

Appendix C. Geotechnical laboratory testing certificates

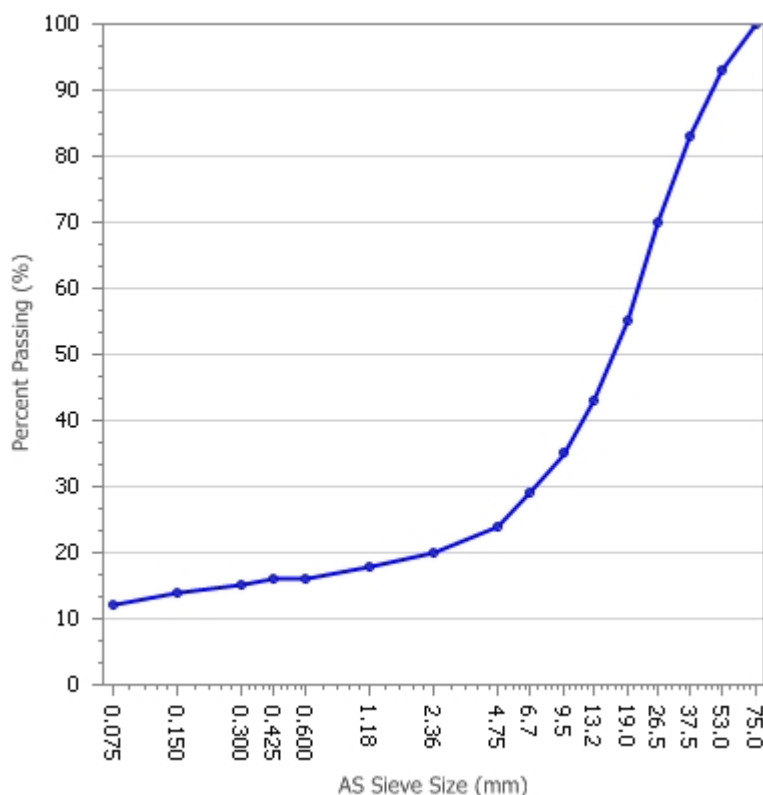
PARTICLE SIZE DISTRIBUTION REPORT

Client:	JACOBS	Report Number:	10823/R/16966-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	25/02/2016 Page 1 of 6

Test Procedures:	AS1289.3.6.1		
Sample Number	10823/S/101019	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP01
Date Sampled	13/02/2016	1.3 - 1.5m	
Sampled By	Client Sampled		
Date Tested	18/02/2016		
Material Source	Insitu	Material Type	Existing

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
75.0		100	
53.0		93	
37.5		83	
26.5		70	
19.0		55	
13.2		43	
9.5		35	
6.7		29	
4.75		24	
2.36		20	
1.18		18	
0.600		16	
0.425		16	
0.300		15	
0.150		14	
0.075		12	
Grading Result Analysis			
0.075/0.425 Ratio		0.75	
D10 (mm)		-	
D60 (mm)		21.72	
UC (D60/D10)		-	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks


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

 Accreditation Number: 1986
 Corporate Site Number: 10823



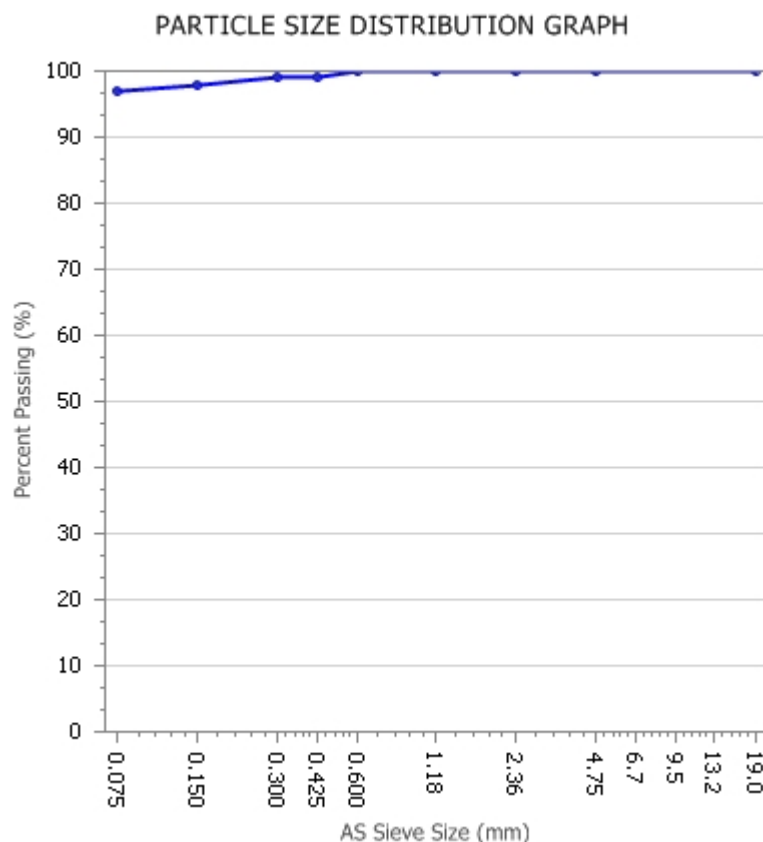
 Approved Signatory: Alexander Matthew
 Form ID: W9UCRep Rev 1

PARTICLE SIZE DISTRIBUTION REPORT

Client:	JACOBS	Report Number:	10823/R/17208-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 1 of 4

Test Procedures:	AS1289.3.6.1		
Sample Number	10823/S/101020	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP02
Date Sampled	13/02/2016	1.60 - 1.8m	
Sampled By	Client Sampled		
Date Tested	1/03/2016		
Material Source	Insitu	Material Type	Existing

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
19.0		100	
4.75		100	
2.36		100	
1.18		100	
0.600		100	
0.425		99	
0.300		99	
0.150		98	
0.075		97	
Grading Result Analysis			
0.075/0.425 Ratio		0.98	
D10 (mm)		-	
D60 (mm)		-	
UC (D60/D10)		-	



Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



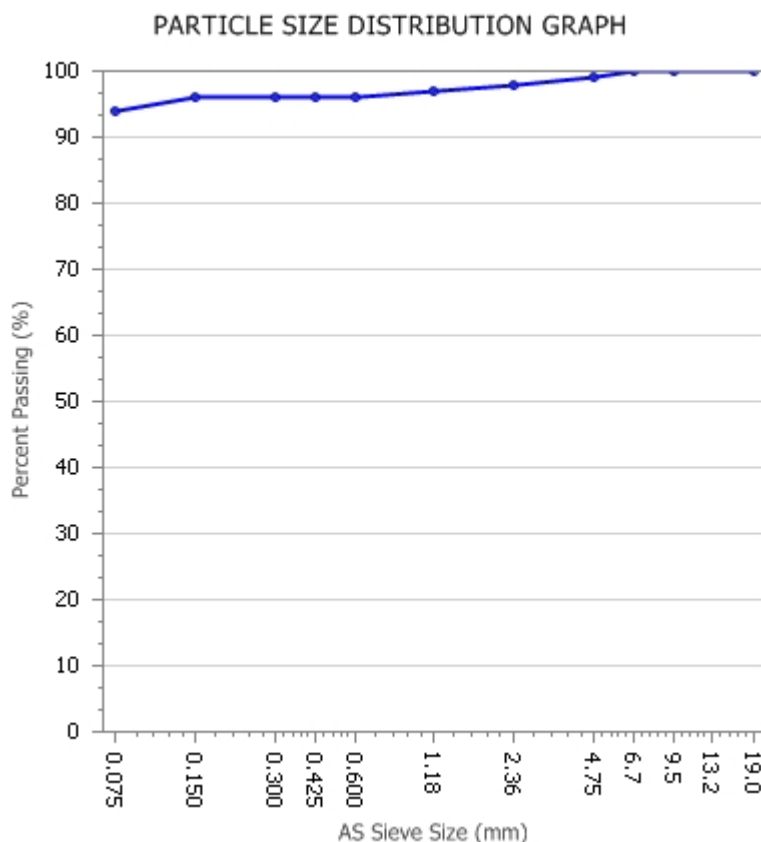
Approved Signatory: Alexander Matthew
 Form ID: W9UCRep Rev 1

PARTICLE SIZE DISTRIBUTION REPORT

Client:	JACOBS	Report Number:	10823/R/16966-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	25/02/2016 Page 2 of 6

Test Procedures:	AS1289.3.6.1		
Sample Number	10823/S/101021	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP03
Date Sampled	13/02/2016	0.8 - 1.0m	
Sampled By	Client Sampled		
Date Tested	22/02/2016		
Material Source	Insitu	Material Type	Existing

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
19.0		100	
9.5		100	
6.7		100	
4.75		99	
2.36		98	
1.18		97	
0.600		96	
0.425		96	
0.300		96	
0.150		96	
0.075		94	
Grading Result Analysis			
0.075/0.425 Ratio		0.98	
D10 (mm)		-	
D60 (mm)		-	
UC (D60/D10)		-	



Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



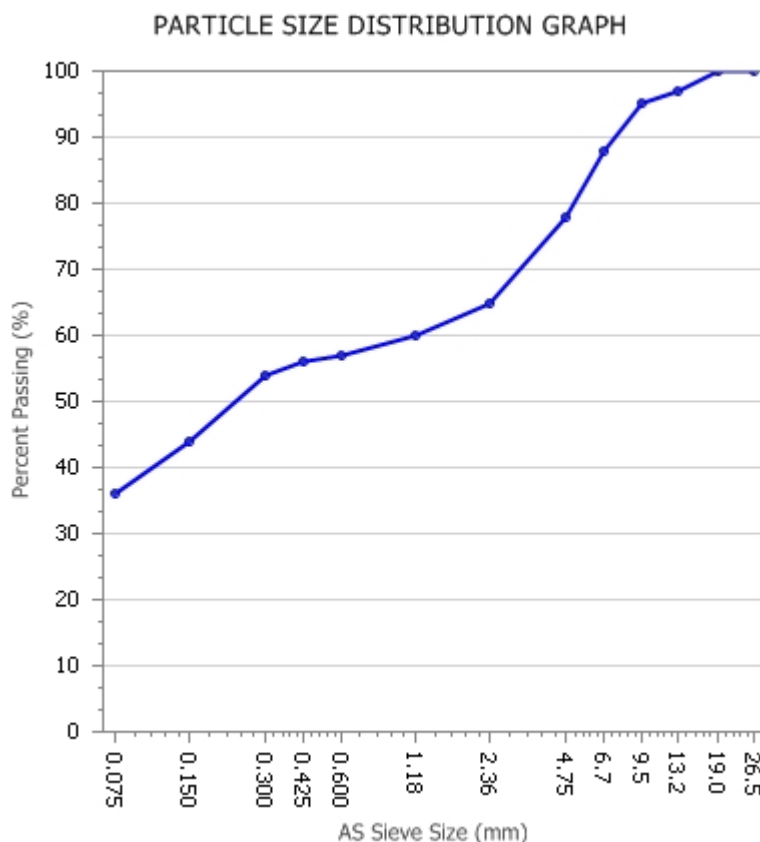
Approved Signatory: Alexander Matthew
 Form ID: W9UCRep Rev 1

PARTICLE SIZE DISTRIBUTION REPORT

Client:	JACOBS	Report Number:	10823/R/17208-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 2 of 4

Test Procedures:	AS1289.3.6.1		
Sample Number	10823/S/101023	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP06
Date Sampled	13/02/2016	1.0 - 1.2m	
Sampled By	Client Sampled		
Date Tested	1/03/2016		
Material Source	Insitu	Material Type	Existing

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
26.5		100	
19.0		100	
13.2		97	
9.5		95	
6.7		88	
4.75		78	
2.36		65	
1.18		60	
0.600		57	
0.425		56	
0.300		54	
0.150		44	
0.075		36	
Grading Result Analysis			
0.075/0.425 Ratio		0.64	
D10 (mm)		-	
D60 (mm)		1.24	
UC (D60/D10)		-	



Remarks

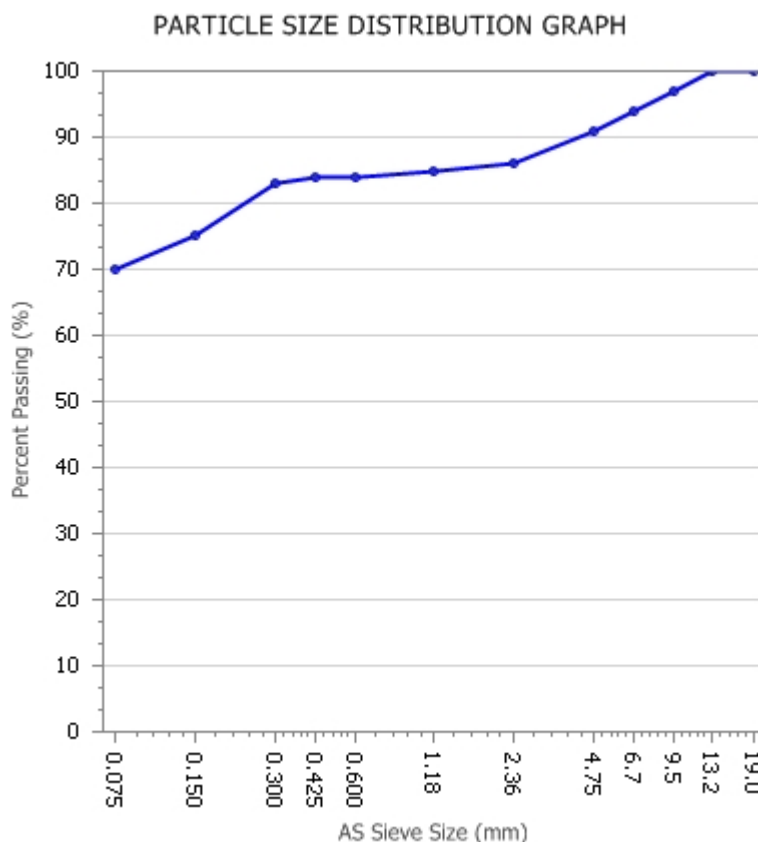
 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W9UCRep Rev 1
--	--

PARTICLE SIZE DISTRIBUTION REPORT

Client:	JACOBS	Report Number:	10823/R/17208-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 3 of 4

Test Procedures:	AS1289.3.6.1		
Sample Number	10823/S/101025	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP08
Date Sampled	13/02/2016	1.3m - 1.5m	
Sampled By	Client Sampled		
Date Tested	22/02/2016		
Material Source	Insitu	Material Type	Existing

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
19.0		100	
13.2		100	
9.5		97	
6.7		94	
4.75		91	
2.36		86	
1.18		85	
0.600		84	
0.425		84	
0.300		83	
0.150		75	
0.075		70	
Grading Result Analysis			
0.075/0.425 Ratio		0.83	
D10 (mm)		-	
D60 (mm)		-	
UC (D60/D10)		-	



Remarks

 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W9UCRep Rev 1
--	--

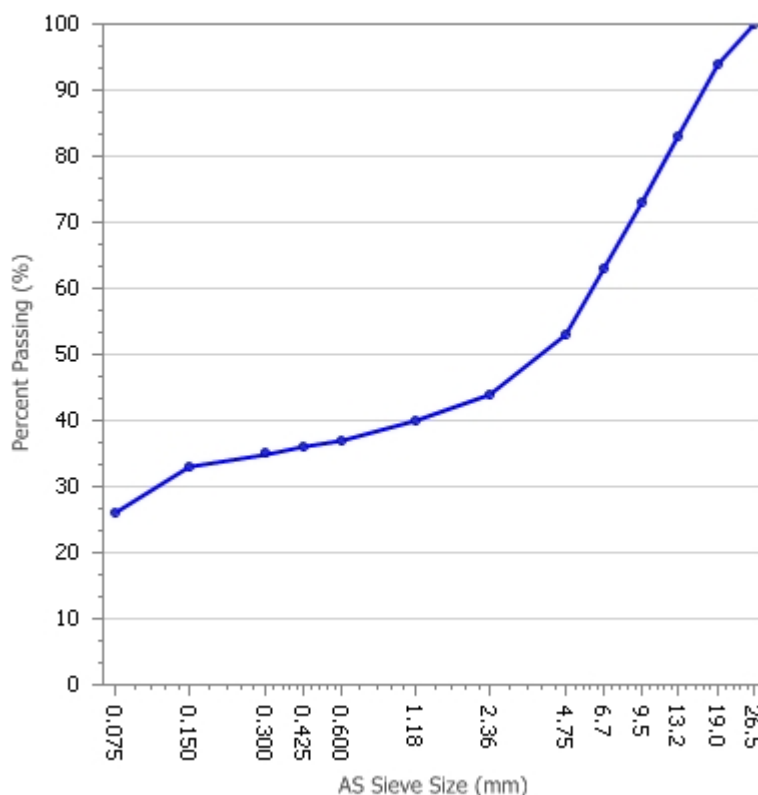
PARTICLE SIZE DISTRIBUTION REPORT

Client:	JACOBS	Report Number:	10823/R/16966-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	25/02/2016 Page 4 of 6

Test Procedures:		AS1289.3.6.1	
Sample Number	10823/S/101026	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP09
Date Sampled	13/02/2016	1.1 - 1.3m	
Sampled By	Client Sampled		
Date Tested	22/02/2016		
Material Source	Insitu	Material Type	Existing

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
26.5		100	
19.0		94	
13.2		83	
9.5		73	
6.7		63	
4.75		53	
2.36		44	
1.18		40	
0.600		37	
0.425		36	
0.300		35	
0.150		33	
0.075		26	
Grading Result Analysis			
0.075/0.425 Ratio		0.72	
D10 (mm)		-	
D60 (mm)		6.11	
UC (D60/D10)		-	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



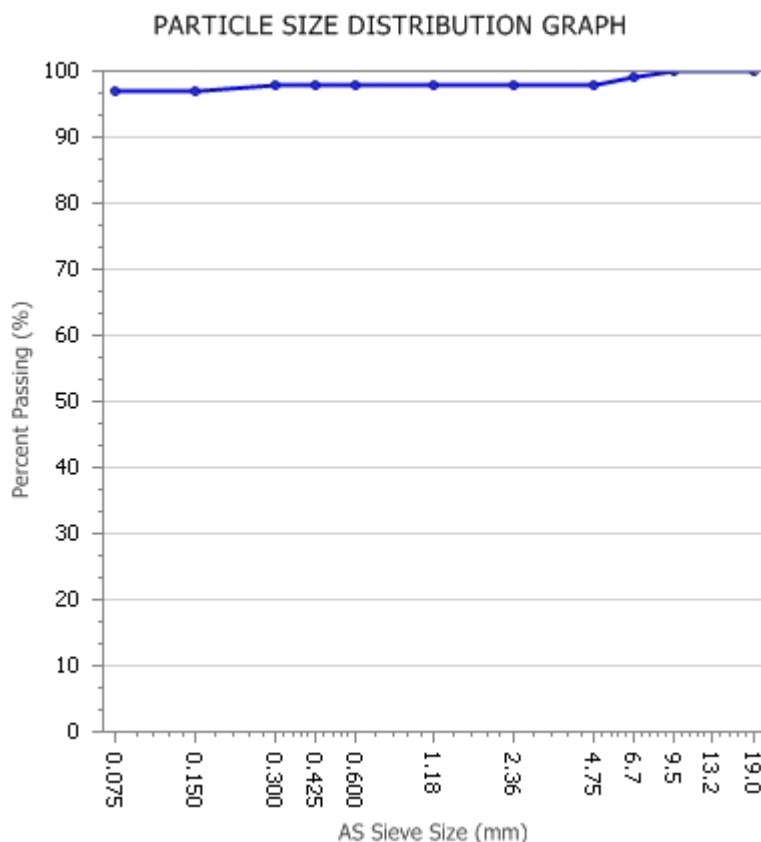
Approved Signatory: Alexander Matthew
 Form ID: W9UCRep Rev 1

PARTICLE SIZE DISTRIBUTION REPORT

Client:	JACOBS	Report Number:	10823/R/16966-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	25/02/2016 Page 5 of 6

Test Procedures:	AS1289.3.6.1		
Sample Number	10823/S/101027	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.4	Test Pit	m GPTP10
Date Sampled	13/02/2016	1.1 - 1.3m	
Sampled By	Client Sampled		
Date Tested	23/02/2016		
Material Source	Insitu	Material Type	Existing

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
19.0		100	
9.5		100	
6.7		99	
4.75		98	
2.36		98	
1.18		98	
0.600		98	
0.425		98	
0.300		98	
0.150		97	
0.075		97	
Grading Result Analysis			
0.075/0.425 Ratio		0.99	
D10 (mm)		-	
D60 (mm)		-	
UC (D60/D10)		-	



Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



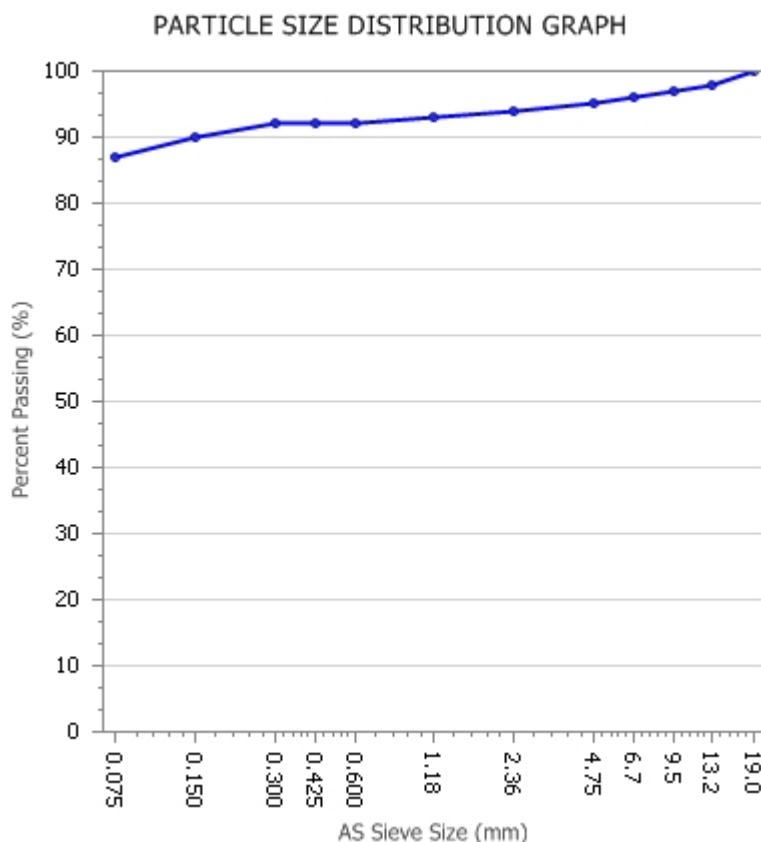
Approved Signatory: Alexander Matthew
 Form ID: W9UCRep Rev 1

PARTICLE SIZE DISTRIBUTION REPORT

Client:	JACOBS	Report Number:	10823/R/17208-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 4 of 4

Test Procedures:	AS1289.3.6.1		
Sample Number	10823/S/101029	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP12
Date Sampled	13/02/2016	1.0 - 1.2m	
Sampled By	Client Sampled		
Date Tested	1/03/2016		
Material Source	Insitu	Material Type	Existing

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
19.0		100	
13.2		98	
9.5		97	
6.7		96	
4.75		95	
2.36		94	
1.18		93	
0.600		92	
0.425		92	
0.300		92	
0.150		90	
0.075		87	
Grading Result Analysis			
0.075/0.425 Ratio		0.95	
D10 (mm)		-	
D60 (mm)		-	
UC (D60/D10)		-	



Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



Approved Signatory: Alexander Matthew
 Form ID: W9UCRep Rev 1

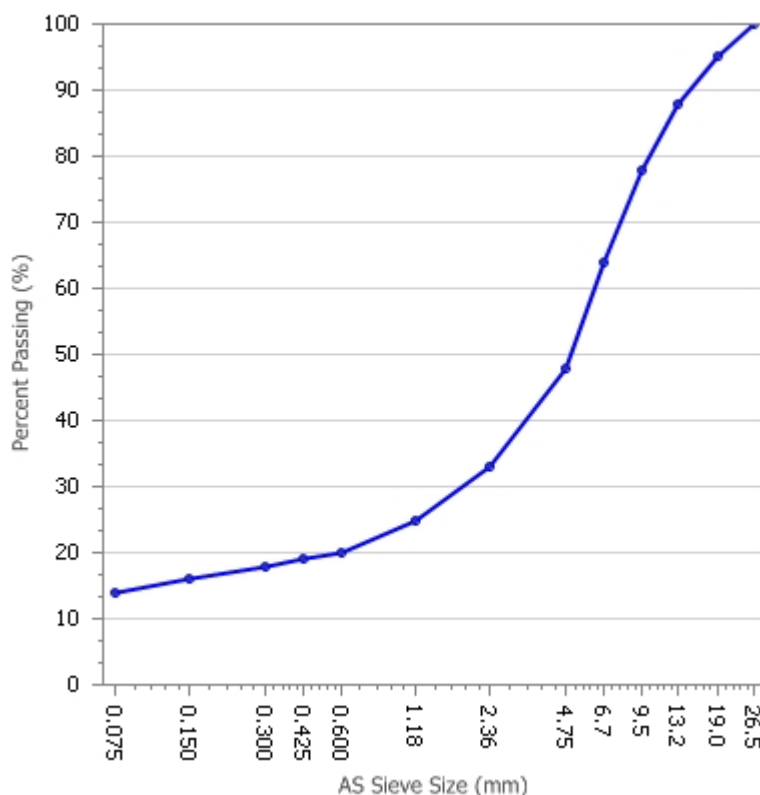
PARTICLE SIZE DISTRIBUTION REPORT

Client:	JACOBS	Report Number:	10823/R/16966-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	25/02/2016 Page 6 of 6

Test Procedures:	AS1289.3.6.1		
Sample Number	10823/S/101031	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP14
Date Sampled	13/02/2016	1.3 - 1.5m	
Sampled By	Client Sampled		
Date Tested	22/02/2016		
Material Source	Insitu	Material Type	Existing

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
26.5		100	
19.0		95	
13.2		88	
9.5		78	
6.7		64	
4.75		48	
2.36		33	
1.18		25	
0.600		20	
0.425		19	
0.300		18	
0.150		16	
0.075		14	
Grading Result Analysis			
0.075/0.425 Ratio		0.74	
D10 (mm)		-	
D60 (mm)		6.17	
UC (D60/D10)		-	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



Approved Signatory: Alexander Matthew
 Form ID: W9UCRep Rev 1

ATTERBERG LIMITS REPORT

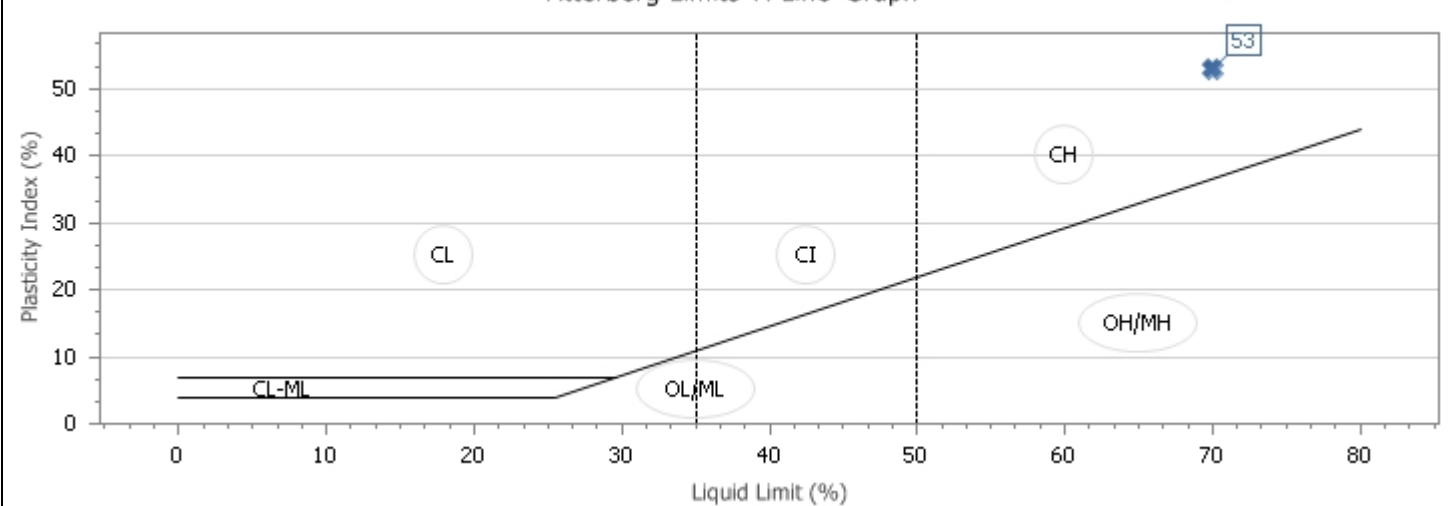
Client:	JACOBS	Report Number:	10823/R/17209-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 1 of 4

Test Procedures:	AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	10823/S/101020	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP02
Date Sampled	13/02/2016		1.60 - 1.8m
Sampled By	Client Sampled		
Date Tested	4/03/2016		
Att. Drying Method	Oven Dried	Material Source	Insitu
Atterberg Preparation	Dry Sieved	Material Type	Existing
Material Description	silty clay,light brown		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		70	
Plastic Limit (%)		17	
Plasticity Index (%)		53	
Linear Shrinkage (%)		21.0	
Linear Shrinkage Defects:	-		

Atterberg Limits 'A-Line' Graph



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



Approved Signatory: Alexander Matthew
 Form ID: W11Rep Rev 1

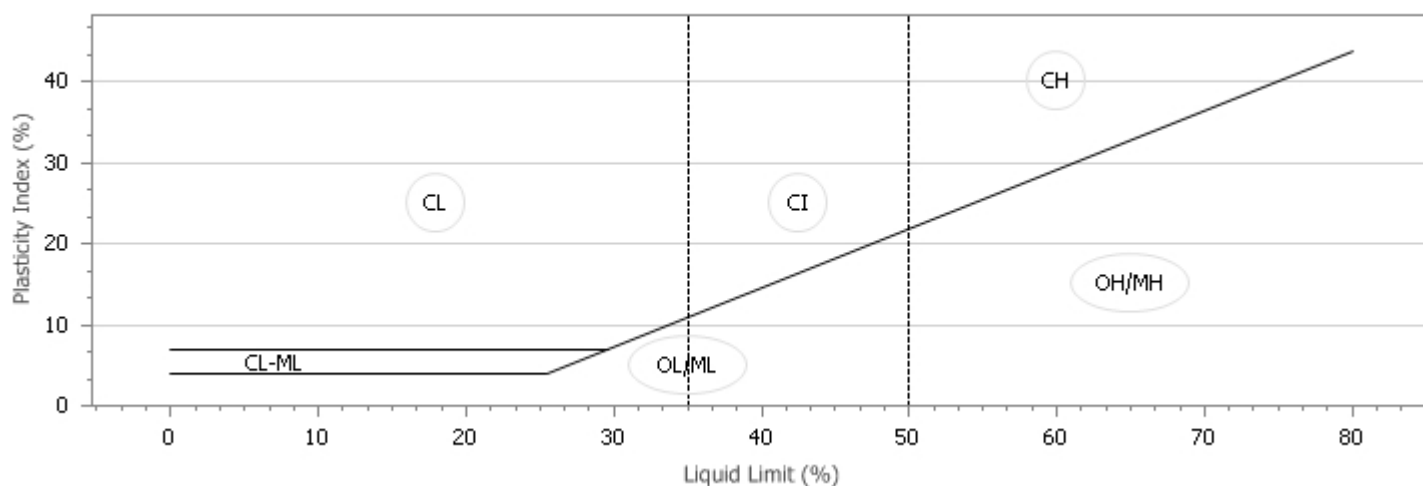
ATTERBERG LIMITS REPORT

Client:	JACOBS	Report Number:	10823/R/16968-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	25/02/2016 Page 1 of 4

Test Procedures:	AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	10823/S/101021	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP03
Date Sampled	13/02/2016		0.8 - 1.0m
Sampled By	Client Sampled		
Date Tested	24/02/2016		
Att. Drying Method	Air Dried	Material Source	Insitu
Atterberg Preparation	Dry Sieved	Material Type	Existing
Material Description	-		

Atterberg Limits Results			
Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		92	
Plastic Limit (%)		18	
Plasticity Index (%)		74	
Linear Shrinkage (%)		19.0	
Linear Shrinkage Defects:	-		

Atterberg Limits 'A-Line' Graph



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



Approved Signatory: Alexander Matthew
 Form ID: W11Rep Rev 1

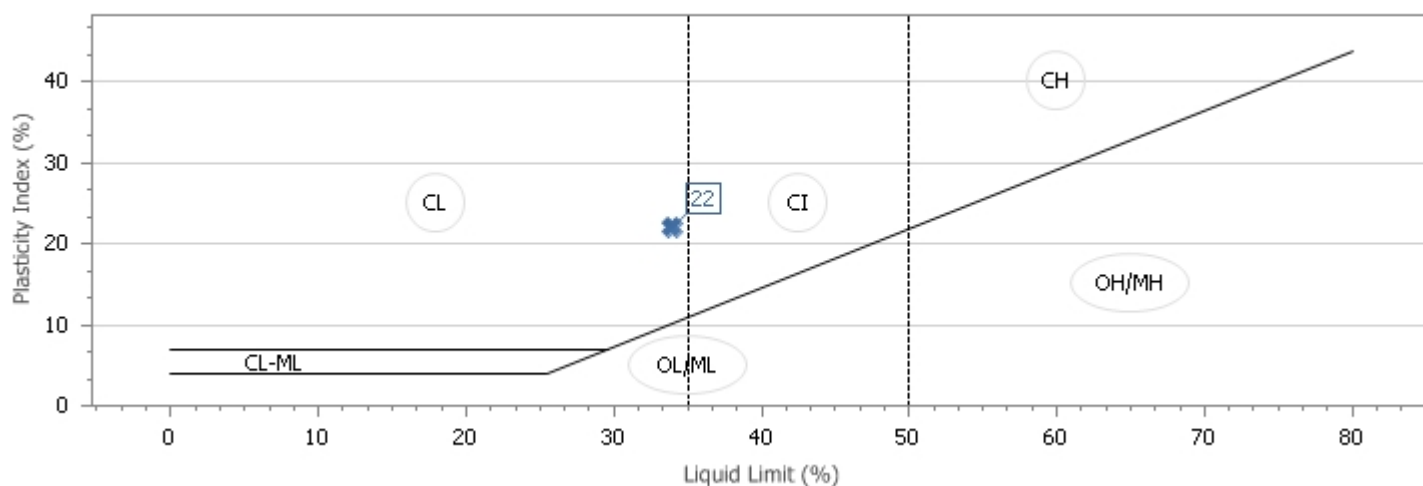
ATTERBERG LIMITS REPORT

Client:	JACOBS	Report Number:	10823/R/17209-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 2 of 4

Test Procedures:	AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	10823/S/101023	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTPO6
Date Sampled	13/02/2016		1.0 - 1.2m
Sampled By	Client Sampled		
Date Tested	4/03/2016		
Att. Drying Method	Oven Dried	Material Source	Insitu
Atterberg Preparation	Dry Sieved	Material Type	Existing
Material Description	gravelly clay		

Atterberg Limits Results			
Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		34	
Plastic Limit (%)		12	
Plasticity Index (%)		22	
Linear Shrinkage (%)		12.0	
Linear Shrinkage Defects:	-		

Atterberg Limits 'A-Line' Graph



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks


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

 Accreditation Number: 1986
 Corporate Site Number: 10823



 Approved Signatory: Alexander Matthew
 Form ID: W11Rep Rev 1

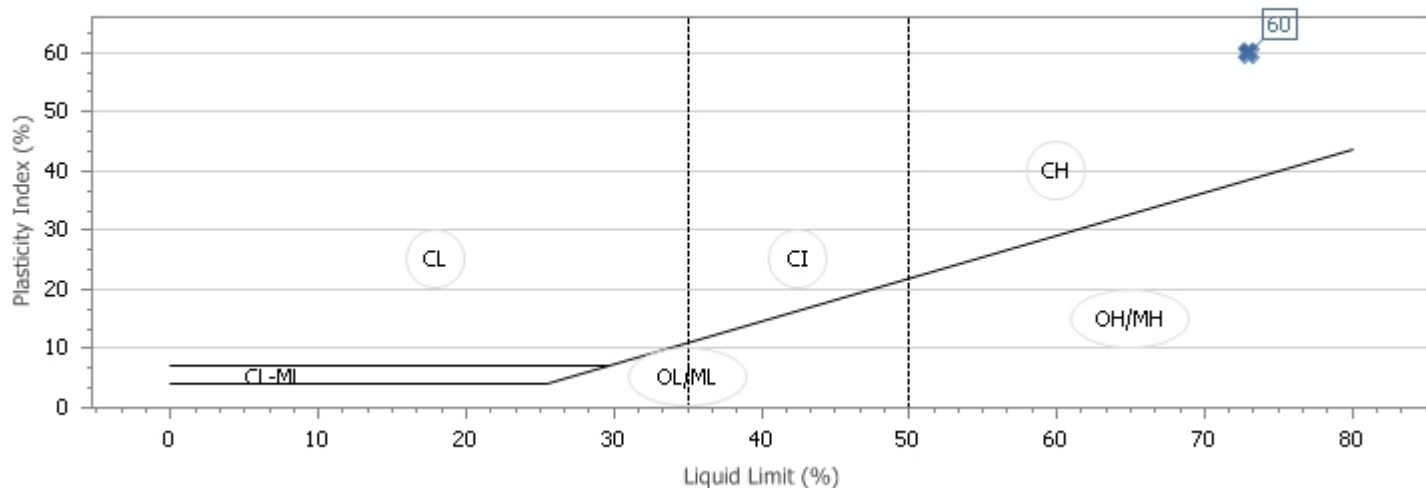
ATTERBERG LIMITS REPORT

Client:	JACOBS	Report Number:	10823/R/17209-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 3 of 4

Test Procedures:	AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	10823/S/101025	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTPO8
Date Sampled	13/02/2016		1.3m - 1.5m
Sampled By	Client Sampled		
Date Tested	23/02/2016		
Att. Drying Method	Oven Dried	Material Source	Insitu
Atterberg Preparation	Dry Sieved	Material Type	Existing
Material Description	silty CLAY,light brown		

Atterberg Limits Results			
Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		73	
Plastic Limit (%)		13	
Plasticity Index (%)		60	
Linear Shrinkage (%)		16.5	
Linear Shrinkage Defects:	Curling		

Atterberg Limits 'A-Line' Graph



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



Approved Signatory: Alexander Matthew
 Form ID: W11Rep Rev 1

ATTERBERG LIMITS REPORT

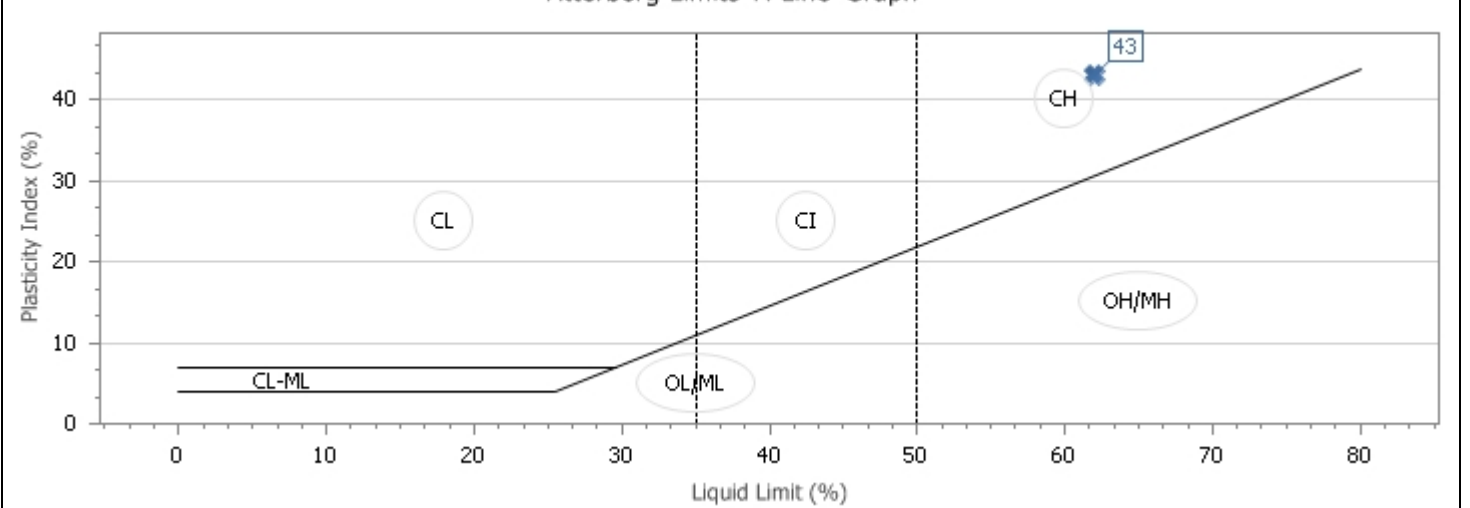
Client:	JACOBS	Report Number:	10823/R/16968-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	25/02/2016 Page 3 of 4

Test Procedures:	AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	10823/S/101027	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP10
Date Sampled	13/02/2016		1.1 - 1.3m
Sampled By	Client Sampled		
Date Tested	22/02/2016		
Att. Drying Method	Oven Dried	Material Source	Insitu
Atterberg Preparation	Dry Sieved	Material Type	Existing
Material Description	-		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		62	
Plastic Limit (%)		19	
Plasticity Index (%)		43	
Linear Shrinkage (%)		15.5	
Linear Shrinkage Defects:	curling and some cracking		

Atterberg Limits 'A-Line' Graph



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



Approved Signatory: Alexander Matthew
 Form ID: W11Rep Rev 1

ATTERBERG LIMITS REPORT

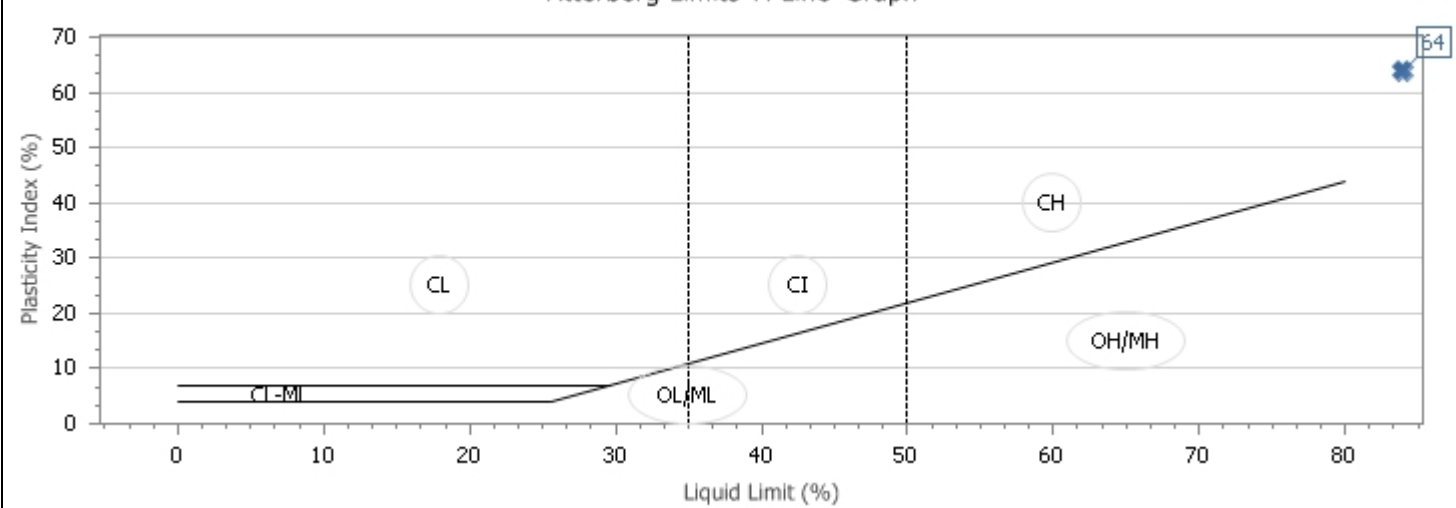
Client:	JACOBS	Report Number:	10823/R/17209-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 4 of 4

Test Procedures:	AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	10823/S/101029	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTP12
Date Sampled	13/02/2016		1.0 - 1.2m
Sampled By	Client Sampled		
Date Tested	8/03/2016		
Att. Drying Method	Oven Dried	Material Source	Insitu
Atterberg Preparation	Dry Sieved	Material Type	Existing
Material Description	silty clay,light brown/orange		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		84	
Plastic Limit (%)		20	
Plasticity Index (%)		64	
Linear Shrinkage (%)		20.0	
Linear Shrinkage Defects:	-		

Atterberg Limits 'A-Line' Graph



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823



Approved Signatory: Alexander Matthew
 Form ID: W11Rep Rev 1

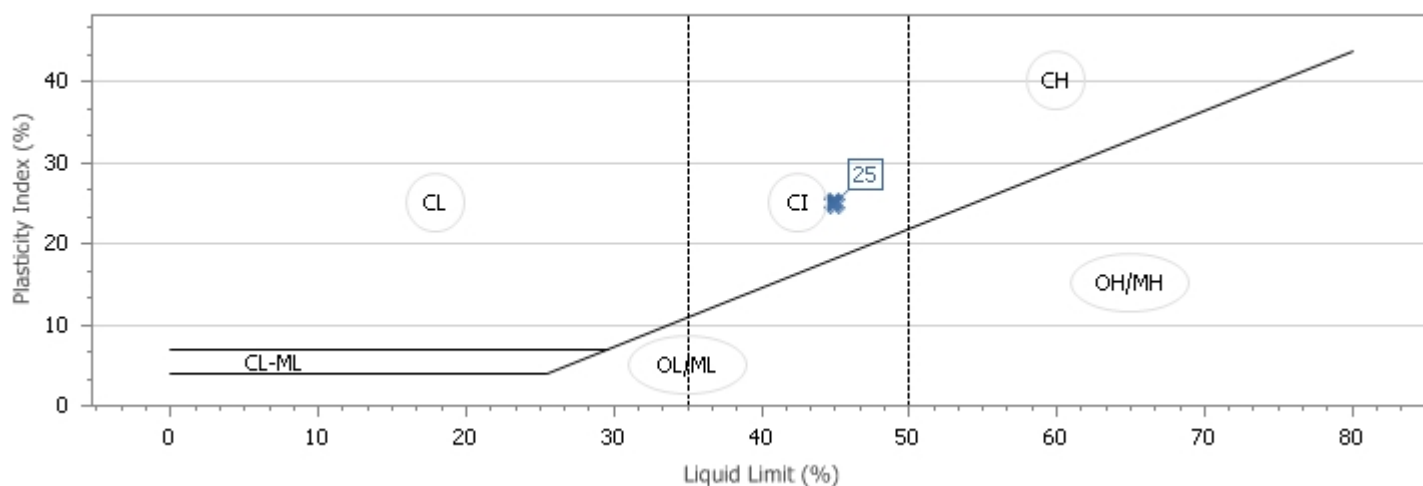
ATTERBERG LIMITS REPORT

Client:	JACOBS	Report Number:	10823/R/16968-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	25/02/2016 Page 4 of 4

Test Procedures:	AS1289.3.1.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	10823/S/101031	Sample Location	
Sampling Method	AS1289.1.2.1 CI 6.5.4	Test Pit	m GPTP14
Date Sampled	13/02/2016		1.3 - 1.5m
Sampled By	Client Sampled		
Date Tested	24/02/2016		
Att. Drying Method	Oven Dried	Material Source	Insitu
Atterberg Preparation	Dry Sieved	Material Type	Existing
Material Description	-		

Atterberg Limits Results			
Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		45	
Plastic Limit (%)		20	
Plasticity Index (%)		25	
Linear Shrinkage (%)		11.5	
Linear Shrinkage Defects:	Curling		

Atterberg Limits 'A-Line' Graph



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks



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

Accreditation Number: 1986
 Corporate Site Number: 10823

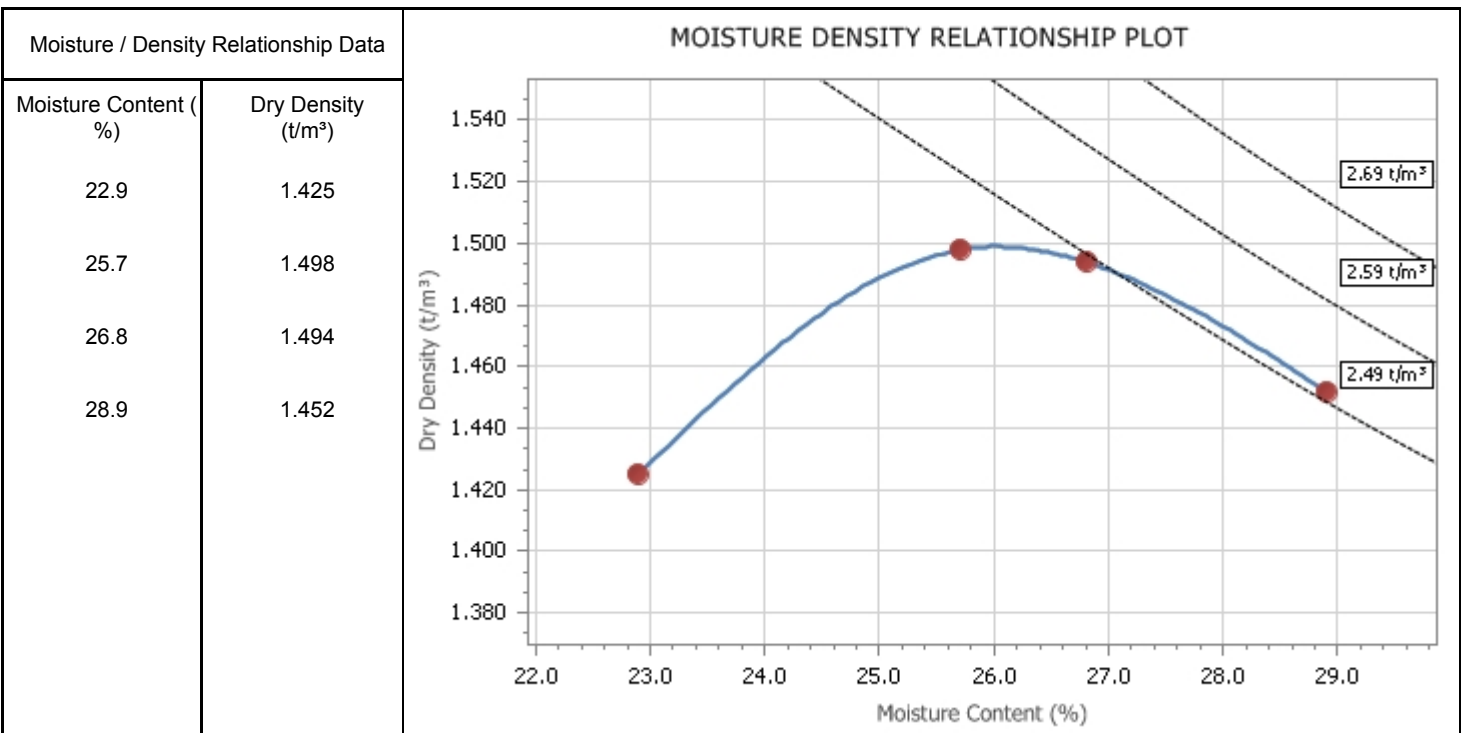


Approved Signatory: Alexander Matthew
 Form ID: W11Rep Rev 1

MOISTURE DENSITY RELATIONSHIP REPORT

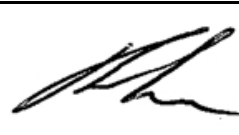
Client:	JACOBS	Report Number:	10823/R/17210-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 1 of 4

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	10823/S/101020	Test Pit	m GPTP02
Sampling Method	AS1289.1.2.1 CI 6.5.4		1.60 - 1.8m
Date Sampled	13/02/2016		
Sampled By	Client Sampled		
Date Tested	2/03/2016	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Existing	Percent Oversize (%)	0.0
Material Description	silty clay,light brown		



Maximum Dry Density (t/m³):	1.50	Optimum Moisture Content (%):	26.0
-----------------------------	------	-------------------------------	------

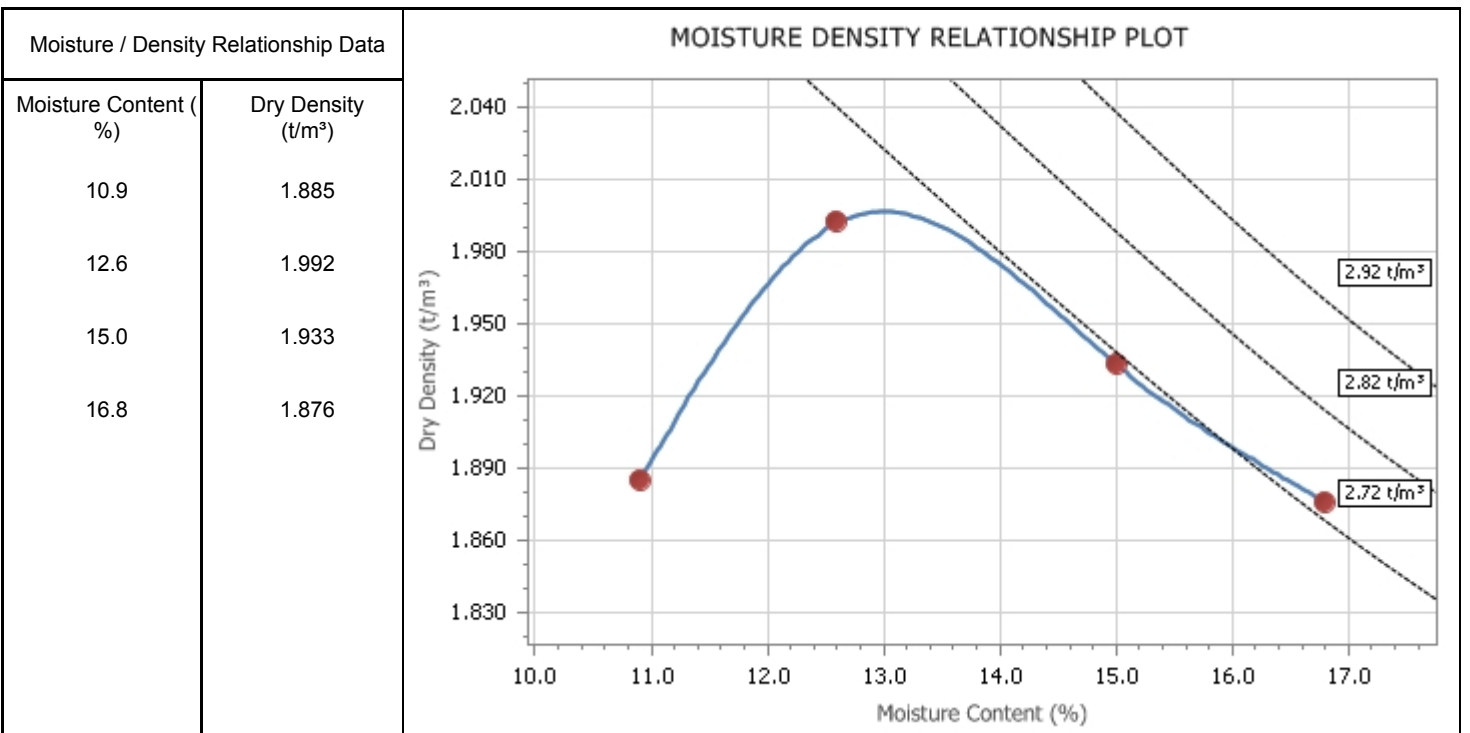
Remarks

 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W4Rep Rev 1
--	--

MOISTURE DENSITY RELATIONSHIP REPORT

Client:	JACOBS	Report Number:	10823/R/17210-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 2 of 4

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	10823/S/101023	Test Pit	m GPTP06
Sampling Method	AS1289.1.2.1 CI 6.5.4		1.0 - 1.2m
Date Sampled	13/02/2016		
Sampled By	Client Sampled		
Date Tested	2/03/2016	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Existing	Percent Oversize (%)	0.0
Material Description	gravelly clay		



Maximum Dry Density (t/m ³):	2.00	Optimum Moisture Content (%):	13.0
--	------	-------------------------------	------

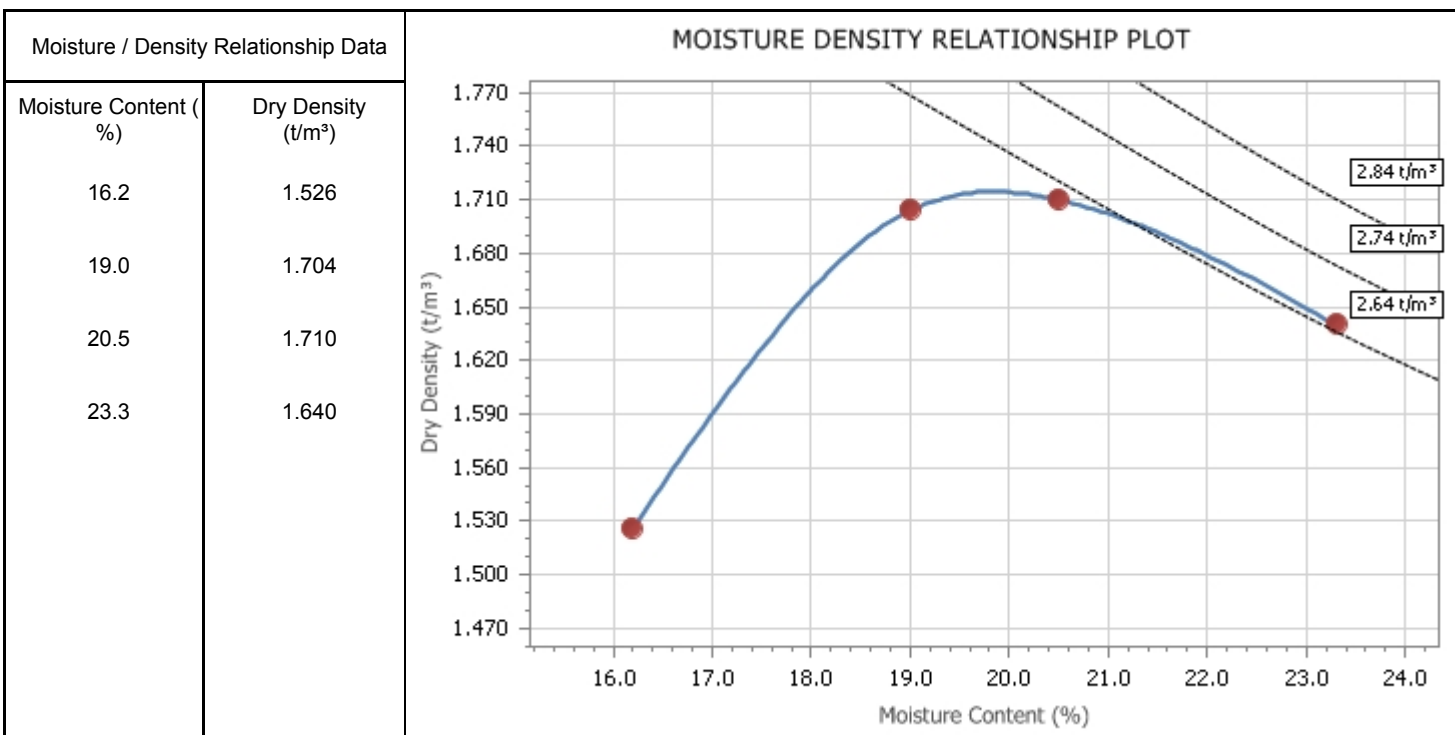
Remarks

 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W4Rep Rev 1
--	--

MOISTURE DENSITY RELATIONSHIP REPORT

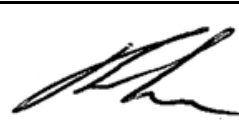
Client:	JACOBS	Report Number:	10823/R/17210-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 3 of 4

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	10823/S/101025	Test Pit	m GPTP08
Sampling Method	AS1289.1.2.1 CI 6.5.4		1.3m - 1.5m
Date Sampled	13/02/2016		
Sampled By	Client Sampled		
Date Tested	2/03/2016	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Existing	Percent Oversize (%)	0.0
Material Description	silty CLAY,light brown		



Maximum Dry Density (t/m³):	1.72	Optimum Moisture Content (%):	20.0
-----------------------------	------	-------------------------------	------

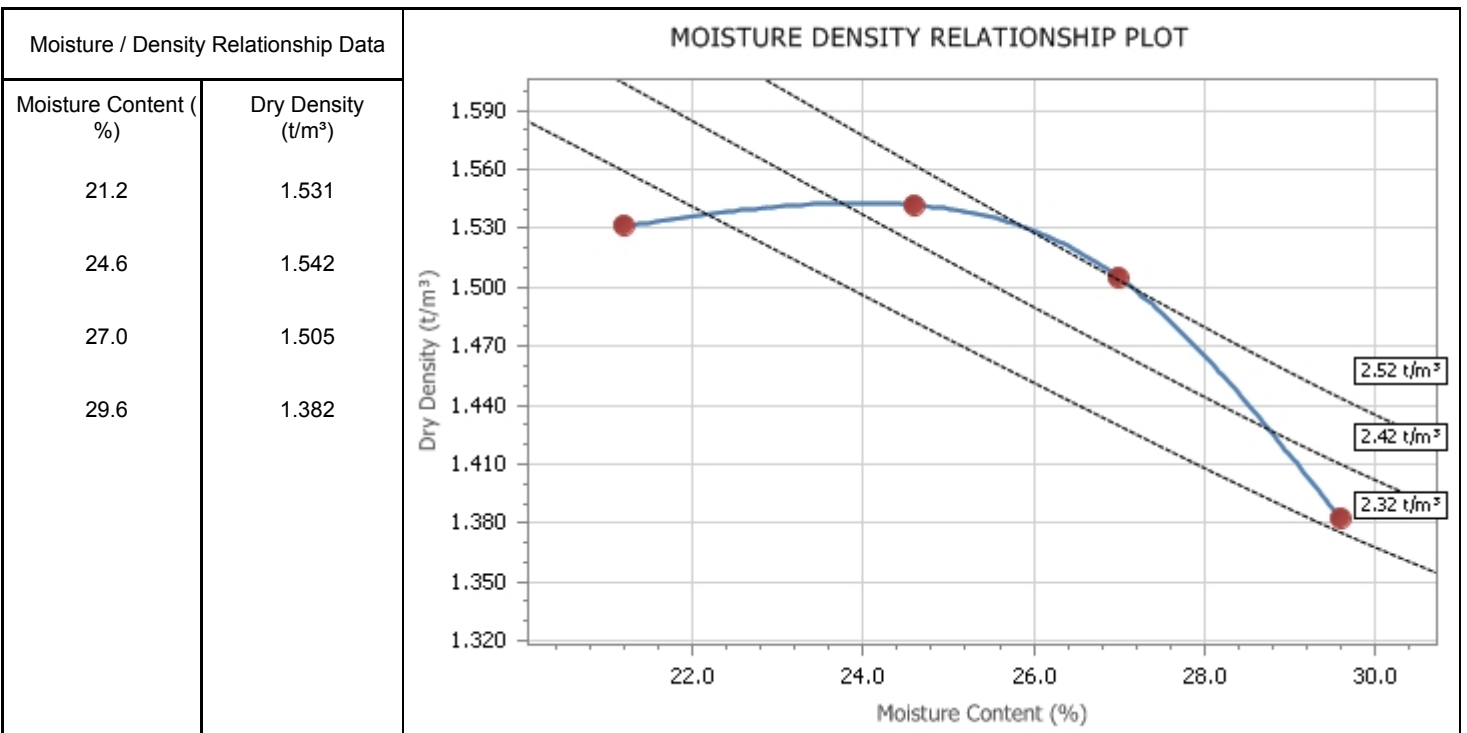
Remarks

 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W4Rep Rev 1
--	--

MOISTURE DENSITY RELATIONSHIP REPORT

Client:	JACOBS	Report Number:	10823/R/17210-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 4 of 4

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	10823/S/101029	Test Pit	m GPTP12
Sampling Method	AS1289.1.2.1 CI 6.5.4		1.0 - 1.2m
Date Sampled	13/02/2016		
Sampled By	Client Sampled		
Date Tested	2/03/2016	Compactive Effort	Standard
Material Source	Insitu	Fraction Tested (mm)	< 19.0mm
Material Type	Existing	Percent Oversize (%)	0.0
Material Description	silty clay,light brown/orange		



Maximum Dry Density (t/m ³):	1.54	Optimum Moisture Content (%):	24.0
--	------	-------------------------------	------

Remarks

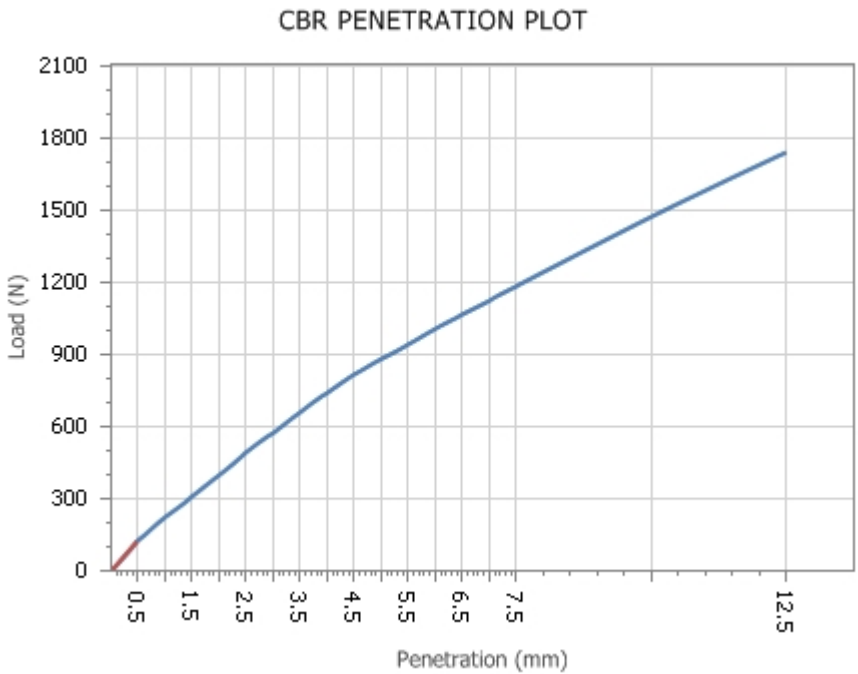
 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W4Rep Rev 1
--	--

CALIFORNIA BEARING RATIO REPORT

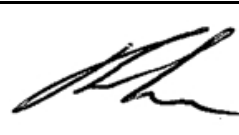
Client:	JACOBS	Report Number:	10823/R/17078-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	2/03/2016 Page 1 of 4

Test Procedures	AS1289.6.1.1, AS1289.5.2.1, AS1289.2.1.1		
Sample Number	10823/S/101019	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTP01
Date Sampled	13/02/2016		1.3 - 1.5m
Sampled By	Client Sampled		
Date Tested	9/02/2016		
Material Source	Insitu	Material Limit Start	-
Material Type	Existing	Material Limit End	-
Client Reference	-	Compactive Effort	Modified

Material Description	-
----------------------	---

Maximum Dry Density (t/m³):	1.90	
Optimum Moisture Content (%):	13.0	
Field Moisture Content (%):	-	
Sample Percent Oversize (%):	16.0	
Oversize Included / Excluded	Excluded	
Target Density Ratio (%):	98	
Target Moisture Ratio (%):	100	
Placement Dry Density (t/m³):	1.86	
Placement Dry Density Ratio (%):	98.0	
Placement Moisture Content (%):	13.1	
Placement Moisture Ratio (%):	101.0	
Test Condition / Soaking Period:	Soaked / 4 Days	
CBR Surcharge (kg)	4.5	
Dry Density After Soak (t/m³):	1.76	
Moisture (top 30mm) After Soak (%):	26.9	
Moisture (remainder) After Soak (%):	19.0	
CBR Swell (%):	6.0	
Minimum CBR Specification (%):	-	
CBR Value @ 5.0mm (%):	4.5	

Remarks	Modified Compaction as requested by client
---------	--

 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W7Rep Rev 1
--	--

CALIFORNIA BEARING RATIO REPORT

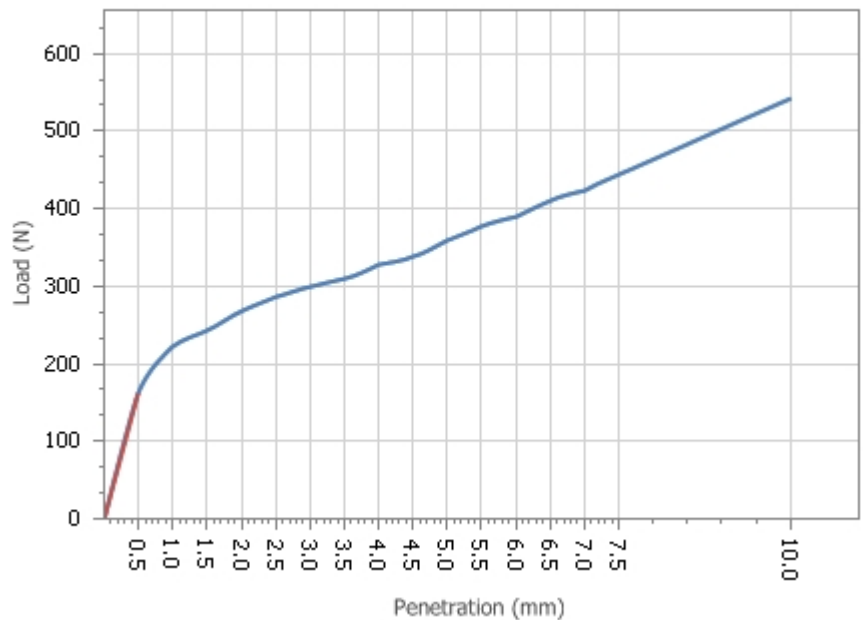
Client:	JACOBS	Report Number:	10823/R/17211-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 1 of 4

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1		
Sample Number	10823/S/101020	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTPO2
Date Sampled	13/02/2016		1.60 - 1.8m
Sampled By	Client Sampled		
Date Tested	8/03/2016		
Material Source	Insitu	Material Limit Start	-
Material Type	Existing	Material Limit End	-
Client Reference	Testing from 1.3.16	Compactive Effort	Standard

Material Description silty clay,light brown

Maximum Dry Density (t/m³):	1.50
Optimum Moisture Content (%):	26.0
Field Moisture Content (%):	-
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	98
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.47
Placement Dry Density Ratio (%):	98.0
Placement Moisture Content (%):	26.1
Placement Moisture Ratio (%):	100.5
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.40
Moisture (top 30mm) After Soak (%)	41.0
Moisture (remainder) After Soak (%)	29.6
CBR Swell (%):	5.0
Minimum CBR Specification (%):	-
CBR Value @ 2.5mm (%):	2.0

CBR PENETRATION PLOT



Remarks


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

 Accreditation Number: 1986
 Corporate Site Number: 10823



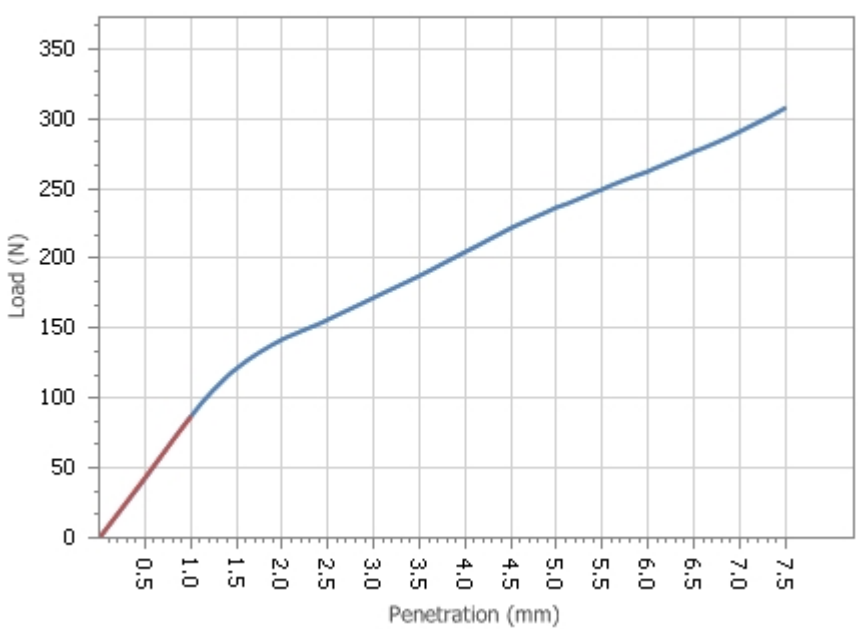
 Approved Signatory: Alexander Matthew
 Form ID: W7Rep Rev 1

CALIFORNIA BEARING RATIO REPORT

Client:	JACOBS	Report Number:	10823/R/17078-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	2/03/2016 Page 2 of 4

Test Procedures	AS1289.6.1.1, AS1289.5.2.1, AS1289.2.1.1		
Sample Number	10823/S/101021	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTP03
Date Sampled	13/02/2016		0.8 - 1.0m
Sampled By	Client Sampled		
Date Tested	26/02/2016		
Material Source	Insitu	Material Limit Start	-
Material Type	Existing	Material Limit End	-
Client Reference	-	Compactive Effort	Modified

Material Description	-
----------------------	---

Maximum Dry Density (t/m³):	1.70	
Optimum Moisture Content (%):	20.0	
Field Moisture Content (%):	-	
Sample Percent Oversize (%)	0.0	
Oversize Included / Excluded	Excluded	
Target Density Ratio (%):	98	
Target Moisture Ratio (%):	100	
Placement Dry Density (t/m³):	1.66	
Placement Dry Density Ratio (%):	98.0	
Placement Moisture Content (%):	19.9	
Placement Moisture Ratio (%):	100.0	
Test Condition / Soaking Period:	Soaked / 4 Days	
CBR Surcharge (kg)	4.5	
Dry Density After Soak (t/m³):	1.57	
Moisture (top 30mm) After Soak (%)	37.2	
Moisture (remainder) After Soak (%)	23.4	
CBR Swell (%):	5.5	
Minimum CBR Specification (%):	-	
CBR Value @ 5.0mm (%):	1.0	

Remarks	Modified Compaction as requested by client
---------	--

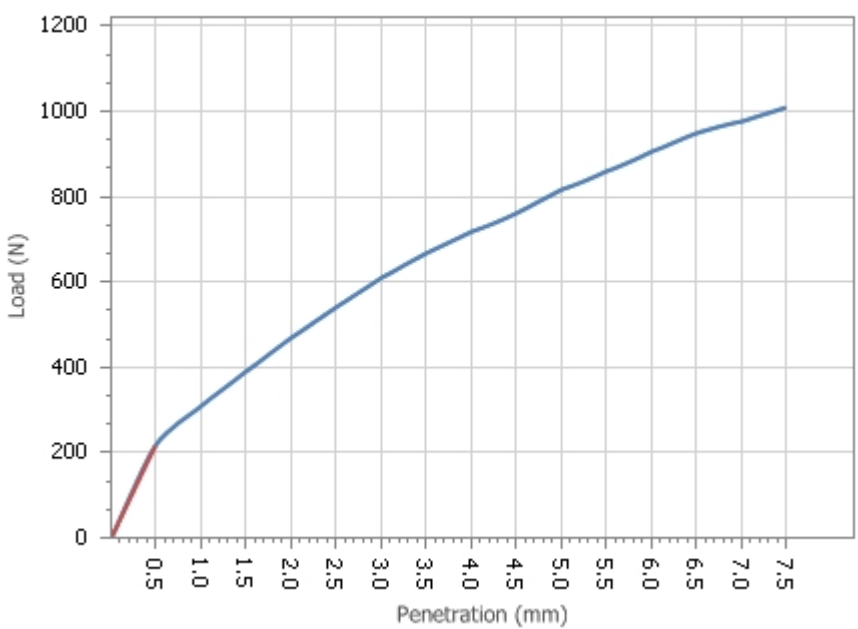
 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W7Rep Rev 1
--	--

CALIFORNIA BEARING RATIO REPORT

Client:	JACOBS	Report Number:	10823/R/17211-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 2 of 4

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1		
Sample Number	10823/S/101023	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTPO6
Date Sampled	13/02/2016		1.0 - 1.2m
Sampled By	Client Sampled		
Date Tested	7/03/2016		
Material Source	Insitu	Material Limit Start	-
Material Type	Existing	Material Limit End	-
Client Reference	Testing from 1.3.16	Compactive Effort	Standard

Material Description	gravelly clay
----------------------	---------------

Maximum Dry Density (t/m³):	2.00	
Optimum Moisture Content (%):	13.0	
Field Moisture Content (%):	-	
Sample Percent Oversize (%)	0.0	
Oversize Included / Excluded	Excluded	
Target Density Ratio (%):	98	
Target Moisture Ratio (%):	100	
Placement Dry Density (t/m³):	1.95	
Placement Dry Density Ratio (%):	97.5	
Placement Moisture Content (%):	12.9	
Placement Moisture Ratio (%):	99.0	
Test Condition / Soaking Period:	Soaked / 4 Days	
CBR Surcharge (kg)	4.5	
Dry Density After Soak (t/m³):	1.93	
Moisture (top 30mm) After Soak (%)	16.0	
Moisture (remainder) After Soak (%)	14.8	
CBR Swell (%):	1.0	
Minimum CBR Specification (%):	-	
CBR Value @ 5.0mm (%):	4.0	

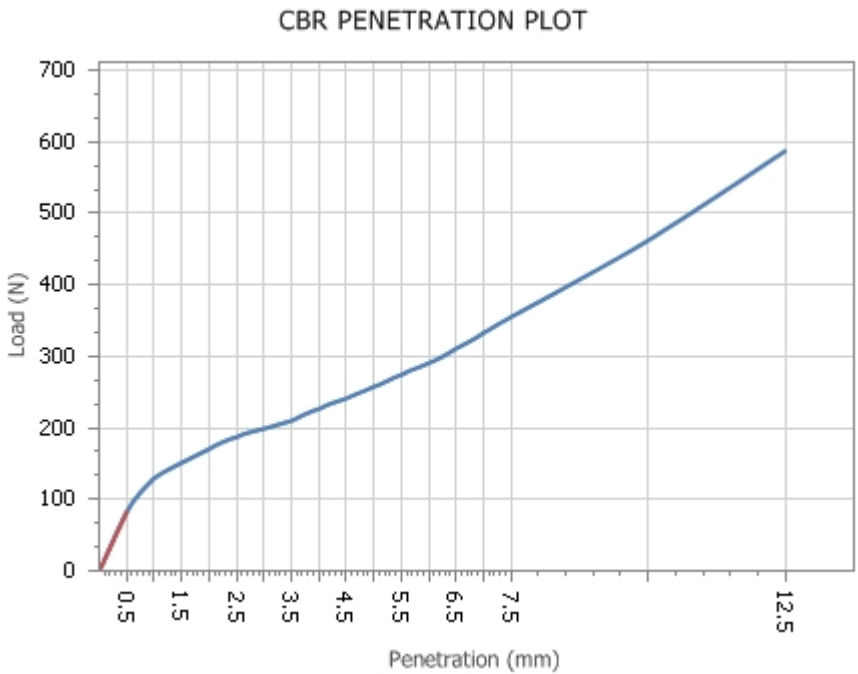
Remarks

 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W7Rev Rev 1
--	--

CALIFORNIA BEARING RATIO REPORT

Client:	JACOBS	Report Number:	10823/R/17211-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 3 of 4

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1		
Sample Number	10823/S/101025	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTPO8
Date Sampled	13/02/2016		1.3m - 1.5m
Sampled By	Client Sampled		
Date Tested	7/03/2016		
Material Source	Insitu	Material Limit Start	-
Material Type	Existing	Material Limit End	-
Client Reference	Testing from 1.3.16	Compactive Effort	Standard

Material Description	silty CLAY,light brown		
Maximum Dry Density (t/m³):	1.72		
Optimum Moisture Content (%):	20.0		
Field Moisture Content (%):	-		
Sample Percent Oversize (%)	0.0		
Oversize Included / Excluded	Excluded		
Target Density Ratio (%):	98		
Target Moisture Ratio (%):	100		
Placement Dry Density (t/m³):	1.69		
Placement Dry Density Ratio (%):	98.5		
Placement Moisture Content (%):	19.1		
Placement Moisture Ratio (%):	96.5		
Test Condition / Soaking Period:	Soaked / 4 Days		
CBR Surcharge (kg)	4.5		
Dry Density After Soak (t/m³):	1.57		
Moisture (top 30mm) After Soak (%)	16.0		
Moisture (remainder) After Soak (%)	14.8		
CBR Swell (%):	7.5		
Minimum CBR Specification (%):	-		
CBR Value @ 2.5mm (%):	1.5		

Remarks


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

 Accreditation Number: 1986
 Corporate Site Number: 10823



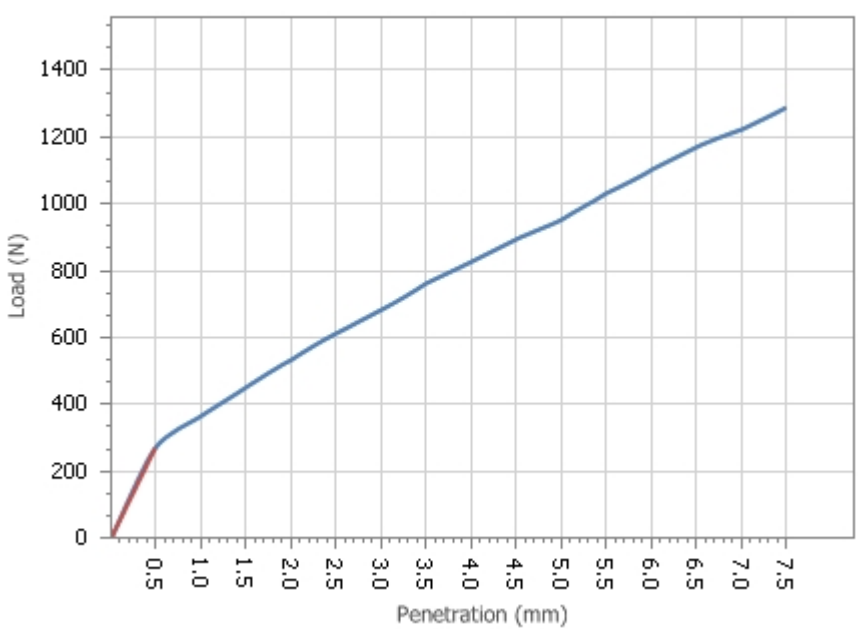
 Approved Signatory: Alexander Matthew
 Form ID: W7Rep Rev 1

CALIFORNIA BEARING RATIO REPORT

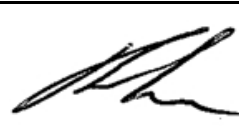
Client:	JACOBS	Report Number:	10823/R/17078-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	2/03/2016 Page 3 of 4

Test Procedures	AS1289.6.1.1, AS1289.5.2.1, AS1289.2.1.1		
Sample Number	10823/S/101026	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTP09
Date Sampled	13/02/2016		1.1 - 1.3m
Sampled By	Client Sampled		
Date Tested	26/02/2016		
Material Source	Insitu	Material Limit Start	-
Material Type	Existing	Material Limit End	-
Client Reference	-	Compactive Effort	Modified

Material Description	-
----------------------	---

Maximum Dry Density (t/m³):	1.93	
Optimum Moisture Content (%):	13.0	
Field Moisture Content (%):	-	
Sample Percent Oversize (%)	0.0	
Oversize Included / Excluded	Excluded	
Target Density Ratio (%):	98	
Target Moisture Ratio (%):	100	
Placement Dry Density (t/m³):	1.89	
Placement Dry Density Ratio (%):	98.0	
Placement Moisture Content (%):	13.1	
Placement Moisture Ratio (%):	100.0	
Test Condition / Soaking Period:	Soaked / 4 Days	
CBR Surcharge (kg)	4.5	
Dry Density After Soak (t/m³):	1.80	
Moisture (top 30mm) After Soak (%)	21.2	
Moisture (remainder) After Soak (%)	15.5	
CBR Swell (%):	5.0	
Minimum CBR Specification (%):	-	
CBR Value @ 5.0mm (%):	5.0	

Remarks	Modified Compaction as requested by client
---------	--

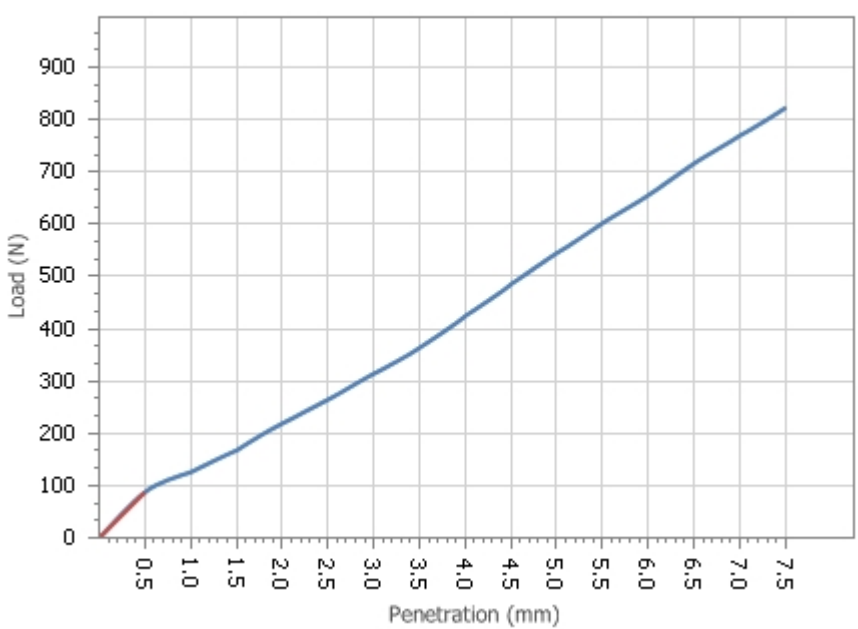
	The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W7Rep Rev 1
--	--	--

CALIFORNIA BEARING RATIO REPORT

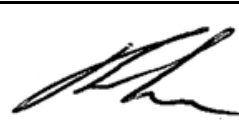
Client:	JACOBS	Report Number:	10823/R/17078-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	2/03/2016 Page 4 of 4

Test Procedures	AS1289.6.1.1, AS1289.5.2.1, AS1289.2.1.1		
Sample Number	10823/S/101027	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTP10
Date Sampled	13/02/2016		1.1 - 1.3m
Sampled By	Client Sampled		
Date Tested	26/02/2016		
Material Source	Insitu	Material Limit Start	-
Material Type	Existing	Material Limit End	-
Client Reference	-	Compactive Effort	Modified

Material Description	-
----------------------	---

Maximum Dry Density (t/m³):	1.77	
Optimum Moisture Content (%):	18.5	
Field Moisture Content (%):	-	
Sample Percent Oversize (%):	8.0	
Oversize Included / Excluded	Excluded	
Target Density Ratio (%):	98	
Target Moisture Ratio (%):	100	
Placement Dry Density (t/m³):	1.73	
Placement Dry Density Ratio (%):	98.0	
Placement Moisture Content (%):	18.4	
Placement Moisture Ratio (%):	100.5	
Test Condition / Soaking Period:	Soaked / 4 Days	
CBR Surcharge (kg)	4.5	
Dry Density After Soak (t/m³):	1.63	
Moisture (top 30mm) After Soak (%):	26.8	
Moisture (remainder) After Soak (%):	22.2	
CBR Swell (%):	6.5	
Minimum CBR Specification (%):	-	
CBR Value @ 5.0mm (%):	3.0	

Remarks	Modified Compaction as requested by client
---------	--

	The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025	
	Accreditation Number: 1986 Corporate Site Number: 10823	 Approved Signatory: Alexander Matthew Form ID: W7Rep Rev 1

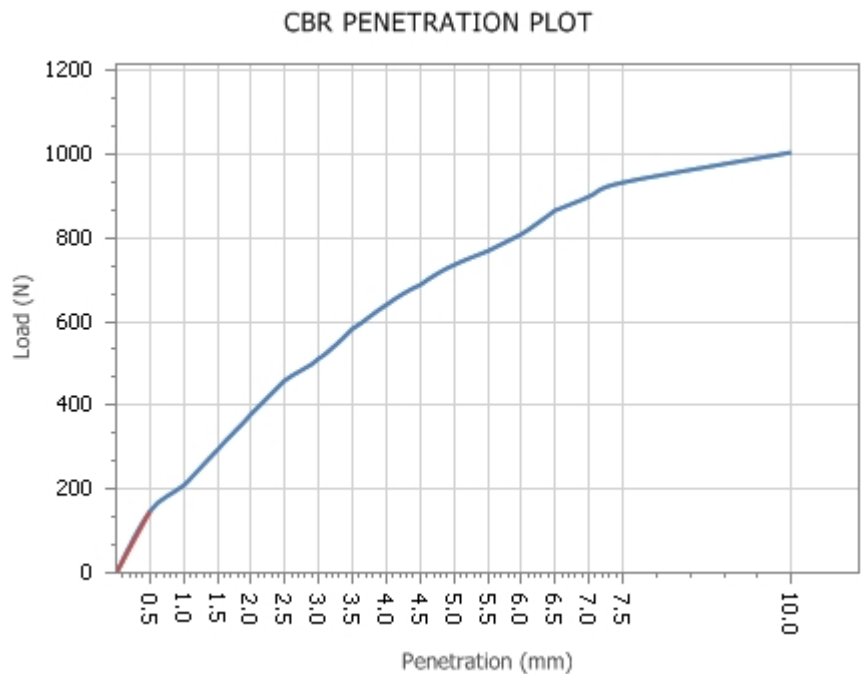
CALIFORNIA BEARING RATIO REPORT

Client:	JACOBS	Report Number:	10823/R/17211-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	10/03/2016 Page 4 of 4

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1		
Sample Number	10823/S/101029	Test Pit	Sample Location
Sampling Method	AS1289.1.2.1 CI 6.5.4	m	GPTP12
Date Sampled	13/02/2016		1.0 - 1.2m
Sampled By	Client Sampled		
Date Tested	7/03/2016		
Material Source	Insitu	Material Limit Start	-
Material Type	Existing	Material Limit End	-
Client Reference	Testing from 1.3.16	Compactive Effort	Standard

Material Description silty clay,light brown/orange

Maximum Dry Density (t/m³):	1.54
Optimum Moisture Content (%):	24.0
Field Moisture Content (%):	-
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	98
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.52
Placement Dry Density Ratio (%):	98.5
Placement Moisture Content (%):	23.5
Placement Moisture Ratio (%):	98.5
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.44
Moisture (top 30mm) After Soak (%)	32.3
Moisture (remainder) After Soak (%)	27.0
CBR Swell (%):	5.0
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	3.5



Remarks


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

 Accreditation Number: 1986
 Corporate Site Number: 10823



 Approved Signatory: Alexander Matthew
 Form ID: W7Rev Rev 1

EMERSON CLASS NUMBER REPORT

Client:	JACOBS	Report Number:	10823/R/16984-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	26/02/2016 Page 1 of 2

Test Procedures:	AS1289.3.8.1
------------------	--------------

Sample Number	10823/S/101019	10823/S/101021	10823/S/101025	10823/S/101026
ID / Client ID	-	-	-	-
Lot Number	GPTPO - IA101200- Test Pits	GPTPO - IA101200- Test Pits	GPTPO - IA101200- Test Pits	GPTPO - IA101200- Test Pits
Date / Time Sampled	13/02/2016	13/02/2016	13/02/2016	13/02/2016
Material Source	Insitu	Insitu	Insitu	Insitu
Material Type	Existing	Existing	Existing	Existing
Sampling Method	AS1289.1.2.1 Cl 6.5.4	AS1289.1.2.1 Cl 6.5.4	AS1289.1.2.1 Cl 6.5.4	AS1289.1.2.1 Cl 6.5.4
Water Type	Distilled	Distilled	Distilled	Distilled
Water Temperature (C°)	22	23	24	24
Test Pit	GPTP01 1.3 - 1.5m	GPTP03 0.8 - 1.0m	GPTP08 1.3m - 1.5m	GPTP09 1.1 - 1.3m
Soil Description	-	-	-	-
Emerson Class Number	2	2	2	2

Remarks


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

 Accreditation Number: 1986
 Corporate Site Number: 10823



 Approved Signatory: Alexander Matthew
 Form ID: W34Rep Rev 1

EMERSON CLASS NUMBER REPORT

Client:	JACOBS	Report Number:	10823/R/16984-1
Client Address:	Level:3,100 Christie Street , St, Leonards	Project Number:	10823/P/126
Project:	Grafton Correctional Facility	Lot Number:	GPTPO - IA101200- Test Pits
Location:	Grafton	Internal Test Request:	10823/T/8391
Component:	Site Investigation	Client Reference/s:	IA101200
Area Description:	Clarence valley Shire	Report Date / Page:	26/02/2016 Page 2 of 2

Test Procedures:	AS1289.3.8.1
------------------	--------------

Sample Number	10823/S/101027	10823/S/101031		
ID / Client ID	-	-		
Lot Number	GPTPO - IA101200- Test Pits	GPTPO - IA101200- Test Pits		
Date / Time Sampled	13/02/2016	13/02/2016		
Material Source	Insitu	Insitu		
Material Type	Existing	Existing		
Sampling Method	AS1289.1.2.1 Cl 6.5.4	AS1289.1.2.1 Cl 6.5.4		
Water Type	Distilled	Distilled		
Water Temperature (C°)	24	24		
Test Pit	GPTP10	GPTP14		
	1.1 - 1.3m	1.3 - 1.5m		
Soil Description	-	-		
Emerson Class Number	2	2		

Remarks


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

 Accreditation Number: 1986
 Corporate Site Number: 10823



 Approved Signatory: Alexander Matthew
 Form ID: W34Rep Rev 1

Appendix D. Environmental soil laboratory testing certificates

CERTIFICATE OF ANALYSIS

Work Order	: EB1604498	Page	: 1 of 6
Client	: JACOBS GROUP (AUSTRALIA) PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR JOHN PLUNKETT	Contact	: Tom Maloney
Address	: 100 CHRISTIE STREET P O BOX 164 ST LEONARDS NSW, AUSTRALIA 2065	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: john.plunkett@jacobs.com	E-mail	: Tom.Maloney@alsglobal.com
Telephone	: +61 08 9469 4400	Telephone	: +61-7-3243 7222
Facsimile	: +61 08 9469 4488	Facsimile	: +61-7-3243 7218
Project	: IA101200- Grafton Correctional Facility	QC Level	: NEPM 2013 B3 & ALS QC Standard
Order number	: ----	Date Samples Received	: 19-Feb-2016 09:00
C-O-C number	: ----	Date Analysis Commenced	: 23-Feb-2016
Sampler	: JOHN PLUNKETT	Issue Date	: 26-Feb-2016 12:52
Site	: ----		
Quote number	: ----	No. of samples received	: 32
		No. of samples analysed	: 16

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils, 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.

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.

- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GPTP02 0.5-0.6	GPTP02 1.4-1.5	GPTP05 0.3-0.5	GPTP06 0.5-0.6	GPTP08 1.2-1.3
Client sampling date / time					[10-Feb-2016]	[10-Feb-2016]	[10-Feb-2016]	[10-Feb-2016]	[09-Feb-2016]
Compound	CAS Number	LOR	Unit		EB1604498-003	EB1604498-004	EB1604498-008	EB1604498-009	EB1604498-014
					Result	Result	Result	Result	Result
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		----	----	----	----	5.8
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		5.5	5.4	5.2	6.0	5.3
pH (Fox)	----	0.1	pH Unit		3.8	4.0	3.4	3.8	3.5
Reaction Rate	----	1	Reaction Unit		3	3	2	3	1
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		----	----	----	----	33.0
EA080: Resistivity									
Resistivity at 25°C	----	1	ohm cm		----	----	----	----	2820
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		----	----	----	----	140
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		----	----	----	----	680



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GPTP09 0.5-0.6	GPTP10 0.6-0.7	GPTP10 1.5-1.6	GPTP11 0.4-0.5	GPTP11 1.4-1.5
Client sampling date / time					[10-Feb-2016]	[09-Feb-2016]	[09-Feb-2016]	[09-Feb-2016]	[09-Feb-2016]
Compound	CAS Number	LOR	Unit		EB1604498-016	EB1604498-017	EB1604498-018	EB1604498-019	EB1604498-020
					Result	Result	Result	Result	Result
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		----	----	5.8	----	----
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		6.0	5.9	----	5.9	7.5
pH (Fox)	----	0.1	pH Unit		3.6	3.3	----	3.9	6.1
Reaction Rate	----	1	Reaction Unit		3	3	----	3	4
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		----	----	19.8	----	----
EA080: Resistivity									
Resistivity at 25°C	----	1	ohm cm		----	----	3880	----	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		----	----	130	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		----	----	390	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GPTP12 0.4-0.5	GPTP12 1.4-1.6	GPTP13 0.8-1.0	GPTP13 1.5-1.6	GPTP14 0.3-0.5
Client sampling date / time					[09-Feb-2016]	[09-Feb-2016]	[08-Feb-2016]	[08-Feb-2016]	[08-Feb-2016]
Compound	CAS Number	LOR	Unit		EB1604498-021	EB1604498-022	EB1604498-025	EB1604498-026	EB1604498-027
					Result	Result	Result	Result	Result
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		----	5.5	----	----	----
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		5.2	----	5.0	5.1	5.8
pH (Fox)	----	0.1	pH Unit		3.3	----	3.3	3.8	3.4
Reaction Rate	----	1	Reaction Unit		3	----	3	3	3
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		----	38.2	----	----	----
EA080: Resistivity									
Resistivity at 25°C	----	1	ohm cm		----	3970	----	----	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		----	170	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		----	440	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	DUP1	----	----	----	----
Client sampling date / time					[19-Feb-2016]	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1604498-032	-----	-----	-----	-----
					Result	Result	Result	Result	Result
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		----	----	----	----	----
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		5.7	----	----	----	----
pH (Fox)	----	0.1	pH Unit		3.5	----	----	----	----
Reaction Rate	----	1	Reaction Unit		3	----	----	----	----
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		----	----	----	----	----
EA080: Resistivity									
Resistivity at 25°C	----	1	ohm cm		----	----	----	----	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		----	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		----	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: EB1606605	Page	: 1 of 4
Client	: JACOBS GROUP (AUSTRALIA) PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR JOHN PLUNKETT	Contact	: Tom Maloney
Address	: 100 CHRISTIE STREET P O BOX 164 ST LEONARDS NSW, AUSTRALIA 2065	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: john.plunkett@jacobs.com	E-mail	: Tom.Maloney@alsglobal.com
Telephone	: +61 08 9469 4400	Telephone	: +61-7-3243 7222
Facsimile	: +61 08 9469 4488	Facsimile	: +61-7-3243 7218
Project	: IA101200- Grafton Correctional Facility	QC Level	: NEPM 2013 B3 & ALS QC Standard
Order number	: ----	Date Samples Received	: 10-Mar-2016 11:05
C-O-C number	: ----	Date Analysis Commenced	: 15-Mar-2016
Sampler	: JOHN PLUNKETT	Issue Date	: 16-Mar-2016 18:19
Site	: ----		
Quote number	: ----	No. of samples received	: 6
		No. of samples analysed	: 6

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Andrew Epps	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, 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.

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.

- **This work order has been created to rebatch samples from previous ALS workorder EB1604498.**
- ASS: EA033 (CRS Suite): ANC not required because pH KCl less than 6.5
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO₃) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m³ in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m³'.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GPTP02, 0.5-0.6 m	GPTP05, 0.3-0.5 m	GPTP10, 0.6-0.7 m	GPTP12, 0.4-0.5 m	GPTP13, 0.8-1.0 m
Client sampling date / time					[10-Feb-2016]	[10-Feb-2016]	[09-Feb-2016]	[09-Feb-2016]	[08-Feb-2016]
Compound	CAS Number	LOR	Unit		EB1606605-001	EB1606605-002	EB1606605-003	EB1606605-004	EB1606605-005
					Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		4.0	4.0	3.8	3.8	4.3
Titrateable Actual Acidity (23F)	----	2	mole H+ / t		119	71	99	118	68
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S		0.19	0.11	0.16	0.19	0.11
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		<0.005	<0.005	<0.005	<0.005	<0.005
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		<10	<10	<10	<10	<10
EA033-D: Retained Acidity									
KCl Extractable Sulfur (23Ce)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
HCl Extractable Sulfur (20Be)	----	0.02	% S		<0.02	0.03	0.03	0.03	0.02
Net Acid Soluble Sulfur (20Je)	----	0.02	% S		<0.02	0.02	0.02	0.02	<0.02
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t		<10	<10	10	11	<10
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S		0.20	0.13	0.18	0.21	0.12
Net Acidity (acidity units)	----	10	mole H+ / t		123	81	110	130	73
Liming Rate	----	1	kg CaCO3/t		9	6	8	10	5
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		0.20	0.13	0.18	0.21	0.12
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		123	81	110	130	73
Liming Rate excluding ANC	----	1	kg CaCO3/t		9	6	8	10	5
EP003TC: Total Carbon (TC) in Soil									
Total Carbon	TC	0.02	%		0.44	0.34	0.29	0.48	0.23



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	GPTP14, 0.3-0.5 m	----	----	----	----
Client sampling date / time				[08-Feb-2016]	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1606605-006	-----	-----	-----	-----
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	4.1	----	----	----	----
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	96	----	----	----	----
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.15	----	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	----	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-D: Retained Acidity								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.02	----	----	----	----
HCl Extractable Sulfur (20Be)	----	0.02	% S	0.03	----	----	----	----
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	0.02	----	----	----	----
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	<10	----	----	----	----
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	----	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	0.17	----	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	106	----	----	----	----
Liming Rate	----	1	kg CaCO3/t	8	----	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.17	----	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	106	----	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	8	----	----	----	----
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	0.56	----	----	----	----

Appendix E. Addendum 1 - results of additional geotechnical investigations



New Grafton Correctional Centre

Infrastructure New South Wales

Addendum 1-Results of Additional Geotechnical Investigations

Report

IA10200-GT-RP-0002 | V01

19 May 2016

NGCC EIS Support



New Grafton Correctional Centre

Project No: IA101200
Document Title: Addendum 1: Results of Additional Geotechnical Investigations
Document No.: IA101200-GT-RP-0002
Revision: V01
Date: 17 May 2016
Client Name: Infrastructure New South Wales
Client No: NGCC EIS Support
Project Manager: Rachel Vazey
Author: Steven Rosin
File Name: J:\IE\Projects\04_Eastern\IA101200\23 Technical\Geotechnical\Draft report Stage 2\New Grafton Correctional Centre R01.docx

Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
710 Hunter Street
Newcastle West NSW 2302 Australia
PO Box 2147 Dangar NSW 2309 Australia
T +61 2 4979 2600
F +61 2 4979 2666
www.jacobs.com

© Copyright 2016 Jacobs Group (Australia) Pty Limited. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This Report has been prepared by Jacobs Group (Australia) Pty Ltd (Jacobs) for the sole use of Infrastructure New South Wales (INSW) in the preparation of the Environmental Impact Assessment for the New Grafton correctional facility, in accordance with the scope of services described in the Consultancy Agreement between Jacobs and INSW. Jacobs has undertaken all investigations and prepared this report in accordance with the usual care and thoroughness of the consulting profession and by reference to applicable procedures and practice at the date of issue of the report. This report remains subject to the following limitations:

- This report should only be presented in full and should not be used to support any purpose other than that for which it has been prepared, as outlined in the Consultancy Agreement. Jacobs accepts no liability to INSW or any third party for any loss and/or damage incurred as a result of reliance of this report for any purpose other than that articulated in the Consultancy Agreement.
- The report only considers the site conditions current at the time of investigation. These conditions may change due to natural forces and/or activities or operations undertaken on or near the Site. Any decisions based on the findings of the report must take into account any subsequent changes in Site conditions and/or developments in legislative and regulatory requirements. Jacobs accepts no liability to INSW or any third party for any loss and/or damage incurred as a result of a change in the site conditions and/or regulatory/legislative framework since the date of the report.
- The report is based on an interpretation of factual information available and the professional opinion and judgement of Jacobs. Unless stated to the contrary, Jacobs has not verified the accuracy or completeness of any information received from INSW or a third party during the performance of the services under the Consultancy Agreement, and Jacobs accepts no liability to INSW or any third party for any loss and/or damage incurred as a result of any inaccurate or incomplete information.

Any reliance on this report by a third party shall be entirely at such party's own risk. Jacobs provides no warranty or guarantee to any third party, express or implied, as to the information and/or professional advice indicated in the report, and accepts no liability for or in respect of any use or reliance upon the report by a third party.

Document history and status

Revision	Date	Description	By	Review	Approved
V01	19/05/2016	Report	Steven Rosin	Scott Raynsford	Rachel Vazey

Contents

1.	Introduction	1
2.	Scope of Further Investigations	2
3.	Updated Site Geotechnical Model	3
3.1	Site topography	3
3.2	Subsurface model	3
4.	Laboratory Rock Strength Correlations	5
5.	Discussion	8
6.	References	9

Figures

Appendix A. Borehole Explanation Sheets

Appendix B. Borehole Logs

Appendix C. Rock Strength Tests

1. Introduction

This Addendum report presents the results of further site geotechnical investigations undertaken by Jacobs Australia Pty Ltd (Jacobs) for Infrastructure New South Wales at the New Grafton Correctional Centre site in northern NSW. The scope of work for this addendum was outlined by Jacobs in Project Variation Request (PVR 1) dated 23/02/2016.

On the 24 March 2016 Jacobs issued the main geotechnical report to Infrastructure New South Wales for the site comprising a Geotechnical Working Paper (Ref; NGCC Geotechnical Working Paper RevB).

This current addendum report should be read in conjunction with the Geotechnical Working Paper report issued on the 24 March 2016 by Jacobs. This previous report provided a comprehensive description of the site topography, regional and local geology of the area, results of previous investigations undertaken by other organisations, the results of site investigations undertaken by Jacobs involving test pit investigations, laboratory testing, presentation of a preliminary geotechnical models, soil and ground water assessment and geotechnical interpretation and reporting.

The further investigation undertaken for this project variation comprised the drilling of six new boreholes across the site and associated rock strength testing of samples recovered from boreholes. The PVR also included the installation of three groundwater wells for monitoring of groundwater levels and groundwater sampling and laboratory testing for aggressivity of groundwater to steel and concrete elements. The results of groundwater field measurement and laboratory testing was provided in the Geotechnical Working Paper and therefore has not been replicated in this current addendum report.

This addendum report is confined to provision of the results of field borehole drilling and laboratory testing of rock samples and an update to the geotechnical site model given the additional available data as well as some discussion on rock mass quality.

The Project Site includes two properties comprised of Lot 26 DP 751376 and Lot 1 DP 1190399 and is 195 hectares in size. The site is bounded by Avenue Road (also recognised as Golden Mile Road) to the east, and Old Six Mile Lane to the south. Avenue Road connects to the Pacific Highway via Eight Mile Lane to the south and Old Six Mile Lane connects to the Pacific Highway to the west via passing the Grafton Airport.

It is noted that the upgraded Pacific Highway, to be constructed by Roads and Maritime Services, will become the southern boundary of this site once completed in approximately 2019. As part of that project, Avenue Road will pass over the Pacific Highway and the intersection of Avenue Road and Old Six Mile Road will be upgraded to improve local access, without direct connection to the highway.

The location of previous investigations for the Pacific Highway upgrade and the current investigations undertaken by Jacobs during 2016 are provided in **Figure 1** for referenced purposes.

2. Scope of Further Investigations

The scope of field work for these additional investigations comprised the drilling of 6 cored boreholes (GBH1-GBH6), in each case to typical depths of 15m below the surface across the project site as shown in **Figure 1**. These cored boreholes were undertaken to compliment the 15 test pits (GPT1 to GPT15) excavated to depths ranging between 1.5 and 2.5m below the surface also shown on the **Figure 1** and reported on in the Geotechnical Working Paper report.

The scope of work for the supplementary geotechnical investigations for this stage of investigations included the following activities:

- All borehole sites were checked for underground services search using a services locator to confirm the absence of any underground services at the nominated test locations.
- Test location coordinates and levels for all boreholes were located by the Jacobs survey team to MGA94 Zone 56 coordinate system and Australian Height Datum (AHD).
- Six boreholes were drilled (GB1-GB6) drilling between the period 29 February and 7 March 2016 by Total Drilling Pty Ltd using a Scout TD105 truck mounted drilling rig under the full time supervision of a Jacobs geotechnical engineer. Each hole was advanced by auger through overburden soils and extremely weathered rock to auger refusal at depths ranging between 2.5 and 3.5 below the surface. Standard Penetration Testing (SPTs) was undertaken over this interval at 1.5m intervals to measure the insitu density/consistency of the soils. The underlying coring with a HQ3 barrel (50 mm core diameter) was used to the final depths of each hole ranging between 15.0 to 15.7m below the surface. Logging of test holes was carried out in accordance with AAS1726-1993 and Jacob's field procedures. An explanation of geotechnical terms used for description of soils and rock is provided in **Appendix A**. The borehole logs and core photos for each hole are provided in **Appendix B**.
- To measure rock strength, 37 selected core samples were submitted a NATA registered laboratory Macquarie Geotech for axial and diametrical point load strength testing (Is50 axial and diametral). In addition to this, 8 core samples were submitted to the same laboratory for Uniaxial Compressive Strength (UCS) testing. Results of all testing is provided in **Appendix C**.
- Three groundwater monitoring wells in BH 1, GBH 3 and GBH5 were constructed after completion of drilling using 50mm machine slotted PVC casing of the lower 9m in each hole with a 1m thick bentonite seal and cement /bentonite seal to the surface for the unslotted PCV sections.. Following purging of all holes of drilling water ground water sampling was undertaken.
- For GBH1 (RL 25.17 mAHD) and GBH3 (RL 26.91 mAHD) in the northern part of the site, no groundwater was encountered for the full depth of each hole indicating a deep groundwater table in the northern part of the site (i.e. inferred as greater than 15 m below existing ground level).
- In the southern part of the site, groundwater was encountered in GBH5 (RL 23.20 AHD) at 5.5 metres below existing ground surface. This reading was recorded on the 8 March 2015, which indicates a relatively shallow groundwater table in this part of the site. The results of the water quality tests are provided in the March 2016 Geotechnical Working Paper report referenced previously.

3. Updated Site Geotechnical Model

3.1 Site topography

The ground slopes within the site area are gently sloping ranging between one to six degrees.

The broad site topography is characterised by a north-south trending gentle ridge line, coincident with Potential Archaeological Deposit (PAD) areas, which forms a drainage divide that directs flows to the western and eastern lower lying boundaries either side of the ridge as shown in **Figure 1**. The occurrence of this ridge would likely dictate the cut/fill requirements for the construction of a level foundation platform for the proposed development. It is noted that the geotechnical bore logs (GBH 1 to GHB 6) locations were partially targeted along the gentle ridge line to assess the excavatability of the rock mass for cut and filling works to form a level platform.

The highest ground is in the northern part of the site at a RL of 32 mAHD in the vicinity of GBH1. Further south, the elevation of the ridge reduces to RL 28 mAHD in the vicinity of GBH3. In the southern part of the site in the vicinity of GHB4 ground slopes reduce to RL 20 mAHD before rising to RL 31 mAHD in the south west and corner southern site boundary.

3.2 Subsurface model

Geologically, the site is known to be underlain by gently dipping sedimentary rocks from the Grafton Formation of early Cretaceous age. The site borehole results show that these sedimentary rocks typically consist of sub horizontal interbeds dominated by light grey sandstones and dark grey to black siltstones with occasional interlaminated siltstones and sandstone beds and shales with minor carbonaceous units (referred to as laminites).

An initial site geotechnical model was provided in the Geotechnical Working Paper without the full results of borehole drilling and relied largely on previous boreholes from the general area and the results of the on-site test pit investigations and initial cored borehole results. With the addition of the six boreholes this generalised geotechnical model has been slightly amended as detailed in **Table 3-1** below. The table provides a revised generalised subsurface profile showing the various geotechnical units of varying engineering properties with depth.

Table 3-1 (revised) Site Geotechnical Unit Descriptions

Geotechnical Unit	Unit Name	Typical Thickness Range (m)	Typical Depth Range Below ground Surface (mbgl)	Typical General Unit Description
Unit 1	Top Soil	0.1-0.25	0.1-0.25	Silty Clay, low to medium plasticity, stiff, pale grey, with some gravel and sand and organic matter.
Unit 2	Colluvial and Residual Soils	0.5-3.0	0.25-3.25	Silty Clay, high plasticity, stiff to hard, grey and mottled red and orange-brown, some sand and variable sized gravels and mainly of colluvial origin in the upper zone with some very stiff /hard high plasticity gravelly clays/clayey gravel residual soils towards the base in certain holes.
Unit 3a	Highly to Moderately Weathered Bedrock	3.0-6.5	3.25—9.75	Sandstone, siltstone, or Interbedded Sandstone and Siltstone (laminites), extremely to moderately weathered, fragmented to fractured, very low to medium strength rock
Unit 3b	Slightly Weathered to Fresh Bedrock.	Below Unit 3a to significant depths	>6.0	Sandstone, Siltstone, Shale or Interbedded Sandstone and Siltstone (laminites), slightly weathered to fresh, slightly fractured, medium to high strength rock.

Note: mbgl = meters below ground level

It is emphasised that this geotechnical model is expected to vary across the site and reference should be made to individual test pits and boreholes to gain an appreciation for site specific profiles at specific structure locations.

4. Laboratory Rock Strength Correlations

The results of laboratory strength tests are summarised in this section to provide some guidance on assigning geotechnical design parameters for such factor as foundation design in rock and other factors such as rock mass excavatability etc.

The mean values from point load rock strength (Is 50 axial) and UCS testing are provided in Table 4-1 below. It is noted that the diametral point load test results have not be used for correlation purposes with UCS as this orientation for point load testing is parallel to bedding along incipient planes of weakness and is 90 degrees to the orientation of axial load adopted for core samples for UCS testing.

Table 4-1; Mean Values from Rock Strength Tests for Rock Units

Rock Unit	Axial Point Load Tests (Is50 axial)		Unconfined Compressive Strength Tests	
	Number of tests	Mean Axial Value (MPa)	Number of tests	Mean UCS (MPa)
3a	14	0.53	2	5.8
3b	23	0.74	6	12.9

The average ratio of UCS/Point load strength from the table for Unit 3a is about 11 and for Unit 3b is 17.5 and these values maybe adopted as a general guide for design. However some caution should be used in adopting these correlations given the limited data available and the dependence of strength dictated by the actual rock type as shown below.

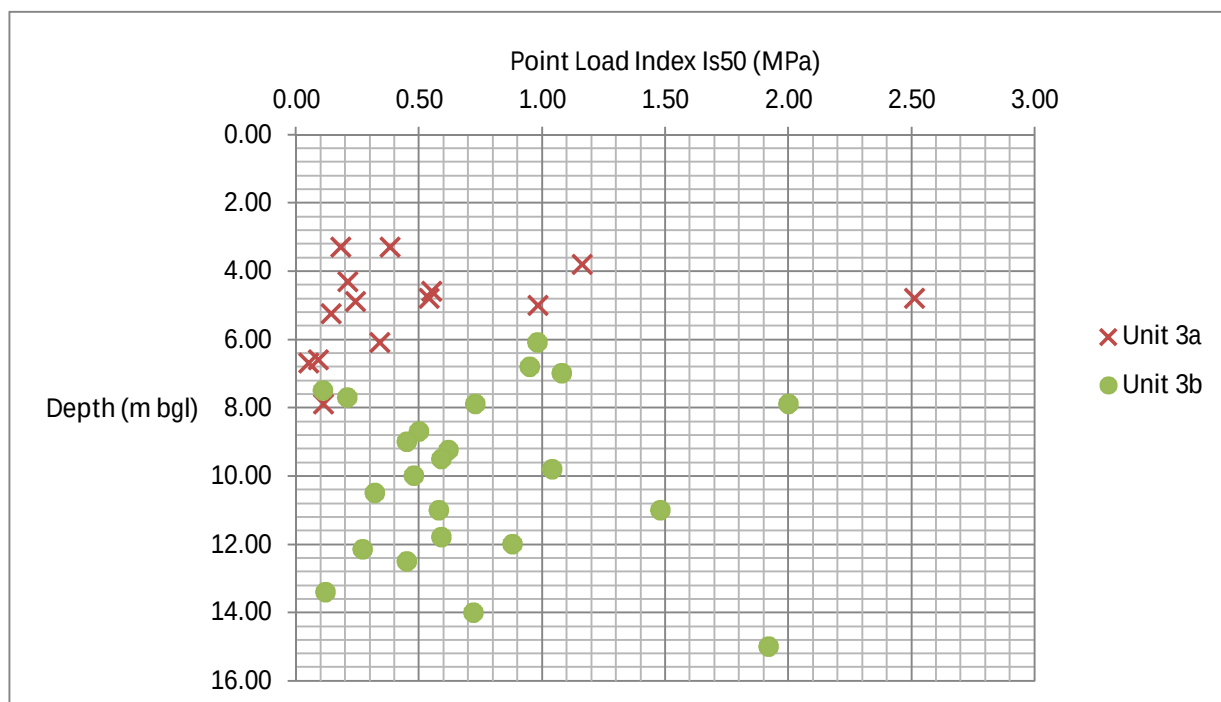


Plate 1-Correlation between Axial Point Load Index and Depth for Various Rock Units

The correlation of Point Load Index with depth for the various units presented in Plate 1 above reflects an increase in strength with depth associated with reduction in the degree of weathering of the rock mass.

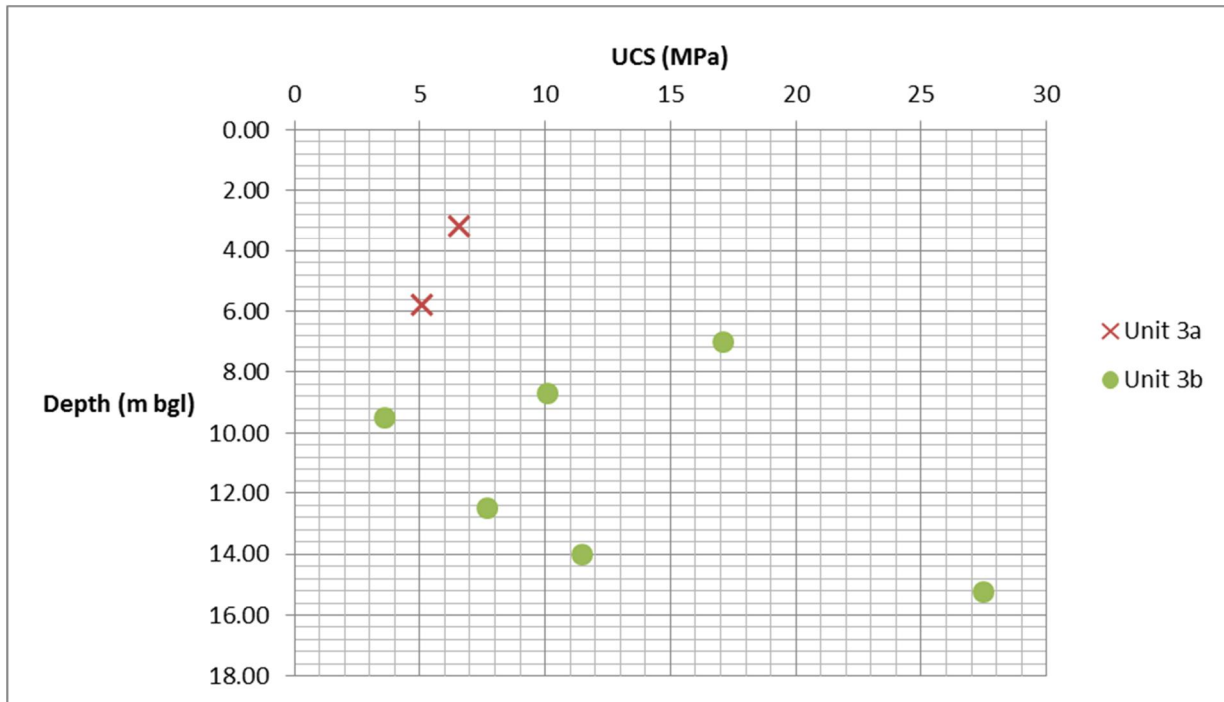


Plate 2 Correlation between Unconfined Compressive Strength and Depth for Various Rock Units

The correlation of UCS with depth for the various units presented in Plate 1 above also reflects an increase in strength with depth associated with reduction in the degree of weathering of the rock mass with depth.

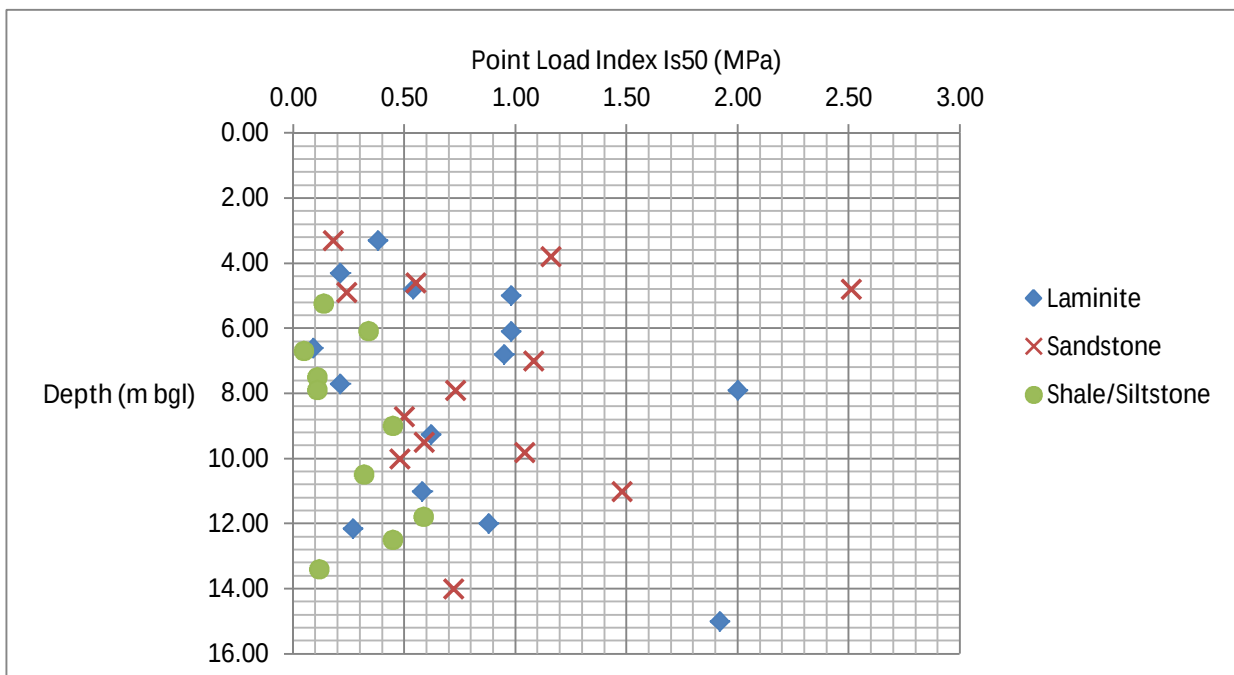


Plate 3- Correlation between Axial Point Load Index and Depth for Various Rock Types

The correlation of Point Load Index with depth for the various units presented in Plate 3 above reflects an increase in strength with depth associated with reduction in the degree of weathering of the rock mass. The above plate however shows that the rock strength is also dependant on the rock types with finer grained rock types (shales and siltstones) showing lower strength than the coarser grained rocks (laminites and sandstones).

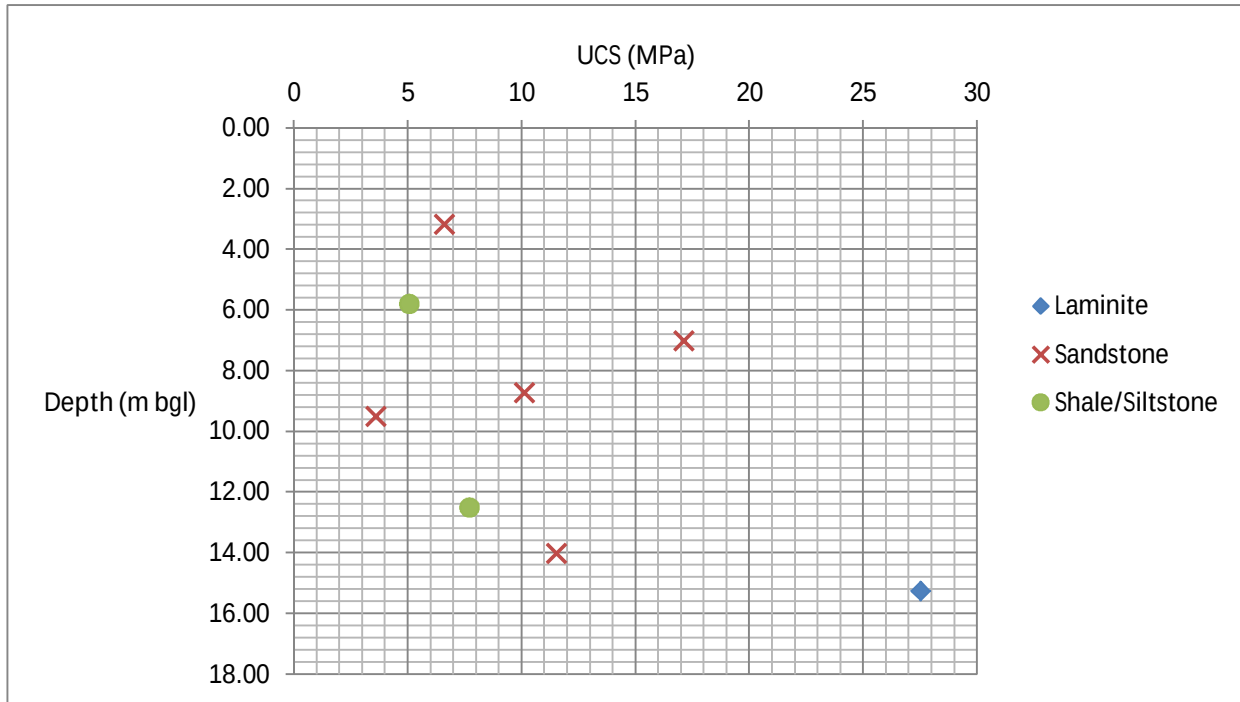


Plate 4 - Correlation between Unconfined Compressive Strength and Depth for Various Rock Types

The correlation of UCS with depth for the various rock types presented in Plate 4 above also reflects an increase in strength with depth associated with reduction in the degree of weathering of the rock mass. The above plate however also shows that the rock strength is also dependant on the rock types with finer grained rock types (shales and siltstones) showing lower strength than the coarser grained rocks (laminites and sandstones).

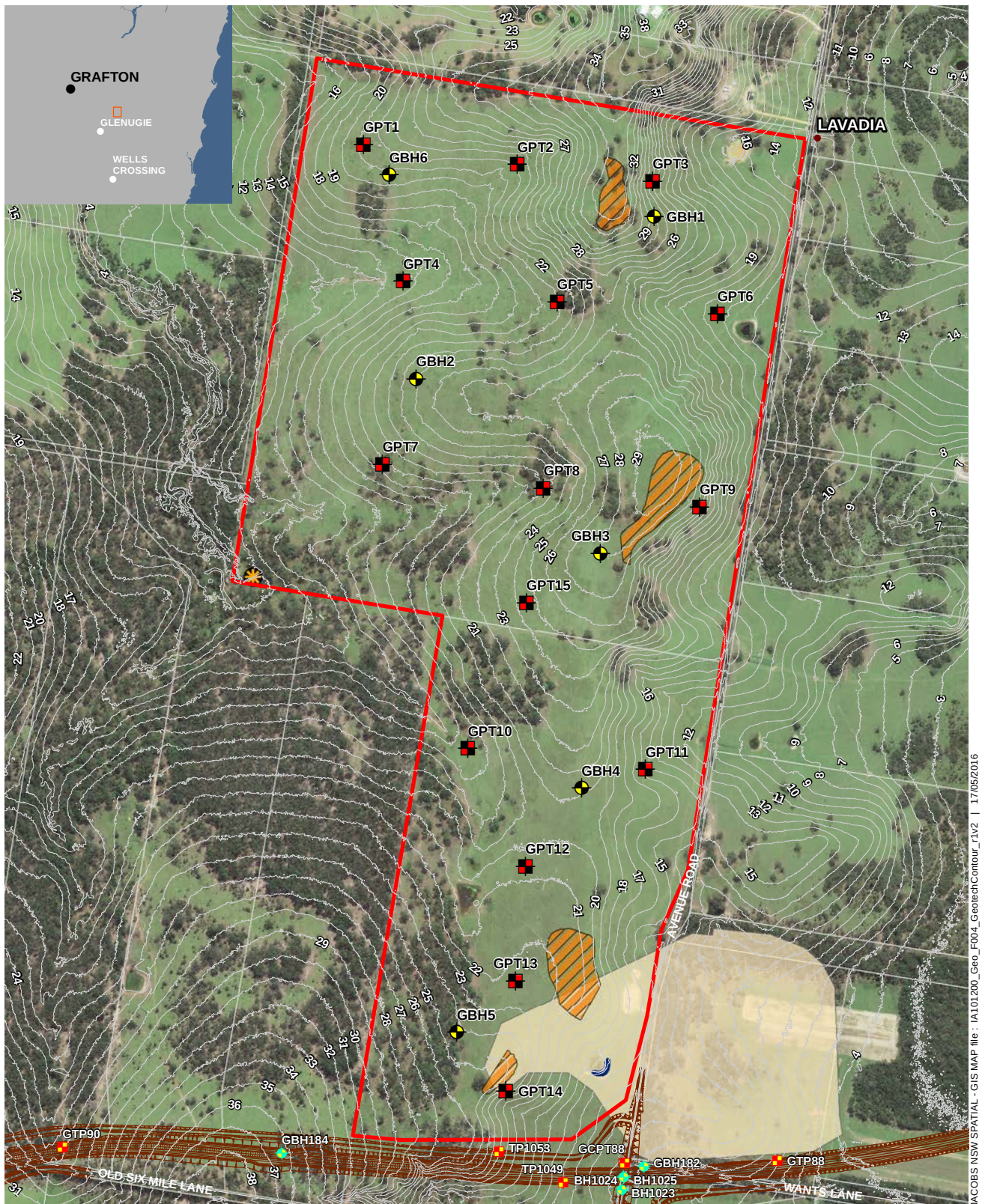
5. Discussion

The following comments are made in relation to the results of the additional borehole drilling;

- Most of the boreholes were drilled along the main ridge line areas of the site where the depth of weathering and strength of the rock is expected to differ to that of the lower lying areas. In the low lying areas of the site the depth of weathering may be greater and thus would likely result in a slightly reduced rock strength with depth compared to the more elevated areas.
- For a preliminary assessment of the excavatability of the rock mass reference has been made to Pettifer and Fookes, 1994. Our preliminary assessment suggests based on rock strength and fracture spacing that for bulk excavation within Unit 3a would likely require “easy ripping” conditions and for excavation within Unit 3b “hard to very hard ripping” conditions. Further more refined assessment of excavatability is recommended once building platform and excavation levels are known on the site.
- For design of foundations in rock for proposed structures, reference could be made to the design procedures recommended by Pells et al 1998, for foundations on sandstone and shale in the Sydney region in the absence of any specific design guidance for rocks within the Grafton Formation. Further geotechnical advice should be sought once building and foundation types/loads are known to assess appropriate foundation types and assign appropriate foundation strength capacities for the different units.

6. References

- 1) P.J.N Pells, G Mostyn and B.F. Walker; Foundations on sandstone and Shales in the Sydney Region. (Australian Geomechanics Journal December 1998);
- 2) G.S. Pettifer and P.G. Fookes; A revision of the graphical method for assessing the excavatability of rock (Quarterly journal of Engineering Geology and Hydrogeology; Volume 27; 1994.)



JACOBS NSW SPATIAL - GIS MAP file: I:\01200_Geo_F004_Geotech\Contour_T1V2 | 17/05/2016

Legend

- The Project
- Grafton Bypass (proposed)
- ✱ Aboriginal site identified during survey
- Artefact scatter
- Previously registered PAD
- Areas of Aboriginal potential archaeological deposit (PAD) identified during survey

Jacobs investigations

- ✱ GBH1 - GBH6 (Proposed Boreholes)
- ✱ GPT1 - GPT15 (Completed Test Pit Feb 2016)
- ✱ Previous drilling for Pacific Highway upgrades
- ✱ Borehole
- ✱ Test Pit

0 250 500 Metres
1:12,500 @ A4



Data sources

Jacobs 2015

LPI 2015

RMS 2013 (W2B Alliance)

Figure 1 | Previous and current geotechnical investigations - Local scale

Appendix A. Borehole Explanation Sheets

DATA FOR DESCRIPTION AND CLASSIFICATION OF SOILS

Explanation tables refer to Jacobs borehole logs only

Moisture Content

CONDITION	CRITERIA
Dry	Cohesive soils hard and friable, granular sands free running
Moist	Soils feel cool, darkened in colour. Cohesive soils can be moulded. Granular soils cohere
Wet	Soil feels cool, darkened in colour. Free water forms on hands when handling

Consistency / Density

SAND

DENSITY	FIELD TEST	PSP Blows/150mm	SPT(N-value)	RELATIVE DENSITY (%)	CPT q _c (Mpa)
Very Loose	Easily penetrated with 13mm reinforcing rod pushed by hand Can be excavated with a spade; 50mm wooden peg can be driven easily	0 - 1	<4	<15	0-2
Loose	Easily penetrated with 13mm reinforcing rod pushed by hand Can be excavated with a spade; 50mm wooden peg can be driven easily	1 - 3	4 - 10	15 - 35	2 - 5
Medium Dense	Penetrated with 13mm reinforcing rod driven with 2kg hammer - hard shovelling	3 - 8	10 - 30	35 - 65	5 - 15
Dense	Penetrated 300mm with 13mm reinforcing rod driven with 2kg hammer, requires pick for excavation; 50mm wooden peg hard to drive	8 - 15	30 - 50	65 - 85	15 - 25
Very Dense	Penetrated only 25 - 50mm with 13mm reinforcing rod driven with 2kg hammer	>15	>50	>85	>25

SILT AND CLAY

CONSISTENCY	FIELD TEST	DCP (blows/ 150mm)	SPT (N)	UNDRAINED SHEAR STRENGTH (kPa)	UCS (pocket penetrom.) (kPa)	CPT q _c (kPa)
Very Soft	Easily penetrated 40mm by thumb. Exudes between thumb and fingers when squeezed	<1	<2	<12	<25	0 - 180
Soft	Easily penetrated 10mm by thumb. Can be moulded by light finger pressure	1 - 1.5	2 - 4	12 - 25	25 - 50	180 - 375
Firm	Impression made by thumb with moderate effort. Can be moulded by strong finger pressure	1.5 - 3	4 - 8	25 - 50	50 - 100	375 - 750
Stiff	Slight impression made by thumb, cannot be moulded by fingers	4 - 6	8 - 16	50 - 100	100 - 200	750 - 1500
Very Stiff	Very tough. Readily indented by thumbnail	7 - 12	16 - 32	100 - 200	200 - 400	1500 - 3000
Hard	Brittle. Indented with difficulty by thumbnail	>12	>32	>200	>400	>3000

Proportion of Secondary Components

COARSE GRAINED SOILS		FINE GRAINED SOILS	
% fines	Modifier	% coarse	Modifier
<5	"with trace"	<15	"with trace"
>5 <15	"with some"	>15 <30	"with some"
>15	prefix soil with "silty, clayey, sandy, or gravelly"	>30	prefix soil with "sandy, gravelly silty, or clayey"

The soil name is derived from the proportion of its components

DATA FOR DESCRIPTION AND CLASSIFICATION OF ROCKS

Explanation tables refer to Jacobs borehole logs only

Strength

Rock Strength is defined by the Point Load Strength Index (Is50) and refers to the strength of the rock substance in the direction normal to the fabric

STRENGTH	SYM-BOL	Is(50) (MPa)	UCS (approx)	FIELD GUIDE
Extremely Low	EL	<0.03	>0.7	Easily remoulded by hand to a material with soil properties.
Very Low	VL	0.03 - 0.1	0.7 - 2.4	Material crumbles under firm blows with sharp end of pick; can be peeled by a knife. Pieces up to 30mm thick can be broken by finger pressure.
Low	L	>0.1 - 0.3	2.4 - 7	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long and 50mm diameter may be broken by hand.
Medium	M	>0.3 - 1.0	7 - 24	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High	H	>1 - 3	24 - 70	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken in one blow by a geological hammer.
Very High	VH	>3 - 10	70 - 240	Hand specimen breaks with geological hammer after more than one blow; rock rings under hammer.
Extremely High	EH	>10	>240	Specimen requires many blows with geological pick break through intact material; rock rings under hammer.

Defect Type

ABBREVIATION	DESCRIPTION
FL	Fault - fracture along which displacement is recognisable
SH	Shear - a fracture along which movement has taken place but no displacement is recognisable. Evidence for movement may be slickensides, polishing, and/or clay gouge.
SZ	Sheared Zone - zone of multiple closely spaced fracture planes with roughly parallel planar boundaries usually forming blocks of lenticular or wedge shaped intact material. Fractures are typically smooth, polished or slickensided, and curved.
BG	Bedding Parting - arrangement in layers of mineral grains or crystals parallel to surface of deposition along which a continuous observable parting occurs.
BSH	Bedding Plane Shear - a shear formed along a bedding plane
JN	Joint - a single fracture across which rock has little or no tensile strength and is not obviously related to rock fabric.
CN	Contact - surface between two lithologies
SC	Schistosity - plane formed by the preferred orientation of the constituent minerals in a parallel arrangement in a medium to coarse grained rock which has undergone regional metamorphism.
CV	Cleavage - plane of mechanical fracture in a rock normally sufficiently closely spaced to form parallel-sided slices.
CZ	Crushed Zone - zone with roughly parallel, planar boundaries (commonly slickensided) containing disorientated usually angular rock fragments of variable size often in a soil matrix.
VN	Vein - fracture in which a tabular or sheet-like body of minerals have been intruded
DZ	Decomposed Zone - zone of any shape but commonly with parallel planar boundaries containing moderately to gradational boundaries into fresher rock.
FZ	Fractured Zone - a zone of closely spaced defects (mainly joints, bedding, cleavage, and/or schistosity) comprised of core lengths in the order of 50mm or less.

Weathering

TERM	SYM-BOL	DEFINITION
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties ie it can be remoulded and can be classified according to the Unified Soil Classification System, but the texture of the rock is still evident.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or affects the rock substance and other signs of chemical or physical decomposition are bleaching evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the fresh rock are no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock and the original colour of the rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance, usually by Limonite, has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
Fresh	FR	Rock substance unaffected by weathering

Rock Quality Designation (RQD)

$$RQD = \frac{\text{cumulative length} > 100\text{mm (m)}}{\text{core run unit length (m)}} \times 100\%$$

The RQD is a modified core recovery percentage in which all the pieces of sound core over 100mm long are summed and divided by the length of the core run.

Rock Quality Designation %	Rock Quality Description
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Defect Shape

Symbol	Term	Description
Pl	Planar	Forms a continuous plane without variation in orientation
Cu	Curved	Has a gradual change in orientation
Wa	Wavy	Has a wavy surface shape
St	Stepped	Has one or more well defined ridges

Defect Roughness

Symbol	Term	Description
Slk	Slickensided polished	Visual evidence of striations or a smooth glassy finish
S	Smooth	Surface appears smooth and feels so to the touch
Sr	Slightly Rough	Asperities on the defect are distinguishable and can be felt
R	Rough	Some ridges and angle steps are evident; asperities are clearly visible and surface feels very abrasive
Vr	Very Rough	Near right angle steps and ridges occur on the surface

Infill Thickness

Measured in mm or use "St" (Stain) - Limonite or "vn" (vener) - other infill types

Defect Infill

Symbol	Description
KL	Clean
Ca	Calcite
Cb	Carbonaceous material
Ch	Chlorite
Lm	Limonite
Qz	Quartz
Su	Sulphides

Rf = Rock fragments

RC = Rock/Clay mixture

Symbol	Description
g	gravelly -
s	sandy -
z	silty -
c	clayey -
G	Gravel
S	Sand
Z	Silt
C	Clay
hp	high plasticity
lp	low plasticity

ORDER OF DESCRIPTION

Soils are described as follows:

A) MAIN SOIL TYPE & UNIFIED CLASSIFICATION SYMBOL (BLOCK LETTERS)

B) Plasticity if fine grained or Particle Size Distribution and Grading if coarse grained

C) Particle Shape

D) Colour.

E) Secondary and Minor component(s); name, estimated proportion, plasticity, particle size, colour.

F) Moisture condition.

G) Consistency or density.

H) Geological Origin (FILL, ALLUVIUM, COLLUVIUM, RESIDUAL etc.).

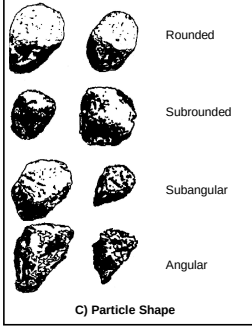
e.g. Silty SAND (SM); medium grained, poorly graded, rounded, yellow-brown, with a trace of fine grained subangular gravel, dry, loose. *Quaternary Alluvium*

B) Plasticity (fine grained soils) OR

Grading (coarse grained soils)

DESCRIPTIVE TERM	LIQUID LIMIT (%)
Of low plasticity	<35
Of medium plasticity	>35; <50
Of high plasticity	>50

DESCRIPTIVE TERM	DEFINITION
Well graded	good representation of all particle size from largest to the smallest
Poorly graded	one or more intermediate size poorly represented
Gap Graded	one or more intermediate sizes absent
Uniform	Essentially one size



D) Colour

Described in the moist condition, using simple terms (eg black, white, grey, red, brown, yellow etc, modified as necessary by 'pale', 'dark' or 'mottled'. Borderline colours may be described as a combination of these colours. (eg dark grey, red-brown)

E) Proportion of Secondary & Minor Components

COARSE GRAINED SOILS		FINE GRAINED SOILS	
% fines	Modifier	% coarse	Modifier
<5	"with a trace of"	<15	"with a trace of"
>5 <15	"with some"	>15 <30	"with some"
>15	prefix soil with "silty, clayey, sandy, or gravelly"	>30	prefix soil with "sandy, gravelly silty, or clayey"

F) Moisture Content

CONDITION	CRITERIA
Dry	Cohesive soils hard and friable, granular sands free running
Moist	Soils feel cool, darkened in colour. Cohesive soils can be moulded. Granular soils cohere
Wet	Soil feels cool, darkened in colour. Free water forms on hands when handling

G) Consistency or Density

GRAVEL/SAND (GW, GP, GM, GC)

DESCRIPTION	FIELD TEST
Loosely Packed	Can be removed from exposure by hand or easily removed by shovel
Tightly Packed	Requires pick for removal, either as lumps or as disaggregated material

SAND (SW, SP, SM, SC)

DENSITY	FIELD TEST	PSP Blows/150mm	SPT(N-value)	RELATIVE DENSITY (%)	CPT q _c (Mpa)
Very Loose	Easily penetrated with 13mm reinforcing rod pushed by hand Can be excavated with a spade; 50mm wooden peg can be driven easily	0 - 1	<4	<15	0-2
Loose	Easily penetrated with 13mm reinforcing rod pushed by hand Can be excavated with a spade; 50mm wooden peg can be driven easily	1 - 3	4 - 10	15 - 35	2 - 5
Medium Dense	Penetrated with 13mm reinforcing rod driven with 2kg hammer - hard shovelling	3 - 8	10 - 30	35 - 65	5 - 15
Dense	Penetrated 300mm with 13mm reinforcing rod driven with 2kg hammer, requires pick for excavation; 50mm wooden peg hard to drive	8 - 15	30 - 50	65 - 85	15 - 25
Very Dense	Penetrated only 25 - 50mm with 13mm reinforcing rod driven with 2kg hammer	>15	>50	>85	>25

SILT AND CLAY (ML, CL, OL, MH, CH, PH, PT)

CONSISTENCY	FIELD TEST	DCP (blows/ 150mm)	SPT (N)	UNDRAINED SHEAR STRENGTH (kPa)	UCS (pocket penetrom.) (kPa)	CPT q _c (kPa)
Very Soft	Easily penetrated 40mm by thumb. Exudes between thumb and fingers when squeezed	<1	<2	<12	<25	0 - 180
Soft	Easily penetrated 10mm by thumb. Can be moulded by light finger pressure	1 - 1.5	2 - 4	12 - 25	25 - 50	180 - 375
Firm	Impression made by thumb with moderate effort. Can be moulded by strong finger pressure	1.5 - 3	4 - 8	25 - 50	50 - 100	375 - 750
Stiff	Slight impression made by thumb, cannot be moulded by fingers	4 - 6	8 - 16	50 - 100	100 - 200	750 - 1500
Very Stiff	Very tough. Readily indented by thumbnail	7 - 12	16 - 32	100 - 200	200 - 400	1500 - 3000
Hard	Brittle. Indented with difficulty by thumbnail	>12	>32	>200	>400	>3000

JACOBS®

DATA FOR DESCRIPTION AND CLASSIFICATION OF SOILS

A) Main Soil Type

(See over for additional details)

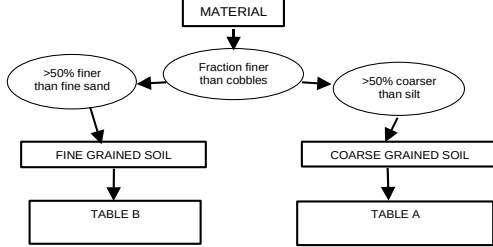


TABLE A : COARSE GRAINED SOILS : more than half of the material less than 60mm is larger than 0.06mm

		GRADATIONS	NATURE OF FINES	DRY STRENGTH	SYMBOL	TYPICAL NAME
>50% finer than coarse sand	Gravels	Good	Wide range in grain size	None	GW	Well graded gravels and sand - gravel mixtures, little or no fines
	Poor	Predominantly one size or range of sizes	Clean materials (not enough fines to bind coarse grains)		GP	Poorly graded gravels and gravel - sand mixtures little or no fines
	Good to Fair	"Dirty" Materials (excess of Fines)	Fines are non-plastic	None to med	GM	Silty Gravels, gravel - sand - silt mixtures
>50% finer than fine gravel	Sands	Good	Wide range in grain size	None	SW	Well graded sands and gravelly sands, little or no fines
		Poor	Predominantly one size or range of sizes		SP	Poorly graded sands and gravelly sands, little or no fines
	Good to Fair		Fines are non-plastic	None to med	SM	Silty Sand, sand-silt mixtures
			Fines are plastic	Med to high	SC	Clayey Sand, sand-clay mixtures

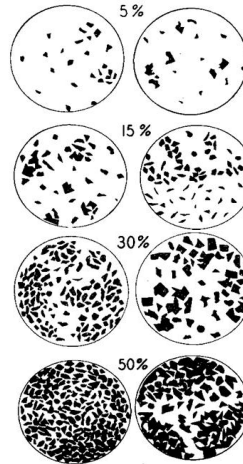
TABLE B : FINE GRAINED SOILS : more than half of the material less than 60mm is smaller than 0.06mm

DRY STRENGTH	DILATANCY	TOUGHNESS	SYMBOL	TYPICAL NAME
None to Low	Quick to Slow	None	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
Medium to high	None to Very Slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays etc
Low to medium	Slow	Low	OL	Organic silts and organic silt clays of low plasticity
Low to medium	Slow to none	Low to Medium	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
High to very high	None	High	CH	Inorganic clays of high plasticity
Medium to high	None to very slow	Low to Medium	OH	Organic clays of medium to high plasticity
Readily identified by colour, odour, spongy feel and generally by fibrous texture			Pt	Peat muck and other highly organic soils

Particle Size	0.002	0.06	0.2	0.6	2.0	6	20	60	200	Size (mm)
			fine	medium	coarse	fine	medium	coarse		
	Clay	Silt	Sand			Gravel		Cobbles	Boulders	

Organic and Artificial Materials

PREFERRED TERMS	TYPE
Fibrous Peat Charcoal Wood Fragments Roots (greater than 2mm dia) Root fibres (less than 2mm dia)	Organic Matter
Oil, Bitumen Domestic Refuse Brickbats Concrete Rubble Fibrous Plaster Wood pieces, shavings, sawdust Iron filings, drums, steel scrap Bottles, broken glass Leather	Waste Fill



Determination of Dry Strength, Dilatency, Toughness and Plasticity

1. Dry Strength (Crushing Characteristics)

After removing particles larger than 0.4mm sieve size, mould a pat of soil to the consistency of putty, adding of water if necessary. Allow the pat to dry completely by oven, sun or air drying, and then test its strength by breaking and crumbling between the fingers. The strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity. High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

2. Dilatancy (Reaction to Shaking)

After removing particles larger than the 0.4mm sieve size, prepare a pat of moist soil with a volume of about 8cm crumbled. Add enough water if necessary to make the soil soft but not sticky. Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens and finally it cracks or crumbs. The rapidity of appearance of water during shaking and of its disappearance during the squeezing assist in identifying the character of the fines in a soil. Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

3. Toughness (Consistency near Plastic Limit)

After removing particles larger than the 0.4mm sieve size a specimen of soil about 12mm cube in size is moulded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about 3mm in diameter. The thread is then folded and re-rolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached. After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles. The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicates either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line. Highly organic clays have a very weak and spongy feel at the plastic limit.

4. Smear Test

A fragment of soil smeared between the thumb and forefinger or drawn across the thumbnail will, by the smoothness and sheen of the smear surface, indicate the plasticity of the soil. A soil of low plasticity will exhibit a rough textured, dull smear while a soil of high plasticity will exhibit a slick, waxy smear surface.

Graphic Symbols

Derivation of Soil Name

Soils are generally made up of more than one component. The soil name depends on the proportion of each component.

The soil name is based on the presence of more than 50% of either fine grained (silt, clay) or coarse grained (sand, gravel) components in the soil. When more than one component exists the smaller amount is placed first.

Example 1: 60% clay
35% sand
5% gravel

is Sandy CLAY, with a trace of Gravel

Example 2: 40% gravel
14% sand
46% silt
} >50% coarse grained :

is Silty GRAVEL with some sand

The soil name can therefore be split into three fractions:
1. Secondary, 2. Major, and 3. Minor



Soils	
	Made ground
	Boulders and cobbles
	Gravel
	Sand
	Silt
	Clay
	Peat
NOTE: Composite soil types will be signified by combined symbols, e.g.,	
	Silty sand

JACOBS®

DATA FOR DESCRIPTION AND
CLASSIFICATION OF SOILS

ORDER OF DESCRIPTION

Rock Material is described as follows:

A) MAIN ROCK TYPE (BLOCK LETTERS)

B) Strength

C) Weathering

D) Colour e.g. black, white, grey, red, brown, orange, yellow, green, or blue - using pale, dark or mottled.

E) Fabric (spacing and development)

F) Particle Size (if coarse grained)

G) Inclusions or minor components

H) Degree of Fracturing (drill core) or Defect spacing (outcrop)

Geological Name (optional)

eg. GRANODIORITE, very high strength, slightly weathered, light pink-grey, massive, coarse sand sized. Jointing widely spaced. *Mowamba Granodiorite*

A) Main Rock Type **SEE OVER PAGE**

B) Strength

Rock Strength is defined by the Point Load Strength Index (Is50) and refers to the strength of the rock substance in the direction normal to the fabric

STRENGTH	SYM-BOL	Is(50) (MPa)	UCS (approx)	FIELD GUIDE
Extremely Low	EL	<0.03	>0.7	Easily remoulded by hand to a material with soil properties
Very Low	VL	0.03 - 0.1	0.7 - 2.4	Material crumbles under firm blows with sharp end of pick; can be peeled by a knife. Pieces up to 30mm thick can be broken by finger pressure.
Low	L	>0.1 - 0.3	2.4 - 7	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long and 50mm diameter may be broken by hand.
Medium	M	>0.3 - 1.0	7 - 24	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty
High	H	>1 - 3	24 - 70	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken in one blow by a geological hammer
Very High	VH	>3 - 10	70 - 240	Hand specimen breaks with geological hammer after more than one blow; rock rings under hammer
Extremely High	EH	>10	>240	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer

C) Weathering

TERM	SYM-BOL	DEFINITION
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties ie it can be remoulded and can be classified according to the Unified Soil Classification System, but the texture of the rock is still evident
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the fresh rock are no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock and the original colour of the rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance, usually by Limonite, has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance
Fresh	FR	Rock substance unaffected by weathering

E) Fabric

Typical rock fabrics include but are not limited to:

- bedding, cross bedding (sedimentary)
- flow banding (igneous)
- schistosity or foliation (metamorphic)

FABRIC SPACING

TERM		SEPARATION OF STRATIFICATION PLANES
Sedimentary	Igneous/Metamorphic	
Thinly laminated Laminated Very thinly bedded Thinly bedded Medium bedded Thickly bedded Very thickly bedded	Thinly foliated Foliated Very thinly layered Thinly layered Medium layered Thickly layered Very thickly layered	< 6mm 6mm to 20mm 20 to 60mm 60mm to 0.2m 0.2m to 0.6m 0.6m to 2m >2m

FABRIC DEVELOPMENT

Massive	No obvious fabric - rock appears homogenous
Poorly developed	Fabric is barely obvious as faint mineralogical layering or grain size banding.
Well developed	Fabric is apparent as distinct layers or lines marked by mineralogical or grain size layering.
Very well developed	Fabric is often marked by a distinct colour banding as well as by mineralogical or grain size layering.

F) Particle Size

0.2	0.6	2.0	6	20	60	200	Size (mm)
fine	medium	coarse	fine	medium	coarse		
Sand			Gravel			Cobbles	Boulders

Sedimentary rocks:

Sandstone - Use sand terms
Conglomerate - Use gravel terms
Shale, Siltstone
Claystone - No description of grain size is necessary

Metamorphic and Igneous Rocks:

Either record the grain size in millimetres or use appropriate sedimentary term, for example, "fine sand sized crystals", "medium gravel sized crystals"

G) Inclusions or Minor Components

Any isolated minor components within the rock material may be described using the appropriate terms. Some examples are given in the table below.

Sedimentary Rocks	Igneous Rocks
Concretions	Vesicles
Ironstone Band	Xenoliths
'Tea leaf' structure	Phenocrysts

H) Degree of Fracturing or Defect Spacing

Degree of Fracturing (borehole core)

TERM	DESCRIPTION
Fragmented	The core is composed primarily of fragments of length less than 20mm, and mostly of width less than the core diameter
Highly Fractured	Core lengths are generally less than 20mm - 40mm with occasional fragments
Fractured	Core lengths are mainly 30 - 100mm with occasional shorter and longer sections
Slightly Fractured	Core lengths are generally 300 - 1000mm with occasional longer sections and occasional sections between 100 to 300mm
Unbroken	The core does not contain any fractures

Defect Spacing (Outcrop)

TERM	SPACING (mm)
Extremely closely spaced	<20
Very closely spaced	20 - 60mm
Closely spaced	60 - 200m
Moderately spaced	200 - 600mm
Widely spaced	600mm - 2m

JACOBS

DATA FOR DESCRIPTION AND CLASSIFICATION OF SOILS

Rock Mass Defects

Order of Description: Type, inclination, shape, roughness, infill type, infill thickness

1. Defect Type

Abbreviation	Map Symbol	Description
FL		Fault - fracture along which displacement is recognisable.
SH		Shear - a fracture along which movement has taken place but no displacement is recognisable. Evidence for movement may be slickensides, polishing and/or clay gouge.
SZ		Sheared Zone - zone of multiple closely spaced fracture planes with roughly parallel planar boundaries usually forming blocks of lenticular or wedge shaped intact material. Fractures are typically smooth, polished or slickensided; and curved.
BG		Bedding parting - arrangement in layers of mineral grains or crystals parallel to surface of deposition along which a continuous observable parting occurs.
BSH		Bedding plane shear - a shear formed along a bedding plane
JN		Joint - a single fracture across which rock has little or no tensile strength and is not obviously related to rock fabric.
CN		Contact - surface between two lithologies.
FO		Foliation - a planar arrangement of textural or structural features in any type of rock, especially the planar orientation of platy minerals.
CV		Cleavage - plane of mechanical fracture in a rock normally sufficiently closely spaced to form parallel-sided slices.
CZ		Crushed Zone - zone with roughly parallel, planar boundaries (commonly slickensided) containing disoriented usually angular rock fragments of variable size often in a soil matrix.
VN		Vein - fracture in which a tabular or sheet-like body of minerals have been intruded.
DZ		Decomposed Zone - zone of any shape but commonly with parallel boundaries containing moderately to extremely weathered rock, typically with gradational boundaries into fresher rock.
FZ		Fractured Zone - a zone of closely spaced defects (mainly joints, bedding, cleavage and/or schistosity) comprised of core lengths in the order of 50mm or less.

2. Defect Inclination

measured as dip/direction in exposure
measured in degrees from core normal in boreholes (90° is vertical)

4. Defect Roughness

3. Defect Shape

Symbol	Term	Description
Pl	Planar	Forms a continuous plane without variation in orientation
Cu	Curved	Has a gradual change in orientation
Wa	Wavy	Has a wavy surface shape
St	Stepped	Has one or more well defined ridges
Ir	Irregular	Many changes of orientation

Sym-bol	Term	Description
Sik	Slickensided /polished	Visual evidence of striations or a smooth glassy finish
S	Smooth	Surface appears smooth and feels so to the touch
Sr	Slightly Rough	Asperities on the defect are distinguishable and can be felt
R	Rough	Some ridges and angle steps are evident; asperities are clearly visible and surface feels very abrasive
Vr	Very Rough	Near right angle steps and ridges occur on the surface

5. Defect Infill

Symbol	Description	Symbol	Description
KL	Clean	g	gravelly -
Ca	Calcite	s	sandy -
Cb	Carbonaceous material	z	silty -
Ch	Chlorite	c	clayey -
Lm	Limonite	G	Gravel
Qz	Quartz	S	Sand
Su	Sulphides	Z	Silt
Rf	Rock fragments	C	Clay
RC	Rock/Clay mixture	hp	high plasticity
		lp	low plasticity

6. Infill Thickness (nearest) - other infill types

A) Main Rock Type

Igneous Rocks

Pyroclastic	Igneous						
At least 50% of grains are of igneous rock	Quartz, feldspars, micas dark minerals		Feldspar, dark minerals	Dark minerals	Composition		
	Acid	Intermediate	Basic	Ultrabasic			
Rounded grains AGGLOMERATE	PEGMATITE			Pyroxenite Peridotite Serpentinite	Very Coarse Grained	60	Predominant Grain Size (mm)
Angular grains VOLCANIC BRECCIA	GRANITE	DIORITE	GABBRO		Coarse Grained		
TUFF			DOLERITE		Medium Grained	0.06	
Fine grained TUFF	RHYOLITE	ANDESITE	BASALT		Fine Grained		
Very Fine Grained TUFF					Very Fine Grained		
	VOLCANIC GLASS (OBSIDIAN)				Glassy Amorphous		

Metamorphic Rocks

Foliated		Massive				
Quartz, feldspars, micas dark minerals		Quartz, feldspars, micas dark minerals, carbonates		Composition		
MIGMATITE	TECTONIC BRECCIA	HORNFELS MARBLE GRANULITE QUARTZITE AMPHIBOLITE	Very Coarse Grained	60	Predominant Grain Size (mm)	
GNEISS			Coarse Grained	2		
SCHIST	Medium Grained		0.06			
PHYLLITE SLATE	MYLONITE		Fine Grained	0.002		
			Very Fine Grained			

Sedimentary Rocks

Detrital Sedimentary					Chemical/ Organic					
Grains of rock, quartz, feldspar and clay minerals				At least 50% of the grains are of carbonate	Salts, carbonates silica, carbonaceous	Composition				
Rudaceous	Grains are typically rock fragments			LIMESTONE (undifferentiated)	CALCI- -RUDITE	<i>Saline Rocks</i> HALITE ANHYDRITE GYPSUM <i>Calcareous Rocks</i> LIMESTONE DOLOMITE <i>Siliceous Rocks</i> CHERT FLINT <i>Carbonaceous Rocks</i> LIGNITE COAL	Very Coarse Grained	60	Predominant Grain Size (mm)	
	Rounded grains: CONGLOMERATE Angular grains: BRECCIA						Coarse Grained	2		
Arenaceous	Grains are typically mineral fragments				CALC- -ARENITE		Medium Grained	0.06		
	SANDSTONE						Fine Grained	0.002		
Argillaceous	MUDSTONE	SILTSTONE: 50% fine grained particles			CALCI- -SILTITE					
	SHALE (fissile mudstone)	CLAYSTONE: 50% very fine grained particles					CALCI- -LUTITE			

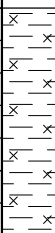
Rocks		Metamorphic		Igneous	
Sedimentary					
Rudaceous Arenaceous Argillaceous	 Chalk			 Coarse-grained	
	 Limestone	 Coarse-grained		 Medium-grained	
	 Conglomerate	 Medium-grained		 Fine-grained	
	 Breccia	 Fine-grained			
	 Sandstone				
	 Siltstone				
	 Mudstone				
	 Shale				
	 Coal				
	 Pyroclastic (volcanic ash)				
	 Gypsum, Rocksalt etc.				

JACOBS®

DATA FOR DESCRIPTION AND CLASSIFICATION OF SOILS

Appendix B. Borehole Logs

POSITION : E: 506216.150, N: 6710415.190 (MGA94 Zone 56)		SURFACE ELEVATION : 25.170 (AHD)		ANGLE FROM HORIZONTAL : 90°	
RIG TYPE : Scout TD105		MOUNTING :		CONTRACTOR : Total Drilling	
				DRILLER :	
DATE STARTED : 29/2/16		DATE COMPLETED : 1/3/16		DATE LOGGED : 16/3/16	
				LOGGED BY : JP	
				CHECKED BY : SGR	

DRILLING					MATERIAL						
PROGRESS		DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
DRILLING & CASING	WATER										
ADIV					0.0		CH	SILTY CLAY Light brown, high plasticity, trace sand.	D	VS	COLLUVIUM
SPT				1.50m SPT 30/135mm N = R 1.64m	1.0						
AD/T					2.0			SANDSTONE Extremely low strength, extremely weathered, recovered as a silty clay, light brown high plasticity, with relict rock fabric.		H	WEATHERED BEDROCK
					2.60m			Continued as Cored Drill Hole			
					3.0						
					4.0						
					5.0						
					6.0						
					7.0						
					8.0						
					9.0						
					10.0						

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

HOLE NO : BH01

PROJECT : Grafton Correctional Facility
LOCATION : GraftonFILE / JOB NO : IA101200
SHEET : 2 OF 3

POSITION : E: 506216.150, N: 6710415.190 (MGA94 Zone 56) SURFACE ELEVATION : 25.170 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :

DATE STARTED : 29/2/16 DATE COMPLETED : 1/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR

CASING DIAMETER : BARREL (Length) : BIT : BIT CONDITION :

DRILLING				MATERIAL				FRACTURES			
PROGRESS		TCR / RQD %	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral	NATURAL FRACTURE (mm)	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
DRILLING & CASING	WATER										
				0.0							
				1.0							
				2.0							
				2.60		START CORING AT 2.60m					
				3.0		SANDSTONE Orange-brown, fine to medium grained, indistinctly bedded 0-5°.	MW				2.60: All defects are sub-horizontal bedding partings unless noted otherwise. 2.62: 2.8: 3.09: 3.11: JT 0 - 10° CN UN RF 3.33: 3.4 - 3.6: JT 80 - 90° CN ST RF 3.68: 3.865: JT 10° CN PR S
				4.0							4.2: 4.36: JT 10° Fe SN CU RF 4.42:
				5.0			EW				4.87: JT 10 - 20° CN CU RF
				5.30		SILTSTONE Orange-brown, indistinctly laminated, with approximately 5% sandstone laminations.	HW to MW				5.46: JT 5 - 10° Fe SN ST RF 5.51: 5.74: JT 5 - 10° Fe SN UN RF 5.83:
				6.0							6.01 - 6.13: CZ CN PR S 6.23: JT 0 - 5° Fe SN CU S 6.3:
				6.13		SILTSTONE Orange-brown, indistinctly laminated, with approximately 5% sandstone laminations.	HW				6.67: 6.7: 6.98: JT 0 - 5° Fe SN ST S
				7.0			MW				7.31: 7.44: 15 - 20° CN ST S 7.56: JT 0 - 10° Fe SN UN RF 7.64: 7.77: JT 30° CN ST RF 7.86:
				7.2 to 7.3		Carbonaceous material					8.04: 8.29: 8.41:
				7.6 to 9.75		Becoming approximately 20% fine grained sandstone.	SW				8.75: 8.78: 8.9: 8.95: 9.25:
				8.0							9.56: 9.73 - 9.77: CZ 0 - 5° Clay FILLED PR S
				9.0							
				9.75			FR				
				10.0							

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

HOLE NO : BH01

PROJECT : Grafton Correctional Facility
LOCATION : GraftonFILE / JOB NO : IA101200
SHEET : 3 OF 3

POSITION : E: 506216.150, N: 6710415.190 (MGA94 Zone 56) SURFACE ELEVATION : 25.170 (AHD) ANGLE FROM HORIZONTAL : 90°
 RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :
 DATE STARTED : 29/2/16 DATE COMPLETED : 1/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR
 CASING DIAMETER : BARREL (Length) : BIT : BIT CONDITION :

DRILLING				MATERIAL				FRACTURES			
PROGRESS		SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50)		NATURAL FRACTURE (mm)	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
DRILLING & CASING	WATER						● Axial ○ Diametral				
HO3	60% LOSS	100% TCR 98% RQD	10.0		SANDSTONE Fine grained, pale grey, distinctly laminated, with approximately 5-10% siltstone and carbanous laminations. (continued)	FR	EL 0.03 VI 0.1 L 0.3 M 1 H 3 VH 10 EH 10		20 40 100 300 1000		9.98:
			11.0								10.54: 10.72:
			12.0								11.78: :
			13.0								12.27: 12.36 - 12.46: JT 50 - 60° CN UN RF 12.58: JT 15 - 20° CA SN PR S
			14.0								12.9:
			15.0								13.49: 13.61: 13.67:
			15.24m UCS =27.5 MPa 15.38m								14.6:
			15.69								:
			16.0		BH01 terminated at target depth 15.69m						
			17.0								
			18.0								
			19.0								
			20.0								

See Explanatory Notes for details of abbreviations & basis of descriptions.

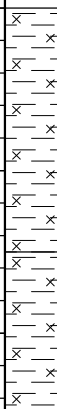


Drawn:	JP		Client:	Infrastructure New South Wales		
Approved:	SR		Project and Location:	Grafton Correctional Facility, Grafton		
Date:	17/03/16		Title:	GBH01 2.60-15.0		
Scale:	NA		Project No.:	IA101200	figure no:	

POSITION : E: 505658.970, N: 6710111.260 (MGA94 Zone 56) SURFACE ELEVATION : 21.810 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Scout TD105	MOUNTING :	CONTRACTOR : Total Drilling	DRILLER :
------------------------	------------	-----------------------------	-----------

DATE STARTED : 3/3/16 DATE COMPLETED : 4/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR

DRILLING					MATERIAL							
PROGRESS		DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations	
DRILLING & CASING	WATER											
↑ ADV ↓					0.0			SILTY CLAY Light brown and mottled orange-brown, high plasticity, traces of sand and gravel.	D	VSt	COLLUVIUM	
↓ SPT ↑				1.50m	1.50m		1.50-2.50: Becoming off-white and mottled red.					WEATHERED BEDROCK
↓ ADV ↑				1.95m	2.0							
			Not Encountered		3.0							
					4.0							
					5.0							
					6.0							
					7.0							
					8.0							
					9.0							
					10.0							

See Explanatory Notes for details of abbreviations & basis of descriptions.

POSITION : E: 505658.970, N: 6710111.260 (MGA94 Zone 56)		SURFACE ELEVATION : 21.810 (AHD)		ANGLE FROM HORIZONTAL : 90°	
RIG TYPE : Scout TD105		MOUNTING :		CONTRACTOR : Total Drilling	
				DRILLER :	
DATE STARTED : 3/3/16		DATE COMPLETED : 4/3/16		DATE LOGGED : 16/3/16	
				LOGGED BY : JP	
				CHECKED BY : SGR	
CASING DIAMETER :		BARREL (Length) :		BIT :	
				BIT CONDITION :	

[illegible]

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

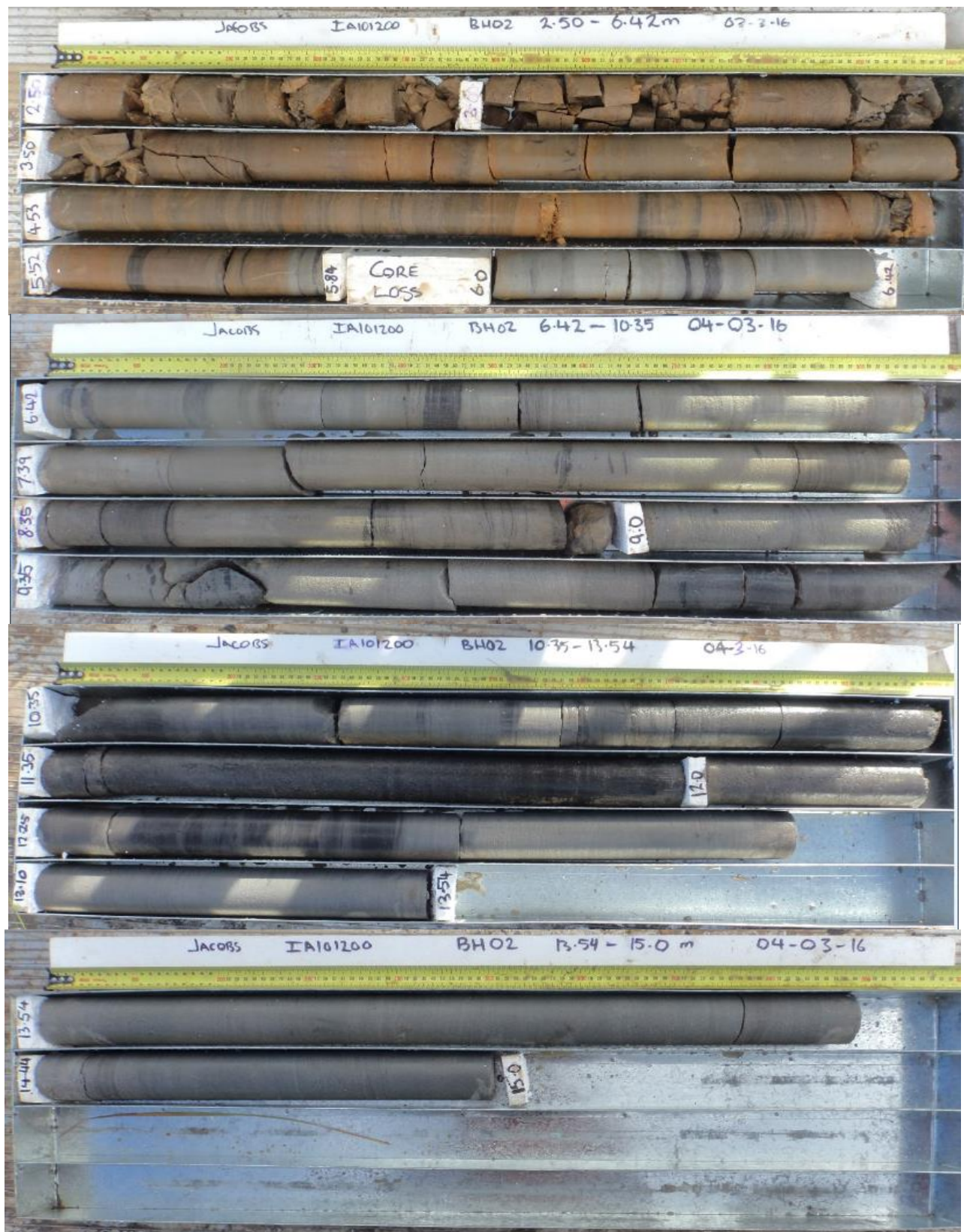
HOLE NO : BH02

PROJECT : Grafton Correctional Facility
LOCATION : GraftonFILE / JOB NO : IA101200
SHEET : 3 OF 3

POSITION : E: 505658.970, N: 6710111.260 (MGA94 Zone 56) SURFACE ELEVATION : 21.810 (AHD) ANGLE FROM HORIZONTAL : 90°
 RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :
 DATE STARTED : 3/3/16 DATE COMPLETED : 4/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR
 CASING DIAMETER : BARREL (Length) : BIT : BIT CONDITION :

DRILLING				MATERIAL				FRACTURES				
PROGRESS		TCR / RQD %	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50)		NATURAL FRACTURE (mm)	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
DRILLING & CASING	WATER							EL	VL			
HQ3	20% LOSS	100% TCR	100% RQD	10.0	XXXXX XXXXX							

See Explanatory Notes for details of abbreviations & basis of descriptions.



Drawn:	JP		Client:	Infrastructure New South Wales		
Approved:	SR		Project and Location:	Grafton Correctional Facility, Grafton		
Date:	17/03/16		Title:	GBH02 2.50-15.0		
Scale:	NA		Project No.:	IA101200	figure no:	

POSITION : E: 506066.100, N: 6709726.300 (MGA94 Zone 56) SURFACE ELEVATION : 26.910 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Scout TD105	MOUNTING :	CONTRACTOR : Total Drilling	DRILLER :
------------------------	------------	-----------------------------	-----------

DATE STARTED : 1/3/16 DATE COMPLETED : 2/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR

DRILLING					MATERIAL						
PROGRESS		DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
DRILLING & CASING	WATER										
↑ ↓ ADV					0.0		CH	SILTY CLAY Dark brown, high plasticity, traces of sand. 0.40m Becoming red-brown.			COLLUVIUM
				1.50m SPT 6,12,22 N=34	1.0		CH	1.00m Becoming orange-brown and pale grey.			
↑ ↓ SPT				1.95m	2.0		CH	2.00m Becoming light brown		H	
↑ ↓ ADV				3.00m SPT 3,15,35 N=50	3.0		CH	3.45m			
↑ ↓ SPT				3.44m				Continued as Cored Drill Hole			
			Not Encountered		4.0						
					5.0						
					6.0						
					7.0						
					8.0						
					9.0						
					10.0						

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

HOLE NO : BH03

PROJECT : Grafton Correctional Facility
LOCATION : GraftonFILE / JOB NO : IA101200
SHEET : 2 OF 3

POSITION : E: 506066.100, N: 6709726.300 (MGA94 Zone 56) SURFACE ELEVATION : 26.910 (AHD) ANGLE FROM HORIZONTAL : 90°
 RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :
 DATE STARTED : 1/3/16 DATE COMPLETED : 2/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR
 CASING DIAMETER : BARREL (Length) : BIT : BIT CONDITION :

DRILLING				MATERIAL				FRACTURES			
PROGRESS		TCR / ROD %	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral	NATURAL FRACTURE (mm)	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
DRILLING & CASING	WATER										
		DRILL DEPTH									
				0.0							
				1.0							
				2.0							
				3.0							
				3.45m		START CORING AT 3.45m					
				4.0		SANDSTONE Fine grained, light brown, indistinctly bedded 0°.	MW				3.45: All defects are sub-horizontal bedding partings unless noted otherwise.
				4.08-4.12- Orange brown band of Sandstone							3.92:
				4.22-4.35 - Pale grey band of Sandstone							4.5: JT 5 - 10° CN PR RF
				4.9-5.1- Pale grey band of Sandstone							4.78:
				5.0							5.38:
				5.52:							5.67:
				5.87: JT 5 - 10° CT CU RF							6.09:
				6.04							6.19:
				6.20m		SILTSTONE INTERLAMINATED WITH SANDSTONE: (80% siltstone, 20% sandstone) Siltstone is dark grey, thinly laminated, 0-5°, sandstone is fine grained and pale grey.	SW to FR				6.27:
				6.32:							6.29:
				6.41: JT 0 - 5° CN UN RF							6.49:
				6.59:							6.69:
				7.01:							7.01:
				7.25:							7.4:
				7.86:							8.34:
				8.49:							8.92:
				9.07- Defect with Pyrite mineralisation.							8.97: JT 0 - 5° CN ST RF
				9.14							9.07 - 9.14: JT 60 - 80° Fe SN ST RF
				9.48: JT 10 - 20° CN UN RF							9.6 - 9.75: JT 60 - 70° Fe SN UN RF
				9.75- Defect with Pyrite mineralisation.							9.83:
				10.0							

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

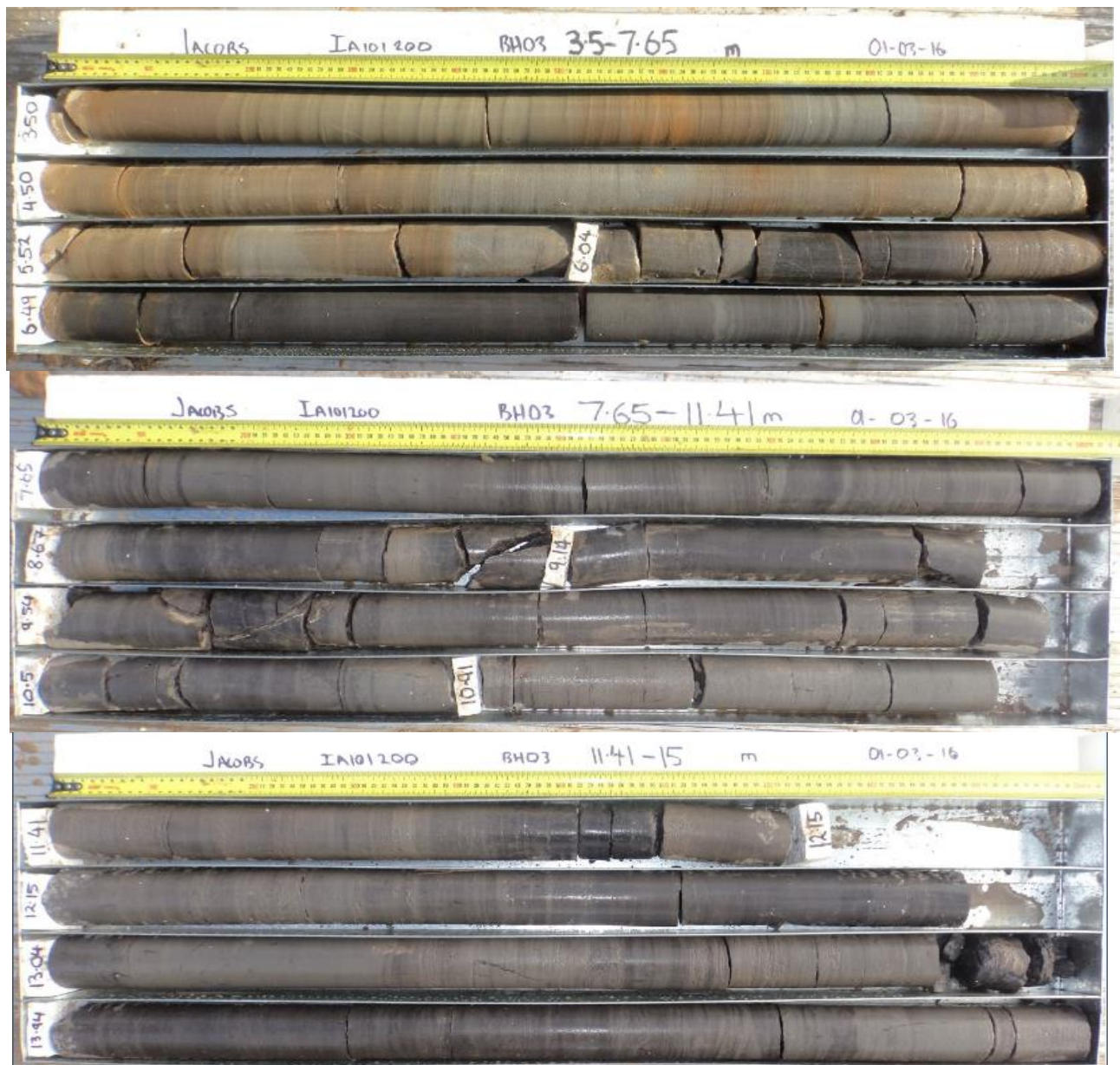
HOLE NO : BH03

PROJECT : Grafton Correctional Facility
LOCATION : GraftonFILE / JOB NO : IA101200
SHEET : 3 OF 3

POSITION : E: 506066.100, N: 6709726.300 (MGA94 Zone 56) SURFACE ELEVATION : 26.910 (AHD) ANGLE FROM HORIZONTAL : 90°
 RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :
 DATE STARTED : 1/3/16 DATE COMPLETED : 2/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR
 CASING DIAMETER : BARREL (Length) : BIT : BIT CONDITION :

DRILLING				MATERIAL				FRACTURES			
PROGRESS		TCR / RQD %	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● Axial ○ Diametral	NATURAL FRACTURE (mm)	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
DRILLING & CASING	WATER										
HQ3	70% LOSS	100% TCR 80% RQD		10.0	XXXXXX XXXXXX XXXXXX XXXXXX	SILTSTONE INTERLAMINATED WITH SANDSTONE: (80% siltstone, 20% sandstone) Siltstone is dark grey, thinly laminated, 0-5°, sandstone is fine grained and pale grey. (continued)	SW to FR				10.01: 10.3: 10.34: 10.43:
HQ3	90% LOSS	100% TCR 91% RQD		11.0	XXXXXX XXXXXX XXXXXX XXXXXX	SANDSTONE Fine grained, pale grey, with siltstone and carbonaceous laminae, approximately 5%. 11.4-11.8: Increasing in Siltstone to approximately 50%	SW to FR				10.8: 11: 11.14: 11.34:
HQ3	100% LOSS	95% TCR 91% RQD		12.0	XXXXXX XXXXXX XXXXXX XXXXXX	SILTSTONE INTERLAMINATED WITH SANDSTONE: (50% siltstone, 50% sandstone) Siltstone is dark grey to black, distinctly laminated, 0-5° with carbonaceous minerals, sandstone is fine grained and pale grey, distinctly bedded.	FR				11.92: :
HQ3	100% LOSS			13.0	XXXXXX XXXXXX XXXXXX XXXXXX						
HQ3	100% LOSS			14.0	XXXXXX XXXXXX XXXXXX XXXXXX						13.9:
				15.0	XXXXXX	BH03 terminated at target depth 15.0m.					
				16.0							
				17.0							
				18.0							
				19.0							

See Explanatory Notes for details of abbreviations & basis of descriptions.



Drawn:	JP		Client:	Infrastructure New South Wales		
Approved:	SR		Project and Location:	Grafton Correctional Facility, Grafton		
Date:	17/03/16		Title:	GBH03 3.50-15.0		
Scale:	NA		Project No.:	IA101200	figure no:	

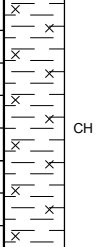
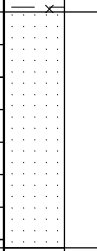
NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH04

PROJECT : Grafton Correctional Facility
LOCATION : Grafton

FILE / JOB NO : IA101200
SHEET : 1 OF 3

POSITION : E: 506027.900, N: 6709213.750 (MGA94 Zone 56) SURFACE ELEVATION : 19.170 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :
DATE STARTED : 2/3/16 DATE COMPLETED : 3/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR

DRILLING						MATERIAL							
PROGRESS		DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY	RELATIVE DENSITY	STRUCTURE & Other Observations	
DRILLING & CASING	WATER												
ADV SPT ADV S					0.0			SILTY CLAY Dark brown, high plasticity, traces of gravel and sand. (Colluvium)				COLLUVIUM	
				1.50m SPT 8.22.19 N=41	1.0		1.60m	1.2-1.6: Becoming light brown and mottled orange-brown.	D	H			
				1.95m	2.0				SANDSTONE Extremely low strength, extremely weathered, recovered as a Silty Clay, light brown high plasticity, with relict rock fabric.	D	H	WEATHERED BEDROCK	
				3.00m SPT 30/50mm N=R 3.05m	3.0		3.05m	Continued as Cored Drill Hole					
			Not Encountered		4.0								
					5.0								
					6.0								
					7.0								
					8.0								
					9.0								
					10.0								

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

HOLE NO : BH04

PROJECT : Grafton Correctional Facility
LOCATION : GraftonFILE / JOB NO : IA101200
SHEET : 2 OF 3

POSITION : E: 506027.900, N: 6709213.750 (MGA94 Zone 56) SURFACE ELEVATION : 19.170 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :

DATE STARTED : 2/3/16 DATE COMPLETED : 3/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR

CASING DIAMETER : BARREL (Length) : BIT : BIT CONDITION :

DRILLING				MATERIAL				FRACTURES			
DRILLING & CASING	WATER	TCR / RQD %	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral	NATURAL FRACTURE (mm)	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
				0.0							
				1.0							
				2.0							
				3.0							
				3.05		3.05m START CORING AT 3.05m					
				3.50		SANDSTONE: light brown, recovered as a Silty Clay, high plasticity, with relict rock fabric	XW				3.05: All defects are sub-horizontal bedding partings unless noted otherwise.
				3.50		SILTSTONE INTERLAMINATED WITH SANDSTONE: (70% Siltstone, 30% Sandstone) Dark grey and brown, sandstone is fine grained, pale grey, distinctly laminated, 0°.	MW				3.56: 3.65: 3.78:
				4.0							3.84 - 4.2: JT 70 - 80° CN ST RF
				4.27							4.27: JT 10° Fe SN CU RF
				4.32							4.32:
				4.55							4.55: JT 5° Fe SN CU S
				4.73							4.73 - 4.86: JT 80 - 90° Fe SN PR S
				4.87							4.87: JT 10° Fe SN IR RF
				5.1							5.1:
				5.2							5.2:
				5.3							5.3:
				5.45							5.45 - 5.86: JT 80 - 90° Fe SN PR S
				5.86		5.86m					
				6.0		6.00m 5.86-6.00: CORE LOSS					
				6.0		SANDSTONE INTERLAMINATED WITH SILTSTONE: (70% sandstone, 30% siltstone) Dark grey and brown, sandstone is fine grained, pale grey, distinctly laminated, 0°.	MW to SW				6.2:
				6.5							6.5: JT 5 - 10° CN UN S
				6.7							6.7: JT 10° Fe SN CU RF
				6.77							6.77: JT 10° Fe SN CU RF
				6.98							6.98:
				7.01							7.01:
				7.16							7.16:
				7.45							7.45:
				7.65							7.65: JT 0 - 10° Fe SN CU VR
				7.87							7.87: JT 0 - 10° Fe SN UN RF
				8							8:
				8.17							8.17:
				8.25							8.25:
				8.44							8.44:
				8.48		8.48-8.60: Residual soil, silty clay.	EW				8.48 - 8.68: CZ 0 - 5° CN PR S
				8.74							8.74:
				9		SANDSTONE Pale grey, fine grained, distinctly laminated, with approximately 5% siltstone and carbonaceous laminations.	MW to SW SW				9:
				9.37							9.37:
				9.51							9.51:
				9.74							9.74:
				9.93							9.93:

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

HOLE NO : BH04

PROJECT : Grafton Correctional Facility
LOCATION : GraftonFILE / JOB NO : IA101200
SHEET : 3 OF 3

POSITION : E: 506027.900, N: 6709213.750 (MGA94 Zone 56) SURFACE ELEVATION : 19.170 (AHD) ANGLE FROM HORIZONTAL : 90°
 RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :
 DATE STARTED : 2/3/16 DATE COMPLETED : 3/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR
 CASING DIAMETER : BARREL (Length) : BIT : BIT CONDITION :

DRILLING				MATERIAL				FRACTURES			
DRILLING & CASING	WATER	TCR / RQD %	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● Axial ○ Diametral	NATURAL FRACTURE (mm)	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
HQ3	30% LOSS	100% TCR 97% RQD		10.0			SW				
				10.30m		Carbonaceous material	MW				10.33: CO 0° CN PR S
				10.40m		SANDSTONE Pale grey, fine grained, distinctly laminated, with approximately 5% siltstone and carbonaceous laminations.	SW				10.38:
				11.0							10.59:
				11.20-11.5		Becoming medium grained.					10.65:
				11.46m		11.40-11.60: Calcite and Pyrite defect mineralisation. SHALE INTERLAMINATED WITH SANDSTONE: Dark grey to black, carbonaceous fissible with regular strongly defined laminations in fraser bedding, sandstone is fine grained, pale grey.					11.12:
				12.0							11.46 - 11.8: JT 90° CA/CB SN ST S
				13.0							12.54:
				14.0							12.95:
				15.0							13.56:
				15.00m		BH04 terminated at target depth 15.0m.					13.6:
				16.0							14.21:
				17.0							
				18.0							
				19.0							
				20.0							

See Explanatory Notes for details of abbreviations & basis of descriptions.

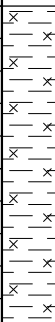
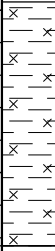


Drawn:	JP		Client:	Infrastructure New South Wales		
Approved:	SR		Project and Location:	Grafton Correctional Facility, Grafton		
Date:	17/03/16		Title:	GBH04 3.50-15.0		
Scale:	NA		Project No.:	IA101200	figure no:	

POSITION : E: 505753.730, N: 6708663.530 (MGA94 Zone 56) SURFACE ELEVATION : 23.200 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Scout TD105	MOUNTING :	CONTRACTOR : Total Drilling	DRILLER :
------------------------	------------	-----------------------------	-----------

DATE STARTED : 2/3/16 DATE COMPLETED : 2/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR

DRILLING					MATERIAL						
PROGRESS		DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
DRILLING & CASING	WATER										
↑ ↓ ADV					0.0		CH	SILTY CLAY Dark brown mottled red-brown, high plasticity, traces of sand.	D	VS	COLLUVIUM
↑ ↓ SPT			1.50m SPT 4,9,13 N=22								
↑ ↓ ADV			1.95m								
↑ ↓ SPT					2.0		CH	SILTY CLAY Red-brown mottled white.	D	H	
↑ ↓ SPT			3.00m SPT 8,15,20 N=35								
			3.45m								
								Continued as Cored Drill Hole			
					4.0						
					5.0						
					6.0						
					7.0						
					8.0						
					9.0						
					10.0						

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

HOLE NO : BH05

PROJECT : Grafton Correctional Facility
LOCATION : GraftonFILE / JOB NO : IA101200
SHEET : 2 OF 3

POSITION : E: 505753.730, N: 6708663.530 (MGA94 Zone 56) SURFACE ELEVATION : 23.200 (AHD) ANGLE FROM HORIZONTAL : 90°
 RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :
 DATE STARTED : 2/3/16 DATE COMPLETED : 2/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR
 CASING DIAMETER : BARREL (Length) : BIT : BIT CONDITION :

DRILLING				MATERIAL				FRACTURES			
DRILLING & CASING	WATER	TCR / ROD %	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral	NATURAL FRACTURE (mm)	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
				0.0							
				1.0							
				2.0							
				3.0							
				3.45m		START CORING AT 3.45m					
				4.0		3.45-4.51: CORE LOSS					3.45: All defects are sub-horizontal bedding partings unless noted otherwise.
				4.51m							
				5.0		SANDSTONE Fine grained, grey and orange-brown.	EW				5.05 - 5.07: CZ 0° CN PR S
				5.20m		SANDSTONE INTERLAMINATED WITH SILTSTONE: Siltstone is dark grey, thinly laminated, 0-5°, sandstone is fine grained and pale grey and orange-brown, remoulds as a silty clay.					5.41: 5.6: 5.66:
				5.95m							
				6.00m		5.95-6.0: CORE LOSS					
				6.10m		Carbanaceous Material	EW				6.1: CO 0° CN PR S
				6.90m		SANDSTONE INTERLAMINATED WITH SILTSTONE: Siltstone is dark grey, thinly laminated, 0-5°, sandstone is fine grained and pale grey and orange-brown, remoulds as a silty clay.	EW				6.47:
				7.00m		Carbanaceous Material	EW				6.78: JT 40 - 50° CN CU RF
				7.55m		SANDSTONE INTERLAMINATED WITH SILTSTONE: Siltstone is dark grey, thinly laminated, 0-5°, sandstone is fine grained and pale grey and orange-brown, remoulds as a silty clay.	HW				7.04 - 7.3: JT 80 - 90° CN PR S
				7.67m		Carbanaceous Material	EW				7.67: CO 0° CN PR S
				8.0		SILTSTONE Dark grey, thinly laminated, 0-5°.	HW				7.77: JT 0 - 10° CN ST S
				8.22m		SANDSTONE INTERLAMINATED WITH SILTSTONE: (50% siltstone, 50% sandstone) Siltstone is dark grey, thinly laminated, 0-5°, sandstone is fine grained and pale grey.	HW				7.88: 8.08: 8.11: 8.12: JT 10 - 20° CN PR S
				9.0							8.28: 8.37: JT 0 - 10° CN UN RF
				9.12m		SANDSTONE Fine grained, pale grey, with dark grey siltstone laminae, approximately 10%.	MW				8.55: JT 10 - 15° CN ST RF
				9.50m			SW				8.59: JT 10 - 15° CN ST RF
				9.70m							8.62 - 8.72: 8.8: 9.48:
				10.0							9.94: JT 10 - 15° CN ST RF

See Explanatory Notes for details of abbreviations & basis of descriptions.

SKM LIB 1.01.2.CLB Log IS AUCORED BOREHOLE 2 (IA101200_LOGS.GPJ) <-DrawingFile> 18/05/2016 09:59 8.30.003 Dargal Lab and in Situ Tool - DGD | Lib SKM 1.01.2 2013-10-17 Proj SKM 1.01.1 2013-10-16

CORED DRILL HOLE LOG

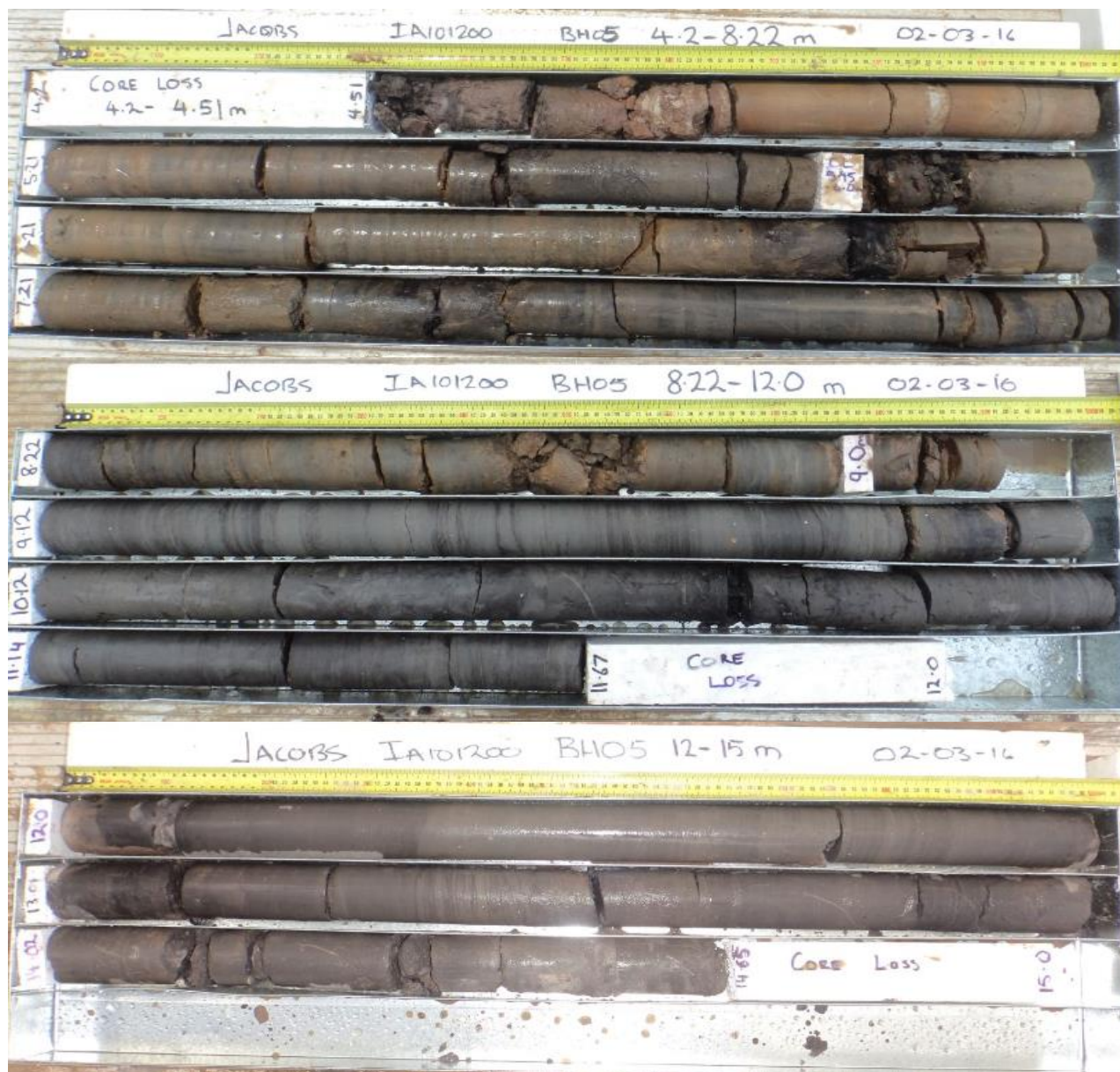
HOLE NO : BH05

PROJECT : Grafton Correctional Facility
LOCATION : GraftonFILE / JOB NO : IA101200
SHEET : 3 OF 3

POSITION : E: 505753.730, N: 6708663.530 (MGA94 Zone 56) SURFACE ELEVATION : 23.200 (AHD) ANGLE FROM HORIZONTAL : 90°
 RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :
 DATE STARTED : 2/3/16 DATE COMPLETED : 2/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR
 CASING DIAMETER : BARREL (Length) : BIT : BIT CONDITION :

DRILLING			MATERIAL			FRACTURES		
PROGRESS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION	Weathering	ESTIMATED STRENGTH Is(50)	NATURAL FRACTURE (mm)	VISUAL	ADDITIONAL DATA
DRILLING & CASING			ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)		● Axial ○ Diametral			(joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
WATER					EL -0.03 VI -0.1 L -0.3 M -1 H -3 VH -10 EH	20 40 100 300 1000		
TCR / RQD %								
SAMPLES & FIELD TESTS								
DRILL DEPTH	10.0		10.30m	SW				10.27:
			SHALE Dark grey to black, distinctly laminated, fissible with carbonaceous minerals.	SW				10.36:
	11.0		11.05m	SW				10.55: JT 10 - 15° CN CU S
			SILTSTONE Dark grey, distinctly laminated with some fine grained sandstone laminations, approximately 5%.					
	11.67m		11.67-12.00: CORE LOSS					11.19:
	12.0		12.00m	SW				:
			SILTSTONE Dark grey, distinctly laminated with some fine grained sandstone laminations, approximately 5%.					
	12.50m		13.00m					
	UCS =7.71 MPa		13.16m					13.14:
	12.80m		Carbanaceous Material					13.54: JT 5 - 10° CN CU S
			SILTSTONE INTERLAMINATED WITH SANDSTONE (80% siltstone, 20% sandstone) Siltstone is dark grey, thinly laminated, 0-5°, sandstone is fine grained and pale grey and orange-brown.					13.84:
	14.0		14.65m					
			14.65-15.00: CORE LOSS					
	15.0		15.00m					
			BH05 terminated at target depth 15.0m.					
	16.0							
	17.0							
	18.0							
	19.0							
	20.0							

See Explanatory Notes for
details of abbreviations
& basis of descriptions.

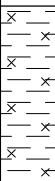


Drawn:	JP		Client:	Infrastructure New South Wales		
Approved:	SR		Project and Location:	Grafton Correctional Facility, Grafton		
Date:	17/03/16		Title:	GBH05 4.20-15.0		
Scale:	NA		Project No.:	IA101200	figure no:	

POSITION : E: 505597.000, N: 6710561.000 (MGA94 Zone 56) SURFACE ELEVATION : 20.700 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Scout TD105	MOUNTING :	CONTRACTOR : Total Drilling	DRILLER :
------------------------	------------	-----------------------------	-----------

DATE STARTED : 7/3/16 DATE COMPLETED : 8/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR

DRILLING					MATERIAL						
PROGRESS		DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
DRILLING & CASING	WATER										
AD/V CASING					0.0		CH	0.00m SILTY CLAY Dark brown, high plasticity, traces of gravel and sand. (Colluvium)	D	H	COLLUVIUM
				1.0	1.10m SANDSTONE Extremely low strength, extremely weathered, recovered as a Silty Clay, light brown high plasticity, with relict rock fabric.			M			WEATHERED BEDROCK
SPT				1.50m SPT 14, 14, 28 N=42 1.95m	2.0						
AD/T					3.0			Continued as Cored Drill Hole			
					4.0						
					5.0						
					6.0						
					7.0						
					8.0						
					9.0						
					10.0						

See Explanatory Notes for details of abbreviations & basis of descriptions.

POSITION : E: 505597.000, N: 6710561.000 (MGA94 Zone 56) SURFACE ELEVATION : 20.700 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Scout TD105	MOUNTING :	CONTRACTOR : Total Drilling	DRILLER :
------------------------	------------	-----------------------------	-----------

DATE STARTED : 7/3/16 DATE COMPLETED : 8/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR

CASING DIAMETER :	BARREL (Length) :	BIT :	BIT CONDITION :
-------------------	-------------------	-------	-----------------

[illegible]

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

HOLE NO : BH06

PROJECT : Grafton Correctional Facility
LOCATION : GraftonFILE / JOB NO : IA101200
SHEET : 3 OF 3

POSITION : E: 505597.000, N: 6710561.000 (MGA94 Zone 56) SURFACE ELEVATION : 20.700 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Scout TD105 MOUNTING : CONTRACTOR : Total Drilling DRILLER :

DATE STARTED : 7/3/16 DATE COMPLETED : 8/3/16 DATE LOGGED : 16/3/16 LOGGED BY : JP CHECKED BY : SGR

CASING DIAMETER : BARREL (Length) : BIT : BIT CONDITION :

DRILLING				MATERIAL				FRACTURES			
PROGRESS		TCR / RQD %	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral	NATURAL FRACTURE (mm)	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
DRILLING & CASING	WATER										
HQ3	15% LOSS	95% TCR 95% RQD		10.0	10.20m	INTERLAMINATED SILTSTONE AND SANDSTONE (50% siltstone, 50% sandstone) Siltstone is dark grey, thinly laminated, 0-5°, sandstone is fine grained and pale grey.	SW SW to F	●			10.2: CO 0 - 5° CN ST RF
				11.0				○			
				12.00	11.90m 12.00m	11.90-12.00 m CORE LOSS					
				12.0		SILTSTONE Dark grey, distinctly laminated with some fine grained sandstone laminations, approximately 5%.	SW SW to F				12.23: JT 70° CN ST RF 12.47:
				13.0				●			
				14.0							14.12: JT 0 - 10° CN CU RF
				14.40m		SANDSTONE Fine and medium grained, pale grey.	SW SW to F				14.58:
				15.00	15.00m	BH06 terminated at target depth 15.0m.					
				16.0							
				17.0							
				18.0							
				19.0							
				20.0							

See Explanatory Notes for details of abbreviations & basis of descriptions.



Drawn:	JP		Client:	Infrastructure New South Wales		
Approved:	SR		Project and Location:	Grafton Correctional Facility, Grafton		
Date:	17/03/16					
Scale:	NA		Title:	GBH06 3.00-15.0		
			Project No.:	IA101200	figure no:	