	23-Nov-2018	~
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P) 330-01-BH2222	26-Oct-2018				27-Oct-2018	23-Nov-2018	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G) 330-01-BH2222	26-Oct-2018				30-Oct-2018	23-Nov-2018	~
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) 330-01-BH2222	26-Oct-2018				27-Oct-2018	28-Oct-2018	~
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G) 330-01-BH2222	26-Oct-2018				30-Oct-2018	23-Nov-2018	~
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G) 330-01-BH2222	26-Oct-2018	29-Oct-2018	23-Nov-2018	1	29-Oct-2018	23-Nov-2018	~
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G) 330-01-BH2222	26-Oct-2018	29-Oct-2018	23-Nov-2018	~	29-Oct-2018	23-Nov-2018	1

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Client	: GOLDER ASSOCIATES
Project	: 1893802 Inland Rail (P13)



Matrix: WATER				Evaluation	: × = Holding time	breach ; 🗸 = Withi	n holding time
Method	Sample Date	Ex	traction / Preparation			Analysis	
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural (EK071G)							
330-01-BH2222	26-Oct-2018				27-Oct-2018	28-Oct-2018	\checkmark



Quality Control Parameter Frequency Compliance

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

Matrix: WATER				Evaluatio	n: 🗴 = Quality Co	ntrol frequency i	not within specification ; \checkmark = Quality Control frequency within specification.
Quality Control Sample Type		C	ount		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	5	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	5	20.00	10.00	\checkmark	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	2	2	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	2	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	2	50.00	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	18	5.56	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	13	7.69	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard



Matrix: WATER				Evaluatio	n: × = Quality Co	ntrol frequency	not within specification ; \checkmark = Quality Control frequency within specification.
Quality Control Sample Type		C	ount		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	1	2	50.00	5.00	√	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	2	50.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	14.29	5.00	1	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	2	50.00	5.00	√	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	8	12.50	5.00	1	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	5	20.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	2	50.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	2	50.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	5.26	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	11	9.09	5.00	√	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	18	5.56	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	8	12.50	5.00	√	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	19	5.26	5.00	√	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	18	5.56	5.00	√	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 CI - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

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Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3 This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions

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Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)



QA/QC Compliance Assessment to assist with Quality Review						
Work Order	EB1828572	Page	: 1 of 9			
Client		Laboratory	: Environmental Division Brisbane			
Contact	: MR SUSANTHA KUMARAPELI	Telephone	: +61 7 3552 8639			
Project	: 1893802 INLAND RAIL (P13)	Date Samples Received	: 22-Nov-2018			
Site	:	Issue Date	: 26-Nov-2018			
Sampler	: SUSANTHA KUMARAPELI	No. of samples received	: 1			
Order number	:	No. of samples analysed	: 1			

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- NO Method Blank value outliers occur.
- <u>NO</u> Duplicate outliers occur.
- <u>NO</u> Laboratory Control outliers occur.
- Matrix Spike outliers exist please see following pages for full details.
- For all regular sample matrices, NO surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

• Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

• NO Quality Control Sample Frequency Outliers exist.



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: WATER

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED045G: Chloride by Discrete Analyser	EB1828285001	Anonymous	Chloride	16887-00-6	Not		MS recovery not determined,
					Determined		background level greater than or
							equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: WATER Method Extraction / Preparation Analysis Date extracted Due for extraction Date analysed Due for analysis Container / Client Sample ID(s) Days Days overdue overdue EA005P: pH by PC Titrator **Clear Plastic Bottle - Natural** 330-01-BH2103 22-Nov-2018 20-Nov-2018 2 ------------

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

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

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

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

Matrix: WATER				Evaluation	: × = Holding time	breach ; 🗸 = Withi	n holding time.
Method	Sample Date	E	traction / Preparation				
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P) 330-01-BH2103	20-Nov-2018				22-Nov-2018	20-Nov-2018	×
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P) 330-01-BH2103	20-Nov-2018				22-Nov-2018	18-Dec-2018	~
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H) 330-01-BH2103	20-Nov-2018				22-Nov-2018	27-Nov-2018	~
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) 330-01-BH2103	20-Nov-2018				22-Nov-2018	04-Dec-2018	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) 330-01-BH2103	20-Nov-2018				22-Nov-2018	18-Dec-2018	✓



Matrix: WATER Evaluation: × = Hol						Holding time breach ; ✓ = Within holding time		
Method	Sample Date	Ex	traction / Preparation		Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) 330-01-BH2103	20-Nov-2018				22-Nov-2018	18-Dec-2018	~	
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2103	20-Nov-2018				23-Nov-2018	18-Dec-2018	1	
ED093F: SAR and Hardness Calculations								
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2103	20-Nov-2018				23-Nov-2018	18-Dec-2018	✓	
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) 330-01-BH2103	20-Nov-2018				23-Nov-2018	19-May-2019	~	
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) 330-01-BH2103	20-Nov-2018	23-Nov-2018	19-May-2019	✓	23-Nov-2018	19-May-2019	~	
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) 330-01-BH2103	20-Nov-2018				23-Nov-2018	18-Dec-2018	✓	
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) 330-01-BH2103	20-Nov-2018				23-Nov-2018	18-Dec-2018	✓	
EK040P: Fluoride by PC Titrator								
Clear Plastic Bottle - Natural (EK040P) 330-01-BH2103	20-Nov-2018				22-Nov-2018	18-Dec-2018	✓	
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) 330-01-BH2103	20-Nov-2018				22-Nov-2018	18-Dec-2018	✓	
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) 330-01-BH2103	20-Nov-2018				22-Nov-2018	22-Nov-2018	~	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) 330-01-BH2103	20-Nov-2018				22-Nov-2018	18-Dec-2018	~	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) 330-01-BH2103	20-Nov-2018	23-Nov-2018	18-Dec-2018	1	23-Nov-2018	18-Dec-2018	1	
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G) 330-01-BH2103	20-Nov-2018	23-Nov-2018	18-Dec-2018	~	23-Nov-2018	18-Dec-2018	√	

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Matrix: WATER				Evaluation	: × = Holding time	breach ; 🗸 = Withi	n holding time.
Method	Sample Date	Ex	traction / Preparation		Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural (EK071G)							
330-01-BH2103	20-Nov-2018				22-Nov-2018	22-Nov-2018	\checkmark



Quality Control Parameter Frequency Compliance

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

Matrix: WATER Evaluation: * = Quality Control frequency not within specification ; 🗸 = Quality Control frequency within specifi							
Quality Control Sample Type		C	Count Rate (%)		Quality Control Specification		
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	3	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	16	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	3	33.33	10.00	\checkmark	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	16	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	8	12.50	10.00	\checkmark	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	16	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	7	14.29	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	8	25.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	18	5.56	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	19	5.26	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard

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Matrix: WATER	Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specificatio						
Quality Control Sample Type		Count Rate (%)			Rate (%)	Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	18	5.56	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	16	6.25	5.00	1	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	2	50.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	19	5.26	5.00	1	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 CI - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.



Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3 This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions

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Work Order	: EB1828572
Client	: GOLDER ASSOCIATES
Project	: 1893802 INLAND RAIL (P13)



Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)



QA/QC Compliance Assessment to assist with Quality Review							
Nork Order	EB1830098	Page	: 1 of 8				
Client		Laboratory	: Environmental Division Brisbane				
Contact	: MR SUSANTHA KUMARAPELI	Telephone	: +61 7 3552 8639				
Project	: 1893802 INLAND RAIL (P13)	Date Samples Received	: 07-Dec-2018				
Site	:	Issue Date	: 11-Dec-2018				
Sampler	: HANNAH GROVES	No. of samples received	: 1				
Order number	:	No. of samples analysed	: 1				

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- NO Method Blank value outliers occur.
- <u>NO</u> Duplicate outliers occur.
- <u>NO</u> Laboratory Control outliers occur.
- Matrix Spike outliers exist please see following pages for full details.
- For all regular sample matrices, NO surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

• Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

• NO Quality Control Sample Frequency Outliers exist.



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: WATER

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG020F: Dissolved Metals by ICP-MS	EB1829556003	Anonymous	Manganese	7439-96-5	Not		MS recovery not determined,
					Determined		background level greater than or
							equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Ex	traction / Preparation			Analysis	
Date extracted	Due for extraction	Days	Date analysed	Due for analysis	Days
		overdue			overdue
			10-Dec-2018	08-Dec-2018	2
	Ex Date extracted	Extraction / Preparation Date extracted Due for extraction	Extraction / Preparation Date extracted Due for extraction Date Date	Extraction / Preparation Days Date extracted Due for extraction Days overdue Date analysed	Extraction / Preparation Days overdue Date analysed Due for analysis Date extracted Due for extraction Days overdue Date analysed Due for analysis 10-Dec-2018 08-Dec-2018

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

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

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

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

Matrix: WATER				Evaluation	: × = Holding time	breach ; 🗸 = Withi	n holding time.
Method	Sample Date	Ex	traction / Preparation		Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P) 330-01-BH2101	07-Dec-2018				10-Dec-2018	08-Dec-2018	×
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P) 330-01-BH2101	07-Dec-2018				10-Dec-2018	04-Jan-2019	~
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H) 330-01-BH2101	07-Dec-2018				08-Dec-2018	14-Dec-2018	~
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) 330-01-BH2101	07-Dec-2018				10-Dec-2018	21-Dec-2018	~
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) 330-01-BH2101	07-Dec-2018				08-Dec-2018	04-Jan-2019	~



Matrix: WATER		x = Holding time breach ; \checkmark = Within holding time.						
Method	Sample Date	Ex	traction / Preparation		Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) 330-01-BH2101	07-Dec-2018				08-Dec-2018	04-Jan-2019	1	
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2101	07-Dec-2018				10-Dec-2018	04-Jan-2019	✓	
ED093F: SAR and Hardness Calculations								
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) 330-01-BH2101	07-Dec-2018				10-Dec-2018	04-Jan-2019	✓	
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) 330-01-BH2101	07-Dec-2018				10-Dec-2018	05-Jun-2019	✓	
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) 330-01-BH2101	07-Dec-2018	10-Dec-2018	05-Jun-2019	~	10-Dec-2018	05-Jun-2019	✓	
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) 330-01-BH2101	07-Dec-2018				10-Dec-2018	04-Jan-2019	~	
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) 330-01-BH2101	07-Dec-2018				10-Dec-2018	04-Jan-2019	✓	
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) 330-01-BH2101	07-Dec-2018				10-Dec-2018	04-Jan-2019	✓	
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) 330-01-BH2101	07-Dec-2018				08-Dec-2018	09-Dec-2018	✓	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) 330-01-BH2101	07-Dec-2018				10-Dec-2018	04-Jan-2019	1	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) 330-01-BH2101	07-Dec-2018	10-Dec-2018	04-Jan-2019	1	10-Dec-2018	04-Jan-2019	1	
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G) 330-01-BH2101	07-Dec-2018	10-Dec-2018	04-Jan-2019	1	10-Dec-2018	04-Jan-2019	1	
EK071G: Reactive Phosphorus as P by discrete analyser								
Clear Plastic Bottle - Natural (EK071G) 330-01-BH2101	07-Dec-2018				08-Dec-2018	09-Dec-2018	~	



Quality Control Parameter Frequency Compliance

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

Matrix: WATER				Evaluatio	n: 🗴 = Quality Co	ntrol frequency i	not within specification ; 🖌 = Quality Control frequency within specification.
Quality Control Sample Type		С	Count Rate (%)				Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	1	3	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	3	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	16	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	6	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	6	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	3	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	3	33.33	5.00	1	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	2	8	25.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	8	25.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	6	33.33	10.00	\checkmark	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	11	9.09	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	3	33.33	5.00	\checkmark	NEPM 2013 B3 & ALS QC Standard

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Work Order	: EB1830098
Client	: GOLDER ASSOCIATES
Project	: 1893802 INLAND RAIL (P13)



Matrix: WATER				Evaluatio	on: × = Quality Co	ontrol frequency	not within specification ; \checkmark = Quality Control frequency within specification.
Quality Control Sample Type		С	Count		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Method Blanks (MB) - Continued							
Chloride by Discrete Analyser	ED045G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	15	6.67	5.00	1	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	6	16.67	5.00	1	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	15	6.67	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	6	16.67	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	13	7.69	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	3	33.33	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	11	9.09	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	18	5.56	5.00	1	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	15	6.67	5.00	1	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	16	6.25	5.00	1	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	1	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	9	11.11	5.00	1	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	15	6.67	5.00	1	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	6	16.67	5.00	1	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	13	7.69	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	3	33.33	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	11	9.09	5.00	1	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	18	5.56	5.00	1	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 CI - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.



Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3 This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
lonic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)

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Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant
			with NEPM (2013) Schedule B(3)



			Heavy Metals																														
		Arsenic	Arsenic (Filtered)	Barium	Barium (Filtered)	Beryllium	Beryllium (Filtered)	Boron	Boron (Filtered)	Cadmium	Cadmium (Filtered)	Chromium	Chromium (Filtered)	Cobalt	Cobalt (Filtered)	Copper	Copper (Filtered)	Iron	Iron (Filtered)	Lead	Lead (Filtered)	Manganese	Manganese (Filtered)	Mercury	Mercury (Filtered)	Nickel	Nickel (Filtered)	Selenium	Selenium (Filtered)	Vanadium	Vanadium (Filtered)	Zinc	Zinc (Filtered)
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL		0.001	0.001	0.001	0.001	0.001	0.001	0.05	0.05	0.0001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.05	0.05	0.001	0.001	0.001	0.001	0.0001	0.0001	0.001	0.001	0.01	0.01	0.01	0.01	0.005	0.005
Borehole ID	Sampled Date																																
330-01-BH2101	7/12/2018	0.004	0.002	0.166	0.196	< 0.001	< 0.001	0.2	0.13	< 0.0001	< 0.0001	0.002	< 0.001	<0.001	< 0.001	0.002	< 0.001	3.31	2.28	< 0.001	< 0.001	0.078	0.069	<0.0001	< 0.0001	0.002	< 0.001	< 0.01	< 0.01	< 0.01	< 0.01	0.014	< 0.005
330-01-BH2102	24/10/2018	0.011	0.008	0.275	0.214	< 0.001	<0.001	0.18	0.18	< 0.0001	<0.0001	0.008	< 0.001	0.008	< 0.001	0.015	< 0.001	13	< 0.05	0.013	< 0.001	0.296	0.086	<0.0001	< 0.0001	0.01	0.001	<0.01	< 0.01	0.02	< 0.01	0.046	0.006
330-01-BH2103	20/11/2018	0.003	0.002	0.105	0.08	< 0.001	<0.001	0.12	0.12	0.0002	<0.0001	0.003	< 0.001	0.005	0.002	0.016	0.003	-	-	0.007	< 0.001	0.178	0.082	<0.0001	< 0.0001	0.006	0.003	<0.01	< 0.01	0.01	< 0.01	0.029	0.04
330-01-BH2104	23/10/2018	0.015	0.008	0.379	0.199	0.002	< 0.001	0.12	0.1	0.0003	< 0.0001	0.012	< 0.001	0.026	0.005	0.045	0.001	25.6	< 0.05	0.039	< 0.001	0.333	0.072	< 0.0001	< 0.0001	0.027	0.008	< 0.01	< 0.01	0.03	< 0.01	0.145	0.007
330-01-BH2207	25/10/2018	0.002	0.002	0.136	0.098	< 0.001	< 0.001	0.26	0.28	< 0.0001	<0.0001	0.021	0.01	0.004	0.003	0.013	0.008	2.93	0.1	0.026	0.004	0.482	0.461	< 0.0001	< 0.0001	0.02	0.013	< 0.01	< 0.01	< 0.01	< 0.01	0.046	0.008
330-01-BH2212	22/10/2018	< 0.001	< 0.001	0.125	0.096	< 0.001	< 0.001	0.06	0.06	< 0.0001	<0.0001	0.003	< 0.001	0.002	0.001	0.002	< 0.001	1.55	< 0.05	0.002	< 0.001	0.154	0.096	<0.0001	< 0.0001	0.006	0.003	< 0.01	< 0.01	0.01	< 0.01	< 0.005	< 0.005
330-01-BH2216	23/10/2018	0.001	< 0.001	0.44	0.279	< 0.001	< 0.001	0.08	0.06	< 0.0001	<0.0001	0.005	0.004	0.002	< 0.001	0.004	0.002	0.87	< 0.05	< 0.001	< 0.001	0.157	< 0.001	<0.0001	< 0.0001	0.002	0.001	< 0.01	< 0.01	< 0.01	< 0.01	< 0.005	< 0.005
330-01-BH2224	26/10/2018	0.002	0.001	0.047	0.029	< 0.001	< 0.001	0.07	0.06	<0.0001	<0.0001	0.01	0.008	0.001	<0.001	0.003	0.003	0.96	<0.05	0.003	< 0.001	0.047	0.006	<0.0001	<0.0001	0.003	0.002	< 0.01	<0.01	< 0.01	< 0.01	0.012	< 0.005
330-01-BH2303	25/10/2018	0.005	U.005	U.468	U.5	<0.001	<0.001	0.05	0.07	<0.0001	<0.0001	<0.001	<0.001	0.021	0.022	<0.001	0.001	1.66	U.15	<0.001	<0.001	0.693	U.79	<0.0001	<0.0001	0.037	0.022	<0.01	<0.01	<0.01	<0.01	0.014	0.014



		Ot	her												Sample	e Quali	ty Para	neters											
		Sodium Absorption Ratio	Sodium Absorption Ratio (Filtered)	Electrical Conductivity @ 25°C	pH (Lab)	Total Dissolved Solids @180°C	Sodium (Filtered)	Potassium (Filtered)	Calcium (Filte red)	Magnesium (Filtered)	Chloride	Sulphate (as SO4) (Filtered)	Bicarbonate Alkalinity (as CaCO3)	Carbonate Alkalinity (as CaCO3)	Hydroxide Alkalinity (as CaCO3)	Total Alkalinity (as CaCO3)	Nitrate (as N)	Nitrite (as N)	Nitrogen (Total Oxidised)	Ammonia (as N)	Total Kjeldahl Nitrogen (as N)	Nitrogen (Total)	Fluoride	Reactive Phosphorus (as P)	Total Phosphorus (as P)	Total Anions	Total Cations	lonic Balance (Lab)	Hardness (as CaCO3) (Filtered)
			-	uS/cm	pH_Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%	mg/L
EQL		0.01		1	0.01	10					1		1	1	1	1	0.01	0.01	0.01	0.01	0.1	0.1	0.1	0.01	0.01	0.01	0.01	0.01	
Borehole ID	Sampled Date																												
330-01-BH2101	7/12/2018	-	33.5	2190	8.8	1280	506	3	9	5	209	51	670	104	<1	774	0.03	< 0.01	0.03	0.97	1.6	1.6		< 0.01	0.03	22.4	22.9	1.16	-
330-01-BH2102	24/10/2018	· ·	25.7	4260	7.95	2340	833	8	40	24	1000	97	457	<1	<1	457	< 0.01	< 0.01	< 0.01	0.89	2.3	2.3	0.4	< 0.01	0.22	39.4	40.4	1.32	199
330-01-BH2103	20/11/2018	-	15.7	3810	8.18	2170	662	8	50	51	709	169	875	<1	<1	875	0.03	< 0.01	0.03	0.23	12	12	0.2	< 0.01	0.12	41	35.7	6.92	335
330-01-BH2104	23/10/2018	21.7	-	4260	8.33	2390	817	8	48	36	980	98	549	7	<1	556	0.01	0.01	0.02	0.66	1.5	1.5	0.7	< 0.01	0.12	40.8	41.1	0.37	268
330-01-BH2207	25/10/2018	-	7.24	1730	8.53	955	246	28	33	33	438	50	116	12	<1	128	0.22	0.2	0.42	0.25	1.4	1.8	0.6	< 0.01	0.09	16	15.8	0.55	218
330-01-BH2212	22/10/2018	29.5	-	5500	8.16	2940	1110	7	38	42	1340	77	601	<1	<1	601	0.48	< 0.01	0.48	0.11	0.6	1.1	0.5	< 0.01	0.08	51.4	53.8	2.28	268
330-01-BH2216	23/10/2018	17.6	-	2530	10.5	1180	451	12	25	15	646	41	<1	194	24	218	0.26	0.01	0.27	0.16	0.8	1.1	0.7	< 0.01	0.04	23.4	22.4	2.24	124
330-01-BH2224	26/10/2018	· ·	4.95	459	9.66	258	68	16	11	2	73	46	31	28	<1	59	0.14	< 0.01	0.14	0.18	0.9	1	0.8	< 0.01	0.02	4.2	4.08	1.39	36
330-01-BH2303	25/10/2018	-	2.58	1720	7.22	999	138	10	118	60	322	20	385	<1	<1	385	< 0.01	< 0.01	< 0.01	0.15	0.4	0.4	0.2	<0.01	0.04	17.2	17.1	0.31	542

Appendix I Important Information Relating to this Report

HELIDON TO CALVERT ENVIRONMENTAL IMPACT STATEMENT



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