# APPENDIX



# Geotechnical

Part 2 of 2

**GOWRIE TO HELIDON** ENVIRONMENTAL IMPACT STATEMENT



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

### Shrink Swell Index

🕓 GOLDER



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

| [                   | <b>AIIB</b> N 117 AII7   |                                   |                           |                       |
|---------------------|--|-----------------------------------|---------------------------|-----------------------|
|                     | SHRINK SWELL<br>Test M   | LINDEX TES<br>ethod AS 1289 7.1.1 | ST REPORT                 |                       |
| Client              | Golder Associates Pty Limited  |                                   | Report No.                | GA101181-ISS          |
|                     |  |                                   | Request No.               | Golder_1893795_TR02   |
| Address             | PO Box 1734 MILTON BC Q  | LD 4064                           | Test Date                 | 14/11/2018            |
|                     |  |                                   | Report Date               | 20/11/2018            |
| Project             | Inland Rail Section 320  |                                   |                           |                       |
| Description         | CLAY-brown   |                                   |                           |                       |
| Sample No.          |  |                                   | 320-01-BH2201             | -U00200               |
| Client ID           |  |                                   | 320-01-BH2                | 201                   |
| Depth (m)           |  |                                   | 2-2.18                    |                       |
|                     | RESULI   | S OF TEST                         | ING                       |                       |
|                     | SWEI   |                                   |                           |                       |
| Swell Pres          | sure (kPa) *   |                                   | 150                       |                       |
| Wet Densit          | y (t/m³)   |                                   | 2.04                      |                       |
| Initial Mois        | ture Content (%)   |                                   | 22.9                      |                       |
| Final Moist         | ture Content (%)   |                                   | 21.4                      |                       |
|                     | Swell (%)  |                                   | 1.8                       |                       |
|                     |  |                                   |                           |                       |
|                     | SHRIN  | KAGE SPECIME                      | N                         |                       |
| Estimated           | Inert Inclusions (%)   |                                   | 10-20                     |                       |
| Extent of C         | rumbling   |                                   | Nil                       |                       |
| Extent of C         | racking  |                                   | Slight                    |                       |
| Moisture (%         | %)   |                                   | 21.4                      |                       |
|                     | Shrinkage (%)  |                                   | 6.7                       |                       |
|                     |  |                                   |                           |                       |
|                     |  |                                   |                           |                       |
| SHRINK              | SWELL INDEX (Iss) (%)  |                                   | 4.2                       |                       |
|                     |  |                                   |                           |                       |
|                     |  |                                   |                           |                       |
|                     |  |                                   |                           |                       |
| Notes/Remarks:      |  |                                   |                           |                       |
|                     | * Swell pressure determination in accorda  | nce with test metho               | d 45/133 3 3              |                       |
| Sample/s supplied I | by client Tested as r  | received                          | u AO <del>Y</del> 100.0.0 | Page: 1 of 1 REP02304 |
| Accredite           | d for compliance with ISO/IEC 17025 - Testing.   |                                   | Authorized Signator       |                       |
| The results of the  | tests, calibrations, and/or measurements included in t<br>t are traceable to Australian/National Standards | his                               |                           | ŇATÀ                  |
| Goodinelli          | Tostad at Trilab Drishana Laboration   |                                   | C. Channon                |                       |
|                     | lested at Trilad Brisbane Laboratory   |                                   | o. onannon                | Laboratory No. 9926   |

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### **Triaxial Compression - Consolidated Undrained**





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|                               |               |                   |            | TRIAXIAL TI<br>Test Method   | EST REF<br>: AS1289.6.4.2 | PORT                       |                    |                                 |                   |
|-------------------------------|---------------|-------------------|------------|--|---------------------------|----------------------------|--------------------|---------------------------------|-------------------|
| lient:                        | Golder        | Associates P      | ty Limited | d  |                           |                            | Report No.:        | GA102082 -                      | CU                |
| ddress                        | PO Bo         | x 1734 MILTC      | ON BC      | QLD 4064   |                           | 1                          | Request No.        | Golder 1893                     | 3795 TR04         |
|                               |               |                   |            |  |                           |                            | Test Date:         | 25/01/2019                      |                   |
| Project                       | Inland        | Rail Section 3    | 20         |  |                           | 1                          | Report Date:       | 14/02/2019                      |                   |
| roject No.                    | 18937         | 95                |            |  | Client Sa                 | ample No.                  | 320-01-BH210       | 3-C00510                        |                   |
| oreHole                       | 320-01        | -BH2103           |            | Depth From (m)   | 5.1                       |                            | Depth <sup>-</sup> | <b>Γο (m)</b> 5.4               | 1                 |
| escription:                   | GRAV          | ELLY SILTY C      | CLAY-bro   | wn/grey  |                           |                            |                    |                                 |                   |
|                               |               |                   |            | SAMPLE & T   | EST DETAI                 | LS                         |                    |                                 |                   |
| Initial Heig<br>Initial Diame | ter: 2.0:1    | mm<br>mm          |            | Initial Moisture Content:<br>Final Moisture Content:<br>Wet Density: | 19.1<br>24.0<br>1 92      | %<br>%<br>t/m <sup>3</sup> | Rat<br>B           | e of Strain: 0.0<br>Response: 9 | 006 %/min<br>19 % |
| L/D Rd                        | 10. 2.0.1     |                   |            | Dry Density:   | 1.61                      | t/m <sup>3</sup>           |                    |                                 |                   |
|                               |               |                   |            | Mohr Circl   | e Diagra                  | m                          | •                  |                                 |                   |
| 1200                          |               |                   |            |  |                           |                            |                    |                                 |                   |
| 1000 -                        |               |                   |            |  |                           |                            |                    |                                 |                   |
| 800 -                         |               |                   |            |  |                           |                            |                    |                                 |                   |
| ss (kPa)                      |               |                   |            |  |                           |                            |                    |                                 |                   |
| shear Stre                    |               |                   |            |  |                           |                            |                    |                                 |                   |
| 400                           | /             |                   |            |  |                           |                            |                    |                                 |                   |
| 200 +                         |               |                   |            |  |                           |                            |                    |                                 |                   |
| 0 1                           |               | 200               | 400        | 600  | 800                       | 1000                       | 1200               | 1400                            | 1600              |
|                               |               |                   |            | Princ  | ipal Stress               | (kPa)                      |                    |                                 |                   |
|                               |               |                   |            | Failure Oritoria   | De els Deire              |                            |                    |                                 |                   |
| ample Type:                   | Sinale Indiv  | idual Undisturbed | Specimen   | Failure Criteria:  | Remarks:                  | Tested as Rec              | KatlO<br>eived     |                                 |                   |
| ample/s supplied              | by the client |                   |            |  | Note: Graph n             | ot to scale                |                    |                                 | Page 1 of 6       |

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|       |  | Test Method: AS1289.6.4.2   |  |
|-------|--|---|--|
|       | Golder Associates Pty Li                           | mited Report  | No.: GA102082 - CU                                 |
| [     | CLIENT:  | Golder Associates Pty Lin   | nited  |
|       | PROJECT:   | Inland Rail Section 320   | BEFORE TEST  |
|       | LAB SAMPLE No.                                     | 102082  | DATE: 21/01/19                                     |
|       | BOREHOLE:  | 320-01-BH2103   | DEPTH: 5.1   |
|       |  |   |  |
|       |  |   |  |
|       | CLIENT:  | Golder Associates Pty Lim   | ited   |
|       | CLIENT:<br>PROJECT:                                | Golder Associates Pty Lim<br>Inland Rail Section 320                            | ited AFTER TEST                                    |
| C     | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.              | Golder Associates Pty Lim<br>Inland Rail Section 320<br>102082                  | ited<br>AFTER TEST<br>DATE: 4/2/19                 |
|       | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty Lim<br>Inland Rail Section 320<br>102082<br>320-01-BH2103 | ited<br>AFTER TEST<br>DATE: 4/2/19<br>DEPTH: 5.1   |
|       | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty Lim<br>Inland Rail Section 320<br>102082<br>320-01-BH2103 | ited<br>AFTER TEST<br>DATE: $u/2/19$<br>DEPTH: 5.1 |
| Гуре: | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty Lim<br>Inland Rail Section 320<br>102082<br>320-01-BH2103 | ited<br>AFTER TEST<br>DATE: $u/2//9$<br>DEPTH: 5.1 |

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## **Triaxial Compression - Rock**



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|   | STRENGTH  | OF ROCK MA  |                    | LINT                | RIAXIAL CON                     | <b>MPRESSION</b>              |  |
|---|---|---|--------------------|---------------------|---------------------------------|-------------------------------|--|
|   |   |   | ASTM               | D7012               |                                 |                               |  |
|   | Standard Test Methods for Compr   | ressive Strength and Elastic                                    | Moduli of Inta     | ct Rock Core S      | Specimens under Varying S       | tates of Stress and Temperatu | res                                      |
| Client  | Method B : Elastic Mo   | oduli of Undrained Rock Cor                                     | e Specimens i      | n Triaxial Corr     | pression Without Pore Pre       |                               |  |
|   |   |   |                    |                     | Report No.                      | GA 102209-RTX                 |  |
| Address   | PO Box 1734 MILTO   | N BC QLD  | 4064               |                     | Test Date                       | 20/01/2010                    |  |
|   |   |   |                    |                     | Report Date                     | 30/01/2019                    |  |
| Project   | Inland Rail Section 3   | 20  | Denth F            | rom (m)             | 104                             | Sample 320-01-                | BH2101_TWR · 320_01_                     |
| Bore Hole   | 320-01-BH2101   | 20  | Dept               | h To (m)            | 104 3                           | No:                           | BH2101-MOI                               |
| Description   | C   |   | Dopt               |                     | 101.0                           |                               |  |
| Sample Type   | Single Individual Roo   | k Core Specimen   |                    |                     |                                 |                               |  |
|   |   | I I   | Samnle             | Details             |                                 |                               |  |
|   |   |   | oampic             | Details             |                                 |                               |  |
| Average Samp  | le Diameter (mm)  | 60  | ).8                | Moistu              | re Content (%)                  |                               | 8.1                                      |
| Sample Height   | : (mm)  | 13  | 2.0                | Wet De              | ensity (t/m <sup>3</sup> )      |                               | 2.20                                     |
| Duration of Tes                                       | st (min)  | 22:1  | 1:00               | Dry De              | ensity (t/m³)                   |                               | 2.04                                     |
| Rate of Strain (                                      | (%/min)   | 0.  | 05                 | Beddir              | ig (°)                          | 5                             |  |
| Rupture Angle   | (°)   | 3   | 0                  | Test Apparatus      |                                 | RTR2500 Triaxial Machine      |  |
| Mode of Failure                                       | e Shear   |   |                    |                     |                                 |                               |  |
|   |   | In  | tact Tes           | t Resul             | ts                              |                               |  |
|   |   | Value at Plastic<br>Deformation                                 | Value at<br>Deforr | t Plastic<br>mation | Value at Plastic<br>Deformation | Peak Value                    |  |
| Confining Pre   | ssure (MPa)   | 12.00   | 24                 | .10                 | 48.12                           | 48.12                         |  |
| Calc'd Peak D   | eviator Stress (MPa)  | 3.10  | 6.                 | 70                  | -                               | -                             |  |
| Deviator Stres  | ss (MPa)  | 3.07  | 6.                 | 63                  | 11.3                            | 11.4                          |  |
| Axial Strain (µ                                       | ıe)   | 1613  | 55                 | 63                  | 22878                           | 28760                         |  |
| Diametral Stra  | ain (µe)  | -185  | 2                  | 9                   | -5822                           | -8821                         |  |
| Tangent Modu  | ulus (GPa)  | 1.92  | 1.                 | 35                  | 3.39                            | -                             |  |
| Poisson's Rat   | io  | 0.146   | 0.0                | 01                  | 0.008                           | -                             |  |
|   |   | Res   | idual Te           | est Resi            | ults                            |                               |  |
| Confining Pre   | ssure (MPa)   | 48.13   | 34                 | .88                 | 11.82                           |                               |  |
| Residual Devi   | ator Stress (MPa)   | 11.2  | 10                 | ).8                 | 10.6                            |                               |  |
| Axial Strain (µ                                       | ie)   | 37875   | 420                | 053                 | 45756                           |                               |  |
| Diametral Stra  | ain (µe)  | -14339  | -18                | 384                 | -21525                          |                               |  |
| Notes/Remarks:  |   |   |                    |                     |                                 |                               |  |
| Sample/s supplied by                                  | y client  |   | Tested as          | received            |                                 |                               | Page 1 of 8 REP16601                     |
| Accredited t<br>The results of the t<br>this document | for compliance with ISO/IES<br>tests, calibrations, and/or me<br>are traceable to Australian/ | 17025 - Testing.<br>easurements included<br>National Standards. | in                 |                     | Authorised Signatory            | _                             | ACCELETES FOR<br>TECHNICAL<br>COMPETENCE |
|   | Tested at Trilab Brisbane Laboratory Laboratory No. 9926                                      |   |                    |                     |                                 |                               |  |

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



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|  | UNLENGT   | ASTM D7012  |                 |                       |                       |                  |
|--|---|---|-----------------|-----------------------|-----------------------|------------------|
|  | Standard Test Methods for Com   | npressive Strength and Elastic Moduli of Intact Rock Core   | e Specimens und | der Varying States of | Stress and Temperatur | res              |
| Client   | Method B : Elastic  | Moduli of Undrained Rock Core Specimens in Triaxial Co  | mpression With  | nout Pore Pressure M  | leasurements          |                  |
| Chem   | Golder Associates   | s r ty Linited  | Repoi           | rt No.                | GA1022                | 209-RTX          |
|  |   | Before and After Test   | Photos          |                       |                       |                  |
|  | CLIENT:   | Golder Associates Pty I   | imited          | 1                     |                       |                  |
|  | PROJECT:  | Inland Rail Section 320   |                 | BEI                   | FORE TE               | ST               |
|  | LAB SAMPLE No.  | 102209  |                 | DATE:                 | 21/01/19              |                  |
| 3  | BOREHOLE:   | 320-01-BH2101   |                 | DEPTH                 | : 104                 |                  |
|  |   |   |                 |                       |                       |                  |
| es/Rema  | arks:   |   |                 |                       |                       |                  |
| es/Remained  | arks:   |   |                 |                       |                       |                  |
| es/Remains   | arks:<br>upplied by client  | E 1702 Totia  |                 |                       |                       | Page 4 of 8 REP1 |
| es/Remains and the result  | arks:<br>upplied by client<br>corredited for compliance with ISO/I<br>ts of the tests, calibrations, and/or   | Photo not to scale         Test 17025 - Testing:         measurements included in   |                 |                       |                       | Page 4 of 8 REP1 |
| es/Remains and the result this content of the second secon | arks:<br>upplied by client<br>corredited for compliance with ISO/I<br>its of the tests, calibrations, and/or<br>document are traceable to Australia | Image: Control of the set of the se | Autho           |                       |                       | Page 4 of 8 REP1 |



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### Point Load Index Testing



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| POINT LOAD TEST REPORT |                         |                                    |                      |                      |  |  |
|------------------------|-------------------------|------------------------------------|----------------------|----------------------|--|--|
| Client                 | Golder Associates Pty L | Test Method: AS 4133.4.1<br>imited | Report No            | GA101184 101220 PI   |  |  |
|                        |                         |                                    | Report No.           | Golder 1803705 TR02  |  |  |
| Address                | PO Box 1734 MILTON B    | 3C QLD 4064                        | Test Date            | 31/10/2018           |  |  |
|                        |                         |                                    | Report Date          | 6/11/2018            |  |  |
| Project                | Inland Rail Section 320 |                                    |                      | 0,11,2010            |  |  |
| Project No             | 1893795                 |                                    |                      |                      |  |  |
|                        |                         | I                                  |                      |                      |  |  |
| Trilab Sample No.      | 101184                  | 101185                             | 101186               | 101188               |  |  |
| Client Sample No       | 320-01-BH2201-C00780    | 320-01-BH2201-C01140               | 320-01-BH2201-C01504 | 320-01-BH2201-C01808 |  |  |
| Bore Hole              | 320-01-BH2201           | 320-01-BH2201                      | 320-01-BH2201        | 320-01-BH2201        |  |  |
| Depth From/To (m)      | 7.80-7.90               | 11.40-11.60                        | 15.04-15.14          | 18.08-18.18          |  |  |
| Description            | С                       | С                                  | С                    | С                    |  |  |
| ls (MPa)               | 0.09                    | 0.21                               | 0.17                 | 2.21                 |  |  |
| Is(50) (MPa)           | 0.09                    | 0.21                               | 0.17                 | 1.99                 |  |  |
| Load Direction         | Axial                   | Axial                              | Axial                | Axial                |  |  |
|                        |                         |                                    |                      |                      |  |  |
| Trilab Sample No.      | 101191                  | 101192                             | 101193               | 101195               |  |  |
| Client Sample No       | 320-01-BH2209-C00550    | 320-01-BH2209-C01190               | 320-01-BH2209-C01460 | 320-01-BH2209-C01670 |  |  |
| Bore Hole              | 320-01-BH2209           | 320-01-BH2209                      | 320-01-BH2209        | 320-01-BH2209        |  |  |
| Depth From/To (m)      | 5.50-10.00              | 11.90-12.00                        | 14.60-14.70          | 16.70-16.80          |  |  |
| Description            | С                       | С                                  | С                    | С                    |  |  |
| ls (MPa)               | 0.06                    | 1.14                               | 3.40                 | 0.67                 |  |  |

1.15

Axial

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

Is(50) (MPa)

Load Direction

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0.06

Axial

Authorised Signatory

3.19

Axial

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REP02102

0.66

Axial

 Laboratory No. 9926

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 ABN 25 065 630 506



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| POINT LOAD TEST REPORT |                         |                      |                      |                      |  |  |
|------------------------|-------------------------|----------------------|----------------------|----------------------|--|--|
| Client                 | Golder Associates Pty L | imited               | Report No.           | GA101184-101220-PL   |  |  |
|                        |                         |                      | Request No           | Golder 1893795 TR02  |  |  |
| Address                | PO Box 1734 MILTON E    | BC QLD 4064          | Test Date            | 31/10/2018           |  |  |
|                        |                         |                      | Report Date          | 6/11/2018            |  |  |
| Project                | Inland Rail Section 320 |                      | ·                    |                      |  |  |
| Project No             | 1893795                 |                      |                      |                      |  |  |
|                        |                         |                      |                      |                      |  |  |
| Trilab Sample No.      | 101196                  | 101197               | 101200               | 101201               |  |  |
| Client Sample No       | 320-01-BH2209-C02000    | 320-01-BH2209-C02000 | 320-01-BH2212-C00660 | 320-01-BH2212-C00950 |  |  |
| Bore Hole              | 320-01-BH2209           | 320-01-BH2209        | 320-01-BH2212        | 320-01-BH2212        |  |  |
| Depth From/To (m)      | 20.00-20.10             | 20.00-20.49          | 6.60-6.70            | 9.50-9.60            |  |  |
| Description            | С                       | С                    | С                    | С                    |  |  |
| ls (MPa)               | 0.43                    | 0.75                 | 0.51                 | 0.08                 |  |  |
| Is(50) (MPa)           | 0.40                    | 0.69                 | 0.50                 | 0.08                 |  |  |
| Load Direction         | Axial                   | Axial                | Axial                | Axial                |  |  |
|                        |                         |                      |                      |                      |  |  |
| Trilab Sample No.      | 101203                  | 101204               | 101205               | 101209               |  |  |
| Client Sample No       | 320-01-BH2212-C01360    | 320-01-BH2212-C01790 | 320-01-BH2212-C02000 | 320-01-BH2218-C00840 |  |  |
| Bore Hole              | 320-01-BH2212           | 320-01-BH2212        | 320-01-BH2212        | 320-01-BH2218        |  |  |
| Depth From/To (m)      | 13.60-13.70             | 17.90-18.00          | 20.00-20.10          | 8.40-8.50            |  |  |
| Description            | С                       | С                    | С                    | С                    |  |  |

0.97

0.97

Axial

NOTES/REMARKS:

Tested as received

0.42

0.39

Axial

ls (MPa)

Is(50) (MPa)

Load Direction

Sample/s supplied by the client

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1.96

1.87

Axial



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2.11

2.05

Axial

Laboratory No. 9926

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Trilab Pty Ltd ABN 25 065 630 506

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



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

| POINT LOAD TEST REPORT |                               |                      |                      |                      |  |  |  |
|------------------------|-------------------------------|----------------------|----------------------|----------------------|--|--|--|
| Client                 | Golder Associates Pty Limited |                      | Report No.           | GA101184-101220-PL   |  |  |  |
|                        |                               |                      | Request No           | Golder_1893795_TR02  |  |  |  |
| Address                | PO Box 1734 MILTON E          | BC QLD 4064          | Test Date            | 31/10/2018           |  |  |  |
|                        |                               |                      | Report Date          | 6/11/2018            |  |  |  |
| Project                | Inland Rail Section 320       |                      |                      |                      |  |  |  |
| Project No             | 1893795                       |                      |                      |                      |  |  |  |
|                        | Γ                             | Γ                    | Γ                    | 1                    |  |  |  |
| Trilab Sample No.      | 101210                        | 101211               | 101213               | 101214               |  |  |  |
| Client Sample No       | 320-01-BH2218-C00935          | 320-01-BH2218-C01000 | 320-01-BH2218-C01170 | 320-01-BH2218-C01200 |  |  |  |
| Bore Hole              | 320-01-BH2218                 | 320-01-BH2218        | 320-01-BH2218        | 320-01-BH2218        |  |  |  |
| Depth From/To (m)      | 9.35-9.45                     | 10.00-10.10          | 11.70-11.80          | 12.00-12.10          |  |  |  |
| Description            | С                             | С                    | С                    | С                    |  |  |  |
| ls (MPa)               | 0.79                          | 1.63                 | 3.97                 | 2.85                 |  |  |  |
| ls(50) (MPa)           | 0.78                          | 1.58                 | 3.74                 | 2.78                 |  |  |  |
| Load Direction         | Axial                         | Axial                | Axial                | Axial                |  |  |  |
|                        |                               |                      |                      |                      |  |  |  |
| Trilab Sample No.      | 101215                        | 101216               | 101218               | 101219               |  |  |  |
| Client Sample No       | 320-01-BH2218-C01405          | 320-01-BH2218-C01500 | 320-01-BH2218-C01640 | 320-01-BH2218-C01880 |  |  |  |
| Bore Hole              | 320-01-BH2218                 | 320-01-BH2218        | 320-01-BH2218        | 320-01-BH2218        |  |  |  |
| Depth From/To (m)      | 14.05-14.15                   | 15.00-15.10          | 16.40-16.50          | 18.80-18.90          |  |  |  |
| Description            | С                             | С                    | С                    | С                    |  |  |  |
| ls (MPa)               | 1.73                          | 4.13                 | 3.98                 | 4.68                 |  |  |  |
| ls(50) (MPa)           | 1.68                          | 4.05                 | 3.80                 | 4.22                 |  |  |  |
| Load Direction         | Axial                         | Axial                | Axial                | Axial                |  |  |  |

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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



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| POINT LOAD TEST REPORT |                               |                      |                      |                      |  |  |
|------------------------|-------------------------------|----------------------|----------------------|----------------------|--|--|
| Client                 | Golder Associates Pty Limited |                      | Report No.           | GA101184-101220-PL   |  |  |
|                        |                               |                      | Request No           | Golder_1893795_TR02  |  |  |
| Address                | PO Box 1734 MILTON E          | 3C QLD 4064          | Test Date            | 31/10/2018           |  |  |
|                        |                               |                      | Report Date          | 6/11/2018            |  |  |
| Project                | Inland Rail Section 320       |                      |                      |                      |  |  |
| Project No             | 1893795                       |                      |                      |                      |  |  |
|                        |                               |                      |                      |                      |  |  |
| Trilab Sample No.      | 101220                        | 101184               | 101185               | 101186               |  |  |
| Client Sample No       | 320-01-BH2218-C02005          | 320-01-BH2201-C00780 | 320-01-BH2201-C01140 | 320-01-BH2201-C01504 |  |  |
| Bore Hole              | 320-01-BH2218                 | 320-01-BH2201        | 320-01-BH2201        | 320-01-BH2201        |  |  |
| Depth From/To (m)      | 20.05-20.15                   | 7.80-7.90            | 11.40-11.60          | 15.04-15.14          |  |  |
| Description            | С                             | С                    | С                    | С                    |  |  |
| ls (MPa)               | 2.63                          | 0.04                 | 0.17                 | 0.25                 |  |  |
| Is(50) (MPa)           | 2.45                          | 0.04                 | 0.17                 | 0.25                 |  |  |
| Load Direction         | Axial                         | Diametral            | Diametral            | Diametral            |  |  |
|                        |                               |                      |                      |                      |  |  |
| Trilab Sample No.      | 101188                        | 101191               | 101192               | 101193               |  |  |
| Client Sample No       | 320-01-BH2201-C01808          | 320-01-BH2209-C00550 | 320-01-BH2209-C01190 | 320-01-BH2209-C01460 |  |  |
| Bore Hole              | 320-01-BH2201                 | 320-01-BH2209        | 320-01-BH2209        | 320-01-BH2209        |  |  |
| Depth From/To (m)      | 18.08-18.18                   | 5.50-10.00           | 11.90-12.00          | 14.60-14.70          |  |  |
| Description            | С                             | С                    | С                    | С                    |  |  |
| ls (MPa)               | 1.16                          | 0.23                 | 0.97                 | 2.72                 |  |  |

NOTES/REMARKS:

Tested as received

1.17

Diametral

Is(50) (MPa)

Load Direction

Sample/s supplied by the client

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0.97

Diametral



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2.69

Diametral

Laboratory No. 9926

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0.23

Diametral

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



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

|                   | POI                           | NT LOAD TEST R       | EPORT                |                      |
|-------------------|-------------------------------|----------------------|----------------------|----------------------|
| Client            | Golder Associates Pty Limited |                      | Report No.           | GA101184-101220-PL   |
|                   |                               |                      |                      | Golder_1893795_TR02  |
| Address           | PO Box 1734 MILTON E          | BC QLD 4064          | Test Date            | 31/10/2018           |
|                   |                               |                      | Report Date          | 6/11/2018            |
| Project           | Inland Rail Section 320       | 1                    |                      |                      |
| Project No        | 1893795                       |                      |                      |                      |
|                   |                               |                      |                      |                      |
| Trilab Sample No. | 101195                        | 101196               | 101197               | 101200               |
| Client Sample No  | 320-01-BH2209-C01670          | 320-01-BH2209-C02000 | 320-01-BH2209-C02000 | 320-01-BH2212-C00660 |
| Bore Hole         | 320-01-BH2209                 | 320-01-BH2209        | 320-01-BH2209        | 320-01-BH2212        |
| Depth From/To (m) | 16.70-16.80                   | 20.00-20.10          | 20.00-20.49          | 6.60-6.70            |
| Description       | С                             | С                    | С                    | С                    |
| ls (MPa)          | 0.28                          | 0.39                 | 0.65                 | 0.12                 |
| ls(50) (MPa)      | 0.28                          | 0.39                 | 0.65                 | 0.12                 |
| Load Direction    | Diametral                     | Diametral            | Diametral            | Diametral            |
|                   |                               |                      |                      |                      |
| Trilab Sample No. | 101201                        | 101203               | 101204               | 101205               |
| Client Sample No  | 320-01-BH2212-C00950          | 320-01-BH2212-C01360 | 320-01-BH2212-C01790 | 320-01-BH2212-C02000 |
| Bore Hole         | 320-01-BH2212                 | 320-01-BH2212        | 320-01-BH2212        | 320-01-BH2212        |
| Depth From/To (m) | 9.50-9.60                     | 13.60-13.70          | 17.90-18.00          | 20.00-20.10          |
| Description       | С                             | С                    | С                    | С                    |
| ls (MPa)          | 0.17                          | 0.06                 | 1.22                 | 1.25                 |
| Is(50) (MPa)      | 0.17                          | 0.06                 | 1.22                 | 1.26                 |
| Load Direction    | Diametral                     | Diametral            | Diametral            | Diametral            |

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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Laboratory No. 9926

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|                   | POI                     | NT LOAD    | D TEST R               | EPORT                |                      |
|-------------------|-------------------------|------------|------------------------|----------------------|----------------------|
| Client            | Golder Associates Pty L | imited     | <u>00. A0 4100.4.1</u> | Report No.           | GA101184-101220-PL   |
|                   |                         |            |                        | Request No           | Golder_1893795_TR02  |
| Address           | PO Box 1734 MILTON E    | BC QLI     | D 4064                 | Test Date            | 31/10/2018           |
|                   |                         |            |                        | Report Date          | 6/11/2018            |
| Project           | Inland Rail Section 320 |            |                        |                      |                      |
| Project No        | 1893795                 |            |                        |                      |                      |
|                   |                         |            |                        |                      |                      |
| Trilab Sample No. | 101209                  | 101        | 210                    | 101211               | 101213               |
| Client Sample No  | 320-01-BH2218-C00840    | 320-01-BH2 | 218-C00935             | 320-01-BH2218-C01000 | 320-01-BH2218-C01170 |
| Bore Hole         | 320-01-BH2218           | 320-01-    | BH2218                 | 320-01-BH2218        | 320-01-BH2218        |
| Depth From/To (m) | 8.40-8.50               | 9.35       | -9.45                  | 10.00-10.10          | 11.70-11.80          |
| Description       | С                       | (          | C                      | С                    | С                    |

| Description              | С    | С         | С         | С         |
|--------------------------|------|-----------|-----------|-----------|
| ls (MPa)                 | 1.92 | 1.56      | 1.44      | 2.59      |
| Is(50) (MPa)             | 1.91 | 1.56      | 1.44      | 2.59      |
| Load Direction Diametral |      | Diametral | Diametral | Diametral |
|                          | •    |           | •         |           |

| Trilab Sample No. | 101214               | 101215               | 101216               | 101218               |
|-------------------|----------------------|----------------------|----------------------|----------------------|
| Client Sample No  | 320-01-BH2218-C01200 | 320-01-BH2218-C01405 | 320-01-BH2218-C01500 | 320-01-BH2218-C01640 |
| Bore Hole         | 320-01-BH2218        | 320-01-BH2218        | 320-01-BH2218        | 320-01-BH2218        |
| Depth From/To (m) | 12.00-12.10          | 14.05-14.15          | 15.00-15.10          | 16.40-16.50          |
| Description       | С                    | С                    | С                    | С                    |
| ls (MPa)          | 1.90                 | 1.43                 | 3.13                 | 3.70                 |
| Is(50) (MPa)      | 1.90                 | 1.43                 | 3.16                 | 3.69                 |
| Load Direction    | Diametral            | Diametral            | Diametral            | Diametral            |

|--|

Tested as received

Sample/s supplied by the client

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 Laboratory No. 9926

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|   | POI   | NT LOAD TEST R   | EPORT                |                      |
|---|---|--|----------------------|----------------------|
| Client  | Golder Associates Pty L   | Test Method: AS 4133.4.1<br>imited                                       | Report No.           | GA101184-101220-PI   |
|   |   |  | Request No           | Golder 1893795 TR02  |
| Address   | PO Box 1734 MILTON E  | BC QLD 4064  | Test Date            | 31/10/2018           |
|   |   |  | Report Date          | 6/11/2018            |
| Project   | Inland Rail Section 320   |  |                      |                      |
| Project No  | 1893795   |  |                      |                      |
|   |   |  |                      |                      |
| Trilab Sample No.   | 101219  | 101220   |                      |                      |
| Client Sample No  | 320-01-BH2218-C01880  | 320-01-BH2218-C02005   |                      |                      |
| Bore Hole   | 320-01-BH2218   | 320-01-BH2218  |                      |                      |
| Depth From/To (m)   | 18.80-18.90   | 20.05-20.15  |                      |                      |
| Description   | С   | С  |                      |                      |
| ls (MPa)  | 4.35  | 2.04   |                      |                      |
| ls(50) (MPa)  | 4.33  | 2.04   |                      |                      |
| Load Direction  | Diametral   | Diametral  |                      |                      |
| Trilah Samala Na  |   |  |                      |                      |
| Trilab Sample No.   |   |  |                      |                      |
| Client Sample No  |   |  |                      |                      |
| Bore Hole   |   |  |                      |                      |
| Depth From/To (m)   |   |  |                      |                      |
| Description   |   |  |                      |                      |
| ls (MPa)  |   |  |                      |                      |
| ls(50) (MPa)  |   |  |                      |                      |
| Load Direction  |   |  |                      |                      |
| NOTES/RFMARKS <sup>.</sup>  | Tested as received  |  |                      |                      |
|   |   |  |                      |                      |
| Sample/s supplied by the<br>This documer<br>accreditation req<br>ISO/IEC 17025 - T<br>and/or measureme<br>to A<br>The results of calibr | e client<br>nt is issued in accordance with NAT.<br>uirements. Accredited for compliance<br>esting. The results of the tests, calil<br>ents included in this document are tr<br>ustralian/National Standards.<br>ations and tests performed apply | A's Auth<br>brations,<br>aceable N<br>only to the specific instrument of | orised Signatory<br> | Page 7 of 7 REP02102 |



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| POINT LOAD TEST REPORT |                         |                          |                      |                      |  |
|------------------------|-------------------------|--------------------------|----------------------|----------------------|--|
|                        | Colder Associates Dtul  | Test Method: AS 4133.4.1 |                      |                      |  |
| Client                 | Golder Associates Pty L | Imited                   | Report No.           | GA101325-101334-PL   |  |
|                        |                         |                          | Request No           | Golder_1893795_TR03  |  |
| Address                | PO Box 1734 MILTON E    | 3C QLD 4064              | Test Date            | 2/11/2018            |  |
|                        |                         |                          | Report Date          | 7/11/2018            |  |
| Project                | Inland Rail Section 320 | Ι                        |                      |                      |  |
| Project No             | 1893795                 |                          |                      |                      |  |
|                        | r                       | r                        | r                    | 1                    |  |
| Trilab Sample No.      | 101325                  | 101326                   | 101327               | 101328               |  |
| Client Sample No       | 320-01-BH2217-C00290    | 320-01-BH2217-C00510     | 320-01-BH2217-C00520 | 320-01-BH2217-C00700 |  |
| Bore Hole              | 320-01-BH2217           | 320-01-BH2217            | 320-01-BH2217        | 320-01-BH2217        |  |
| Depth From/To (m)      | 2.90-3.00               | 5.10-5.20                | 5.20-5.40            | 7.00-7.10            |  |
| Description            | С                       | С                        | С                    | С                    |  |
| ls (MPa)               | 3.16                    | 4.81                     | 3.15                 | 4.08                 |  |
| ls(50) (MPa)           | 3.10                    | 4.65                     | 3.16                 | 4.08                 |  |
| Load Direction         | Axial                   | Axial                    | Axial                | Axial                |  |
|                        |                         |                          |                      |                      |  |
|                        | Γ                       | Γ                        | Γ                    | I                    |  |
| Trilab Sample No.      | 101329                  | 101330                   | 101331               | 101332               |  |
| Client Sample No       | 320-01-BH2217-C00710    | 320-01-BH2217-C01100     | 320-01-BH2217-C01600 | 320-01-BH2217-C01610 |  |
| Bore Hole              | 320-01-BH2217           | 320-01-BH2217            | 320-01-BH2217        | 320-01-BH2217        |  |
| Depth From/To (m)      | 7.10-7.30               | 11.00-11.10              | 16.00-16.10          | 16.10-16.30          |  |
| Description            | С                       | С                        | С                    | С                    |  |
| ls (MPa)               | 3.32                    | 2.52                     | 4.61                 | 3.94                 |  |
| ls(50) (MPa)           | 3.08                    | 2.43                     | 4.51                 | 3.86                 |  |
| Load Direction         | Axial                   | Axial                    | Axial                | Axial                |  |

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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Laboratory No. 9926

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| POINT LOAD TEST REPORT |                         |            |                        |                      |                      |
|------------------------|-------------------------|------------|------------------------|----------------------|----------------------|
| Client                 | Golder Associates Pty L | imited     | <u>50: A5 4155.4.1</u> | Report No.           | GA101325-101334-PL   |
|                        |                         |            |                        | Request No           | Golder_1893795_TR03  |
| Address                | PO Box 1734 MILTON E    | BC QLI     | D 4064                 | Test Date            | 2/11/2018            |
|                        |                         |            |                        | Report Date          | 7/11/2018            |
| Project                | Inland Rail Section 320 |            | 1                      |                      |                      |
| Project No             | 1893795                 |            |                        |                      |                      |
|                        | I                       | Γ          |                        | I                    | 1                    |
| Trilab Sample No.      | 101333                  | 101        | 334                    | 101325               | 101326               |
| Client Sample No       | 320-01-BH2217-C02025    | 320-01-BH2 | 217-C02040             | 320-01-BH2217-C00290 | 320-01-BH2217-C00510 |
| Bore Hole              | 320-01-BH2217           | 320-01-    | BH2217                 | 320-01-BH2217        | 320-01-BH2217        |
| Depth From/To (m)      | 20.25-20.35             | 20.40      | -20.57                 | 2.90-3.00            | 5.10-5.20            |
| Description            | С                       | (          | C                      | С                    | С                    |
| ls (MPa)               | 0.06                    | 3.         | 03                     | 2.55                 | 4.26                 |
| ls(50) (MPa)           | 0.06                    | 2.         | 80                     | 2.54                 | 4.19                 |
| Load Direction         | Axial                   | Aک         | tial                   | Diametral            | Diametral            |
|                        |                         |            |                        |                      |                      |
| Trilab Sample No.      | 101327                  | 101        | 328                    | 101329               | 101330               |
| Client Sample No       | 320-01-BH2217-C00520    | 320-01-BH2 | 217-C00700             | 320-01-BH2217-C00710 | 320-01-BH2217-C01100 |
| Bore Hole              | 320-01-BH2217           | 320-01-    | BH2217                 | 320-01-BH2217        | 320-01-BH2217        |
| Depth From/To (m)      | 5.20-5.40               | 7.00       | -7.10                  | 7.10-7.30            | 11.00-11.10          |
| Description            | С                       | (          | <b>b</b>               | С                    | С                    |
| ls (MPa)               | 3.00                    | 2.         | 29                     | 4.66                 | 2.23                 |
| Is(50) (MPa)           | 2.99                    | 2.         | 29                     | 4.64                 | 2.23                 |

NOTES/REMARKS:

Tested as received

Diametral

Load Direction

Sample/s supplied by the client

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Diametral



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Diametral

 Laboratory No. 9926

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Diametral



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

|   | POI   | NT LOAD TEST R  | EPORT                    |   |
|---|---|---|--------------------------|---|
| Client  | Golder Associates Pty L   | Test Method: AS 4133.4.1<br>imited                                | Report No.<br>Request No | GA101325-101334-PL<br>Golder 1893795 TR03 |
| Address   | PO Box 1734 MILTON E  | 3C QLD 4064   | Test Date<br>Report Date | 2/11/2018<br>7/11/2018                    |
| Project   | Inland Rail Section 320   |   |                          |   |
| Project No  | 1893795   |   |                          |   |
|   |   |   |                          |   |
| Trilab Sample No.   | 101331  | 101332  | 101333                   | 101334                                    |
| Client Sample No  | 320-01-BH2217-C01600  | 320-01-BH2217-C01610  | 320-01-BH2217-C02025     | 320-01-BH2217-C02040                      |
| Bore Hole   | 320-01-BH2217   | 320-01-BH2217   | 320-01-BH2217            | 320-01-BH2217                             |
| Depth From/To (m)   | 16.00-16.10   | 16.10-16.30   | 20.25-20.35              | 20.40-20.57                               |
| Description   | С   | С   | С                        | С   |
| ls (MPa)  | 4.44  | 4.06  | 1.56                     | 1.56                                      |
| Is(50) (MPa)  | 4.43  | 4.05  | 1.53                     | 1.53                                      |
| Load Direction  | Diametral   | Diametral   | Diametral                | Diametral                                 |
| Trilab Sample No.   |   |   |                          |   |
| Trilab Sample No.   |   |   |                          |   |
| Client Sample No  |   |   |                          |   |
| Bore Hole   |   |   |                          |   |
| Depth From/To (m)   |   |   |                          |   |
| Description   |   |   |                          |   |
| ls (MPa)  |   |   |                          |   |
| ls(50) (MPa)  |   |   |                          |   |
| Load Direction  |   |   |                          |   |
| NOTES/REMARKS:  | Tested as received  |   |                          |   |
| Sample/s supplied by the  | e client  |   |                          | Page 3 of 3 RFP02102                      |
| This documer<br>accreditation requision SO/IEC 17025 - To<br>and/or measurement<br>to A | nt is issued in accordance with NAT,<br>uirements. Accredited for compliance<br>esting. The results of the tests, calit<br>ents included in this document are tr<br>ustralian/National Standards.<br>ations and tests performed apply | A's Auth<br>partions, aceable nonly to the specific instrument or | orised Signatory         | Laboratory No. 9926                       |



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| Unerit   | Golder Associates Pty L   | imited  | Report No.   | GA102052-102170-PL  |
|--|---|---|--|---|
|  |   |   | Request No   | Golder 1893795 TR04   |
| Address  | PO Box 1734 MILTON B  | BC QLD 4064   | Test Date  | 23/01/2019  |
|  |   |   | Report Date  | 25/01/2019  |
| Project  | Inland Rail Section 320   | I   |  |   |
| Project No   | 1893795   |   |  |   |
|  | 1   | I   | Ι  | 1   |
| Trilab Sample No.  | 102052  | 102054  | 102055   | 102056  |
| Client Sample No   | 320-01-BH2102-C19600  | 320-01-BH2102-C19740  | 320-01-BH2102-C20140   | 320-01-BH2102-C20600  |
| Bore Hole  | 320-01-BH2102   | 320-01-BH2102   | 320-01-BH2102  | 320-01-BH2102   |
| Depth From/To (m)  | 196.12-196.27   | 197.40-197.60   | 201.40-201.60  | 206.00-206.10   |
| Description  | С   | С   | С  | С   |
| ls (MPa)   | 0.51  | 0.01  | 0.05   | 0.09  |
| Is(50) (MPa)   | 0.56  | 0.01  | 0.06   | 0.08  |
| Load Direction   | Axial   | Axial   | Axial  | Axial   |
|  |   |   | <u></u>  |   |
|  |   |   |  |   |
| Trilab Sample No.  | 102057  | 102059  | 102061   | 102064  |
| Trilab Sample No.<br>Client Sample No  | 102057<br>320-01-BH2102-C20820  | 102059<br>320-01-BH2102-C21140  | 102061<br>320-01-BH2102-C21480   | 102064<br>320-01-BH2102-C21780  |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole   | 102057<br>320-01-BH2102-C20820<br>320-01-BH2102                                       | 102059<br>320-01-BH2102-C21140<br>320-01-BH2102                                       | 102061<br>320-01-BH2102-C21480<br>320-01-BH2102                                      | 102064<br>320-01-BH2102-C21780<br>320-01-BH2102                                       |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)  | 102057<br>320-01-BH2102-C20820<br>320-01-BH2102<br>208.20-208.40                      | 102059<br>320-01-BH2102-C21140<br>320-01-BH2102<br>211.40-211.60                      | 102061<br>320-01-BH2102-C21480<br>320-01-BH2102<br>214.62-24.78                      | 102064<br>320-01-BH2102-C21780<br>320-01-BH2102<br>217.80-217.90                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description                             | 102057<br>320-01-BH2102-C20820<br>320-01-BH2102<br>208.20-208.40<br>C                 | 102059<br>320-01-BH2102-C21140<br>320-01-BH2102<br>211.40-211.60<br>C                 | 102061<br>320-01-BH2102-C21480<br>320-01-BH2102<br>214.62-24.78<br>C                 | 102064<br>320-01-BH2102-C21780<br>320-01-BH2102<br>217.80-217.90<br>C                 |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)                 | 102057<br>320-01-BH2102-C20820<br>320-01-BH2102<br>208.20-208.40<br>C<br>0.04         | 102059<br>320-01-BH2102-C21140<br>320-01-BH2102<br>211.40-211.60<br>C<br>0.13         | 102061<br>320-01-BH2102-C21480<br>320-01-BH2102<br>214.62-24.78<br>C<br>1.04         | 102064<br>320-01-BH2102-C21780<br>320-01-BH2102<br>217.80-217.90<br>C<br>0.49         |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa) | 102057<br>320-01-BH2102-C20820<br>320-01-BH2102<br>208.20-208.40<br>C<br>0.04<br>0.04 | 102059<br>320-01-BH2102-C21140<br>320-01-BH2102<br>211.40-211.60<br>C<br>0.13<br>0.14 | 102061<br>320-01-BH2102-C21480<br>320-01-BH2102<br>214.62-24.78<br>C<br>1.04<br>1.13 | 102064<br>320-01-BH2102-C21780<br>320-01-BH2102<br>217.80-217.90<br>C<br>0.49<br>0.52 |

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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Authorised Signatory Nell N. Maddison



Laboratory No. 9926

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| POINT LOAD TEST REPORT |                         |                      |                      |                      |  |
|------------------------|-------------------------|----------------------|----------------------|----------------------|--|
| Client                 | Golder Associates Pty L | imited               | Report No.           | GA102052-102170-PL   |  |
|                        |                         |                      | Request No           | Golder_1893795_TR04  |  |
| Address                | PO Box 1734 MILTON E    | 3C QLD 4064          | Test Date            | 23/01/2019           |  |
|                        |                         |                      | Report Date          | 25/01/2019           |  |
| Project                | Inland Rail Section 320 |                      |                      |                      |  |
| Project No             | 1893795                 |                      |                      |                      |  |
|                        |                         |                      |                      |                      |  |
| Trilab Sample No.      | 102066                  | 102068               | 102069               | 102072               |  |
| Client Sample No       | 320-01-BH2102-C21900    | 320-01-BH2102-C22100 | 320-01-BH2102-C22390 | 320-01-BH2102-C22720 |  |
| Bore Hole              | 320-01-BH2102           | 320-01-BH2102        | 320-01-BH2102        | 320-01-BH2102        |  |
| Depth From/To (m)      | 219.00-219.10           | 221.00-221.10        | 223.90-224.00        | 227.20-227.40        |  |
| Description            | С                       | С                    | С                    | С                    |  |
| ls (MPa)               | 1.43                    | 7.94                 | 1.26                 | 1.09                 |  |
| Is(50) (MPa)           | 1.46                    | 8.28                 | 1.17                 | 1.20                 |  |
| Load Direction         | Axial                   | Axial                | Axial                | Axial                |  |
|                        |                         |                      |                      |                      |  |
| Trilab Sample No.      | 102074                  | 102076               | 102083               | 102085               |  |
| Client Sample No       | 320-01-BH2102-C23310    | 320-01-BH2102-C23800 | 320-01-BH2103-C01050 | 320-01-BH2103-C01700 |  |
| Bore Hole              | 320-01-BH2102           | 320-01-BH2102        | 320-01-BH2103        | 320-01-BH2103        |  |
| Depth From/To (m)      | 233.17-233.30           | 238.00-238.10        | 10.50-10.60          | 17.00-17.20          |  |
| Description            | С                       | С                    | С                    | С                    |  |

0.03

0.03

Axial

NOTES/REMARKS:

Tested as received

0.32

0.34

Axial

\_\_\_\_\_

ls (MPa)

Is(50) (MPa)

Load Direction

Sample/s supplied by the client

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0.06

0.06

Axial



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0.50

0.53

Axial

 Laboratory No. 9926

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| POINT LOAD TEST REPORT |                         |                      |                      |                      |  |
|------------------------|-------------------------|----------------------|----------------------|----------------------|--|
| Client                 | Golder Associates Pty L | imited               | Report No.           | GA102052-102170-PL   |  |
|                        |                         |                      | Request No           | Golder_1893795_TR04  |  |
| Address                | PO Box 1734 MILTON E    | BC QLD 4064          | Test Date            | 23/01/2019           |  |
|                        |                         |                      | Report Date          | 25/01/2019           |  |
| Project                | Inland Rail Section 320 | 1                    |                      |                      |  |
| Project No             | 1893795                 |                      |                      |                      |  |
|                        | [                       | I                    | I                    | 1                    |  |
| Trilab Sample No.      | 102087                  | 102089               | 102099               | 102100               |  |
| Client Sample No       | 320-01-BH2103-C01910    | 320-01-BH2103-C02480 | 320-01-BH2203-C01000 | 320-01-BH2203-C01200 |  |
| Bore Hole              | 320-01-BH2103           | 320-01-BH2103        | 320-01-BH2203        | 320-01-BH2203        |  |
| Depth From/To (m)      | 19.00-19.15             | 24.77-24.85          | 10.00-10.12          | 12.10-12.23          |  |
| Description            | С                       | С                    | С                    | С                    |  |
| ls (MPa)               | 0.38                    | 0.33                 | 0.18                 | 0.33                 |  |
| ls(50) (MPa)           | 0.39                    | 0.29                 | 0.18                 | 0.31                 |  |
| Load Direction         | Axial                   | Axial                |                      | Axial                |  |
|                        |                         |                      |                      |                      |  |
| Trilab Sample No.      | 102102                  | 102103               | 102111               | 102112               |  |
| Client Sample No       | 320-01-BH2203-C01600    | 320-01-BH2203-C01950 | 320-01-BH2207-C01100 | 320-01-BH2207-C01600 |  |
| Bore Hole              | 320-01-BH2203           | 320-01-BH2203        | 320-01-BH2207        | 320-01-BH2207        |  |
| Depth From/To (m)      | 16.02-16.15             | 19.50-19.60          | 11.00-11.10          | 16.00-16.10          |  |
| Description            | С                       | С                    | С                    | С                    |  |
| ls (MPa)               | 0.51                    | 4.24                 | 0.10                 | 0.22                 |  |
| ls(50) (MPa)           | 0.47                    | 4.19                 | 0.10                 | 0.22                 |  |
| Load Direction         | Axial                   | Axial                | Axial                | Axial                |  |
|                        |                         |                      |                      |                      |  |

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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 Laboratory No. 9926

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| POINT LOAD TEST REPORT |                         |                          |                      |                      |
|------------------------|-------------------------|--------------------------|----------------------|----------------------|
|                        |                         | Test Method: AS 4133.4.1 | -                    |                      |
| Client                 | Golder Associates Pty L | imited                   | Report No.           | GA102052-102170-PL   |
|                        |                         |                          | Request No           | Golder_1893795_TR04  |
| Address                | PO Box 1734 MILTON E    | 3C QLD 4064              | Test Date            | 23/01/2019           |
|                        |                         |                          | Report Date          | 25/01/2019           |
| Project                | Inland Rail Section 320 | l                        |                      |                      |
| Project No             | 1893795                 |                          |                      |                      |
|                        |                         |                          |                      |                      |
| Trilab Sample No.      | 102113                  | 102115                   | 102119               | 102120               |
| Client Sample No       | 320-01-BH2207-C01800    | 320-01-BH2207-C02000     | 320-01-BH2215-C00740 | 320-01-BH2215-C01000 |
| Bore Hole              | 320-01-BH2207           | 320-01-BH2207            | 320-01-BH2215        | 320-01-BH2215        |
| Depth From/To (m)      | 18.00-18.10             | 20.00-20.11              | 7.40-7.50            | 10.00-10.10          |
| Description            | С                       | С                        | С                    | С                    |
| ls (MPa)               | 0.51                    | 0.47                     | 0.05                 | 0.29                 |
| ls(50) (MPa)           | 0.51                    | 0.46                     | 0.05                 | 0.29                 |
| Load Direction         | Axial                   | Axial                    | Axial                | Axial                |
|                        |                         |                          |                      |                      |
|                        |                         |                          |                      |                      |
|                        |                         |                          |                      |                      |
|                        |                         |                          |                      |                      |
| Trilab Sample No.      | 102122                  | 102123                   | 102124               | 102129               |
| Client Sample No       | 320-01-BH2215-C01370    | 320-01-BH2215-C01500     | 320-01-BH2215-C01950 | 320-01-BH2216-C00490 |
| Bore Hole              | 320-01-BH2215           | 320-01-BH2215            | 320-01-BH2215        | 320-01-BH2216        |
| Depth From/To (m)      | 13.60-13.73             | 15.00-15.10              | 19.50-19.60          | 4.90-5.00            |
| Description            | С                       | С                        | С                    | С                    |
| ls (MPa)               | 0.02                    | 0.49                     | 1.86                 | 1.41                 |
| ls(50) (MPa)           | 0.02                    | 0.49                     | 1.84                 | 1.41                 |

NOTES/REMARKS:

Tested as received

Axial

Load Direction

Sample/s supplied by the client

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Axial



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Axial

 Laboratory No. 9926

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Axial



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| POINT LOAD TEST REPORT |                         |                                    |                          |                          |
|------------------------|-------------------------|------------------------------------|--------------------------|--------------------------|
| Client                 | Golder Associates Pty L | Test Method: AS 4133.4.1<br>imited | Report No.               | GA102052-102170-PL       |
| Address                | PO Box 1734 MILTON E    | 3C QLD 4064                        | Test Date<br>Report Date | 23/01/2019<br>25/01/2019 |
| Project                | Inland Rail Section 320 |                                    |                          |                          |
| Project No             | 1893795                 |                                    |                          |                          |
|                        |                         |                                    |                          |                          |
| Trilab Sample No.      | 102130                  | 102131                             | 102132                   | 102134                   |
| Client Sample No       | 320-01-BH2216-C00700    | 320-01-BH2216-C01000               | 320-01-BH2216-C01500     | 320-01-BH2216-C01800     |
| Bore Hole              | 320-01-BH2216           | 320-01-BH2216                      | 320-01-BH2216            | 320-01-BH2216            |
| Depth From/To (m)      | 7.00-7.12               | 10.00-10.10                        | 15.00-15.10              | 18.00-18.10              |
| Description            | С                       | С                                  | С                        | С                        |
| ls (MPa)               | 2.80                    | 1.00                               | 0.59                     | 0.71                     |
| ls(50) (MPa)           | 2.75                    | 0.99                               | 0.59                     | 0.72                     |
| Load Direction         | Axial                   | Axial                              | Axial                    | Axial                    |
|                        |                         |                                    |                          |                          |
| Trilab Sample No.      | 102143                  | 102145                             | 102146                   | 102148                   |
| Client Sample No       | 320-01-BH2301-C01109    | 320-01-BH2301-C01290               | 320-01-BH2301-C01470     | 320-01-BH2301-C01600     |
| Bore Hole              | 320-01-BH2301           | 320-01-BH2301                      | 320-01-BH2301            | 320-01-BH2301            |
| Depth From/To (m)      | 11.09-11.20             | 12.90-13.00                        | 14.70-14.80              | 16.00-16.10              |

С

3.08

3.08

Axial

NOTES/REMARKS:

Tested as received

С

0.75

0.72

Axial

Sample/s supplied by the client

Description

ls (MPa)

Is(50) (MPa)

Load Direction

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С

0.44

0.44

Axial



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С

1.24

1.23

Axial

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### POINT LOAD TEST REPORT Test Method: AS 4133.4.1 Golder Associates Pty Limited Client **Report No.** GA102052-102170-PL Golder 1893795 TR04 **Request No** PO Box 1734 MILTON BC QLD 4064 Address **Test Date** 23/01/2019 **Report Date** 25/01/2019 Inland Rail Section 320 Project **Project No** 1893795 Trilab Sample No. 102149 102151 102153 102154 **Client Sample No** 320-01-BH2301-C01800 320-01-BH2301-C02000 320-01-BH2302-C00110 320-01-BH2302-C00300 320-01-BH2301 320-01-BH2301 320-01-BH2302 320-01-BH2302 **Bore Hole** Depth From/To (m) 18 00-18 10 20 00-20 10 1 10-1 20 3 01-3 12

| Depth From/To (m) | 18.00-18.10 | 20.00-20.10 | 1.10-1.20 | 3.01-3.12 |
|-------------------|-------------|-------------|-----------|-----------|
| Description       | С           | С           | С         | С         |
| İs (MPa)          | 0.56        | 0.98        | 0.25      | 0.34      |
| Is(50) (MPa)      | 0.53        | 0.98        | 0.25      | 0.34      |
| Load Direction    | Axial       | Axial       | Axial     | Axial     |

| Trilab Sample No. | 102156               | 102157               | 102160               | 102161               |
|-------------------|----------------------|----------------------|----------------------|----------------------|
| Client Sample No  | 320-01-BH2302-C00500 | 320-01-BH2302-C00700 | 320-01-BH2302-C00900 | 320-01-BH2302-C01200 |
| Bore Hole         | 320-01-BH2302        | 320-01-BH2302        | 320-01-BH2302        | 320-01-BH2302        |
| Depth From/To (m) | 5.00-5.10            | 7.00-7.11            | 9.00-9.10            | 12.00-12.10          |
| Description       | С                    | С                    | С                    | С                    |
| ls (MPa)          | 0.54                 | 0.37                 | 0.69                 | 0.35                 |
| Is(50) (MPa)      | 0.54                 | 0.37                 | 0.69                 | 0.35                 |
| Load Direction    | Axial                | Axial                | Axial                | Axial                |

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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 Laboratory No. 9926

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|  | Golder Associates Pty L  | imited   | Report No.           | GA102052-102170-PL   |
|--|--|--|----------------------|----------------------|
|  |  |  | Request No           | Golder_1893795_TR04  |
| Address  | PO Box 1734 MILTON E   | BC QLD 4064  | Test Date            | 23/01/2019           |
|  |  |  | Report Date          | 25/01/2019           |
| Project  | Inland Rail Section 320  |  |                      |                      |
| Project No   | 1893795  |  |                      |                      |
|  | 1  | 1  | r                    | T                    |
| Trilab Sample No.  | 102163   | 102164   | 102166               | 102167               |
| Client Sample No   | 320-01-BH2302-C01400   | 320-01-BH2302-C01700   | 320-01-BH2302-C02000 | 320-01-BH2302-C02390 |
| Bore Hole  | 320-01-BH2302  | 320-01-BH2302  | 320-01-BH2302        | 320-01-BH2302        |
| Depth From/To (m)  | 14.00-14.10  | 17.00-17.10  | 20.00-20.10          | 23.90-24.00          |
| Description  | С  | С  | С                    | С                    |
| ls (MPa)   | 1.51   | 0.69   | 0.31                 | 0.39                 |
| Is(50) (MPa)   | 1.50   | 0.68   | 0.31                 | 0.39                 |
| Load Direction   | Axial  | Avial  | Axial                | Axial                |
|  |  |  |                      | 1                    |
|  |  |  |                      | 1                    |
| Trilab Sample No.  | 102169   | 102170   |                      |                      |
| Trilab Sample No.  | 102169<br>320-01-BH2302-C02800   | 102170<br>320-01-BH2302-C03000   |                      |                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole   | 102169<br>320-01-BH2302-C02800<br>320-01-BH2302  | 102170<br>320-01-BH2302-C03000<br>320-01-BH2302  |                      |                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)  | 102169<br>320-01-BH2302-C02800<br>320-01-BH2302<br>28.00-28.11                               | 102170<br>320-01-BH2302-C03000<br>320-01-BH2302<br>30.00-30.10                                       |                      |                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description   | 102169<br>320-01-BH2302-C02800<br>320-01-BH2302<br>28.00-28.11<br>C                          | 102170<br>320-01-BH2302-C03000<br>320-01-BH2302<br>30.00-30.10<br>C                                  |                      |                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)                                   | 102169<br>320-01-BH2302-C02800<br>320-01-BH2302<br>28.00-28.11<br>C<br>0.25                  | 102170<br>320-01-BH2302-C03000<br>320-01-BH2302<br>30.00-30.10<br>C<br>0.35                          |                      |                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)                   | 102169<br>320-01-BH2302-C02800<br>320-01-BH2302<br>28.00-28.11<br>C<br>0.25<br>0.25          | 102170<br>320-01-BH2302-C03000<br>320-01-BH2302<br>30.00-30.10<br>C<br>0.35<br>0.35                  |                      |                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)<br>Load Direction | 102169<br>320-01-BH2302-C02800<br>320-01-BH2302<br>28.00-28.11<br>C<br>0.25<br>0.25<br>Axial | 102170<br>320-01-BH2302-C03000<br>320-01-BH2302<br>30.00-30.10<br>C<br>0.35<br>0.35<br>0.35<br>Axial |                      |                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)<br>Load Direction | 102169<br>320-01-BH2302-C02800<br>320-01-BH2302<br>28.00-28.11<br>C<br>0.25<br>0.25<br>Axial | 102170<br>320-01-BH2302-C03000<br>320-01-BH2302<br>30.00-30.10<br>C<br>0.35<br>0.35<br>Axial         |                      |                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)<br>Load Direction | 102169<br>320-01-BH2302-C02800<br>320-01-BH2302<br>28.00-28.11<br>C<br>0.25<br>0.25<br>Axial | 102170<br>320-01-BH2302-C03000<br>320-01-BH2302<br>30.00-30.10<br>C<br>0.35<br>0.35<br>0.35<br>Axial |                      |                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)<br>Load Direction | 102169<br>320-01-BH2302-C02800<br>320-01-BH2302<br>28.00-28.11<br>C<br>0.25<br>0.25<br>Axial | 102170<br>320-01-BH2302-C03000<br>320-01-BH2302<br>30.00-30.10<br>C<br>0.35<br>0.35<br>Axial         |                      |                      |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)<br>Load Direction | 102169<br>320-01-BH2302-C02800<br>320-01-BH2302<br>28.00-28.11<br>C<br>0.25<br>0.25<br>Axial | 102170<br>320-01-BH2302-C03000<br>320-01-BH2302<br>30.00-30.10<br>C<br>0.35<br>0.35<br>Axial         |                      |                      |

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| POINT LOAD TEST REPORT |                         |                      |                      |                      |
|------------------------|-------------------------|----------------------|----------------------|----------------------|
| Client                 | Golder Associates Pty L | imited               | Report No.           | GA102052-102170-PL   |
|                        |                         |                      | Request No           | Golder_1893795_TR04  |
| Address                | PO Box 1734 MILTON E    | 3C QLD 4064          | Test Date            | 23/01/2019           |
|                        |                         |                      | Report Date          | 25/01/2019           |
| Project                | Inland Rail Section 320 | 1                    |                      |                      |
| Project No             | 1893795                 |                      |                      |                      |
|                        |                         | 1                    | 1                    | 1                    |
| Trilab Sample No.      | 102052                  | 102054               | 102055               | 102056               |
| Client Sample No       | 320-01-BH2102-C19600    | 320-01-BH2102-C19740 | 320-01-BH2102-C20140 | 320-01-BH2102-C20600 |
| Bore Hole              | 320-01-BH2102           | 320-01-BH2102        | 320-01-BH2102        | 320-01-BH2102        |
| Depth From/To (m)      | 196.12-196.27           | 197.40-197.60        | 201.40-201.60        | 206.00-206.10        |
| Description            | С                       | С                    | С                    | С                    |
| ls (MPa)               | 1.82                    | 0.00                 | 0.05                 | 0.17                 |
| ls(50) (MPa)           | 1.97                    | 0.00                 | 0.05                 | 0.18                 |
| Load Direction         | Diametral               | Diametral            | Diametral            | Diametral            |
|                        |                         |                      |                      |                      |
| Trilab Sample No.      | 102057                  | 102059               | 102061               | 102064               |
| Client Sample No       | 320-01-BH2102-C20820    | 320-01-BH2102-C21140 | 320-01-BH2102-C21480 | 320-01-BH2102-C21780 |
| Bore Hole              | 320-01-BH2102           | 320-01-BH2102        | 320-01-BH2102        | 320-01-BH2102        |
| Depth From/To (m)      | 208.20-208.40           | 211.40-211.60        | 214.62-214.78        | 217.80-217.90        |
| Description            | С                       | С                    | С                    | С                    |
| ls (MPa)               | 0.06                    | 0.01                 | 2.86                 | 0.30                 |
| ls(50) (MPa)           | 0.06                    | 0.01                 | 3.00                 | 0.31                 |
| Load Direction         | Diametral               | Diametral            | Diametral            | Diametral            |
|                        |                         |                      |                      |                      |

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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 Laboratory No. 9926

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 Trilab Pty Ltd
 ABN 25 065 630 506



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

| POINT LOAD TEST REPORT |                         |                      |                      |                      |
|------------------------|-------------------------|----------------------|----------------------|----------------------|
| Client                 | Golder Associates Pty L | imited               | Report No.           | GA102052-102170-PL   |
|                        |                         |                      | Request No           | Golder_1893795_TR04  |
| Address                | PO Box 1734 MILTON E    | 3C QLD 4064          | Test Date            | 23/01/2019           |
|                        |                         |                      | Report Date          | 25/01/2019           |
| Project                | Inland Rail Section 320 |                      |                      |                      |
| Project No             | 1893795                 |                      |                      |                      |
|                        |                         |                      |                      |                      |
| Trilab Sample No.      | 102066                  | 102068               | 102069               | 102072               |
| Client Sample No       | 320-01-BH2102-C21900    | 320-01-BH2102-C22100 | 320-01-BH2102-C22390 | 320-01-BH2102-C22720 |
| Bore Hole              | 320-01-BH2102           | 320-01-BH2102        | 320-01-BH2102        | 320-01-BH2102        |
| Depth From/To (m)      | 219.00-219.10           | 221.00-221.10        | 223.90-224.00        | 227.20-227.40        |
| Description            | С                       | С                    | С                    | С                    |
| ls (MPa)               | 1.75                    | 5.20                 | 1.00                 | 1.66                 |
| ls(50) (MPa)           | 1.80                    | 5.57                 | 1.06                 | 1.67                 |
| Load Direction         | Diametral               | Diametral            | Diametral            | Diametral            |
|                        |                         |                      |                      |                      |
| Trilab Sample No.      | 102074                  | 102076               | 102083               | 102085               |
| Client Sample No       | 320-01-BH2102-C23310    | 320-01-BH2102-C23800 | 320-01-BH2103-C01050 | 320-01-BH2103-C01700 |
| Bore Hole              | 320-01-BH2102           | 320-01-BH2102        | 320-01-BH2103        | 320-01-BH2103        |
| Depth From/To (m)      | 233.17-233.30           | 238.00-238.10        | 10.50-10.60          | 17.00-17.20          |
| Description            | С                       | С                    | С                    | С                    |
| ls (MPa)               | 0.06                    | 0.01                 | 0.16                 | 0.61                 |
| ls(50) (MPa)           | 0.06                    | 0.01                 | 0.15                 | 0.61                 |
| Load Direction         | Diametral               | Diametral            | Diametral            | Diametral            |
|                        |                         |                      |                      |                      |

NOTES/REMARKS:

Tested as received

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Sample/s supplied by the client

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 Laboratory No. 9926

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| Client   |  | Test Method: AS 4133 4 1   |  |   |
|--|--|--|--|---|
| Cheffi   | Golder Associates Pty L  | imited   | Report No.   | GA102052-102170-PL  |
|  |  |  | Request No   | Golder_1893795_TR04   |
| Address  | PO Box 1734 MILTON E   | BC QLD 4064  | Test Date  | 23/01/2019  |
|  |  |  | Report Date  | 25/01/2019  |
| Project  | Inland Rail Section 320  | Γ  |  |   |
| Project No   | 1893795  |  |  |   |
|  | 1  | 1  | 1  | 1   |
| Trilab Sample No.  | 102087   | 102089   | 102099   | 102100  |
| Client Sample No   | 320-01-BH2103-C01910   | 320-01-BH2103-C02480   | 320-01-BH2203-C01000   | 320-01-BH2203-C01200  |
| Bore Hole  | 320-01-BH2103  | 320-01-BH2103  | 320-01-BH2203  | 320-01-BH2203   |
| Depth From/To (m)  | 19.00-19.15  | 24.77-24.85  | 10.00-10.12  | 12.10-12.23   |
| Description  | С  | С  | С  | С   |
| ls (MPa)   | 0.22   | 0.19   | 0.03   | 0.05  |
| Is(50) (MPa)   | 0.22   | 0.19   | 0.03   | 0.05  |
| Load Direction   | Diametral  | Diametral  | Diametral  | Diametral   |
|  |  |  |  |   |
|  |  |  |  |   |
| Trilab Sample No.  | 102102   | 102103   | 102111   | 102112  |
| Trilab Sample No.<br>Client Sample No  | 102102<br>320-01-BH2203-C01600   | 102103<br>320-01-BH2203-C01950   | 102111<br>320-01-BH2207-C01100   | 102112<br>320-01-BH2207-C01600  |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole   | 102102<br>320-01-BH2203-C01600<br>320-01-BH2203  | 102103<br>320-01-BH2203-C01950<br>320-01-BH2203  | 102111<br>320-01-BH2207-C01100<br>320-01-BH2207  | 102112<br>320-01-BH2207-C01600<br>320-01-BH2207   |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)  | 102102<br>320-01-BH2203-C01600<br>320-01-BH2203<br>16.02-16.15                                   | 102103<br>320-01-BH2203-C01950<br>320-01-BH2203<br>19.50-19.60                                   | 102111<br>320-01-BH2207-C01100<br>320-01-BH2207<br>11.00-11.10                                   | 102112<br>320-01-BH2207-C01600<br>320-01-BH2207<br>16.00-16.10  |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description   | 102102<br>320-01-BH2203-C01600<br>320-01-BH2203<br>16.02-16.15<br>C                              | 102103<br>320-01-BH2203-C01950<br>320-01-BH2203<br>19.50-19.60<br>C                              | 102111<br>320-01-BH2207-C01100<br>320-01-BH2207<br>11.00-11.10<br>C                              | 102112<br>320-01-BH2207-C01600<br>320-01-BH2207<br>16.00-16.10<br>C   |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)                                   | 102102<br>320-01-BH2203-C01600<br>320-01-BH2203<br>16.02-16.15<br>C<br>0.28                      | 102103<br>320-01-BH2203-C01950<br>320-01-BH2203<br>19.50-19.60<br>C<br>1.20                      | 102111<br>320-01-BH2207-C01100<br>320-01-BH2207<br>11.00-11.10<br>C<br>0.06                      | 102112<br>320-01-BH2207-C01600<br>320-01-BH2207<br>16.00-16.10<br>C<br>0.21   |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)                   | 102102<br>320-01-BH2203-C01600<br>320-01-BH2203<br>16.02-16.15<br>C<br>0.28<br>0.28              | 102103<br>320-01-BH2203-C01950<br>320-01-BH2203<br>19.50-19.60<br>C<br>1.20<br>1.20              | 102111<br>320-01-BH2207-C01100<br>320-01-BH2207<br>11.00-11.10<br>C<br>0.06<br>0.06              | 102112<br>320-01-BH2207-C01600<br>320-01-BH2207<br>16.00-16.10<br>C<br>0.21<br>0.21   |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)<br>Load Direction | 102102<br>320-01-BH2203-C01600<br>320-01-BH2203<br>16.02-16.15<br>C<br>0.28<br>0.28<br>Diametral | 102103<br>320-01-BH2203-C01950<br>320-01-BH2203<br>19.50-19.60<br>C<br>1.20<br>1.20<br>Diametral | 102111<br>320-01-BH2207-C01100<br>320-01-BH2207<br>11.00-11.10<br>C<br>0.06<br>0.06<br>Diametral | 102112         320-01-BH2207-C01600         320-01-BH2207         16.00-16.10         C         0.21         0.21         Diametral |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)<br>Load Direction | 102102<br>320-01-BH2203-C01600<br>320-01-BH2203<br>16.02-16.15<br>C<br>0.28<br>0.28<br>Diametral | 102103<br>320-01-BH2203-C01950<br>320-01-BH2203<br>19.50-19.60<br>C<br>1.20<br>1.20<br>Diametral | 102111<br>320-01-BH2207-C01100<br>320-01-BH2207<br>11.00-11.10<br>C<br>0.06<br>0.06<br>Diametral | 102112         320-01-BH2207-C01600         320-01-BH2207         16.00-16.10         C         0.21         0.21         Diametral |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)<br>Load Direction | 102102<br>320-01-BH2203-C01600<br>320-01-BH2203<br>16.02-16.15<br>C<br>0.28<br>0.28<br>Diametral | 102103<br>320-01-BH2203-C01950<br>320-01-BH2203<br>19.50-19.60<br>C<br>1.20<br>1.20<br>Diametral | 102111<br>320-01-BH2207-C01100<br>320-01-BH2207<br>11.00-11.10<br>C<br>0.06<br>0.06<br>Diametral | 102112         320-01-BH2207-C01600         320-01-BH2207         16.00-16.10         C         0.21         0.21         Diametral |
| Trilab Sample No.<br>Client Sample No<br>Bore Hole<br>Depth From/To (m)<br>Description<br>Is (MPa)<br>Is(50) (MPa)<br>Load Direction | 102102<br>320-01-BH2203-C01600<br>320-01-BH2203<br>16.02-16.15<br>C<br>0.28<br>0.28<br>Diametral | 102103<br>320-01-BH2203-C01950<br>320-01-BH2203<br>19.50-19.60<br>C<br>1.20<br>1.20<br>Diametral | 102111<br>320-01-BH2207-C01100<br>320-01-BH2207<br>11.00-11.10<br>C<br>0.06<br>0.06<br>Diametral | 102112         320-01-BH2207-C01600         320-01-BH2207         16.00-16.10         C         0.21         0.21         Diametral |

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| POINT LOAD TEST REPORT<br>Test Method: AS 4133.4.1 |                         |                      |                      |                      |  |
|--|-------------------------|----------------------|----------------------|----------------------|--|
| Client   | Golder Associates Pty L | imited               | Report No.           | GA102052-102170-PL   |  |
|  |                         |                      | Request No           | Golder_1893795_TR04  |  |
| Address  | PO Box 1734 MILTON E    | BC QLD 4064          | Test Date            | 23/01/2019           |  |
|  |                         |                      | Report Date          | 25/01/2019           |  |
| Project  | Inland Rail Section 320 |                      |                      |                      |  |
| Project No   | 1893795                 |                      |                      |                      |  |
|  |                         |                      |                      |                      |  |
| Trilab Sample No.                                  | 102113                  | 102115               | 102119               | 102120               |  |
| Client Sample No                                   | 320-01-BH2207-C01800    | 320-01-BH2207-C02000 | 320-01-BH2215-C00740 | 320-01-BH2215-C01000 |  |
| Bore Hole  | 320-01-BH2207           | 320-01-BH2207        | 320-01-BH2215        | 320-01-BH2215        |  |
| Depth From/To (m)                                  | 18.00-18.10             | 20.00-20.10          | 7.40-7.50            | 10.00-10.10          |  |
| Description  | С                       | С                    | С                    | С                    |  |
| İs (MPa)   | 0.31                    | 0.10                 | 0.16                 | 0.36                 |  |
| Is(50) (MPa)                                       | 0.31                    | 0.10                 | 0.16                 | 0.36                 |  |
| Load Direction                                     | Diametral               | Diametral            | Diametral            | Diametral            |  |
|  |                         |                      |                      |                      |  |
| Trilab Sample No.                                  | 102122                  | 102123               | 102124               | 102129               |  |
| Client Sample No                                   | 320-01-BH2215-C01370    | 320-01-BH2215-C01500 | 320-01-BH2215-C01950 | 320-01-BH2216-C00490 |  |
| Bore Hole  | 320-01-BH2215           | 320-01-BH2215        | 320-01-BH2215        | 320-01-BH2216        |  |
| Depth From/To (m)                                  | 13.60-13.73             | 15.00-15.10          | 19.50-19.60          | 4.90-5.00            |  |
| Description  | С                       | С                    | С                    | С                    |  |
| ls (MPa)   | 0.03                    | 0.56                 | 1.63                 | 0.62                 |  |
| Is(50) (MPa)                                       | 0.03                    | 0.56                 | 1.63                 | 0.63                 |  |

NOTES/REMARKS:

Tested as received

Diametral

Load Direction

Sample/s supplied by the client

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Diametral



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Diametral

Laboratory No. 9926

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Diametral



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| POINT LOAD TEST REPORT<br>Test Method: AS 4133 4.1 |                         |                      |                      |                      |
|--|-------------------------|----------------------|----------------------|----------------------|
| Client   | Golder Associates Pty L | imited               | Report No.           | GA102052-102170-PL   |
|  |                         |                      | Request No           | Golder_1893795_TR04  |
| Address  | PO Box 1734 MILTON E    | BC QLD 4064          | Test Date            | 23/01/2019           |
|  |                         |                      | Report Date          | 25/01/2019           |
| Project  | Inland Rail Section 320 |                      |                      |                      |
| Project No   | 1893795                 |                      |                      |                      |
|  |                         |                      |                      |                      |
| Trilab Sample No.                                  | 102130                  | 102131               | 102132               | 102134               |
| Client Sample No                                   | 320-01-BH2216-C00700    | 320-01-BH2216-C01000 | 320-01-BH2216-C01500 | 320-01-BH2216-C01800 |
| Bore Hole  | 320-01-BH2216           | 320-01-BH2216        | 320-01-BH2216        | 320-01-BH2216        |
| Depth From/To (m)                                  | 7.00-7.12               | 10.00-10.10          | 15.00-15.10          | 18.00-18.10          |
| Description  | С                       | С                    | С                    | С                    |
| ls (MPa)   | 2.72                    | 0.50                 | 0.33                 | 0.90                 |
| Is(50) (MPa)                                       | 2.70                    | 0.50                 | 0.33                 | 0.90                 |
| Load Direction                                     | Diametral               | Diametral            | Diametral            | Diametral            |
|  |                         |                      |                      |                      |
| Trilab Sample No.                                  | 102143                  | 102145               | 102146               | 102148               |
| Client Sample No                                   | 320-01-BH2301-C01109    | 320-01-BH2301-C01290 | 320-01-BH2301-C01470 | 320-01-BH2301-C01600 |
| Bore Hole  | 320-01-BH2301           | 320-01-BH2301        | 320-01-BH2301        | 320-01-BH2301        |
| Depth From/To (m)                                  | 11.09-11.20             | 12.90-13.00          | 14.70-14.80          | 16.00-16.10          |
| Description  | С                       | С                    | С                    | с                    |
| ls (MPa)   | 0.31                    | 1.65                 | 0.28                 | 1.07                 |
| ls(50) (MPa)                                       | 0.31                    | 1.64                 | 0.28                 | 1.07                 |

NOTES/REMARKS:

Tested as received

Diametral

Sample/s supplied by the client

Load Direction

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Authorised Signatory N. Maddison

Diametral



Diametral

Laboratory No. 9926

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Diametral



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## POINT LOAD TEST REPORT Test Method: AS 4133.4.1 Golder Associates Pty Limited Client **Report No.** GA102052-102170-PL Golder 1893795 TR04 **Request No** PO Box 1734 MILTON BC QLD 4064 Address **Test Date** 23/01/2019 **Report Date** 25/01/2019 Inland Rail Section 320 Project **Project No** 1893795 Trilab Sample No. 102149 102151 102153 102154 **Client Sample No** 320-01-BH2301-C01800 320-01-BH2301-C02000 320-01-BH2302-C00110 320-01-BH2302-C00300 **Bore Hole** 320-01-BH2301 320-01-BH2301 320-01-BH2302 320-01-BH2302 Depth From/To (m) 18.00-18.10 20.00-20.10 1.10-1.20 3.01-3.12

| Description    | С         | С         | С         | С         |
|----------------|-----------|-----------|-----------|-----------|
| İs (MPa)       | 0.58      | 0.60      | 0.29      | 0.12      |
| Is(50) (MPa)   | 0.58      | 0.60      | 0.29      | 0.11      |
| Load Direction | Diametral | Diametral | Diametral | Diametral |

| Trilab Sample No. | 102156               | 102157               | 102160               | 102161               |
|-------------------|----------------------|----------------------|----------------------|----------------------|
| Client Sample No  | 320-01-BH2302-C00500 | 320-01-BH2302-C00700 | 320-01-BH2302-C00900 | 320-01-BH2302-C01200 |
| Bore Hole         | 320-01-BH2302        | 320-01-BH2302        | 320-01-BH2302        | 320-01-BH2302        |
| Depth From/To (m) | 5.00-5.10            | 7.00-7.11            | 9.00-9.10            | 12.00-12.10          |
| Description       | С                    | С                    | С                    | С                    |
| ls (MPa)          | 0.38                 | 0.21                 | 0.42                 | 0.22                 |
| Is(50) (MPa)      | 0.38                 | 0.21                 | 0.42                 | 0.22                 |
| Load Direction    | Diametral            | Diametral            | Diametral            | Diametral            |

|--|

Tested as received

Sample/s supplied by the client

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Authorised Signatory NorM N. Ma

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| POINT LOAD TEST REPORT |                         |                          |                      |                      |
|------------------------|-------------------------|--------------------------|----------------------|----------------------|
| <b>•</b> ••            |                         | Test Method: AS 4133.4.1 |                      |                      |
| Client                 | Golder Associates Pty L | limited                  | Report No.           | GA102052-102170-PL   |
|                        |                         |                          | Request No           | Golder_1893795_TR04  |
| Address                | PO Box 1734 MILTON E    | 3C QLD 4064              | Test Date            | 23/01/2019           |
|                        |                         |                          | Report Date          | 25/01/2019           |
| Project                | Inland Rail Section 320 |                          |                      |                      |
| Project No             | 1893795                 |                          |                      |                      |
|                        | Ι                       | I                        |                      | T                    |
| Trilab Sample No.      | 102163                  | 102164                   | 102166               | 102167               |
| Client Sample No       | 320-01-BH2302-C01400    | 320-01-BH2302-C01700     | 320-01-BH2302-C02000 | 320-01-BH2302-C02390 |
| Bore Hole              | 320-01-BH2302           | 320-01-BH2302            | 320-01-BH2302        | 320-01-BH2302        |
| Depth From/To (m)      | 14.00-14.10             | 17.00-17.10              | 20.00-20.10          | 23.90-24.00          |
| Description            | С                       | С                        | С                    | С                    |
| ls (MPa)               | 2.33                    | 0.47                     | 0.23                 | 0.07                 |
| ls(50) (MPa)           | 2.31                    | 0.47                     | 0.23                 | 0.07                 |
| Load Direction         | Diametral               | Diametral                | Diametral            | Diametral            |
|                        |                         |                          |                      |                      |
| Trilab Sample No.      | 102169                  | 102170                   |                      |                      |
| Client Sample No       | 320-01-BH2302-C02800    | 320-01-BH2302-C03000     |                      |                      |
| Bore Hole              | 320-01-BH2302           | 320-01-BH2302            |                      |                      |
| Depth From/To (m)      | 28.00-28.11             | 30.00-30.10              |                      |                      |
| Description            | С                       | С                        |                      |                      |
| ls (MPa)               | 0.40                    | 0.25                     |                      |                      |
| ls(50) (MPa)           | 0.40                    | 0.25                     |                      |                      |
| Load Direction         | Diametral               | Diametral                |                      |                      |
|                        |                         |                          |                      |                      |

NOTES/REMARKS:

<u>RKS:</u> Tested as received

Sample/s supplied by the client

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 Laboratory No. 9926

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| POINT LOAD TEST REPORT |                          |               |               |                    |  |
|------------------------|--------------------------|---------------|---------------|--------------------|--|
| Client                 | Golder Associates Pty Li | mited         | Report No.    | GA102180-102249-PL |  |
| Address                | PO Box 1734 MILTON B     | C QLD 4064    | Test Date     | 22/01/2019         |  |
|                        |                          |               | Report Date   | 23/01/2019         |  |
| Project                | Inland Rail Section 320  | 1             |               |                    |  |
| Project No             | 1893795                  |               |               |                    |  |
|                        | 1                        |               |               |                    |  |
| Trilab Sample No.      | 102180                   | 102182        | 102183        | 102187             |  |
| Client Sample No       | 320-01-BH2101            | 320-01-BH2101 | 320-01-BH2101 | 320-01-BH2101      |  |
| Bore Hole              | 320-01-BH2101            | 320-01-BH2101 | 320-01-BH2101 | 320-01-BH2101      |  |
| Depth From/To (m)      | 78.57-78.72              | 80.0-80.23    | 82.61-82.76   | 93.53-93.66        |  |
| Description            | С                        | С             | С             | С                  |  |
| ls (MPa)               | 0.37                     | 0.33          | 0.31          | 0.41               |  |
| ls(50) (MPa)           | 0.40                     | 0.35          | 0.34          | 0.44               |  |
| Load Direction         | Axial                    | Axial         | Axial         | Axial              |  |
|                        |                          |               |               |                    |  |
| Trilab Sample No.      | 102195                   | 102197        | 102199        | 102205             |  |
| Client Sample No       | 320-01-BH2101            | 320-01-BH2101 | 320-01-BH2101 | 320-01-BH2101      |  |
| Bore Hole              | 320-01-BH2101            | 320-01-BH2101 | 320-01-BH2101 | 320-01-BH2101      |  |
| Depth From/To (m)      | 93.53-93.75              | 93.61-93.75   | 95.60-95.73   | 96.40-96.58        |  |
| Description            | С                        | С             | С             | С                  |  |
| ls (MPa)               | 3.65                     | 0.17          | 2.47          | 0.50               |  |
| ls(50) (MPa)           | 4.01                     | 0.18          | 2.73          | 0.55               |  |
| Load Direction         | Axial                    | Axial         | Axial         | Axial              |  |
|                        |                          |               |               |                    |  |

NOTES/REMARKS:

Tested as received

\_\_\_\_\_

Sample/s supplied by the client

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 Laboratory No. 9926

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 ABN 25 065 630 506



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| POINT LOAD TEST REPORT |                         |               |               |                    |  |
|------------------------|-------------------------|---------------|---------------|--------------------|--|
| Client                 | Golder Associates Pty L | imited        | Report No.    | GA102180-102249-PL |  |
|                        |                         |               | Request No    | 1893795_TR01       |  |
| Address                | PO Box 1734 MILTON E    | 3C QLD 4064   | Test Date     | 22/01/2019         |  |
|                        |                         |               | Report Date   | 23/01/2019         |  |
| Project                | Inland Rail Section 320 |               |               |                    |  |
| Project No             | 1893795                 |               |               |                    |  |
|                        | 1                       | 1             |               |                    |  |
| Trilab Sample No.      | 102213                  | 102215        | 102219        | 102224             |  |
| Client Sample No       | 320-01-BH2101           | 320-01-BH2101 | 320-01-BH2101 | 320-01-BH2101      |  |
| Bore Hole              | 320-01-BH2101           | 320-01-BH2101 | 320-01-BH2101 | 320-01-BH2101      |  |
| Depth From/To (m)      | 102.88-103              | 105.00-105.08 | 105.80-106.00 | 108.70-109.00      |  |
| Description            | С                       | С             | С             | С                  |  |
| ls (MPa)               | 0.17                    | 0.12          | 0.02          | 0.11               |  |
| ls(50) (MPa)           | 0.18                    | 0.14          | 0.03          | 0.13               |  |
| Load Direction         | Axial                   | Axial         | Axial         | Axial              |  |
|                        |                         |               |               |                    |  |
| Trilab Sample No.      | 102243                  | 102244        | 102249        | 102180             |  |
| Client Sample No       | 320-01-BH2101           | 320-01-BH2101 | 320-01-BH2101 | 320-01-BH2101      |  |
| Bore Hole              | 320-01-BH2101           | 320-01-BH2101 | 320-01-BH2101 | 320-01-BH2101      |  |
| Depth From/To (m)      | 129.33-129.50           | 131.03-131.14 | 140.38-140.74 | 78.57-78.72        |  |
| Description            | С                       | С             | С             | С                  |  |
| ls (MPa)               | 0.32                    | 0.40          | 0.05          | 0.51               |  |

NOTES/REMARKS:

Tested as received

0.35

Axial

Sample/s supplied by the client

Is(50) (MPa)

Load Direction

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0.05

Axial



0.52

Diametral

Laboratory No. 9926

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0.41

Axial



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|                   | POII                    | NT LOAD TEST R | EPORT         |                    |
|-------------------|-------------------------|----------------|---------------|--------------------|
| Client            | Golder Associates Pty L | imited         | Report No.    | GA102180-102249-PL |
|                   |                         |                | Request No    | 1893795_TR01       |
| Address           | PO Box 1734 MILTON E    | 3C QLD 4064    | Test Date     | 22/01/2019         |
|                   |                         |                | Report Date   | 23/01/2019         |
| Project           | Inland Rail Section 320 |                |               |                    |
| Project No        | 1893795                 |                |               |                    |
|                   |                         |                |               |                    |
| Trilab Sample No. | 102182                  | 102183         | 102187        | 102195             |
| Client Sample No  | 320-01-BH2101           | 320-01-BH2101  | 320-01-BH2101 | 320-01-BH2101      |
| Bore Hole         | 320-01-BH2101           | 320-01-BH2101  | 320-01-BH2101 | 320-01-BH2101      |
| Depth From/To (m) | 80.0-80.23              | 82.61-82.76    | 93.53-93.66   | 93.53-93.75        |
| Description       | С                       | С              | С             | С                  |
| ls (MPa)          | 0.37                    | 0.33           | 0.39          | 3.36               |
| ls(50) (MPa)      | 0.40                    | 0.35           | 0.40          | 3.53               |
| Load Direction    | Diametral               | Diametral      | Diametral     | Diametral          |
|                   |                         |                |               |                    |
| Trilab Sample No. | 102197                  | 102199         | 102205        | 102213             |
| Client Sample No  | 320-01-BH2101           | 320-01-BH2101  | 320-01-BH2101 | 320-01-BH2101      |
| Bore Hole         | 320-01-BH2101           | 320-01-BH2101  | 320-01-BH2101 | 320-01-BH2101      |
| Depth From/To (m) | 93.61-93.75             | 95.60-95.73    | 96.40-96.58   | 102.88-103         |
| Description       | С                       | С              | С             | С                  |
| ls (MPa)          | 0.48                    | 2.57           | 4.96          | 0.08               |
| Is(50) (MPa)      | 0.45                    | 2.73           | 5.32          | 0.09               |
| Load Direction    | Diametral               | Diametral      | Diametral     | Diametral          |
|                   |                         |                |               |                    |

NOTES/REMARKS:

Tested as received

Sample/s supplied by the client

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|                         | POIN                      | IT LOAD TEST R           | EPORT         |                      |
|-------------------------|---------------------------|--------------------------|---------------|----------------------|
|                         |                           | Test Method: AS 4133.4.1 | •···          |                      |
| Client                  | Golder Associates Pty Lir | nited                    | Report No.    | GA102180-102249-PL   |
| A dalara a a            |                           |                          | Request No    | 1893795_TR01         |
| Address                 | PO BOX 1734 MILTON B      | C QLD 4064               | Test Date     | 22/01/2019           |
| <b>D</b> : (            |                           |                          | Report Date   | 23/01/2019           |
| Project No.             | Inland Rall Section 320   |                          |               |                      |
| Project No              | 1695795                   |                          |               |                      |
| Trilab Sample No.       | 102215                    | 102219                   | 102224        | 102243               |
| Client Sample No        | 320-01-BH2101             | 320-01-BH2101            | 320-01-BH2101 | 320-01-BH2101        |
| Bore Hole               | 320-01-BH2101             | 320-01-BH2101            | 320-01-BH2101 | 320-01-BH2101        |
| Depth From/To (m)       | 105.00-105.08             | 105.80-106.00            | 108.70-109.00 | 129.33-129.50        |
| Description             | С                         | С                        | С             | С                    |
| ls (MPa)                | 0.09                      | 0.00                     | 0.05          | 0.23                 |
| ls(50) (MPa)            | 0.10                      | 0.00                     | 0.05          | 0.24                 |
| Load Direction          | Diametral                 | Diametral                | Diametral     | Diametral            |
|                         |                           |                          |               |                      |
| Trilab Sample No.       | 102244                    | 102249                   |               |                      |
| Client Sample No        | 320-01-BH2101             | 320-01-BH2101            |               |                      |
| Bore Hole               | 320-01-BH2101             | 320-01-BH2101            |               |                      |
| Depth From/To (m)       | 131.03-131.14             | 140.38-140.74            |               |                      |
| Description             | С                         | С                        |               |                      |
| ls (MPa)                | 0.17                      | 0.06                     |               |                      |
| Is(50) (MPa)            | 0.19                      | 0.06                     |               |                      |
| Load Direction          | Diametral                 | Diametral                |               |                      |
|                         |                           |                          |               |                      |
| NOTES/REMARKS:          | Tested as received        |                          |               |                      |
| Sample/s supplied by th | e client                  |                          |               | Page 4 of 4 REP02102 |

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Authorised Signatory Nel N. Maddis



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## Unconfined Compressive Strength of Rock



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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

ABN 25 065 630 506

Trilab Pty Ltd



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| U  | NIAXIAL COMPRES  | SIVE STRENGTH  | & DEFC        | RMATION TEST R            | EPORT           |          |
|--|--|--|---------------|---------------------------|-----------------|----------|
| Client                                     | Golder Associates Pty L  | imited   | 100.4.0.1     | Report No. GA1            | 01187-MOD       |          |
| Average Sample                             | e Diameter (mm)  | 51.8   | Moistur       | L E Content (%)           | 7.7             |          |
| Sample Height                              | (mm)   | 142.0  | Wet De        | nsity (t/m <sup>3</sup> ) | 2.34            |          |
| Duration of Test                           | t (min)  | 4.87   | Drv Der       | nsity (t/m <sup>3</sup> ) | 2.17            |          |
| Rate of Loading                            | u (MPa/min)  | 0.29   | Bedding       | n (°)                     | 40              |          |
| Mode of Failure                            | , ()   | Shear  | Test Ap       | paratus Kelba             | a 1000kN Load C | ell      |
|  | CLIENT:  | Golder Associates P  | tv Limite     | d                         |                 |          |
|  | PROJECT:   | Inland Rail Section  | 320           | BEFORE TEST               | Г               |          |
|  | LAB SAMPLE No.   | 101187   |               | DATE: oslu 1.9            |                 |          |
|  | BOREHOLE:  | 320-01-BH2201  |               | DEPTH: 17                 |                 |          |
|  | CLIENT:  | Golder Associates Pt   | ty Limite     | d                         |                 |          |
|  | PROJECT:   | Inland Rail Section 3  | 320           | AFTER TEST                |                 |          |
|  | LAB SAMPLE No  | 101187   | _             | DATE: CL                  |                 |          |
|  | BOREHOLE:  | 320-01-BH2201  |               | DEPTH: 17                 |                 |          |
|  |  |  | -             |                           |                 |          |
| Notes/Remarks:                             |  |  |               |                           |                 |          |
| Sample/s supplied by cli                   | ient Graph   | not to scale   | Tested as rec | ceived.                   | Page 2 of 2     | REP03603 |
| Accredit<br>The results of t<br>this docum | ted for compliance with ISO/IEC <sup>2</sup> the tests, calibrations, and/or meanent are traceable to Australian/N | 17025 - Testing.<br>asurements included in<br>ational Standards. |               | Authorised Signatory      | NATA            |          |
|  | Tested at Trilab Brisbane Labor  | ratory.  |               | N. Maddison               | Laboratory I    | No. 9926 |



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| UN   | IAXIAL COMPRE  | SSIVE STRENGTH   | <b>&amp; DEFC</b>  | DRMATION TES                                    | ST REPORT                 |            |
|--|--|--|--------------------|---|---------------------------|------------|
| Client   | Golder Associates Pty  | Limited  | 33.4.3.1           | Report No.                                      | GA101190-MOD              |            |
| Average Sample I<br>Sample Height (m             | Diameter (mm)<br>m)  | 51.7<br>145.0  | Moistur<br>Wet De  | I<br>e Content (%)<br>nsity (t/m <sup>3</sup> ) | 7.4<br>2.26               |            |
| Duration of Test (                               | min)   | 10.27  | Dry Dei            | nsity (t/m <sup>3</sup> )                       | 2.10                      |            |
| Rate of Loading (I<br>Mode of Failure            | MPa/min)   | 0.91<br>Conical  | Bedding<br>Test Ar | g (~)<br>poaratus                               | 5<br>Kelba 1000kN I oad ( | Cell       |
|  |  |  |                    | F   |                           |            |
|  | CLIENT:<br>PROJECT:  | Golder Associates Pty<br>Inland Rail Section 32                                    | Limited 0          | BEFORE T  | FST                       |            |
|  | LAB SAMPLE No.<br>BOREHOLE:  | 101190<br>320-01-BH2209  |                    | DATE: 31/10/18<br>DEPTH: 5.5                    |                           |            |
|  | CLIENT:  | Golder Associates Pty  | Limited            |   |                           |            |
| _  | PROJECT:   | Inland Rail Section 32   | 20                 | AFTER TE  | EST                       |            |
|  | LAB SAMPLE No.<br>BOREHOLE:  | 101190<br>320-01-BH2209  |                    | DATE: 31 /10/18<br>DEPTH: 5.5                   |                           |            |
|  |  |  |                    |   |                           |            |
|  |  |  |                    |   |                           |            |
| otes/Remarks:                                    |  |  |                    |   | 1000                      |            |
| mple/s supplied by clien                         | t Grap   | oh not to scale  | Tested as rec      | ceived.   | Page 2 of 2               | REP03      |
| Accredited<br>The results of the<br>this documen | d for compliance with ISO/IEC<br>e tests, calibrations, and/or m<br>nt are traceable to Australian/<br>Tested at Trilab Brisbane Lab | C 17025 - Testing.<br>easurements included in<br>/National Standards.<br>poratory. |                    | Authorised Signatory                            |                           | 7 No. 9926 |



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| l   | UNIAXIAL COMPRE   | SSIVE STRENGTH  | <b>&amp; DEFOR</b> | MATION TE              | ST REPORT        |           |
|---|---|---|--------------------|------------------------|------------------|-----------|
| Client  | Golder Associates Pty   | / Limited   | 4133.4.3.1         | Report No.             | GA101194-MOD     |           |
| Average Samp  | ble Diameter (mm)   | 51.8  | Moisture C         | content (%)            | 6.9              |           |
| Sample Height   | t (mm)  | 141.2   | Wet Densi          | ty (t/m <sup>3</sup> ) | 2.25             |           |
| Duration of Te  | st (min)  | 9.92  | Drv Densit         | v (t/m <sup>3</sup> )  | 2.10             |           |
| Rate of Loadin  | ng (MPa/min)  | 1.56  | Bedding (°         | )<br>')                | Nil              |           |
| Mode of Failur  | e   | Shear   | Test Appar         | ratus                  | Kelba 1000kN Loa | id Cell   |
|   | CLIENT:   | Golder Associates Pr  | v Limited          |                        |                  |           |
|   | PROJECT:  | Inland Rail Section   | 320                | BEFORE                 | TEST             |           |
|   | LAB SAMPLE No.  | 101194  | D                  | ATE: 03/11             | 18               |           |
|   | BOREHOLE:   | 320-01-BH2209   | D                  | EPTH: 16.5             |                  |           |
|   | CLIENT:   | Colder Associates P   | y Limited          |                        |                  |           |
|   | PROJECT:  | Inland Rail Section 3   | 320                | AFTED T                | TEST             |           |
|   | LAR SAMPLE No   | 101104  | D                  | ATE. ozlal             | 201              |           |
|   | BOREHOLE:   | 320-01-BH2209   |                    | EPTH: 16.5             | 18               |           |
|   |   |   |                    |                        |                  |           |
| tes/Remarks:<br>mple/s supplied by<br>Accrea<br>The results o | client Gran<br>dited for compliance with ISO/IE0<br>f the tests, calibrations, and/or m | ph not to scale<br>C 17025 - Testing.<br>reasurements included in | Tested as receive  | ed.                    | Page 2 o         | f 2 REP03 |
| this docu   | ument are traceable to Australian   | /National Standards.  | Na                 | n al te                | ALCONO TOD       | 1019      |
|   | Tested at Trilab Brisbane I at  | poratory  |                    | N. Maddison            | COMPETEN         | CE        |



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| Client   | Golder Associates   | Pty Limited  |           | Report No.                  | GA101202-MOD                 |
|--|---|--|-----------|-----------------------------|------------------------------|
|  |   |  |           |                             |                              |
| Average Samp                                     | ole Diameter (mm)   | 51.3   | Moist     | ure Content (%)             | 11.6                         |
| Sample Height                                    | t (mm)  | 142.9  | Wet D     | Density (t/m <sup>3</sup> ) | 2.24                         |
| Duration of Te                                   | st (min)  | 32.83  | Dry D     | ensity (t/m <sup>3</sup> )  | 2.01                         |
| Rate of Displace                                 | cement (mm/min)   | 0.10   | Beddi     | ng (°)                      | 5                            |
| Mode of Failur                                   | e   | Conical  | Test A    | Apparatus                   | 100kN Compression<br>Machine |
|  | CLIENT:   | Golder Associates Pty  | Limited   | 1                           |                              |
|  | PROJECT:  | Inland Rail Section 3  | 20        | BEFORE T                    | EST                          |
|  | LAB SAMPLE No.  | 101202   |           | DATE: 31 Julio              |                              |
| - 1  | BOREHOLE:   | 320-01-BH2212  |           | DEPTH: 13.4                 |                              |
|  |   |  |           |                             |                              |
|  | CLIENT:   | Golder Associates Pt   | y Limite  | d                           |                              |
|  | PROJECT:  | Inland Rail Section 3  | 20        | AFTER T                     | EST                          |
|  | LAB SAMPLE No.  | 101202   |           | DATE: 31 10/18              |                              |
|  | BOREHOLE:   | 320-01-BH2212  |           | DEPTH: 13.4                 |                              |
|  | •   |  |           |                             |                              |
| Notes/Remarks:                                   |   |  |           |                             |                              |
| Sample/s supplied by                             | client Phot   | to not to scale  | Tested as | received.                   | Page 2 of 2 REP1340          |
| Accredited<br>The results of the<br>this documer | I for compliance with ISO/IEC<br>e tests, calibrations, and/or me<br>nt are traceable to Australian/I<br>Tested at Trilab Brisbane Labo | 17025 - Testing.<br>easurements included in<br>National Standards.<br>pratory. |           | Authorised Signatory        | TELEVILLE                    |

 Laboratory No. 9926

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

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| U   | NIAXIAL COMPRE  | SSIVE STRENGTH   | & DEFC        | RMATION TEST                   | REPORT      |          |
|---|---|--|---------------|--------------------------------|-------------|----------|
| Client  | Golder Associates Pty   | / Limited  | 100.4.0.1     | Report No. GA                  | A101212-MOD |          |
| Average Sample                                | Diameter (mm)   | 51.7   | Moistur       | e Content (%)                  | 4.2         |          |
| Sample Height (r                              | nm)   | 140.0  | Wet De        | ensity (t/m <sup>3</sup> )     | 2.21        |          |
| Duration of Test                              | (min)   | 7 37   | Dry De        | nsity (t/m <sup>3</sup> )      | 2 12        |          |
| Rate of Loading                               | (MPa/min)   | 3 94   | Beddin        | n (°)                          | Nil         |          |
| Mode of Failure                               |   | Conical  | T             | 9()                            |             |          |
|   |   |  | Test Ap       | st Apparatus Keida Tuuukin Loa |             | ell      |
|   | CLIENT:   | Golder Associates Pty  | Limited       |                                |             |          |
|   | PROJECT:  | Inland Rail Section 32   | 0             | BEFORE TEST                    | Г           |          |
|   | LAB SAMPLE No.  | 101212   |               | DATE: 31/10/18                 |             |          |
|   | BOREHOLE:   | 320-01-BH2218  |               | DEPTH: 11.5                    |             |          |
|   | CLIENT:   | Golder Associates Pty  | Limited       |                                |             |          |
|   | PROJECT:  | Inland Rail Section 32   | 0             | AFTER TEST                     | •           |          |
|   | LAB SAMPLE No.  | 101212   |               | DATE: 31/10/18                 |             |          |
|   | BOREHOLE:   | 320-01-BH2218  |               | DEPTH: 11.5                    |             |          |
|   |   | 0  |               |                                |             |          |
|   |   |  | 1             |                                |             |          |
| tes/Remarks:                                  | nt o  | nh not to cools  | Tootoda       |                                | Daws 0 - 60 | DEDAA    |
| mple/s supplied by clie                       | nt Gra  | ph not to scale  | l ested as re | ceived.                        | Page 2 of 2 | REP03    |
| Accredite<br>The results of th<br>this docume | ed for compliance with ISO/IE(<br>le tests, calibrations, and/or ment are traceable to Australian | ن 1/025 - Lesting.<br>neasurements included in<br>/National Standards. |               | Authorised Signatory           | NATA        |          |
|   | Tested at Trilab Brisbane Lat   | poratory.  |               | N. Maddison                    |             | No. 9926 |



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| UN   | IIAXIAL COMPRE   | SSIVE STRENGTH   | & DEFC       | DRMATION TES            | ST REPORT           |         |
|--|--|--|--------------|-------------------------|---------------------|---------|
| Client   | Golder Associates Pty  | Limited  | 155.4.5.1    | Report No.              | GA101217-MOD        |         |
| Average Sample                                 | Diameter (mm)  | 52 0   | Moistur      | oisture Content (%) 7 7 |                     |         |
| Sample Height (n                               | nm)  | 145.2  | Wet De       | $(t/m^3)$               | 2 28                |         |
| Duration of Tost (                             | (min)  | 5 25   |              | nsity $(t/m^3)$         | 2.20                |         |
| Duration of Loading (                          | MDo/min)   | 5.25   | Diy Dei      | a (°)                   | 2.1Z                |         |
| Rate of Loading (                              | MPa/min)   | 5.59   | Beaging      | 9()                     | INII                |         |
| Mode of Failure                                |  | Conical  | Test Ap      | oparatus                | Kelba 1000kN Load C | Cell    |
| _  | CLIENT:  | Golder Associates Pt   | y Limite     | d                       |                     |         |
|  | PROJECT:   | Inland Rail Section 3  | 320          | BEFORE                  | TEST                |         |
|  | LAB SAMPLE No.   | 101217   |              | DATE: 31/10/18          |                     |         |
|  | BOREHOLE:  | 320-01-BH2218  |              | DEPTH: 16.2             |                     |         |
|  | CLIENT:<br>PROJECT:  | Golder Associates Pty<br>Inland Rail Section 3                                     | Limited      | AFTER T                 | EST                 |         |
|  | LAB SAMPLE No.   | 101217   |              | DATE: 2115/18           |                     |         |
|  | BOREHOLE:  | 320-01-BH2218  |              | DEPTH: 16.2             |                     |         |
|  |  |  |              |                         |                     |         |
| otes/Remarks:                                  |  |  |              |                         | and a series of     |         |
| ample/s supplied by clier                      | nt Grap  | oh not to scale  | Tested as re | ceived.                 | Page 2 of 2         | REP036  |
| Accredite<br>The results of the<br>this docume | d for compliance with ISO/IEC<br>e tests, calibrations, and/or m<br>nt are traceable to Australian,<br>Tested at Trilab Brisbane Lab | C 17025 - Testing.<br>easurements included in<br>/National Standards.<br>poratory. |              | Authorised Signatory    |                     | No 9926 |



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|                                     | UNIAXIAL COMPR  | ESSIVE STRENGTH                               | <b>1 &amp; DEFORMATION</b> 7    | TEST REPORT            |
|-------------------------------------|---|---|---------------------------------|------------------------|
| Client                              | Golder Associates Pt  | y Limited                                     | Report No.                      | GA101325-MOD           |
| Average Sam                         | ole Diameter (mm)   | 51.6  | Moisture Content (%)            | 4.3                    |
| Sample Heigh                        | t (mm)  | 136.9   | Wet Density (t/m <sup>3</sup> ) | 2.23                   |
| Duration of Te                      | est (min)   | 5.10  | Dry Density (t/m <sup>3</sup> ) | 2.14                   |
| Rate of Loadir                      | ng (MPa/min)  | 8.20  | Bedding (°)                     | 25                     |
| Mode of Failur                      | re  | Shear   | Test Apparatus                  | Kelba 1000kN Load Cell |
|                                     | CLIENT  | Colder Associates D                           | for Limited                     |                        |
|                                     | PROJECT:  | Inland Rail Section                           | 320                             |                        |
|                                     |   |   | BEFOR                           | E TEST                 |
|                                     | LAB SAMPLE NO.  | 101325  | DATE: 03/11                     | (18                    |
|                                     | BOREHOLE:   | 320-01-BH2217                                 | DEPTH: 2.9                      |                        |
|                                     | CLIENT:<br>PROJECT:   | Golder Associates Pt<br>Inland Rail Section 3 | y Limited<br>320 AFTER          | TEST                   |
|                                     | LAB SAMPLE No.  | 101325  | DATE                            |                        |
|                                     | BOREHOLE:   | 320-01-BH2217                                 | DEPTH: 2.9                      | 18                     |
|                                     |   |   |                                 |                        |
| tes/Remarks:<br>mple/s supplied by  | client Gr.  | aph not to scale                              | Tested as received.             | Page 2 of 2 REP03      |
| Accre<br>The results c<br>this docu | oned for compliance with ISO/IE<br>of the tests, calibrations, and/or i<br>ument are traceable to Australia | n/National Standards.                         | Authorised Signator             | NATA                   |
|                                     | Tested at Trilab Brisbane La  | aboratory.                                    | N. Maddison                     | TECHNICAL              |
|                                     |   | -   |                                 | Laboratory No. 992     |



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|   |   | SSIVE STRENGTH   | & DEFC            | RMATION TEST            | REPORT              |        |
|---|---|--|-------------------|-------------------------|---------------------|--------|
| Client  | Golder Associates Pty   | Limited  | 33.4.3.1          | Report No. GA           | 101327-MOD          |        |
| Average Sample  | Diameter (mm)   | 51.7   | Moistur           | e Content (%)           | 3.9                 |        |
| Sample Height (r  | nm)   | 144.5  | Wet De            | nsity $(t/m^3)$         | 2.25                |        |
| Duration of Tost  | (min)   | 6.02   |                   | $r_{\rm acity} (t/m^3)$ | 2.23                |        |
| Duration of Leading   | $(\mathbf{MDe}(\mathbf{min}))$  | 0.23   | Diy Dei<br>Deddie | - (2)                   | Z. 17               |        |
| Rate of Loading (   | MPa/min)  | 5.13   | Beagin            | g ( <sup>-</sup> )      | INII                |        |
| Mode of Failure   |   | Conical  | Test Ap           | paratus Ke              | lba 1000kN Load Cel | I      |
|   | CLIENT:   | Golder Associates Pty  | Limited           | l                       |                     |        |
|   | PROJECT:  | Inland Rail Section 32   | 20                | BEFORE TES              | Г                   |        |
|   | LAB SAMPLE No.  | 101327   |                   | DATE: 03/11/18          |                     |        |
|   | BOREHOLE:   | 320-01-BH2217  |                   | DEPTH: 5.2              |                     |        |
|   | CLIENT:   | Golder Associates Pty  | Limited           |                         |                     |        |
|   | PROJECT:  | Inland Rail Section 32   | 20                | AFTER TEST              |                     |        |
|   | LAB SAMPLE No.  | 101327   |                   | DATE: 03/11/18          |                     |        |
|   | BOREHOLE:   | 320-01-BH2217  |                   | DEPTH: 5.2              |                     |        |
|   |   |  |                   |                         |                     |        |
|   |   |  |                   |                         |                     |        |
| <u>ptes/Remarks:</u><br>mple/s supplied by clien  | <u>t Grap</u>   | h not to scale   | Tested as rec     | peived.                 | Page 2 of 2         | REP036 |
| tes/Remarks:<br>nple/s supplied by clien<br>Accredite<br>The results of th                | nt Grap<br>d for compliance with ISO/IEC<br>e tests, calibrations, and/or me                                    | h not to scale<br>2 17025 - Testing.<br>easurements included in                        | Tested as ree     | veived.                 | Page 2 of 2         | REP036 |
| tes/Remarks:<br>mple/s supplied by clien<br>Accredite<br>The results of th<br>this docume | nt Grap<br>d for compliance with ISO/IEC<br>e tests, calibrations, and/or me<br>nt are traceable to Australian/ | h not to scale<br>2 17025 - Testing.<br>easurements included in<br>National Standards. | Tested as rea     | veived.                 | Page 2 of 2         | REP03( |



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| l                                    | UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT         Test Method: A5 4133.4.31         Report No. GA101329-MOD         age Sample Diameter (mm)       51.8<br>ple Height (mm)       Moisture Content (%)       4.7<br>Wet Density (t/m <sup>2</sup> )       2.36<br>Dr. Density (t/m <sup>2</sup> )       2.36<br>Dr. Density (t/m <sup>2</sup> )       2.36<br>Dr. Density (t/m <sup>2</sup> )       2.35<br>Dr. Density (t/m <sup>2</sup> )       2.25<br>Dr. Density (t/ |   |              |                      |                     |
|--------------------------------------|--|---|--------------|----------------------|---------------------|
| Client                               | Golder Associates P  | ty Limited  | 33.4.3.1     | Report No. GA101     | 329-MOD             |
| Average Samp                         | ble Diameter (mm)  | 51.8  | Moistu       | re Content (%)       | 4.7                 |
| Sample Heigh                         | t (mm)   | 141.1   | Wet De       | ensity (t/m°)        | 2.36                |
| Duration of Te                       | st (min)   | 7.27  | Dry De       | ensity (t/m³)        | 2.25                |
| Rate of Loadin                       | ng (MPa/min)   | 4.65  | Beddin       | g (°)                | Nil                 |
| Mode of Failur                       | e  | Conical   | Test A       | pparatus Kelba       | 1000kN Load Cell    |
|                                      | CLIENT:  | Golder Associates Pty   | Limited      |                      |                     |
|                                      | PROJECT:   | Inland Rail Section 320   | )            | BEFORE TEST          |                     |
|                                      | LAB SAMPLE No.   | 101329  |              | DATE: 3/11/10        |                     |
|                                      | BOREHOLE:  | 320-01-BH2217   |              | <b>DEPTH: 7.1</b>    |                     |
|                                      |  |   |              |                      |                     |
|                                      | CLIENT:  | Golder Associates Pty I   | imited       |                      |                     |
|                                      | PROJECT:   | Inland Rail Section 320   |              | AFTER TEST           |                     |
|                                      | LAB SAMPLE No.   | 101329  | 1            | DATE: ozlaha         | _                   |
|                                      | BOREHOLE:  | 320-01-BH2217   | ]            | DEPTH: 7.1           | -                   |
|                                      |  |   |              |                      |                     |
|                                      |  |   |              |                      |                     |
| Notes/Remarks:                       |  |   |              |                      |                     |
| Sample/s supplied by                 | client Gr  | raph not to scale   | Tested as re | eceived.             | Page 2 of 2 REP0360 |
| Accrea<br>The results o<br>this docu | dited for compliance with ISO/IE<br>f the tests, calibrations, and/or<br>ument are traceable to Australia<br>Tested at Trilab Brisbane Li  | EC 17025 - Testing.<br>measurements included in<br>in/National Standards.<br>aboratory. |              | Authorised Signatory |                     |



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| Clien   | t                     | Golder Associ   | ates Pty Limited                                    |                      |               | Repor            | t No.          | GA101332    | 2-MOD       |        |
|---------|-----------------------|---|---|----------------------|---------------|------------------|----------------|-------------|-------------|--------|
| Addr    | ess                   | PO Box 1734   | MILTON BC QI  | _D 4064              |               | Reque            | st No.         | Golder_18   | 93795_TR    | 03     |
|         |                       |   |   |                      |               | Test D           | ate            | 3/11/2018   |             |        |
| Proje   | ct                    | Inland Rail Se  | ction 320   |                      |               | Repor            | t Date         | 6/11/2018   |             |        |
| Proje   | ct No.                | 1893795   |   | Client               | Sample N      | 0.               | 320-01-B       | H2217-C01   | 610         |        |
| Bore    | Hole                  | 320-01-BH221  | 17 Depth From (                                     | (m)                  | 16.1          |                  | Depth          | To (m)      | 16.3        |        |
| Desc    | ription               | С   |   |                      |               |                  | -              |             |             |        |
| Samp    | ole Type              | e Single  | Individual Rock Cor                                 | e Specimen           |               |                  |                |             |             |        |
|         |                       | Uni   | axial Compressiv                                    | ve Strength          | 51.9          | MPa              |                |             |             |        |
|         |                       | You   | ng's Modulus  | Poiss                | on Ratio      |                  |                |             |             |        |
|         |                       | Tang  | ent 30.1 GPa  | 0.                   | .064          | from 20 °        | % to 42 % (    | of Max UCS  |             |        |
|         |                       | Sec   | ant 29.6 GPa  | 0.                   | 064           | from 0 %         | to 42 % of     | Max UCS     |             |        |
|         |                       |   |   | troop ve St          |               | to               |                |             |             |        |
|         | —— Axi                | ial 1 — Axial 2   |   | Diametral            |               | Secant           | Tangent        |             | Volumetric  |        |
|         | 45 F                  |   |   |                      |               |                  |                |             |             |        |
|         | ŀ                     | $\lambda$   |   |                      | 13            |                  | ,<br>,         |             |             |        |
|         | 40 -                  |   |   |                      | /             |                  |                |             |             |        |
|         | ŀ                     |   |   | <i>[</i> ]           |               |                  | /              |             |             |        |
|         | 35                    |   |   |                      |               |                  |                |             |             |        |
|         | Ē                     |   |   |                      |               |                  |                |             |             |        |
|         | 30                    |   | /   |                      | /             |                  |                |             |             |        |
| APa)    |                       |   |   |                      |               |                  |                |             |             |        |
| ess (I  | 25                    |   |   | 1                    |               |                  |                |             |             |        |
| al Str  | 20                    |   |   | *                    |               |                  |                |             |             |        |
| Axia    | 20                    |   |   |                      |               |                  |                |             |             |        |
|         | 15                    |   |   |                      |               |                  |                |             |             |        |
|         |                       |   |   |                      |               |                  |                |             |             |        |
|         | 10                    |   |   | /                    |               |                  |                |             |             |        |
|         |                       |   |   |                      |               |                  |                |             |             |        |
|         | 5                     | /   |   |                      |               |                  |                |             |             |        |
|         | ł                     |   |   |                      |               |                  |                |             |             |        |
|         | ٥F                    |   |   |                      |               |                  |                | .           |             |        |
|         | -500                  | Ó   | 500   | 10<br>Strain         | 00            | 1500             |                | 2000        |             | 2500   |
|         | <u> </u>              |   |   | σuan - μ             | ~             |                  |                |             |             |        |
| otes/Re | marks:                |   |   |                      |               |                  |                |             |             |        |
| mple/s  | supplied by           | / client  | Graph not to scale                                  |                      | Tested as re  | eceived.         |                |             | Page 1 of 2 | REP    |
| _       | Accre                 | edited for compliance wit                               | h ISO/IEC 17025 - Testir                            | ıg.                  |               | Authorised       | Signatory      |             | ~           |        |
| Th      | e results<br>this doc | ot the tests, calibrations,<br>ument are traceable to A | and/or measurements in<br>Australian/National Stand | cluded in ards.      |               | North            |                |             | NATA        |        |
|         |                       | Tested at Trilah Pric                                   | shane Laboratory                                    |                      |               | N. Madd          | ison           |             | TECHNICAL   |        |
|         | Th                    |   |   |                      |               |                  |                |             | Laboratory  | No. 99 |
|         |                       | A FACILITE AT COMPRATIANC CON                           | tacte nortarmad annu annu                           | to the chooitin inct | rumont or com | nnia at tha time | A TOOL INDIANA | othony of a |             |        |

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| UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT   |                       |   |                                       |               |              |          |  |  |
|---|-----------------------|---|---------------------------------------|---------------|--------------|----------|--|--|
| Client  | Golder Associates Pty | Limited   | 100.4.0.1                             | Report No.    | GA101332-MOD |          |  |  |
| Average Sample D  | iameter (mm)          | 51.7  | Moistur                               | e Content (%) | 8.1          |          |  |  |
| Sample Height (mm)  |                       | 135.3   | Wet Density (t/m <sup>3</sup> ) 2.32  |               |              |          |  |  |
| Duration of Test (min)  |                       | 5.23  | Dry Density (t/m <sup>3</sup> ) 2.15  |               |              |          |  |  |
| Rate of Loading (MPa/min)   |                       | 9.92  | Bedding (°) Nil                       |               | Nil          |          |  |  |
| Mode of Failure   |                       | Conical   | Test Apparatus Kelba 1000kN Load Cell |               | ell          |          |  |  |
|   |                       |   |                                       |               |              |          |  |  |
| -   | CLIENT:               | Golder Associates Pty Limited                   |                                       |               |              |          |  |  |
|   | PROJECT:              | Inland Rail Section 32                          | 0                                     | BEFORE T      | EST          |          |  |  |
|   | LAB SAMPLE No.        | 101332  |                                       | DATE: 3/11/18 |              |          |  |  |
|   | BOREHOLE:             | 320-01-BH2217                                   |                                       | DEPTH: 16.1   | 745.57       |          |  |  |
| F   | CLIENT:<br>PROJECT:   | Golder Associates Pty<br>Inland Rail Section 32 | Limited                               | I<br>AFTER T  | FST          |          |  |  |
| +   | LAR SAMPLE No         | 101332  |                                       | DATE          |              |          |  |  |
| -   | BOREHOLE:             | 320-01-BH2217                                   |                                       | DEPTH: 16.1   |              |          |  |  |
|   |                       |   |                                       |               |              |          |  |  |
| Notes/Remarks:  |                       |   |                                       |               |              |          |  |  |
| Sample/s supplied by client   | Gra                   | ph not to scale                                 | Tested as re                          | ceived.       | Page 2 of 2  | REP0360  |  |  |
| Accredited for compliance with ISO/IEC 17025 - Testing.<br>The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.<br>Tested at Trilab Brisbane Laboratory. |                       |   |                                       |               |              | No. 9926 |  |  |



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| UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT  |  |   |  |   |  |  |  |  |
|--|--|---|--|---|--|--|--|--|
| Client   | Golder Associates Pty  | / Limited   | Report No. GA  | 101334-MOD  |  |  |  |  |
| Average Sample Diameter (mm)<br>Sample Height (mm)<br>Duration of Test (min)<br>Rate of Loading (MPa/min)<br>Mode of Failure |  | 51.8<br>132.3<br>5.88<br>3.34<br>Conical                                  | Moisture Content (%)<br>Wet Density (t/m <sup>3</sup> )<br>Dry Density (t/m <sup>3</sup> )<br>Bedding (°)<br>Test Apparatus Kel  | Content (%)         4.6           Isity (t/m <sup>3</sup> )         2.48           sity (t/m <sup>3</sup> )         2.37           (°)         5           paratus         Kelba 1000kN Load Cell |  |  |  |  |
|  | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:   | Golder Associates Pty<br>Inland Rail Section 3<br>101334<br>320-01-BH2217 | DATE:         03         111         118           DEPTH:         20.4         20 |   |  |  |  |  |
|  | CLIENT:  | Golder Associates P   | ty Limited   |   |  |  |  |  |
|  | PROJECT:   | Inland Rail Section .   | 320 AFTER TEST   |   |  |  |  |  |
|  | LAB SAMPLE No.<br>BOREHOLE:  | 101334<br>320-01-BH2217   | DATE: 03 /n (18<br>DEPTH: 20.4   |   |  |  |  |  |
|  |  |   |  |   |  |  |  |  |
| Notes/Remarks:   |  |   |  |   |  |  |  |  |
| Sample/s supplied by   | client Graj  | ph not to scale   | Tested as received.  | Page 2 of 2 REP03603  |  |  |  |  |
| Accre<br>The results o<br>this docu  | dited for compliance with ISO/IE0<br>of the tests, calibrations, and/or m<br>ument are traceable to Australian | C 17025 - Testing.<br>easurements included in<br>/National Standards.     | Authorised Signatory   | TECHNICAL   |  |  |  |  |
|  | N. Maddison  | Laboratory No. 9926   |  |   |  |  |  |  |



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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING


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| UNIA   | XIAL COMPRES   | SIVE STRENGTH   | & DEFORMATION TEST  | REPORT  |
|--|--|---|---|---|
| Client   | Golder Associates Pty Li   | mited   | Report No. G  | A102053-MOD   |
| Average Sample Dia<br>Sample Height (mm<br>Duration of Test (min<br>Rate of Loading (MF<br>Mode of Failure | ameter (mm)<br>)<br>n)<br>Pa/min)                                  | 60.6<br>160.3<br>12.42<br>12.49<br>Disintegration                     | Moisture Content (%)<br>Wet Density (t/m <sup>3</sup> )<br>Dry Density (t/m <sup>3</sup> )<br>Bedding (°)<br>Test Apparatus K | 1.1<br>2.87<br>2.84<br>Nil<br>elba 1000kN Load Cell |
|  | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:                 | Golder Associates I<br>Inland Rail Section<br>102053<br>320-01-BH2102 | Pty Limited<br>320 BEFORE TE<br>DATE: os/oz/(<br>DEPTH: 196.1   | 2 <b>ST</b>   |
|  |  |   |   |   |
| - 1  | CLIENT:  | Golder Associates P   | ty Limited  |   |
| - 1  | PROJECT:   | Inland Rail Section   | 320 AFTER TES   | ST  |
|  | LAB SAMPLE No.<br>BOREHOLE:  | 102053<br>320-01-BH2102   | DATE: 05/02/1<br>DEPTH: 196.1   | 9,  |
|  |  |   |   |   |
| ites/Remarks:  |  |   | Tested on monimal   |   |
| mpie/s supplied by client  | Graph n  | ot to scale   | l ested as received.  | Page 2 of 2 REP036                                  |
| Accredited to<br>The results of the te<br>this document a  | ists, calibrations, and/or meas<br>are traceable to Australian/Nat | u2o - resting.<br>surements included in<br>tional Standards.          | Authorised Signatory  | TECHNICA  |



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| Client       Golder Associates Pty Limited       Report No.       GA1020         Average Sample Diameter (mm)       58.7       Moisture Content (%)         Sample Height (mm)       147.6       Wet Density (t/m³)         Duration of Test (min)       11.48       Dry Density (t/m³)         Rate of Displacement (mm/min)       0.10       Bedding (°)         Mode of Failure       Shear       Test Apparatus       100kN (         Element       Golder Associates Pty Limited       PROJECT:       Inland Rail Section 320       BEFORE TEST         LAB SAMPLE No.       102058       DATE: 05/02/02       DEPTH: 208.4       0   | PORT                |
|--|---------------------|
| Average Sample Diameter (mm)       58.7       Moisture Content (%)         Sample Height (mm)       147.6       Wet Density (t/m³)         Duration of Test (min)       11.48       Dry Density (t/m³)         Rate of Displacement (mm/min)       0.10       Bedding (°)         Mode of Failure       Shear       Test Apparatus       100kN (         Image: CLIENT:       Golder Associates Pty Limited       PROJECT:       Inland Rail Section 320       BEFORE TEST         LAB SAMPLE No.       102058       DATE: 05/02/(9)       DEPTH: 208.4       Image: Clienter content (%)  | 058-MOD             |
| Sample Height (mm)       147.6       Wet Density (t/m³)         Duration of Test (min)       11.48       Dry Density (t/m³)         Rate of Displacement (mm/min)       0.10       Bedding (°)         Mode of Failure       Shear       Test Apparatus       100kN (rest)         Image: Shear       Image: Shear       Test Apparatus       100kN (rest)         Image: Shear       Image: Shear       Image: Shear       Image: Shear       Image: Shear         Image: Shear       Ima   | 15.2                |
| Duration of Test (min)       11.48       Dry Density (t/m <sup>3</sup> )         Rate of Displacement (mm/min)       0.10       Bedding (°)         Mode of Failure       Shear       Test Apparatus       100kN (         Image: CLIENT:       Golder Associates Pty Limited       PROJECT:       Inland Rail Section 320       BEFORE TEST         LAB SAMPLE No.       102058       DATE: 05/02/(rg)       DEPTH: 208.4       Image: Client in the section in the section in the section in the section in the section in the section in the section in the section in the section in the section in the section in the section in the section in the section in the section is considered in the section in the section in the section is considered in the section in the section in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section is considered in the section in the section in the section is considered in the section in the section is considered in the section in the section is considered in the section in the section in the section is considered in the section in the section in the section is considered in the section in the section in the section in the section in the section in the section in the section in the section in the section in the section in the section in   | 2.10                |
| Rate of Displacement (mm/min)       0.10       Bedding (°)         Mode of Failure       Shear       Test Apparatus       100kN (°)         Image: CLIENT:       Golder Associates Pty Limited       PROJECT:       Inland Rail Section 320       BEFORE TEST         Image: LAB SAMPLE No.       102058       DATE: 05/02/09       DEPTH: 208.4       DEPTH: 208.4  | 1.82                |
| Mode of Failure       Shear       Test Apparatus       100kN         Image: Client is a structure in the image of th | Nil                 |
| CLIENT: Golder Associates Pty Limited         PROJECT:       Inland Rail Section 320       BEFORE TEST         LAB SAMPLE No.       102058       DATE: 05/02/19         BOREHOLE:       320-01-BH2102       DEPTH: 208.4   | Compression Machine |
| CLIENT:       Golder Associates Pty Limited         PROJECT:       Inland Rail Section 320       BEFORE TEST         LAB SAMPLE No.       102058       DATE: 05/02/19         BOREHOLE:       320-01-BH2102       DEPTH: 208.4   |                     |
| LAB SAMPLE No.     102058     DATE: 05/02/19       BOREHOLE:     320-01-BH2102     DEPTH:     208.4  |                     |
| BOREHOLE: 320-01-BH2102 DEPTH: 208.4   |                     |
|  |                     |
| CLIENT: Colder Associates Day Limited  |                     |
| PROJECT: Inland Bail Section 320   |                     |
| AFTER TEST   |                     |
| LAB SAMPLE No. 102058 DATE: 05/02/19.  |                     |
|  |                     |
| Notes/Remarks:   |                     |
| Sample/s supplied by client Photo not to scale Tested as received.   | Page 2 of 2 REP1340 |
| Accredited for compliance with ISO/IEC 17025 - Testing.<br>The results of the tests, calibrations, and/or measurements included in<br>this document are traceable to Australian/National Standards.<br>Tested at Trilab Brisbane Laboratory.   | NATA                |



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|  | UNIAXIAL COMPR   | ESSIVE STRENGTH  | <b>&amp; DEF</b>                               | DRMATION TE   | ST REPORT   |          |
|--|--|--|--|---|---|----------|
| Client   | Golder Associates P  | ty Limited   | 33.4.3.1                                       | Report No.  | GA102062-MOD                                      |          |
| Average Sam<br>Sample Heig<br>Duration of T<br>Rate of Load<br>Mode of Failu | nple Diameter (mm)<br>ht (mm)<br>est (min)<br>ing (MPa/min)<br>ure   | 60.9<br>160.6<br>6.30<br>7.46<br>Conical                                 | Moistu<br>Wet De<br>Dry De<br>Beddin<br>Test A | re Content (%)<br>ensity (t/m <sup>3</sup> )<br>ensity (t/m <sup>3</sup> )<br>g (°)<br>oparatus | 2.5<br>2.63<br>2.57<br>Nil<br>Kelba 1000kN Load ( | Cell     |
|  | CLIENT:  | Golder Associates Pty I  | imited   |   |   |          |
|  | PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:  | Inland Rail Section 320<br>102062<br>320-01-BH2102                       | I  | AFTER TES<br>DATE: 05/02/1<br>DEPTH: 214.9  | <b>T</b>  |          |
|  |  |  |  |   |   |          |
|  | CLIENT:<br>PROJECT:  | Golder Associates Pty L<br>Inland Rail Section 320                       | imited   |   |   |          |
|  |  | Infund Itan Section 520  |  | AFTER TES   | Г   |          |
|  | BOREHOLE:  | 102062<br>320-01-BH2102  |  | DATE: 05/02/1-<br>DEPTH: 214.9  | 9,  |          |
|  |  |  |  |   |   |          |
| Notes/Remarks:   |  |  |  |   |   |          |
| Sample/s supplied b  | y client Gr  | aph not to scale   | Tested as re                                   | eceived.  | Page 2 of 2                                       | REP0360  |
| Accr<br>The results<br>this doo  | edited for compliance with ISO/IE<br>of the tests, calibrations, and/or<br>cument are traceable to Australia | EC 17025 - Testing.<br>measurements included in<br>n/National Standards. |  | Authorised Signatory  | TEGNNICAL   |          |
| Th   | nesulte of calibrations and tests pe   | reformed apply only to the specific instru                               | ment or sam                                    | into at the time of test unless   | Laboratory  | No. 9926 |



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| Client  | Golder Associates Pty L   | imited  |                   | Report No.                                   | GA102065-MOD           |
|---|---|---|-------------------|--|------------------------|
| Average Sam   | nole Diameter (mm)  | 60.5  | Moistu            | re Content (%)                               | 33.4                   |
| Sample Height (mm)  |   | 143.1   | Wet D             | ensity (t/m <sup>3</sup> )                   | 1 81                   |
| Duration of Te  | est (min)   | 9 58  | Dry De            | ensity (t/m <sup>3</sup> )                   | 1.36                   |
| Pate of Displa  | acoment (mm/min)  | 0.10  | Beddir            |  | Nil                    |
| Mode of Failure   |   | Shear   | Test A            | pparatus                                     | 100kN Compression Mach |
|   |   |   |                   |  |                        |
|   | CLIENT:<br>PROJECT:   | Golder Associates P   | ty Limite         | d  |                        |
|   |   | mand Ran Section  | 520               | BEFORE T                                     | EST                    |
|   | LAB SAMPLE No.<br>BOREHOLE:   | 102065<br>320-01-BH2102   |                   | DATE: 05/02/<br>DEPTH: 218                   | //19                   |
|   |   |   |                   |  |                        |
|   | CLIENT:<br>PROJECT:   | Golder Associates P<br>Inland Rail Section                            | ty Limitee<br>320 | AFTER TH                                     | est                    |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No,   | Golder Associates P<br>Inland Rail Section<br>102065                  | ty Limited<br>320 | AFTER TH<br>DATE: 05/07                      | EST                    |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:  | Golder Associates P<br>Inland Rail Section<br>102065<br>320-01-BH2102 | ty Limited<br>320 | I<br>AFTER TH<br>DATE: 05 /0 2<br>DEPTH: 218 | 2 <b>ST</b>            |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:  | Golder Associates P<br>Inland Rail Section<br>102065<br>320-01-BH2102 | ty Limited<br>320 | AFTER TH<br>DATE: 05 /02<br>DEPTH: 218       | 2 <b>ST</b>            |
| :es/Remarks:  | CLIENT:         PROJECT:         LAB SAMPLE No.         BOREHOLE:   | Golder Associates P<br>Inland Rail Section<br>102065<br>320-01-BH2102 | ty Limited<br>320 | AFTER TH<br>DATE: 05 /02<br>DEPTH: 218       | EST<br>//g.            |
| es/Remarks:   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:  | Golder Associates P<br>Inland Rail Section<br>102065<br>320-01-BH2102 | ty Limited<br>320 | AFTER TH<br>DATE: 05 /0 2<br>DEPTH: 218      | 25T<br>7/9<br>         |
| es/Remarks:<br>ple/s supplied by<br>Accre<br>The results of<br>this doc | CLIENT:         PROJECT:         LAB SAMPLE No.         BOREHOLE:         Image: Complexity of the length to diameter ratio falls out of the tests, calibrations, and/or measurement are traceable to Australian/National contents of the length to diameter of the length to diameter ratio falls out of the tests, calibrations, and/or measurement are traceable to Australian/National contents of the length to diameter of the length to diameter ratio falls out of the length to diameter r | Golder Associates P<br>Inland Rail Section<br>102065<br>320-01-BH2102 | ty Limited<br>320 | AFTER TH<br>DATE: 05 /02<br>DEPTH: 218       | Page 2 of 2 REP        |



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|          | U                | NIAXIAL COMPRE                   | SSIVE STREN<br>Test Method: AS 4 | GTH & C     | <b>EFOR</b><br>6 4133.1.1.1 | MATIO          | N TEST    | REPOR        | Г                    |
|----------|------------------|----------------------------------|----------------------------------|-------------|-----------------------------|----------------|-----------|--------------|----------------------|
| Clien    | nt               | Golder Associates Pty            | Limited                          |             |                             | Report         | No.       | GA102070     | -MOD                 |
| Addr     | ress             | PO Box 1734 MILTON               | IBC QLD 4                        | 1064        |                             | Reques         | t No.     | Golder 18    | 93795 TR04           |
|          |                  |                                  |                                  |             |                             | Test Da        | ite       | 5/02/2019    |                      |
| Proje    | ect              | Inland Rail Section 32           | 0                                |             |                             | Report         | Date      | 6/02/2019    |                      |
| Proje    | ect No.          | 1893795                          | Depth From                       | (m)         | 224.07                      |                | Sample    | 320-01-BH210 | 2-C22400-UCY : 320-0 |
| Bore     | Hole             | 320-01-BH2102                    | Depth To                         | (m)         | 224.22                      |                | No.       | BH21         | 02-C22400-MOI        |
| Desc     | ription          | С                                |                                  |             |                             |                |           |              |                      |
| Sam      | ple Type         | Single Individ                   | ual Rock Core Speci              | men         |                             |                |           |              |                      |
|          |                  | Uniaxial                         | Compressive St                   | rength      | 26.4                        | MPa            |           |              |                      |
|          |                  | Young's Mo                       | dulus_                           | Poisson     | Ratio                       |                |           |              |                      |
|          |                  | Tangent 15.                      | 4 GPa                            | 0.12        | 2                           | from 20 %      | to 42 % o | f Max UCS    |                      |
|          |                  | Secant 14.                       | 1 GPa                            | 0.12        | 3                           | from 0 % t     | o 42 % of | Max UCS      |                      |
|          |                  |                                  | Axial Stress                     | vs Strair   | Plots                       |                |           |              |                      |
|          |                  |                                  |                                  |             |                             |                | • *       |              | <b>X</b> 1 - C       |
|          | 20 T             | Axiai i Axiai                    | 2 Avg Axiai                      | Diame       | trai                        | × Secant       | • Tang    | ent          | - volumetric         |
|          | -                |                                  |                                  |             |                             |                |           |              |                      |
|          | 18               |                                  |                                  |             |                             | /              | /         |              |                      |
|          | -                |                                  |                                  |             |                             | * /            |           |              |                      |
|          | 16 –             |                                  |                                  | /           |                             |                | /         |              |                      |
|          | 14               |                                  |                                  |             |                             |                |           |              |                      |
|          |                  |                                  |                                  | 11          | . /                         |                |           |              |                      |
| MPa)     | 12               |                                  |                                  | +           |                             |                |           |              |                      |
| ess (1   |                  |                                  |                                  | // *        |                             |                |           |              |                      |
| al Stro  | 10 -             |                                  | /                                | $\vdash$    |                             |                |           |              |                      |
| Axia     |                  |                                  |                                  |             |                             |                |           |              |                      |
|          | 8                |                                  |                                  | /           |                             |                |           |              |                      |
|          | 6                |                                  |                                  |             |                             |                |           |              |                      |
|          | -                |                                  | +                                |             |                             |                |           |              |                      |
|          | 4                |                                  |                                  |             |                             |                |           |              |                      |
|          |                  |                                  |                                  |             |                             |                |           |              |                      |
|          | 2                |                                  |                                  |             |                             |                |           |              |                      |
|          | -                |                                  |                                  |             |                             |                |           |              |                      |
|          | 0 <u> </u>       |                                  | 500                              |             | 100                         |                | 1         | 500          |                      |
|          |                  |                                  | s                                | strain - μe |                             |                |           |              |                      |
| lotes/Re | emarks:          |                                  |                                  |             |                             |                |           |              |                      |
| Sample/s | supplied by clie | ent Gra                          | oh not to scale                  | Т           | ested as ree                | ceived.        |           |              | Page 1 of 2 (EP134)  |
|          | Accred           | ited for compliance with ISO/IE  | C 17025 - Testing.               |             |                             | Authorised Sig | gnatory   |              | ~                    |
| Th       | e results of th  | e tests, calibrations, and/or me | easurements included in t        | this        |                             | SaMA.12-       | -         |              | NATA                 |
|          | uocuille         |                                  |                                  |             |                             | N. Maddiso     | on        |              | TECHNICAL            |
|          |                  | Tested at Trilab Brisbane La     | boratory.                        |             |                             |                |           |              | Laboratory No. 9926  |



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| Client   | Golder Associates Pty  | Limited  |                 | Report No.                            | GA102070-MOD             |
|--|--|--|-----------------|---------------------------------------|--------------------------|
|  |  |  |                 |                                       |                          |
| Average Sample   | e Diameter (mm)  | 59.7 Mois  |                 | re Content (%)                        | 7.6                      |
| Sample Height (mm)   |  | 159.4 V  |                 | ensity (t/m <sup>3</sup> )            | 2.43                     |
| Duration of Test (min) 2   |  | 25.15  | Dry De          | ensity (t/m <sup>3</sup> )            | 2.25                     |
| Rate of Displace   | ement (mm/min)   | 0.10   |                 | ng (°)                                | Nil                      |
| Mode of Failure  |  | Conical  | Test A          | pparatus                              | 100kN Compression Machin |
|  |  |  |                 |                                       |                          |
|  | CLIENT:  | Golder Associates Pt   | y Limited       |                                       |                          |
|  | TROJECT.   | Infantu Ran Section 5  | 20              | BEFORE TE                             | ST                       |
|  | LAB SAMPLE No.   | . 102070   |                 | DATE: 05/02/                          | 19                       |
|  | BOREHOLE:  | 320-01-BH2102  |                 | DEPTH: 224                            |                          |
|  |  |  |                 |                                       |                          |
|  | CLIENT:  | Golder Associates Pt   | y Limited       | 1                                     |                          |
|  | CLIENT:<br>PROJECT:  | Golder Associates Pt<br>Inland Rail Section 3                            | y Limitee       | 1<br>AFTER TI                         | ST                       |
|  | CLIENT:<br>PROJECT:  | Golder Associates Pt<br>Inland Rail Section 3                            | y Limited<br>20 | AFTER TH                              | EST                      |
|  | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:   | Golder Associates Pt<br>Inland Rail Section 3<br>102070<br>320-01-BH2102 | y Limited       | AFTER TH<br>DATE: 05/02<br>DEPTH: 224 | E <b>ST</b><br>//9.      |
|  | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:   | Golder Associates Pt<br>Inland Rail Section 3<br>102070<br>320-01-BH2102 | y Limited       | AFTER TH<br>DATE: 05/02<br>DEPTH: 224 | 2 <b>ST</b>              |
| tes/Remarks:   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:   | Golder Associates Pt<br>Inland Rail Section 3<br>102070<br>320-01-BH2102 | y Limited       | AFTER TH<br>DATE: 05/02<br>DEPTH: 224 | SST<br>//9.              |
| tes/Remarks:<br>nple/s supplied by clia  | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:   | Golder Associates Pt<br>Inland Rail Section 3<br>102070<br>320-01-BH2102 | y Limited       | AFTER TH<br>DATE: 05/02<br>DEPTH: 224 | ST<br>//٩.               |
| tes/Remarks:<br>mple/s supplied by clie<br>Accredit<br>The results of th<br>this docum | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:<br>Official and the second | Golder Associates Pt<br>Inland Rail Section 3<br>102070<br>320-01-BH2102 | y Limited       | AFTER TH<br>DATE: 05/02<br>DEPTH: 224 | Page 2 of 2 REP13        |



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The results of calibrations and tests performed apply only to the specific instrument or sample at the time of test unless otherwise clearly stated. Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details.

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| UN   | IAXIAL COMPRES   | SSIVE STRENGTH<br>Test Method: AS 4133.4.3                        | & DEF            | ORMATION TES                    | ST REPORT                |  |
|--|--|---|------------------|---------------------------------|--------------------------|--|
| Client   | Golder Associates Pty  | Limited   | 12 0 10 110      | Report No.                      | GA102073-MOD             |  |
| Average Sample D                                 | Diameter (mm)  | 60.8  | Moist            | ure Content (%)                 | 2.9                      |  |
| Sample Height (mm)                               |  | 159.4 Wet De  |                  | Density (t/m <sup>3</sup> )     | 2.61                     |  |
| Duration of Test (n                              | ,<br>nin)  | 17.68   | Dry D            | ensity (t/m <sup>3</sup> )      | 2.54                     |  |
| Rate of Displacem                                | ent (mm/min)   | 0.10  | 0.10 Bedding (°) |                                 | Nil                      |  |
| Mode of Failure                                  |  | Shear   | Test /           | Apparatus                       | 100kN Compression Machin |  |
|  | ·  |   |                  |                                 |                          |  |
|  | CLIENT:  | Golder Associates Pty   | y Limited        | 1                               | and the second second    |  |
|  | PROJECT:   | Inland Rail Section 3   | 20               | BEFORE TES                      | T                        |  |
|  | LAB SAMPLE No.<br>BOREHOLE:  | 102073<br>320-01-BH2102   | 4                | DATE: 05/02/(4<br>DEPTH: 227.4/ | 9                        |  |
|  | CLIENT   | Golder Associates Ptv   | Limited          |                                 |                          |  |
|  | PROJECT:   | Inland Rail Section 3   | 20               | AFTER TEST                      | r                        |  |
|  | LAB SAMPLE No.   | 102073  |                  | DATE: 05/02/19                  |                          |  |
| - 1  | BOREHOLE:  | 320-01-BH2102   |                  | DEPTH: 227.4                    |                          |  |
|  |  |   |                  |                                 |                          |  |
| otes/Remarks:                                    |  |   |                  |                                 | <b>-</b>                 |  |
| imple/s supplied by client                       | Photo  | not to scale  | Tested as        | received.                       | Page 2 of 2 REP134       |  |
| Accredited<br>The results of the<br>this documen | for compliance with ISO/IEC tests, calibrations, and/or me t are traceable to Australian/N | 17025 - Testing.<br>asurements included in<br>lational Standards. |                  | Authorised Signatory            | NATA                     |  |
| Т  | ested at Trilab Brisbane Labo  | pratory.  |                  | N. Maddison                     | Laboratory No. 9926      |  |



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| UNI                       | AXIAL COMPRES                 | SSIVE STRENGTH  | <b>&amp; DEF</b> ( |                      | ST REPORT  |
|---------------------------|-------------------------------|---|--------------------|----------------------|--|
| Client                    | Golder Associates Pty         | Limited   | .2 & AO 4100.      | Report No.           | GA102075-MOD   |
| Average Sample Di         | iameter (mm)                  | 60.5  | Moistu             | re Content (%)       | 6.7  |
| Sample Height (mm)        |                               | 157.6 Wet Density (t/m <sup>3</sup> )   |                    |                      | 2.35   |
| Duration of Test (m       | ,<br>in)                      | 31.15   | Drv De             | 2.20                 |  |
| Rate of Displaceme        | nt (mm/min)                   | 0.10  | 0.10 Bedding (°)   |                      | Nil  |
| Mode of Failure           |                               | Shear   | Deddii             | 9()                  | I NII  |
|                           |                               | Chour   | Test A             | pparatus             | 100kN Compression Machir   |
|                           | CLIENT:                       | Golder Associates Pty   | v Limited          |                      |  |
|                           | PROJECT:                      | Inland Rail Section 3   | 20                 | DEEODE TE            | CT   |
|                           |                               | 103075  |                    | DATE /               | 51   |
|                           | BOREHOLE:                     | 102075<br>320-01-BH2102   |                    | DATE: 05 02 1        | 9  |
|                           | BOREHOLE.                     | 520-01-0112102  |                    | DEFTH: 255.2         |  |
|                           |                               |   |                    |                      |  |
|                           |                               | ·   |                    |                      |  |
|                           | 124                           |   |                    |                      | and the second se  |
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|                           |                               |   |                    |                      |  |
|                           | CLIENT:                       | Golder Associates Pty   | y Limited          |                      |  |
|                           | PROJECT:                      | Inland Rail Section 3   | 20                 | AFTER TES            | ST   |
|                           | LAB SAMPLE No.                | 102075  |                    | DATE: 05/02/1        | 9.   |
|                           | BOREHOLE:                     | 320-01-BH2102   |                    | DEPTH: 233.2         |  |
|                           |                               |   |                    | * *                  |  |
|                           |                               | - Office  | and a              |                      |  |
|                           |                               |   | MIS CA             |                      |  |
|                           |                               | 2   |                    | la .                 |  |
|                           |                               | States and  | 193                |                      |  |
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| otes/Remarks:             | A REAL PROPERTY AND           |   |                    |                      |  |
| mple/s supplied by client | Photo                         | not to scale  | Tested as re       | eceived.             | Page 2 of 2 REP13  |
| Accredited f              | or compliance with ISO/IEC    | 17025 - Testing   |                    |                      | <b>^</b>   |
| The results of the t      | ests, calibrations, and/or me | asurements included in  |                    | Authorised Signatory | NATA   |
| this document             | are traceable to Australian/N | lational Standards.   |                    | Nangelik             | ACCESSION 100  |
| Te                        | ested at Trilab Brisbane Labo | pratory.  |                    | N. Maddison          | COMPETENCE   |
| -                         |                               | -   |                    |                      | Laboratory No. 9926  |



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| UNI   | AXIAL COMPRE  | SSIVE STRENGTH   | & DEF                      | ORMATION TES                 | ST REPORT           |                 |
|---|---|--|----------------------------|------------------------------|---------------------|-----------------|
| Client  | Golder Associates Pty   | Limited  | .2 & A5 413.               | Report No.                   | GA102077-MOD        |                 |
| Average Sample D                                      | iameter (mm)  | 60.4   | Moist                      | ure Content (%)              | 12.5                |                 |
| Sample Height (mn                                     | Sample Height (mm)  |  | Wet [                      | Density (t/m <sup>3</sup> )  | 2.23                |                 |
| Duration of Test (min) 15.82                          |   | Drv D  | Dry Density $(t/m^3)$ 1.98 |                              |                     |                 |
| Rate of Displaceme                                    | ate of Displacement (mm/min) 0 10 Bedding (°)   |  | ina (°)                    | Nil                          |                     |                 |
| Mode of Failure                                       |   | Shear  | Boud                       |                              |                     |                 |
|   |   |  | Test /                     | Apparatus                    | 100kN Compression N | <i>l</i> achine |
|   | CLIENT:   | Golder Associates Ptv  | Limited                    |                              |                     |                 |
| 181   | PROJECT:  | Inland Rail Section 32   | 20                         | BEFORE TES                   | T                   |                 |
| 100   | LAR SAMPLE No.  | 102077   | _                          | DATE: 05/00/0                |                     |                 |
|   | BOREHOLE:   | 320-01-BH2102  |                            | DEPTH: 238.2                 |                     |                 |
|   |   |  |                            |                              |                     |                 |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.   | Golder Associates Pty<br>Inland Rail Section 32                    | Limited<br>0               | AFTER TEST<br>DATE: 05/02/00 |                     |                 |
|   | BOREHOLE:   | 320-01-BH2102  |                            | DEPTH: 238.2                 |                     |                 |
|   |   |  |                            |                              |                     |                 |
| Notes/Remarks:  |   |  |                            |                              |                     |                 |
| Sample/s supplied by client                           | Phot  | o not to scale   | Tested as                  | received.                    | Page 2 of 2         | REP13402        |
| Accredited f<br>The results of the t<br>this document | for compliance with ISO/IEC<br>tests, calibrations, and/or mo<br>are traceable to Australian/ | 17025 - Testing.<br>easurements included in<br>National Standards. |                            | Authorised Signatory         | TECHNICAL           |                 |
| Te  | ested at Trilab Brisbane Lab  | oratory.   |                            | N. MAUUISON                  | Laboratory          | No. 9926        |



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| U  | NIAXIAL COMPRE  | SSIVE STRENGTH &                                    | DEFO             | RMATION TE               | ST REPORT            |         |
|--|---|---|------------------|--------------------------|----------------------|---------|
| Client   | Golder Associates Pty   | Limited   | A3 4133.1.       | Report No.               | GA102084-MOD         |         |
| Average Sample                                     | Diameter (mm)   | 51.2  | Moisture         | e Content (%)            | 16.4                 |         |
| Sample Height (r                                   | m) 140.0 Wet Density (t/m <sup>3</sup> )                            |   | 2.06             |                          |                      |         |
| Duration of Test                                   | (min)   | 28.53   | Dry Den          | sity (t/m <sup>3</sup> ) | 1.77                 |         |
| Rate of Displace                                   | ment (mm/min)   | 0.10  | 0.10 Bedding (°) |                          | Nil                  |         |
| Mode of Failure                                    |   | Shear   | Test Ap          | paratus                  | 100kN Compression Ma | achine  |
| _  | CLIENT:   | Coldon Associatos Dtv I                             | imited           |                          |                      |         |
|  | PROJECT:  | Golder Associates Pty L<br>Inland Rail Section 320  | Imited           |                          |                      |         |
|  | - ROULET.   | mand Ran Section 520                                |                  | BEFORE T                 | EST                  |         |
|  | LAB SAMPLE No.  | 102084  |                  | DATE: 29/01/19           | 10000                |         |
|  | BOREHOLE:   | 320-01-BH2103                                       |                  | DEPTH: 10.6              |                      |         |
|  | CLIENT:<br>PROJECT:   | Golder Associates Pty Li<br>Inland Rail Section 320 | mited            | AFTER TES                | r                    |         |
|  | LAB SAMPLE No.  | 102084  | D                | ATE:29/01/19             | at the               |         |
|  | BOREHOLE:   | 320-01-BH2103                                       | D                | EPTH: 10.6               |                      |         |
|  |   |   |                  |                          |                      |         |
| <u>Votes/Remarks:</u><br>Sample/s supplied by clie | nt Phoi   | to not to scale                                     | ested as rec     | eived                    | Page 2 of 2          | REP134  |
|  | d for compliance with ISO/IEC                                       | 17025 Testing                                       | 5100 03 100      |                          |                      | 104     |
| The results of th<br>this docume                   | e tests, calibrations, and/or m<br>ent are traceable to Australian/ | easurements included in //National Standards.       |                  | Authorised Signatory     | NATA                 |         |
|  | Tootod at Trilah Drichana Lat                                       | poratory  |                  | N. Maddison              | TECHNICAL            |         |
|  | resteu at miab Brisbane Lac   | ou atory.   |                  |                          | Laboratory No        | o. 9926 |



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| 51   |   | Test Method: AS 4133.4   | .3.2 & AS 4133 | <u>3.1.1.1</u>              |                               |     |
|--|---|--|----------------|-----------------------------|-------------------------------|-----|
| Client   | Golder Associates Pty   | Limited  |                | Report No.                  | GA102088-MOD                  |     |
| Average Sample   | Diameter (mm)   | 51.9   | Moist          | ure Content (%)             | 8.6                           |     |
| Sample Height (m   | nm)   | 139.1  | Wet D          | Density (t/m <sup>3</sup> ) | 2.21                          |     |
| Duration of Test (min) 18.72 Dry Density (t/m <sup>3</sup> ) |   | ensity (t/m <sup>3</sup> )   | 2 04           |                             |                               |     |
| Rate of Displacen  | nent (mm/min)   | 0.10   | Podding (°)    |                             | 20                            |     |
|  |   | 0.10   | Deuui          | ng ( )                      | 20                            |     |
|  |   | Conical  | Test A         | Apparatus                   | 100kN Compression Mac         | hir |
|  | CLIENT:   | Golder Associates P  | tv Limite      | d                           |                               |     |
|  | PROJECT:  | Inland Rail Section  | 320            | BEFORE T                    | EST                           |     |
|  | LAB SAMPLE No.  | 102088   |                | DATE: 30/01                 | 19.                           |     |
| _  | BOREHOLE:   | 320-01-BH2103  |                | DEPTH: 19.2                 | / / (.*                       |     |
|  | CLIENT:<br>PROJECT:   | Golder Associates P  | ty Limited     | 1                           |                               |     |
|  |   | manu run Section   |                | AFTER TE                    | ST                            |     |
|  | LAB SAMPLE No.  | 102088   |                | DATE: 30 /01/               | /9-                           |     |
| - 1  | BOREHOLE:   | 320-01-BH2103  |                | DEPTH: 19.2                 |                               |     |
|  |   |  |                |                             |                               |     |
| tes/Remarks:   |   |  |                |                             |                               |     |
| mple/s supplied by clien                                     | nt Phot   | o not to scale   | Tested as      | received.                   | Page 2 of 2 RE                | P13 |
| Accredited<br>The results of the<br>this docume              | d for compliance with ISO/IEC<br>e tests, calibrations, and/or month<br>nt are traceable to Australian/ | 5 17025 - Testing.<br>easurements included in<br>National Standards. |                | Authorised Signatory        | NATA                          |     |
|  | Tested at Trilab Brisbane Lab   | oratory.   |                | N. Maddison                 | TECHNICAL<br>Laboratory No. 9 | 92  |



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| Client                              | Golder Associate                     | es Pty Limited            |                              | Report No.                  | GA102090-MOD       |
|-------------------------------------|--------------------------------------|---------------------------|------------------------------|-----------------------------|--------------------|
| Average San                         | nple Diameter (mm)                   | 51.6                      | Mois                         | sture Content (%)           | 11.5               |
| Sample Height (mm)                  |                                      | 141.7                     | Wet                          | Density (t/m <sup>3</sup> ) | 2.20               |
| Duration of T                       | est (min)                            | 25.65                     | Dry I                        | Density (t/m <sup>3</sup> ) | 1.97               |
| Rate of Displ                       | splacement (mm/min) 0.10 Bedding (°) |                           | 5                            |                             |                    |
| Mode of Failu                       | de of Failure Conical Test Apparatus |                           | 100kN Compression<br>Machine |                             |                    |
|                                     | CLIENT                               | Colder Associates P       | v I imite                    | d                           |                    |
|                                     | PROJECT:                             | Inland Rail Section .     | 320                          |                             | POP                |
|                                     |                                      | 102000                    |                              | BEFORE I                    |                    |
|                                     | BORFHOLE                             | - 102090<br>320-01-RH2103 | _                            | DATE: 25/01/                | 19.                |
|                                     | BOREHOLE:                            | 320-01-BH2103             |                              | DEPTH: 24.9                 |                    |
|                                     | CLIENT:                              | Golder Associates Pty     | Limited                      |                             |                    |
|                                     | PROJECT:                             | Infand Kan Section 32     | 0                            | AFTER TEST                  | Г                  |
|                                     | LAB SAMPLE No.                       | 102090                    | ]                            | DATE: 25/01/19              |                    |
|                                     | (                                    |                           |                              |                             |                    |
|                                     |                                      |                           |                              |                             |                    |
| otes/Remarks:                       | 1                                    |                           |                              |                             |                    |
| otes/Remarks:<br>ample/s supplied b | by client Pł                         | noto not to scale         | Tested a                     | as received.                | Page 2 of 2 REP134 |

 Laboratory No. 9926

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| Client  | Golder Associates Pt                               | y Limited  |   | Report No.                            | GA102101-     | MOD             |
|---|--|--|---|---------------------------------------|---------------|-----------------|
| Average Samp  | ple Diameter (mm)                                  | 51.6   | Moistu                                    | re Content (%)                        | 10.4          | 4               |
| Sample Height (mm)  |  | 94.8   | Wet D                                     | ensity (t/m <sup>3</sup> )            | 2.2           | 2               |
| Duration of Te  | est (min)  | 22.02  | Dry De                                    | ensity (t/m <sup>3</sup> )            | 2.0           | 1               |
| Rate of Displa  | icement (mm/min)                                   | 0.10   | Beddir                                    | ng (°)                                | 5             |                 |
| /lode of Failur   | re   | Disintegration Test A  |   | est Apparatus 100kN Compression       |               | pression Mach   |
|   | CLIENT:  | Golder Associates Pty  | Limited                                   |                                       |               |                 |
|   | PROJECT:   | Inland Rail Section 3  | 20  | BEFORE                                | TEST          |                 |
|   | LAB SAMPLE No.                                     | 102101   |   | DATE: 04/0                            | 12/19         |                 |
|   | BOREHOLE:  | 320-01-BH2203  |   | DEPTH: 12.1                           | /             |                 |
|   |  |  |   |                                       |               |                 |
|   |  |  |   |                                       |               |                 |
|   | CLIENT:<br>PROJECT:                                | Golder Associates Pty<br>Inland Rail Section 3                             | Limited                                   | AFTER I                               | TEST          |                 |
|   | CLIENT:<br>PROJECT:                                | Golder Associates Pty<br>Inland Rail Section 3                             | / Limited<br>20                           | AFTER T                               | TEST          |                 |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 3<br>102101<br>320-01-BH2203  | / Limited<br>20                           | AFTER T<br>DATE: 04/02<br>DEPTH: 12.1 | T <b>EST</b>  |                 |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 33<br>102101<br>320-01-BH2203 | / Limited<br>20                           | AFTER T<br>DATE: 04/02<br>DEPTH: 12.1 | TEST<br>2/191 |                 |
| ss/Remarks:   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 33<br>102101<br>320-01-BH2203 | 7 Limited<br>20                           | AFTER T<br>DATE: 04/02<br>DEPTH: 12.1 | TEST<br>2/19, |                 |
| <u>:s/Remarks:</u><br>ple/s supplied by                                       | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 32<br>102101<br>320-01-BH2203 | 20<br>20<br>St to 3.0:1.<br>Tested as re  | AFTER T<br>DATE: 04/02<br>DEPTH: 12.1 | TEST<br>2/191 | Page 2 of 2 REF |
| <u>s/Remarks:</u><br>ple/s supplied by<br>Accre<br>The results c<br>this docu | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 3<br>102101<br>320-01-BH2203  | 20<br>20<br>5:1 to 3.0:1.<br>Tested as re | AFTER T<br>DATE: 04/02<br>DEPTH: 12.1 | TEST          | Page 2 of 2 REF |



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|                                      | UNIAXIAL COMPRE   | ESSIVE STRENGTH                                  | & DEFORMAT           | ION TEST REPORT           |
|--------------------------------------|---|--|----------------------|---------------------------|
| Client                               | Golder Associates Pty   | / Limited  | Report               | rt No. GA102104-MOD       |
| Average Samp                         | ole Diameter (mm)   | 51.7   | Moisture Conten      | t (%) 1.6                 |
| Sample Heigh                         | Sample Height (mm) 140.6  |  | Wet Density (t/m     | <sup>3</sup> ) 2.54       |
| Duration of Te                       | Duration of Test (min) 31.23  |  | Drv Density (t/m     | 3) 2.49                   |
| Rate of Displacement (mm/min)        |   | 0.10   | Bedding (°)          | Nil                       |
| Mode of Failur                       | е   | Conical  | Test Apparatus       | 100kN Compression Machine |
|                                      |   |  |                      |                           |
|                                      | CLIENT:   | Golder Associates Pty                            | Limited              |                           |
|                                      | PROJECT:  | Infand Kan Section 52                            | BE                   | FORE TEST                 |
|                                      | LAB SAMPLE No.  | 102104   | DATE:                | 05/02/19,                 |
|                                      | BOREHOLE:   | 320-01-BH2203                                    | DEPTH                | : 19.6                    |
|                                      | CLIENT:   | Golder Associates Pty                            | Limited              |                           |
|                                      | PROJECT:  | Inland Rail Section 32                           | 0 AF                 | TER TEST                  |
|                                      | LAB SAMPLE No.  | 102104   | DATE:                | 05/02/19.                 |
|                                      | BOREHOLE:   | 320-01-BH2203                                    | DEPTH                | 19.6                      |
|                                      |   |  |                      |                           |
| otes/Remarks:                        |   |  |                      |                           |
| ample/s supplied by                  | client Pho  | to not to scale                                  | l ested as received. | Page 2 of 2 REP134        |
|                                      | dited for compliance with ISO/IE0                                     | C 17025 - Testing.                               | Authorise            | d Signatory               |
| Accree<br>The results o<br>this docu | of the tests, calibrations, and/or mument are traceable to Australian | neasurements included in<br>/National Standards. | Na/14,11             |                           |



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| UNIAXIA                                     |   | SIVE STRENGTH<br>Test Method: AS 4133.4.  | <b>8 D</b>        | EFORMATION                    | N TEST REPORT                                 |
|---|---|---|-------------------|-------------------------------|---|
| Client                                      | Golder Associate  | es Pty Limited  |                   | Report No.                    | GA102114-MOD                                  |
| Average Sam                                 | ple Diameter (mm)   | 51.9  | Moi               | sture Content (%)             | 8.0   |
| Sample Heig                                 | ht (mm)   | 142.2   | We                | t Density (t/m <sup>3</sup> ) | 2.25  |
| Duration of T                               | est (min)   | 31.85   | Dry               | Density (t/m <sup>3</sup> )   | 2.08  |
| Rate of Displa                              | acement (mm/min)  | 0.10  | Bed               | lding (°)                     | 35  |
| Mode of Failu                               | ire   | Shear   | Test Apparatus 10 |                               | 100kN Compression<br>Machine                  |
|   | CLIENT.   | Colden Associates Di  | . Timite          |                               |   |
|   | PROJECT:  | Inland Rail Section 3   | 20                | d                             |   |
|   |   |   |                   | BEFORE TH                     | EST   |
|   | LAB SAMPLE No   | . 102114  |                   | DATE: 25/01/                  | 19  |
|   | BOREHOLE:   | 320-01-BH2207   |                   | DEPTH: 18.1                   | Contraction of the                            |
|   | CLIENT:<br>PROJECT:   | Golder Associates Pty<br>Inland Rail Section 320  | Limited           | AFTER TES                     | r   |
|   | LAB SAMPLE No.  | 102114  |                   | DATE: 25/01/19                |   |
|   | BOREHOLE:   | 320-01-BH2207   |                   | DEPTH: 18.1                   |   |
|   |   |   |                   |                               |   |
| Notes/Remarks:                              |   |   |                   |                               |   |
| Sample/s supplied b                         | y client P  | hoto not to scale   | Tested            | as received.                  | Page 2 of 2 REP13402                          |
| Accredit<br>The results of tl<br>this docum | ed for compliance with ISO/I<br>he tests, calibrations, and/or<br>ent are traceable to Australia<br>Tested at Trilab Brisbane L | EC 17025 - Testing.<br>measurements included in<br>an/National Standards.<br>aboratory. |                   | Authorised Signatory          | TECHNICAL<br>TECHNICAL<br>Laboratory No. 9926 |



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| Client                        | Golder Associates Pty  | / Limited   |                         | Report No.                 | GA102121-MOD   |
|-------------------------------|--|---|-------------------------|----------------------------|--|
| Average Sample                | e Diameter (mm)  | 51.8  | Moistu                  | re Content (%)             | 5.7  |
| Sample Height                 | (mm)   | 137.4   | Wet D                   | ensity (t/m <sup>3</sup> ) | 2.10   |
| Duration of Test (min)        |  | 16.73   | Drv De                  | ensity (t/m <sup>3</sup> ) | 1.99   |
| Rate of Displacement (mm/min) |  | 0.10  | Beddir                  | na (°)                     | Nil  |
| Mode of Failure               |  | Conical   | al Test Apparatus 100kl |                            | 100kN Compression Mach   |
|                               | CLIENT:  | Golder Associates P   | ty Limited              | 1                          |  |
|                               | PROJECT:   | Inland Rail Section :   | 320                     | BEFORE                     | TEST   |
|                               | LAR SAMPLE No  | 102121  |                         | DATE: 01/02                | 1.0  |
|                               | BOREHOLE:  | 320-01-BH2215   |                         | DEPTH: 10.1                | 419  |
|                               |  |   |                         |                            |  |
|                               | 1  |   |                         |                            |  |
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|                               |  |   |                         |                            |  |
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|                               | CLIENT   | Golder Associates Pt  | v Limited               |                            |  |
|                               | PROJECT:   | Inland Rail Section 3   | 320                     | AFTER TI                   | CST  |
|                               |  |   |                         | DATE: OF OF                | 10   |
|                               | LAB SAMPLE No.   | 102121<br>220 01 BH2215   |                         | DEPTH: 10.1                | -/ 19  |
|                               | BOREHOLE:  | 320-01-BH2215   |                         | DEI III. IO.I              |  |
|                               |  |   | 4                       |                            |  |
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| es/Remarks:                   | an angener a serie a serie a serie a serie a serie a serie a serie a serie a serie a serie a serie a serie a s |   |                         |                            |  |
| nple/s supplied by cli        | lient Pho  | to not to scale   | Tested as re            | eceived.                   | Page 2 of 2 REP  |
| Accredi                       | ited for compliance with ISO/IE0   | C 17025 - Testing.  |                         | Authorised Signatory       | ~  |
| The results of this docun     | the tests, calibrations, and/or ment are traceable to Australian   | easurements included in<br>/National Standards.   |                         | NaMAIL                     |  |
|                               | Tootod at Trilah Driahar - L-I   |   |                         | N. Maddison                | TECHNICAL<br>COMPETENCE  |
|                               | i ested at Trilab Brisbane Lab   | poratory.   |                         |                            | Laboratory No. 001   |



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| <b>A</b> II                    |  | Test Method: AS 4133.4.3                         | .2 & AS 4133.                   | 1.1.1                      |                          |
|--------------------------------|--|--|---------------------------------|----------------------------|--------------------------|
| Client                         | Golder Associates P  | ty Limited                                       |                                 | Report No.                 | GA102125-MOD             |
| Average Sample                 | e Diameter (mm)  | 52.0   | Moistu                          | re Content (%)             | 3.1                      |
| Sample Height (                | (mm)   | 140.0  | Wet De                          | ensity (t/m <sup>3</sup> ) | 2.40                     |
| Duration of Test               | t (min)  | 22.53  | Dry Density (t/m <sup>3</sup> ) |                            | 2.32                     |
| Rate of Displacement (mm/min)  |  | 0.10   | Beddin                          | ng (°)                     | 10                       |
| Mode of Failure                |  | Conical  | Test A                          | pparatus                   | 100kN Compression Machin |
| _                              | CLIENT:  | Golder Associates Pty                            | Limited                         |                            |                          |
|                                | PROJECT:   | Inland Rail Section 32                           | 20                              | BEFORE T                   | TEST                     |
|                                | LAB SAMPLE No.   | 102125   |                                 | DATE: 01/02                | 2/19                     |
|                                | BOREHOLE:  | 320-01-BH2215                                    |                                 | DEPTH: 19.6                |                          |
|                                |  | State of Constant                                |                                 |                            |                          |
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|                                |  |  |                                 |                            | 1000                     |
|                                | CLIENT.  | Coldor Associates Ptv                            | Limited                         |                            |                          |
|                                | PROJECT:   | Inland Rail Section 32                           | 0                               | AFTER TH                   | EST                      |
|                                | LAB SAMPLE No.   | 102125   | 1                               | DATE: 01/02,               | 119.                     |
|                                | BOREHOLE:  | 320-01-BH2215                                    | 1                               | DEPTH: 19.6                |                          |
|                                |  |  |                                 |                            |                          |
|                                |  |  |                                 |                            |                          |
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|                                |  |  |                                 | C.                         |                          |
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| es/Remarks:                    |  |  |                                 |                            |                          |
| nple/s supplied by cli         | ent Ph   | oto not to scale                                 | Tested as re                    | eceived.                   | Page 2 of 2 REP1         |
| Accredit                       | ted for compliance with ISO/IE                                     | EC 17025 - Testing.                              |                                 | Authorised Signatory       | ~                        |
| The results of t<br>this docum | the tests, calibrations, and/or<br>ment are traceable to Australia | measurements included in<br>n/National Standards |                                 | No/Malt-                   | NATA                     |
|                                |  |  |                                 | N. Maddison                | TECHNICAL                |
|                                | rested at Trilab Brisbane La                                       | adoratory.                                       |                                 |                            | Laboratory No. 992       |



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|                                     | UNIAXIAL COMPR   | ESSIVE STRENGTH  | & DEF       | ORMATION TE          | ST REPORT         |             |  |
|-------------------------------------|--|--|-------------|----------------------|-------------------|-------------|--|
| Client                              | Golder Associates P  | ty Limited   | 2 & AS 4133 | Report No.           | GA102133-MOD      |             |  |
| Average Sam                         | ple Diameter (mm)  | 51.8   | Moistu      | ure Content (%)      | 4.4               |             |  |
| Sample Height (mm)                  |  | 1/1 /  | Wet D       | Density $(t/m^3)$    | 2 30              |             |  |
| Duration of Te                      | et (min)   | 26.13  |             | ensity $(t/m^3)$     | 2.00              |             |  |
| Pate of Displa                      | vcement (mm/min)   | 0.10   | Boddi       | na (°)               | 2.23              | 20          |  |
|                                     |  | Conicol  | Deuui       | Bedding ()           |                   | 20          |  |
| WOULE OF Failur                     |  | Conical  | Test A      | Apparatus            | 100kN Compression | Machine     |  |
|                                     | CLIENT:  | Golder Associates Pty  | Limited     | 1                    |                   |             |  |
|                                     | PROJECT:   | Inland Rail Section 32   | 0           | BEFORE T             | EST               |             |  |
|                                     | LAB SAMPLE No.   | 102133   |             | DATE: 01/02          | 2/19              |             |  |
|                                     | BOREHOLE:  | 320-01-BH2216  |             | DEPTH: 15.1          |                   |             |  |
|                                     | CLIENT:<br>PROJECT:  | Golder Associates Pty<br>Inland Rail Section 32                          | Limited     | AFTER TE             | ST                |             |  |
|                                     | LAB SAMPLE No.   | 102133   |             | DATE: 01/02          | /19               |             |  |
|                                     |  | 20001-DH2210   |             |                      |                   |             |  |
| Notes/Remarks:                      |  |  |             |                      |                   |             |  |
| Sample/s supplied by                | client Ph  | oto not to scale   | Tested as r | received.            | Page 2 of 2       | REP13402    |  |
| Accre<br>The results o<br>this doce | dited for compliance with ISO/IE<br>of the tests, calibrations, and/or<br>ument are traceable to Australia | EC 17025 - Testing.<br>measurements included in<br>n/National Standards. |             | Authorised Signatory | NATA              |             |  |
|                                     | rested at Trilab Brisbane La   | adoratory.   |             |                      | Laborato          | ry No. 9926 |  |



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|                                    | UNIAXIAL COMPR   | RESSIVE STRENGTH &  | <b>DEF</b>  |                                   | REPORT       |                     |  |
|------------------------------------|--|---|-------------|-----------------------------------|--------------|---------------------|--|
| Client                             | Golder Associates F  | Pty Limited   | x AU 4133.  | <b>Report No.</b> GA <sup>2</sup> | 102147-MOD   |                     |  |
| Average Sam                        | ple Diameter (mm)  | 51.8  | Moistu      | I re Content (%)                  | 4.2          |                     |  |
| Sample Heigh                       | Sample Height (mm) 141.7   |   | Wet De      | ensity (t/m <sup>3</sup> )        | 2.40         |                     |  |
| Duration of Te                     | est (min)  | 28.10   | Dry De      | ensity (t/m <sup>3</sup> )        | 2.30         |                     |  |
| Rate of Displa                     | acement (mm/min)   | 0.10  | Beddin      | ng (°)                            | 30           |                     |  |
| Mode of Failure                    |  | Conical   |             | Test Apparatus 100kN              |              | Compression Machine |  |
|                                    | CLIENT:  | Golder Associates Pty L   | imited      |                                   |              |                     |  |
|                                    | PROJECT:   | Inland Rail Section 320   |             | BEFORE TEST                       |              |                     |  |
|                                    | LAB SAMPLE No.   | 102147  |             | DATE: OL Tos Lig                  |              |                     |  |
|                                    | BOREHOLE:  | 320-01-BH2301   |             | DEPTH: 14.8                       |              |                     |  |
|                                    | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.  | Golder Associates Pty Li<br>Inland Rail Section 320<br>102147             | mited       | AFTER TEST<br>DATE: 01/02/19      |              |                     |  |
|                                    | BOREHOLE:  | 320-01-BH2301   | , I         | DEPTH: 14.8                       |              |                     |  |
|                                    |  |   |             |                                   |              |                     |  |
| lotes/Remarks:                     |  |   |             |                                   |              |                     |  |
| ample/s supplied by                | client P   | hoto not to scale T   | ested as re | eceived.                          | Page 2 of 2  | REP134              |  |
| Accre<br>The results o<br>this doc | edited for compliance with ISO/I<br>of the tests, calibrations, and/or<br>ument are traceable to Australia | EC 17025 - Testing.<br>measurements included in<br>an/National Standards. |             | Authorised Signatory              | NATA         |                     |  |
|                                    | Tested at Trilab Brisbane L  | aboratory.  |             | N. Maddison                       | Laboratory 1 | No. 9926            |  |



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| Client  | Coldon Accordet - D                                | Test Method: AS 4133.4.3.   | 2 & AS 4133. | 1.1.1  |                          |
|---|--|---|--------------|--|--------------------------|
| Client  | Golder Associates P                                | rty Limited   |              | Report No.                                   | GA102150-MOD             |
| Average Sam   | ple Diameter (mm)                                  | 51.8  | Moistu       | re Content (%)                               | 6.0                      |
| Sample Heigh  | nt (mm)  | 142.5   | Wet D        | ensity (t/m <sup>3</sup> )                   | 2.35                     |
| Duration of Test (min) 29.8   |  | 29.87   | Dry De       | ensity (t/m³)                                | 2.21                     |
| Rate of Displa  | acement (mm/min)                                   | 0.10  | Beddir       | ng (°)                                       | Nil                      |
| Mode of Failure   |  | Conical   | Test A       | pparatus                                     | 100kN Compression Machin |
|   | CLIENT:  | Golder Associates Ptv I   | imited       |  |                          |
|   | PROJECT:   | Inland Rail Section 320   | )            | DEFODE TE                                    | C/T                      |
|   |  | 100100  |              | BEFORE IE                                    | 51                       |
|   | LAB SAMPLE No.                                     | 102150<br>320_01_BH2301   |              | DATE: 01/02/1                                | 7 .                      |
|   |  |   |              |  |                          |
|   |  |   |              |  |                          |
|   | CLIENT   | Golder Associates Ptv   | Limited      |  |                          |
|   | CLIENT:<br>PROJECT:                                | Golder Associates Pty<br>Inland Rail Section 320                            | Limited      | AFTED TE                                     | CTT                      |
|   | CLIENT:<br>PROJECT:                                | Golder Associates Pty<br>Inland Rail Section 320                            | Limited      | AFTER TE                                     | ST                       |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 320<br>102150<br>220.01 RH2201 | Limited      | AFTER TE:<br>DATE: Or Joz/14<br>DEPTH: 191   | ST 7.                    |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 320<br>102150<br>320-01-BH2301 | Limited<br>0 | AFTER TE:<br>DATE: Or forfit<br>DEPTH: 18.1  | ST<br>?.                 |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 320<br>102150<br>320-01-BH2301 | Limited<br>0 | AFTER TE:<br>DATE: Or for for<br>DEPTH: 18.1 | ST                       |
| <u>;es/Remarks:</u>   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 320<br>102150<br>320-01-BH2301 |              | AFTER TE<br>DATE: O O O O                    |                          |
| es/Remarks:<br>nple/s supplied by                                       | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 320<br>102150<br>320-01-BH2301 | Limited<br>0 | AFTER TE<br>DATE: Or for for<br>DEPTH: 18.1  | ST                       |
| es/Remarks:<br>nple/s supplied by<br>Accre<br>The results do<br>this do | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE: | Golder Associates Pty<br>Inland Rail Section 320<br>102150<br>320-01-BH2301 | Limited<br>0 | AFTER TE<br>DATE: 0/0//<br>DEPTH: 18.1       | ST<br>Page 2 of 2 REP1:  |



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|  | Golder Associates                         | Pty Limited                           |                  | Report No.                  | GA102155-MOD   |
|--|---|---------------------------------------|------------------|-----------------------------|--|
| Average Samp                                       | ble Diameter (mm)                         | 51.1                                  | Moist            | ture Content (%)            | 7.7  |
| Sample Height (mm)                                 |   | 141.9 Wet Density (t/m <sup>3</sup> ) |                  | 2.22                        |  |
| Duration of Test (min)                             |   | 28.40                                 | Dry D            | Density (t/m <sup>3</sup> ) | 2.06   |
| Rate of Displacement (mm/min)                      |   | 0.10 Bedding (°)                      |                  | 25                          |  |
| Mode of Failure                                    |   | Shear                                 | Test Apparatus 1 |                             | 100kN Compression<br>Machine   |
|  | CLIENT:                                   | Golder Associates Pty                 | Limited          |                             |  |
| _  | PROJECT:                                  | Inland Rail Section 32                | 0                | BEFORE TE                   | ST   |
|  | LAB SAMPLE No.                            | 102155                                |                  | DATE: 25/01/19              |  |
| _  | BOREHOLE:                                 | 320-01-BH2302                         |                  | DEPTH: 3.1                  |  |
|  | CLIENT:                                   | Golder Associates Pty                 | Limited          | 1                           |  |
| - 1  | PROJECT:                                  | Inland Rail Section 32                | 20               | AFTER TE                    | ST   |
|  | LAB SAMPLE No.                            | 102155                                |                  | DATE: 25/01/1               | 19.  |
| - 1  | BOREHOLE:                                 | 320-01-BH2302                         |                  | DEPTH: 3.1 /                |  |
|  |   |                                       |                  |                             | and the second second second second second second second second second second second second second second second |
|  |   |                                       |                  | 6                           |  |
| <u>tes/Remarks:</u>                                | client Pho                                | to not to scale                       | Tested as        | a received                  | Page 2 of 2 REP 12   |
| otes/Remarks:<br>umple/s supplied by<br>Accredited | client Pho<br>for compliance with ISO/IFC | to not to scale                       | Tested as        | s received.                 | Page 2 of 2 REP13  |



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|                               | Golder Associate   | s Pty Limited           |        | Report No.                  | GA102158-MOD                 |
|-------------------------------|--------------------|-------------------------|--------|-----------------------------|------------------------------|
| Average Sar                   | nple Diameter (mm) | 51.9                    | Moist  | ure Content (%)             | 7.2                          |
| Sample Height (mm)            |                    | 140.3 Wet D             |        | Density (t/m <sup>3</sup> ) | 2.22                         |
| Duration of Test (min)        |                    | 27.95 Di                |        | Density (t/m <sup>3</sup> ) | 2.08                         |
| Rate of Displacement (mm/min) |                    | 0.10 Bedd               |        | ing (°)                     | 10                           |
| Mode of Failure               |                    | Conical                 | Test   | Apparatus                   | 100kN Compression<br>Machine |
|                               | CLIENT:            | Golder Associates Pty I | imited |                             |                              |
|                               | PROJECT:           | Inland Rail Section 320 |        | BEFORE TE                   | ST                           |
|                               | LAB SAMPLE No.     | 102158                  |        | DATE: 2 5/01/               | 9                            |
|                               | BOREHOLE:          | 320-01-BH2302           |        | DEPTH: 7.1                  |                              |
|                               |                    |                         |        |                             |                              |
|                               | CLIENT:            | Golder Associates Pty I | imited |                             |                              |
|                               | PROJECT:           | Inland Rail Section 320 | Inned  | AFTER TES                   | ST                           |
|                               | LAB SAMPLE No.     | 102158                  |        | DATE: 25/01/19              |                              |
|                               |                    |                         |        |                             |                              |
|                               | BOREHOLE:          | 320-01-BH2302           |        | DEPTH: 7.1                  |                              |
|                               | BOREHOLE:          | 320-01-BH2302           |        | DEPTH: 7.1                  |                              |
| <u>&gt;tes/Remarks:</u>       | BOREHOLE:          | 320-01-BH2302           |        | DEPTH: 7.1                  |                              |

 Laboratory No. 9926

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| Client Cold  | er Associator  | s Pty Limited  |               | <b>D ( )</b>                               |  |
|--|--|--|---------------|--|--|
| Cheffit Golde  |  | s F ty Linnied   |               | Report No.                                 | GA102162-MOD   |
| Average Sample Dia   | meter (mm)   | 51.0   | Mois          | ture Content (%)                           | 8.2  |
| Sample Height (mm)   |  | 142.5 Wet Density (t/m <sup>3</sup> )                                      |               | 2.25                                       |  |
| Duration of Test (min)   |  | 31.80  | Dry D         | Density (t/m³)                             | 2.08   |
| Rate of Displacemen  | t (mm/min)   | 0.10 Bedding (°)   |               | ling (°)                                   | 5  |
| Mode of Failure  |  | Shear  | Test          | Apparatus                                  | 100kN Compression<br>Machine   |
| CLIE   | NT:  | Golder Associates Ptv  | Limited       |  |  |
| PRO  | JECT:  | Inland Rail Section 32   | 20            | DEEODE TE                                  | (CTT   |
| LABS   | SAMPLE No.   | 102162   | _             | BEFORE IE                                  | .51  |
| BOR  | EHOLE:   | 320-01-BH2302  |               | DEPTH: 25/01/1                             | 9  |
|  |  | 520-01-5112502   |               | DEI III. 12.1                              |  |
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| and the second   |  | State Barris   |               |  | 1  |
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|  |  |  |               |  | 1000000  |
|  |  |  |               |  |  |
| CLIE   | NT:  | Golder Associates Pty  | Limited       |  |  |
| CLIE<br>PROJ   | INT:<br>JECT:  | Golder Associates Pty<br>Inland Rail Section 32                            | Limited       | AFTER TE                                   | ST   |
| CLIE<br>PROJ<br>LAB S  | INT:<br>JECT:<br>SAMPLE No.  | Golder Associates Pty<br>Inland Rail Section 32                            | Limited       | AFTER TE                                   | ST   |
| CLIE<br>PROJ<br>LAB S<br>BORI  | ENT:<br>JECT:<br>SAMPLE No.<br>EHOLE:  | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | Limited       | AFTER TES<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PROJ<br>LAB S<br>BORI  | NT:<br>JECT:<br>SAMPLE No.<br>EHOLE:   | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | Limited       | AFTER TE:<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PROJ<br>LAB S<br>BORI  | NT:<br>JECT:<br>SAMPLE No.<br>EHOLE:   | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | Limited       | AFTER TE:<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PROJ<br>LAB S<br>BORI  | INT:<br>JECT:<br>SAMPLE No.<br>EHOLE:  | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | 20            | AFTER TES<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PRO.<br>LAB S<br>BOR   | NT:<br>JECT:<br>SAMPLE No.<br>EHOLE:   | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | 20            | AFTER TE:<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PRO.<br>LAB S<br>BORI  | INT:<br>JECT:<br>SAMPLE No.<br>EHOLE:  | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | 20            | AFTER TES<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PRO.<br>LAB S<br>BORI  | NT:<br>JECT:<br>SAMPLE No.<br>EHOLE:   | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | 20            | AFTER TE:<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PRO.<br>LAB S<br>BORI  | INT:<br>JECT:<br>SAMPLE No.<br>EHOLE:  | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | 20            | AFTER TES<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PRO.<br>LAB S<br>BORI  | INT:<br>JECT:<br>SAMPLE No.<br>EHOLE:  | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | Limited<br>20 | AFTER TE:<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PRO.<br>LAB S<br>BORI  | INT:<br>JECT:<br>SAMPLE No.<br>EHOLE:  | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | 20            | AFTER TES<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PRO.<br>LAB S<br>BORI  | INT:<br>JECT:<br>SAMPLE No.<br>EHOLE:  | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | 20            | AFTER TES<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| CLIE<br>PRO.<br>LAB S<br>BORI  | INT:<br>JECT:<br>SAMPLE No.<br>EHOLE:  | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | Limited<br>20 | AFTER TES<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| tes/Remarks:   | NT:<br>JECT:<br>SAMPLE No.<br>EHOLE:   | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | Limited<br>20 | AFTER TES<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| tes/Remarks:<br>nple/s supplied by client  | INT:<br>JECT:<br>SAMPLE No.<br>EHOLE:  | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | Limited<br>20 | AFTER TES<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| tes/Remarks:<br>mple/s supplied by client<br>Accredited for comp<br>The results of the tests, cal                            | ENT:<br>JECT:<br>SAMPLE No.<br>EHOLE:<br>HOLE:<br>Pho<br>diance with ISO/IEd<br>librations, and/or m   | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | Limited<br>20 | AFTER TEX<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |
| tes/Remarks:<br>mple/s supplied by client<br>Accredited for comp<br>The results of the tests, cal<br>this document are trace | ENT:<br>JECT:<br>SAMPLE No.<br>EHOLE:<br>Photosoft of the second secon | Golder Associates Pty<br>Inland Rail Section 32<br>102162<br>320-01-BH2302 | Limited<br>20 | AFTER TES<br>DATE: 25/01/10<br>DEPTH: 12.1 | ST   |



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| Average Samp<br>Sample Heigh<br>Duration of Te<br>Rate of Displa<br>Mode of Failur | ole Diameter (mm)<br>t (mm)<br>st (min)<br>cement (mm/min)<br>re<br>CLIENT:<br>PROJECT: | 51.3<br>141.2<br>21.23<br>0.10<br>Shear<br>Golder Associates Ptv   | Moiste<br>Wet D<br>Dry D<br>Beddi<br>Test A | ure Content (%)<br>Density (t/m <sup>3</sup> )<br>ensity (t/m <sup>3</sup> )            | 4.7<br>2.22<br>2.12<br>45  |
|--|---|--|---|---|--|
| Average Samp<br>Sample Heigh<br>Duration of Te<br>Rate of Displa<br>Mode of Failur | ole Diameter (mm)<br>t (mm)<br>st (min)<br>cement (mm/min)<br>re<br>CLIENT:<br>PROJECT: | 51.3<br>141.2<br>21.23<br>0.10<br>Shear<br>Golder Associates Ptv   | Moiste<br>Wet D<br>Dry D<br>Beddi<br>Test A | ure Content (%)<br>Density (t/m <sup>3</sup> )<br>ensity (t/m <sup>3</sup> )<br>ing (°) | 4.7<br>2.22<br>2.12<br>45  |
| Sample Heigh<br>Duration of Te<br>Rate of Displa<br>Mode of Failur                 | t (mm)<br>st (min)<br>cement (mm/min)<br>re<br><u>CLIENT:</u><br><b>PROJECT:</b>        | 141.2<br>21.23<br>0.10<br>Shear<br>Golder Associates Ptv   | Wet D<br>Dry D<br>Beddi<br>Test A           | Density (t/m <sup>3</sup> )<br>ensity (t/m <sup>3</sup> )<br>ing (°)                    | 2.22<br>2.12<br>45   |
| Duration of Te<br>Rate of Displa<br>Mode of Failur                                 | st (min)<br>cement (mm/min)<br>e<br>CLIENT:<br>PROJECT:                                 | 21.23<br>0.10<br>Shear<br>Golder Associates Ptv  | Dry D<br>Beddi<br>Test A                    | ensity (t/m <sup>3</sup> )<br>ing (°)   | 2.12<br>45   |
| Rate of Displa<br>Mode of Failur   | cement (mm/min)<br>re<br>CLIENT:<br>PROJECT:  | 0.10<br>Shear<br>Golder Associates Ptv   | Beddi<br>Test A                             | ing (°)   | 45   |
| Mode of Failur   | CLIENT:<br>PROJECT:   | Shear<br>Golder Associates Ptv   | Test A                                      |   |  |
|  | CLIENT:<br>PROJECT:   | Golder Associates Ptv  |   | Apparatus   | 100kN Compression<br>Machine   |
|  | PROJECT:  | Golder Associates Fiv  | Limited                                     | and the second states   |  |
|  |   | Inland Rail Section 32   | 0   | DEFODE TE   |  |
|  | T + D C + M DY D M  |  |   | BEFORE TE   | ST   |
|  | LAB SAMPLE No.  | 102165<br>320.01 PH2202  |   | DATE: 25/01/19  |  |
|  | BOREHOLE:   | 320-01-BH2302  |   | DEPTH: 17.1   |  |
|  |   |  |   |   |  |
|  |   | ALL CONTRACTOR   |   |   |  |
| 4  | CLIENT  |  |   |   |  |
|  | PROJECT:  | Golder Associates Pty I  | Limited                                     |   |  |
|  | - noule II  | finand Ran Section 520   |   | AFTER TES   | T  |
|  | LAB SAMPLE No.  | 102165   | 1   | DATE: 25/01/19.   |  |
|  | BOREHOLE:   | 320-01-BH2302  | 1   | DEPTH: 17.1   |  |
|  |   | In the second second second second second second second second second second second second second second second  | tota deficie                                |   |  |
|  |   | The Street of  |   | Sale II   | Contraction of the local division of the loc |
|  | 1   | THE REAL PROPERTY AND A DECIMAL OF A DECIMAL |   | C. C. C. C. C. C. C. C. C. C. C. C. C. C  |  |
|  |   |  |   |   |  |
|  | 1   |  |   | A REAL PROPERTY OF  | and the second second  |
|  |   | A Same Berg  |   | 1   | Contraction of the   |
|  |   |  |   |   | ALL STREET   |
|  |   |  |   |   |  |
|  |   |  |   |   |  |
| otes/Remarks:  |   |  |   |   |  |
| otes/Remarks:  | client DL   | ato not to scale   | Tootod or                                   | received  | Dage 2 of 2 DED  |
| otes/Remarks:<br>mple/s supplied by  | client Ph   | oto not to scale   | Tested as                                   | received.   | Page 2 of 2 REP  |
| <u>tes/Remarks:</u><br>mple/s supplied by<br>Accredited<br>The results of the      | client Ph<br>d for compliance with ISO/IE<br>e tests, calibrations, and/or n            | oto not to scale<br>C 17025 - Testing.<br>neasurements included in   | Tested as                                   | received.   | Page 2 of 2 REP  |

 Laboratory No. 9926

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

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 ABN 25 065 630 506



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| UNIAXIA                                    | AL COMPRESS   | IVE STRENGTH<br>Test Method: AS 4133.4.3.                              | & DE                            | FORMATION                   | N TEST RE             | PORT             |
|--|---|--|---------------------------------|-----------------------------|-----------------------|------------------|
| Client                                     | Golder Associates   | s Pty Limited  |                                 | Report No.                  | GA102168-N            | IOD              |
| Average San                                | ple Diameter (mm)   | 51.7   | Moist                           | ure Content (%)             | 3.6                   |                  |
| Sample Heig                                | ht (mm)   | 141.2  | Wet [                           | Density (t/m <sup>3</sup> ) | 2.47                  |                  |
| Duration of Test (min)                     |   | 28.03  | Dry Density (t/m <sup>3</sup> ) |                             | 2.39                  |                  |
| Rate of Displ                              | acement (mm/min)  | 0.10 Beddir  |                                 | ing (°)                     | Nil                   |                  |
| Mode of Failu                              | ure   | Conical  | Test /                          | Apparatus                   | 100kN Comp<br>Machine | pression         |
|  | CLIENT  | Colden Associates Dt.  | T 2                             |                             |                       |                  |
|  | PROJECT:  | Inland Rail Section 32   | 20                              |                             |                       |                  |
|  |   |  |                                 | BEFORE TI                   | EST                   |                  |
|  | LAB SAMPLE No.  | 102168<br>320.01.01/2202   |                                 | DATE: 25/01/                | (9.                   |                  |
|  | BOREHULE:   | 320-01-BH2302  |                                 | DEPTH: 24                   |                       |                  |
|  | CLIENT:   | Golder Associates Pty  | Limited                         |                             |                       |                  |
|  | PROJECT:  | Inland Rail Section 32   | 20                              | AFTER TE                    | ST                    |                  |
|  | LAB SAMPLE No.  | 102168   |                                 | DATE: 25/61                 | /19                   |                  |
|  | BOREHOLE:   | 320-01-BH2302  |                                 | DEPTH: 24                   |                       |                  |
|  |   |  |                                 | -                           |                       |                  |
|  |   | White  |                                 | in the second               |                       |                  |
|  |   | La contraction de  | - 10 4                          |                             |                       |                  |
|  |   | State and France   | and the second second           |                             | The second second     |                  |
|  |   |  | E A                             | - Call                      |                       |                  |
|  |   | and the second second  |                                 |                             |                       |                  |
|  |   |  |                                 |                             |                       |                  |
|  |   |  |                                 |                             |                       |                  |
|  |   |  |                                 |                             | 1200 3                |                  |
| Notes/Remarks:                             |   |  |                                 |                             |                       |                  |
| Sample/s supplied b                        | by client Pho   | oto not to scale   | Tested as                       | received.                   | Page                  | 2 of 2 REP13402  |
| Accredit<br>The results of t<br>this docum | ed for compliance with ISO/IEC<br>he tests, calibrations, and/or m<br>ent are traceable to Australian | C 17025 - Testing.<br>leasurements included in<br>/National Standards. |                                 | Authorised Signatory        | N                     | TA               |
|  | Tested at Trilab Brisbane Lab   | poratory.  |                                 | N. Maddison                 | Labo                  | oratory No. 9926 |



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|   | UNIAXIA  | L COMPRESSIVE ST<br>Test Method: AS 4133 4 |            | TEST REPORT            |   |
|---|--|--|------------|------------------------|---|
| Client Golder   | Associates Pty Limited   | . 551 metriou. Au 4103.44                  |            | Report No.             | GA102200-UCS                              |
|   |  |  |            | Request No.            | 1893795_TR01                              |
| Address PO Box  | ress PO Box 1734 MILTON BC QLD 4064  |  |            | Test Date              | 22/01/2019                                |
|   |  |  |            | Report Date            | 23/01/2019                                |
| Project Inland Rail   | Section 320  |  |            | Project No             | 1893795                                   |
| Bore Hole:  | 320-01-BH2101  | Depth F                                    |            | Depth From (m)         | 96.64                                     |
| Client Sample No.   | 320-01-BH2101  |  |            | Depth To (m)           | 96.81                                     |
| Description   | C  | Toot Dot                                   |            |                        |   |
|   |  | Test Dei                                   |            |                        |   |
| Specimen Length (mm)  |  | 161.1                                      | Moisture C | Content (%)            | 3.3                                       |
| Specimen Diameter (mm)  |  | 60.7                                       | Wet Densi  | ty (t/m³)              | 2.59                                      |
| Mode of Failure   |  | Shear                                      | Dry Densit | sy (t/m <sup>3</sup> ) | 2.50                                      |
| Test Duration (Min:Sec)   |  | 7:11                                       |            |                        |   |
|   |  | UCS (MPa)                                  |            | 39.4                   |   |
|   |  | Before and Aft                             | er Photo's |                        |   |
|   | CLIENT:  | Golder Associates Pty                      | Limited    |                        |   |
|   | PROJECT:   | Inland Rail Section 3                      | 20         | BEFORE TEST            |   |
|   | LAB SAMPLE No.   | 102200                                     | 1          | DATE: 22/ou/in         |   |
|   | BOREHOLE:  | 320-01-BH2101                              | 1          | DEPTH: 96.8            |   |
|   |  |  |            |                        |   |
|   | CLIENT:  | Golder Associates Pty                      | Limited    |                        |   |
|   | PROJECT;   | Inland Rail Section 32                     | 20         | AFTER TEST             |   |
|   | LAB SAMPLE No.   | 102200                                     | D          | ATE: 22/01/19          |   |
|   | BOREHOLE:  | 320-01-BH2101                              | D          | EPTH: 96.8             | 1   |
|   |  |  | A.         |                        |   |
| TES/REMARKS:<br>red and tested as received<br>mple/s supplied by the client |  | Test Apparatus - Kelba 1000 kN             | Load Cell  |                        | Photo not to scale<br>Page: 1 of 1 REP027 |
| Accredited for of<br>The results of the tests, calibrat<br>traceable        | compliance with ISO/IEC 17025 -<br>tions, and/or measurements inclu<br>e to Australian/National Standard | Testing.<br>ded in this document are<br>s. | New        | thorised Signatory     |   |
| Teste   | ed at Trilab Brisbane Laboratory.  |  |            |                        | COMPETENCE                                |

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|   |   | Tank Markards AD 4400  |                               |  |  |
|---|---|--|-------------------------------|--|--|
| Client Golder   | Associates Pty Limited  | i est method: AS 4133  | 0.4.2.1 & AS 413              | Report No.   | GA102206-UCS                               |
|   |   |  |                               | Request No.  | 1893795_TR01                               |
| Address PO Box  | ox 1734 MILTON BC QLD 4064  |  | Test Date                     | 22/01/2019   |  |
|   |   |  |                               | Report Date  | 23/01/2019                                 |
| Project Inland Ra   | I Section 320   |  |                               | Project No   | 1893795                                    |
| Bore Hole:  | 320-01-BH2101   |  |                               | Depth From (m)   | 103.1                                      |
| Client Sample No.   | 320-01-BH2101   |  |                               | Depth To (m)   | 103.26                                     |
| Description   | С   | Test D   | etails                        |  |  |
| Specimen Length (mm)  |   | 161.0  | Moistu                        | re Content (%)   | 11   |
| Specimen Diameter (mm)  |   | 60.8   | Wet Dr                        | $\frac{1}{2} \frac{1}{2} \frac{1}$ | 2.81                                       |
| Mode of Failure   |   | Disintegration   |                               | $ansity (t/m^3)$   | 2.01                                       |
|   |   | 0.29   | Diy De                        |  | 2.70                                       |
| Test Duration (Min.Sec)   |   | 9.30<br>UCS (MPa)  |                               | 150  |  |
|   |   | Before and A   | After Photo                   | )'e  |  |
|   | ( married and a second s |  |                               |  |  |
|   | CLIENT:   | Golder Associates I  | Pty Limite                    | bd   |  |
|   | PROJECT:  | infand Rail Section  | 1320                          | BEFORE TEST  |  |
|   | LAB SAMPLE No.  | 102206   |                               | DATE: 22/01/19   |  |
|   | BOREHOLE:   | 320-01-BH2101  |                               | DEPTH: 103.1   |  |
|   |   |  |                               |  |  |
|   | CLIENT:   | Golder Associates P  | Pty Limite                    | d  |  |
|   | CLIENT:<br>PROJECT:   | Golder Associates P<br>Inland Rail Section   | Pty Limite<br>320             | d<br>AFTER TEST  |  |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.   | Golder Associates P<br>Inland Rail Section<br>102206   | Pty Limite<br>320             | d<br>AFTER TEST<br>DATE: 22/0//9   |  |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:  | Golder Associates P<br>Inland Rail Section<br>102206<br>320-01-BH2101  | Pty Limite<br>320             | d<br>AFTER TEST<br>DATE: 22/0//9<br>DEPTH: 103.1   |  |
|   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:  | Golder Associates P<br>Inland Rail Section<br>102206<br>320-01-BH2101  | rty Limite<br>320             | d<br>AFTER TEST<br>DATE: 22/0//9<br>DEPTH: 103.1   |  |
| DTES/REMARKS:<br>DTES/REMARKS:<br>Dred and tested as received   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:  | Golder Associates P<br>Inland Rail Section<br>102206<br>320-01-BH2101  | <sup>r</sup> ty Limite<br>320 | d<br>AFTER TEST<br>DATE: 2000/0<br>DEPTH: 103.1  | Photo not to scale                         |
| DTES/REMARKS:<br>pred and tested as received<br>mple/s supplied by the client   | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHOLE:  | Golder Associates P<br>Inland Rail Section<br>102206<br>320-01-BH2101  | Pty Limite<br>320             | d<br>AFTER TEST<br>DATE: 24/0/0<br>DEPTH: 103.1  | Photo not to scale<br>Page: 1 of 1 REPOZIO |
| DTES/REMARKS:<br>pred and tested as received<br>mple/s supplied by the client<br>Accredited for<br>The results of the tests, calibra<br>traceab | CLIENT:<br>PROJECT:<br>LAB SAMPLE No.<br>BOREHIOLE:   | Golder Associates P<br>Inland Rail Section<br>102206<br>320-01-BH2101<br>Test Apparatus - Kelba 1000 k<br>Testing.<br>ded in this document are<br>s. | Ty Limite<br>320 KN Load Cell | AFTER TEST<br>DATE:<br>DEPTIH: 103.1   | Photo not to scale<br>Page: 1 of 1 REPOZAT |



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| UN   | NIAXIAL COMPRESSIVE STI<br>Test Method: AS 4133.4.2.:  | <b>RENG</b><br>2 & AS 413: | TH TEST RE                                 | PORT                                     |
|--|--|----------------------------|--|--|
| Client Go  | older Associates Pty Limited   |                            | Report No.                                 | GA102210-UCS                             |
|  |  |                            | Request No.                                | 1893795_TR01                             |
| Address PC   | Box 1734 MILTON BC QLD   | 4064                       | Test Date                                  | 22/01/2019                               |
|  |  |                            | Report Date                                | 23/01/2019                               |
| Project  | Inland Rail Section 320  |                            | Project No.                                | 1893795                                  |
|  |  |                            |  |  |
|  | Bore Hole  |                            | 320-01-BH2101                              |  |
|  | Client Sample No:  |                            | 320-01-BH2101                              |  |
|  | Depth From (m)   |                            | 104.32                                     |  |
|  | Depth To (m)   |                            | 104.48                                     |  |
|  | Description  |                            | С  |  |
|  | Wet Density (t/m <sup>3</sup> )  |                            | 2.19                                       |  |
|  | Moisture Content (%)   |                            | 8.1  |  |
|  | Specimen Length (mm)   |                            | 161.0                                      |  |
|  | Specimen Diameter (mm)   |                            | 60.8                                       |  |
|  | Mode of Failure  |                            | Shear                                      |  |
|  | Rate of Displacement (mm/min)  |                            | 0.1  |  |
|  | Test Duration (Min:Sec)  |                            | 21:38                                      |  |
|  | CLIENT: Golder Associates<br>PROJECT: Inland Rail Section<br>LAB SAMPLE No. 102210<br>BOREHOLE: 320-01-BH2101<br>UCS (MPa)   | Pty Limited                | AFTER TEST<br>DATE: 22/0/4<br>DEPTH: 104.3 |  |
|  |  |                            | 0.00                                       |  |
| NOTES/REMARKS:<br>Stored and tested as rec<br>Sample/s supplied by the | eived<br>e client Test Apparatus - 100kN Cor   | npression                  | Machine                                    | Photo not to scale Page: 1 of 1 REP13302 |
| Accredited<br>The results of the tests<br>this document are<br>Tested  | for compliance with ISO/IEC 17025.<br>, calibrations, and/or measurements included in<br>traceable to Australian/National Standards.<br>I at Trilab Brisbane Laboratory. | A                          | C. Purvis                                  | ACCRETION                                |



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|                                       | UNIAXIAL COMPRESSIVE ST  | RENG                   | TH TEST RE                                | PORT                                     |
|---------------------------------------|--|------------------------|---|--|
| Client                                | Test Method: AS 4133.4.2<br>Golder Associates Ptv Limited  | 2.2 & AS 413           | Banart No                                 | GA102216 LICS                            |
|                                       |  |                        | Report No.                                | GA 1022 10-005                           |
| Address                               | PO Box 1734 MILTON BC QLD  | 4064                   | Test Date                                 | 22/01/2019                               |
|                                       |  |                        | Report Date                               | 23/01/2019                               |
| Project                               | Inland Rail Section 320  |                        | Project No.                               | 1893795                                  |
|                                       |  |                        |   |  |
|                                       | Bore Hole  |                        | 320-01-BH2101                             |  |
|                                       | Client Sample No:  |                        | 320-01-BH2101                             |  |
|                                       | Depth From (m)   |                        | 105.17                                    |  |
|                                       | Depth To (m)   |                        | 105.29                                    |  |
|                                       | Description  |                        | С   |  |
|                                       | Wet Density (t/m <sup>3</sup> )  |                        | 2.23                                      |  |
|                                       | Moisture Content (%)   |                        | 13.5                                      |  |
|                                       | Specimen Length (mm)   |                        | 126.1 *                                   |  |
|                                       | Specimen Diameter (mm)   |                        | 60.6                                      |  |
|                                       | Mode of Failure  |                        | Conical                                   |  |
|                                       | Rate of Displacement (mm/min)  |                        | 0.1                                       |  |
|                                       | Test Duration (Min:Sec)  |                        | 18:04                                     |  |
|                                       | CLIENT: Golder Associates<br>PROJECT: Inland Rail Section<br>LAB SAMPLE No. 102216<br>BOREHOLE: 320-01-BH2101  | s Pty Limite<br>on 320 | d<br>AFTER TEST<br>DATE:<br>DEPTH: 105.24 |  |
| NOTES/REMAR                           | K <u>S:</u>  |                        |   |  |
| Stored and tester<br>Sample/s supplie | d as received * Length t<br>ed by the client Test Apparatus - 100kN Co   | o diameter             | ratio less than 2.5:1<br>Machine          | Photo not to scale Page: 1 of 1 REP13302 |
| A<br>The results of<br>this docu      | ccredited for compliance with ISO/IEC 17025.<br>the tests, calibrations, and/or measurements included in<br>ment are traceable to Australian/National Standards. | P                      | Authorised Signatory                      | ACOREDITO FOR<br>TECHNICAL<br>COMPETENCE |
|                                       | Tested at Trilab Brisbane Laboratory.  |                        |   | Laboratory No. 992                       |



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|                                       | UNIAXIAL COMPRESSIVE ST  | RENG                   | TH TEST RE                                    | PORT   |
|---------------------------------------|--|------------------------|---|--|
| Client                                | Test Method: AS 4133.4.2<br>Golder Associates Pty Limited  | .2 & AS 413            | 3.1.1.1                                       | 04400005 1100                                |
| Ollent                                | Colder Associates 1 ty Linned  |                        | Report No.                                    | GA102225-UCS                                 |
| Address                               | PO Box 1734 MILTON BC QLD  | 4064                   | Request No.                                   | 22/01/2010                                   |
|                                       |  |                        | Report Date                                   | 23/01/2019                                   |
| Proiect                               | Inland Rail Section 320  |                        | Project No.                                   | 1893795                                      |
|                                       |  |                        |   |  |
|                                       | Bore Hole  |                        | 320-01-BH2101                                 |  |
|                                       | Client Sample No:  |                        | 320-01-BH2101                                 |  |
|                                       | Depth From (m)   |                        | 109.02  |  |
|                                       | Depth To (m)   |                        | 109.22  |  |
|                                       | Description  |                        | С   |  |
|                                       | Wet Density (t/m <sup>3</sup> )  |                        | 2.12  |  |
|                                       | Moisture Content (%)   |                        | 9.5   |  |
|                                       | Specimen Length (mm)   |                        | 160.8   |  |
|                                       | Specimen Diameter (mm)   |                        | 60.4  |  |
|                                       | Mode of Failure  |                        | Shear   |  |
|                                       | Rate of Displacement (mm/min)  |                        | 0.1   |  |
|                                       | Test Duration (Min:Sec)  |                        | 20:28   |  |
|                                       | CLIENT: Golder Associate<br>PROJECT: Inland Rail Sector<br>LAB SAMPLE No. 102225<br>BOREHOLE: 320-01-BH2101  | s Pty Limite<br>on 320 | AFTER TEST<br>DATE: 22/0°//9<br>DEPTH: 109.02 |  |
| NOTES/REMARK                          | <u>(S:</u>   |                        |   |  |
| Stored and tested<br>Sample/s supplie | I as received<br>d by the client Test Apparatus - 100kN Co   | mpression              | Machine                                       | Photo not to scale<br>Page: 1 of 1 REP13302  |
| Ac<br>The results of<br>this docur    | credited for compliance with ISO/IEC 17025.<br>the tests, calibrations, and/or measurements included in<br>ment are traceable to Australian/National Standards.<br>Tested at Trilab Brisbane Laboratory. | А                      | uthorised Signatory<br>C. Purvis              | ACCEPTOR TECHNICAL<br>COMPTICAL<br>COMPTICAL |

# Petrographic Analyses Reports

Feb 2019

February 2019

Dr Rowena Duckworth MAIG, MAusIMM, FSEG

#### Mintex Petrological Solutions



Mobile: 0429600754 Email: rowenaduckworth@bigpond.com

Client: Chris Channon - Trilab Pty Ltd

Mintex report number: 410219



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#### Introduction

This report details the results of transmitted light microscopy observations on one core sample GA102224 (320-01-BH2101-108.70-109.00m) submitted by Trilab Pty Ltd. Darren Richardson of Ingham Petrographics prepared a cover slipped thin section from the sample.

A full petrographic description of the section was undertaken using transmitted light microscopy and observations are listed below.

#### Summary

- The supplied rock is identified as a sandstone.
- 55% quartz content in the sandstone occurs as unstrained grains of crystalline quartz.
- Mica, chlorite and clays form approximately 25% of the rock.
- For engineering purposes, the sample may be summarised as:
  - Containing 55% total free silica, which is unstrained,
  - Quartz crystals occur as fine to coarse subangular to subrounded, anhedral grains between 0.3-0.5mm across, possessing a hardness of 7 on the Mohs scale, and are commonly clean.
  - Containing 58% robust and durable minerals and 25% weak minerals.
  - Predicted to be innocuous in relation to alkali silica reactivity in concrete.
  - Interpreted to be suitable for use as a source for concrete aggregate pursuant to Australian Standards 2758.1, Queensland Department of Transport and Main Roads Standards MRTS70 Fine Concrete Aggregate.
  - Contains no observable asbestiform minerals

#### Sample Description

The sample GA102224 / 320-01-BH2101 / 108.70-109.00m is pale brown in colour with a darker weathered surround. Grain size is fairly homogenous around 0.5mm. The interstitial cement is finer grained and softer than the sand-sized grains which form the bulk of the sample. Porosity is around 5%.



#### **Microscopic Observations**

Petrographic analysis shows that this rock this is a sedimentary clastic rock that can be classified as a *sub-arkosic arenaceous sandstone*.

It can be described as a well sorted, medium-grained sandstone with dominant quartz grains and lesser altered feldspar grains hosted in a chloritic matrix. Minor opaques are present (often with orange iron staining indicative of iron oxide/sulphide grains). Rare quartz rich lithic clasts occur. Porosity is approximately 5%.

The sandstone is composed dominantly of 55% quartz and 23% clay-altered feldspar grains. The grain size of these silicate components is 0.2-0.5mm.

Quartz occurs as discrete anhedral subrounded-subangular grains, 0.3-0.5mm across, occasionally with sutured grain boundaries, but with no evidence of strain.

Clay altered probable feldspar grains (alteration is partial to almost complete) are present as discrete anhedral grains and these range in size from 0.2-0.4mm. These make up 23% of the sample, and 20% of this is *clay* after feldspar.

Opaques make up 2% of the sample. Occasional grains of white mica (muscovite are present). The cementing matrix is composed of very fine-grained chlorite.

One 0.2mm subrounded lithic clast was observed which is composed of interlocking strained quartz grains.

Photographs and a mode based on a count of 200 widely spaced grains (Table 1) appear below.

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*Plane polarised photomicrographs (x4) showing subrounded-subangular colourless quartz grains in fine grained cement, with dark brown altered. Dark grains are opaques.* 



*Cross polarised photomicrograph (x4) showing the texture of sub-rounded quartz grains, clay altered feldspar and one rare strained quartz lithic clast (centre).* 

Feb 2019



*Cross polarised photomicrograph (x10) showing nature of the fine grained chloritic matrix between the quartz grains and a fine-grained clay altered ex-feldspar grain.* 

A mode based on a count of 100 widely spaced grains is listed below in Table 1.

#### Table 1 – Modal Analysis of sample GA102224

| MINERALS                               | MODE % | COMMENTS  |
|--|--------|---|
| Quartz                                 | 55     | Anhedral, grain size from 0.3-0.5mm                 |
| Clay altered feldspar                  | 23     | Anhedral grains 0.2-0.4mm, 20% totally clay altered |
| Chlorite                               | 11     | Fine-grained, forms cement                          |
| Mica                                   | 4      | Occasional grains, 0.2-0.4mm                        |
| Porosity                               | 5      |   |
| Opaque phases-<br>probable iron phases | 2      | Disseminated  |
| Lithic clasts                          | <1     | Rare  |
| Total                                  | 100    |   |

As defined by the Queensland Department of Main Roads Test Method (Standard Q-188) the free silica content is 55%, in the form of crystalline quartz grains.

#### Interpretation

Petrographic analysis indicates that the major components are quartz, clay altered feldspar and chlorite. The supplied sample is identified as a sub-arkosic arenaceous sandstone. Quartz is crystalline but not visibly strained.

For industrial applications the supplied sample can be summarised as:

- Containing 55% free silica.
- Containing 55% unstrained quartz and <1% strained crystalline quartz in rare lithic clasts and is, on these grounds, considered unlikely to cause alkali silica reactivity in concrete.
- Contains 25% weak clay, chlorite and mica

The sandstone is predicted to be suitable for use as unbound pavement materials, pursuant to Australian Standards 2758.1, Queensland Department of Transport and Main Roads Standards MRTS70.

N.B. The petrology assessment for Alkali Silica Reactivity was based on:

- ASTM C 295 Standard Guide for Petrographic Assessment of Aggregates for Concrete
- AS2758.1 2014 Aggregates and rock for engineering purposes part 1: Concrete aggregates (Appendix B)
- AS1141 Standard Guide for the Method for sampling and testing aggregates



# **Geochempet Services**

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



5/14 Redcliffe Gardens Drive Clontarf, QLD 4019 Telephone: (07) 3284 0020

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

#### PETROGRAPHIC REPORT ON THIN SECTION LABELLED (GA102073)

prepared for

#### GOLDERS ASSOCIATES PTY LTD MILTON

Purchase Order: Invoice Number: Client Ref: 20051 00008781 Morgan Midgley

Issued by

K. E. Spring B.Sc.(Hons), MAppSc 1 July 2019

JUNE, 2019

*Gl190601* 

Page 1 of 4

| Thin Section Sample   | e Number:  | GA102073:302-01   |   |
|-----------------------|--|---|---|
| Borehole:             | 320-01-BH21  | 02  | <b>Depth:</b> 227.5-227.65m   |
| Source:               | Not Provided   |   |   |
| Work Requested        | Petrographic a   | nalysis of provided thin  | n section   |
| <u>Methods</u>        | Account take<br>Assessment of<br>Aggregates a<br>aggregates (A | en of ASTM C295<br>f Aggregates for Cou<br>und rock for engined<br>ppendix B) | Standard Guide for <i>Petrographic</i><br><i>ncrete</i> and the AS2758.1 – 2014<br><i>ering purposes part 1; Concrete</i> |
| <b>Identification</b> | Richly glassy  | basalt  |   |

#### Description

No sample was supplied, thin section only.

A thin section was supplied and detailed microscopic examination in transmitted, polarized light was undertaken. An approximate average composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

#### **Primary Components**

- 41% plagioclase feldspar
- 39% mesostasis of brown/black glass with microlites of pyroxene and opaque oxide
- <1% opaque oxide (magnetite and/or ilmenite) as discrete grains
- 3% orthopyroxene

#### **Secondary Minerals**

- 15% yellowish smectite clay
- 1% calcite
- 1% zeolite

Microscopically, the sectioned rock is seen to display finely crystalline and glassy igneous textures of basic volcanic style. The plagioclase laths are mainly 0.05 to 0.7 mm long with small grains of pyroxene and there is an interstitial, interconnected, black to brown, glassy mesostasis with microlites of opaque oxides and pyroxenes. Irregularly-shaped incipient vesicles were originally filled by a late, fractionated glass but are now entirely replaced by yellowish-green smectite clay and anisotropic zeolite.

The sectioned rock is characterised by randomly orientated, fresh laths of twinned plagioclase feldspar and small fresh clear pyroxene grains (probably diopside) within an inter-granular and intersertal texture. A network between the pyroxene and feldspar consists of a dark mesostasis which involves microlites of pyroxene and opaque oxide set in brown to black glass. There are a few tiny equant opaque oxides (probably magnetite) scattered in the groundmass. Smectite-

#### JUNE. 2019

#### Gl190601

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altered former mafic phenocrysts and crudely prismatic groundmass grains (probably former orthopyroxene) are relatively common. Other disseminated patches of a yellowish smectite (probably after a late glass) fill angular and irregular interstitial spaces (up to about 1 mm in size), some are less commonly filled by calcite and isotropic zeolite.

An intersecting pattern of thin fracture veins are filled by late calcite, isotropic zeolite and smectite clay.

#### **Comments and Interpretations**

The supplied thin section (labelled GA102073:320-01) is interpreted to be richly glassy, pyroxene basalt, a basic volcanic rock.

The basalt originally carries two types of glass: namely, a "normal" dark, silica-poor basaltic glass within an interstitial mesostasis and a more fractionated and silica-enriched glass formed as a late component filling former incipient vesicles.

#### Free Silica Content

Apparently nil. The supplied sample does not carry any free crystalline silica minerals. However, it is noteworthy that this sample carried late fractionated glass, so perhaps the glass concealed a trace of cryptocrystalline or amorphous silica.



**Plate 1.** Digital photomicrograph at low magnification showing occurrence of patches of yellow smectite clay (after orthopyroxene and late glass) in a groundmass dominated by brown to black basaltic glass and abundant white plagioclase laths. Note the fine intersecting calcite veins in the image.



# **Geochempet Services**

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#### PETROGRAPHIC REPORT ON THIN SECTION LABELLED (GA102075)

prepared for

#### GOLDERS ASSOCIATES PTY LTD MILTON

Purchase Order: Invoice Number: Client Ref: 20051 00008808 Morgan Midgley Iain Turner

K. E. Spring B.Sc.(Hons), MAppSc 1 July 2019

JUNE, 2019

*Gl190602* 

Page 1 of 4

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Issued by

C + 100075 200 01

| I nin Section Sample | <u>e Number</u> :  | GA1020/5:320-01   |  |  |
|----------------------|--|---|--|--|
| Borehole:            | 320-01-BH21  | 02  | <u>Depth:</u> 233.0-233.                                     | 16m  |
| Source:              | Not Provideo   | d   |  |  |
| Work Requested       | Petrographic a   | analysis of provided thin   | n section  |  |
| <u>Methods</u>       | Account take<br>Assessment of<br>Aggregates a<br>aggregates (A | en of ASTM C295<br>f Aggregates for Cou<br>and rock for engined<br>ppendix B) | Standard Guide fo<br>ncrete and the AS<br>ering purposes par | r Petrographic<br>2758.1 – 2014<br>t 1; Concrete |
| Identification       | Clay-cemented  | d quartzose sandstone   |  |  |

#### **Description**

...

No sample was supplied, thin section only.

1 1.1

A thin section was supplied and detailed microscopic examination in transmitted, polarized light was undertaken. An approximate average composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

- 35% quartz sand grains
- 1% feldspar sand grains
- 1% lithic clasts of acid volcanics
- 2% quartzite clasts
- <1% epidote grains
- 53% Illite-smectite clay matrix
- 8% siderite
- <1% ferricrete fragments
- trace carbonaceous specks

In thin section, the rock is seen to be sandstone composed of clay cemented quartz and a few feldspar grains with minor acid volcanics and quartzite clasts.

Microscopically, the rocks display fine-grained arenaceous textures with poorly-sorted and loosely packed, angular, sub-angular to less commonly sub-rounded clasts, ranging from about 0.01 to 1 mm in size.

The sandstone is texturally matrix-supported by a moderately birefringent clay of mixed illite/smectite style. The dominant detrital grains are quartz grains, most of which show unstrained to mostly mild straining. Some of the quartz have preserved rims of quartz overgrowths indicating derivation from a sandstone that has suffered at least burial metamorphism. There also a few quartzite clasts showing a moderate degree of straining and may be derived from a cratonic source. Minor blocky, detrital feldspar grains are present. Lithic clasts appear to be devitrified acid tuffaceous clasts, composed of fine-grained quartzo-

JUNE, 2019

*Gl190602* 

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feldspathic intergrowths. A few large ferricrete or ironstone fragments (around 1 mm in size) are noted in the sandstone matrix.

The late brownish siderite forms radial aggregates or nodules (sometime enclosing a quartz grain at its centre), which shows outer rims of expelled iron oxides. These nodules are relatively common and are scattered irregular in the matrix.

#### **Comments and Interpretations**

The supplied thin section (labelled GA102075:320-01) is interpreted to be clay-cemented quartzose sandstone, a sedimentary rock.

The sandstone is dominated by an interconnected clay matrix, with predominately quartz and minor feldspar grains along with a few lithic clasts of acid volcanic and quartzite style. The partial alteration of the sandstone by carbonates is attributed to diagenetic or hydrothermal processes after initial sedimentation. These sandstones are probably fairly mature with quartz persisting while other labile minerals are degraded to clays.

#### **Free Silica Content**

About 37%.

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**Plate 1.** Digital photomicrograph at low magnification, plane polarised transmitted light showing abundant of quartz grains of various sizes and shapes occurring in an interconnected clay matrix. Note the brownish nodules of siderite overprinting parts of the matrix and closing some quartz grains.

# **Brazilian Disc - Tensile Strength**



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

| Client Golder Assoc   | Report No.      | GA102207-BR     |           |             |            |
|---|-----------------|-----------------|-----------|-------------|------------|
| Address PO Box 1734   |                 |                 | 4064      | Tast Data   | 00/04/0040 |
|   |                 |                 | Test Date | 22/01/2019  |            |
| Project Inland Rail Se  | ction 320       |                 |           | Report Date | 23/01/2019 |
| -   |                 |                 |           |             |            |
| Sample No.  | 102207          | 102223          |           |             |            |
| Client ID   | 320-01-BH2101   | 320-01-BH2101   |           |             |            |
| Depth (m)   | 103.38-103.66   | 108.61-108.70   |           |             |            |
| Description   | с               | С               |           |             |            |
| Wet Density (t/m³)  | 2.83            | 2.02            |           |             |            |
| Moisture Content (%)  | 0.8             | 11.9            |           |             |            |
| Specimen Length (mm)  | 39.3            | 41.7            |           |             |            |
| Specimen Diameter (mm)  | 60.7            | 60.1            |           |             |            |
| Bedding Angle with Relation to<br>Axial Plane (°)   | Nil             | Nil             |           |             |            |
| Bedding Parallel or Perpendicular to Direction of Loading                                     | N/A             | N/A             |           |             |            |
| Mode of Failure   | Axial Splitting | Axial Splitting |           |             |            |
| Test Duration (min:sec)   | 1:46            | 0:28            |           |             |            |
| Average Load Rate (MPa/sec)   | 0.086           | 0.004           |           |             |            |
| Load at Primary Failure (N)   | 34286           | 434             |           |             |            |
| TENSILE STRENGTH (MPa)<br>TS = 0.636 x ( <sup>Load</sup> / <sub>Diameter x Length</sub> ) MPa | 9.14            | 0.110           |           |             |            |

NOTES/REMARKS:

Sample/s supplied by the client

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

Authorised Signatory

C. Purvis



REP07102

Page 1 of 1

Tested at Trilab Brisbane Laboratory.

 Laboratory No. 9926

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

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

 Trilab Pty Ltd
 ABN 25 065 630 506

## **Cerchar Abrasivity**

🕓 GOLDER



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

|  |   | CERCH  |   |                                 |                      |                       |                           |                                  |
|--|---|--|---|---------------------------------|----------------------|-----------------------|---------------------------|----------------------------------|
| ASTM D7625 - 10 - Standard Test Method for Laboratory Determination of Abrasiveness of Rock Using the Cerchar Method |   |  |   |                                 | od                   |                       |                           |                                  |
| Client Golder Associates Pty Limited   |   |  |   | Repo                            | Report No GA102062-C |                       | 2-CERC                    |                                  |
|  |   |  |   | Requ                            | est No.              | Golder 1              | 893795 TR04               |                                  |
| Address PO Box 1734 MILTON BC QLD 4064   |   |  |   |                                 | Test Date 31/01/2019 |                       | 9                         |                                  |
|  |   |  |   | <b>Report Date</b> 4/02/2019    |                      | )                     |                           |                                  |
| Project Inl  | Project Inland Rail Section 320 Sample Type Single Individ                                  |  |   |                                 |                      | lividual Rock         |                           |                                  |
| Project No 18  | Project No 1893795 Depth From (m) 214.9 Core Specimen                                       |  |   |                                 |                      | cimen                 |                           |                                  |
| Bore Hole 32   | 20-01-E   | 3H2102   | Depth To (m)                                    | 215                             | Samp                 | le No                 | 320-01-BH2<br>: 320-01-BH | 2102-C21490-CAT<br>12102-C21490- |
| Description C  |   |  | SAMPLE I  | DETAILS                         |                      |                       | MOI                       |                                  |
| Samplo Diamotor  | (mm);   |  | 60.7  | Moisture Content                | (0/.).               |                       | 1.0                       |                                  |
| Sample Diameter  | (IIIII):  |  | 70.3  | Dry Density (t/m <sup>3</sup> ) | (70):<br>)           | 1.8                   |                           | 2                                |
|  | <i>.</i>  | Smooth   | (Saw Cut) Surface                               | Wet Density (t/m <sup>3</sup>   | <u>,</u>             |                       | 2.05                      | 1                                |
| ounace Type.   |   | SHIOUIT  | RESULTS O                                       | F TESTING                       | 1                    | I                     | 2.04                      | T                                |
| Hardness of Tip U  | Jsed  | 25 HRC   | Hardness of Tip Used                            | 43 HRC                          | Hardı                | rdness of Tip Used 53 |                           | 53 HRC                           |
| Average Diameter   | (mm)  | *CAI   | Average Diameter (mm)                           | *CAI                            | Avera                | ge Diamet             | er (mm)                   | *CAI                             |
| 0.06   |   | 0.55   | 0.04  | 0.36                            |                      | 0.00                  |                           | 0.00                             |
| Linear Relationship between Tip Hardness and CAI<br>CAI = (-0.0183 x HRC) + 1.0362                                   |   |  |   |                                 |                      |                       |                           |                                  |
|  |   | Average  | e CAI <sub>s</sub> (HRC55) =                    | 0.51                            | Corrected for S      | Smooth Saw Cu         | t Surface                 |                                  |
|  |   |  | Classification :                                | Low abrasivenes                 | s                    |                       |                           |                                  |
|  |   |  | CAI v's Har                                     | dness Plot                      |                      |                       |                           |                                  |
| 0.70   | 0.70  |  |   |                                 |                      |                       |                           |                                  |
| 0.60   | 0.60  |  |   |                                 |                      |                       |                           |                                  |
| 0.50   |   |  |   |                                 |                      |                       |                           |                                  |
| 0.40   | = 0.40  |  |   |                                 |                      |                       |                           |                                  |
| <b>5</b><br><sub>0.30</sub>  |   |  |   |                                 |                      | $\overline{}$         |                           |                                  |
| 0.20   |   |  |   |                                 |                      |                       |                           |                                  |
| 0.10   |   |  |   |                                 |                      |                       | $\checkmark$              |                                  |
| 0.00   |   |  |   |                                 |                      |                       | $\sim$                    |                                  |
| 0.00   |   | 10   | 20<br>Hardne                                    | <sup>30</sup><br>ss (HRC)       | 40                   |                       | 50                        | 60                               |
| Remarks:   |   |  |   |                                 |                      |                       |                           |                                  |
| Sample/s supplied by cli   | Sample/s supplied by client * CAI values corrected for smooth surface. Page: 1 of 2 REP0680 |  |   |                                 |                      | of 2 REP06801         |                           |                                  |
| Accredited for c<br>The results of the tests<br>this document are  | complianc<br>s, calibrati<br>traceable  | e with ISO/IEC 17025<br>ions, and/or measuren<br>e to Australian/Nationa | - Testing.<br>nents included in<br>I Standards. | Authorised S                    | Signatory            |                       |                           | NATA<br>ACCREDITED FOR           |
| Tested at Trilab Brisbane Laboratory. C. Purvis Technical Competence Laboratory No. 99                               |   |  |   | Laboratory No. 9926             |                      |                       |                           |                                  |

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#### ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



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#### **CERCHAR ABRASIVITY INDEX TEST REPORT**

ASTM D7625 - 10 - Standard Test Method for Laboratory Determination of Abrasiveness of Rock Using the Cerchar Method

| Client                              | Golder Associates Pty Limited   | Report No. GA102062-CERC          |
|-------------------------------------|---|-----------------------------------|
|                                     | BEFORE & AFTER PHO  | TOS                               |
|                                     |   |                                   |
|                                     | CLIENT: Golder Associates Pty Lin   | nited                             |
|                                     | PROJECT: Inland Rail Section 320  | BEFORE TEST                       |
|                                     | LAB SAMPLE No. 102062   | DATE: 31/01/19                    |
|                                     | CLIENT: Golder Associates Pty Limit   | red                               |
|                                     | PROJECT: Inland Rail Section 320  | AFTER TEST                        |
|                                     | LAB SAMPLE No. 102062   | DATE: 31/01/19                    |
|                                     | BOREHOLE: 320-01-BH2102   | DEPTH: 214.9                      |
|                                     |   |                                   |
| Remarks:                            |   |                                   |
| Sample/s supplie                    | ed by client * CAI values corrected for smooth s  | urface. Page: 2 of 2 REP068       |
| Accre<br>The results o<br>this docu | dited for compliance with ISO/IEC 17025 - Testing.<br>of the tests, calibrations, and/or measurements included in<br>ument are traceable to Australian/National Standards.<br>Tested at Trilab Brisbane Laboratory. | Authorised Signatory<br>C. Purvis |

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

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING


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

|  | CERC   | HAR ABRASIVITY   |                                   |                 | ORT           |               |                                |
|--|--|--|-----------------------------------|-----------------|---------------|---------------|--------------------------------|
| ASTM D7625   | - 10 - Standard Te   | st Method for Laboratory Deter                           | mination of Abrasivene            | ess of Rock     | Using the     | Cerchar Metho | d                              |
| Client Golder A  | ssociates Pty I  | Limited  |                                   | Repo            | rt No.        | GA102070      | -CERC                          |
|  |  |  |                                   | Requ            | est No.       | Golder 18     | 93795 TR04                     |
| Address PO Box   | 1734 MILTON  | BC QLD 4064  |                                   | Test [          | Date          | 31/01/2019    | )                              |
|  |  |  |                                   | Repo            | rt Date       | 4/02/2019     |                                |
| Project Inland R   | ail Section 320  |  |                                   | Samp            | le Туре       | Single Indi   | vidual Rock                    |
| Project No 1893795   | 5  | Depth From (m)   | 224.07                            |                 |               | Core Spec     | imen                           |
| Bore Hole 320-01-  | 3H2102   | Depth To (m)   | 224.22                            | Samp            | le No         | 320-01-BH2    | 102-C22400-CAT<br>2102-C22400- |
| Description C  |  |  |                                   |                 |               | MOI           |                                |
|  |  | SAMPLE I   | DETAILS                           |                 | [             |               |                                |
| Sample Diameter (mm):  |  | 58.6   | Moisture Content                  | (%):            |               | 3.1           |                                |
| Sample Height (mm):  |  | 65.3   | Dry Density (t/m <sup>3</sup> )   | )               |               | 2.45          |                                |
| Surface Type :   | Smooth   | n (Saw Cut) Surface                                      | Wet Density (t/m <sup>3</sup> )   | )               |               | 2.53          |                                |
|  |  | RESULIS O  | <u>F TESTING</u>                  |                 |               | I             |                                |
| Hardness of Tip Used   | 25 HRC   | Hardness of Tip Used                                     | 43 HRC                            | Hardr           | ness of Tip   | Used          | 53 HRC                         |
| Average Diameter (mm)  | ^CAI   | Average Diameter (mm)                                    | ^CAI                              | Averaç          | ge Diamete    | er (mm)       | "CAI                           |
| 0.07   | 0.66   | 0.04   | 0.37                              |                 | 0.00          |               | 0.00                           |
|  | 1  | Linear Relationship betwe                                | en Tip Hardness and               | CAI             |               |               |                                |
|  |  | CAI =  | (-0.0222 x HRC)                   | + 1.2362        |               |               |                                |
|  | Averag   | e CAI. (HRC55) =   | 0.50                              | Corrected for S | smooth Saw Cu | t Surface     |                                |
|  | / tronug   |  |                                   |                 |               |               |                                |
|  |  | Classification :   | Very low abrasiv                  | eness           |               |               |                                |
|  |  | CAI v's Har  | cdness Plot<br>—— Line of Best Fi | it              |               |               |                                |
| 0.80   |  |  |                                   |                 |               |               |                                |
| 0.70   |  |  |                                   |                 |               |               |                                |
| 0.60   |  |  |                                   |                 |               |               |                                |
| 0.50   |  |  |                                   |                 |               |               |                                |
| <b>S</b> 0.40  |  |  |                                   |                 |               |               |                                |
| 0.30   |  |  |                                   |                 |               |               |                                |
| 0.20   |  |  |                                   |                 |               |               |                                |
| 0.10   |  |  |                                   |                 |               |               |                                |
| 0.00<br>0  | 10   | 20<br>Hardne   | <sup>30</sup><br>ss (HRC)         | 40              |               | 50            | 60                             |
| Remarks:   |  |  |                                   |                 |               |               |                                |
| Sample/s supplied by client  |  | * CAI values corrected for smoo                          | oth surface.                      |                 |               | Page: 1       | of 2 REP06801                  |
| Accredited for compliance<br>The results of the tests, calibrate<br>this document are traceable<br>Tested at Trila | e with ISO/IEC 17025<br>tions, and/or measure<br>e to Australian/Nation<br>b Brisbane Laboratory | 5 - Testing.<br>ments included in<br>al Standards.<br>/. | Authorised S<br>C. Pure           | Bignatory       |               |               | KATA<br>KATA<br>COMPTENCE      |



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#### **CERCHAR ABRASIVITY INDEX TEST REPORT**

ASTM D7625 - 10 - Standard Test Method for Laboratory Determination of Abrasiveness of Rock Using the Cerchar Method

| Client                                     | Golder Associates Pty Lir   | nited  | Report No.      | GA102070-CE  | RC  |
|--|---|--|-----------------|--------------|---|
|  |   | <b>BEFORE &amp; AFTER PHOT</b>                       | <u>os</u>       |              |   |
|  | CLIENT:   | Golder Associates Pty Lim                            | ited            |              |   |
|  | PROJECT:  | Inland Rail Section 320                              | BEFORE TE       | ST           |   |
|  | LAB SAMPLE No.  | 102070   | DATE: 5//01/19  |              |   |
|  | BOREHOLE:   | 320-01-BH2102  | DEPTH: 224      |              |   |
|  | CLIENT:<br>PROJECT:   | Golder Associates Pty Lim<br>Inland Rail Section 320 | ited            |              |   |
|  |   |  | AFIERIES        |              |   |
|  | LAB SAMPLE No.  | 102070   | DATE: 51/01 /19 |              |   |
|  | DOREMOLE.   |  |                 |              |   |
|  |   |  |                 |              |   |
| Remarks:                                   |   |  |                 |              |   |
| Sample/s supplied                          | by client   | * CAI values corrected for smooth su                 | rface.          | Page: 2 of 2 | REP0680                                   |
| Accredit<br>The results of t<br>this docum | ted for compliance with ISO/IEC 17025 -<br>the tests, calibrations, and/or measurem<br>nent are traceable to Australian/National<br>Tested at Trilab Brisbane Laboratory. | Testing. A<br>ents included in<br>Standards.         | C. Purvis       | 1.04-0-      | ACCREMITED FOR<br>TECHNICAL<br>COMPETENCE |



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|   | CERC  | HAR ABRASIVITY   |                                 |                 | ORT                    |                            |
|---|---|--|---------------------------------|-----------------|------------------------|----------------------------|
| ASTM D7625  | - 10 - Standard Tes   | st Method for Laboratory Deter                           | mination of Abrasivene          | ess of Rock     | Using the Cerchar Me   | thod                       |
| Client Golder A   | ssociates Pty I   | _imited  |                                 | Repo            | rt No. GA1021          | 90-CERC                    |
|   |   |  |                                 | Requ            | est No. 1893795        | 5 TR01                     |
| Address PO Box  | 1734 MILTON   | BC QLD 4064  |                                 | Test I          | Date 22/01/20          |                            |
|   |   |  |                                 | Repo            | rt Date 23/01/20       | )19                        |
| Project Inland Ra   | ail Section 320   |  |                                 | Samp            | le Type Single Ir      | ndividual Rock             |
| Project No 1893795  |   | Depth From (m)   | 89.5                            |                 | Core Sp                | ecimen                     |
| Bore Hole 320-01-E  | 3H2101  | Depth To (m)   | 89.65                           | Samp            | le No 320-01-I         | BH2101-CER :               |
| Description C   |   |  |                                 |                 | 320-01-                | BH2101-MOI                 |
|   |   | SAMPLE I   | DETAILS                         |                 | l                      |                            |
| Sample Diameter (mm):   |   | 60.4   | Moisture Content                | (%):            | 29                     | 0.3                        |
| Sample Height (mm):   |   | 81.7   | Dry Density (t/m <sup>3</sup> ) |                 | 1.                     | 35                         |
| Surface Type :  | Smooth  | (Saw Cut) Surface  | Wet Density (t/m <sup>3</sup>   | )               | 1.                     | 74                         |
|   |   |  | <u>r iesting</u>                |                 |                        | _                          |
| Hardness of Tip Used  | 25 HRC  | Hardness of Tip Used                                     | 43 HRC                          | Hardr           | ness of Tip Used       | 53 HRC                     |
| Average Diameter (mm)   | ~CAI  | Average Diameter (mm)                                    | ^CAI                            | Averaç          | ge Diameter (mm)       |                            |
| 0.05  | 0.52  | 0.00   | 0.00                            |                 | 0.00                   | 0.00                       |
|   |   | Linear Relationship betwee                               | en Tip Hardness and             | CAI             |                        | ·                          |
|   |   | CAI =  | (-0.0199 x HRC)                 | + 0.9742        |                        |                            |
|   | Averag  | e CAI <sub>s</sub> (HRC55) =                             | 0.36                            | Corrected for S | smooth Saw Cut Surface |                            |
|   |   | Classification :   | Very low abrasiv                | eness           |                        |                            |
|   |   | CAI v's Har  | dness Plot                      |                 |                        |                            |
| 0.60  |   | Test Data  | Line of Best F                  | it              |                        |                            |
| 0.50  |   | ×  |                                 |                 |                        |                            |
| 0.40  |   |  |                                 |                 |                        |                            |
| 0.30  |   |  |                                 |                 |                        |                            |
| 0.20  |   |  |                                 |                 |                        |                            |
| 0.10  |   |  |                                 |                 |                        |                            |
| 0.00  |   |  |                                 |                 |                        |                            |
| -0.10   |   |  |                                 |                 |                        |                            |
| -0.20   |   |  |                                 |                 |                        |                            |
| 0   | 10  | 20<br>Hardne   | 30<br>ss (HRC)                  | 40              | 50                     | 60                         |
| Remarks:  |   |  |                                 |                 |                        |                            |
| Sample/s supplied by client   |   | * CAI values corrected for smoo                          | oth surface.                    |                 | Page                   | :1 of 2 REP06801           |
| Accredited for complianc<br>The results of the tests, calibrat<br>this document are traceable<br>Tested at Trilat | e with ISO/IEC 17025<br>ions, and/or measure<br>a to Australian/Nation<br>b Brisbane Laboratory | 5 - Testing.<br>ments included in<br>al Standards.<br>r. | Authorised S<br>C. Pure         | Signatory       |                        | ACCOUNTER FOR<br>TECHNICAL |



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#### **CERCHAR ABRASIVITY INDEX TEST REPORT**

ASTM D7625 - 10 - Standard Test Method for Laboratory Determination of Abrasiveness of Rock Using the Cerchar Method

| Client                                | Golder Assoc  | iates Pty Lin   | nited  | Report No.                        | GA102190-CE  | RC  |
|---------------------------------------|---|---|--|-----------------------------------|--------------|---|
|                                       |   |   | BEFORE & AFTER PH  | OTOS                              |              |   |
|                                       |   |   |  |                                   |              |   |
|                                       | CLIE  | ENT:  | Golder Associates Pty Lin  | nited                             |              |   |
|                                       | PRO.  | JECT:   | Inland Rail Section 320  | BEFORE TEST                       |              |   |
|                                       | LABS  | SAMPLE No.  | 102190   | DATE: 22/01/19                    |              |   |
|                                       | BOR   | EHOLE:  | 320-01-BH2101  | DEPTH: 89.5                       |              |   |
|                                       |   |   |  |                                   |              |   |
|                                       | CLIENT:<br>PROJECT:   |   | Golder Associates Pty Limited<br>Inland Rail Section 320 AFTER TES |                                   |              |   |
|                                       | LAB S   | AMPLE No.   | 102190   | DATE: 22/01/19                    |              |   |
|                                       | BORE  | EHOLE:  | 320-01-BH2101  | DEPTH: 89.5                       |              |   |
|                                       |   |   |  |                                   |              |   |
| Remarks:                              |   |   |  |                                   |              |   |
| Sample/s supplie                      | d by client   |   | * CAI values corrected for smooth                                  | surface.                          | Page: 2 of 2 | REP0680                                     |
| Accred<br>The results of<br>this docu | lited for compliance with<br>the tests, calibrations, a<br>ment are traceable to Au<br>Tested at Trilab Brisb | ISO/IEC 17025 -<br>and/or measureme<br>ustralian/National S<br>pane Laboratory. | Testing.<br>nts included in<br>Standards.                          | Authorised Signatory<br>C. Purvis | Labora       | ACCREMENTAL<br>COMPETENCE<br>atory No. 9926 |

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|        |   |   | CERCI   | HAR ABRASIVITY   |                                 |                 | ORT              |                      |                                   |
|--------|---|---|---|--|---------------------------------|-----------------|------------------|----------------------|-----------------------------------|
|        |   | ASTM D7625  | - 10 - Standard Tes   | st Method for Laboratory Deter   | mination of Abrasiven           | ess of Rock     | Using the        | Cerchar Meth         | od                                |
| Cli    | ient  | Golder A  | ssociates Pty I   | _imited  |                                 | Repo            | rt No.           | GA10220 <sup>2</sup> | 1-CERC                            |
|        |   |   |   |  |                                 | Requ            | est No.          | 1893795_             | TR01                              |
| Ad     | ldress                                      | PO Box  | 1734 MILTON   | BC QLD 4064  |                                 | Test I          | Date             | 22/01/201            | 9                                 |
|        |   |   |   |  |                                 | Repo            | rt Date          | 23/01/201            | 9                                 |
| Pre    | oject                                       | Inland Ra   | ail Section 320   | 1  |                                 | Samp            | le Туре          | Single Ind           | ividual Rock                      |
| Pre    | oject No                                    | 1893795   |   | Depth From (m)   | 97.15                           |                 |                  | Core Spec            | Jinen                             |
| Во     | ore Hole                                    | 320-01-E  | 3H2101  | Depth To (m)   | 97.35                           | Samp            | le No            | 320-01-BH            | 12101-CER :                       |
| De     | scriptio                                    | n C   |   |  |                                 | · ·             |                  | 320-01-BF            | 12101-MOI                         |
|        |   |   |   | SAMPLE   | DETAILS                         |                 |                  |                      |                                   |
| Sar    | mple Dian                                   | neter (mm):   |   | 60.4   | Moisture Content                | : (%):          |                  | 2.6                  |                                   |
| Sar    | mple Heig                                   | ht (mm):  |   | 82.5   | Dry Density (t/m <sup>3</sup> ) | )               |                  | 2.54                 |                                   |
| Su     | тасе Тур                                    | Ð:  | Smooth  | (Saw Cut) Surface  | wet Density (t/m°<br>F TESTING  | )               |                  | 2.61                 |                                   |
| Hai    | rdness of                                   | Tin Llead   | 25 HPC  | Hardness of Tip Llead  | 43 HRC                          | Hard            | less of Ti-      | lised                | 53 HRC                            |
| Ave    | rage Dian                                   | neter (mm)  | *CAI  | Average Diameter (mm)  | *CAI                            | Avera           | be Diamet        | er (mm)              | *CAI                              |
| 700    | lugo Dian                                   |   |   |  |                                 | 711014          | <u>go Diamot</u> |                      |                                   |
|        | 0.24  | 4   | 2.35  | 0.10   | 0.96                            |                 | 0.02             |                      | 0.22                              |
|        |   |   |   | CAI =  | ( -0.0755 x HRC )               | + 4.2106        |                  |                      |                                   |
|        |   |   | Averag  | e CAI <sub>s</sub> (HRC55) =<br>Classification :   | 0.54<br>Low abrasivenes         | Corrected for S | Smooth Saw Cu    | t Surface            |                                   |
|        |   |   |   | CAI v's Har  | dness Plot                      |                 |                  |                      |                                   |
|        | 2.50  |   |   | Test Data  | —— Line of Best F               | it              |                  |                      |                                   |
|        |   |   |   |  |                                 |                 |                  |                      |                                   |
|        | 2.00  |   |   |  |                                 |                 |                  |                      |                                   |
|        | 1.50  |   |   |  |                                 |                 |                  |                      |                                   |
| CAI    |   |   |   |  |                                 |                 |                  |                      |                                   |
|        | 1.00  |   |   |  |                                 |                 |                  |                      |                                   |
|        |   |   |   |  |                                 |                 |                  |                      |                                   |
|        | 0.50  |   |   |  |                                 |                 |                  |                      |                                   |
|        | 0.00  |   |   |  |                                 |                 |                  |                      |                                   |
|        | 0   |   | 10  | 20<br>Hardne   | <sup>30</sup><br>ss (HRC)       | 40              |                  | 50                   | 60                                |
| Rema   | rks:  |   |   |  |                                 |                 |                  |                      |                                   |
| Sample | e/s supplied                                | l by client   |   | * CAI values corrected for smoo  | oth surface.                    |                 |                  | Page: 1              | of 2 REP06801                     |
| The    | Accredite<br>e results of th<br>this docume | ed for complianc<br>ne tests, calibrat<br>ent are traceable<br>Tested at Trilat | e with ISO/IEC 17025<br>ions, and/or measure<br>e to Australian/Nation<br>o Brisbane Laboratory | 5 - Testing.<br>ments included in<br>al Standards.<br>/.   | Authorised S<br>C. Pur          | Signatory       |                  |                      | ACCEPTION OF TECHNICAL COMPETENCE |
|        |   |   | - (*  | for a state of the |                                 |                 |                  | 0                    | Laboratory No. 9926               |

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#### **CERCHAR ABRASIVITY INDEX TEST REPORT**

ASTM D7625 - 10 - Standard Test Method for Laboratory Determination of Abrasiveness of Rock Using the Cerchar Method

| Client Gol  | der Associates Pty Lir   | nited                                      | Report No.                        | GA102201-CE  | RC                                     |
|---|--|--|-----------------------------------|--------------|--|
|   |  | BEFORE & AFTER PHO                         | DTOS                              |              |  |
|   |  |  |                                   |              |  |
|   | CLIENT:  | Golder Associates Pty Limi                 | ited                              |              |  |
|   | PROJECT:   | Inland Rail Section 320                    | BEFORE TEST                       |              |  |
|   | LAB SAMPLE No.   | 102201                                     | DATE: 22/01/19                    |              |  |
|   | BOREHOLE:  | 320-01-BH2101                              | DEPTH: 97.15                      |              |  |
|   |  |  |                                   |              |  |
|   | CLIENT:  | Golder Associates Pty Limi                 | ited                              |              |  |
|   | PROJECT:   | CT: Inland Rail Section 320 Al             |                                   |              |  |
|   | LAB SAMPLE No.   | 102201                                     | DATE: 22/01/19.                   |              |  |
|   | BOREHOLE:  | 320-01-BH2101                              | DEPTH: 97.15                      |              |  |
|   |  |  |                                   |              |  |
| Remarks:  |  |  |                                   |              |  |
| Sample/s supplied by clie   | nt   | * CAI values corrected for smooth          | surface.                          | Page: 2 of 2 | REP06801                               |
| Accredited for c<br>The results of the tests<br>this document are<br>Tested | ompliance with ISO/IEC 17025 -<br>s, calibrations, and/or measurem<br>traceable to Australian/National<br>d at Trilab Brisbane Laboratory. | Testing.<br>ents included in<br>Standards. | Authorised Signatory<br>C. Purvis | Labora       | COMPORTED FOR<br>ECHNICAL<br>OMPETENCE |

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|  |   | CERC  |   |  | T REPO                   | ORT           |               |               |
|--|---|---|---|--|--------------------------|---------------|---------------|---------------|
|  | ASTM D7625  | - 10 - Standard Te  | est Method for Laboratory Dete  | rmination of Abrasivene                | ess of Rock              | Using the     | Cerchar Metho | d             |
| Client   | Golder A  | ssociates Pty   | Limited   |  | Report No. GA102204-CERC |               | -CERC         |               |
|  |   |   |   |  | Requ                     | est No.       | 1893795       | FR01          |
| Address  | PO Box '  | 1734 MILTON   | BC QLD 4064   |  | Test Date 22/01/2019     |               |               | )             |
|  |   |   |   |  | Report Date 23/01/2019   |               |               | )             |
| Project  | Inland Ra   | ail Section 320   | )   |  | Samp                     | le Туре       | Single Indi   | vidual Rock   |
| Project No   | 1893795   |   | Depth From (m)  | 102.65                                 |                          |               | Core Spec     | Imen          |
| Bore Hole  | 320-01-E  | 3H2101  | Depth To (m)  | 102.75                                 | Samp                     | le No         | 320-01-BH     | 2101-CER :    |
| Descriptio   | n C   |   |   |  |                          |               | 320-01-BH     | 2101-MOI      |
|  |   |   | SAMPLE  | DETAILS                                |                          |               |               |               |
| Sample Diam  | neter (mm):   |   | 60.8  | Moisture Content                       | t (%):                   |               | 0.8           |               |
| Sample Heig  | ht (mm):  |   | 82.1  | Dry Density (t/m <sup>3</sup> )        | )                        |               | 2.74          |               |
| Surface Type   | ə:  | Smoot   | h (Saw Cut) Surface   | Wet Density (t/m <sup>3</sup>          | °)                       |               | 2.76          |               |
|  |   |   | <u>RESOLIS (</u>  |  |                          |               |               |               |
| Hardness of  | Tip Used  | 25 HRC  | Hardness of Tip Used  | 43 HRC                                 | Hardi                    | ness of Tip   | Used          | 53 HRC        |
| Average Diam   | leter (mm)  | CAI   | Average Diameter (mm)   | CAI                                    | Avera                    | je Diamete    | er (mm)       | CAI           |
| 0.26   | 5   | 2.59  | 0.13  | 1.30                                   |                          | 0.08          |               | 0.82          |
|  |   |   | Linear Relationship betwe   | en Tip Hardness and                    | I CAI                    |               | ·             |               |
|  |   |   | CAI =   | (-0.0638 x HRC)                        | + 4.1314                 |               |               |               |
|  |   | Averag  | <b>Je CAI</b> s (HRC55) =<br>Classification :   | 1.10<br>Medium abrasive                | Corrected for S          | Smooth Saw Cu | t Surface     |               |
|  |   |   | CAI v's Ha  | rdness Plot                            |                          |               |               |               |
| 3.00   |   |   |   | Line of Best F                         | -it                      |               |               |               |
| 2.50   |   |   |   |  |                          |               |               |               |
| 2.00   |   |   |   |  |                          |               |               |               |
| 2.00   |   |   |   |  |                          |               |               |               |
| <b>B</b> 1.50  |   |   |   |  |                          |               |               |               |
| 1.00   |   |   |   |  |                          |               |               |               |
| 0.50   |   |   |   |  |                          |               |               |               |
| 0.50   |   |   |   |  |                          |               |               |               |
| 0.00   |   | 10  | 20  | 30                                     | 40                       |               | 50            | 60            |
|  |   | -   | Hardn   | ess (HRC)                              |                          |               |               |               |
| Domorko:   |   |   |   |  |                          |               |               |               |
| Remarks.   |   |   |   |  |                          |               |               |               |
| Sample/s supplied  | by client   |   | * CAI values corrected for smo  | oth surface.                           |                          |               | Page: 1 o     | of 2 REP06801 |
| Sample/s supplied<br>Accredite<br>The results of th<br>this docume | by client<br>ed for complianc<br>le tests, calibrati<br>ent are traceable | e with ISO/IEC 1702<br>ions, and/or measure<br>to Australian/Nation | * CAI values corrected for smo<br>25 - Testing.<br>ements included in<br>nal Standards. | oth surface.<br>Authorised S<br>C. Pur | Signatory                |               | Page: 1 d     | of 2 REP06801 |

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#### **CERCHAR ABRASIVITY INDEX TEST REPORT**

ASTM D7625 - 10 - Standard Test Method for Laboratory Determination of Abrasiveness of Rock Using the Cerchar Method

| Client  | Golder Associates Pty Lin   | nited                                      | Report No.                        | GA102204-CERC      |  |  |
|---|---|--|-----------------------------------|--------------------|--|--|
|   |   | BEFORE & AFTER PHO                         | TOS                               |                    |  |  |
|   |   |  |                                   |                    |  |  |
|   | CLIENT:   | Golder Associates Pty Limi                 | ted                               |                    |  |  |
|   | PROJECT:  | Inland Rail Section 320                    | BEFORE TEST                       |                    |  |  |
|   | LAB SAMPLE No.  | 102204                                     | DATE: 22/01/19                    |                    |  |  |
|   | BOREHOLE:   | 320-01-BH2101                              | DEPTH: 102.65                     |                    |  |  |
|   |   |  |                                   |                    |  |  |
|   | CLIENT:   | CLIENT: Golder Associates Pty Limited      |                                   |                    |  |  |
|   | PROJECT:  | Inland Rail Section 320 AFTER TEST         |                                   |                    |  |  |
|   | LAB SAMPLE No.  | 102204                                     | DATE: 22/01/19                    |                    |  |  |
|   | BOREHOLE:   | 320-01-BH2101                              | DEPTH: 102.65                     |                    |  |  |
|   |   |  |                                   |                    |  |  |
| Remarks:                                      |   |  |                                   |                    |  |  |
| Sample/s supplied b                           | by client   | * CAI values corrected for smooth s        | surface.                          | Page: 2 of 2 REP06 |  |  |
| Accredite<br>The results of th<br>this docume | d for compliance with ISO/IEC 17025 -<br>e tests, calibrations, and/or measurement<br>are traceable to Australian/National<br>Tested at Trilab Brisbane Laboratory. | Testing.<br>ents included in<br>Standards. | Authorised Signatory<br>C. Purvis |                    |  |  |

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|   | CERCH  |  | INDEX TEST                      |                  | ORT                    |                     |  |  |  |
|---|--|--|---------------------------------|------------------|------------------------|---------------------|--|--|--|
| ASTM D7625  | - 10 - Standard Tes  | t Method for Laboratory Deter                    | mination of Abrasivene          | ess of Rock      | Using the Cerchar Met  | nod                 |  |  |  |
| Client Golder A   | ssociates Pty L  | imited   |                                 | Rano             | t No GA10221           | 1-CERC              |  |  |  |
|   | 2  |  |                                 | Requi            | est No. 1893795        | TR01                |  |  |  |
| Address PO Box  | 1734 MILTON E  | 3C QLD 4064                                      |                                 | Teet F           | Date 22/01/20          | 19                  |  |  |  |
|   |  |  |                                 | Reno             | <b>t Date</b> 23/01/20 | 10                  |  |  |  |
| Project Inland R  | ail Section 320  |  |                                 | Samp             | le Type Single Ind     | dividual Rock       |  |  |  |
| Project No 1893795  |  | Depth From (m)                                   | 104 5                           | •                | Core Spe               | ecimen              |  |  |  |
| Bore Hole 320-01-E  | ,<br>3H2101  | Depth Tolm (iii)                                 | 104.3                           |                  | 320.01                 |                     |  |  |  |
|   | 5112101  | Deptil 10 (III)                                  | 104.0                           | Samp             | ole No 320-01-         | -BH2101-MOI         |  |  |  |
| Description   |  | SAMPLE   | DETAILS                         |                  |                        |                     |  |  |  |
| Sample Diameter (mm):   |  | 60.6   | Moisture Content                | (%).             | 7 (                    | 3                   |  |  |  |
| Sample Height (mm).   |  | 21.5 Dry Doneity (t/m <sup>3</sup> )             |                                 | ( /0]•           | 1.0                    | ,<br>2              |  |  |  |
| Surface Type :  | Smooth   | (Saw Cut) Surface                                | Wet Density (t/m <sup>3</sup> ) | )                | 1.9                    | 7                   |  |  |  |
| ounade Type .   |  | <u>R</u> ESULTS O                                | F TESTING                       | /                | 2.0                    | 1                   |  |  |  |
| Hardness of Tin Llead   | 25 HRC   | Hardness of Tin Llead                            | 43 HRC                          | Hardr            | less of Tin Llead      | 53 HRC              |  |  |  |
| Average Diameter (mm)   | *CAI   | Average Diameter (mm)                            | *CAI                            | Avera            | ne Diameter (mm)       | *CAI                |  |  |  |
| Average Diameter (mm)   |  | Average Diameter (mm)                            |                                 | Averag           | je Diameter (mm)       |                     |  |  |  |
| 0.00  | 0.00   | 0.00   | 0.00                            |                  | 0.00                   | 0.00                |  |  |  |
|   | Linear Relationship between Tip Hardness and CAI   |  |                                 |                  |                        |                     |  |  |  |
|   |  | CAI =  | ( 0 x HRC ) + 0                 |                  |                        |                     |  |  |  |
|   | Average  | e CAI <sub>s</sub> (HRC55) =                     | 0.48                            | Corrected for S  | mooth Saw Cut Surface  |                     |  |  |  |
|   |  | Classification :                                 | Very low abrasive               | eness            |                        |                     |  |  |  |
|   |  | CAI v's Har                                      | dness Plot                      |                  |                        |                     |  |  |  |
| 1.00  |  | Test Data  | —— Line of Best Fi              | it               |                        | I                   |  |  |  |
| 0.90  |  |  |                                 |                  |                        |                     |  |  |  |
| 0.80  |  |  |                                 |                  |                        |                     |  |  |  |
| 0.70  |  |  |                                 |                  |                        |                     |  |  |  |
| 0.60  |  |  |                                 |                  |                        |                     |  |  |  |
| <b>3</b> 0.50   |  |  |                                 |                  |                        |                     |  |  |  |
| 0.30  |  |  |                                 |                  |                        |                     |  |  |  |
| 0.20  |  |  |                                 |                  |                        |                     |  |  |  |
| 0.10  |  |  |                                 |                  |                        |                     |  |  |  |
| 0.00  | 40   | •  | 20                              | 40               |                        |                     |  |  |  |
| U   | ΙU   | Hardne   | ss (HRC)                        | 40               | 50                     | 60                  |  |  |  |
| Remarks:  |  |  |                                 |                  |                        |                     |  |  |  |
| Sample/s supplied by client   |  | * CAI values corrected for smoo                  | oth surface.                    |                  | Page:                  | 1 of 2 REP06801     |  |  |  |
| Accredited for complianc<br>The results of the tests, calibrat<br>this document are traceable<br>Tested at Trilat | e with ISO/IEC 17025<br>ions, and/or measurer<br>e to Australian/Nationa<br>b Brisbane Laboratory. | - Testing.<br>nents included in<br>al Standards. | Authorised S<br>C. Purv         | lignatory<br>/ls |                        | Laboratory No. 9926 |  |  |  |

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#### **CERCHAR ABRASIVITY INDEX TEST REPORT**

ASTM D7625 - 10 - Standard Test Method for Laboratory Determination of Abrasiveness of Rock Using the Cerchar Method

| Client   | Golder Associates Pty Lin   | nited  | Report No.                        | GA102211-CE  | RC       |
|--|---|--|-----------------------------------|--------------|----------|
|  |   | BEFORE & AFTER PHO                               | ros                               |              |          |
|  | CLIENT.   | Colden Associatos Dtv Limi                       | ited                              |              |          |
|  | PROJECT:  | Inland Rail Section 320                          | BEFORE TEST                       | r            |          |
|  | LAB SAMPLE No.  | 102211   | DATE: 22/01/19                    |              |          |
|  | BOREHOLE:   | 320-01-BH2101                                    | DEPTH: 104.5                      |              |          |
|  |   |  |                                   |              |          |
|  | CLIENT:   | Golder Associates Pty Limit                      | ted                               |              |          |
|  | PROJECT:  | Inland Rail Section 320                          | AFTER TEST                        |              |          |
|  | LAB SAMPLE No.  | 102211<br>220.01.PU2101                          | DATE: 22/01/19                    |              |          |
|  | BOREHOLE:   | 320-01-BH2101                                    | DEPTH: 104.5                      |              |          |
| Remarks:   |   |  |                                   |              |          |
|  |   |  |                                   |              |          |
| Sample/s supplied<br>Accredi<br>The results of<br>this docun | I by client<br>ted for compliance with ISO/IEC 17025 -<br>the tests, calibrations, and/or measureme<br>nent are traceable to Australian/National s<br>Tested at Trilab Brisbane Laboratory. | * CAI values corrected for smooth si<br>Testing. | Authorised Signatory<br>C. Purvis | Page: 2 of 2 | REP06801 |



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|   | CERCH  | AR ABRASIVITY                                   | INDEX TEST                      |                 | ORT                       |                                   |
|---|--|---|---------------------------------|-----------------|---------------------------|-----------------------------------|
| ASTM D7625  | - 10 - Standard Tes  | t Method for Laboratory Deter                   | mination of Abrasivene          | ess of Rock     | Using the Cerchar Met     | nod                               |
| Client Golder A   | ssociates Pty L  | imited  |                                 | Repo            | rt No. GA10221            | 4-CERC                            |
|   |  |   |                                 | Reque           | est No. 1893795           | TR01                              |
| Address PO Box  | 1734 MILTON E  | 3C QLD 4064                                     |                                 | Test D          | Date 22/01/20             | 19                                |
|   |  |   |                                 | Repor           | rt Date 23/01/20          | 19                                |
| Project Inland R  | ail Section 320  |   |                                 | Samp            | le Type Single Ind        | dividual Rock                     |
| Project No 1893795  |  | Depth From (m)                                  | 105.39                          |                 | Core Spe                  | ecimen                            |
| Bore Hole 320-01-E  | 3H2101   | Depth To (m)                                    | 105.46                          | 0               | 320-01-                   | BH2101-CER :                      |
| Description C   |  | · · · · ·                                       |                                 | Samp            | 320-01                    | -BH2101-MOI                       |
|   |  | SAMPLE I  | DETAILS                         |                 |                           |                                   |
| Sample Diameter (mm):   |  | 60.5  | Moisture Content                | (%):            | 12.                       | 3                                 |
| Sample Height (mm):   |  | 76.7  | Dry Density (t/m <sup>3</sup> ) |                 | 2.0                       | 4                                 |
| Surface Type :  | Smooth   | (Saw Cut) Surface                               | Wet Density (t/m <sup>3</sup> ) | )               | 2.2                       | 9                                 |
|   |  | RESULTS O                                       | F TESTING                       |                 |                           |                                   |
| Hardness of Tip Used  | 25 HRC   | Hardness of Tip Used                            | 43 HRC                          | Hardr           | ness of Tip Used          | 53 HRC                            |
| Average Diameter (mm)   | *CAI   | Average Diameter (mm)                           | *CAI                            | Averag          | ge Diameter (mm)          | *CAI                              |
| 0.00  | 0.00   | 0.00  | 0.00                            |                 | 0.00                      | 0.00                              |
|   |  | Linear Relationship betwe                       | en Tip Hardness and             | CAI             |                           |                                   |
|   |  | CAI =   | (0 x HRC) + 0                   |                 |                           |                                   |
|   | Average  | e CAI <sub>s</sub> (HRC55) =                    | 0.48                            | Corrected for S | imooth Saw Cut Surface    |                                   |
|   |  | Classification :                                | Very low abrasive               | eness           |                           |                                   |
|   |  | CAI v's Har                                     | dness Plot                      |                 |                           |                                   |
| 1.00  |  | Test Data                                       | —— Line of Best Fi              | it              |                           | I                                 |
| 0.90  |  |   |                                 |                 |                           |                                   |
| 0.80  |  |   |                                 |                 |                           |                                   |
| 0.70  |  |   |                                 |                 |                           |                                   |
| 0.60  |  |   |                                 |                 |                           |                                   |
| 3 0.50<br>0.40  |  |   |                                 |                 |                           |                                   |
| 0.30  |  |   |                                 |                 |                           |                                   |
| 0.20  |  |   |                                 |                 |                           |                                   |
| 0.10  |  |   |                                 |                 |                           |                                   |
| 0.00  | 10   |   | 20                              | 40              |                           |                                   |
| 0   | 10   | Hardne  | ss (HRC)                        | 40              | 50                        | 60                                |
| Remarks:  |  |   |                                 |                 |                           |                                   |
| Sample/s supplied by client   |  | * CAI values corrected for smoo                 | oth surface.                    |                 | Page:                     | 1 of 2 REP06801                   |
| Accredited for complianc<br>The results of the tests, calibrat<br>this document are traceable<br>Tested at Trilal | e with ISO/IEC 17025<br>ions, and/or measurer<br>e to Australian/Nationa<br>o Brisbane Laboratory. | - Testing.<br>nents included in<br>I Standards. | Authorised S<br>C. Purv         | vis             |                           | COMPETENCE<br>Laboratory No. 9926 |
| The results of calibr   | ations and tests perf  | ormed apply only to the specific                | instrument or sample at         | the time of t   | est unless otherwise clea | rlv stated.                       |

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#### **CERCHAR ABRASIVITY INDEX TEST REPORT**

ASTM D7625 - 10 - Standard Test Method for Laboratory Determination of Abrasiveness of Rock Using the Cerchar Method

| Client Gold  | ler Associates Pty Lir  | nited   | Report No.                        | GA102214-CE           | RC       |
|--|---|---|-----------------------------------|-----------------------|----------|
|  |   | BEFORE & AFTER PHO  | DTOS                              |                       |          |
|  |   |   |                                   |                       |          |
|  | CI IENT   | C.D   |                                   |                       |          |
|  | PROJECT:  | Golder Associates Pty Lim   | ited                              |                       |          |
|  | TROJECT:  | Infanti Kan Section 520   | BEFORE TEST                       |                       |          |
|  | LAB SAMPLE No.  | 102214  | DATE: 22/01/19                    |                       |          |
|  | BOREHOLE:   | 320-01-BH2101   | DEPTH: 105.08                     |                       |          |
|  |   | 0   |                                   |                       |          |
|  | CLIENT:<br>PROJECT:   | Golder Associates Pty Lim<br>Inland Rail Section 320                            | ited<br>AFTER TEST                | -                     |          |
|  | LAB SAMPLE No.  | 102214  | DATE: 22 loulia                   |                       |          |
|  | BOREHOLE:   | 320-01-BH2101   | DEPTH: 105.08                     |                       |          |
| Remarks:   |   |   |                                   |                       |          |
|  |   |   |                                   | _                     |          |
| Sample/s supplied by client<br>Accredited for cor<br>The results of the tests,<br>this document are tr<br>Tested a | t<br>mpliance with ISO/IEC 17025 -<br>calibrations, and/or measurem<br>aceable to Australian/National<br>at Trilab Brisbane Laboratory. | * CAI values corrected for smooth<br>Testing.<br>ents included in<br>Standards. | Authorised Signatory<br>C. Purvis | Page: 2 of 2<br>Labor | REP06801 |

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



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| ASTM D7825 - 10 - Standard Test Method for Laboratory Determination of Abraviveness of Rock Using the Cerchar Method          Client       Golder Associates Pty Limited       Report No.       GA102218-CERC         Address       PO Box 1734 MILTON BC       QLD       4064       Test Date       2307/2019         Project       Inland Rail Section 320       Sample Type       Single Individual Rock<br>Core Specimen       Sample No       320/01-BH2101         Description C       Sample No       320/01-BH2101       Depth Trom (m)       105.7         Bore Hold 320.01-BH2101       Depth To (m)       105.7       Sample No       320/01-BH2101-CER : 320         Bore Hold 320.01-BH2101       Depth To (m)       105.7       Depth Rock       Depth Rock       Depth Rock         Sample Hold (mm):       59.25       Molsture Content (%):       10.9       320/01-BH2101-CER : 320         Barnelo Blameter (mm):       59.25       Molsture Content (%):       10.9       320/01-BH2101-CER : 320         Surface Type :       Smooth (Saw Cut) Surface       Wet Density (t/m <sup>3</sup> )       1.79       33/01/2014         Surface Type :       Smooth (Saw Cut) Surface       Wet Density (t/m <sup>3</sup> )       1.99       25/01-BH2101-CER : 320         Verage Diameter (mm)       *CAI       Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI   |   | CERCI  |  | INDEX TEST                      |             | ORT         |              |   |
|---|---|--|--|---------------------------------|-------------|-------------|--------------|---|
| Client         Golder Associates Pty Limited         Report No.         GA102218-CERC           Address         PO Box 1734 MILTON BC         QLD         4064         Test Date         22/01/2019           Project         Inland Rail Section 320         Sample Type         Single Individual Rock Core Specimen         32/01/2019           Project         Inland Rail Section 320         Sample No         32/01/2019         Single Individual Rock Core Specimen           Bore Hole         32/01-BH2101         Depth Tron (m)         105.7         Sample No         32/01-BH2101-CER : 32/0 HE/101-CER : 32/0 HE/101  | ASTM D762   | 5 - 10 - Standard Tes  | st Method for Laboratory Deter                     | mination of Abrasivene          | ess of Rock | Using the   | Cerchar Meth | od  |
| Report Rot         Report  | Client Golder   | Associates Ptv I   | _imited  |                                 | Reno        | rt No       | GA10221      | 8-CERC  |
| Address     PO Box 1734 MILTON BC     OLD     4064     Test Date     22/01/2019       Project     Inland Rail Section 320     Sample Type     Sample Type     Single Individual Rock<br>Core Specimen       Project No     1893795     Depth From (m)     105.7       Bore Hole     320-01-BH2101     Depth To (m)     105.8       Sample Type     Sample Type     Sample Type       Sample Meight (mm):     59.25     Moisture Content (%):     10.9       Sample Height (mm):     59.25     Moisture Content (%):     10.9       Sample Height (mm):     75.2     Dy Density (t/m <sup>3</sup> )     1.79       Surface Type :     Smooth (Saw Cut) Surface     Wet Density (t/m <sup>3</sup> )     1.99       Hardness of Tip Used     25 HRC     Hardness of Tip Used     43 HRC     Hardness of Tip Used     53 HRC       Average Diameter (mm)     *CAI     Average Diameter (mm)     *CAI     Average Diameter (mm)     *CAI       0.00     0.00     0.00     0.00     0.00     0.00     0.00       Linear Relationship between Tip Hardness and CAI       CAI = (0 x HRC ) + 0     Care Smooth Saw Cut Surface     Care State       Cals iffication : Very low abrasiveness       Cals iffication : Very low abrasiveness       Sure of Suread Surface    <   |   |  |  |                                 | Requi       | est No      | 1803705      |   |
| Test Date     23/01/2019       Report Date     23/01/2019       Sample Type     Single Individual Rock<br>Core Specimen       Bore Hole     320-01-BH2101     Depth From (m)     105.7       Bore Hole     320-01-BH2101     Depth Trom (m)     105.8       Description C       Sample Diameter (mm):     59.25     Molsture Content (%):     10.9       Sample Meight (mm):     75.2     Dry Density (fm²)     1.73       Sufface Type :       Samoth (Saw Cul) Surface       Wet Best Colspan="2">Wet Best Colspan="2">Sample No       Bore Hole     25 HRC       Hardness of Tip Used     25 HRC       Hardness of Tip Used     25 HRC       Hardness of Tip Used     53 HRC       Average Diameter (mm)     *CAI       Average Diameter (mm)     *CAI       Average CAI <sub>8</sub> (HRC55) =     0.48       Conscription C  | Address PO Box  | 1734 MILTON  | BC QLD 4064  |                                 | Toet [      | Dato        | 22/01/201    | <u>0</u>  |
| Reput to 2017/02/16/2017/02   |   |  |  |                                 | Popol       | t Data      | 22/01/201    | 9   |
| Project India Nam Sector 200       Depth From (m)       105.7       Sample No       320-01-BH2101-CER : 320         Bore Hole       320-01-BH2101       Depth To (m)       105.8       Sample No       320-01-BH2101-CER : 320         Bore Hole       320-01-BH2101       Depth To (m)       105.8       Sample No       320-01-BH2101-CER : 320         Bore Hole       320-01-BH2101-CER : 320       Moisture Content (%):       10.9       Sample No       320-01-BH2101-CER : 320         Sample Height (mm):       75.2       Dry Density (t/m <sup>3</sup> )       1.99       RESULTS OF TESTING         Hardness of Tip Used       25 HRC       Hardness of Tip Used       43 HRC       Hardness of Tip Used       53 HRC         Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI         0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00         Linear Relationship between Tip Hardness and CAI         CAI = (0 x HRC) + 0       Careeted for Smooth Saw Cut Surface         Classification : Very low abrasiveness         CAI vis Hardness Plot         100       10       0       0       0       0       0       0       0       0       <   | <b>Project</b> Inland   | Dail Soction 320   |  |                                 | Samp        |             | Single Ind   | j<br>lividual Rock                              |
| Project No         105/11         Depth Trout (m)         103.7         Sample No         320-01-BH2101-CER: 320<br>BH2101-KOI           Description C         Sample Diameter (mm):         59.25         Moisture Content (%):         10.9           Sample Height (mm):         75.2         Dry Density (tim*)         1.79           Surface Type :         Smooth (Saw Cut) Surface         Wet Density (tim*)         1.99           Hardness of Tip Used         25 HRC         Hardness of Tip Used         43 HRC         Hardness of Tip Used         53 HRC           Average Diameter (mm)         *CAI         Average Diameter (mm)         *CAI         Average Diameter (mm)         *CAI           0.00<  | Project No. 180370  |  | Dopth From (m)                                     | 105.7                           |             |             | Core Spe     | cimen   |
| Barrier Note       Sample No       Sample No <td><b>Boro Holo</b> 320.01</td> <td>BH2101</td> <td>Depth From (m)</td> <td>105.7</td> <td></td> <td></td> <td>200.04 DU0</td> <td></td>  | <b>Boro Holo</b> 320.01   | BH2101   | Depth From (m)                                     | 105.7                           |             |             | 200.04 DU0   |   |
| SAMPLE DETAILS           SAMPLE DETAILS           Sample Diameter (mm):         59.25         Moisture Content (%):         10.9           Sample Height (mm):         75.2         Dry Density (t/m³)         1.79           Surface Type :         Smooth (Saw Cut) Surface         Wet Density (t/m³)         1.99           Hardness of Tip Used         25 HRC         Hardness of Tip Used         43 HRC         Hardness of Tip Used         53 HRC           Average Diameter (mm)         *CAI         Average Diameter (mm)         *CAI         Average Diameter (mm)         *CAI           0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00           Linear Relationship between Tip Hardness and CAI           CAI = (0 x HRC) + 0           Average CAI <sub>8</sub> (HRC55) =         0.48            Classification : Very low abrasiveness           CAI v5 Hardness Plot           Test Data         Une of Best Fit           000         0         40         90         000           0          CAI vs/us corrected for  | Description C   | -0112101   | Deptil 10 (III)                                    | 105.8                           | Samp        | le No       | BH2101-MC    | 2101-CER : 320-01-<br>)                         |
| Sample Diameter (mm):       59.25       Moisture Content (%):       10.9         Sample Height (mm):       75.2       Dry Density (t/m³)       1.79         Surface Type :       Smooth (Saw Cut) Surface       Wet Density (t/m³)       1.99         Hardness of Tip Used       25 HRC       Hardness of Tip Used       43 HRC       Hardness of Tip Used       53 HRC         Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI         0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00         Linear Relationship between Tip Hardness and CAI         CAI = (0 x HRC) + 0         Average CAI <sub>s</sub> (HRC55) =       0.48       Corrected for Smooth Saw Cut Surface         CAI v's Hardness Plot         100       00       0.00       0.00       0.00       60         0.00       10       20       0       0.00       60       60         *CAI v's Hardness (HRC)       40       50       60         *CAI v's Hardness (HRC)       40       50       60         *CAI v's Hardness (HRC)       40       50       60         *CAI vis lauses corre  | Description   |  | SAMPLE I   | DETAILS                         |             |             |              |   |
| Sample Height (mm):       75.2       Dry Density (t/m³)       1.79         Surface Type :       Smooth (Saw Cut) Surface       Wet Density (t/m³)       1.99         RESULTS OF TESTING         Hardness of Tip Used       25 HRC       Hardness of Tip Used       43 HRC       Hardness of Tip Used       53 HRC         Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI         0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00         Linear Relationship between Tip Hardness and CAI         CAI = (0 x HRC) + 0       CAI = (0 x HRC ) + 0       Average CAI <sub>3</sub> (HRC55) =       0.48       Corrected for Smooth Saw Cut Surface         CAI v's Hardness Plot         0.49       Sample/Sample   | Sample Diameter (mm)  | :  | 59.25  | Moisture Content                | (%):        |             | 10.9         | )   |
| Surface Type :     Smooth (Saw Cut) Surface     Wet Density (t/m <sup>2</sup> )     1.99       RESULTS OF TESTING       Hardness of Tip Used     25 HRC     Hardness of Tip Used     43 HRC     Hardness of Tip Used     53 HRC       Average Diameter (mm)     *CAI     Average Diameter (mm)     *CAI     Average Diameter (mm)     *CAI       0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00       Linear Relationship between Tip Hardness and CAI     CAI = (0 x HRC) + 0     Cal = (0 x HRC) + 0     Cal sciences       Average CAIs     (HRC55) =     0.48     Corrected for Smooth Saw Cut Surface       Classification : Very low abrasiveness     Cal v's Hardness Plot     Line of Best Fit       100     0.00     10     20     0.00     40     50     60       0.00     10     20     0.00     40     50     60       Remarks:     *CAI values corrected for smooth surface.     Page: 1 of 2     REPORT  | Sample Height (mm):   | -  | 75.2   | Dry Density (t/m <sup>3</sup> ) | (10)-       |             | 1.79         | )   |
| RESULTS OF TESTING         Hardness of Tip Used       25 HRC       Hardness of Tip Used       43 HRC       Hardness of Tip Used       53 HRC         Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI         0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00         Linear Relationship between Tip Hardness and CAI         CAI v HRC ) + 0         Average CAI <sub>s</sub> (HRC55) =       0.48       Corrected for Smooth Saw Cut Surface         Claiv's Hardness Plot         Line of Best Fit         100       00       0       0       0       0       0       0         0       All of Best Fit         100       0       0       0       0       0       0       0       0         030       0       0       0       0       0       0       0       0       0       0       0       0         000       0       10       20       3       40       50       60         Remarks:         Sample's supplied by client       * CAl values correct  | Surface Type :  | Smooth   | (Saw Cut) Surface                                  | Wet Density (t/m <sup>3</sup> ) | )           |             | 1.99         | )   |
| Hardness of Tip Used       25 HRC       Hardness of Tip Used       43 HRC       Hardness of Tip Used       53 HRC         Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI         0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00         Linear Relationship between Tip Hardness and CAI         CAI = (0 x HRC) + 0         Average CAIs (HRC55) = 0.48       Corrected for Smooth Saw Out Surface         Classification : Very low abrasiveness         CAI v's Hardness Plot         Line of Best Fit         0.00       0       0       0       0       0       0       0         Official of the structure of the  | RESULTS OF TESTING  |  |  |                                 |             |             |              |   |
| Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI       Average Diameter (mm)       *CAI         0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00         Linear Relationship between Tip Hardness and CAI         CAI = (0 x HRC) + 0         Average CAI <sub>s</sub> (HRC55) = 0.48 Corrected for Smooth Saw Cut Surface         Classification : Very low abrasiveness         CAI v's Hardness Plot         100       0.00       10       0       0       0       0       0       0       0         0.00          | Hardness of Tip Used  | 25 HRC   | Hardness of Tip Used                               | 43 HRC                          | Hardr       | ness of Tir | o Used       | 53 HRC  |
| 0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00         Linear Relationship between Tip Hardness and CAI         CAI = (0 x HRC) + 0         Average CAI <sub>s</sub> (HRC55) = 0.48 Corrected for Smooth Saw Cut Surface         Classification : Very low abrasiveness         CAI v's Hardness Plot         Line of Best Fit         100       20       30         030       0       10       20         Classification : Very low abrasiveness         CAI v's Hardness Plot         Line of Best Fit         100       20       30         030       0       10       20         Cal v's Hardness (HRC)         40       50       60         Remarks:         Sample/s supplied by client       * CAI values corrected for smooth surface.   | Average Diameter (mm)   | *CAI   | Average Diameter (mm)                              | *CAI                            | Averad      | ge Diamet   | er (mm)      | *CAI  |
| Linear Relationship between Tip Hardness and CAI<br>CAI = (0 x HRC) + 0<br>Average CAI <sub>s</sub> (HRC55) = 0.48 Corrected for Smooth Saw Cut Surface<br>Classification : Very low abrasiveness<br>CAI v's Hardness Plot<br>- Test Data Line of Best Fit<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.  |   | 0.00   | 0.00   | 0.00                            |             |             |              | 0.00  |
| Linear Relationship between Tip Hardness and CAI<br>CAI = (0 x HRC) + 0<br>Average CAI <sub>s</sub> (HRC55) = 0.48 corrected for Smooth Saw Cut Surface<br>Classification : Very low abrasiveness<br>CAI v's Hardness Plot<br>100<br>000<br>000<br>000<br>000<br>000<br>000<br>00   | 0.00  | 0.00   | 0.00   | 0.00                            |             | 0.00        |              | 0.00  |
| CAI = (0 x HRC) + 0<br>Average CAI <sub>s</sub> (HRC55) = 0.48 Corrected for Smooth Saw Cut Surface<br>Classification : Very low abrasiveness<br>CAI v's Hardness Plot<br>Une of Best Fit<br>1.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00   | Linear Relationship between Tip Hardness and CAI  |  |  |                                 |             |             |              |   |
| Average CAI <sub>s</sub> (HRC55) = 0.48 Corrected for Smooth Saw Cut Surface<br>Classification : Very low abrasiveness<br>CAI v's Hardness Plot<br>Test Data Uine of Best Fit<br>CAI values of Best Fit<br>CAI values of Best Fit<br>1.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.00<br>0.0  |   |  | CAI =  | ( 0 x HRC ) + 0                 |             |             |              |   |
| Classification : Very low abrasiveness CAI v's Hardness Plot Une of Best Fit Une of Best Fit Geo Geo Geo Geo Geo Geo Geo Geo Geo Geo  | Average CAI <sub>s</sub> (HRC55) = 0.48 Corrected for Smooth Saw Cut Surface                          |  |  |                                 |             |             |              |   |
| CAI v's Hardness Plot<br>Test Data Line of Best Fit<br>CAI v's Hardness Plot<br>Line of Best Fit<br>Line of Best Fit<br>000<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0  |   |  | Classification :                                   | Very low abrasive               | eness       |             |              |   |
| 100     Image: Test Data     Line of Best Fit       090     080       070     060       060     050       060     050       060     040       030     020       010     20       Hardness (HRC)     40       50     60  |   |  | CAI v's Har  | dness Plot                      |             |             |              |   |
| $\begin{array}{c} 0.90\\ 0.80\\ 0.70\\ 0.60\\ 0.50\\ 0.50\\ 0.40\\ 0.30\\ 0.20\\ 0.10\\ 0.00\\ 0\end{array} \qquad 10 \qquad 20 \qquad 40 \qquad 50 \qquad 60 \\ \hline \\ Remarks: \\ \hline \\ \hline \\ \hline \\ Sample/s \ supplied \ by \ client \qquad * CAl \ values \ corrected \ for \ smooth \ surface. \qquad Pag: 1 \ of 2 \qquad REPORT \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ $  | 1.00  |  | Test Data  | —— Line of Best Fi              | it          |             |              | 1   |
| Remarks:<br>Sample/s supplied by client * CAI values corrected for smooth surface.<br>Page: 1 of 2<br>Report<br>Remarks:<br>Sample/s supplied by client * CAI values corrected for smooth surface.<br>Remarks:<br>Sample/s supplied by client * CAI values corrected for smooth surface.  | 0.90  |  |  |                                 |             |             |              |   |
| $\begin{array}{c} 0.70 \\ 0.60 \\ 0.50 \\ 0.40 \\ 0.30 \\ 0.20 \\ 0.10 \\ 0.00 \\ 0 \end{array} \qquad 10 \qquad 20 \qquad \begin{array}{c} 0 \\ Hardness (HRC) \end{array} \qquad 40 \qquad 50 \qquad 60 \end{array}$ Remarks:   Sample/s supplied by client * CAI values corrected for smooth surface. Page: 1 of 2 REPORT  | 0.80  |  |  |                                 |             |             |              |   |
| $\begin{array}{c} & 0.60 \\ \hline \mathbf{S} & 0.50 \\ 0.40 \\ 0.30 \\ 0.20 \\ 0.10 \\ 0.00 \\ 0 \end{array} \qquad 10 \qquad 20 \qquad \begin{array}{c} & \mathbf{Mardness} (HRC) \\ \hline \mathbf{Hardness} (HRC) \end{array} \qquad 40 \qquad 50 \qquad 60 \\ \hline \mathbf{Remarks:} \\ \hline \hline \mathbf{Sample/s \ supplied \ by \ client} \qquad ^{*} CAl \ values \ corrected \ for \ smooth \ surface. \qquad \hline \mathbf{Page: 1 \ of 2}  REPORt \\ \hline \mathbf{Remorks:} \\ \hline \hline \mathbf{Sample/s \ supplied \ by \ client} \qquad ^{*} CAl \ values \ corrected \ for \ smooth \ surface. \qquad \hline \mathbf{Page: 1 \ of 2}  REPORt \\ \hline \hline \mathbf{Remorks:} \\ \hline \hline \hline \mathbf{Sample/s \ supplied \ by \ client} \qquad ^{*} CAl \ values \ corrected \ for \ smooth \ surface. \qquad \hline \hline \hline \mathbf{Remorks:} \\ \hline \hline \hline \hline \hline \mathbf{Sample/s \ supplied \ by \ client} \qquad ^{*} CAl \ values \ corrected \ for \ smooth \ surface. \qquad \hline \hline \hline \hline \mathbf{Sample/s \ supplied \ by \ client} \qquad \mathbf{Sample/s \ by \ client} \qquad \mathbf{Sample/s \ supplied \ by \ client} \qquad \mathbf{Sample/s \ supplied \ by \ client} \qquad \mathbf{Sample/s \ supplied \ by \ client} \qquad \mathbf{Sample/s \ supplied \ by \ client} \qquad \mathbf{Sample/s \ supplied \ by \ client} \qquad \mathbf{Sample/s \ supplied \ by \ client} \qquad \mathbf{Sample/s \ supplied \ by \ client} \qquad \mathbf{Sample/s \ supplied \ by \ client} \qquad \mathbf{Sample/s \ suppli} \qquad Sampl$ | 0.70  |  |  |                                 |             |             |              |   |
| 3       0.50         0.40       0.30         0.20       0.10         0.00       0         10       20         Hardness (HRC)       40         50       60         Remarks:       Sample/s supplied by client         * CAI values corrected for smooth surface.       Page: 1 of 2         REPORT       * CAI values corrected for smooth surface.  | 0.60  |  |  |                                 |             |             |              |   |
| 0.40       0.30       0.20       0.10       0.00       0       10       20       Hardness (HRC)       40       50       60   Remarks:       Sample/s supplied by client       * CAI values corrected for smooth surface.   Page: 1 of 2 REPORT  | <b>3</b> 0.50   |  |  |                                 |             |             |              |   |
| 0.30     0.20       0.10     0.00       0.00     0       10     20       Hardness (HRC)       40       50       60   Remarks:       Sample/s supplied by client     * CAI values corrected for smooth surface.     Page: 1 of 2     REPORT  | 0.40  |  |  |                                 |             |             |              |   |
| 0.10     0.00     0     10     20     30     40     50     60       Remarks:       Sample/s supplied by client     * CAl values corrected for smooth surface.     Page: 1 of 2     REPORT   | 0.30  |  |  |                                 |             |             |              |   |
| 0.00     0     10     20     30     40     50     60       Remarks:       Sample/s supplied by client     * CAI values corrected for smooth surface.     Page: 1 of 2     REPOR   | 0.10  |  |  |                                 |             |             |              |   |
| 0     10     20     30<br>Hardness (HRC)     40     50     60       Remarks:       Sample/s supplied by client     * CAI values corrected for smooth surface.     Page: 1 of 2     REPORT   | 0.00  |  | <b></b>  |                                 |             |             |              |   |
| Remarks:       Sample/s supplied by client     * CAI values corrected for smooth surface.       Page: 1 of 2  | 0   | 10   | 20<br>Hardne                                       | <sup>30</sup><br>ss (HRC)       | 40          |             | 50           | 60  |
| Sample/s supplied by client * CAI values corrected for smooth surface. Page: 1 of 2 REPOR   | Remarks:  |  |  |                                 |             |             |              |   |
|   | Sample/s supplied by client   |  | * CAI values corrected for smoo                    | oth surface.                    |             |             | Page: 1      | of 2 REP06801                                   |
| Accredited for compliance with ISO/IEC 17025 - Iesting.<br>The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.<br>Tested at Trilab Brisbane Laboratory.<br>Laboratory No. 99  | Accredited for complia<br>The results of the tests, calib<br>this document are tracea<br>Tested at Tr | nce with ISO/IEC 17025<br>ations, and/or measure<br>ble to Australian/Nationa<br>lab Brisbane Laboratory | i - Testing.<br>ments included in<br>al Standards. | Authorised S<br>C. Purv         | Bignatory   |             |              | ACCEPTENCE<br>COMPETENCE<br>Laboratory No. 9926 |

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#### **CERCHAR ABRASIVITY INDEX TEST REPORT**

ASTM D7625 - 10 - Standard Test Method for Laboratory Determination of Abrasiveness of Rock Using the Cerchar Method

| Client Gol  | der Associates Pty Lim   | ited  | Report No.     | GA102218-CE  | RC                                       |
|---|--|---|----------------|--------------|--|
|   |  | <b>BEFORE &amp; AFTER PHOT</b>                          | <u>OS</u>      |              |  |
|   |  |   |                |              |  |
|   | CLIENT:  | Golder Associates Pty Limit                             | ed             |              |  |
|   | PROJECT:   | Inland Rail Section 320                                 | BEFORE TEST    |              |  |
|   | LAB SAMPLE No.   | 102218  | DATE: 22/01/19 |              |  |
|   | BOREHOLE:  | 320-01-BH2101   | DEPTH: 105.7   |              |  |
|   |  |   |                |              |  |
|   | CLIENT:<br>PROJECT:  | Golder Associates Pty Limite<br>Inland Rail Section 320 | ed AFTER TEST  | 7            |  |
|   | LAB SAMPLE No.   | 102218  | DATE: Zz/or/m  | -            |  |
|   | BOREHOLE:  | 320-01-BH2101   | DEPTH: 105.7   |              |  |
|   |  |   |                |              |  |
| Remarks:  |  |   |                |              |  |
| Sample/s supplied by clier  | nt   | * CAI values corrected for smooth su                    | rface.         | Page: 2 of 2 | REP06801                                 |
| Accredited for co<br>The results of the tests,<br>this document are t<br>Tested | ompliance with ISO/IEC 17025 - 7<br>, calibrations, and/or measureme<br>traceable to Australian/National S<br>, at Trilab Brisbane Laboratory. | Festing. A<br>nts included in<br>Standards.             | C. Purvis      | Labor        | ACCEPTIFE FOR<br>TECHNICAL<br>COMPETENCE |

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

### Slake Durability

🕓 GOLDER



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|            |  | SLAKE DURABILIT   | Y INDEX TES | ST REPORT   |                     |
|------------|--|---|-------------|-------------|---------------------|
| Cli        | ent  | Golder Associates Pty Limited   |             | Report No.  | GA102178-SD         |
| Ad         | dress  | PO Box 1734 MILTON BC QLD   | 4064        | Request No. | 1893795_TR01        |
|            |  |   |             | Test Date   | 21/01/2019          |
| Pre        | oject  | Inland Rail Section 320   |             | Report Date | 24/01/2019          |
| Pr         | oject No   | 1893795   | Client Sam  | ple No. 320 | )-01-BH2101         |
|            |  |   |             |             |                     |
|            | Sample No.   |   | 102         | 2178        |                     |
|            | BoreHole   |   | 320-01-     | -BH2101     |                     |
|            | Depth From (m)   |   | 7           | 6.5         |                     |
|            | Depth To (m)   |   | 7           | 6.7         |                     |
|            | Description  |   |             | С           |                     |
|            | Slake Durability (   | 1st cycle) (%)  | 9           | 7.5         |                     |
|            | Slake Durability (   | 2nd cycle) (%)  | 9           | 7.3         |                     |
|            | Slake Durability (   | 3rd cycle) (%)  |             | -           |                     |
|            | Slake Durability (   | 4th cycle) (%)  |             | -           |                     |
|            | Water Used   |   | Тар         | Water       |                     |
|            | Temperature (°C)   |   | 2           | 0.3         |                     |
|            | Appearance of frag   | gments retained in the drum   | Origin      | al Form     |                     |
|            | Appearance of frag   | gments passing through the drum   | Fragmen     | its & Fines |                     |
|            |  |   |             |             |                     |
| NOTE       | S/REMARKS:   | ient  |             |             | Dava 4 of 4         |
| Som-       | iers supplied by the Cl  | IGH   |             |             | Page 1 of 1 REP0240 |
| Samp       |  |   |             |             |                     |
| Samp<br>Tł | Accredited for co<br>ne results of the tests,<br>this document are t | mpliance with ISO/IEC 17025 - Testing.<br>calibrations, and/or measurements included in<br>raceable to Australian/National Standards. |             |             |                     |



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|   | SLAKE DURABILIT  | Y INDEX TE<br>od: AS 4133.3.4                   | ST REPORT  |                                    |
|---|--|---|--|------------------------------------|
| Client  | Golder Associates Pty Limited  |   | Report No.   | GA102184-SD                        |
| Address   | PO Box 1734 MILTON BC QLD  | 4064  | Request No.  | 1893795_TR01                       |
|   |  |   | Test Date  | 22/01/2019                         |
| Project   | Inland Rail Section 320  |   | Report Date  | 24/01/2019                         |
| Project No  | 1893795  | Client Sar                                      | nple No. 320   | )-01-BH2101                        |
|   |  |   |  |                                    |
| Sample No.  |  | 1   | 02184  |                                    |
| BoreHole  |  | 320-0   | 1-BH2101   |                                    |
| Depth From (m)  | )  |   | 83.7   |                                    |
| Depth To (m)  |  |   | 83.9   |                                    |
| Description   |  |   | С  |                                    |
| Slake Durabilit   | y (1st cycle) (%)  |   | 80.3   |                                    |
| Slake Durabilit   | y (2nd cycle) (%)  |   | 55.4   |                                    |
| Slake Durabilit   | ty (3rd cycle) (%)   |   | -  |                                    |
| Slake Durabilit   | ty (4th cycle) (%)   |   | -  |                                    |
| Water Used  |  | Та  | p Water  |                                    |
| Temperature (°  | C)   |   | 20.6   |                                    |
| Appearance of   | fragments retained in the drum   | Moderate  | Deterioration  |                                    |
| Appearance of   | fragments passing through the drum   | Fragme  | ents & Fines   |                                    |
|   |  |   |  |                                    |
| NOTES/REMARKS:  | 2 client   |   |  |                                    |
| Accredited for<br>The results of the tes<br>this document a | compliance with ISO/IEC 17025 - Testing.<br>sts, calibrations, and/or measurements included in<br>re traceable to Australian/National Standards. | Authorise                                       | ed Signatory   |                                    |
| Test  | ted at Trilab Brisbane Laboratory.   | C.1   | Purvis   | Laboratory No. 99                  |
| The res   | ults of calibrations and tests performed apply only to the spe<br>Reference should be made to Trilab's "Standard<br>Trilab Phylod                | cific instrument or sar<br>I Terms and Conditio | mple at the time of test unless<br>ns of Business" for further det | otherwise clearly stated.<br>ails. |



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|  | SLAKE DURABILIT  | Y INDEX TI<br>od: AS 4133.3.4 | EST REPORT      |                      |
|--|--|-------------------------------|-----------------|----------------------|
| Client                                     | Golder Associates Pty Limited  |                               | Report No.      | GA102198-SD          |
| Address                                    | PO Box 1734 MILTON BC QLD  | 4064                          | Request No.     | 1893795_TR01         |
|  |  |                               | Test Date       | 22/01/2019           |
| Project                                    | Inland Rail Section 320  |                               | Report Date     | 24/01/2019           |
| Project No                                 | 1893795  | Client Sa                     | mple No. 320-   | 01-BH2101            |
|  |  |                               |                 |                      |
| Sample No.                                 |  |                               | 102198          |                      |
| BoreHole                                   |  | 320-                          | 01-BH2101       |                      |
| Depth From (m                              | )  |                               | 95.73           |                      |
| Depth To (m)                               |  |                               | 96              |                      |
| Description                                |  |                               | С               |                      |
| Slake Durabili                             | ty (1st cycle) (%)   |                               | 87.4            |                      |
| Slake Durabili                             | ty (2nd cycle) (%)   |                               | 69.7            |                      |
| Slake Durabili                             | ty (3rd cycle) (%)   |                               | -               |                      |
| Slake Durabili                             | ty (4th cycle) (%)   |                               | -               |                      |
| Water Used                                 |  | Ta                            | ap Water        |                      |
| Temperature (°                             | C)   |                               | 20.4            |                      |
| Appearance of                              | fragments retained in the drum   | Moderat                       | e Deterioration |                      |
| Appearance of                              | fragments passing through the drum   | Fragm                         | ients & Fines   |                      |
|  |  |                               |                 |                      |
| NOTES/REMARKS:<br>Sample/s supplied by the | e client   |                               |                 | Page 1 of 1 REP02402 |
| The results of the test                    | e compliance with ISO/IEC 17025 - Testing.<br>sts, calibrations, and/or measurements included in<br>re traceable to Australian/National Standards. | Authoris                      |                 |                      |
| Taa  | ted at Trilah Brishane Laboratory  | C.                            | Purvis          | COMPETENCE           |



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| Client  |   | 00. AS 4133.3.4 | 1             |                  |
|---|---|-----------------|---------------|------------------|
|   | Golder Associates Pty Limited   |                 | Report No.    | GA102211-SD      |
| Address   | PO Box 1734 MILTON BC QLD   | 4064            | Request No.   | 1893795_TR01     |
|   |   |                 | Test Date     | 22/01/2019       |
| Project   | Inland Rail Section 320   |                 | Report Date   | 24/01/2019       |
| Project No  | 1893795   | Client San      | nple No. 3    | 20-01-BH2101     |
|   |   |                 | 0044          |                  |
| Sample N  | 0.  | 10              |               |                  |
| BoreHole  |   | 320-0           | 04.5          |                  |
|   | (m)   |                 | 04.5          |                  |
| Depth To  | (m)   | 1               | 04.8          |                  |
| Descriptio  | n   |                 | С             |                  |
| Slake Dur   | rability (1st cycle) (%)  |                 | 59.9          |                  |
| Slake Dur   | rability (2nd cycle) (%)  | · · · ·         | 17.8          |                  |
| Slake Dur   | rability (3rd cycle) (%)  |                 | -             |                  |
| Slake Dur   | rability (4th cycle) (%)  |                 | -             |                  |
| Water Use   | ed  | Tap             | Water         |                  |
| Temperatu   | ure (°C)  |                 | 20.9          |                  |
| Appearant   | ce of fragments retained in the drum  | Moderate        | Deterioration |                  |
| Appearan  | ce of fragments passing through the drum  | Fragme          | nts & Fines   |                  |
|   |   |                 |               |                  |
|   |   |                 |               |                  |
| DTES/REMARKS:   |   |                 |               |                  |
| DTES/REMARKS:   | by the client   |                 |               | Page 1 of 1 REPO |
| <u>ITES/REMARKS:</u><br>mple/s supplied<br>Accredite<br>The results of th<br>this docum | by the client<br>ed for compliance with ISO/IEC 17025 - Testing.<br>he tests, calibrations, and/or measurements included in<br>ient are traceable to Australian/National Standards. | Authorise       | d Signatory   | Page 1 of 1 REPO |



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| Client  |  | 100: AS 4133.3.4 |                 |                   |
|---|--|------------------|-----------------|-------------------|
|   | Golder Associates Pty Limited  |                  | Report No.      | GA102212-SD       |
| Address   | PO Box 1734 MILTON BC QLD  | 4064             | Request No.     | 1893795_TR01      |
|   |  |                  | Test Date       | 22/01/2019        |
| Project   | Inland Rail Section 320  |                  | Report Date     | 24/01/2019        |
| Project No  | 1893795  | Client Sa        | mple No. 320    | D-01-BH2101       |
|   |  |                  |                 |                   |
| Sample No.  |  |                  | 102212          |                   |
| BoreHole  |  | 320-             | 01-BH2101       |                   |
| Depth From (r   | n)   |                  | 104.8           |                   |
| Depth To (m)  |  |                  | 105             |                   |
| Description   |  |                  | С               |                   |
| Slake Durabi  | lity (1st cycle) (%)   |                  | 76.6            |                   |
| Slake Durabi  | lity (2nd cycle) (%)   |                  | 58.5            |                   |
| Slake Durabi  | lity (3rd cycle) (%)   |                  | -               |                   |
| Slake Durabi  | lity (4th cycle) (%)   |                  | -               |                   |
| Water Used  |  | Та               | ap Water        |                   |
| Temperature   | (°C)   |                  | 20.6            |                   |
| Appearance o  | f fragments retained in the drum   | Moderat          | e Deterioration |                   |
| Appearance o  | f fragments passing through the drum   | Fragm            | ents & Fines    |                   |
|   |  |                  |                 |                   |
|   |  |                  |                 |                   |
| OTES/REMARKS:   | ha cliant  |                  |                 | Date 1 of 1       |
| <u>OTES/REMARKS:</u><br>ample/s supplied by t   | he client  |                  |                 | Page 1 of 1 REPO2 |
| <u>DTES/REMARKS:</u><br>ample/s supplied by th<br>Accredited fo<br>The results of the to<br>this document | he client<br>or compliance with ISO/IEC 17025 - Testing.<br>ests, calibrations, and/or measurements included in<br>are traceable to Australian/National Standards. | Authoris         | sed Signatory   | Page 1 of 1 REPOZ |



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|       |  | SLAKE DURABILIT  | Y INDEX TE   | ST REPORT  |   |
|-------|--|--|--|--|---|
| Cli   | ent  | Golder Associates Pty Limited  |  | Report No.   | GA102220-SD                               |
| Ad    | dress  | PO Box 1734 MILTON BC QLD  | 4064   | Request No.  | 1893795_TR01                              |
|       |  |  |  | Test Date  | 23/01/2019                                |
| Pro   | oject  | Inland Rail Section 320  |  | Report Date  | 25/01/2019                                |
| Pro   | oject No   | 1893795  | Client Sa  | mple No.   | 320-01-BH2101                             |
|       |  |  |  |  |   |
|       | Sample No.   |  | 1  | 02220  |   |
|       | BoreHole   |  | 320-0  | )1-BH2101  |   |
|       | Depth From (m)   |  | 1  | 106.05   |   |
|       | Depth To (m)   |  | 1  | 106.22   |   |
|       | Description  |  |  | С  |   |
|       | Slake Durability (1  | st cycle) (%)  |  | 0.1  |   |
|       | Slake Durability (2  | 2nd cycle) (%)   |  | 0.1  |   |
|       | Slake Durability (3  | 3rd cycle) (%)   |  | -  |   |
|       | Slake Durability (4  | Ith cycle) (%)   |  | -  |   |
|       | Water Used   |  | Та   | ıp Water   |   |
|       | Temperature (°C)   |  |  | 29.1   |   |
|       | Appearance of frag   | ments retained in the drum   | High D   | Deterioration  |   |
|       | Appearance of frag   | ments passing through the drum   | Fragm  | ents & Fines   |   |
|       |  |  |  |  |   |
| NOTES | S/REMARKS:   | t  |  |  | David of d                                |
| Sampl |  |  |  | ined Gimer's   | Fage For T REP02402                       |
| Th    | Accredited for cor<br>ne results of the tests,<br>this document are tr | mpliance with ISO/IEC 17025 - Testing.<br>calibrations, and/or measurements included in<br>aceable to Australian/National Standards. | Name   | ised Signatory   | TECHNICAL                                 |
|       | Tested a   | at Trilab Brisbane Laboratory.   | N. N   | naddison   | Laboratory No. 9926                       |
|       | The results  | of calibrations and tests performed apply only to the spe<br>Reference should be made to Trilab's "Standard<br>Trilab Pty I td       | cific instrument or sa<br>I Terms and Conditio<br>ABN 25 065 630 506 | mple at the time of test unl<br>ons of Business" for further | ess otherwise clearly stated.<br>details. |



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|       |   | SLAKE DURABILIT  | Y INDEX TES  | ST REPORT   |   |
|-------|---|--|--|---|---|
| Cli   | ent   | Golder Associates Pty Limited  |  | Report No.  | GA102240-SD                                     |
| Ad    | dress   | PO Box 1734 MILTON BC QLD  | 4064   | Request No.                                       | 1893795_TR01                                    |
|       |   |  |  | Test Date   | 23/01/2019                                      |
| Pro   | oject   | Inland Rail Section 320  |  | Report Date                                       | 25/01/2019                                      |
| Pro   | oject No  | 1893795  | Client Sam   | ple No.   | 320-01-BH2101                                   |
|       |   |  |  |   |   |
|       | Sample No.  |  | 102  | 2240  |   |
|       | BoreHole  |  | 320-01-  | BH2101  |   |
|       | Depth From (m)  |  | 12   | 8.3   |   |
|       | Depth To (m)  |  | 128  | 3.44  |   |
|       | Description   |  |  | С   |   |
|       | Slake Durability (1   | st cycle) (%)  | 8  | 8.7   |   |
|       | Slake Durability (2   | nd cycle) (%)  | 8  | 0.8   |   |
|       | Slake Durability (3   | rd cycle) (%)  |  | -   |   |
|       | Slake Durability (4   | th cycle) (%)  |  | -   |   |
|       | Water Used  |  | Тар  | Water   |   |
|       | Temperature (°C)  |  | 2  | 9.1   |   |
|       | Appearance of frag  | ments retained in the drum   | Slight De  | terioration                                       |   |
|       | Appearance of frag  | ments passing through the drum   | Fragmen  | ts & Fines  |   |
|       |   |  |  |   |   |
| NOTES | S/REMARKS:  | ant  |  |   |   |
| Janp  |   |  | A.ithar!   | d Signatory                                       |   |
| Tł    | Accredited for cor<br>ne results of the tests, o<br>this document are tra | npliance with ISO/IEC 17025 - Testing.<br>calibrations, and/or measurements included in<br>aceable to Australian/National Standards. | NaMeli   |   | TECHNICAL                                       |
|       | Tested a  | at Trilab Brisbane Laboratory.   | N. Ma  | ddison  | Laboratory No. 9926                             |
|       | The results   | of calibrations and tests performed apply only to the spe<br>Reference should be made to Trilab's "Standard<br>Trilab Ptv I td       | cific instrument or samp<br>I Terms and Conditions<br>ABN 25 065 630 506 | ble at the time of test us of Business" for furth | unless otherwise clearly stated.<br>er details. |







| : 1 of 2  |
|---|
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| : Customer Services EB  |
| : 2 Byth Street Stafford QLD Aus  |
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| : +61-7-3243 7222   |
| Received : 21-Nov-2018 12:00  |
| Commenced : 23-Nov-2018   |
| : 28-Nov-2018 14:24   |
|   |
|   |
|   |
|   |
|   |
| <ul> <li>1 of 2</li> <li>Environmental Division Bris</li> <li>Customer Services EB</li> <li>2 Byth Street Stafford QLD</li> <li>+61-7-3243 7222</li> <li>Received</li> <li>21-Nov-2018 12:00</li> <li>Commenced</li> <li>23-Nov-2018 14:24</li> </ul> |

This Certificate of Analysis contains the following information:

- **General Comments**
- Analytical Results

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

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

| Signatories | Position                 | Accreditation Category                      |
|-------------|--------------------------|---|
| Diana Mesa  | 2IC Organic Chemist      | Brisbane Inorganics, Stafford, QLD          |
| Kim McCabe  | Senior Inorganic Chemist | Brisbane Acid Sulphate Soils, Stafford, QLD |
| Kim McCabe  | Senior Inorganic Chemist | Brisbane Inorganics, Stafford, QLD          |
|             |                          |   |

|                | on 320 |
|----------------|--------|
| published by t |        |
| the USEPA,     |        |
| APHA, AS       |        |
| and NEPM       |        |
| . In house     |        |

Project Client Work Order Page : 2 of 2 : EB1828518 : TRILAB PTY LTD : 1893795 - Inland Rail Se

# **General Comments**

developed procedures are employed in the absence of c The analytical procedures used by the Environm or by client leque

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

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

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

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

purposes.

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

- Key : -CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
- LOR = Limit of reporting
- \* = This result is computed from individual analyte detections at or above the level of reporting
- ø = ALS is not NATA accredited for these tests
- $\sim$  = Indicates an estimated value.
- CORROSION ASSESSMENT: As per Australian Standard (AS2159-1995, section 6), the Exposure Classification for all samples is rated as Non Aggressive. ALS is not NATA accredited for this comment.

## Analytical Results

| Sub-Matrix: SOIL                          |            | Clie        | int sample ID | 101183 /            | 101189 /            | 101199 /            | 101208 /            | ł |
|---|------------|-------------|---------------|---------------------|---------------------|---------------------|---------------------|---|
| (Matrix: SOIL)                            |            |             |               | 320-01-BH2201-S0050 | 320-01-BH2209-S0020 | 320-01-BH2212-S0035 | 320-01-BH2218-S0050 |   |
|   |            |             |               | 0 / 5.00-5.20m      | 0 / 2.00-2.45m      | 0 / 3.50-3.95m      | 0 / 5.00-5.41m      |   |
|   | Clie       | ent samplin | ıg date∕time  | [20-Nov-2018]       | [20-Nov-2018]       | [20-Nov-2018]       | [20-Nov-2018]       |   |
| Compound                                  | CAS Number | LOR         | Unit          | EB1828518-001       | EB1828518-002       | EB1828518-003       | EB1828518-004       |   |
|   |            |             |               | Result              | Result              | Result              | Result              |   |
| EA002: pH 1:5 (Soils)                     |            |             |               |                     |                     |                     |                     |   |
| pH Value                                  |            | 0.1         | pH Unit       | 8.7                 | 9.0                 | 6.4                 | 9.5                 |   |
| EA055: Moisture Content (Dried @ 105-110° | <u>c</u>   |             |               |                     |                     |                     |                     |   |
| Moisture Content                          |            | 1.0         | %             | 12.6                | 15.9                | 14.6                | 10.9                | - |
| ED040S : Soluble Sulfate by ICPAES        |            |             |               |                     |                     |                     |                     |   |
| Sulfate as SO4 2-                         | 14808-79-8 | 10          | mg/kg         | 30                  | 20                  | 10                  | 10                  |   |
| ED045G: Chloride by Discrete Analyser     |            |             |               |                     |                     |                     |                     |   |
| Chloride                                  | 16887-00-6 | 10          | mg/kg         | 780                 | 310                 | <10                 | 110                 | I |



|                          | CERTIFICATE                         | OF ANALYSIS                  |  |                                |
|--------------------------|-------------------------------------|------------------------------|--|--------------------------------|
| Nork Order               | : EB1902048                         | Page                         | : 1 of 2   |                                |
| Client                   | : TRILAB PTY LTD                    | Laboratory                   | : Environmental Division Brisbane  |                                |
| Contact                  | : THE ADMIN RESULTS                 | Contact                      | : Customer Services EB   |                                |
| Address                  | : 346A BILSEN RD                    | Address                      | : 2 Byth Street Stafford QLD Australia   | a 4053                         |
|                          | GEEBUNG QLD, AUSTRALIA 4031         |                              |  |                                |
| <b>Felephone</b>         | : +61 07 3265 5656                  | Telephone                    | : +61-7-3243 7222  |                                |
| <sup>o</sup> roject      | : 1893795 - Inland Rail Section 320 | Date Samples Received        | : 25-Jan-2019 13:01  | ANTIPER.                       |
| Order number             | : BNE 1901037                       | Date Analysis Commenced      | : 29-Jan-2019  | Contraction                    |
| C-O-C number             |                                     | Issue Date                   | : 04-Feb-2019 10:25  |                                |
| Sampler                  |                                     |                              |  | 市連条                            |
| Site                     |                                     |                              | in the second  |                                |
| Quote number             | : EN/333                            |                              | in the second se | Arrentizion No 200             |
| No. of samples received  | <br>СЛ                              |                              |  | Accredited for compliance with |
| No. of samples analysed  | :5                                  |                              |  | ISO/IEC 17025 - Testing        |
| This report supersedes a |                                     | submitted. This document sha | all not be reproduced, except in full.   |                                |

This Certificate of Analysis contains the following information:

- **General Comments**
- Analytical Results

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

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

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

| Project                             | Client           | Work Order  | Page     |
|-------------------------------------|------------------|-------------|----------|
| : 1893795 - Inland Rail Section 320 | : TRILAB PTY LTD | : EB1902048 | : 2 of 2 |

# **General Comments**

developed procedures are employed in the absence of documented standards or by client request. -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

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

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

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

purposes. -

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

- Key : -CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
- LOR = Limit of reporting
- ^ = This result is computed from individual analyte detections at or above the level of reporting
- ø = ALS is not NATA accredited for these tests
- ~ = Indicates an estimated value.
- CORROSION ASSESSMENT: As per Australian Standard (AS2159-1995, section 6), the Exposure Classification for all samples is rated Mild to Non Aggressive. ALS is not NATA accredited for this comment.

## **Analytical Results**

| Sub-Matrix: SOIL                            |        | Clien       | t sample ID   | 102094 /            | 102097 /            | 102108 /            | 102118 /            | 102128 /            |
|---|--------|-------------|---------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| (Matrix: SOIL)                              |        |             |               | 320-01-BH2203-S0035 | 320-01-BH2203-S0080 | 320-01-BH2207-S0050 | 320-01-BH2215-S0035 | 320-01-BH2216-S0028 |
|   |        |             |               | 0 / 3.50-3.95m      | 0 / 8.00-8.10m      | 0 / 5.00-5.45m      | 0 / 3.50-3.77m      | 0 / 2.80-2.92m      |
|   | Clien  | it sampling | t date ∕ time | 24-Jan-2019 00:00   | 24-Jan-2019 00:00   | 24-Jan-2019 00:00   | 24-Jan-2019 00:00   | 24-Jan-2019 00:00   |
| Compound CAS N                              | umber  | LOR         | Unit          | EB1902048-001       | EB1902048-002       | EB1902048-003       | EB1902048-004       | EB1902048-005       |
|   |        |             |               | Result              | Result              | Result              | Result              | Result              |
| EA002: pH 1:5 (Soils)                       |        |             |               |                     |                     |                     |                     |                     |
| pH Value                                    | -      | 0.1         | pH Unit       | 8.0                 | 8.2                 | 7.3                 | 5.2                 | 9.8                 |
| EA055: Moisture Content (Dried @ 105-110°C) |        |             |               |                     |                     |                     |                     |                     |
| Moisture Content                            | -      | 1.0         | %             | 15.1                | 22.0                | 16.8                | 12.5                | 6.2                 |
| ED040S : Soluble Sulfate by ICPAES          |        |             |               |                     |                     |                     |                     |                     |
| Sulfate as SO4 2- 1480                      | 8-79-8 | 10          | mg/kg         | 20                  | <10                 | <10                 | 70                  | 40                  |
| ED045G: Chloride by Discrete Analyser       |        |             |               |                     |                     |                     |                     |                     |
| Chloride 1688                               | 7-00-6 | 10          | mg/kg         | 220                 | 240                 | <10                 | 160                 | 120                 |

# APPENDIX

## Geotechnical

## Appendix E Hydraulic testing results

**GOWRIE TO HELIDON** ENVIRONMENTAL IMPACT STATEMENT

| Golde             | er<br>ates    |        |                        | ١          | WATER PRES     | SURE TE          | ST (5 Stage)            |                           |             | <b>D</b> '         | aion Ma                | 40           |
|-------------------|---------------|--------|------------------------|------------|----------------|------------------|-------------------------|---------------------------|-------------|--------------------|------------------------|--------------|
| Job Nº ·          | 1893795       |        | Hole № ·               | BH2101     | г              | Drilling Method  | HQ                      | Vertical depth            | Immedia     | tely prior to test | sion N° :<br>(m bal) : | 18<br>63.44  |
| Client :          | FFJV          |        | Dip (Deg) :            | -90        | Hole           | e Diameter (m) : | 0.096                   | to                        | l           | Jsed in analysis   | (m bgl) :              | 63.44        |
| Proiect :         | Inland Rail   |        | DH Interval Top (m) :  | 94.00      | Downhole Te    | sted Length (m): | 5.00                    | Groundwater               | Pressur     | e Gauge Height     | (m aql) :              | 0.00         |
| Location :        | 320-01-BH2101 |        | DH Interval Base (m) : | 99.00      | Packer Type:   | Pne              | umatic - Wireline - D   | ouble                     | Presum      | ed Water Tempe     | erature :              | 26           |
| Tested By :       | SK            |        | Computed By :          | SK         | Rock tested :  |                  |                         |                           | Casir       | ng Inner Diamete   | er (mm) ·              | 77 80        |
| Date ·            | 20/08/2001    |        | Date :                 | 26/08/2018 | Water N        | leter Reading in | Litres                  | Checked By :              | Guon        |                    | Date ·                 | 11.00        |
| Duic .            | 20/00/2001    |        | Bute :                 | Actual     | Time           | Water Meter Re   | eadings                 | Volume                    | Discharge   | Discharge/m        | Dute :                 |              |
| Pressure<br>Stage | Gauge Pr      | essure | No                     | Time       | Intervals      | Reading          |                         | (L)                       | (L/min)     | (L/min/m)          |                        | Remarks      |
| 9-                | kPa           | 1      | 0                      | (h:m:s)    | (min)          | (Litres)         |                         | 0.00                      | 0.00        | 0.00               | с:                     | ·            |
|                   |               |        | 1                      | 8:49:00    | 01:00          | 10795.0          |                         | 3.00                      | 3.00        | 0.60               | 1                      |              |
|                   |               |        | 2                      | 8:50:00    | 01:00          | 10798.0          |                         | 3.00                      | 3.00        | 0.60               |                        |              |
|                   |               |        | 3                      | 8:51:00    | 01:00          | 10801.0          |                         | 3.00                      | 3.00        | 0.60               | -                      |              |
| P1                | 200           | )      | 5                      | 8:53:00    | 01:00          | 10805.0          |                         | 2.00                      | 2.00        | 0.40               |                        |              |
|                   |               |        | 6                      | 8:54:00    | 01:00          | 10808.0          |                         | 3.00                      | 3.00        | 0.60               | -                      |              |
|                   |               |        | 8                      | 8:55:00    | 01:00          | 10810.0          |                         | 2.00                      | 2.00        | 0.40               | -                      |              |
|                   |               |        | 9                      | 8:57:00    | 01:00          | 10818.0          |                         | 4.00                      | 4.00        | 0.80               |                        |              |
|                   |               |        | 10                     | 8:58:00    | 01:00          | 10823.0          |                         | 5.00                      | 5.00        | 1.00               |                        |              |
|                   |               |        |                        |            |                |                  |                         | Total :<br>Average:       | 31.00       | 6.20               | Start Da               | ate & Time : |
|                   |               |        | 0                      | 8:58:00    | 0              | 10823.0          |                         | 0.00                      | 0.00        | 0.020              | с:                     |              |
|                   |               |        | 1                      | 8:59:00    | 01:00          | 10829.0          |                         | 6.00                      | 6.00        | 1.20               | -                      |              |
|                   |               |        | 3                      | 9:00:00    | 01:00          | 10835.0          |                         | 6.00                      | 6.00        | 1.20               | -                      |              |
|                   |               |        | 4                      | 9:02:00    | 01:00          | 10846.0          |                         | 5.00                      | 5.00        | 1.00               |                        |              |
| P2                | 300           | )      | 5                      | 9:03:00    | 01:00          | 10855.0          |                         | 9.00                      | 9.00        | 1.80               | -                      |              |
|                   |               |        | 6                      | 9:04:00    | 01:00          | 10858.0          |                         | 4.00                      | 4.00        | 0.60               | -                      |              |
|                   |               |        | 8                      | 9:06:00    | 01:00          | 10869.0          |                         | 7.00                      | 7.00        | 1.40               |                        |              |
|                   |               |        | 9                      | 9:07:00    | 01:00          | 10875.0          |                         | 6.00                      | 6.00        | 1.20               | -                      |              |
|                   |               |        | 10                     | 9.00.00    | 01.00          | 10662.0          |                         | Total :                   | 59.00       | 11.80              | -                      |              |
|                   |               |        |                        | 0.00.00    | 0              | 10000 0          |                         | Average:                  | 5.900       | 1.180              |                        |              |
|                   |               |        | 1                      | 9:08:00    | 01:00          | 10882.0          |                         | 7.00                      | 7.00        | 0.00               | C:                     |              |
|                   |               |        | 2                      | 9:10:00    | 01:00          | 10895.0          |                         | 6.00                      | 6.00        | 1.20               |                        |              |
|                   |               |        | 3                      | 9:11:00    | 01:00          | 10902.0          |                         | 7.00                      | 7.00        | 1.40               | -                      |              |
| P3                | 400           | )      | 5                      | 9:12:00    | 01:00          | 10909.0          |                         | 7.00                      | 7.00        | 1.40               | -                      |              |
|                   |               |        | 6                      | 9:14:00    | 01:00          | 10923.0          |                         | 7.00                      | 7.00        | 1.40               | 1                      |              |
|                   |               |        | 7                      | 9:15:00    | 01:00          | 10929.0          |                         | 6.00                      | 6.00        | 1.20               | -                      |              |
|                   |               |        | 9                      | 9:17:00    | 01:00          | 10930.0          |                         | 8.00                      | 8.00        | 1.60               | 1                      |              |
|                   |               |        | 10                     | 9:18:00    | 01:00          | 10952.0          |                         | 8.00                      | 8.00        | 1.60               |                        |              |
|                   |               |        |                        |            |                |                  |                         | Total :                   | 70.00       | 14.00              | -                      |              |
|                   |               |        | 0                      | 9:18:00    | 0              | 10952.0          |                         | 0.00                      | 0.00        | 0.00               | с:                     | ,            |
|                   |               |        | 1                      | 9:19:00    | 01:00          | 10961.0          |                         | 9.00                      | 9.00        | 1.80               | 1                      |              |
|                   |               |        | 2                      | 9:20:00    | 01:00          | 10966.0          |                         | 5.00                      | 5.00        | 1.00               | -                      |              |
|                   |               |        | 4                      | 9:22:00    | 01:00          | 10973.0          |                         | 6.00                      | 6.00        | 1.40               | -                      |              |
| P4                | 300           | )      | 5                      | 9:23:00    | 01:00          | 10986.0          |                         | 7.00                      | 7.00        | 1.40               | 1                      |              |
|                   |               |        | 6                      | 9:24:00    | 01:00          | 10992.0          |                         | 6.00                      | 6.00        | 1.20               | -                      |              |
|                   |               |        | 8                      | 9:26:00    | 01:00          | 11004.0          |                         | 6.00                      | 6.00        | 1.20               | -                      |              |
|                   |               |        | 9                      | 9:27:00    | 01:00          | 11010.0          |                         | 6.00                      | 6.00        | 1.20               |                        |              |
|                   |               |        | 10                     | 9:28:00    | 01:00          | 11016.0          |                         | 6.00                      | 6.00        | 1.20               | -                      |              |
|                   |               |        |                        |            |                |                  |                         | Average:                  | 6.400       | 1.280              | -                      |              |
|                   |               |        | 0                      | 9:28:00    | 0              | 11016.0          |                         | 0.00                      | 0.00        | 0.00               | с:                     |              |
|                   |               |        | 2                      | 9:29:00    | 01:00          | 11020.0          |                         | 4.00                      | 4.00        | 0.80               | -                      |              |
|                   |               |        | 3                      | 9:31:00    | 01:00          | 11030.0          |                         | 5.00                      | 5.00        | 1.00               | 1                      |              |
| DE                |               |        | 4                      | 9:32:00    | 01:00          | 11035.0          |                         | 5.00                      | 5.00        | 1.00               | -                      |              |
| 25                |               |        | 5                      | 9:33:00    | 01:00          | 11040.0          |                         | 5.00                      | 5.00        | 1.00               | 4                      |              |
|                   |               |        | 7                      | 9:35:00    | 01:00          | 11049.0          |                         | 4.00                      | 4.00        | 0.80               | 1                      |              |
|                   |               |        | 8                      | 9:36:00    | 01:00          | 11053.0          |                         | 4.00                      | 4.00        | 0.80               | -                      |              |
|                   |               |        | 10                     | 9:38:00    | 01:00          | 11061.0          |                         | 4.00                      | 4.00        | 0.80               | -                      |              |
|                   |               |        |                        |            |                |                  |                         | Total :                   | 45.00       | 9.00               | Finish Da              | ate & Time : |
|                   |               |        |                        |            |                |                  |                         | Average:                  | 4.500       | 0.900              |                        |              |
| TEST RESU         | JLTS          |        |                        |            | ·              |                  |                         |                           |             |                    |                        |              |
| Stage No.         | Lugeon (1933) | L      | ugeon Value Curve      | 9          | Nett Pressures |                  | Pressure Vs Flow        | ,                         | Interpreted | Result & Hydra     | ulic Con               | ductivity    |
| _                 | value         |        |                        |            |                |                  |                         |                           | -           | -                  |                        | -            |
|                   |               |        | Lugeon Value           |            |                | 0.50400          | Interval Pressure (kPa) | 7 - M O M = M O M = M O O |             |                    |                        |              |



| ient              |                 |                    |          | F              | Project          |                  |                |               |                    | Project N              | lumber      |
|-------------------|-----------------|--------------------|----------|----------------|------------------|------------------|----------------|---------------|--------------------|------------------------|-------------|
| A G               | older           |                    | N        | WATER PRES     | SURE TE          | ST (5 Stage)     |                |               |                    |                        |             |
| Ass               | sociates        |                    | DUD404   | -              | rilling Math     |                  | Vertical depth | المرجم معاجبا | Revis              | sion Nº :              | 18          |
| JOD IN° :         | 1893795<br>EEN/ | Hole N° :          | BH2101   | L              | Diameter (m)     |                  | to             | Immedia       | tely prior to test | (m bgi) :<br>(m bgi) : | 62.18       |
| Droigot :         | . FFJV          | Dip (Deg) :        | -90      |                | Diameter (m)     | 0.096            | Groundwater    | Proseur       |                    | (m  od):               | 0.00        |
|                   |                 |                    | 103.00   | Downhole Tes   |                  | 4.00             | oublo          | Presum        | e Gauge Height     | (iii agi) .            | 0.00        |
| Location :        | . 320-01-ВП2101 | Computed By:       | 107.00   | Packer Type.   | FIE              |                  | Juble          | Casir         | eu water Tempe     | r (mm) :               | 20          |
| Dete :            | 17/08/2001      | Computed By :      | 3N       | Notor Mator M  | latar Deading in | Litroo           | Checked By J   | Casil         |                    |                        | 77.00       |
| Date :            |                 | Date :             | Actual   | Time           | Water Meter Re   | eadings          | Volume         | Discharge     | Discharge/m        | Date :                 |             |
| Pressure<br>Stage | Gauge Pressure  | No                 | Time     | Intervals      | Reading          | Jaamgo           | (L)            | (L/min)       | (L/min/m)          | I                      | Remarks     |
| Olage             | kPa             | 0                  | (h:m:s)  | (min)          | (Litres)         |                  | 0.00           | 0.00          | 0.00               | c:                     |             |
|                   |                 | 1                  | 10:08:00 | 01:00          | 7190.0           |                  | 0.00           | 0.00          | 0.00               | -                      |             |
|                   |                 | 2                  | 10:10:00 | 01:00          | 7192.0           |                  | 2.00           | 2.00          | 0.50               |                        |             |
|                   |                 | 3                  | 10:11:00 | 01:00          | 7192.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
| P1                | 200             | 5                  | 10:12:00 | 01:00          | 7192.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
|                   |                 | 6                  | 10:14:00 | 01:00          | 7192.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
|                   |                 | 7                  | 10:15:00 | 01:00          | 7192.0           |                  | 0.00           | 0.00          | 0.00               | -                      |             |
|                   |                 | 9                  | 10:17:00 | 01:00          | 7193.0           |                  | 0.00           | 0.00          | 0.00               | -                      |             |
|                   |                 | 10                 | 10:18:00 | 01:00          | 7193.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
|                   |                 |                    |          |                |                  |                  | Total :        | 3.00          | 0.75               | Start Dat              | te & Time : |
|                   |                 | 0                  | 10:18:00 | 0              | 7193.0           |                  | 0.00           | 0.00          | 0.075              | с:                     |             |
|                   |                 | 1                  | 10:19:00 | 01:00          | 7194.0           |                  | 1.00           | 1.00          | 0.25               | 1                      |             |
|                   |                 | 2                  | 10:20:00 | 01:00          | 7195.0           |                  | 1.00           | 1.00          | 0.25               | -                      |             |
|                   |                 | 4                  | 10:21:00 | 01:00          | 7195.0           |                  | 0.00           | 0.00          | 0.00               | -                      |             |
| P2                | 300             | 5                  | 10:23:00 | 01:00          | 7196.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
|                   |                 | 6                  | 10:24:00 | 01:00          | 7197.0           |                  | 1.00           | 1.00          | 0.25               | -                      |             |
|                   |                 | / 8                | 10:25:00 | 01:00          | 7197.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
|                   |                 | 9                  | 10:27:00 | 01:00          | 7198.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
|                   |                 | 10                 | 10:28:00 | 01:00          | 7199.0           |                  | 1.00           | 1.00          | 0.25               | -                      |             |
|                   |                 |                    |          |                |                  |                  | Average:       | 0.600         | 0.150              | -                      |             |
|                   |                 | 0                  | 10:29:00 | 0              | 7199.0           |                  | 0.00           | 0.00          | 0.00               | c:                     |             |
|                   |                 | 1                  | 10:30:00 | 01:00          | 7200.0           |                  | 1.00           | 1.00          | 0.25               | -                      |             |
|                   |                 | 3                  | 10:32:00 | 01:00          | 7201.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
| 50                | 100             | 4                  | 10:33:00 | 01:00          | 7202.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
| P3                | 400             | 5                  | 10:34:00 | 01:00          | 7202.0           |                  | 0.00           | 0.00          | 0.00               | -                      |             |
|                   |                 | 7                  | 10:36:00 | 01:00          | 7204.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
|                   |                 | 8                  | 10:37:00 | 01:00          | 7205.0           |                  | 1.00           | 1.00          | 0.25               | -                      |             |
|                   |                 | 9                  | 10:38:00 | 01:00          | 7206.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
|                   |                 | 10                 | 10.00.00 | 01.00          | 1201.0           |                  | Total :        | 8.00          | 2.00               |                        |             |
|                   |                 | -                  |          | _              |                  |                  | Average:       | 0.800         | 0.200              |                        |             |
|                   |                 | 0                  | 10:39:00 | 0              | 7207.0           |                  | 0.00           | 0.00          | 0.00               | с:                     |             |
|                   |                 | 2                  | 10:41:00 | 01:00          | 7207.0           |                  | 0.00           | 0.00          | 0.00               | -                      |             |
|                   |                 | 3                  | 10:42:00 | 01:00          | 7207.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
| P4                | 300             | 4                  | 10:43:00 | 01:00          | 7208.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
| . 4               | 000             | 6                  | 10:45:00 | 01:00          | 7209.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
|                   |                 | 7                  | 10:46:00 | 01:00          | 7209.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
|                   |                 | 8                  | 10:47:00 | 01:00          | 7210.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
|                   |                 | 10                 | 10:49:00 | 01:00          | 7211.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
|                   |                 |                    |          | -              |                  |                  | Total :        | 4.00          | 1.00               |                        |             |
|                   |                 | 0                  | 10.40.00 | 0              | 7211.0           |                  | Average:       | 0.400         | 0.100              | c :                    |             |
|                   |                 | 1                  | 10:50:00 | 01:00          | 7211.0           |                  | 0.00           | 0.00          | 0.00               | <u>.</u>               |             |
|                   |                 | 2                  | 10:51:00 | 01:00          | 7211.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
|                   |                 | 3                  | 10:52:00 | 01:00          | 7211.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
| P5                |                 | 5                  | 10:54:00 | 01:00          | 7212.0           |                  | 0.00           | 0.00          | 0.20               |                        |             |
|                   |                 | 6                  | 10:55:00 | 01:00          | 7212.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
|                   |                 | 7                  | 10:56:00 | 01:00          | 7213.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
|                   |                 | 9                  | 10:58:00 | 01:00          | 7214.0           |                  | 1.00           | 1.00          | 0.25               |                        |             |
|                   |                 | 10                 | 10:59:00 | 01:00          | 7214.0           |                  | 0.00           | 0.00          | 0.00               |                        |             |
|                   |                 |                    |          |                |                  |                  | Total :        | 3.00          | 0.75               | Finish Dat             | te & Time : |
| ERT DECI          |                 |                    |          |                |                  |                  | Average.       | 0.300         | 0.075              |                        |             |
| ESTRES            |                 |                    |          |                | T                |                  |                |               |                    |                        |             |
| Stage No.         | Lugeon (1933)   | Lugeon Value Curve | e        | Nett Pressures |                  | Pressure Vs Flow |                | Interpreted   | Result & Hvdra     | ulic Cond              | ductivitv   |
































# APPENDIX

### Geotechnical

## Appendix F Slug testing results

**GOWRIE TO HELIDON** ENVIRONMENTAL IMPACT STATEMENT











































# APPENDIX

### Geotechnical

## **Appendix G** Vibrating wire piezometer calibration sheets

**GOWRIE TO HELIDON** ENVIRONMENTAL IMPACT STATEMENT

#### SLOPE INDICATOR

#### VW Piezometer Calibration Certificate

Serial #: 1803844 Range : 3500 kPa Cable Length: 140 m Date of Calibration: 11/14/2018 Part #: 52611050 Cable Part #: 50613824 Calibrated by: KB Note:

ABC Calibration Factors

|     | A            | в            | C           |
|-----|--------------|--------------|-------------|
| kPa | -6.044013E-4 | -9.569014E-1 | 8.311351E+3 |
| psi | -8.766100E-5 | -1.387868E-1 | 1.205460E+3 |

Pressure in kPa/psi =  $(A \times Hz^2) + (B \times Hz) + C$ , where Hz is frequency in Hertz.

#### **TI** Calibration Factors

|          | CO                  | C1                | C2                       | C3                | C4                     | C5           |
|----------|---------------------|-------------------|--------------------------|-------------------|------------------------|--------------|
| kPa      | 8.296855E+3         | -9.511214E-1      | 6.037635E-1              | -6.055243E-4      | 6.070409E-6            | -9.885988E-3 |
| psi      | 1.203315E+3         | -1.379436E-1      | 8.756541E-2              | -8.782078E-5      | 8.804074E-7            | -1.433791E-3 |
| Pressure | e in kPa/psi = C0 + | (C1 x Hz) + (C2 > | $(T) + (C3 \times Hz^2)$ | + (C4 x Hz x T) + | (C5 x T <sup>2</sup> ) |              |

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C. TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.

Applied pressure and temperature are NIST traceable.

#### Summary of Test Results at 15°C

Thermistor reading is 15.2 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

| Applied | Equivalent | Frequency | Calcu  | lated  | Error |
|---------|------------|-----------|--------|--------|-------|
| (kPa)   | (psi)      | (Hz)      | (kPa)  | (psi)  | (%FS) |
| 0.0     | 0.00       | 2999.9    | 1.5    | 0.22   | -0.04 |
| 350.0   | 50.76      | 2922.8    | 351.3  | 50.95  | -0.04 |
| 700.0   | 101.53     | 2844.6    | 698.7  | 101.34 | 0.04  |
| 1050.0  | 152.29     | 2764.3    | 1047.7 | 151.96 | 0.06  |
| 1400.0  | 203.05     | 2681.8    | 1398.2 | 202.80 | 0.05  |
| 1750.0  | 253.82     | 2597.1    | 1749.5 | 253.75 | 0.01  |
| 2100.0  | 304.58     | 2510.2    | 2100.9 | 304.72 | -0.03 |
| 2450.0  | 355.34     | 2421.1    | 2451.8 | 355.60 | -0.05 |
| 2800.0  | 406.11     | 2329.6    | 2802.1 | 406.40 | -0.06 |
| 3150.0  | 456.87     | 2235.6    | 3151.4 | 457.07 | -0.04 |
| 3500.0  | 507.63     | 2139.5    | 3497.4 | 507.26 | 0.07  |

SLOPE INDICATOR

#### VW Piezometer Calibration Certificate

 Serial #: 1803845
 Part #: 52611050

 Range : 3500 kPa
 Cable Part #: 50613824

 Cable Length: 280 m
 Calibrated by: KB

 Date of Calibration: 11/14/2018
 Note:

ABC Calibration Factors

|     | A            | в           | C           |
|-----|--------------|-------------|-------------|
| kPa | -8.314060E-4 | 4.733899E-1 | 5.682691E+3 |
| psi | -1.205853E-4 | 6.865940E-2 | 8.242047E+2 |

Pressure in kPa/psi =  $(A \times Hz^2) + (B \times Hz) + C$ , where Hz is frequency in Hertz.

**TI** Calibration Factors

|          | CO                  | C1                | C2                             | C3                | C4                     | C5           |
|----------|---------------------|-------------------|--------------------------------|-------------------|------------------------|--------------|
| kPa      | 5.676418E+3         | 4.702452E-1       | 8.042299E-1                    | -8.306168E-4      | -3.364994E-5           | -7.939171E-3 |
| psi      | 8.232658E+2         | 6.820090E-2       | 1.166396E-1                    | -1.204665E-4      | -4.880339E-6           | -1.151439E-3 |
| Pressure | e in kPa/psi = C0 + | (C1 x Hz) + (C2 ) | x T) + (C3 x Hz <sup>2</sup> ) | + (C4 x Hz x T) + | (C5 x T <sup>2</sup> ) |              |

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C. TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C. Applied pressure and temperature are NIST traceable.

#### Summary of Test Results at 15°C

Thermistor reading is 15.3 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

| Applied | Equivalent | Frequency | Calcu  | lated  | Error |
|---------|------------|-----------|--------|--------|-------|
| (kPa)   | (psi)      | (Hz)      | (kPa)  | (psi)  | (%FS) |
| 0.0     | 0.00       | 2914.6    | -0.3   | -0.04  | 0.01  |
| 350.0   | 50.76      | 2833.0    | 351.0  | 50.91  | -0.03 |
| 700.0   | 101.53     | 2749.3    | 699.9  | 101.51 | 0.00  |
| 1050.0  | 152.29     | 2662.5    | 1049.3 | 152.19 | 0.02  |
| 1400.0  | 203.05     | 2572.3    | 1399.2 | 202.94 | 0.02  |
| 1750.0  | 253.82     | 2478.2    | 1749.8 | 253.79 | 0.01  |
| 2100.0  | 304.58     | 2380.0    | 2099.9 | 304.57 | 0.00  |
| 2450.0  | 355.34     | 2276.9    | 2450.3 | 355.39 | -0.01 |
| 2800.0  | 406.11     | 2168.1    | 2800.9 | 406.23 | -0.03 |
| 3150.0  | 456.87     | 2053.0    | 3150.3 | 456.92 | -0.01 |
| 3500.0  | 507.63     | 1930.1    | 3499.2 | 507.51 | 0.02  |

#### SLOPE INDICATOR

**Calibration** Record

V-Logger



| Part Nu                          | Part Number: 52615140                  |                        | Serial Number:       |       |               | 1832651                 |
|----------------------------------|--|------------------------|----------------------|-------|---------------|-------------------------|
| Specification                    |  |                        |                      |       |               |                         |
| Frequency Acc<br>Temperature Acc | uracy: $\pm$ (0.0<br>uracy: $\pm$ .5 ° | 02% of Reading<br>C    | +0.04Hz)             |       |               |                         |
| Frequency Generato               | r                                      |                        |                      |       |               |                         |
| Calibration Sta                  | ndard: A                               | gilent 33210A          | Serial Number:       |       |               | 20-78-SI                |
|                                  |  | )                      | Calibrator Re-       | Certi | fication Due: | Feb. 9th, 2019          |
| Temperature Resista              | nce                                    |                        |                      |       |               |                         |
| Calibration Sta                  | ndard: Sha                             | alleross Decade        | Serial Number:       |       |               | 20-15-SI                |
|                                  |  | 1                      | Calibrator Re-       | Certi | fication Due: | Feb. 15th, 2020         |
|                                  | IN                                     | PUT (Hz)               | ACCEPTABL            | E RE: | SPONSE (Hz)   | ACTUAL<br>RESPONSE (Hz) |
|                                  | 4                                      | 50.000                 | 449.951              | to    | 450.049       | 449.998                 |
|                                  | 1000.000                               |                        | 999.940              | to    | 1000.060      | 999.991                 |
|                                  | 2000.000                               |                        | 1999.920             | to    | 2000.080      | 1999.976                |
| FREQUENCY                        | 3000.000                               |                        | 2999.900             | to    | 3000.100      | 2999.964                |
|                                  | 4                                      | 000.000                | 3999.880             | to    | 4000.120      | 3999.952                |
|                                  | 5000.000                               |                        | 4999.860             | to    | 5000.140      | 4999.943                |
| 1                                | 6                                      | 000.000                | 5999.840 to 6000.160 |       | 6000.160      | 5999.927                |
|                                  | INPUT (Ω)                              | IDEAL<br>RESPONSE (°C) | ACCEPTABL.           | E RES | SPONSE (°C)   | ACTUAL<br>RESPONSE (°C) |
| TEMPERATURE                      | 1715                                   | -20.0                  | -20.5                | to    | -19.5         | -19.9                   |
| RTD                              | 2076                                   | 30.0                   | 29.5                 | to    | 30.5          | 30.3                    |
|                                  | 2482                                   | 80.0                   | 79.5                 | to    | 80.5          | 80.2                    |
|                                  | 29142                                  | -20.0                  | -20.5                | to    | -19.5         | -20.1                   |
| THERMISTOR                       | 2416                                   | 30.0                   | 29.5                 | to    | 30.5          | 29.9                    |
|                                  | 377                                    | 80.0                   | 79.5                 | to    | 80.5          | 80.0                    |

This Certificate confirms that the equipment listed above has been calibrated in accordance with the manufacturer's specifications with calibration standards that are traceable to the National Institute of Standards and Technology (NIST).

Calibrated By: TQL

Date: November 8th, 2018

## APPENDIX

## Geotechnical

### Appendix H Hydrographs

**GOWRIE TO HELIDON** ENVIRONMENTAL IMPACT STATEMENT




| CLIENT  | FFJV         |      |          | PROJECT   | Inland Rail – G2 | 2H             |          |    |
|---------|--------------|------|----------|-----------|------------------|----------------|----------|----|
| DRAWN   | SK           | DATE | 12/03/19 | TITLE     | 220 01 002101    | Hydrograph     |          |    |
| CHECKED | DB           | DATE | 12/03/19 |           | 320-01-002101    | пушодгарн      |          |    |
| SCALE   | Not to Scale | )    |          | PROJECT N | • 1893795        | FIGURE No H1.1 | REV No 3 | A4 |





| CLIENT FFJV     |      |          | PROJECT    | Inland Rail – G2 | 2H        |      |          |    |
|-----------------|------|----------|------------|------------------|-----------|------|----------|----|
| drawn SK        | DATE | 12/03/19 | TITLE      | 220 01 002102    |           | anh  |          |    |
| CHECKED DB      | DATE | 12/03/19 |            | 320-01-BH2102    |           | арп  |          |    |
| SCALE Not to Sc | ale  |          | PROJECT No | 1893795          | FIGURE No | H1.2 | REV No 3 | A4 |





| CLIENT FFJV        |               | PROJECT   | Inland Rail – G | 2H            |          |    |
|--------------------|---------------|-----------|-----------------|---------------|----------|----|
| drawn SK           | date 12/03/19 | TITLE     | 220 01 00210    | Hudrograph    |          |    |
| CHECKED DB         | date 12/03/19 |           | 320-01-BH2103   | пушодгарн     |          |    |
| scale Not to Scale | 9             | PROJECT N | • 1893795       | FIGURE № H1.3 | REV No 3 | A4 |





| CLIENT FFJV        |      |          | PROJECT   | Inland Rail – G2 | 2H             |          |    |
|--------------------|------|----------|-----------|------------------|----------------|----------|----|
| drawn SK           | DATE | 12/03/19 | TITLE     | 220 01 012201    | Hydrograph     |          |    |
| CHECKED DB         | DATE | 12/03/19 |           | 320-01-DH2201    | пушодгарн      |          |    |
| SCALE Not to Scale | Э    |          | PROJECT N | • 1893795        | FIGURE NO H1.4 | REV No 3 | A4 |





| CLIENT FFJ | IV       |      |          | PROJECT   | Inland Rail – G2 | 2H        |      |          |    |
|------------|----------|------|----------|-----------|------------------|-----------|------|----------|----|
| drawn SK   |          | DATE | 12/03/19 | TITLE     | 220 01 002216    | Ludrog    | anh  |          |    |
| CHECKED DB |          | DATE | 12/03/19 |           | 320-01-002210    | пушоді    | арп  |          |    |
| SCALE NOT  | to Scale | ;    |          | PROJECT N | • 1893795        | FIGURE No | H1.5 | REV No 3 | A4 |





| CLIENT FFJV  |       |          | PROJECT    | Inland Rail – G | 2H        |      |          |    |
|--------------|-------|----------|------------|-----------------|-----------|------|----------|----|
| drawn SK     | DATE  | 12/03/19 | TITLE      | 220 01 04221    | 7 Uvdroar | anh  |          |    |
| CHECKED DB   | DATE  | 12/03/19 |            | 320-01-002217   | пушоді    | арп  |          |    |
| SCALE Not to | Scale |          | PROJECT No | 1893795         | FIGURE No | H1.6 | REV No 3 | A4 |





| CLIENT FFJV        |               | PROJECT   | Inland Rail – G2 | 2H        |      |          |    |
|--------------------|---------------|-----------|------------------|-----------|------|----------|----|
| drawn SK           | date 12/03/19 | TITLE     | 220 01 002210    |           | nh   |          |    |
| CHECKED DB         | date 12/03/19 |           | 320-01-DH2210    | пушоўга   | рп   |          |    |
| SCALE Not to Scale | e             | PROJECT N | • 1893795        | FIGURE No | H1.7 | REV No 3 | A4 |





| CLIENT FFJV        |               | PROJECT   | Inland Rail – G2 | 2H            |          |    |
|--------------------|---------------|-----------|------------------|---------------|----------|----|
| drawn SK           | date 12/03/19 | TITLE     | 220 01 012201    | Hydrograph    |          |    |
| CHECKED DB         | date 12/03/19 |           | 320-01-00230     | пушодгарн     |          |    |
| SCALE Not to Scale | 9             | PROJECT N | • 1893795        | FIGURE № H1.8 | REV No 3 | A4 |



# APPENDIX

# Geotechnical

# Appendix I

# Groundwater laboratory reports

**GOWRIE TO HELIDON** ENVIRONMENTAL IMPACT STATEMENT



|                 |                         |        |                   |           |                      |            |                  |                |                          |                  |                     |                |                   |        | Heavy N           | letals   |                 |              |                  |
|-----------------|-------------------------|--------|-------------------|-----------|----------------------|------------|------------------|----------------|--------------------------|------------------|---------------------|----------------|-------------------|--------|-------------------|----------|-----------------|--------------|------------------|
| Arsenic<br>T/8m | R<br>Arsenic (Filtered) | Barium | Barium (Filtered) | Beryllium | Reryllium (Filtered) | uouo<br>Ba | Boron (Filtered) | cadmiu<br>mg/L | admium (Filtered)<br>M∧m | Chromium<br>T/am | Chromium (Filtered) | Cobait<br>T/8w | Cobait (Filtered) | Copper | Copper (Filtered) | <u>Ę</u> | Iron (Filtered) | lead<br>mg/L | للعام (Filtered) |
| <br>0.001       | 0.001                   | 0.001  | 0.001             | 0.001     | 0.001                | 0.05       | 0.05             | 0.0001         | 0.0001                   | 0.001            | 0.001               | 0.001          | 0.001             | 0.001  | 0.001             | 0.05     | 0.05            | 0.001        | 0.001            |

#### Borehole ID Sampled Date

EQL

| 320-01-BH2101 | 13/09/2018 | 0.004 | 0.003 | 0.756 | 0.748 | < 0.001 | < 0.001 | < 0.05 | 0.06   | 0.0001   | <0.0001  | 0.003 | 0.003   | <0.001 | <0.001 | 0.003 | 0.002  | 0.31 | 0.17   | < 0.001 | <0.001  |
|---------------|------------|-------|-------|-------|-------|---------|---------|--------|--------|----------|----------|-------|---------|--------|--------|-------|--------|------|--------|---------|---------|
| 320-01-BH2103 | 11/02/2019 | 0.001 | 0.001 | 0.145 | 0.111 | < 0.001 | <0.001  | < 0.05 | < 0.05 | < 0.0001 | <0.0001  | 0.002 | <0.001  | 0.005  | 0.004  | 0.002 | <0.001 | 1.42 | 0.11   | <0.001  | <0.001  |
| 320-01-BH2201 | 30/10/2018 | 0.007 | 0.005 | 0.314 | 0.238 | < 0.001 | < 0.001 | 0.22   | 0.22   | < 0.0001 | <0.0001  | 0.005 | <0.001  | 0.005  | <0.001 | 0.008 | <0.001 | 6.72 | 0.76   | 0.005   | <0.001  |
| 320-01-BH2216 | 26/02/2019 | 0.01  | 0.007 | 0.625 | 0.488 | < 0.001 | < 0.001 | 0.29   | 0.31   | < 0.0001 | < 0.0001 | 0.006 | < 0.001 | 0.009  | 0.002  | 0.01  | <0.001 | 4.08 | < 0.05 | 0.008   | < 0.001 |
| 320-01-BH2217 | 30/10/2018 | 0.036 | 0.035 | 0.383 | 0.309 | < 0.001 | < 0.001 | 0.42   | 0.42   | < 0.0001 | < 0.0001 | 0.005 | < 0.001 | 0.028  | 0.017  | 0.043 | <0.001 | 2.24 | 0.34   | 0.012   | < 0.001 |
| 320-01-BH2218 | 22/11/2018 | 0.028 | 0.004 | 0.611 | 0.182 | 0.009   | 0.002   | 0.39   | 0.4    | 0.0005   | <0.0001  | 0.113 | 0.008   | 0.126  | 0.005  | 0.288 | 0.004  | -    | -      | 0.172   | 0.007   |
| 320-01-BH2301 | 07/12/2018 | 0.685 | 0.003 | 28.3  | 0.124 | 0.1     | < 0.001 | 0.4    | 0.08   | 0.0564   | <0.0001  | 0.488 | <0.001  | 1.7    | 0.002  | -     | -      | 2020 | < 0.05 | 2.31    | <0.001  |



|                   |                      |                    |                    |                |                   |                  |                     |                  |                       |             |                 | Oth   | ner                                |                                   |                               |                                    |                   |                      |                      |
|-------------------|----------------------|--------------------|--------------------|----------------|-------------------|------------------|---------------------|------------------|-----------------------|-------------|-----------------|---|------------------------------------|-----------------------------------|-------------------------------|------------------------------------|-------------------|----------------------|----------------------|
| Manganese<br>Ma/T | Manganese (Filtered) | Mercury<br>Mercury | Mercury (Filtered) | Nicke<br>Nicke | Nickel (Filtered) | Selenium<br>T/8m | Selenium (Filtered) | Vanadium<br>7/au | کا<br>۲/۵۳ (Filtered) | Zinc<br>//# | Zinc (Filtered) | <ul> <li>Sodium Absorption Ratio</li> </ul> | Sodium Absorption Ratio (Filtered) | SS Electrical Conductivity @ 25°C | (qep)<br>Hd Units<br>BH Units | 표<br>Total Dissolved Solids @180°C | Radium (Filtered) | Potassium (Filtered) | A Calcium (Filtered) |
| <br>0.001         | 0.001                | 0.0001             | 0.0001             | 0.001          | 0.001             | 0.01             | 0.01                | 0.01             | 0.01                  | 0.005       | 0.005           | 0.01  | 0.01                               | 1                                 | 0.01                          | 10                                 |                   |                      |                      |

#### Borehole ID Sampled Date

EQL

| 320-01-BH2101 | 13/09/2018 | 0.002 | < 0.001 | < 0.0001 | < 0.0001 | 0.003 | 0.002 | < 0.01 | < 0.01 | 0.04  | 0.04   | < 0.005 | 0.005   | 3.58 | -    | 3040 | 12   | 985  | 174 | 58 | 178 |
|---------------|------------|-------|---------|----------|----------|-------|-------|--------|--------|-------|--------|---------|---------|------|------|------|------|------|-----|----|-----|
| 320-01-BH2103 | 11/02/2019 | 0.493 | 0.467   | < 0.0001 | <0.0001  | 0.005 | 0.005 | < 0.01 | < 0.01 | <0.01 | < 0.01 | 0.009   | 0.01    | -    | 1.77 | 1460 | 7.72 | 921  | 94  | 1  | 78  |
| 320-01-BH2201 | 30/10/2018 | 0.101 | 0.029   | < 0.0001 | <0.0001  | 0.015 | 0.009 | < 0.01 | < 0.01 | <0.01 | < 0.01 | 0.023   | < 0.005 | -    | 9.81 | 2640 | 8.04 | 1570 | 442 | 7  | 101 |
| 320-01-BH2216 | 26/02/2019 | 0.11  | 0.031   | <0.0001  | <0.0001  | 0.01  | 0.006 | < 0.01 | < 0.01 | <0.01 | <0.01  | 0.027   | < 0.005 | -    | 25.1 | 2800 | 7.78 | 1770 | 612 | 18 | 22  |
| 320-01-BH2217 | 30/10/2018 | 0.077 | 0.054   | < 0.0001 | <0.0001  | 0.029 | 0.018 | < 0.01 | < 0.01 | 0.01  | < 0.01 | 0.044   | 0.01    | -    | 21.7 | 2080 | 7.72 | 1300 | 461 | 19 | 21  |
| 320-01-BH2218 | 22/11/2018 | 0.458 | 0.04    | <0.0001  | <0.0001  | 0.169 | 0.008 | < 0.01 | < 0.01 | 0.28  | 0.02   | 0.423   | 0.054   | -    | 21.4 | 1210 | 7.17 | 1160 | 257 | 12 | 6   |
| 320-01-BH2301 | 07/12/2018 | 70.9  | 0.073   | <0.001   | <0.0001  | 1.71  | 0.003 | <0.1   | <0.01  | 1.24  | <0.01  | 12.2    | 0.014   | -    | 23.7 | 5690 | 8.22 | 3420 | 974 | 12 | 83  |



|                      |          |                              |                                   |                                 | Sampl                           | e Quali                     | ty Paran       | neters         |                           |                |                                |                  |          |                            |                         |              |               |                     |                                |
|----------------------|----------|------------------------------|-----------------------------------|---------------------------------|---------------------------------|-----------------------------|----------------|----------------|---------------------------|----------------|--------------------------------|------------------|----------|----------------------------|-------------------------|--------------|---------------|---------------------|--------------------------------|
| Magnesium (Filtered) | Chloride | Sulphate (as SO4) (Filtered) | Bicarbonate Alkalinity (as CaCO3) | Carbonate Alkalinity (as CaCO3) | Hydroxide Alkalinity (as CaCO3) | Total Alkalinity (as CaCO3) | Nitrate (as N) | Nitrite (as N) | Nitrogen (Total Oxidised) | Ammonia (as N) | Total Kjeldahl Nitrogen (as N) | Nitrogen (Total) | Fluoride | Reactive Phosphorus (as P) | Total Phosphorus (as P) | Total Anions | Total Cations | lonic Balance (Lab) | Hardness (as CaCO3) (Filtered) |
| mg/L                 | mg/L     | mg/L                         | mg/L                              | mg/L                            | mg/L                            | mg/L                        | mg/L           | mg/L           | mg/L                      | mg/L           | mg/L                           | mg/L             | mg/L     | mg/L                       | mg/L                    | meq/L        | meq/L         | %                   | mg/L                           |
|                      | 1        |                              | 1                                 | 1                               | 1                               | 1                           | 0.01           | 0.01           | 0.01                      | 0.01           | 0.1                            | 0.1              | 0.1      | 0.01                       | 0.01                    | 0.01         | 0.01          | 0.01                |                                |

| Borehole ID | Sampled Date |
|-------------|--------------|

EQL

| 320-01-BH2101 | 13/09/2018 | <1 | 87   | 77  | <1   | 92 | 562 | 654  | 0.02   | < 0.01 | 0.02   | 4.59 | 4.5  | 4.5  | 0.3 | < 0.01 | 0.02 | 17.1 | 17.9 | 2.31 | 444 |
|---------------|------------|----|------|-----|------|----|-----|------|--------|--------|--------|------|------|------|-----|--------|------|------|------|------|-----|
| 320-01-BH2103 | 11/02/2019 | 82 | 229  | 34  | 430  | <1 | <1  | 430  | 0.08   | < 0.01 | 0.08   | 0.89 | 9.1  | 9.2  | 0.2 | 0.01   | 0.02 | 15.8 | 14.8 | 3.29 | 532 |
| 320-01-BH2201 | 30/10/2018 | 32 | 403  | 18  | 830  | <1 | <1  | 830  | <0.01  | < 0.01 | < 0.01 | 0.43 | 1.1  | 1.1  | 0.4 | < 0.01 | 0.09 | 28.3 | 27.1 | 2.25 | 384 |
| 320-01-BH2216 | 26/02/2019 | 14 | 321  | 4   | 1020 | <1 | <1  | 1020 | 0.06   | < 0.01 | 0.06   | 0.21 | 0.7  | 0.8  | -   | < 0.01 | 0.14 | 29.5 | 29.3 | 0.32 | -   |
| 320-01-BH2217 | 30/10/2018 | 8  | 164  | 7   | 893  | <1 | <1  | 893  | < 0.01 | < 0.01 | < 0.01 | 0.06 | 0.2  | 0.2  | 1.8 | 0.01   | 0.17 | 22.6 | 22.2 | 0.82 | 85  |
| 320-01-BH2218 | 22/11/2018 | 3  | 126  | 2   | 421  | <1 | <1  | 421  | 0.16   | < 0.01 | 0.16   | 0.24 | 3    | 3.2  | 0.8 | < 0.01 | 2.41 | 12   | 12   | 0.1  | 27  |
| 320-01-BH2301 | 07/12/2018 | 27 | 1450 | 323 | 209  | <1 | <1  | 209  | 0.07   | < 0.01 | 0.07   | 0.68 | 49.3 | 49.4 | -   | < 0.01 | 127  | 51.8 | 49   | 2.74 | -   |

|                          | CHAIN OF CUSTODY<br>ALS Laboratory: please tick → | QADELAIDE 3/1 Surma Road Pooraka SA 5<br>Ph 08 3162 5130 E: adelside@alisglobal.co.<br>QBRISBANE 2 Byth Street Stafford CLD 405<br>Ph: 07 3243 7222 E: samples brisbane@alisg<br>QGLADSTONE 48 Calemondah Drive Glady<br>Ph: 07 4978 7944 E: gtadstone@alisglobal.co | 095         LIMACKAY 78 Harbour Road 1           m         Ph: 07 4944 0177 E: mackay@           g         UMELBOURNE 2-4 Westall F           lobal.com         Ph: 03 8549 9600 E: semoles           tone QLD 4680         DMUDGEE 129 Sydney Roa           m         Ph: 02 6372 6735 E: mudgee. | Alackay QLD 4740<br>talsglobal.com<br>Road Springvale VIC 3171<br>melbourne@alsglobal.com<br>Il Mudgee NSW 2850<br>mail@alsglobal.com | DNEWCASTLE 5/585 Mailtand Road Mayfield West<br>Ph: 02 4014 2500 E: samples newcastle@atsglobal.o<br>DNOWRA 4/13 Geary Place North Nowia NSW 2541<br>Ph: 02 4423 2053 E: nowe@atsglobal.com<br>DPERTH 10 Hod Way Malaga WA 6090<br>Ph: 08 9209 7655 E: samples.perth@atsglobal.com   | NSW 2304<br>OBYDNEY 277-289 Woo<br>Ph: 02 8784 8555 E: san<br>OTOWNSVILLE 14-15 D<br>Envir<br>Ph: Envir<br>Ph: Envir | dpark Road Smithfield NSW 2154<br>pressydney@alsglobal.com<br>esma Court Bohle QLD 4818<br><b>Conmental Division</b>  |
|--------------------------|---|--|--|---|--|--|---|
| FICE: BIZIS              | BAWE  | TURNAR<br>(Standard T<br>e.g. Ultra T<br>PRO JECT NO : 1000 ALS OUT  | CUND REQUIREMENTS : Standard   | TAT (List due date):<br>dard or urgent TAT (List du   | ve date):  | FOR LAB( Wo<br>Custody Sea   | rk Order Reference<br>B1826458  |
| RDER NUMBER:             | PURCHASE  | ORDER NOT 180 210 COUNTR   |  |   | COC SEQUENCE NUMBER (Circle)   | receipt?   | 21020100  |
| OJECT MANAGER:           | MITCH MCGINI                                      | WES CONTACT PH:  |  |   | $- \frac{1}{2} \frac{1}{3} \frac{1}{4} \frac{1}{5} \frac{1}{6} \frac{1}{6} \frac{1}{2} \frac{1}{3} \frac{1}{4} \frac{1}{5} \frac{1}{6} $ | 7 Random Sa  |   |
| MPLER: ROB               | (UPPEN  | SAMPLER MOBILE: /  | 6448 611 113 RELINQUISH  | ED BY:  | RECEIVED BY  | 7 Other comm   |   |
| DC Emailed to ALS?       | (YES / NO)  | EDD FORMAT (or defa  | ult):  |   | De GK  |  |   |
| nail Reports to (will o  | default to PM if no other addresses are li        | sted): Skumarapeli 6   | 9010 er. COM. GU DATE/TIME:  |   | DATE/TIME:   | DATE/TIME:   |   |
| nail Invoice to (will de | efgult to PM if no other addresses are lis        | ited):   | J  |   | 1/11/11/ 1500  | Telephon   | le : + 61-7-3243 7222   |
| MMENTS/SPECIAL           | HANDLING/STORAGE OR DISPOSAL                      |  |  |   |  | 2  |   |
| ALS USE ONLY             | SAMPLE  | DETAILS  |  | ANALX6IS F  | REQUIRED including SUITES (NB. Suite Cod   | es must be listed to attract suite price)  |   |
|                          | MATRIX: Soli                                      | d(S) Water(W)  |  | Where Metal   | s are required, specify Total (unfiftered bottle required) or t  | Bolved (field filtered bottle required).   | Additional Information  |
|                          |   |  |  | ions<br>a, C, F<br>nity, Hau  | Vitute)  | hesphou<br>7100  | Comments on likely contaminant levels,<br>dilutions, or samples requiring specific QC<br>analysis etc.  |
| LABID                    | SAMPLE ID   | DATE / TIME MATRIX   | 1YPE & PRESERVATIVE<br>(refer to codes below) E  | TOTAL + 19 HOTTLES  | c, p +1<br>8, Ba, Ba, Ba, Ba, Ba, Ba, Ba, Ba, Ba, Ba   | Hed PSN<br>Hed PSN<br>drinn,<br>ssorphor   |   |
| 1                        | 720 01 010017                                     | 20/10/10 200 111   |  | - E199 -  | A PLANT ASA  | 36 2 <u>5</u>  |   |
|                          | 320-01-842211                                     | 20110118 200pm W   | IV, SP   | 4   | ////   |  |   |
|                          | 320-01-BH2201                                     | 30/10/18 1.00pm W  | IN, SP   | 4 /   | ////   |  |   |
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|                          |   |  | TOTAL  | 0   |  |  | i   |
| er Container Codes:      | P = Unpreserved Plastic; N = Nitric Preserved     | d Plastic; ORC = Nitric Preserved ORC; SH  | = Sodium Hydroxide/Cd Preserved; S = Sodium Hydr   | oxide Preserved Plastic; AG =   | Amber Glass Unpreserved; AP - Airfreight Uppreserved; AP - Airfreight Uppreserved; AP - Airfreight Uppreserved; AP - Airfreight Uppr   | erved Plastic  |   |

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| CLIENT: ( 0/0ER           | CHAIN OF CUSTODY<br>ALS Laboretory: please tick → | AADELAIDE 3/1 Burma Read P<br>Ph: 08 B162 5130 E: adelaide@<br>BERISSANE 2 byth Street Staff<br>Ph: 07 3243 7222 E: samples.br<br>DGLADSTONE 46 Callemondal<br>Ph: 07 4978 7944 E: gladstone@ | Pooraka SA 505<br>alsglobal.com<br>ford QLD 4053<br>isbane@alsglo<br>h Drive Gladsto<br>galsglobal.com | 35 UMACKAY 78 Harbour Road<br>Pr: 07 4944 0177 E: mackay@<br>UMELBOURNE 24 Vestall<br>bal.com Ph: 03 8549 9500 E: samples<br>Ine QLD 4580 UMUDGEE 1/29 Sydney Roa<br>Ph: 02 6372 6735 E: mudgee | Nackay QLO 4740<br>Jalsglobal.com<br>Road Springvale VIC 3171<br>.melbourna@alsglobal.cor<br>d Mudgse NSW 2850<br>mail@alsglobal.com | m          | DNEWCASTLE 5/586 Maitland Road Mayfield West NS<br>Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com<br>DNOWRA 4/13 Gaary Place North Nowra NSW 2541<br>Ph: 02 423 2063 E: nowra@alsglobal.com<br>DPERTH 10 Hod Way Malaga WA 6000<br>Ph: 08 9209 7655 E: samples.perth@alsglobal.com | W 2304 SYDNEY 277-289 Woodp<br>Ph: 02 8784 8555 E: sampl<br>DTOWNSVILLE 14-15 Des<br>Ph: 07 4796 0500 E: teumas<br>DWOLLONGONG 1/19-21<br>Ph: 02 4225 3125 E: wolfor | ark Road Smithfield NSW 2164<br>as sydney@alsglobal.com<br>ma Court Bohle QLD 4818<br>fillia.environmani@alsglobal.com<br>Ralph Black Drive, Nth Wollongong NSW 2500<br>gong@alsglobal.com |
|---------------------------|---|---|--|---|--|------------|---|--|--|
| OFFICE: ( ni Dra          | 2 BRISANNES                                       |   | TURNARC<br>(Standard TA  | DUND REQUIREMENTS : Standard  | i TAT (List due date)  | ):         | 4860  | FOR LABORATORY USE O   | NLY (Circle)   |
| PROJECT                   | 10 PAUL DO  | 1993795   | e.g Ultra Tr   | ace Organics)   | idard or urgent TAT (  | (List due  | ie date): -( O MY )   | Custody Seal Intact?   | Yes No N/A   |
| ORDER NUMBER              | PAIL VIL  | ROJECT NO.: 10 TOTOL  | ALS QUO  | TE NO.:   |  |            | COC SEQUENCE NUMBER (Circle)  | receipt?   | it upon Yes No N/A   |
| PROJECT MANAGER           | Vilch Al CinAse                                   | ORDER NO.:  | COUNTRY  | OF ORIGIN:  |  |            | COC: 1 2 3 4 5 6  | 7 Random Sample Temperature or   | Receipt *C   |
| SAMPLER 7                 | WICH MCGIMIS                                      | , CONTACT PE  |  | 1 - 12: (0  |  |            | OF: 1 2 3 4 5 6   | 7 Other comment:   | 8  |
| COC Emailed to AI S2 (    | (YES I NO)  | NTMA SAMPLER MI   |  | HOOZ3462 RELINQUISH   |  |            | RECEIVED BY:  | ELINQUISHED BY:  | RECEIVED BY:   |
| Email Reports to (will de | efault to PM if no other addresses are li         | CAPEC EDDFORMA  | T (or defau  |   | LENT   |            | KYLIE   |  |  |
| Email Invoice to (will de | fault to PM if no other addresses are in          | sied): Skumarap   | ener   | golder. Com au DATE/TIME:   | 12   |            | DATE/TIME:  | ATE/TIME:  | DATE/TIME:   |
| COMMENTERPECIAL           | Induction with the other addresses are its        | (ed):   |  |   | 10   |            | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  |  |  |
| COMMENTS/SPECIAL          | HANDLING/STORAGE OR DISPOSAL                      |   |  |   |  |            |   |  |  |
| ALS USE ONLY              | SAMPLE  | DETAILS   |  |   | ANAL   | YSIS R     | REQUIRED including SUITES (NB. Suite Codes  | must be listed to attract suite price)   |  |
|                           | MATRIX: Soli                                      | d(S) Water(W)   |  | CONTAINER INFORMATION   | Wh   |            | is are required, specify Total (unfiltered bottle required) or Dis  | solved (field filtered bottle required).   | Additional Information   |
|                           |   |   |  |   | (ALL -   | ŝ          |   | 2  | Comments on likely contaminant levels,   |
| •                         | · · · · · · · · · · · · · · · · · · ·             |   |  |   | 1, 1,  | . E        |   | SA 2   | analysis etc.  |
|                           | and the second second                             |   |  |   | E C  | . Xt č     | 2 222 2 12 1  | ST 2   |  |
| LAB ID                    | SAMPLE ID   | DATE / TIME   | MATRIX   | TYPE & PRESERVATIVE   | TOTAL  | - <u>ド</u> | - Maren 12 42   | 2 2 2 4  |  |
|                           |   |   |  | (refer to codes below)  | SOTTLES  | L Pa       | I 0355 5 595  | 3 2 2 2  |  |
|                           |   |   |  |   | 104  | ,Ā Q       | I I I I I I I I I I I I I I I I I I I   | र दे र है  |  |
|                           |   |   |  |   | N.O  | 1 6        | A Long A La   | A ve s   |  |
| 1                         | 200 DI RUMIO                                      | 21/11/10 202  | 3.1  | NL CO   |  |            |   |  |  |
|                           | 5-W-01-0F12210                                    | 21111118 0430   |  | N SP  | 4 1  |            |   |  |  |
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|                           | )   |   |  |   |  |            | Environmental Division  |  | 2 ENT  |
|                           |   |   |  |   |  |            | Brisbane  | 0171   | JEINI  |
|                           |   | · · · · · · · · · · · · · · · · · · ·   |  |   |  |            | Work Order Reference  |  |  |
|                           |   |   |  |   |  |            | EB1828548   |  |  |
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|                           |   |   |  |   |  | -+         | (四川) 위신가 이번에 위신은 (四川))  |  |  |
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|                           |   |   |  |   |  | -          |   |  | ·  |
|                           |   |   | +  |   |  |            | Telephone : + 61-7-3243 7222  |  |  |
|                           |   |   |  |   |  |            | , SIGPHINE . + 01-7-0240 7222   |  |  |
|                           |   | 1   |  |   |  |            | i   ) I   |  |  |
|                           | ······································            | - <u> </u>  |  | •<br>•  |  |            |   |  |  |
|                           |   |   |  | TOTAL   | 4  |            |   |  |  |

V = VOA Vial HCI Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCI preserved Plastic; H = HCI preserved Plastic; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; SP = Sulfuric Preserved Bottle; SP = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; L = Lugols Iodine Preserved Bottle; ST = Sterile Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; L = Lugols Iodine Preserved Bottle; ST = Sterile Sodium Thiosulfate Preserved Bottles.

Called and the set of

| CCC Emailed to ALS?                                    | CHAIN OF CUSTODY<br>ALS Laboratory: please tick -><br>R_ASSOCIATES FTY<br>2- BRISBANE<br>VD RAIL (P12)<br>PURCHASE<br>MITCH-M.GINNAS<br>VAH-GROVES<br>YES 1,000 | CADELAIDE 3/1 Burma Road<br>Ph: 08 8162 5130 E: adelaide<br>CBRISBANE 2 Byth Street Sta<br>Ph: 07 3263 7222 E: semples.<br>CADSTONE 48 Catternon<br>Ph: 07 4976 7844 E: gladstone<br>Ph: 07 4976 7844 E: gladstone<br>Ph: 07 4976 7844 E: gladstone<br>Ph: 07 4976 7844 E: gladstone<br>CONTACT P<br>SAMPLER NO.:<br>EDD FORMA | Pooraka SA 509<br>Palaglobal.com<br>fiford QLD 4053<br>an Drive Gladato<br>@alaglobal.com<br>TURNARO<br>(Standard TA'<br>e.g Ultra Tra<br>e.g Ultra Tra<br>e.g Ultra Tra<br>COUNTRY<br>H:<br>IOBILE: 04<br>IT (or defaul | 5     DMACKAY 78 Harbour Roi<br>Pri: 07 4944 0177 E: macky       balcom     DMELBOURNE 2-4 Westi<br>Ph: 03 8549 6600 E: samp<br>Ph: 02 6372 6735 E: muldy       INUD REQUIREMENTS :     Standa<br>Standa       UND REQUIREMENTS :     Standa       Image: Standard St | di Mackay OLO 4741<br>Y@aksglobal.com<br>all Road Springvale.<br>Isa melbourne@aksglobal.co<br>and TAT (List du<br>landard or urger<br>SHED BY: | IC 3171<br>lobal.com<br>850<br>m<br><b>e date):</b><br>It TAT (List du | DNEWCASTLE 5/686 /<br>Ph: 02 4014 2500 E: se<br>DNOWRA 4/3 0691 /<br>Ph: 02 422 2063 E: on<br>DPERTH 10 Hod way<br>Ph: 08 9209 7655 E: s<br># 8 UUKS<br>e date):<br># COC SEQUEN<br>COC: 1 2<br>OF: 1 2<br>RECEIVED BY: | failliand Road Mayfield Wess<br>mpkes.newcasile@alcglobal.<br>Iace North Novra NSW 254<br>wa@alsglobal.com<br>Melega W & 6090<br>mmples.perth@alsglobal.com<br>CE NUMBER (Circle)<br>3 4 5 6<br>3 4 5 6<br>3 4 5 6 | NSW 2304<br>com<br>FOR<br>Cush<br>Free<br>recei<br>7 Rank<br>7 Othe<br>RELINQU | BYDNEY 277-289 Wood<br>Ph 12 R784 8655 F same<br>Brisbane<br>Work Orde<br>EB18 | ark Road Smithfield NSW 2164<br>re surfax/Rakalabal com<br>ntal Division<br>r Reference<br>330099<br>N/A |
|--|---|--|--|---|---|--|---|--|--|--|--|
| Email Invoice to (will de                              | ault to PM if no other addresses are lis<br>ault to PM if no other addresses are lis  | sted): <u>SKUMARA</u><br>ted):   | PELLO  | GOLDER.COM. DATE/TIME<br>AU 7/R   | -118  |  | DATE/TIME:<br>7/12//  | 3 1920   | DATE/TIN   | Telephone : + 61-  | ··3243 7222  |
| ALS USE ONLY   | SAMPLE<br>MATRIX: Soli  | DETAILS<br>d(S) Water(W)   |  | CONTAINER INFORMATION   |   | ANALYSIS R   | EQUIRED including   | SUITES (NB. Suite Coo  | ies must be list   | ed to attract suite price)   | Additional Information   |
| LAB ID   | SAMPLE ID   | DATE / TIME  | MATRIX   | TYPE & PRESERVATIVE<br>(refer to codes below)   | TOTAL<br>BOTTLES  | O4, AIKalinin Haches   | 2, pH, TDS<br>DTAL/DISSOLUED<br>S.B.B. B. B. alphan   | ULTPLEUTS<br>ULTPLEUTS<br>ULTPLEUTS<br>TITPLEUTS<br>TITPLEUTS  | TEACTIVE HIDSPACE  | Illered bottle required).  | Comments on likely contaminant levels,<br>ditutions, or samples requiring specific QC<br>analysis etc.   |
|  | 320-01-BH230  | 1 7/12/18  | W  | NISP  | 4   |  |   |  |  |  |  |
|  |   |  |  |   |   |  |   |  |  |  |  |
|  |   |  |  |   |   |  |   |  |  |  |  |
|  |   |  |  |   |   |  |   |  |  |  |  |
| Water Container Codes: 1<br>V = VOA Vial HCI Preserver | <ul> <li><sup>2</sup> = Unpreserved Plastic; N = Nitric Preserve</li> <li>; VB = VOA Vial Sodium Bisulphate Preserve</li> </ul>                                 | d Plastic; ORC = Nitric Preserve<br>ed; VS = VOA Vlal Sulfuric Preşe   | d ORC; SH = :<br>rved; AV = Airf.  | TOTAL<br>Sodium Hydroxide/Cd Preserved: S = Sodium H<br>reight Unpreserved Vial SG = Sulfuric Preserve  | ydroxide Preserve<br>Amber Glass:   | ed Plastic; AG =   | Amber Glass Unpreserv   | ed; AP - Ainfreight Unpre-   | served Plastic   | Preserved Plactice 6 - E-  | maklabuda Prasaanad Class  |

| ALS  | CHAIN OF CUSTODY<br>ALS Laboratory: please tick →  | DACELAIDE 3/1 Buinna Road<br>Ph. 08 9162 5130 E. adelaide@<br>CBRISBANE 2 Byin Street Stat<br>Ph. 07 3243 7222 E. samples b<br>DCLAOSTONE 48 Catemenod,<br>Ph. 07 4978 7944 E. gladstone | Pooraka SA 5095<br>Balsglobat.com<br>ford 01:0 4053<br>risbane@atsglobat<br>wh Drive Gtadstone<br>@atsglobat.com   | UMACKAN<br>Ph D7 394<br>LÌMELBO<br>com Ph 03 85<br>QLD 4680 IJMUOGE<br>Ph 02 631                                  | 778 Haibout Road<br>14 0177 E. mackaye<br>149 9600 E. sample<br>149 9600 E. sample<br>149 9600 E. sample<br>149 9603 E. mudget | Mackay OLLI 4<br>Balaglobal com<br>Road Springval<br>s melbourne@a<br>ad Hudgoe NSv<br>i mai@alsgloba | 43<br>9 VIC 3171<br>Isglobal com<br>7 2850<br>I com  | ONE<br>Ph<br>ONC<br>Ph C<br>Ph C<br>Ph | EWCASTLE 5/585<br>02 4014 2500 E s<br>02 4014 2500 E s<br>02 4423 2063 E n<br>ERTH 10 Hod Wi<br>08 9209 7655 E | Mailland Road<br>amples newcas<br>Place North No<br>owra@alsgloba<br>iy Maiaga WA<br>sanioles pertig | Mayfield West<br>sile@alsglobal o<br>wra NSW 2541<br>I com<br>6090<br>@alsglobal com | NSW 2304<br>com                           | USYONEY 277<br>Ph 02 8784 85<br>UTOWNSVILL<br>Ph 07 4796 06<br>UWOLLONGO<br>Ph 02 4225 31 | -289 Woodpa<br>55 E' sample:<br>E 14 15 Desn<br>00 E Townsvill<br>ING 1/19-21 R<br>25 E wollong | rk Road Smithfeid NSW 2154<br>sydney@alsglobil<br>wa Cowi Bohir OL D 4818<br>é anvedniental@disglobil.com<br>alph Black Drive Nih Wotlongong NS<br>ong@alsglobal.com | W 2500                     |
|--|--|--|--|---|--|---|--|--|--|--|--|---|---|---|--|----------------------------|
| LIENT: Golder Ass                                  | ociates Pty Ltd  |  | TURNAROU   | ND REQUIREMENTS :   | Standa:  | d TAT (List e   | lue date):   |  |  |  |  | FOR                                       | ABORATOR  | Y USE OI  | VLY (Circle)   |                            |
| FFICE: Golder - Bri                                | sbane  | 1892795  | Standard TAT   | may be longer for some tests  | Non Sta  | ndard or urg  | ent TAT (List  | due date)                              | :  |  |  | Cuslod                                    | y Seal Intact?  |   | Yes No   | N/A                        |
| ROJECT: Inland Rai                                 | il (Pkg 1  | PROJECT NO 1897791   | ALS QUOTE  | NO.:  |  |   |  |  | COC SEQUE  | NCE NUMBE  | R (Circle)   | Free ic                                   | e / frozen ice br   | icks present  | upon Yes No  | N/A                        |
| RDER NUMBER:                                       | PURCHAS  | E ORDER NO.:   | COUNTRY O  | F ORIGIN:   |  |   | - *  | coc                                    | 1 2  | 34   | 56   | 7 Rando                                   | m Sample Tem  | perature on   | Receipt C  |                            |
| ROJECT MANAGER:                                    | Mitch McGinnis   | , CONTACT P  | H: 040   | CINS  | -  | en an belikke den fengen gan das sonere   |  | OF:                                    | 12   | 34   | 56   | 7 Other                                   | omment  |   | •  |                            |
| AMPLER: Hannah (                                   | Broves / Ying Zhang LOB  | CUP DELSAMPLER N   | OBILE: 040   | 5 048 250   | RELINQUIS  | HED BY:   |  | REC                                    | EIVED BY:  |  |  | RELINQUIS                                 | HED BY:   | ,   | RECEIVED BY:   |                            |
| OC Emailed to ALS? (                               | YES / NO)  | EDD FORMA  | T (or default)   | :   | -  |   |  | B                                      | innone   | -  |  |   |   |   |  |                            |
| mail Reports to (will de                           | efault to PM if no other addresses are   | listed) skumarapeli@gold   | ler.com.au, h  | groves@golder.com.au  | DATE/TIME  | :   |  | DAT                                    | E/TIME:  |  |  | DATE/TIME                                 | :   |   | DATE/TIME:   |                            |
| mail Invoice to (will de                           | fault to PM if no other addresses are li   | sted):   |  | · · · · · · · · · · · · · · · · · · ·   | -  |   |  | 13                                     | 1210   | 9 13   | SIPm.  |   |   |   |  |                            |
| OMMENTS/SPECIAL                                    | HANDLING/STORAGE OR DISPOSA  |  | a in the second se |   |  |   |  |  |  |  |  |   |   |   |  |                            |
| ALS USE ONLY                                       | SAMPLE<br>Matrix: So   |  | CONTAINER INF  | INFORMATION Where Matel   |  |   |  | RED includin                           | g SUITES (<br>al (unfiliered bo  | NB: Suite Co   | des must be fis<br>Dissolved (held   | tod to attract sur<br>filtered bottle req | ule price)<br>uired)  | Additional Inform   | ation  |                            |
| LABID  | LAB ID SAMPLE ID DA  |  | MATRIX   | TYPE & PRESERVA<br>(refer lo codes belo   | ITIVE<br>ow)   | HILES   |  | EC, pH, TDS                            | Total/Dissolved Metals: As,<br>B, Ba, Be, Cd, Cr, Co, Cu, Cd,<br>Mn, Fe, Ni, Pb, Se, V, Zn, Hg                 | X Nutrients: Nitrate, Nitrite,   | X Reactive Phosphorus,<br>Total P, Total N, TKN                                      | X Sodium Adsorption<br>Ratio              |   |   | Comments on likely contamina<br>dilutions or samples requiring<br>analysis etc   | ni ičvelS<br>specific QC   |
|  |  |  |  | 1   |  |   |  |  |  |  |  |   | · · · · · · · · · · · · · · · · · · ·   |   | Environmental<br>Brisbane<br>Work Order Ref<br>EB190   | Division<br>erence<br>3588 |
| Water Container Codes:<br>V = VOA Vial HCl Preserv | Container Codes: P = Unpreserved Plastic: N = Nitinc Preserved Plastic: ORC = Nitiric Preserved ORC; SH = Sodium Hydroxide/C<br>A Vial HCI Preserved, VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfunc Preserved; AV = Anfreight Unpreserved V |  | Sodium Hydroxide/Cd Preserve<br>reight Unpreserved Vial SG = 5   | TOTAL<br>de/CdProserved, S = Sodium Hydroxide Preserved Pla<br>ved Vial SG = Sulfunc Preserved Amber Glass. H = H |  |   | ic. AG = Ambér Gláss Unpreserved, AP - Airfreight Unpre<br>I proserved Plastic; HS = HC) preserved Speciation bollie |  |  |  |  | c<br>IC Preserved Ph                      | asııc,  |   |  |                            |

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| (ALS)                    | CHAIN OF CUSTODY<br>ALS Laboratory: please tick $\Rightarrow$ | DADELAIDE 3/1 Burna Road Po<br>Ph. 08.8162.5130 E. addetaide@a<br>UBRISBANE 2.Byin Steel Stafo<br>Ph. 07.3243.7222 E. samples bris<br>ULQLAOSTONE 48.Cattemondah<br>Ph. 07.4978.7944 E. gladstone@a | koraka SA 5095<br>Isglobal com<br>Id DLD 4053<br>bane@alsglobal<br>Drive Gladstone<br>alsglobal com | UMACRAY<br>Ph. 07-394<br>DMEL60<br>com Ph. 03-85<br>QLD -1680 CMU00E<br>Ph. 02-637<br>Ph. 02-637 | 78 Harbour Roa<br>4 8177 E mackay<br>URNE 2-4 Westa<br>19 9600 E sampl<br>E 1/29 Sydnay Ri<br>2 6735 E mudge | I Mackay QLQ<br>@alsglobal.com<br>I Road Springvi<br>Is nielbourne@<br>ad Mudgco NS<br>a mail@alsglob | 740<br>1<br>9 VIC 3171<br>9 sglobal com<br>W 2850<br>81 com       | QNE<br>Ph I<br>DNO<br>Ph 0<br>DP<br>Ph 0<br>Ph | WGASTLE 5/58<br>02 4014 2500 E<br>WRA 4/13 Geary<br>2 4423 2063 E<br>ERTH 10 Hod W<br>08 9209 7655 E | S Mailland Roa<br>samples newca<br>r Place North N<br>10wra@alsglob<br>ay Maiaga WA<br>sanibles perth | d Mayfield West<br>Islia@alsglobul<br>Iowra NSW 254<br>al com<br>6090<br>@alsglobal com | i NSW 2304<br>com<br>r                       | GSYDNEY 277-2891<br>Ph 02 8784 8555 E:<br>UTOWNSVILLE 14<br>Ph 07 4796 0600 E<br>LIWOLLONGONG I<br>Ph 02 4225 3125 E | Vooddark Road Smithleid<br>Sambias sydneyalsgibba<br>5 Desma Couri Bonie Ou<br>Sowasville sneroninenia@ai<br>19-21 Raipti Black Drive N<br>vollongorg@aisgibbai.com | NSW 2154<br>I com<br>24818<br>Sglobal com<br>Illa Wolloigong NSW 2500<br>n |            |
|--------------------------|---|---|---|--|--|---|---|--|--|---|---|--|--|---|--|------------|
| CLIENT: Golder As        | sociates Pty Ltd  | 1   | TURNAROU  | ND REQUIREMENTS :  | 🗍 Standa   | d TAT (List   | due date):  |  |  |   |   | FC   | OR LABORATORY U  | E ONLY (Circle)   |  | -          |
| OFFICE: Golder - B       | risbane   | 1895195   | Mandard TAT n<br>g . Ultra Trace  | ay be longer for some tests<br>Organics)   | I Non St   | Indard or ur  | ent TAT (List   | due date).                                     | 481  | nom   | 5.  | Cu   | ustody Seal Intact?  | Ye  | 15 No  | N/A        |
| PROJECT: Inland R        | ail <del>(Pkg 11) -</del> P/2                                 | PROJECT NO.: 1897791 /  | ALS QUOTE   | ND.:   |  |   |   |  | COC SEQUE  | NCE NUMBI   | ER (Circle)   | Fre  | ee ice / frozen ice bricks p   | resent upon Ye  | 95 No  | NZA        |
| ORDER NUMBER:            | PURCHASE  | ORDER NO.: C  | OUNTRY O  | F ORIGIN:  |  | •   | . *   | coc:   | 1 2  | 34  | 5 6   | 7 Ra   | ceipir<br>andom Sample Temperate   | ire on Receipt  | 'C   |            |
| PROJECT MANAGER:         | Mitch McGinnis  | CONTACT PH:   | 044   | Scilling   |  |   | a   | OF:  | 1 2  | 34  | 56  | 7 01   | her comment  |   | -  |            |
| SAMPLER: <u>Hannah</u>   | Broves 7 Ying Zhang LOBELT                                    | CAPPENSAMPLER MO  | BILE: -0405   | 846-250  | RELINQUIS  | HED BY:   | 3   | RECI   | EIVED BY:  |   |   | RELING                                       | UISHED BY:   | RECEIV  | ED BY:   |            |
| COC Emailed to ALS?      | ( YES / NO)   | EDD FORMAT  | (or default):   |  | 1  |   |   | R  | OBENJ  | CMP   | 1En   | 2  | F  | For   | 9,6  |            |
| Email Reports to (will c | default to PM if no other addresses are lis                   | sted skumarapeli@golder   | r.com.au, he  | groves@golder.com.au   | DATE/TIME  |   |   | DATE   | E/T,IME:   |   |   | DATER  | IME:   | DATE/T  | IME:   |            |
| Email Invoice to (will d | efault to PM if no other addresses are lis                    | led):   |   |  |  |   |   | 27   | 12/10  | 12  | 00  |  |  | ובר   | Sha w  | 55         |
| COMMENTS/SPECIAL         | HANDLING/STORAGE OR DISPOSAL                                  | -   |   |  |  |   |   |  |  |   |   | _1   |  |   |  |            |
| ALS USE ONLY             | SAMPLE<br>MATRIX: Soli  | DETAILS<br>d(S) Water(W)  |   | CONTAINER INF  | ORMATION   |   | ANALYSI:  | S REQUIR                                       | ED includin  | g SUITES (  | (NB Suite Co  | des must b<br>r Dissolvad (                  | e listed to affract suite pri<br>(field littered bottle required)  | :e) Addı  | tional Information   |            |
| LAB ID                   | SAMPLE ID<br>320-01 - BH221G                                  | DATE / TIME 1<br>26-02-2019<br>8.20 AM  |   | TYPE & PRESERVAT<br>(refer lo codes belo   | ſIVE<br>₩)   | TOTAL<br>BOTTLES  | Anions/Cations: Ca, Mg,<br>Na, Cl, F, SO4<br>Alkalinity, Hardness | Ec, pH, TDS                                    | Totať/Dissofved Metals: As,<br>B, Ba, Be, Cd, Cr, Co, Cu, Cd,<br>Mn, Fe, Ni, Pb, Se, V, Zn, Hg       | Nutrients: Nitrate, Nitrite,<br>Ammonia   | Reactive Phosphorus,<br>Total P, Total N, TKN   | Sodium Adsorption<br>Ratio                   |  | Comments on in<br>dilutions, or sam<br>analysis etc   | keiy contamutant levels<br>npies requiring specific (                      | ЭС         |
|                          |   |   |   |  |  |   |   |  |  |   |   |  |  |   |  |            |
|                          |   |   |   |  |  |   |   |  | 7  |   |   |  | Env<br>Bris  | I<br>Ironmentai<br>Ibane<br>Iork Order Ref<br>EB1904  | Division<br>erence<br><b>1979</b>  |            |
|                          |   |   |   |  |  | NI  | •   |  |  |   |   | n - Sana an an an an an an an an an an an an |  |   |  | lare, waar |
|                          |   |   |   |  |  |   |   |  |  |   |   |  |  |   |  |            |
|                          |   |   |   | *  | **   |   |   |  | 1  |   |   | -  | Telepi;  | one : + 61-7-3243 7   | 222  |            |
|                          |   |   |   |  | TOTAL  | 4   |   |  |  |   |   |  |  |   |  |            |
| Water Container Codes:   | P = Unpreserved Plastic: N = Nitric Preserve                  | d Plastic ORC = Nitric Preservert   |   |  | C - Codure -   |   | Deved Direction   | C - A - L                                      |  | 1   |   |  | <u> </u>   | <u> </u>  |  |            |



#### **CERTIFICATE OF ANALYSIS**

| Work Order              | EB1826458                  | Page                    | : 1 of 5                                    |
|-------------------------|----------------------------|-------------------------|---|
| Client                  | : GOLDER ASSOCIATES        | Laboratory              | Environmental Division Brisbane             |
| Contact                 | : MR MITCH McGINNIS        | Contact                 | : Andrew Epps                               |
| Address                 | : P O BOX 1734             | Address                 | : 2 Byth Street Stafford QLD Australia 4053 |
|                         | MILTON QLD, AUSTRALIA 4064 |                         |   |
| Telephone               | : +61 07 3721 5400         | Telephone               | : +61 7 3552 8639                           |
| Project                 | : 1893795                  | Date Samples Received   | : 01-Nov-2018 15:00                         |
| Order number            | 17893795                   | Date Analysis Commenced | : 01-Nov-2018                               |
| C-O-C number            | :                          | Issue Date              | : 06-Nov-2018 17:32                         |
| Sampler                 | : ROBERT CUPPER            |                         | Hac-MRA NATA                                |
| Site                    | : INLAND RAIL (P12)        |                         |   |
| Quote number            | : EN/002/18 National BQ    |                         | According to a set                          |
| No. of samples received | : 2                        |                         | Accredited for compliance with              |
| No. of samples analysed | : 2                        |                         | ISO/IEC 17025 - Testing                     |

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

#### Signatories

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

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



#### **General Comments**

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

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

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

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

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

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

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

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

ø = ALS is not NATA accredited for these tests.

 $\sim$  = Indicates an estimated value.

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

| Page       | : 3 of 5            |
|------------|---------------------|
| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | : 1893795           |



| Sub-Matrix: WATER<br>(Matrix: WATER)     |             | Clie         | ent sample ID  | 310-01-BH2217     | 310-01-BH2201     | <br> |  |
|--|-------------|--------------|----------------|-------------------|-------------------|------|--|
|  | Cl          | ient samplii | ng date / time | 30-Oct-2018 15:00 | 30-Oct-2018 13:00 | <br> |  |
| Compound                                 | CAS Number  | LOR          | Unit           | EB1826458-001     | EB1826458-002     | <br> |  |
|  |             |              |                | Result            | Result            | <br> |  |
| EA005P: pH by PC Titrator                |             |              |                |                   |                   |      |  |
| pH Value                                 |             | 0.01         | pH Unit        | 7.72              | 8.04              | <br> |  |
| EA010P: Conductivity by PC Titrator      |             |              |                |                   |                   |      |  |
| Electrical Conductivity @ 25°C           |             | 1            | μS/cm          | 2080              | 2640              | <br> |  |
| EA015: Total Dissolved Solids dried at 1 | 80 ± 5 °C   |              |                |                   |                   |      |  |
| Total Dissolved Solids @180°C            |             | 10           | mg/L           | 1300              | 1570              | <br> |  |
| ED037P: Alkalinity by PC Titrator        |             |              |                |                   |                   |      |  |
| Hydroxide Alkalinity as CaCO3            | DMO-210-001 | 1            | mg/L           | <1                | <1                | <br> |  |
| Carbonate Alkalinity as CaCO3            | 3812-32-6   | 1            | mg/L           | <1                | <1                | <br> |  |
| Bicarbonate Alkalinity as CaCO3          | 71-52-3     | 1            | mg/L           | 893               | 830               | <br> |  |
| Total Alkalinity as CaCO3                |             | 1            | mg/L           | 893               | 830               | <br> |  |
| ED041G: Sulfate (Turbidimetric) as SO4 2 | 2- by DA    |              |                |                   |                   |      |  |
| Sulfate as SO4 - Turbidimetric           | 14808-79-8  | 1            | mg/L           | 7                 | 18                | <br> |  |
| ED045G: Chloride by Discrete Analyser    |             |              |                |                   |                   |      |  |
| Chloride                                 | 16887-00-6  | 1            | mg/L           | 164               | 403               | <br> |  |
| ED093F: Dissolved Major Cations          |             |              |                |                   |                   |      |  |
| Calcium                                  | 7440-70-2   | 1            | mg/L           | 21                | 101               | <br> |  |
| Magnesium                                | 7439-95-4   | 1            | mg/L           | 8                 | 32                | <br> |  |
| Sodium                                   | 7440-23-5   | 1            | mg/L           | 461               | 442               | <br> |  |
| Potassium                                | 7440-09-7   | 1            | mg/L           | 19                | 7                 | <br> |  |
| ED093F: SAR and Hardness Calculations    | 5           |              |                |                   |                   |      |  |
| Total Hardness as CaCO3                  |             | 1            | mg/L           | 85                | 384               | <br> |  |
| ^ Sodium Adsorption Ratio                |             | 0.01         | -              | 21.7              | 9.81              | <br> |  |
| EG020F: Dissolved Metals by ICP-MS       |             |              |                |                   |                   |      |  |
| Arsenic                                  | 7440-38-2   | 0.001        | mg/L           | 0.035             | 0.005             | <br> |  |
| Boron                                    | 7440-42-8   | 0.05         | mg/L           | 0.42              | 0.22              | <br> |  |
| Barium                                   | 7440-39-3   | 0.001        | mg/L           | 0.309             | 0.238             | <br> |  |
| Beryllium                                | 7440-41-7   | 0.001        | mg/L           | <0.001            | <0.001            | <br> |  |
| Cadmium                                  | 7440-43-9   | 0.0001       | mg/L           | <0.0001           | <0.0001           | <br> |  |
| Cobalt                                   | 7440-48-4   | 0.001        | mg/L           | 0.017             | <0.001            | <br> |  |
| Chromium                                 | 7440-47-3   | 0.001        | mg/L           | <0.001            | <0.001            | <br> |  |
| Copper                                   | 7440-50-8   | 0.001        | mg/L           | <0.001            | <0.001            | <br> |  |
| Manganese                                | 7439-96-5   | 0.001        | mg/L           | 0.054             | 0.029             | <br> |  |
| Nickel                                   | 7440-02-0   | 0.001        | mg/L           | 0.018             | 0.009             | <br> |  |
| Lead                                     | 7439-92-1   | 0.001        | mg/L           | <0.001            | <0.001            | <br> |  |

| Page       | : 4 of 5            |
|------------|---------------------|
| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | : 1893795           |



| Sub-Matrix: WATER<br>(Matrix: WATER)    | Client sample ID |              |                | 310-01-BH2217     | 310-01-BH2201     | <br> |  |
|---|------------------|--------------|----------------|-------------------|-------------------|------|--|
|   | Cli              | ient sampliı | ng date / time | 30-Oct-2018 15:00 | 30-Oct-2018 13:00 | <br> |  |
| Compound                                | CAS Number       | LOR          | Unit           | EB1826458-001     | EB1826458-002     | <br> |  |
|   |                  |              |                | Result            | Result            | <br> |  |
| EG020F: Dissolved Metals by ICP-MS - C  | ontinued         |              |                |                   |                   |      |  |
| Selenium                                | 7782-49-2        | 0.01         | mg/L           | <0.01             | <0.01             | <br> |  |
| Vanadium                                | 7440-62-2        | 0.01         | mg/L           | <0.01             | <0.01             | <br> |  |
| Zinc                                    | 7440-66-6        | 0.005        | mg/L           | 0.010             | <0.005            | <br> |  |
| Iron                                    | 7439-89-6        | 0.05         | mg/L           | 0.34              | 0.76              | <br> |  |
| EG020T: Total Metals by ICP-MS          |                  |              |                |                   |                   |      |  |
| Arsenic                                 | 7440-38-2        | 0.001        | mg/L           | 0.036             | 0.007             | <br> |  |
| Boron                                   | 7440-42-8        | 0.05         | mg/L           | 0.42              | 0.22              | <br> |  |
| Barium                                  | 7440-39-3        | 0.001        | mg/L           | 0.383             | 0.314             | <br> |  |
| Beryllium                               | 7440-41-7        | 0.001        | mg/L           | <0.001            | <0.001            | <br> |  |
| Cadmium                                 | 7440-43-9        | 0.0001       | mg/L           | <0.0001           | <0.0001           | <br> |  |
| Cobalt                                  | 7440-48-4        | 0.001        | mg/L           | 0.028             | 0.005             | <br> |  |
| Chromium                                | 7440-47-3        | 0.001        | mg/L           | 0.005             | 0.005             | <br> |  |
| Copper                                  | 7440-50-8        | 0.001        | mg/L           | 0.043             | 0.008             | <br> |  |
| Manganese                               | 7439-96-5        | 0.001        | mg/L           | 0.077             | 0.101             | <br> |  |
| Nickel                                  | 7440-02-0        | 0.001        | mg/L           | 0.029             | 0.015             | <br> |  |
| Lead                                    | 7439-92-1        | 0.001        | mg/L           | 0.012             | 0.005             | <br> |  |
| Selenium                                | 7782-49-2        | 0.01         | mg/L           | <0.01             | <0.01             | <br> |  |
| Vanadium                                | 7440-62-2        | 0.01         | mg/L           | 0.01              | <0.01             | <br> |  |
| Zinc                                    | 7440-66-6        | 0.005        | mg/L           | 0.044             | 0.023             | <br> |  |
| Iron                                    | 7439-89-6        | 0.05         | mg/L           | 2.24              | 6.72              | <br> |  |
| EG035F: Dissolved Mercury by FIMS       |                  |              |                |                   |                   |      |  |
| Mercury                                 | 7439-97-6        | 0.0001       | mg/L           | <0.0001           | <0.0001           | <br> |  |
| EG035T: Total Recoverable Mercury by    | FIMS             |              |                |                   |                   |      |  |
| Mercury                                 | 7439-97-6        | 0.0001       | mg/L           | <0.0001           | <0.0001           | <br> |  |
| EK040P: Fluoride by PC Titrator         |                  |              |                |                   |                   |      |  |
| Fluoride                                | 16984-48-8       | 0.1          | mg/L           | 1.8               | 0.4               | <br> |  |
| EK055G: Ammonia as N by Discrete Ana    | alvser           |              |                |                   |                   |      |  |
| Ammonia as N                            | 7664-41-7        | 0.01         | mg/L           | 0.06              | 0.43              | <br> |  |
| EK057G: Nitrite as N by Discrete Analys | ser              |              |                |                   |                   |      |  |
| Nitrite as N                            | 14797-65-0       | 0.01         | mg/L           | <0.01             | <0.01             | <br> |  |
| FK058G: Nitrate as N by Discrete Analy  | ser              |              |                |                   |                   |      |  |
| Nitrate as N                            | 14797-55-8       | 0.01         | ma/L           | <0.01             | <0.01             | <br> |  |
| EK059G: Nitrito plue Nitrato as N (NOx) | by Discrete Are  | lyeor        |                |                   |                   |      |  |
| Nitrite + Nitrate as N                  | by Discrete Ana  | 0.01         | ma/l           | <0.01             | <0.01             | <br> |  |
| mane · maate us n                       |                  | 0.01         |                | -0.01             | -0.01             | <br> |  |

| Page       | 5 of 5              |
|------------|---------------------|
| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | 1893795             |



| Sub-Matrix: WATER<br>(Matrix: WATER)  | Client sample ID    |            | 310-01-BH2217  | 310-01-BH2201     | <br>              |      |  |
|---------------------------------------|---------------------|------------|----------------|-------------------|-------------------|------|--|
|                                       | Cli                 | ent sampli | ng date / time | 30-Oct-2018 15:00 | 30-Oct-2018 13:00 | <br> |  |
| Compound                              | CAS Number          | LOR        | Unit           | EB1826458-001     | EB1826458-002     | <br> |  |
|                                       |                     |            |                | Result            | Result            | <br> |  |
| EK061G: Total Kjeldahl Nitrogen By Di | iscrete Analyser    |            |                |                   |                   |      |  |
| Total Kjeldahl Nitrogen as N          |                     | 0.1        | mg/L           | 0.2               | 1.1               | <br> |  |
| EK062G: Total Nitrogen as N (TKN + N  | Ox) by Discrete An  | alyser     |                |                   |                   |      |  |
| ^ Total Nitrogen as N                 |                     | 0.1        | mg/L           | 0.2               | 1.1               | <br> |  |
| EK067G: Total Phosphorus as P by Dis  | screte Analyser     |            |                |                   |                   |      |  |
| Total Phosphorus as P                 |                     | 0.01       | mg/L           | 0.17              | 0.09              | <br> |  |
| EK071G: Reactive Phosphorus as P by   | y discrete analyser |            |                |                   |                   |      |  |
| Reactive Phosphorus as P              | 14265-44-2          | 0.01       | mg/L           | 0.01              | <0.01             | <br> |  |
| EN055: Ionic Balance                  |                     |            |                |                   |                   |      |  |
| Total Anions                          |                     | 0.01       | meq/L          | 22.6              | 28.3              | <br> |  |
| Total Cations                         |                     | 0.01       | meq/L          | 22.2              | 27.1              | <br> |  |
| Ionic Balance                         |                     | 0.01       | %              | 0.82              | 2.25              | <br> |  |



#### **CERTIFICATE OF ANALYSIS**

| Work Order              | EB1828548                  | Page                    | : 1 of 5                                    |
|-------------------------|----------------------------|-------------------------|---|
| Client                  | : GOLDER ASSOCIATES        | Laboratory              | Environmental Division Brisbane             |
| Contact                 | : MR MITCH McGINNIS        | Contact                 | : Andrew Epps                               |
| Address                 | : P O BOX 1734             | Address                 | : 2 Byth Street Stafford QLD Australia 4053 |
|                         | MILTON QLD, AUSTRALIA 4064 |                         |   |
| Telephone               | : +61 07 3721 5400         | Telephone               | : +61 7 3552 8639                           |
| Project                 | : 1893795 INLAND RAIL P12  | Date Samples Received   | : 22-Nov-2018 08:35                         |
| Order number            | :                          | Date Analysis Commenced | : 22-Nov-2018                               |
| C-O-C number            | :                          | Issue Date              | : 26-Nov-2018 14:46                         |
| Sampler                 | : SUSANTHA KUMARAPELI      |                         | Hac-MRA NATA                                |
| Site                    | :                          |                         |   |
| Quote number            | : EN/002/18 National BQ    |                         | Accordition No. 925                         |
| No. of samples received | : 1                        |                         | Accredited for compliance with              |
| No. of samples analysed | : 1                        |                         | ISO/IEC 17025 - Testing                     |

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

#### Signatories

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

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



#### **General Comments**

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

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

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

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

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

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

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

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

ø = ALS is not NATA accredited for these tests.

 $\sim$  = Indicates an estimated value.

- It is recognised that EG020-T (Total Metals by ICP-MS) is less than EG020-F (Dissolved Metals by ICP-MS) for sample EB1828548-001(320-01-BH2218). However, the difference is within experimental variation of the methods.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.</li>

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|------------|---------------------------|
| Work Order | : EB1828548               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER<br>(Matrix: WATER)      | Client sample ID |              |                | 320-01-BH2218     | <br> | <br> |
|---|------------------|--------------|----------------|-------------------|------|------|
|   | Cl               | ient samplii | ng date / time | 22-Nov-2018 00:00 | <br> | <br> |
| Compound                                  | CAS Number       | LOR          | Unit           | EB1828548-001     | <br> | <br> |
|   |                  |              |                | Result            | <br> | <br> |
| EA005P: pH by PC Titrator                 |                  |              |                |                   |      |      |
| pH Value                                  |                  | 0.01         | pH Unit        | 7.17              | <br> | <br> |
| EA010P: Conductivity by PC Titrator       |                  |              |                |                   |      |      |
| Electrical Conductivity @ 25°C            |                  | 1            | µS/cm          | 1210              | <br> | <br> |
| EA015: Total Dissolved Solids dried at 18 | 80 ± 5 °C        |              |                |                   |      |      |
| Total Dissolved Solids @180°C             |                  | 10           | mg/L           | 1160              | <br> | <br> |
| ED037P: Alkalinity by PC Titrator         |                  |              |                |                   |      |      |
| Hydroxide Alkalinity as CaCO3             | DMO-210-001      | 1            | mg/L           | <1                | <br> | <br> |
| Carbonate Alkalinity as CaCO3             | 3812-32-6        | 1            | mg/L           | <1                | <br> | <br> |
| Bicarbonate Alkalinity as CaCO3           | 71-52-3          | 1            | mg/L           | 421               | <br> | <br> |
| Total Alkalinity as CaCO3                 |                  | 1            | mg/L           | 421               | <br> | <br> |
| ED041G: Sulfate (Turbidimetric) as SO4 2  | 2- by DA         |              |                |                   |      |      |
| Sulfate as SO4 - Turbidimetric            | 14808-79-8       | 1            | mg/L           | 2                 | <br> | <br> |
| ED045G: Chloride by Discrete Analyser     |                  |              |                |                   |      |      |
| Chloride                                  | 16887-00-6       | 1            | mg/L           | 126               | <br> | <br> |
| ED093F: Dissolved Major Cations           |                  |              |                |                   |      |      |
| Calcium                                   | 7440-70-2        | 1            | mg/L           | 6                 | <br> | <br> |
| Magnesium                                 | 7439-95-4        | 1            | mg/L           | 3                 | <br> | <br> |
| Sodium                                    | 7440-23-5        | 1            | mg/L           | 257               | <br> | <br> |
| Potassium                                 | 7440-09-7        | 1            | mg/L           | 12                | <br> | <br> |
| ED093F: SAR and Hardness Calculations     | 5                |              |                |                   |      |      |
| Total Hardness as CaCO3                   |                  | 1            | mg/L           | 27                | <br> | <br> |
| ^ Sodium Adsorption Ratio                 |                  | 0.01         | -              | 21.4              | <br> | <br> |
| EG020F: Dissolved Metals by ICP-MS        |                  |              |                |                   |      |      |
| Arsenic                                   | 7440-38-2        | 0.001        | mg/L           | 0.004             | <br> | <br> |
| Boron                                     | 7440-42-8        | 0.05         | mg/L           | 0.40              | <br> | <br> |
| Barium                                    | 7440-39-3        | 0.001        | mg/L           | 0.182             | <br> | <br> |
| Beryllium                                 | 7440-41-7        | 0.001        | mg/L           | 0.002             | <br> | <br> |
| Cadmium                                   | 7440-43-9        | 0.0001       | mg/L           | <0.0001           | <br> | <br> |
| Cobalt                                    | 7440-48-4        | 0.001        | mg/L           | 0.005             | <br> | <br> |
| Chromium                                  | 7440-47-3        | 0.001        | mg/L           | 0.008             | <br> | <br> |
| Copper                                    | 7440-50-8        | 0.001        | mg/L           | 0.004             | <br> | <br> |
| Manganese                                 | 7439-96-5        | 0.001        | mg/L           | 0.040             | <br> | <br> |
| Nickel                                    | 7440-02-0        | 0.001        | mg/L           | 0.008             | <br> | <br> |
| Lead                                      | 7439-92-1        | 0.001        | mg/L           | 0.007             | <br> | <br> |

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|------------|---------------------------|
| Work Order | : EB1828548               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER<br>(Matrix: WATER)    | Client sample ID |              |                | 320-01-BH2218     |  |  |  |  |
|---|------------------|--------------|----------------|-------------------|--|--|--|--|
|   | Cli              | ient samplir | ng date / time | 22-Nov-2018 00:00 |  |  |  |  |
| Compound                                | CAS Number       | LOR          | Unit           | EB1828548-001     |  |  |  |  |
|   |                  |              |                | Result            |  |  |  |  |
| EG020F: Dissolved Metals by ICP-MS - C  | ontinued         |              |                |                   |  |  |  |  |
| Selenium                                | 7782-49-2        | 0.01         | mg/L           | <0.01             |  |  |  |  |
| Vanadium                                | 7440-62-2        | 0.01         | mg/L           | 0.02              |  |  |  |  |
| Zinc                                    | 7440-66-6        | 0.005        | mg/L           | 0.054             |  |  |  |  |
| EG020T: Total Metals by ICP-MS          |                  |              |                |                   |  |  |  |  |
| Arsenic                                 | 7440-38-2        | 0.001        | mg/L           | 0.028             |  |  |  |  |
| Boron                                   | 7440-42-8        | 0.05         | mg/L           | 0.39              |  |  |  |  |
| Barium                                  | 7440-39-3        | 0.001        | mg/L           | 0.611             |  |  |  |  |
| Beryllium                               | 7440-41-7        | 0.001        | mg/L           | 0.009             |  |  |  |  |
| Cadmium                                 | 7440-43-9        | 0.0001       | mg/L           | 0.0005            |  |  |  |  |
| Cobalt                                  | 7440-48-4        | 0.001        | mg/L           | 0.126             |  |  |  |  |
| Chromium                                | 7440-47-3        | 0.001        | mg/L           | 0.113             |  |  |  |  |
| Copper                                  | 7440-50-8        | 0.001        | mg/L           | 0.288             |  |  |  |  |
| Manganese                               | 7439-96-5        | 0.001        | mg/L           | 0.458             |  |  |  |  |
| Nickel                                  | 7440-02-0        | 0.001        | mg/L           | 0.169             |  |  |  |  |
| Lead                                    | 7439-92-1        | 0.001        | mg/L           | 0.172             |  |  |  |  |
| Selenium                                | 7782-49-2        | 0.01         | mg/L           | <0.01             |  |  |  |  |
| Vanadium                                | 7440-62-2        | 0.01         | mg/L           | 0.28              |  |  |  |  |
| Zinc                                    | 7440-66-6        | 0.005        | mg/L           | 0.423             |  |  |  |  |
| EG035F: Dissolved Mercury by FIMS       |                  |              |                |                   |  |  |  |  |
| Mercury                                 | 7439-97-6        | 0.0001       | mg/L           | <0.0001           |  |  |  |  |
| EG035T: Total Recoverable Mercury by    | FIMS             |              |                |                   |  |  |  |  |
| Mercury                                 | 7439-97-6        | 0.0001       | mg/L           | <0.0001           |  |  |  |  |
| EK040P: Fluoride by PC Titrator         |                  |              |                |                   |  |  |  |  |
| Fluoride                                | 16984-48-8       | 0.1          | mg/L           | 0.8               |  |  |  |  |
| EK055G: Ammonia as N by Discrete Ana    | llyser           |              |                |                   |  |  |  |  |
| Ammonia as N                            | 7664-41-7        | 0.01         | mg/L           | 0.24              |  |  |  |  |
| EK057G: Nitrite as N by Discrete Analys | er               |              |                |                   |  |  |  |  |
| Nitrite as N                            | 14797-65-0       | 0.01         | mg/L           | <0.01             |  |  |  |  |
| EK058G: Nitrate as N by Discrete Analys | ser              |              |                |                   |  |  |  |  |
| Nitrate as N                            | 14797-55-8       | 0.01         | mg/L           | 0.16              |  |  |  |  |
| EK059G: Nitrite plus Nitrate as N (NOx) | by Discrete Ana  | lvser        |                |                   |  |  |  |  |
| Nitrite + Nitrate as N                  |                  | 0.01         | mg/L           | 0.16              |  |  |  |  |
| FK061G: Total Kieldahl Nitrogen By Disc | rete Analyser    |              |                |                   |  |  |  |  |
| Total Kieldahl Nitrogen as N            |                  | 0.1          | mg/L           | 3.0               |  |  |  |  |
|   |                  | · ·          | J· =           |                   |  |  |  |  |

| Page       | 5 of 5                    |
|------------|---------------------------|
| Work Order | : EB1828548               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER                     | Client sample ID  |                |                   | 320-01-BH2218 | <br> | <br> |
|---------------------------------------|-------------------|----------------|-------------------|---------------|------|------|
|                                       | ent sampli        | ng date / time | 22-Nov-2018 00:00 | <br>          | <br> |      |
| Compound                              | CAS Number        | LOR            | Unit              | EB1828548-001 | <br> | <br> |
|                                       |                   |                |                   | Result        | <br> | <br> |
| EK062G: Total Nitrogen as N (TKN + NC | x) by Discrete An | alyser         |                   |               |      |      |
| ^ Total Nitrogen as N                 |                   | 0.1            | mg/L              | 3.2           | <br> | <br> |
| EK067G: Total Phosphorus as P by Disc | crete Analyser    |                |                   |               |      |      |
| Total Phosphorus as P                 |                   | 0.01           | mg/L              | 2.41          | <br> | <br> |
| EK071G: Reactive Phosphorus as P by   |                   |                |                   |               |      |      |
| Reactive Phosphorus as P              | 14265-44-2        | 0.01           | mg/L              | <0.01         | <br> | <br> |
| EN055: Ionic Balance                  |                   |                |                   |               |      |      |
| Total Anions                          |                   | 0.01           | meq/L             | 12.0          | <br> | <br> |
| Total Cations                         |                   | 0.01           | meq/L             | 12.0          | <br> | <br> |
| Ionic Balance                         |                   | 0.01           | %                 | 0.10          | <br> | <br> |



#### **CERTIFICATE OF ANALYSIS**

| Work Order              | EB1830099                  | Page                    | : 1 of 5                                    |
|-------------------------|----------------------------|-------------------------|---|
| Client                  | : GOLDER ASSOCIATES        | Laboratory              | Environmental Division Brisbane             |
| Contact                 | : MR SUSANTHA KUMARAPELI   | Contact                 | : Andrew Epps                               |
| Address                 | : P O BOX 1734             | Address                 | : 2 Byth Street Stafford QLD Australia 4053 |
|                         | MILTON QLD, AUSTRALIA 4064 |                         |   |
| Telephone               | : +61 07 3721 5400         | Telephone               | : +61 7 3552 8639                           |
| Project                 | : 1893795 INLAND RAIL P12  | Date Samples Received   | : 07-Dec-2018 19:20                         |
| Order number            | :                          | Date Analysis Commenced | : 08-Dec-2018                               |
| C-O-C number            | :                          | Issue Date              | : 12-Dec-2018 08:39                         |
| Sampler                 | : HANNAH GROVES            |                         | HAC-MRA NAIA                                |
| Site                    | :                          |                         |   |
| Quote number            | : EN/002/18 National BQ    |                         | Accordition No. 225                         |
| No. of samples received | : 1                        |                         | Accredited for compliance with              |
| No. of samples analysed | : 1                        |                         | ISO/IEC 17025 - Testing                     |

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

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- General Comments
- Analytical Results

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

#### Signatories

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

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



#### **General Comments**

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

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

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

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

ø = ALS is not NATA accredited for these tests.

 $\sim$  = Indicates an estimated value.

- EG020T (Total Metals by ICP-MS): Limit of reporting raised for sample EB1830099-001(320-01-BH2301) due to matrix interference.
- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- -EG035T (Total Mercury): Sample EB1830099-001(320-01-BH2301) diluted due to matrix interference. LOR adjusted accordingly.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.</li>

| Page       | : 3 of 5                  |
|------------|---------------------------|
| Work Order | : EB1830099               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER<br>(Matrix: WATER)      | Client sample ID |              |                | 320-01-BH2301     | <br> | <br> |
|---|------------------|--------------|----------------|-------------------|------|------|
|   | Cl               | ient sampliı | ng date / time | 07-Dec-2018 00:00 | <br> | <br> |
| Compound                                  | CAS Number       | LOR          | Unit           | EB1830099-001     | <br> | <br> |
|   |                  |              |                | Result            | <br> | <br> |
| EA005P: pH by PC Titrator                 |                  |              |                |                   |      |      |
| pH Value                                  |                  | 0.01         | pH Unit        | 8.22              | <br> | <br> |
| EA010P: Conductivity by PC Titrator       |                  |              |                |                   |      |      |
| Electrical Conductivity @ 25°C            |                  | 1            | μS/cm          | 5690              | <br> | <br> |
| EA015: Total Dissolved Solids dried at 18 | 80 ± 5 °C        |              |                |                   |      |      |
| Total Dissolved Solids @180°C             |                  | 10           | mg/L           | 3420              | <br> | <br> |
| ED037P: Alkalinity by PC Titrator         |                  |              |                |                   |      |      |
| Hydroxide Alkalinity as CaCO3             | DMO-210-001      | 1            | mg/L           | <1                | <br> | <br> |
| Carbonate Alkalinity as CaCO3             | 3812-32-6        | 1            | mg/L           | <1                | <br> | <br> |
| Bicarbonate Alkalinity as CaCO3           | 71-52-3          | 1            | mg/L           | 209               | <br> | <br> |
| Total Alkalinity as CaCO3                 |                  | 1            | mg/L           | 209               | <br> | <br> |
| ED041G: Sulfate (Turbidimetric) as SO4 2  | 2- by DA         |              |                |                   |      |      |
| Sulfate as SO4 - Turbidimetric            | 14808-79-8       | 1            | mg/L           | 323               | <br> | <br> |
| ED045G: Chloride by Discrete Analyser     |                  |              |                |                   |      |      |
| Chloride                                  | 16887-00-6       | 1            | mg/L           | 1450              | <br> | <br> |
| ED093F: Dissolved Major Cations           |                  |              |                |                   |      |      |
| Calcium                                   | 7440-70-2        | 1            | mg/L           | 83                | <br> | <br> |
| Magnesium                                 | 7439-95-4        | 1            | mg/L           | 27                | <br> | <br> |
| Sodium                                    | 7440-23-5        | 1            | mg/L           | 974               | <br> | <br> |
| Potassium                                 | 7440-09-7        | 1            | mg/L           | 12                | <br> | <br> |
| ED093F: SAR and Hardness Calculations     | ;                |              |                |                   |      |      |
| ^ Sodium Adsorption Ratio                 |                  | 0.01         | -              | 23.7              | <br> | <br> |
| EG020F: Dissolved Metals by ICP-MS        |                  |              |                |                   |      |      |
| Arsenic                                   | 7440-38-2        | 0.001        | mg/L           | 0.003             | <br> | <br> |
| Beryllium                                 | 7440-41-7        | 0.001        | mg/L           | <0.001            | <br> | <br> |
| Barium                                    | 7440-39-3        | 0.001        | mg/L           | 0.124             | <br> | <br> |
| Cadmium                                   | 7440-43-9        | 0.0001       | mg/L           | <0.0001           | <br> | <br> |
| Chromium                                  | 7440-47-3        | 0.001        | mg/L           | <0.001            | <br> | <br> |
| Cobalt                                    | 7440-48-4        | 0.001        | mg/L           | 0.002             | <br> | <br> |
| Lead                                      | 7439-92-1        | 0.001        | mg/L           | <0.001            | <br> | <br> |
| Manganese                                 | 7439-96-5        | 0.001        | mg/L           | 0.073             | <br> | <br> |
| Nickel                                    | 7440-02-0        | 0.001        | mg/L           | 0.003             | <br> | <br> |
| Selenium                                  | 7782-49-2        | 0.01         | mg/L           | <0.01             | <br> | <br> |
| Vanadium                                  | 7440-62-2        | 0.01         | mg/L           | <0.01             | <br> | <br> |
| Zinc                                      | 7440-66-6        | 0.005        | mg/L           | 0.014             | <br> | <br> |

| Page       | : 4 of 5                |
|------------|-------------------------|
| Work Order | : EB1830099             |
| Client     | : GOLDER ASSOCIATES     |
| Project    | 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER<br>(Matrix: WATER)         | Client sample ID |                 | 320-01-BH2301  | <br>              | <br> |      |
|--|------------------|-----------------|----------------|-------------------|------|------|
|  | Cl               | ient sampliı    | ng date / time | 07-Dec-2018 00:00 | <br> | <br> |
| Compound C                                   | CAS Number       | LOR             | Unit           | EB1830099-001     | <br> | <br> |
|  |                  |                 |                | Result            | <br> | <br> |
| EG020F: Dissolved Metals by ICP-MS - Contin  | ued              |                 |                |                   |      |      |
| Boron  | 7440-42-8        | 0.05            | mg/L           | 0.08              | <br> | <br> |
| Iron   | 7439-89-6        | 0.05            | mg/L           | <0.05             | <br> | <br> |
| EG020T: Total Metals by ICP-MS               |                  |                 |                |                   |      |      |
| Arsenic                                      | 7440-38-2        | 0.001           | mg/L           | 0.685             | <br> | <br> |
| Beryllium                                    | 7440-41-7        | 0.001           | mg/L           | 0.100             | <br> | <br> |
| Barium                                       | 7440-39-3        | 0.001           | mg/L           | 28.3              | <br> | <br> |
| Cadmium                                      | 7440-43-9        | 0.0001          | mg/L           | 0.0564            | <br> | <br> |
| Chromium                                     | 7440-47-3        | 0.001           | mg/L           | 0.488             | <br> | <br> |
| Cobalt                                       | 7440-48-4        | 0.001           | mg/L           | 1.70              | <br> | <br> |
| Lead   | 7439-92-1        | 0.001           | mg/L           | 2.31              | <br> | <br> |
| Manganese                                    | 7439-96-5        | 0.001           | mg/L           | 70.9              | <br> | <br> |
| Nickel                                       | 7440-02-0        | 0.001           | mg/L           | 1.71              | <br> | <br> |
| Selenium                                     | 7782-49-2        | 0.01            | mg/L           | <0.10             | <br> | <br> |
| Vanadium                                     | 7440-62-2        | 0.01            | mg/L           | 1.24              | <br> | <br> |
| Zinc   | 7440-66-6        | 0.005           | mg/L           | 12.2              | <br> | <br> |
| Boron  | 7440-42-8        | 0.05            | mg/L           | 0.40              | <br> | <br> |
| Iron   | 7439-89-6        | 0.05            | mg/L           | 2020              | <br> | <br> |
| EG035F: Dissolved Mercury by FIMS            |                  |                 |                |                   |      |      |
| Mercury                                      | 7439-97-6        | 0.0001          | mg/L           | <0.0001           | <br> | <br> |
| EG035T: Total Recoverable Mercury by FIMS    | ;                |                 |                |                   |      |      |
| Mercury                                      | 7439-97-6        | 0.0001          | mg/L           | <0.0010           | <br> | <br> |
| EK055G: Ammonia as N by Discrete Analyser    | r                |                 |                |                   |      |      |
| Ammonia as N                                 | 7664-41-7        | 0.01            | mg/L           | 0.68              | <br> | <br> |
| EK057G: Nitrite as N by Discrete Analyser    |                  |                 |                |                   |      |      |
| Nitrite as N                                 | 14797-65-0       | 0.01            | mg/L           | <0.01             | <br> | <br> |
| EK058G: Nitrate as N by Discrete Analyser    |                  |                 |                |                   |      |      |
| Nitrate as N                                 | 14797-55-8       | 0.01            | mg/L           | 0.07              | <br> | <br> |
| EK059G: Nitrite plus Nitrate as N (NOx) by D | iscrete Ana      | lyser           |                |                   |      |      |
| Nitrite + Nitrate as N                       |                  | 0.01            | mg/L           | 0.07              | <br> | <br> |
| EK061G: Total Kjeldahl Nitrogen By Discrete  | Analyser         |                 |                |                   |      |      |
| Total Kjeldahl Nitrogen as N                 |                  | 0.1             | mg/L           | 49.3              | <br> | <br> |
| EK062G: Total Nitrogen as N (TKN + NOx) by   | Discrete Ar      | nalys <u>er</u> |                |                   |      |      |
| ^ Total Nitrogen as N                        |                  | 0.1             | mg/L           | 49.4              | <br> | <br> |

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|------------|---------------------------|
| Work Order | : EB1830099               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER<br>(Matrix: WATER)                  | Client sample ID |            |                | 320-01-BH2301     |  | <br> |  |
|---|------------------|------------|----------------|-------------------|--|------|--|
|   | Cli              | ent sampli | ng date / time | 07-Dec-2018 00:00 |  | <br> |  |
| Compound  | CAS Number       | LOR        | Unit           | EB1830099-001     |  | <br> |  |
|   |                  |            |                | Result            |  | <br> |  |
| EK067G: Total Phosphorus as P by Di                   | screte Analyser  |            |                |                   |  |      |  |
| Total Phosphorus as P                                 |                  | 0.01       | mg/L           | 127               |  | <br> |  |
| EK071G: Reactive Phosphorus as P by discrete analyser |                  |            |                |                   |  |      |  |
| Reactive Phosphorus as P                              | 14265-44-2       | 0.01       | mg/L           | <0.01             |  | <br> |  |
| EN055: Ionic Balance                                  |                  |            |                |                   |  |      |  |
| Total Anions  |                  | 0.01       | meq/L          | 51.8              |  | <br> |  |
| Total Cations   |                  | 0.01       | meq/L          | 49.0              |  | <br> |  |
| Ionic Balance   |                  | 0.01       | %              | 2.74              |  | <br> |  |



#### **CERTIFICATE OF ANALYSIS**

| Work Order              | EB1903588                      | Page                    | : 1 of 5                                    |
|-------------------------|--------------------------------|-------------------------|---|
| Client                  | : GOLDER ASSOCIATES            | Laboratory              | Environmental Division Brisbane             |
| Contact                 | : MR MITCH McGINNIS            | Contact                 | : Andrew Epps                               |
| Address                 | : 32 SHAND STREET              | Address                 | : 2 Byth Street Stafford QLD Australia 4053 |
|                         | BRISBANE QLD, AUSTRALIA 4053   |                         |   |
| Telephone               | : +61 07 3721 5400             | Telephone               | : +61 7 3552 8639                           |
| Project                 | : 1893795 Inland Rail (Pkg 12) | Date Samples Received   | : 13-Feb-2019 13:51                         |
| Order number            | :                              | Date Analysis Commenced | : 13-Feb-2019                               |
| C-O-C number            | :                              | Issue Date              | : 20-Feb-2019 16:34                         |
| Sampler                 | : ROBERT CUPPER                |                         | Hac-MRA NATA                                |
| Site                    | :                              |                         |   |
| Quote number            | : EN/002/18 National BQ        |                         | Accordition No. 925                         |
| No. of samples received | : 1                            |                         | Accredited for compliance with              |
| No. of samples analysed | :1                             |                         | ISO/IEC 17025 - Testing                     |

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

#### Signatories

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

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



#### **General Comments**

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

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

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

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

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

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

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

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

 $\emptyset$  = ALS is not NATA accredited for these tests.

 $\sim$  = Indicates an estimated value.

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



| Sub-Matrix: WATER<br>(Matrix: WATER)      | Client sample ID |              |                | 320-01-BH2103     | <br> | <br> |
|---|------------------|--------------|----------------|-------------------|------|------|
|   | Cl               | ient sampliı | ng date / time | 11-Feb-2019 02:30 | <br> | <br> |
| Compound                                  | CAS Number       | LOR          | Unit           | EB1903588-001     | <br> | <br> |
|   |                  |              |                | Result            | <br> | <br> |
| EA005P: pH by PC Titrator                 |                  |              |                |                   |      |      |
| pH Value                                  |                  | 0.01         | pH Unit        | 7.72              | <br> | <br> |
| EA010P: Conductivity by PC Titrator       |                  |              |                |                   |      |      |
| Electrical Conductivity @ 25°C            |                  | 1            | µS/cm          | 1460              | <br> | <br> |
| EA015: Total Dissolved Solids dried at 18 | 30 ± 5 °C        |              |                |                   |      |      |
| Total Dissolved Solids @180°C             |                  | 10           | mg/L           | 921               | <br> | <br> |
| ED037P: Alkalinity by PC Titrator         |                  |              |                |                   |      |      |
| Hydroxide Alkalinity as CaCO3             | DMO-210-001      | 1            | mg/L           | <1                | <br> | <br> |
| Carbonate Alkalinity as CaCO3             | 3812-32-6        | 1            | mg/L           | <1                | <br> | <br> |
| Bicarbonate Alkalinity as CaCO3           | 71-52-3          | 1            | mg/L           | 430               | <br> | <br> |
| Total Alkalinity as CaCO3                 |                  | 1            | mg/L           | 430               | <br> | <br> |
| ED041G: Sulfate (Turbidimetric) as SO4 2  | 2- by DA         |              |                |                   |      |      |
| Sulfate as SO4 - Turbidimetric            | 14808-79-8       | 1            | mg/L           | 34                | <br> | <br> |
| ED045G: Chloride by Discrete Analyser     |                  |              |                |                   |      |      |
| Chloride                                  | 16887-00-6       | 1            | mg/L           | 229               | <br> | <br> |
| ED093F: Dissolved Major Cations           |                  |              |                |                   |      |      |
| Calcium                                   | 7440-70-2        | 1            | mg/L           | 78                | <br> | <br> |
| Magnesium                                 | 7439-95-4        | 1            | mg/L           | 82                | <br> | <br> |
| Sodium                                    | 7440-23-5        | 1            | mg/L           | 94                | <br> | <br> |
| Potassium                                 | 7440-09-7        | 1            | mg/L           | 1                 | <br> | <br> |
| ED093F: SAR and Hardness Calculations     | ;                |              |                |                   |      |      |
| Total Hardness as CaCO3                   |                  | 1            | mg/L           | 532               | <br> | <br> |
| ^ Sodium Adsorption Ratio                 |                  | 0.01         | -              | 1.77              | <br> | <br> |
| EG020F: Dissolved Metals by ICP-MS        |                  |              |                |                   |      |      |
| Arsenic                                   | 7440-38-2        | 0.001        | mg/L           | 0.001             | <br> | <br> |
| Boron                                     | 7440-42-8        | 0.05         | mg/L           | <0.05             | <br> | <br> |
| Barium                                    | 7440-39-3        | 0.001        | mg/L           | 0.111             | <br> | <br> |
| Beryllium                                 | 7440-41-7        | 0.001        | mg/L           | <0.001            | <br> | <br> |
| Cadmium                                   | 7440-43-9        | 0.0001       | mg/L           | <0.0001           | <br> | <br> |
| Cobalt                                    | 7440-48-4        | 0.001        | mg/L           | 0.004             | <br> | <br> |
| Chromium                                  | 7440-47-3        | 0.001        | mg/L           | <0.001            | <br> | <br> |
| Copper                                    | 7440-50-8        | 0.001        | mg/L           | <0.001            | <br> | <br> |
| Manganese                                 | 7439-96-5        | 0.001        | mg/L           | 0.467             | <br> | <br> |
| Nickel                                    | 7440-02-0        | 0.001        | mg/L           | 0.005             | <br> | <br> |
| Lead                                      | 7439-92-1        | 0.001        | mg/L           | <0.001            | <br> | <br> |

| Page       | : 4 of 5   |
|------------|--|
| Work Order | : EB1903588                                      |
| Client     | : GOLDER ASSOCIATES                              |
| Project    | <ul> <li>1893795 Inland Rail (Pkg 12)</li> </ul> |



| Sub-Matrix: WATER<br>(Matrix: WATER)                         | Client sample ID            |        |      | 320-01-BH2103     |  |  |  |  |
|--|-----------------------------|--------|------|-------------------|--|--|--|--|
|  | Client sampling date / time |        |      | 11-Feb-2019 02:30 |  |  |  |  |
| Compound   | CAS Number                  | LOR    | Unit | EB1903588-001     |  |  |  |  |
|  |                             |        |      | Result            |  |  |  |  |
| EG020F: Dissolved Metals by ICP-MS - Continued               |                             |        |      |                   |  |  |  |  |
| Selenium   | 7782-49-2                   | 0.01   | mg/L | <0.01             |  |  |  |  |
| Vanadium   | 7440-62-2                   | 0.01   | mg/L | <0.01             |  |  |  |  |
| Zinc   | 7440-66-6                   | 0.005  | mg/L | 0.010             |  |  |  |  |
| Iron   | 7439-89-6                   | 0.05   | mg/L | 0.11              |  |  |  |  |
| EG020T: Total Metals by ICP-MS                               |                             |        |      |                   |  |  |  |  |
| Arsenic  | 7440-38-2                   | 0.001  | mg/L | 0.001             |  |  |  |  |
| Boron  | 7440-42-8                   | 0.05   | mg/L | <0.05             |  |  |  |  |
| Barium   | 7440-39-3                   | 0.001  | mg/L | 0.145             |  |  |  |  |
| Beryllium  | 7440-41-7                   | 0.001  | mg/L | <0.001            |  |  |  |  |
| Cadmium  | 7440-43-9                   | 0.0001 | mg/L | <0.0001           |  |  |  |  |
| Cobalt   | 7440-48-4                   | 0.001  | mg/L | 0.005             |  |  |  |  |
| Chromium   | 7440-47-3                   | 0.001  | mg/L | 0.002             |  |  |  |  |
| Copper   | 7440-50-8                   | 0.001  | mg/L | 0.002             |  |  |  |  |
| Manganese  | 7439-96-5                   | 0.001  | mg/L | 0.493             |  |  |  |  |
| Nickel   | 7440-02-0                   | 0.001  | mg/L | 0.005             |  |  |  |  |
| Lead   | 7439-92-1                   | 0.001  | mg/L | <0.001            |  |  |  |  |
| Selenium   | 7782-49-2                   | 0.01   | mg/L | <0.01             |  |  |  |  |
| Vanadium   | 7440-62-2                   | 0.01   | mg/L | <0.01             |  |  |  |  |
| Zinc   | 7440-66-6                   | 0.005  | mg/L | 0.009             |  |  |  |  |
| Iron   | 7439-89-6                   | 0.05   | mg/L | 1.42              |  |  |  |  |
| EG035F: Dissolved Mercury by FIMS                            |                             |        |      |                   |  |  |  |  |
| Mercury  | 7439-97-6                   | 0.0001 | mg/L | <0.0001           |  |  |  |  |
| EG035T: Total Recoverable Mercury by FIMS                    |                             |        |      |                   |  |  |  |  |
| Mercury  | 7439-97-6                   | 0.0001 | mg/L | <0.0001           |  |  |  |  |
| EK040P: Fluoride by PC Titrator                              |                             |        |      |                   |  |  |  |  |
| Fluoride   | 16984-48-8                  | 0.1    | mg/L | 0.2               |  |  |  |  |
| EK055G: Ammonia as N by Discrete Ana                         | llyser                      |        |      |                   |  |  |  |  |
| Ammonia as N   | 7664-41-7                   | 0.01   | mg/L | 0.89              |  |  |  |  |
| EK057G: Nitrite as N by Discrete Analys                      | er                          |        |      |                   |  |  |  |  |
| Nitrite as N   | 14797-65-0                  | 0.01   | mg/L | <0.01             |  |  |  |  |
| EK058G: Nitrate as N by Discrete Analyser                    |                             |        |      |                   |  |  |  |  |
| Nitrate as N   | 14797-55-8                  | 0.01   | mg/L | 0.08              |  |  |  |  |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser |                             |        |      |                   |  |  |  |  |
| Nitrite + Nitrate as N                                       |                             | 0.01   | mg/L | 0.08              |  |  |  |  |
|  |                             |        | 5    |                   |  |  |  |  |
| Page       | 5 of 5                       |
|------------|------------------------------|
| Work Order | : EB1903588                  |
| Client     | : GOLDER ASSOCIATES          |
| Project    | 1893795 Inland Rail (Pkg 12) |



| Sub-Matrix: WATER<br>(Matrix: WATER) | Client sample ID     |             |                | 320-01-BH2103     | <br> | <br> |
|--------------------------------------|----------------------|-------------|----------------|-------------------|------|------|
|                                      | Cli                  | ient sampli | ng date / time | 11-Feb-2019 02:30 | <br> | <br> |
| Compound                             | CAS Number           | LOR         | Unit           | EB1903588-001     | <br> | <br> |
|                                      |                      |             |                | Result            | <br> | <br> |
| EK061G: Total Kjeldahl Nitrogen By   | Discrete Analyser    |             |                |                   |      |      |
| Total Kjeldahl Nitrogen as N         |                      | 0.1         | mg/L           | 9.1               | <br> | <br> |
| EK062G: Total Nitrogen as N (TKN +   | NOx) by Discrete An  | alyser      |                |                   |      |      |
| ^ Total Nitrogen as N                |                      | 0.1         | mg/L           | 9.2               | <br> | <br> |
| EK067G: Total Phosphorus as P by     | Discrete Analyser    |             |                |                   |      |      |
| Total Phosphorus as P                |                      | 0.01        | mg/L           | 0.02              | <br> | <br> |
| EK071G: Reactive Phosphorus as P     | by discrete analyser |             |                |                   |      |      |
| Reactive Phosphorus as P             | 14265-44-2           | 0.01        | mg/L           | 0.01              | <br> | <br> |
| EN055: Ionic Balance                 |                      |             |                |                   |      |      |
| Total Anions                         |                      | 0.01        | meq/L          | 15.8              | <br> | <br> |
| Total Cations                        |                      | 0.01        | meq/L          | 14.8              | <br> | <br> |
| Ionic Balance                        |                      | 0.01        | %              | 3.29              | <br> | <br> |



# **CERTIFICATE OF ANALYSIS**

| Work Order              | EB1904979   | Page                    | : 1 of 5                                    |
|-------------------------|---|-------------------------|---|
| Client                  | : GOLDER ASSOCIATES   | Laboratory              | Environmental Division Brisbane             |
| Contact                 | : MR SUSANTHA KUMARAPELI  | Contact                 | : Andrew Epps                               |
| Address                 | C/- GOLDING CONTRACTORS PTY LTD LEVEL 3 8 GARDNER<br>CLOSE<br>MILTON QLD 4064 | Address                 | : 2 Byth Street Stafford QLD Australia 4053 |
| Telephone               | : +61 07 3721 5400  | Telephone               | : +61 7 3552 8639                           |
| Project                 | : 1893795 Inland Rail P/2   | Date Samples Received   | : 27-Feb-2019 14:55                         |
| Order number            | :   | Date Analysis Commenced | : 27-Feb-2019                               |
| C-O-C number            | :   | Issue Date              | : 04-Mar-2019 09:43                         |
| Sampler                 | : ROBERT CUPPER   |                         | Hac-MRA NATA                                |
| Site                    | :   |                         |   |
| Quote number            | : EN/002/18 National BQ   |                         | Accorditation No. 825                       |
| No. of samples received | : 1   |                         | Accredited for compliance with              |
| No. of samples analysed | : 1   |                         | ISO/IEC 17025 - Testing                     |

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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



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

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

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

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

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

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

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

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

| Page       | 3 of 5                    |
|------------|---------------------------|
| Work Order | : EB1904979               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 Inland Rail P/2 |



| Sub-Matrix: WATER<br>(Matrix: WATER)      | Client sample ID |              |                | 320-01-BH2216     | <br> | <br> |
|---|------------------|--------------|----------------|-------------------|------|------|
|   | Cl               | ient sampliı | ng date / time | 26-Feb-2019 08:20 | <br> | <br> |
| Compound                                  | CAS Number       | LOR          | Unit           | EB1904979-001     | <br> | <br> |
|   |                  |              |                | Result            | <br> | <br> |
| EA005P: pH by PC Titrator                 |                  |              |                |                   |      |      |
| pH Value                                  |                  | 0.01         | pH Unit        | 7.78              | <br> | <br> |
| EA010P: Conductivity by PC Titrator       |                  |              |                |                   |      |      |
| Electrical Conductivity @ 25°C            |                  | 1            | µS/cm          | 2800              | <br> | <br> |
| EA015: Total Dissolved Solids dried at 18 | 30 ± 5 °C        |              |                |                   |      |      |
| Total Dissolved Solids @180°C             |                  | 10           | mg/L           | 1770              | <br> | <br> |
| ED037P: Alkalinity by PC Titrator         |                  |              |                |                   |      |      |
| Hydroxide Alkalinity as CaCO3             | DMO-210-001      | 1            | mg/L           | <1                | <br> | <br> |
| Carbonate Alkalinity as CaCO3             | 3812-32-6        | 1            | mg/L           | <1                | <br> | <br> |
| Bicarbonate Alkalinity as CaCO3           | 71-52-3          | 1            | mg/L           | 1020              | <br> | <br> |
| Total Alkalinity as CaCO3                 |                  | 1            | mg/L           | 1020              | <br> | <br> |
| ED041G: Sulfate (Turbidimetric) as SO4 2  | 2- by DA         |              |                |                   |      |      |
| Sulfate as SO4 - Turbidimetric            | 14808-79-8       | 1            | mg/L           | 4                 | <br> | <br> |
| ED045G: Chloride by Discrete Analyser     |                  |              |                |                   |      |      |
| Chloride                                  | 16887-00-6       | 1            | mg/L           | 321               | <br> | <br> |
| ED093F: Dissolved Major Cations           |                  |              |                |                   |      |      |
| Calcium                                   | 7440-70-2        | 1            | mg/L           | 22                | <br> | <br> |
| Magnesium                                 | 7439-95-4        | 1            | mg/L           | 14                | <br> | <br> |
| Sodium                                    | 7440-23-5        | 1            | mg/L           | 612               | <br> | <br> |
| Potassium                                 | 7440-09-7        | 1            | mg/L           | 18                | <br> | <br> |
| ED093F: SAR and Hardness Calculations     | ;                |              |                |                   |      |      |
| ^ Sodium Adsorption Ratio                 |                  | 0.01         | -              | 25.1              | <br> | <br> |
| EG020F: Dissolved Metals by ICP-MS        |                  |              |                |                   |      |      |
| Arsenic                                   | 7440-38-2        | 0.001        | mg/L           | 0.007             | <br> | <br> |
| Beryllium                                 | 7440-41-7        | 0.001        | mg/L           | <0.001            | <br> | <br> |
| Barium                                    | 7440-39-3        | 0.001        | mg/L           | 0.488             | <br> | <br> |
| Cadmium                                   | 7440-43-9        | 0.0001       | mg/L           | <0.0001           | <br> | <br> |
| Chromium                                  | 7440-47-3        | 0.001        | mg/L           | <0.001            | <br> | <br> |
| Cobalt                                    | 7440-48-4        | 0.001        | mg/L           | 0.002             | <br> | <br> |
| Copper                                    | 7440-50-8        | 0.001        | mg/L           | <0.001            | <br> | <br> |
| Lead                                      | 7439-92-1        | 0.001        | mg/L           | <0.001            | <br> | <br> |
| Manganese                                 | 7439-96-5        | 0.001        | mg/L           | 0.031             | <br> | <br> |
| Nickel                                    | 7440-02-0        | 0.001        | mg/L           | 0.006             | <br> | <br> |
| Selenium                                  | 7782-49-2        | 0.01         | mg/L<br>       | <0.01             | <br> | <br> |
| Vanadium                                  | 7440-62-2        | 0.01         | mg/L           | <0.01             | <br> | <br> |

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|------------|---------------------------|
| Work Order | : EB1904979               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 Inland Rail P/2 |



| Sub-Matrix: WATER<br>(Matrix: WATER)                         | Client sample ID  |              |                | 320-01-BH2216     |  |  |  |  |
|--|-------------------|--------------|----------------|-------------------|--|--|--|--|
|  | Cli               | ient samplir | ng date / time | 26-Feb-2019 08:20 |  |  |  |  |
| Compound   | CAS Number        | LOR          | Unit           | EB1904979-001     |  |  |  |  |
|  |                   |              |                | Result            |  |  |  |  |
| EG020F: Dissolved Metals by ICP-MS - Co                      | ontinued          |              |                |                   |  |  |  |  |
| Zinc   | 7440-66-6         | 0.005        | mg/L           | <0.005            |  |  |  |  |
| Boron  | 7440-42-8         | 0.05         | mg/L           | 0.31              |  |  |  |  |
| Iron   | 7439-89-6         | 0.05         | mg/L           | <0.05             |  |  |  |  |
| EG020T: Total Metals by ICP-MS                               |                   |              |                |                   |  |  |  |  |
| Arsenic  | 7440-38-2         | 0.001        | mg/L           | 0.010             |  |  |  |  |
| Beryllium  | 7440-41-7         | 0.001        | mg/L           | <0.001            |  |  |  |  |
| Barium   | 7440-39-3         | 0.001        | mg/L           | 0.625             |  |  |  |  |
| Cadmium  | 7440-43-9         | 0.0001       | mg/L           | <0.0001           |  |  |  |  |
| Chromium   | 7440-47-3         | 0.001        | mg/L           | 0.006             |  |  |  |  |
| Cobalt   | 7440-48-4         | 0.001        | mg/L           | 0.009             |  |  |  |  |
| Copper   | 7440-50-8         | 0.001        | mg/L           | 0.010             |  |  |  |  |
| Lead   | 7439-92-1         | 0.001        | mg/L           | 0.008             |  |  |  |  |
| Manganese  | 7439-96-5         | 0.001        | mg/L           | 0.110             |  |  |  |  |
| Nickel   | 7440-02-0         | 0.001        | mg/L           | 0.010             |  |  |  |  |
| Selenium   | 7782-49-2         | 0.01         | mg/L           | <0.01             |  |  |  |  |
| Vanadium   | 7440-62-2         | 0.01         | mg/L           | <0.01             |  |  |  |  |
| Zinc   | 7440-66-6         | 0.005        | mg/L           | 0.027             |  |  |  |  |
| Boron  | 7440-42-8         | 0.05         | mg/L           | 0.29              |  |  |  |  |
| Iron   | 7439-89-6         | 0.05         | mg/L           | 4.08              |  |  |  |  |
| EG035F: Dissolved Mercury by FIMS                            |                   |              |                |                   |  |  |  |  |
| Mercury  | 7439-97-6         | 0.0001       | mg/L           | <0.0001           |  |  |  |  |
| EG035T: Total Recoverable Mercury by F                       | FIMS              |              |                |                   |  |  |  |  |
| Mercury  | 7439-97-6         | 0.0001       | mg/L           | <0.0001           |  |  |  |  |
| EK055G: Ammonia as N by Discrete Anal                        | lyser             |              |                |                   |  |  |  |  |
| Ammonia as N   | 7664-41-7         | 0.01         | mg/L           | 0.21              |  |  |  |  |
| EK057G: Nitrite as N by Discrete Analyse                     | er                |              |                |                   |  |  |  |  |
| Nitrite as N   | 14797-65-0        | 0.01         | mg/L           | <0.01             |  |  |  |  |
| EK058G: Nitrate as N by Discrete Analys                      | ser               |              |                |                   |  |  |  |  |
| Nitrate as N   | 14797-55-8        | 0.01         | mg/L           | 0.06              |  |  |  |  |
| EK059G: Nitrite plus Nitrate as N (NOx)                      | bv Discrete Ana   | lvser        |                |                   |  |  |  |  |
| Nitrite + Nitrate as N                                       |                   | 0.01         | mg/L           | 0.06              |  |  |  |  |
| EK061G: Total Kieldahl Nitrogen By Disc                      | rete Analyser     |              |                |                   |  |  |  |  |
| Total Kjeldahl Nitrogen as N                                 |                   | 0.1          | mg/L           | 0.7               |  |  |  |  |
| EK062G: Total Nitrogen as N (TKN + NOx                       | () by Discrete An | alvser       |                |                   |  |  |  |  |
| EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser |                   |              |                |                   |  |  |  |  |

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|------------|---------------------------|
| Work Order | : EB1904979               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 Inland Rail P/2 |



| Sub-Matrix: WATER<br>(Matrix: WATER) | Client sample ID   |            |                 | 320-01-BH2216     | <br> | <br> |
|--------------------------------------|--------------------|------------|-----------------|-------------------|------|------|
|                                      | Cli                | ent sampli | ing date / time | 26-Feb-2019 08:20 | <br> | <br> |
| Compound                             | CAS Number         | LOR        | Unit            | EB1904979-001     | <br> | <br> |
|                                      |                    |            |                 | Result            | <br> | <br> |
| EK062G: Total Nitrogen as N (TKN + N | Dx) by Discrete An | alyser - C | Continued       |                   |      |      |
| ^ Total Nitrogen as N                |                    | 0.1        | mg/L            | 0.8               | <br> | <br> |
| EK067G: Total Phosphorus as P by Dis | crete Analyser     |            |                 |                   |      |      |
| Total Phosphorus as P                |                    | 0.01       | mg/L            | 0.14              | <br> | <br> |
| EK071G: Reactive Phosphorus as P by  | discrete analyser  |            |                 |                   |      |      |
| Reactive Phosphorus as P             | 14265-44-2         | 0.01       | mg/L            | <0.01             | <br> | <br> |
| EN055: Ionic Balance                 |                    |            |                 |                   |      |      |
| Total Anions                         |                    | 0.01       | meq/L           | 29.5              | <br> | <br> |
| Total Cations                        |                    | 0.01       | meq/L           | 29.3              | <br> | <br> |
| Ionic Balance                        |                    | 0.01       | %               | 0.32              | <br> | <br> |



# **QUALITY CONTROL REPORT**

| Work Order              | EB1826458                                    | Page                    | : 1 of 8                    |                                |
|-------------------------|--|-------------------------|-----------------------------|--------------------------------|
| Client                  | : GOLDER ASSOCIATES                          | Laboratory              | : Environmental Division B  | risbane                        |
| Contact                 | : MR MITCH McGINNIS                          | Contact                 | : Andrew Epps               |                                |
| Address                 | : P O BOX 1734<br>MILTON QLD. AUSTRALIA 4064 | Address                 | : 2 Byth Street Stafford QL | D Australia 4053               |
| Telephone               | +61 07 3721 5400                             | Telephone               | : +61 7 3552 8639           |                                |
| Project                 | : 1893795                                    | Date Samples Received   | : 01-Nov-2018               | AND IN CONTRACTOR OF A         |
| Order number            | : 17893795                                   | Date Analysis Commenced | : 01-Nov-2018               | summer and                     |
| C-O-C number            | :  | Issue Date              | : 06-Nov-2018               | NATA                           |
| Sampler                 | : ROBERT CUPPER                              |                         |                             | HALA NALA                      |
| Site                    | : INLAND RAIL (P12)                          |                         |                             |                                |
| Quote number            | EN/002/18 National BQ                        |                         |                             | Accorditation No. 825          |
| No. of samples received | : 2  |                         |                             | Accredited for compliance with |
| No. of samples analysed | : 2  |                         |                             | ISO/IEC 17025 - Testing        |

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

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

## Signatories

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



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

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

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

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

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

#### Laboratory Duplicate (DUP) Report

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

| Sub-Matrix: WATER     |                               |  |             | Laboratory Duplicate (DUP) Report |         |                 |                  |         |                     |
|-----------------------|-------------------------------|--|-------------|-----------------------------------|---------|-----------------|------------------|---------|---------------------|
| Laboratory sample ID  | Client sample ID              | Method: Compound                         | CAS Number  | LOR                               | Unit    | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |
| EA005P: pH by PC Tit  | trator (QC Lot: 2015212)      |  |             |                                   |         |                 |                  |         |                     |
| EB1826453-001         | Anonymous                     | EA005-P: pH Value                        |             | 0.01                              | pH Unit | 7.81            | 7.80             | 0.128   | 0% - 20%            |
| EA010P: Conductivity  | y by PC Titrator (QC Lot: 20  | 15213)                                   |             |                                   |         |                 |                  |         |                     |
| EB1826453-001         | Anonymous                     | EA010-P: Electrical Conductivity @ 25°C  |             | 1                                 | μS/cm   | 1020            | 1020             | 0.498   | 0% - 20%            |
| EA015: Total Dissolve | ed Solids dried at 180 ± 5 °C | (QC Lot: 2015717)                        |             |                                   |         |                 |                  |         |                     |
| EB1826453-001         | Anonymous                     | EA015H: Total Dissolved Solids @180°C    |             | 10                                | mg/L    | 724             | 774              | 6.76    | 0% - 20%            |
| ED037P: Alkalinity by | PC Titrator (QC Lot: 20152    | 11)                                      |             |                                   |         |                 |                  |         |                     |
| EB1826453-001         | Anonymous                     | ED037-P: Hydroxide Alkalinity as CaCO3   | DMO-210-001 | 1                                 | mg/L    | <1              | <1               | 0.00    | No Limit            |
|                       |                               | ED037-P: Carbonate Alkalinity as CaCO3   | 3812-32-6   | 1                                 | mg/L    | <1              | <1               | 0.00    | No Limit            |
|                       |                               | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3     | 1                                 | mg/L    | 381             | 380              | 0.278   | 0% - 20%            |
|                       |                               | ED037-P: Total Alkalinity as CaCO3       |             | 1                                 | mg/L    | 381             | 380              | 0.278   | 0% - 20%            |
| ED041G: Sulfate (Tur  |                               |  |             |                                   |         |                 |                  |         |                     |
| EB1826477-004         | Anonymous                     | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8  | 1                                 | mg/L    | 305             | 307              | 0.534   | 0% - 20%            |
| EB1826453-001         | Anonymous                     | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8  | 1                                 | mg/L    | 4               | 4                | 0.00    | No Limit            |
| ED045G: Chloride by   | Discrete Analyser (QC Lot:    | 2015252)                                 |             |                                   |         |                 |                  |         |                     |
| EB1826477-004         | Anonymous                     | ED045G: Chloride                         | 16887-00-6  | 1                                 | mg/L    | 463             | 461              | 0.486   | 0% - 20%            |
| EB1826453-001         | Anonymous                     | ED045G: Chloride                         | 16887-00-6  | 1                                 | mg/L    | 113             | 114              | 0.00    | 0% - 20%            |
| ED093F: Dissolved M   | ajor Cations (QC Lot: 2015)   | 721)                                     |             |                                   |         |                 |                  |         |                     |
| EB1826406-006         | Anonymous                     | ED093F: Calcium                          | 7440-70-2   | 1                                 | mg/L    | 9               | 10               | 0.00    | No Limit            |
|                       |                               | ED093F: Magnesium                        | 7439-95-4   | 1                                 | mg/L    | 6               | 6                | 0.00    | No Limit            |
|                       |                               | ED093F: Sodium                           | 7440-23-5   | 1                                 | mg/L    | 28              | 28               | 0.00    | 0% - 20%            |
|                       |                               | ED093F: Potassium                        | 7440-09-7   | 1                                 | mg/L    | 3               | 3                | 0.00    | No Limit            |
| EB1826295-015         | Anonymous                     | ED093F: Calcium                          | 7440-70-2   | 1                                 | mg/L    | 381             | 382              | 0.00    | 0% - 20%            |
|                       |                               | ED093F: Magnesium                        | 7439-95-4   | 1                                 | mg/L    | 258             | 256              | 0.443   | 0% - 20%            |
|                       |                               | ED093F: Sodium                           | 7440-23-5   | 1                                 | mg/L    | 2030            | 1990             | 1.90    | 0% - 20%            |

| Page       | : 3 of 8            |
|------------|---------------------|
| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | 1893795             |



| Sub-Matrix: WATER    |                             |                     |            | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                     |
|----------------------|-----------------------------|---------------------|------------|-----------------------------------|------|-----------------|------------------|---------|---------------------|
| Laboratory sample ID | Client sample ID            | Method: Compound    | CAS Number | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |
| ED093F: Dissolved M  | lajor Cations (QC Lot: 2015 | 721) - continued    |            |                                   |      |                 |                  |         |                     |
| EB1826295-015        | Anonymous                   | ED093F: Potassium   | 7440-09-7  | 1                                 | mg/L | 9               | 9                | 0.00    | No Limit            |
| EG020F: Dissolved N  | letals by ICP-MS (QC Lot: 2 | 015722)             |            |                                   |      |                 |                  |         |                     |
| EB1826295-015        | Anonymous                   | EG020A-F: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
|                      |                             | EG020A-F: Arsenic   | 7440-38-2  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Beryllium | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Barium    | 7440-39-3  | 0.001                             | mg/L | 0.154           | 0.148            | 3.69    | 0% - 20%            |
|                      |                             | EG020A-F: Chromium  | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Cobalt    | 7440-48-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Copper    | 7440-50-8  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Lead      | 7439-92-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Manganese | 7439-96-5  | 0.001                             | mg/L | 0.295           | 0.293            | 0.604   | 0% - 20%            |
|                      |                             | EG020A-F: Nickel    | 7440-02-0  | 0.001                             | mg/L | 0.002           | 0.001            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Zinc      | 7440-66-6  | 0.005                             | mg/L | <0.005          | <0.005           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Selenium  | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Vanadium  | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Boron     | 7440-42-8  | 0.05                              | mg/L | 0.54            | 0.52             | 3.20    | 0% - 50%            |
|                      |                             | EG020A-F: Iron      | 7439-89-6  | 0.05                              | mg/L | 0.78            | 0.76             | 2.59    | 0% - 50%            |
| EG020T: Total Metals | by ICP-MS (QC Lot: 20157    | 14)                 |            |                                   |      |                 |                  |         |                     |
| EB1826414-002        | Anonymous                   | EG020A-T: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | <0.1 µg/L       | <0.0001          | 0.00    | No Limit            |
|                      |                             | EG020A-T: Arsenic   | 7440-38-2  | 0.001                             | mg/L | 2 µg/L          | 0.002            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Beryllium | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Barium    | 7440-39-3  | 0.001                             | mg/L | 0.074           | 0.074            | 0.00    | 0% - 20%            |
|                      |                             | EG020A-T: Chromium  | 7440-47-3  | 0.001                             | mg/L | <1 µg/L         | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Cobalt    | 7440-48-4  | 0.001                             | mg/L | <1 µg/L         | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Copper    | 7440-50-8  | 0.001                             | mg/L | 2 µg/L          | 0.001            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Lead      | 7439-92-1  | 0.001                             | mg/L | <1 µg/L         | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Manganese | 7439-96-5  | 0.001                             | mg/L | 24 µg/L         | 0.021            | 14.0    | 0% - 20%            |
|                      |                             | EG020A-T: Nickel    | 7440-02-0  | 0.001                             | mg/L | 2 µg/L          | 0.002            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Zinc      | 7440-66-6  | 0.005                             | mg/L | <5 µg/L         | <0.005           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Selenium  | 7782-49-2  | 0.01                              | mg/L | <10 µg/L        | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Vanadium  | 7440-62-2  | 0.01                              | mg/L | <10 µg/L        | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Boron     | 7440-42-8  | 0.05                              | mg/L | 130 µg/L        | 0.14             | 0.00    | No Limit            |
|                      |                             | EG020A-T: Iron      | 7439-89-6  | 0.05                              | mg/L | 320 µg/L        | 0.24             | 31.6    | No Limit            |
| EB1826295-015        | Anonymous                   | EG020A-T: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | 0.0004          | <0.0001          | 114     | No Limit            |
|                      |                             | EG020A-T: Arsenic   | 7440-38-2  | 0.001                             | mg/L | 0.001           | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Beryllium | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Barium    | 7440-39-3  | 0.001                             | mg/L | 0.175           | 0.172            | 2.17    | 0% - 20%            |
|                      |                             | EG020A-T: Chromium  | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Cobalt    | 7440-48-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Copper    | 7440-50-8  | 0.001                             | mg/L | 0.002           | 0.001            | 0.00    | No Limit            |

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|------------|---------------------|
| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | 1893795             |



| Sub-Matrix: WATER                                 |                             |                                      | Laboratory Duplicate (DUP) Report |        |      |                 |                  |         |                     |
|---|-----------------------------|--------------------------------------|-----------------------------------|--------|------|-----------------|------------------|---------|---------------------|
| Laboratory sample ID                              | Client sample ID            | Method: Compound                     | CAS Number                        | LOR    | Unit | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |
| EG020T: Total Metals                              | by ICP-MS (QC Lot: 201571   | 14) - continued                      |                                   |        |      |                 |                  |         |                     |
| EB1826295-015                                     | Anonymous                   | EG020A-T: Lead                       | 7439-92-1                         | 0.001  | mg/L | 0.001           | <0.001           | 0.00    | No Limit            |
|   |                             | EG020A-T: Manganese                  | 7439-96-5                         | 0.001  | mg/L | 0.339           | 0.322            | 5.24    | 0% - 20%            |
|   |                             | EG020A-T: Nickel                     | 7440-02-0                         | 0.001  | mg/L | 0.002           | 0.002            | 0.00    | No Limit            |
|   |                             | EG020A-T: Zinc                       | 7440-66-6                         | 0.005  | mg/L | 0.006           | <0.005           | 21.2    | No Limit            |
|   |                             | EG020A-T: Selenium                   | 7782-49-2                         | 0.01   | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|   |                             | EG020A-T: Vanadium                   | 7440-62-2                         | 0.01   | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|   |                             | EG020A-T: Boron                      | 7440-42-8                         | 0.05   | mg/L | 0.54            | 0.52             | 4.50    | 0% - 50%            |
|   |                             | EG020A-T: Iron                       | 7439-89-6                         | 0.05   | mg/L | 1.85            | 1.86             | 0.00    | 0% - 20%            |
| EG035F: Dissolved M                               | ercury by FIMS (QC Lot: 20  | 15723)                               |                                   |        |      |                 |                  |         |                     |
| EB1826295-015                                     | Anonymous                   | EG035F: Mercury                      | 7439-97-6                         | 0.0001 | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
| EG035T: Total Recov                               | verable Mercury by FIMS (Q  | C Lot: 2015712)                      |                                   |        |      |                 |                  |         |                     |
| EB1826295-015                                     | Anonymous                   | EG035T: Mercury                      | 7439-97-6                         | 0.0001 | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
| EK040P: Fluoride by PC Titrator (QC Lot: 2015210) |                             |                                      |                                   |        |      |                 |                  |         |                     |
| EB1826453-001                                     | Anonymous                   | EK040P: Fluoride                     | 16984-48-8                        | 0.1    | mg/L | 0.2             | 0.2              | 0.00    | No Limit            |
| EK055G: Ammonia as                                | N by Discrete Analyser (Q   | C Lot: 2015264)                      |                                   |        |      |                 |                  |         |                     |
| EB1826453-001                                     | Anonymous                   | EK055G: Ammonia as N                 | 7664-41-7                         | 0.01   | mg/L | 0.09            | 0.12             | 25.0    | 0% - 50%            |
| EB1826477-001                                     | Anonymous                   | EK055G: Ammonia as N                 | 7664-41-7                         | 0.01   | mg/L | 0.08            | 0.09             | 0.00    | No Limit            |
| EK057G: Nitrite as N                              | by Discrete Analyser (QC L  | _ot: 2015253)                        |                                   |        |      |                 |                  |         |                     |
| EB1826477-004                                     | Anonymous                   | EK057G: Nitrite as N                 | 14797-65-0                        | 0.01   | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
| EB1826453-001                                     | Anonymous                   | EK057G: Nitrite as N                 | 14797-65-0                        | 0.01   | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
| EK059G: Nitrite plus                              | Nitrate as N (NOx) by Discr | rete Analyser (QC Lot: 2015265)      |                                   |        |      |                 |                  |         |                     |
| EB1826453-001                                     | Anonymous                   | EK059G: Nitrite + Nitrate as N       |                                   | 0.01   | mg/L | 0.08            | 0.08             | 0.00    | No Limit            |
| EB1826477-001                                     | Anonymous                   | EK059G: Nitrite + Nitrate as N       |                                   | 0.01   | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
| EK061G: Total Kjelda                              | hl Nitrogen By Discrete Ana | ılyser (QC Lot: 2015244)             |                                   |        |      |                 |                  |         |                     |
| EB1826453-001                                     | Anonymous                   | EK061G: Total Kjeldahl Nitrogen as N |                                   | 0.1    | mg/L | 23.2            | 24.3             | 4.75    | 0% - 20%            |
| EB1826477-001                                     | Anonymous                   | EK061G: Total Kjeldahl Nitrogen as N |                                   | 0.1    | mg/L | 10.8            | 10.7             | 0.00    | 0% - 20%            |
| EK067G: Total Phosp                               | horus as P by Discrete Ana  | lyser (QC Lot: 2015243)              |                                   |        |      |                 |                  |         |                     |
| EB1826453-001                                     | Anonymous                   | EK067G: Total Phosphorus as P        |                                   | 0.01   | mg/L | 0.30            | 0.30             | 0.00    | 0% - 20%            |
| EB1826477-001                                     | Anonymous                   | EK067G: Total Phosphorus as P        |                                   | 0.01   | mg/L | 0.67            | 0.66             | 0.00    | 0% - 20%            |
| EK071G: Reactive Ph                               | osphorus as P by discrete a | analyser (QC Lot: 2015250)           |                                   |        |      |                 |                  |         |                     |
| EB1826453-001                                     | Anonymous                   | EK071G: Reactive Phosphorus as P     | 14265-44-2                        | 0.01   | mg/L | 0.10            | 0.10             | 0.00    | No Limit            |



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

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

| Sub-Matrix: WATER  |            |         | Method Blank (MB) | Laboratory Control Spike (LCS) Report |                    |          |            |  |
|--|------------|---------|-------------------|---------------------------------------|--------------------|----------|------------|--|
|  |            |         | Report            | Spike                                 | Spike Recovery (%) | Recovery | Limits (%) |  |
| Method: Compound CAS Nur   | iber LOR   | Unit    | Result            | Concentration                         | LCS                | Low      | High       |  |
| EA005P: pH by PC Titrator (QCLot: 2015212)                         |            |         |                   |                                       |                    |          |            |  |
| EA005-P: pH Value  |            | pH Unit |                   | 4 pH Unit                             | 99.2               | 98       | 102        |  |
|  |            |         |                   | 7 pH Unit                             | 100                | 98       | 102        |  |
| EA010P: Conductivity by PC Titrator (QCLot: 2015213)               |            |         |                   |                                       |                    |          |            |  |
| EA010-P: Electrical Conductivity @ 25°C                            | 1          | μS/cm   | <1                | 2100 µS/cm                            | 100                | 91       | 107        |  |
|  |            |         | <1                | 12890 µS/cm                           | 99.3               | 91       | 107        |  |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 2015717) |            |         |                   |                                       |                    |          |            |  |
| EA015H: Total Dissolved Solids @180°C                              | 10         | mg/L    | <10               | 293 mg/L                              | 103                | 88       | 112        |  |
|  |            |         | <10               | 2000 mg/L                             | 101                | 88       | 112        |  |
| ED037P: Alkalinity by PC Titrator (QCLot: 2015211)                 |            |         |                   |                                       |                    |          |            |  |
| ED037-P: Total Alkalinity as CaCO3                                 |            | mg/L    |                   | 200 mg/L                              | 93.4               | 80       | 120        |  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (OCLot: 2015251)   |            |         |                   |                                       |                    |          |            |  |
| ED041G: Sulfate as SO4 - Turbidimetric 14808-7                     | 9-8 1      | mg/L    | <1                | 25 mg/L                               | 103                | 85       | 118        |  |
|  |            | _       | <1                | 100 mg/L                              | 102                | 85       | 118        |  |
| ED045G: Chloride by Discrete Analyser (QCLot: 2015252)             |            |         |                   |                                       |                    |          |            |  |
| ED045G: Chloride 16887-0   | )-6 1      | mg/L    | <1                | 10 mg/L                               | 107                | 90       | 115        |  |
|  |            | _       | <1                | 1000 mg/L                             | 104                | 90       | 115        |  |
| ED093F: Dissolved Major Cations (QCLot: 2015721)                   |            |         |                   |                                       |                    |          |            |  |
| ED093F: Calcium 7440-7   | )-2 1      | mg/L    | <1                |                                       |                    |          |            |  |
| ED093F: Magnesium 7439-9   | 5-4 1      | mg/L    | <1                |                                       |                    |          |            |  |
| ED093F: Sodium 7440-2  | 3-5 1      | mg/L    | <1                |                                       |                    |          |            |  |
| ED093F: Potassium 7440-0   | 9-7 1      | mg/L    | <1                |                                       |                    |          |            |  |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 2015722)                |            |         |                   |                                       |                    |          |            |  |
| EG020A-F: Arsenic 7440-3   | 3-2 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 96.0               | 88       | 116        |  |
| EG020A-F: Beryllium 7440-4   | I-7 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 87.2               | 81       | 117        |  |
| EG020A-F: Barium 7440-3  | 9-3 0.001  | mg/L    | <0.001            | 0.5 mg/L                              | 88.8               | 70       | 130        |  |
| EG020A-F: Cadmium 7440-4   | 3-9 0.0001 | mg/L    | <0.0001           | 0.1 mg/L                              | 92.1               | 88       | 108        |  |
| EG020A-F: Chromium 7440-4  | 7-3 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 109                | 87       | 113        |  |
| EG020A-F: Cobalt 7440-4  | 3-4 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 94.8               | 86       | 112        |  |
| EG020A-F: Copper 7440-5  | 0.001      | mg/L    | <0.001            | 0.2 mg/L                              | 108                | 88       | 114        |  |
| EG020A-F: Lead 7439-9  | 2-1 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 96.0               | 89       | 110        |  |
| EG020A-F: Manganese 7439-9   | 6-5 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 96.5               | 89       | 120        |  |
| EG020A-F: Nickel 7440-0  | 2-0 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 92.8               | 89       | 113        |  |
| EG020A-F: Selenium 7782-4  | 9-2 0.01   | mg/L    | <0.01             | 0.1 mg/L                              | 94.8               | 83       | 112        |  |
| EG020A-F: Vanadium 7440-6  | 2-2 0.01   | mg/L    | <0.01             | 0.1 mg/L                              | 111                | 88       | 114        |  |

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|------------|---------------------|
| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | 1893795             |



| Sub-Matrix: WATER  |                          |        |          | Method Blank (MB) | Laboratory Control Spike (LCS) Report |                    |          |            |
|--|--------------------------|--------|----------|-------------------|---------------------------------------|--------------------|----------|------------|
|  |                          |        |          | Report            | Spike                                 | Spike Recovery (%) | Recovery | Limits (%) |
| Method: Compound   | CAS Number               | LOR    | Unit     | Result            | Concentration                         | LCS                | Low      | High       |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 201                 | 5722) - continued        |        |          |                   |                                       |                    |          |            |
| EG020A-F: Zinc   | 7440-66-6                | 0.005  | mg/L     | <0.005            | 0.2 mg/L                              | 94.9               | 87       | 113        |
| EG020A-F: Boron  | 7440-42-8                | 0.05   | mg/L     | <0.05             | 0.5 mg/L                              | 99.0               | 81       | 125        |
| EG020A-F: Iron   | 7439-89-6                | 0.05   | mg/L     | <0.05             | 0.5 mg/L                              | 96.7               | 82       | 114        |
| EG020T: Total Metals by ICP-MS (QCLot: 2015714                 | )                        |        |          |                   |                                       |                    |          |            |
| EG020A-T: Arsenic  | 7440-38-2                | 0.001  | mg/L     | <0.001            | 0.1 mg/L                              | 98.0               | 88       | 112        |
| EG020A-T: Beryllium  | 7440-41-7                | 0.001  | mg/L     | <0.001            | 0.1 mg/L                              | 85.8               | 81       | 119        |
| EG020A-T: Barium   | 7440-39-3                | 0.001  | mg/L     | <0.001            | 0.5 mg/L                              | 95.6               | 70       | 130        |
| EG020A-T: Cadmium  | 7440-43-9                | 0.0001 | mg/L     | <0.0001           | 0.1 mg/L                              | 96.6               | 88       | 111        |
| EG020A-T: Chromium   | 7440-47-3                | 0.001  | mg/L     | <0.001            | 0.1 mg/L                              | 100                | 89       | 115        |
| EG020A-T: Cobalt   | 7440-48-4                | 0.001  | mg/L     | <0.001            | 0.1 mg/L                              | 103                | 89       | 115        |
| EG020A-T: Copper   | 7440-50-8                | 0.001  | mg/L     | <0.001            | 0.2 mg/L                              | 105                | 88       | 116        |
| EG020A-T: Lead   | 7439-92-1                | 0.001  | mg/L     | <0.001            | 0.1 mg/L                              | 93.5               | 89       | 112        |
| EG020A-T: Manganese  | 7439-96-5                | 0.001  | mg/L     | <0.001            | 0.1 mg/L                              | 104                | 88       | 114        |
| EG020A-T: Nickel   | 7440-02-0                | 0.001  | mg/L     | <0.001            | 0.1 mg/L                              | 97.8               | 88       | 116        |
| EG020A-T: Selenium   | 7782-49-2                | 0.01   | mg/L     | <0.01             | 0.1 mg/L                              | 96.2               | 79       | 111        |
| EG020A-T: Vanadium   | 7440-62-2                | 0.01   | mg/L     | <0.01             | 0.1 mg/L                              | 113                | 87       | 114        |
| EG020A-T: Zinc   | 7440-66-6                | 0.005  | mg/L     | <0.005            | 0.2 mg/L                              | 94.4               | 84       | 114        |
| EG020A-T: Boron  | 7440-42-8                | 0.05   | mg/L     | <0.05             | 0.5 mg/L                              | 97.4               | 82       | 128        |
| EG020A-T: Iron   | 7439-89-6                | 0.05   | mg/L     | <0.05             | 0.5 mg/L                              | 98.6               | 82       | 118        |
| EG035F: Dissolved Mercury by FIMS (QCLot: 201                  | 5723)                    |        |          |                   |                                       |                    |          |            |
| EG035F: Mercury  | 7439-97-6                | 0.0001 | mg/L     | <0.0001           | 0.01 mg/L                             | 86.2               | 84       | 118        |
| EG035T: Total Recoverable Mercury by FIMS (QC                  | Lot: 2015712)            |        |          |                   |                                       |                    |          |            |
| EG035T: Mercury  | 7439-97-6                | 0.0001 | mg/L     | <0.0001           | 0.01 mg/L                             | 84.9               | 84       | 118        |
| EK040P: Fluoride by PC Titrator (QCLot: 2015210)               |                          |        |          |                   |                                       |                    |          |            |
| EK040P: Fluoride   | 16984-48-8               | 0.1    | mg/L     | <0.1              | 5 mg/L                                | 106                | 80       | 117        |
| EK055G: Ammonia as N by Discrete Analyser (QC                  | Lot: 2015264)            |        |          |                   |                                       |                    |          |            |
| EK055G: Ammonia as N   | 7664-41-7                | 0.01   | mg/L     | <0.01             | 0.5 mg/L                              | 97.0               | 86       | 112        |
| EK057G: Nitrite as N by Discrete Analyser (OCI o               | t: 2015253)              |        | _        |                   |                                       |                    |          |            |
| EK057G: Nitrite as N   | 14797-65-0               | 0.01   | mg/L     | <0.01             | 0.5 mg/L                              | 98.9               | 90       | 110        |
| FK059G <sup>+</sup> Nitrite plus Nitrate as N (NOx), by Discre | te Analyser (QCI of: 201 | 5265)  |          |                   |                                       |                    |          |            |
| EK059G: Nitrite + Nitrate as N                                 |                          | 0.01   | mg/L     | <0.01             | 0.5 mg/L                              | 98.7               | 89       | 115        |
| EK061G: Total Kieldahl Nitrogen By Discrete Anal               | vser (QCLot: 2015244)    |        |          |                   |                                       |                    |          |            |
| EK061G: Total Kjeldahl Nitrogen as N                           |                          | 0.1    | mg/L     | <0.1              | 10 mg/L                               | 99.9               | 70       | 111        |
| EK067G: Total Phosphorus as P by Discrete Analy                | (ser (QCI of: 2015243)   |        |          |                   |                                       |                    |          |            |
| EK067G: Total Phosphorus as P                                  |                          | 0.01   | mg/L     | <0.01             | 4.42 mg/L                             | 94.8               | 77       | 109        |
| EK071G: Reactive Phosphorus as P by discrete ar                | nalvser (QCL of: 2015250 |        |          |                   |                                       |                    |          |            |
| EK071G: Reactive Phosphorus as P                               | 14265-44-2               | 0.01   | mg/L     | <0.01             | 0.5 mg/L                              | 92.6               | 88       | 115        |
|  |                          |        | <b>.</b> |                   | Ŭ Ŭ                                   |                    |          |            |



# Matrix Spike (MS) Report

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

| Sub-Matrix: WATER    |   |  |            |               | Matrix Spike (MS) Report |            |            |  |  |  |
|----------------------|---|--|------------|---------------|--------------------------|------------|------------|--|--|--|
|                      |   |  |            | Spike         | SpikeRecovery(%)         | Recovery I | .imits (%) |  |  |  |
| Laboratory sample ID | Client sample ID                            | Method: Compound                       | CAS Number | Concentration | MS                       | Low        | High       |  |  |  |
| ED041G: Sulfate (    | Furbidimetric) as SO4 2- by DA (QCLot: 2015 | 251)                                   |            |               |                          |            |            |  |  |  |
| EB1826453-002        | Anonymous                                   | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 20 mg/L       | 108                      | 70         | 130        |  |  |  |
| ED045G: Chloride     | by Discrete Analyser (QCLot: 2015252)       |  |            |               |                          |            |            |  |  |  |
| EB1826453-002        | Anonymous                                   | ED045G: Chloride                       | 16887-00-6 | 400 mg/L      | 108                      | 70         | 130        |  |  |  |
| EG020F: Dissolve     | d Metals by ICP-MS (QCLot: 2015722)         |  |            |               |                          |            |            |  |  |  |
| EB1826467-001        | Anonymous                                   | EG020A-F: Arsenic                      | 7440-38-2  | 0.1 mg/L      | 99.6                     | 70         | 130        |  |  |  |
|                      | -   | EG020A-F: Bervllium                    | 7440-41-7  | 0.1 mg/L      | 94.0                     | 70         | 130        |  |  |  |
|                      |   | EG020A-F: Barium                       | 7440-39-3  | 0.5 mg/L      | 90.8                     | 70         | 130        |  |  |  |
|                      |   | EG020A-F: Cadmium                      | 7440-43-9  | 0.1 mg/L      | 94.8                     | 70         | 130        |  |  |  |
|                      |   | EG020A-F: Chromium                     | 7440-47-3  | 0.1 mg/L      | 109                      | 70         | 130        |  |  |  |
|                      |   | EG020A-F: Cobalt                       | 7440-48-4  | 0.1 mg/L      | 94.8                     | 70         | 130        |  |  |  |
|                      |   | EG020A-F: Copper                       | 7440-50-8  | 0.2 mg/L      | 107                      | 70         | 130        |  |  |  |
|                      |   | EG020A-F: Lead                         | 7439-92-1  | 0.1 mg/L      | 102                      | 70         | 130        |  |  |  |
|                      |   | EG020A-F: Manganese                    | 7439-96-5  | 0.1 mg/L      | 94.3                     | 70         | 130        |  |  |  |
|                      |   | EG020A-F: Nickel                       | 7440-02-0  | 0.1 mg/L      | 94.7                     | 70         | 130        |  |  |  |
|                      | EG020A-F: Selenium                          | 7782-49-2                              | 0.1 mg/L   | 99.7          | 70                       | 130        |            |  |  |  |
|                      |   | EG020A-F: Vanadium                     | 7440-62-2  | 0.1 mg/L      | 102                      | 70         | 130        |  |  |  |
|                      |   | EG020A-F: Zinc                         | 7440-66-6  | 0.2 mg/L      | 99.8                     | 70         | 130        |  |  |  |
|                      |   | EG020A-F: Boron                        | 7440-42-8  | 0.5 mg/L      | 98.5                     | 70         | 130        |  |  |  |
| EG020T: Total Me     | als by ICP-MS (QCLot: 2015714)              |  |            |               |                          |            |            |  |  |  |
| EB1826406-001        | Anonymous                                   | EG020A-T: Arsenic                      | 7440-38-2  | 1 mg/L        | 102                      | 70         | 130        |  |  |  |
|                      |   | EG020A-T: Beryllium                    | 7440-41-7  | 0.1 mg/L      | 88.7                     | 70         | 130        |  |  |  |
|                      |   | EG020A-T: Barium                       | 7440-39-3  | 1 mg/L        | 105                      | 70         | 130        |  |  |  |
|                      |   | EG020A-T: Cadmium                      | 7440-43-9  | 0.5 mg/L      | 102                      | 70         | 130        |  |  |  |
|                      |   | EG020A-T: Chromium                     | 7440-47-3  | 1 mg/L        | 91.6                     | 70         | 130        |  |  |  |
|                      |   | EG020A-T: Cobalt                       | 7440-48-4  | 1 mg/L        | 90.8                     | 70         | 130        |  |  |  |
|                      |   | EG020A-T: Copper                       | 7440-50-8  | 1 mg/L        | 92.8                     | 70         | 130        |  |  |  |
|                      |   | EG020A-T: Lead                         | 7439-92-1  | 1 mg/L        | 92.8                     | 70         | 130        |  |  |  |
|                      |   | EG020A-T: Manganese                    | 7439-96-5  | 1 mg/L        | 88.9                     | 70         | 130        |  |  |  |
|                      |   | EG020A-T: Nickel                       | 7440-02-0  | 1 mg/L        | 91.1                     | 70         | 130        |  |  |  |
|                      |   | EG020A-T: Vanadium                     | 7440-62-2  | 1 mg/L        | 96.6                     | 70         | 130        |  |  |  |
| L                    |   | EG020A-T: Zinc                         | 7440-66-6  | 1 mg/L        | 90.6                     | 70         | 130        |  |  |  |
| EG035F: Dissolve     | d Mercury by FIMS (QCLot: 2015723)          |  |            |               |                          |            |            |  |  |  |
| EB1826295-015        | Anonymous                                   | EG035F: Mercury                        | 7439-97-6  | 0.01 mg/L     | 78.0                     | 70         | 130        |  |  |  |

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|------------|---------------------|
| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | 1893795             |



#### Matrix Spike (MS) Report Sub-Matrix: WATER Spike SpikeRecovery(%) Recovery Limits (%) Client sample ID Laboratory sample ID CAS Number MS Concentration Low High Method: Compound EG035T: Total Recoverable Mercury by FIMS (QCLot: 2015712) EB1826414-001 Anonymous 7439-97-6 0.05 mg/L 84.3 70 130 EG035T: Mercury EK040P: Fluoride by PC Titrator (QCLot: 2015210) EB1826453-002 16984-48-8 Anonymous 5 mg/L 101 70 130 EK040P: Fluoride EK055G: Ammonia as N by Discrete Analyser (QCLot: 2015264) EB1826453-002 7664-41-7 Anonymous 0.4 mg/L 82.0 70 130 EK055G: Ammonia as N EK057G: Nitrite as N by Discrete Analyser (QCLot: 2015253) EB1826453-002 Anonymous 14797-65-0 0.4 mg/L 101 70 130 EK057G: Nitrite as N EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2015265) EB1826453-002 Anonymous 0.4 mg/L 100 70 130 EK059G: Nitrite + Nitrate as N ----EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2015244) EB1826453-002 Anonymous EK061G: Total Kjeldahl Nitrogen as N 5 mg/L 97.5 70 130 \_\_\_\_ EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2015243) EB1826453-002 Anonymous 1 mg/L 112 70 130 EK067G: Total Phosphorus as P \_\_\_\_ EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2015250) EB1826453-002 Anonymous 14265-44-2 0.4 mg/L 101 70 130 EK071G: Reactive Phosphorus as P



# QUALITY CONTROL REPORT

| Work Order              | EB1828548                  | Page                    | : 1 of 8                   |                                |
|-------------------------|----------------------------|-------------------------|----------------------------|--------------------------------|
| Client                  | : GOLDER ASSOCIATES        | Laboratory              | : Environmental Division I | Brisbane                       |
| Contact                 | : MR MITCH McGINNIS        | Contact                 | : Andrew Epps              |                                |
| Address                 | : P O BOX 1734             | Address                 | : 2 Byth Street Stafford Q | LD Australia 4053              |
| Telephone               | MILTON QLD, AUSTRALIA 4064 | Telephone               | +61 7 3552 8639            |                                |
| Project                 | : 1893795 INLAND RAIL P12  | Date Samples Received   | : 22-Nov-2018              | sullu.                         |
| Order number            | :                          | Date Analysis Commenced | : 22-Nov-2018              |                                |
| C-O-C number            | :                          | Issue Date              | : 26-Nov-2018              |                                |
| Sampler                 | : SUSANTHA KUMARAPELI      |                         |                            | HAC-MRA NAIA                   |
| Site                    | :                          |                         |                            |                                |
| Quote number            | : EN/002/18 National BQ    |                         |                            | Accorditation No. 825          |
| No. of samples received | : 1                        |                         |                            | Accredited for compliance with |
| No. of samples analysed | : 1                        |                         |                            | ISO/IEC 17025 - Testing        |

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

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

## Signatories

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



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

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

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

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

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

#### Laboratory Duplicate (DUP) Report

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

| Sub-Matrix: WATER     |                               |  |             |      | Laboratory Duplicate (DUP) Report |                 |                  |         |                     |  |
|-----------------------|-------------------------------|--|-------------|------|-----------------------------------|-----------------|------------------|---------|---------------------|--|
| Laboratory sample ID  | Client sample ID              | Method: Compound                         | CAS Number  | LOR  | Unit                              | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |  |
| EA005P: pH by PC Ti   | trator (QC Lot: 2051941)      |  |             |      |                                   |                 |                  |         |                     |  |
| EB1828142-003         | Anonymous                     | EA005-P: pH Value                        |             | 0.01 | pH Unit                           | 7.68            | 7.74             | 0.778   | 0% - 20%            |  |
| EB1828180-003         | Anonymous                     | EA005-P: pH Value                        |             | 0.01 | pH Unit                           | 7.57            | 7.64             | 0.920   | 0% - 20%            |  |
| EA010P: Conductivity  | y by PC Titrator (QC Lot: 20  | 51943)                                   |             |      |                                   |                 |                  |         |                     |  |
| EB1828142-003         | Anonymous                     | EA010-P: Electrical Conductivity @ 25°C  |             | 1    | μS/cm                             | 404             | 404              | 0.00    | 0% - 20%            |  |
| EB1828180-003         | Anonymous                     | EA010-P: Electrical Conductivity @ 25°C  |             | 1    | μS/cm                             | 16800           | 16800            | 0.482   | 0% - 20%            |  |
| EA015: Total Dissolv  | ed Solids dried at 180 ± 5 °C | (QC Lot: 2052371)                        |             |      |                                   |                 |                  |         |                     |  |
| EB1828018-001         | Anonymous                     | EA015H: Total Dissolved Solids @180°C    |             | 10   | mg/L                              | 1590            | 1580             | 0.883   | 0% - 20%            |  |
| ED037P: Alkalinity by | PC Titrator (QC Lot: 20519    | 42)                                      |             |      |                                   |                 |                  |         |                     |  |
| EB1828142-003         | Anonymous                     | ED037-P: Hydroxide Alkalinity as CaCO3   | DMO-210-001 | 1    | mg/L                              | <1              | <1               | 0.00    | No Limit            |  |
|                       |                               | ED037-P: Carbonate Alkalinity as CaCO3   | 3812-32-6   | 1    | mg/L                              | <1              | <1               | 0.00    | No Limit            |  |
|                       |                               | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3     | 1    | mg/L                              | 87              | 86               | 0.00    | 0% - 20%            |  |
|                       |                               | ED037-P: Total Alkalinity as CaCO3       |             | 1    | mg/L                              | 87              | 86               | 0.00    | 0% - 20%            |  |
| EB1828180-003         | Anonymous                     | ED037-P: Hydroxide Alkalinity as CaCO3   | DMO-210-001 | 1    | mg/L                              | <1              | <1               | 0.00    | No Limit            |  |
|                       |                               | ED037-P: Carbonate Alkalinity as CaCO3   | 3812-32-6   | 1    | mg/L                              | <1              | <1               | 0.00    | No Limit            |  |
|                       |                               | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3     | 1    | mg/L                              | 637             | 642              | 0.699   | 0% - 20%            |  |
|                       |                               | ED037-P: Total Alkalinity as CaCO3       |             | 1    | mg/L                              | 637             | 642              | 0.699   | 0% - 20%            |  |
| ED041G: Sulfate (Tur  | bidimetric) as SO4 2- by DA   | (QC Lot: 2052011)                        |             |      |                                   |                 |                  |         |                     |  |
| EB1827988-001         | Anonymous                     | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8  | 1    | mg/L                              | 11              | 11               | 0.00    | 0% - 50%            |  |
| EB1828167-005         | Anonymous                     | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8  | 1    | mg/L                              | <1              | 1                | 0.00    | No Limit            |  |
| ED045G: Chloride by   | Discrete Analyser (QC Lot:    | 2052012)                                 |             |      |                                   |                 |                  |         |                     |  |
| EB1827988-001         | Anonymous                     | ED045G: Chloride                         | 16887-00-6  | 1    | mg/L                              | 153             | 154              | 0.00    | 0% - 20%            |  |
| EB1828167-005         | Anonymous                     | ED045G: Chloride                         | 16887-00-6  | 1    | mg/L                              | 744             | 740              | 0.540   | 0% - 20%            |  |
| ED093F: Dissolved M   | ajor Cations (QC Lot: 20530   | 078)                                     |             |      |                                   |                 |                  |         |                     |  |
| EB1828548-001         | 320-01-BH2218                 | ED093F: Calcium                          | 7440-70-2   | 1    | mg/L                              | 6               | 6                | 0.00    | No Limit            |  |

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|------------|-------------------------|
| Work Order | EB1828548               |
| Client     | GOLDER ASSOCIATES       |
| Project    | 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER    |                             |                     |            | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                     |
|----------------------|-----------------------------|---------------------|------------|-----------------------------------|------|-----------------|------------------|---------|---------------------|
| Laboratory sample ID | Client sample ID            | Method: Compound    | CAS Number | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |
| ED093F: Dissolved N  | lajor Cations (QC Lot: 2053 | 8078) - continued   |            |                                   |      |                 |                  |         |                     |
| EB1828548-001        | 320-01-BH2218               | ED093F: Magnesium   | 7439-95-4  | 1                                 | mg/L | 3               | 3                | 0.00    | No Limit            |
|                      |                             | ED093F: Sodium      | 7440-23-5  | 1                                 | mg/L | 257             | 259              | 0.827   | 0% - 20%            |
|                      |                             | ED093F: Potassium   | 7440-09-7  | 1                                 | mg/L | 12              | 12               | 0.00    | 0% - 50%            |
| EG020F: Dissolved N  | letals by ICP-MS (QC Lot: 2 | 2053080)            |            |                                   |      |                 | <u> </u>         |         |                     |
| EB1828548-001        | 320-01-BH2218               | EG020A-E: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | <0.0001         | < 0.0001         | 0.00    | No Limit            |
|                      |                             | EG020A-F: Arsenic   | 7440-38-2  | 0.001                             | mg/L | 0.004           | 0.004            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Bervllium | 7440-41-7  | 0.001                             | mg/L | 0.002           | 0.001            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Barium    | 7440-39-3  | 0.001                             | mg/L | 0.182           | 0.191            | 4.88    | 0% - 20%            |
|                      |                             | EG020A-F: Chromium  | 7440-47-3  | 0.001                             | mg/L | 0.008           | 0.007            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Cobalt    | 7440-48-4  | 0.001                             | mg/L | 0.005           | 0.006            | 18.1    | No Limit            |
|                      |                             | EG020A-F: Copper    | 7440-50-8  | 0.001                             | mg/L | 0.004           | 0.003            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Lead      | 7439-92-1  | 0.001                             | mg/L | 0.007           | 0.007            | 0.00    | No Limit            |
|                      |                             | FG020A-F: Manganese | 7439-96-5  | 0.001                             | mg/L | 0.040           | 0.040            | 0.00    | 0% - 20%            |
|                      |                             | EG020A-F: Nickel    | 7440-02-0  | 0.001                             | mg/L | 0.008           | 0.006            | 26.0    | No Limit            |
|                      |                             | EG020A-F: Zinc      | 7440-66-6  | 0.005                             | mg/L | 0.054           | 0.050            | 7.93    | 0% - 50%            |
|                      |                             | EG020A-F: Selenium  | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Vanadium  | 7440-62-2  | 0.01                              | mg/L | 0.02            | 0.02             | 0.00    | No Limit            |
|                      |                             | EG020A-F: Boron     | 7440-42-8  | 0.05                              | mg/L | 0.40            | 0.40             | 0.00    | No Limit            |
| EG020T: Total Metals | by ICP-MS (QC Lot: 2053)    | 085)                |            |                                   |      |                 |                  |         |                     |
| EB1828168-001        | Anonymous                   | EG020A-T: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
|                      | -                           | EG020A-T: Arsenic   | 7440-38-2  | 0.001                             | mg/L | 0.002           | 0.002            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Bervllium | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Barium    | 7440-39-3  | 0.001                             | mg/L | 0.113           | 0.114            | 1.47    | 0% - 20%            |
|                      |                             | EG020A-T: Chromium  | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Cobalt    | 7440-48-4  | 0.001                             | mg/L | 0.003           | 0.003            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Copper    | 7440-50-8  | 0.001                             | mg/L | 0.004           | 0.004            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Lead      | 7439-92-1  | 0.001                             | mg/L | 0.001           | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Manganese | 7439-96-5  | 0.001                             | mg/L | 0.385           | 0.384            | 0.00    | 0% - 20%            |
|                      |                             | EG020A-T: Nickel    | 7440-02-0  | 0.001                             | mg/L | 0.006           | 0.006            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Zinc      | 7440-66-6  | 0.005                             | mg/L | 0.007           | 0.006            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Selenium  | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Vanadium  | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Boron     | 7440-42-8  | 0.05                              | mg/L | 0.14            | 0.14             | 0.00    | No Limit            |
| EG035F: Dissolved N  | lercury by FIMS (QC Lot: 2  | 053079)             |            |                                   |      |                 |                  |         |                     |
| EB1828548-001        | 320-01-BH2218               | EG035F: Mercury     | 7439-97-6  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
| EG035T: Total Recov  | verable Mercury by FIMS (0  | QC Lot: 2053088)    |            |                                   |      |                 |                  |         |                     |
| EB1828168-001        | Anonymous                   | EG035T: Mercury     | 7439-97-6  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
| EK040P: Fluoride by  | PC Titrator (QC Lot: 20519  | 44)                 |            |                                   |      |                 |                  |         |                     |
| EB1828142-003        | Anonymous                   | EK040P: Fluoride    | 16984-48-8 | 0.1                               | mg/L | 0.1             | 0.1              | 0.00    | No Limit            |

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|------------|---------------------------|
| Work Order | : EB1828548               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER   |                             |                                      |            |      | Laboratory Duplicate (DUP) Report |                 |                  |         |                     |  |  |
|---|-----------------------------|--------------------------------------|------------|------|-----------------------------------|-----------------|------------------|---------|---------------------|--|--|
| Laboratory sample ID  | Client sample ID            | Method: Compound                     | CAS Number | LOR  | Unit                              | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |  |  |
| EK040P: Fluoride by PC Titrator (QC Lot: 2051944) - continued |                             |                                      |            |      |                                   |                 |                  |         |                     |  |  |
| EB1828180-003   | Anonymous                   | EK040P: Fluoride                     | 16984-48-8 | 0.1  | mg/L                              | 0.2             | 0.2              | 0.00    | No Limit            |  |  |
| EK055G: Ammonia as  | s N by Discrete Analyser (Q | C Lot: 2052027)                      |            |      |                                   |                 |                  |         |                     |  |  |
| EB1828540-001   | Anonymous                   | EK055G: Ammonia as N                 | 7664-41-7  | 0.01 | mg/L                              | 0.02            | 0.05             | 81.1    | No Limit            |  |  |
| EK057G: Nitrite as N  | by Discrete Analyser (QC I  | _ot: 2052014)                        |            |      |                                   |                 |                  |         |                     |  |  |
| EB1828548-001   | 320-01-BH2218               | EK057G: Nitrite as N                 | 14797-65-0 | 0.01 | mg/L                              | <0.01           | <0.01            | 0.00    | No Limit            |  |  |
| EK059G: Nitrite plus  | Nitrate as N (NOx) by Disci | rete Analyser (QC Lot: 2052026)      |            |      |                                   |                 |                  |         |                     |  |  |
| EB1828540-001   | Anonymous                   | EK059G: Nitrite + Nitrate as N       |            | 0.01 | mg/L                              | 0.06            | 0.07             | 0.00    | No Limit            |  |  |
| EK061G: Total Kjelda  | hl Nitrogen By Discrete Ana | alyser (QC Lot: 2052364)             |            |      |                                   |                 |                  |         |                     |  |  |
| EB1828147-001   | Anonymous                   | EK061G: Total Kjeldahl Nitrogen as N |            | 0.1  | mg/L                              | 2.6             | 2.7              | 4.48    | 0% - 20%            |  |  |
| EB1828540-001   | Anonymous                   | EK061G: Total Kjeldahl Nitrogen as N |            | 0.1  | mg/L                              | 0.6             | 0.5              | 0.00    | No Limit            |  |  |
| EK067G: Total Phosp   | horus as P by Discrete Ana  | lyser (QC Lot: 2052363)              |            |      |                                   |                 |                  |         |                     |  |  |
| EB1828147-001   | Anonymous                   | EK067G: Total Phosphorus as P        |            | 0.01 | mg/L                              | 0.38            | 0.37             | 0.00    | 0% - 20%            |  |  |
| EB1828540-001   | Anonymous                   | EK067G: Total Phosphorus as P        |            | 0.01 | mg/L                              | <0.01           | <0.01            | 0.00    | No Limit            |  |  |
| EK071G: Reactive Ph   | osphorus as P by discrete a | analyser (QC Lot: 2052015)           |            |      |                                   |                 |                  |         |                     |  |  |
| EB1828548-001   | 320-01-BH2218               | EK071G: Reactive Phosphorus as P     | 14265-44-2 | 0.01 | mg/L                              | <0.01           | <0.01            | 0.00    | No Limit            |  |  |



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

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

| Sub-Matrix: WATER                                    |               |        |         | Method Blank (MB) |               | Laboratory Control Spike (LCS | S) Report |            |
|--|---------------|--------|---------|-------------------|---------------|-------------------------------|-----------|------------|
|  |               |        |         | Report            | Spike         | Spike Recovery (%)            | Recovery  | Limits (%) |
| Method: Compound                                     | CAS Number    | LOR    | Unit    | Result            | Concentration | LCS                           | Low       | High       |
| EA005P: pH by PC Titrator (QCLot: 2051941)           |               |        |         |                   |               |                               |           |            |
| EA005-P: pH Value                                    |               |        | pH Unit |                   | 4 pH Unit     | 101                           | 98        | 102        |
|  |               |        |         |                   | 7 pH Unit     | 100                           | 98        | 102        |
| EA010P: Conductivity by PC Titrator (QCLot: 2051943  | )             |        |         |                   |               |                               |           |            |
| EA010-P: Electrical Conductivity @ 25°C              |               | 1      | µS/cm   | <1                | 2100 µS/cm    | 96.6                          | 91        | 107        |
|  |               |        |         | <1                | 24800 µS/cm   | 99.5                          | 91        | 107        |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C(QC | Lot: 2052371) |        |         |                   |               |                               |           |            |
| EA015H: Total Dissolved Solids @180°C                |               | 10     | mg/L    | <10               | 293 mg/L      | 99.6                          | 88        | 112        |
|  |               |        |         | <10               | 2000 mg/L     | 99.8                          | 88        | 112        |
| ED037P: Alkalinity by PC Titrator (QCLot: 2051942)   |               |        |         |                   |               |                               |           |            |
| ED037-P: Total Alkalinity as CaCO3                   |               |        | mg/L    |                   | 50 mg/L       | 103                           | 80        | 120        |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (OC  | ot: 2052011)  |        |         |                   |               |                               |           |            |
| ED041G: Sulfate as SO4 - Turbidimetric               | 14808-79-8    | 1      | mg/L    | <1                | 25 mg/L       | 104                           | 85        | 118        |
|  |               |        |         | <1                | 100 mg/L      | 98.3                          | 85        | 118        |
| ED045G: Chlorido by Discroto Analysor (OCL ot: 2052) | 112)          |        |         |                   |               |                               |           |            |
| ED045G: Chloride                                     | 16887-00-6    | 1      | ma/l    | <1                | 10 mg/l       | 99.4                          | 90        | 115        |
|  |               | •      |         | <1                | 1000 mg/L     | 105                           | 90        | 115        |
| ED093E: Dissolved Major Cations (OCI of: 2053078)    |               |        |         |                   |               |                               |           |            |
| ED093E: Calcium                                      | 7440-70-2     | 1      | ma/L    | <1                |               |                               |           |            |
| ED093F: Magnesium                                    | 7439-95-4     | 1      | ma/L    | <1                |               |                               |           |            |
| ED093F: Sodium                                       | 7440-23-5     | 1      | mg/L    | <1                |               |                               |           |            |
| ED093F: Potassium                                    | 7440-09-7     | 1      | mg/L    | <1                |               |                               |           |            |
| EG020E: Dissolved Metals by ICP-MS (OCI of: 205308   | ດາ            |        |         |                   |               |                               |           |            |
| EG020A-F: Arsenic                                    | 7440-38-2     | 0.001  | mg/L    | <0.001            | 0.1 mg/L      | 97.1                          | 88        | 116        |
| EG020A-F: Bervllium                                  | 7440-41-7     | 0.001  | mg/L    | <0.001            | 0.1 mg/L      | 101                           | 81        | 117        |
| EG020A-F: Barium                                     | 7440-39-3     | 0.001  | mg/L    | <0.001            | 0.5 mg/L      | 95.1                          | 70        | 130        |
| EG020A-F: Cadmium                                    | 7440-43-9     | 0.0001 | mg/L    | <0.0001           | 0.1 mg/L      | 91.0                          | 88        | 108        |
| EG020A-F: Chromium                                   | 7440-47-3     | 0.001  | mg/L    | <0.001            | 0.1 mg/L      | 91.8                          | 87        | 113        |
| EG020A-F: Cobalt                                     | 7440-48-4     | 0.001  | mg/L    | <0.001            | 0.1 mg/L      | 92.5                          | 86        | 112        |
| EG020A-F: Copper                                     | 7440-50-8     | 0.001  | mg/L    | <0.001            | 0.2 mg/L      | 96.9                          | 88        | 114        |
| EG020A-F: Lead                                       | 7439-92-1     | 0.001  | mg/L    | <0.001            | 0.1 mg/L      | 97.7                          | 89        | 110        |
| EG020A-F: Manganese                                  | 7439-96-5     | 0.001  | mg/L    | <0.001            | 0.1 mg/L      | 92.7                          | 89        | 120        |
| EG020A-F: Nickel                                     | 7440-02-0     | 0.001  | mg/L    | <0.001            | 0.1 mg/L      | 95.6                          | 89        | 113        |
| EG020A-F: Selenium                                   | 7782-49-2     | 0.01   | mg/L    | <0.01             | 0.1 mg/L      | 94.3                          | 83        | 112        |
| EG020A-F: Vanadium                                   | 7440-62-2     | 0.01   | mg/L    | <0.01             | 0.1 mg/L      | 95.7                          | 88        | 114        |

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|------------|---------------------------|
| Work Order | : EB1828548               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER                                |                          |        |       | Method Blank (MB) | Laboratory Control Spike (LCS) Report |                    |          |            |  |
|--|--------------------------|--------|-------|-------------------|---------------------------------------|--------------------|----------|------------|--|
|  |                          |        |       | Report            | Spike                                 | Spike Recovery (%) | Recovery | Limits (%) |  |
| Method: Compound                                 | CAS Number               | LOR    | Unit  | Result            | Concentration                         | LCS                | Low      | High       |  |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 20    | 53080) - continued       |        |       |                   |                                       |                    |          |            |  |
| EG020A-F: Zinc                                   | 7440-66-6                | 0.005  | mg/L  | <0.005            | 0.2 mg/L                              | 96.7               | 87       | 113        |  |
| EG020A-F: Boron                                  | 7440-42-8                | 0.05   | mg/L  | <0.05             | 0.5 mg/L                              | 99.4               | 81       | 125        |  |
| EG020T: Total Metals by ICP-MS (QCLot: 205308    | 5)                       |        |       |                   |                                       |                    |          |            |  |
| EG020A-T: Arsenic                                | 7440-38-2                | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 97.8               | 88       | 112        |  |
| EG020A-T: Beryllium                              | 7440-41-7                | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 92.7               | 81       | 119        |  |
| EG020A-T: Barium                                 | 7440-39-3                | 0.001  | mg/L  | <0.001            | 0.5 mg/L                              | 93.8               | 70       | 130        |  |
| EG020A-T: Cadmium                                | 7440-43-9                | 0.0001 | mg/L  | <0.0001           | 0.1 mg/L                              | 90.6               | 88       | 111        |  |
| EG020A-T: Chromium                               | 7440-47-3                | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 97.5               | 89       | 115        |  |
| EG020A-T: Cobalt                                 | 7440-48-4                | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 98.3               | 89       | 115        |  |
| EG020A-T: Copper                                 | 7440-50-8                | 0.001  | mg/L  | <0.001            | 0.2 mg/L                              | 102                | 88       | 116        |  |
| EG020A-T: Lead                                   | 7439-92-1                | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 97.4               | 89       | 112        |  |
| EG020A-T: Manganese                              | 7439-96-5                | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 104                | 88       | 114        |  |
| EG020A-T: Nickel                                 | 7440-02-0                | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 98.1               | 88       | 116        |  |
| EG020A-T: Selenium                               | 7782-49-2                | 0.01   | mg/L  | <0.01             | 0.1 mg/L                              | 94.4               | 79       | 111        |  |
| EG020A-T: Vanadium                               | 7440-62-2                | 0.01   | mg/L  | <0.01             | 0.1 mg/L                              | 110                | 87       | 114        |  |
| EG020A-T: Zinc                                   | 7440-66-6                | 0.005  | mg/L  | <0.005            | 0.2 mg/L                              | 94.2               | 84       | 114        |  |
| EG020A-T: Boron                                  | 7440-42-8                | 0.05   | mg/L  | <0.05             | 0.5 mg/L                              | 96.6               | 82       | 128        |  |
| EG035F: Dissolved Mercury by FIMS (QCLot: 205    | 53079)                   |        |       |                   |                                       |                    |          |            |  |
| EG035F: Mercury                                  | 7439-97-6                | 0.0001 | mg/L  | <0.0001           | 0.01 mg/L                             | 90.3               | 84       | 118        |  |
| EG035T: Total Recoverable Mercury by FIMS (Q     | CLot: 2053088)           |        |       |                   |                                       |                    |          |            |  |
| EG035T: Mercury                                  | 7439-97-6                | 0.0001 | mg/L  | <0.0001           | 0.01 mg/L                             | 89.5               | 84       | 118        |  |
| EK040P: Fluoride by PC Titrator (QCLot: 2051944  | 4)                       |        |       |                   |                                       |                    |          |            |  |
| EK040P: Fluoride                                 | 16984-48-8               | 0.1    | mg/L  | <0.1              | 5 mg/L                                | 93.6               | 80       | 117        |  |
| EK055G· Ammonia as N by Discrete Analyser. (O    | CL of: 2052027)          |        |       |                   |                                       |                    |          |            |  |
| EK055G: Ammonia as N                             | 7664-41-7                | 0.01   | ma/L  | <0.01             | 0.5 mg/L                              | 95.7               | 86       | 112        |  |
| EK057C: Nitrite as N by Discrete Analyser (OCL)  | ot: 2052014)             |        | 5     |                   |                                       |                    |          |            |  |
| EK057G: Nitrite as N                             | 14797-65-0               | 0.01   | ma/l  | <0.01             | 0.5 mg/l                              | 102                | 90       | 110        |  |
|  |                          | 0.01   | ing/2 | 0.01              | o.o mg/L                              | 102                | 00       | 110        |  |
| EK059G: Nitrite plus Nitrate as N (NOX) by Discr | ete Analyser (QCLot: 205 | 0.01   | ma/l  | <0.01             | 0.5 mg/l                              | 102                | 89       | 115        |  |
|  |                          | 0.01   | ing/L | \$0.01            | 0.0 mg/L                              | 102                | 03       | 113        |  |
| EK061G: Total Kjeldahl Nitrogen By Discrete Ana  | lyser (QCLot: 2052364)   | 0.1    |       | 10.4              | 4                                     | 02.0               | 70       | 400        |  |
| EK061G: Total Kjeldahl Nitrogen as N             |                          | 0.1    | mg/L  | <0.1              | 1 mg/L                                | 83.8               | 70       | 108        |  |
| EK067G: Total Phosphorus as P by Discrete Anal   | yser (QCLot: 2052363)    |        |       |                   |                                       |                    |          | 16-        |  |
| EK067G: Total Phosphorus as P                    |                          | 0.01   | mg/L  | <0.01             | 0.442 mg/L                            | 93.4               | 79       | 105        |  |
| EK071G: Reactive Phosphorus as P by discrete a   | nalyser (QCLot: 2052015  | )      |       |                   |                                       |                    |          |            |  |
| EK071G: Reactive Phosphorus as P                 | 14265-44-2               | 0.01   | mg/L  | <0.01             | 0.5 mg/L                              | 95.2               | 88       | 115        |  |



# Matrix Spike (MS) Report

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

| Sub-Matrix: WATER    |  |  |            | Ma            | atrix Spike (MS) Report |            |           |
|----------------------|--|--|------------|---------------|-------------------------|------------|-----------|
|                      |  |  |            | Spike         | SpikeRecovery(%)        | Recovery L | imits (%) |
| Laboratory sample ID | Client sample ID                               | Method: Compound                       | CAS Number | Concentration | MS                      | Low        | High      |
| ED041G: Sulfate (T   | urbidimetric) as SO4 2- by DA (QCLot: 2052011) |  |            |               |                         |            |           |
| EB1828101-001        | Anonymous                                      | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 20 mg/L       | # Not                   | 70         | 130       |
|                      |  |  |            |               | Determined              |            |           |
| ED045G: Chloride     | by Discrete Analyser (QCLot: 2052012)          |  |            |               |                         |            |           |
| EB1828101-001        | Anonymous                                      | ED045G: Chloride                       | 16887-00-6 | 400 ma/L      | 81.9                    | 70         | 130       |
| EC020E: Dissolved    |  |  |            |               |                         |            |           |
| EG020F. DISSOIVED    |  |  | 7440.00.0  | 0.4 mm/       | 00.4                    | 70         | 100       |
| EB1828572-001        | Anonymous                                      | EG020A-F: Arsenic                      | 7440-38-2  | 0.1 mg/L      | 99.1                    | 70         | 130       |
|                      |  | EG020A-F: Beryllium                    | 7440-41-7  | 0.1 mg/L      | 94.5                    | 70         | 130       |
|                      |  | EG020A-F: Barium                       | 7440-39-3  | 0.5 mg/L      | 100                     | 70         | 130       |
|                      |  | EG020A-F: Cadmium                      | 7440-43-9  | 0.1 mg/L      | 91.1                    | 70         | 130       |
|                      |  | EG020A-F: Chromium                     | 7440-47-3  | 0.1 mg/L      | 85.8                    | 70         | 130       |
|                      |  | EG020A-F: Cobalt                       | 7440-48-4  | 0.1 mg/L      | 88.8                    | 70         | 130       |
|                      |  | EG020A-F: Copper                       | 7440-50-8  | 0.2 mg/L      | 90.3                    | 70         | 130       |
|                      |  | EG020A-F: Lead                         | 7439-92-1  | 0.1 mg/L      | 86.4                    | 70         | 130       |
|                      |  | EG020A-F: Manganese                    | 7439-96-5  | 0.1 mg/L      | 87.3                    | 70         | 130       |
|                      |  | EG020A-F: Nickel                       | 7440-02-0  | 0.1 mg/L      | 88.2                    | 70         | 130       |
|                      |  | EG020A-F: Selenium                     | 7782-49-2  | 0.1 mg/L      | 98.9                    | 70         | 130       |
|                      |  | EG020A-F: Vanadium                     | 7440-62-2  | 0.1 mg/L      | 94.2                    | 70         | 130       |
|                      |  | EG020A-F: Zinc                         | 7440-66-6  | 0.2 mg/L      | 89.5                    | 70         | 130       |
|                      |  | EG020A-F: Boron                        | 7440-42-8  | 0.5 mg/L      | 89.2                    | 70         | 130       |
| EG020T: Total Meta   | als by ICP-MS (QCLot: 2053085)                 |  |            |               |                         |            |           |
| EB1828168-002        | Anonymous                                      | EG020A-T: Arsenic                      | 7440-38-2  | 1 mg/L        | 88.2                    | 70         | 130       |
|                      |  | EG020A-T: Bervllium                    | 7440-41-7  | 0.1 mg/L      | 90.8                    | 70         | 130       |
|                      |  | EG020A-T: Barium                       | 7440-39-3  | 1 mg/L        | 90.4                    | 70         | 130       |
|                      |  | EG020A-T: Cadmium                      | 7440-43-9  | 0.5 mg/L      | 93.3                    | 70         | 130       |
|                      |  | EG020A-T: Chromium                     | 7440-47-3  | 1 mg/L        | 90.9                    | 70         | 130       |
|                      |  | EG020A-T: Cobalt                       | 7440-48-4  | 1 mg/L        | 88.1                    | 70         | 130       |
|                      |  | EG020A-T: Copper                       | 7440-50-8  | 1 mg/L        | 93.9                    | 70         | 130       |
|                      |  | FG020A-T' Lead                         | 7439-92-1  | 1 mg/L        | 88.3                    | 70         | 130       |
|                      |  | EG020A-T: Manganese                    | 7439-96-5  | 1 mg/L        | 89.9                    | 70         | 130       |
|                      |  | FG020A-T' Nickel                       | 7440-02-0  | 1 mg/L        | 90.9                    | 70         | 130       |
|                      |  | FG020A-T: Vanadium                     | 7440-62-2  | 1 ma/L        | 86.2                    | 70         | 130       |
|                      |  | FG020A-T: Zinc                         | 7440-66-6  | 1 mg/L        | 88.0                    | 70         | 130       |
| EG035E: Disselved    | Marcury by EIMS (OCI at: 2053079)              |  |            | 5             |                         |            |           |
| EB4000570 004        |  |  | 7420.07.0  | 0.01 mm//     | 00.0                    | 70         | 120       |
| EB18285/2-001        | Anonymous                                      | EG035F: Mercury                        | 1439-91-0  | 0.01 mg/L     | 80.2                    | 70         | 130       |

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|------------|---------------------------|
| Work Order | : EB1828548               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER    |  | [                                    | Ма         | trix Spike (MS) Report |                  |               |         |
|----------------------|--|--------------------------------------|------------|------------------------|------------------|---------------|---------|
|                      |  |                                      |            | Spike                  | SpikeRecovery(%) | Recovery Limi | its (%) |
| Laboratory sample ID | Client sample ID                                       | Method: Compound                     | CAS Number | Concentration          | MS               | Low           | High    |
| EG035T: Total Re     | coverable Mercury by FIMS (QCLot: 2053088)             |                                      |            |                        |                  |               |         |
| EB1828168-002        | Anonymous  | EG035T: Mercury                      | 7439-97-6  | 0.01 mg/L              | 81.7             | 70            | 130     |
| EK040P: Fluoride     | by PC Titrator (QCLot: 2051944)                        |                                      |            |                        |                  |               |         |
| EB1828142-004        | Anonymous  | EK040P: Fluoride                     | 16984-48-8 | 5 mg/L                 | 90.4             | 70            | 130     |
| EK055G: Ammonia      | a as N by Discrete Analyser (QCLot: 2052027)           |                                      |            |                        |                  |               |         |
| EB1828548-001        | 320-01-BH2218  | EK055G: Ammonia as N                 | 7664-41-7  | 0.4 mg/L               | 86.8             | 70            | 130     |
| EK059G: Nitrite p    | us Nitrate as N (NOx) by Discrete Analyser (QCLot: 205 | 2026)                                |            |                        |                  |               |         |
| EB1828548-001        | 320-01-BH2218  | EK059G: Nitrite + Nitrate as N       |            | 0.4 mg/L               | 94.9             | 70            | 130     |
| EK061G: Total Kje    | Idahl Nitrogen By Discrete Analyser (QCLot: 2052364)   |                                      |            |                        |                  |               |         |
| EB1828148-001        | Anonymous  | EK061G: Total Kjeldahl Nitrogen as N |            | 5 mg/L                 | 96.1             | 70            | 130     |
| EK067G: Total Pho    | osphorus as P by Discrete Analyser (QCLot: 2052363)    |                                      |            |                        |                  |               |         |
| EB1828148-001        | Anonymous  | EK067G: Total Phosphorus as P        |            | 1 mg/L                 | 94.5             | 70            | 130     |



# **QUALITY CONTROL REPORT**

| Work Order              | : EB1830099               | Page                    | : 1 of 7                                  |                                |  |  |
|-------------------------|---------------------------|-------------------------|---|--------------------------------|--|--|
| Client                  | : GOLDER ASSOCIATES       | Laboratory              | : Environmental Division B                | risbane                        |  |  |
| Contact                 | : MR SUSANTHA KUMARAPELI  | Contact                 | : Andrew Epps                             |                                |  |  |
| Address                 |                           | Address                 | 2 Byth Street Stafford QLD Australia 4053 |                                |  |  |
| Telephone               | : +61 07 3721 5400        | Telephone               | : +61 7 3552 8639                         |                                |  |  |
| Project                 | : 1893795 INLAND RAIL P12 | Date Samples Received   | : 07-Dec-2018                             | sullu.                         |  |  |
| Order number            | :                         | Date Analysis Commenced | : 08-Dec-2018                             | stimulation of the             |  |  |
| C-O-C number            | :                         | Issue Date              | : 12-Dec-2018                             | NATA                           |  |  |
| Sampler                 | : HANNAH GROVES           |                         |   | HAC-MRA NAIA                   |  |  |
| Site                    | :                         |                         |   |                                |  |  |
| Quote number            | : EN/002/18 National BQ   |                         |   | Acceptization No. 825          |  |  |
| No. of samples received | : 1                       |                         |   | Accredited for compliance with |  |  |
| No. of samples analysed | : 1                       |                         |   | ISO/IEC 17025 - Testing        |  |  |

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

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

## Signatories

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



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

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

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

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

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

#### Laboratory Duplicate (DUP) Report

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

| Sub-Matrix: WATER     |                               |  |             |      | Laboratory Duplicate (DUP) Report |                 |                  |         |                     |  |
|-----------------------|-------------------------------|--|-------------|------|-----------------------------------|-----------------|------------------|---------|---------------------|--|
| Laboratory sample ID  | Client sample ID              | Method: Compound                         | CAS Number  | LOR  | Unit                              | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |  |
| EA005P: pH by PC Tit  | trator (QC Lot: 2082923)      |  |             |      |                                   |                 |                  |         |                     |  |
| EB1829787-001         | Anonymous                     | EA005-P: pH Value                        |             | 0.01 | pH Unit                           | 8.84            | 8.92             | 0.901   | 0% - 20%            |  |
| EA010P: Conductivity  | y by PC Titrator (QC Lot: 20  | 82922)                                   |             |      |                                   |                 |                  |         |                     |  |
| EB1829787-001         | Anonymous                     | EA010-P: Electrical Conductivity @ 25°C  |             | 1    | μS/cm                             | 5280            | 5250             | 0.575   | 0% - 20%            |  |
| EA015: Total Dissolve | ed Solids dried at 180 ± 5 °C | (QC Lot: 2083184)                        |             |      |                                   |                 |                  |         |                     |  |
| EB1830080-004         | Anonymous                     | EA015H: Total Dissolved Solids @180°C    |             | 10   | mg/L                              | 5140            | 5220             | 1.54    | 0% - 20%            |  |
| ED037P: Alkalinity by | PC Titrator (QC Lot: 20829    | 25)                                      |             |      |                                   |                 |                  |         |                     |  |
| EB1830028-001         | Anonymous                     | ED037-P: Hydroxide Alkalinity as CaCO3   | DMO-210-001 | 1    | mg/L                              | <1              | <1               | 0.00    | No Limit            |  |
|                       |                               | ED037-P: Carbonate Alkalinity as CaCO3   | 3812-32-6   | 1    | mg/L                              | <1              | <1               | 0.00    | No Limit            |  |
|                       |                               | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3     | 1    | mg/L                              | 161             | 167              | 3.96    | 0% - 20%            |  |
|                       |                               | ED037-P: Total Alkalinity as CaCO3       |             | 1    | mg/L                              | 161             | 167              | 3.96    | 0% - 20%            |  |
| ED041G: Sulfate (Tur  | bidimetric) as SO4 2- by DA   | (QC Lot: 2083109)                        |             |      |                                   |                 |                  |         |                     |  |
| EB1830063-007         | Anonymous                     | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8  | 1    | mg/L                              | 8               | 8                | 0.00    | No Limit            |  |
| EB1830002-001         | Anonymous                     | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8  | 1    | mg/L                              | 100             | 100              | 0.00    | 0% - 20%            |  |
| ED045G: Chloride by   | Discrete Analyser (QC Lot:    | 2083112)                                 |             |      |                                   |                 |                  |         |                     |  |
| EB1830063-007         | Anonymous                     | ED045G: Chloride                         | 16887-00-6  | 1    | mg/L                              | 95              | 97               | 1.49    | 0% - 20%            |  |
| EB1830002-001         | Anonymous                     | ED045G: Chloride                         | 16887-00-6  | 1    | mg/L                              | 900             | 901              | 0.00    | 0% - 20%            |  |
| ED093F: Dissolved M   | ajor Cations (QC Lot: 2083    | 337)                                     |             |      |                                   |                 |                  |         |                     |  |
| EB1830099-001         | 320-01-BH2301                 | ED093F: Calcium                          | 7440-70-2   | 1    | mg/L                              | 83              | 84               | 0.00    | 0% - 20%            |  |
|                       |                               | ED093F: Magnesium                        | 7439-95-4   | 1    | mg/L                              | 27              | 28               | 0.00    | 0% - 20%            |  |
|                       |                               | ED093F: Sodium                           | 7440-23-5   | 1    | mg/L                              | 974             | 972              | 0.165   | 0% - 20%            |  |
|                       |                               | ED093F: Potassium                        | 7440-09-7   | 1    | mg/L                              | 12              | 12               | 0.00    | 0% - 50%            |  |
| EB1829556-001         | Anonymous                     | ED093F: Calcium                          | 7440-70-2   | 1    | mg/L                              | 87              | 86               | 1.52    | 0% - 20%            |  |
|                       |                               | ED093F: Magnesium                        | 7439-95-4   | 1    | mg/L                              | 65              | 64               | 0.00    | 0% - 20%            |  |
|                       |                               | ED093F: Sodium                           | 7440-23-5   | 1    | mg/L                              | 356             | 350              | 1.55    | 0% - 20%            |  |

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|------------|---------------------------|
| Work Order | : EB1830099               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER    |                            |                     |            |        |      | Laboratory L    | Duplicate (DUP) Report |         |                     |
|----------------------|----------------------------|---------------------|------------|--------|------|-----------------|------------------------|---------|---------------------|
| Laboratory sample ID | Client sample ID           | Method: Compound    | CAS Number | LOR    | Unit | Original Result | Duplicate Result       | RPD (%) | Recovery Limits (%) |
| ED093F: Dissolved M  | ajor Cations (QC Lot: 2083 | 837) - continued    |            |        |      |                 |                        |         |                     |
| EB1829556-001        | Anonymous                  | ED093F: Potassium   | 7440-09-7  | 1      | mg/L | 3               | 3                      | 0.00    | No Limit            |
| EG020F: Dissolved M  | etals by ICP-MS (QC Lot: 2 | 2083841)            |            |        |      |                 |                        |         |                     |
| EB1830099-001        | 320-01-BH2301              | EG020A-F: Cadmium   | 7440-43-9  | 0.0001 | mg/L | <0.0001         | <0.0001                | 0.00    | No Limit            |
|                      |                            | EG020A-F: Arsenic   | 7440-38-2  | 0.001  | mg/L | 0.003           | 0.003                  | 0.00    | No Limit            |
|                      |                            | EG020A-F: Beryllium | 7440-41-7  | 0.001  | mg/L | <0.001          | <0.001                 | 0.00    | No Limit            |
|                      |                            | EG020A-F: Barium    | 7440-39-3  | 0.001  | mg/L | 0.124           | 0.123                  | 0.00    | 0% - 20%            |
|                      |                            | EG020A-F: Chromium  | 7440-47-3  | 0.001  | mg/L | <0.001          | <0.001                 | 0.00    | No Limit            |
|                      |                            | EG020A-F: Cobalt    | 7440-48-4  | 0.001  | mg/L | 0.002           | 0.002                  | 0.00    | No Limit            |
|                      |                            | EG020A-F: Lead      | 7439-92-1  | 0.001  | mg/L | <0.001          | <0.001                 | 0.00    | No Limit            |
|                      |                            | EG020A-F: Manganese | 7439-96-5  | 0.001  | mg/L | 0.073           | 0.073                  | 0.00    | 0% - 20%            |
|                      |                            | EG020A-F: Nickel    | 7440-02-0  | 0.001  | mg/L | 0.003           | 0.003                  | 0.00    | No Limit            |
|                      |                            | EG020A-F: Zinc      | 7440-66-6  | 0.005  | mg/L | 0.014           | 0.014                  | 0.00    | No Limit            |
|                      |                            | EG020A-F: Selenium  | 7782-49-2  | 0.01   | mg/L | <0.01           | <0.01                  | 0.00    | No Limit            |
|                      |                            | EG020A-F: Vanadium  | 7440-62-2  | 0.01   | mg/L | <0.01           | <0.01                  | 0.00    | No Limit            |
|                      |                            | EG020A-F: Boron     | 7440-42-8  | 0.05   | mg/L | 0.08            | 0.08                   | 0.00    | No Limit            |
|                      |                            | EG020A-F: Iron      | 7439-89-6  | 0.05   | mg/L | <0.05           | <0.05                  | 0.00    | No Limit            |
| EG020T: Total Metals | by ICP-MS (QC Lot: 20839   | 97)                 |            |        |      |                 |                        |         |                     |
| EB1830098-001        | Anonymous                  | EG020A-T: Cadmium   | 7440-43-9  | 0.0001 | mg/L | <0.0001         | <0.0001                | 0.00    | No Limit            |
|                      |                            | EG020A-T: Arsenic   | 7440-38-2  | 0.001  | mg/L | 0.004           | 0.004                  | 0.00    | No Limit            |
|                      |                            | EG020A-T: Beryllium | 7440-41-7  | 0.001  | mg/L | <0.001          | <0.001                 | 0.00    | No Limit            |
|                      |                            | EG020A-T: Barium    | 7440-39-3  | 0.001  | mg/L | 0.166           | 0.162                  | 2.30    | 0% - 20%            |
|                      |                            | EG020A-T: Chromium  | 7440-47-3  | 0.001  | mg/L | 0.002           | 0.002                  | 0.00    | No Limit            |
|                      |                            | EG020A-T: Cobalt    | 7440-48-4  | 0.001  | mg/L | <0.001          | <0.001                 | 0.00    | No Limit            |
|                      |                            | EG020A-T: Lead      | 7439-92-1  | 0.001  | mg/L | <0.001          | 0.001                  | 0.00    | No Limit            |
|                      |                            | EG020A-T: Manganese | 7439-96-5  | 0.001  | mg/L | 0.078           | 0.076                  | 2.83    | 0% - 20%            |
|                      |                            | EG020A-T: Nickel    | 7440-02-0  | 0.001  | mg/L | 0.002           | 0.002                  | 0.00    | No Limit            |
|                      |                            | EG020A-T: Zinc      | 7440-66-6  | 0.005  | mg/L | 0.014           | 0.014                  | 0.00    | No Limit            |
|                      |                            | EG020A-T: Selenium  | 7782-49-2  | 0.01   | mg/L | <0.01           | <0.01                  | 0.00    | No Limit            |
|                      |                            | EG020A-T: Vanadium  | 7440-62-2  | 0.01   | mg/L | <0.01           | <0.01                  | 0.00    | No Limit            |
|                      |                            | EG020A-T: Boron     | 7440-42-8  | 0.05   | mg/L | 0.20            | 0.13                   | 42.2    | No Limit            |
|                      |                            | EG020A-T: Iron      | 7439-89-6  | 0.05   | mg/L | 3.31            | 3.15                   | 5.05    | 0% - 20%            |
| EB1829787-001        | Anonymous                  | EG020A-T: Cadmium   | 7440-43-9  | 0.0001 | mg/L | 0.0001          | 0.0002                 | 0.00    | No Limit            |
|                      |                            | EG020A-T: Arsenic   | 7440-38-2  | 0.001  | mg/L | 0.006           | 0.006                  | 0.00    | No Limit            |
|                      |                            | EG020A-T: Beryllium | 7440-41-7  | 0.001  | mg/L | <0.001          | <0.001                 | 0.00    | No Limit            |
|                      |                            | EG020A-T: Barium    | 7440-39-3  | 0.001  | mg/L | 0.287           | 0.292                  | 1.56    | 0% - 20%            |
|                      |                            | EG020A-T: Chromium  | 7440-47-3  | 0.001  | mg/L | <0.001          | <0.001                 | 0.00    | No Limit            |
|                      |                            | EG020A-T: Cobalt    | 7440-48-4  | 0.001  | mg/L | <0.001          | <0.001                 | 0.00    | No Limit            |
|                      |                            | EG020A-T: Lead      | 7439-92-1  | 0.001  | mg/L | <0.001          | <0.001                 | 0.00    | No Limit            |
|                      |                            | EG020A-T: Manganese | 7439-96-5  | 0.001  | mg/L | 0.038           | 0.038                  | 0.00    | 0% - 20%            |
|                      |                            | EG020A-T: Nickel    | 7440-02-0  | 0.001  | mg/L | 0.060           | 0.063                  | 4.50    | 0% - 20%            |

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|------------|---------------------------|
| Work Order | : EB1830099               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER    |                             |                                      |            |        | Laboratory Duplicate (DUP) Report |                 |                  |         |                     |
|----------------------|-----------------------------|--------------------------------------|------------|--------|-----------------------------------|-----------------|------------------|---------|---------------------|
| Laboratory sample ID | Client sample ID            | Method: Compound                     | CAS Number | LOR    | Unit                              | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |
| EG020T: Total Metals | by ICP-MS (QC Lot: 208399   | 97) - continued                      |            |        |                                   |                 |                  |         |                     |
| EB1829787-001        | Anonymous                   | EG020A-T: Zinc                       | 7440-66-6  | 0.005  | mg/L                              | 0.037           | 0.037            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Selenium                   | 7782-49-2  | 0.01   | mg/L                              | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Vanadium                   | 7440-62-2  | 0.01   | mg/L                              | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Boron                      | 7440-42-8  | 0.05   | mg/L                              | 1.54            | 1.83             | 17.3    | 0% - 20%            |
|                      |                             | EG020A-T: Iron                       | 7439-89-6  | 0.05   | mg/L                              | 2.62            | 2.68             | 2.08    | 0% - 20%            |
| EG035F: Dissolved M  | ercury by FIMS (QC Lot: 20  | 83838)                               |            |        |                                   |                 |                  |         |                     |
| EB1830022-001        | Anonymous                   | EG035F: Mercury                      | 7439-97-6  | 0.0001 | mg/L                              | <0.0001         | <0.0001          | 0.00    | No Limit            |
| EB1829556-001        | Anonymous                   | EG035F: Mercury                      | 7439-97-6  | 0.0001 | mg/L                              | <0.0001         | <0.0001          | 0.00    | No Limit            |
| EG035T: Total Recov  | erable Mercury by FIMS (Q   | C Lot: 2083995)                      |            |        |                                   |                 |                  |         |                     |
| EB1830028-001        | Anonymous                   | EG035T: Mercury                      | 7439-97-6  | 0.0001 | mg/L                              | 0.0705          | 0.0745           | 5.52    | 0% - 20%            |
| EK055G: Ammonia as   | N by Discrete Analyser (Q   | C Lot: 2087612)                      |            |        |                                   |                 |                  |         |                     |
| EB1830099-001        | 320-01-BH2301               | EK055G: Ammonia as N                 | 7664-41-7  | 0.01   | mg/L                              | 0.68            | 0.68             | 0.00    | 0% - 20%            |
| EK057G: Nitrite as N | by Discrete Analyser (QC L  | _ot: 2083111)                        |            |        |                                   |                 |                  |         |                     |
| EB1830063-007        | Anonymous                   | EK057G: Nitrite as N                 | 14797-65-0 | 0.01   | mg/L                              | <0.01           | <0.01            | 0.00    | No Limit            |
| EB1830002-001        | Anonymous                   | EK057G: Nitrite as N                 | 14797-65-0 | 0.01   | mg/L                              | <0.01           | <0.01            | 0.00    | No Limit            |
| EK059G: Nitrite plus | Nitrate as N (NOx) by Discr | rete Analyser (QC Lot: 2087613)      |            |        |                                   |                 |                  |         |                     |
| EB1830099-001        | 320-01-BH2301               | EK059G: Nitrite + Nitrate as N       |            | 0.01   | mg/L                              | 0.07            | 0.06             | 0.00    | No Limit            |
| EK061G: Total Kjelda | hl Nitrogen By Discrete Ana | ılyser (QC Lot: 2084226)             |            |        |                                   |                 |                  |         |                     |
| EB1829364-001        | Anonymous                   | EK061G: Total Kjeldahl Nitrogen as N |            | 0.1    | mg/L                              | 2.7             | 2.8              | 0.00    | 0% - 20%            |
| EB1830099-001        | 320-01-BH2301               | EK061G: Total Kjeldahl Nitrogen as N |            | 0.1    | mg/L                              | 49.3            | 55.1             | 11.1    | No Limit            |
| EK067G: Total Phosp  | horus as P by Discrete Ana  | lyser (QC Lot: 2084225)              |            |        |                                   |                 |                  |         |                     |
| EB1829364-001        | Anonymous                   | EK067G: Total Phosphorus as P        |            | 0.01   | mg/L                              | 0.39            | 0.38             | 3.38    | 0% - 20%            |
| EB1830099-001        | 320-01-BH2301               | EK067G: Total Phosphorus as P        |            | 0.01   | mg/L                              | 127             | 125              | 2.10    | 0% - 20%            |
| EK071G: Reactive Ph  | osphorus as P by discrete a | analyser (QC Lot: 2083110)           |            |        |                                   |                 |                  |         |                     |
| EB1830002-001        | Anonymous                   | EK071G: Reactive Phosphorus as P     | 14265-44-2 | 0.01   | mg/L                              | 0.05            | 0.05             | 0.00    | No Limit            |



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

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

| Sub-Matrix: WATER  |       |        |         | Method Blank (MB) | Laboratory Control Spike (LCS) Report |                    |          |            |  |
|--|-------|--------|---------|-------------------|---------------------------------------|--------------------|----------|------------|--|
|  |       |        |         | Report            | Spike                                 | Spike Recovery (%) | Recovery | Limits (%) |  |
| Method: Compound CAS N   | umber | LOR    | Unit    | Result            | Concentration                         | LCS                | Low      | High       |  |
| EA005P: pH by PC Titrator (QCLot: 2082923)                       |       |        |         |                   |                                       |                    |          |            |  |
| EA005-P: pH Value  |       |        | pH Unit |                   | 4 pH Unit                             | 101                | 98       | 102        |  |
|  |       |        |         |                   | 7 pH Unit                             | 100                | 98       | 102        |  |
| EA010P: Conductivity by PC Titrator (QCLot: 2082922)             |       |        |         |                   |                                       |                    |          |            |  |
| EA010-P: Electrical Conductivity @ 25°C                          |       | 1      | µS/cm   | <1                | 220 µS/cm                             | 103                | 91       | 107        |  |
|  |       |        |         | <1                | 12890 µS/cm                           | 98.9               | 91       | 107        |  |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C(QCLot: 2083184 |       |        |         |                   |                                       |                    |          |            |  |
| EA015H: Total Dissolved Solids @180°C                            |       | 10     | mg/L    | <10               | 293 mg/L                              | 102                | 88       | 112        |  |
|  |       |        |         | <10               | 2000 mg/L                             | 98.0               | 88       | 112        |  |
| ED037P: Alkalinity by PC Titrator (QCLot: 2082925)               |       |        |         |                   |                                       |                    |          |            |  |
| ED037-P: Total Alkalinity as CaCO3                               |       |        | mg/L    |                   | 50 mg/L                               | 107                | 80       | 120        |  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (OCI of: 2083109 |       |        |         |                   |                                       |                    |          |            |  |
| ED041G: Sulfate as SO4 - Turbidimetric 14808-                    | 79-8  | 1      | mg/L    | <1                | 25 mg/L                               | 101                | 85       | 118        |  |
|  |       |        | Ū       | <1                | 100 mg/L                              | 95.5               | 85       | 118        |  |
| ED045G: Chloride by Discrete Analyser (QCI of: 2083112)          |       |        |         |                   |                                       |                    |          |            |  |
| ED045G: Chloride 16887   | 00-6  | 1      | mg/L    | <1                | 10 mg/L                               | 103                | 90       | 115        |  |
|  |       |        | Ū       | <1                | 1000 mg/L                             | 102                | 90       | 115        |  |
| ED093F: Dissolved Major Cations (QCLot: 2083837)                 |       |        |         |                   |                                       |                    |          |            |  |
| ED093F: Calcium 7440   | 70-2  | 1      | mg/L    | <1                |                                       |                    |          |            |  |
| ED093F: Magnesium 7439   | 95-4  | 1      | mg/L    | <1                |                                       |                    |          |            |  |
| ED093F: Sodium 7440  | 23-5  | 1      | mg/L    | <1                |                                       |                    |          |            |  |
| ED093F: Potassium 7440   | 09-7  | 1      | mg/L    | <1                |                                       |                    |          |            |  |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 2083841)              |       |        |         |                   |                                       |                    |          |            |  |
| EG020A-F: Arsenic 7440   | 38-2  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 91.9               | 88       | 116        |  |
| EG020A-F: Beryllium 7440   | 41-7  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 95.1               | 81       | 117        |  |
| EG020A-F: Barium 7440  | 39-3  | 0.001  | mg/L    | <0.001            | 0.5 mg/L                              | 104                | 70       | 130        |  |
| EG020A-F: Cadmium 7440   | 43-9  | 0.0001 | mg/L    | <0.0001           | 0.1 mg/L                              | 97.0               | 88       | 108        |  |
| EG020A-F: Chromium 7440  | 47-3  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 88.0               | 87       | 113        |  |
| EG020A-F: Cobalt 7440  | 48-4  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 92.3               | 86       | 112        |  |
| EG020A-F: Lead 7439  | 92-1  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 92.1               | 89       | 110        |  |
| EG020A-F: Manganese 7439   | 96-5  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 92.6               | 89       | 120        |  |
| EG020A-F: Nickel 7440  | 02-0  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 90.0               | 89       | 113        |  |
| EG020A-F: Selenium 7782-   | 49-2  | 0.01   | mg/L    | <0.01             | 0.1 mg/L                              | 95.6               | 83       | 112        |  |
| EG020A-F: Vanadium 7440-   | 62-2  | 0.01   | mg/L    | <0.01             | 0.1 mg/L                              | 101                | 88       | 114        |  |
| EG020A-F: Zinc 7440-   | 66-6  | 0.005  | mg/L    | <0.005            | 0.2 mg/L                              | 89.8               | 87       | 113        |  |

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|------------|---------------------------|
| Work Order | : EB1830099               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Sub-Matrix: WATER                                |                             |        |        |         | Laboratory Control Spike (LCS) Report |                    |          |            |  |
|--|-----------------------------|--------|--------|---------|---------------------------------------|--------------------|----------|------------|--|
|  |                             |        |        | Report  | Spike                                 | Spike Recovery (%) | Recovery | Limits (%) |  |
| Method: Compound                                 | CAS Number                  | LOR    | Unit   | Result  | Concentration                         | LCS                | Low      | High       |  |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 2     | 2083841) - continued        |        |        |         |                                       |                    |          |            |  |
| EG020A-F: Boron                                  | 7440-42-8                   | 0.05   | mg/L   | <0.05   | 0.5 mg/L                              | 102                | 81       | 125        |  |
| EG020A-F: Iron                                   | 7439-89-6                   | 0.05   | mg/L   | <0.05   | 0.5 mg/L                              | 95.0               | 82       | 114        |  |
| EG020T: Total Metals by ICP-MS (QCLot: 20839     | 97)                         |        |        |         |                                       |                    |          |            |  |
| EG020A-T: Arsenic                                | 7440-38-2                   | 0.001  | mg/L   | <0.001  | 0.1 mg/L                              | 99.8               | 88       | 112        |  |
| EG020A-T: Beryllium                              | 7440-41-7                   | 0.001  | mg/L   | <0.001  | 0.1 mg/L                              | 87.4               | 81       | 119        |  |
| EG020A-T: Barium                                 | 7440-39-3                   | 0.001  | mg/L   | <0.001  | 0.5 mg/L                              | 93.4               | 70       | 130        |  |
| EG020A-T: Cadmium                                | 7440-43-9                   | 0.0001 | mg/L   | <0.0001 | 0.1 mg/L                              | 91.0               | 88       | 111        |  |
| EG020A-T: Chromium                               | 7440-47-3                   | 0.001  | mg/L   | <0.001  | 0.1 mg/L                              | 99.9               | 89       | 115        |  |
| EG020A-T: Cobalt                                 | 7440-48-4                   | 0.001  | mg/L   | <0.001  | 0.1 mg/L                              | 104                | 89       | 115        |  |
| EG020A-T: Lead                                   | 7439-92-1                   | 0.001  | mg/L   | <0.001  | 0.1 mg/L                              | 95.6               | 89       | 112        |  |
| EG020A-T: Manganese                              | 7439-96-5                   | 0.001  | mg/L   | <0.001  | 0.1 mg/L                              | 97.7               | 88       | 114        |  |
| EG020A-T: Nickel                                 | 7440-02-0                   | 0.001  | mg/L   | <0.001  | 0.1 mg/L                              | 100                | 88       | 116        |  |
| EG020A-T: Selenium                               | 7782-49-2                   | 0.01   | mg/L   | <0.01   | 0.1 mg/L                              | 98.2               | 79       | 111        |  |
| EG020A-T: Vanadium                               | 7440-62-2                   | 0.01   | mg/L   | <0.01   | 0.1 mg/L                              | 102                | 87       | 114        |  |
| EG020A-T: Zinc                                   | 7440-66-6                   | 0.005  | mg/L   | <0.005  | 0.2 mg/L                              | 104                | 84       | 114        |  |
| EG020A-T: Boron                                  | 7440-42-8                   | 0.05   | mg/L   | <0.05   | 0.5 mg/L                              | 93.8               | 82       | 128        |  |
| EG020A-T: Iron                                   | 7439-89-6                   | 0.05   | mg/L   | <0.05   | 0.5 mg/L                              | 96.3               | 82       | 118        |  |
| EG035F: Dissolved Mercury by FIMS (QCLot: 20     | 083838)                     |        |        |         |                                       |                    |          |            |  |
| EG035F: Mercury                                  | 7439-97-6                   | 0.0001 | mg/L   | <0.0001 | 0.01 mg/L                             | 99.3               | 84       | 118        |  |
| EG035T: Total Recoverable Mercury by FIMS (      | QCLot: 2083995)             |        |        |         |                                       |                    |          |            |  |
| EG035T: Mercury                                  | 7439-97-6                   | 0.0001 | mg/L   | <0.0001 | 0.01 mg/L                             | 97.6               | 84       | 118        |  |
| EK055G: Ammonia as N by Discrete Analyser (      | QCI of: 2087612)            |        |        |         |                                       |                    |          |            |  |
| EK055G: Ammonia as N                             | 7664-41-7                   | 0.01   | mg/L   | <0.01   | 0.5 mg/L                              | 101                | 86       | 112        |  |
| EK057G: Nitrite as N by Discrete Analyser (OC    | Lot: 2083111)               |        |        |         |                                       |                    |          |            |  |
| EK057G: Nitrite as N                             | 14797-65-0                  | 0.01   | mg/L   | <0.01   | 0.5 mg/L                              | 101                | 90       | 110        |  |
| EK059G · Nitrite plus Nitrate as N (NOx) by Disc | crete Analyser (OCI of: 20) | 87613) |        |         |                                       |                    |          |            |  |
| EK059G: Nitrite + Nitrate as N                   |                             | 0.01   | ma/L   | <0.01   | 0.5 mg/L                              | 95.5               | 89       | 115        |  |
| EKOCAC: Total Kialdahl Nitragan Dy Discrete Ar   | alveer (OCL et 2004220)     |        | 5      |         |                                       |                    |          | -          |  |
| EK061C: Total Kjeldahl Nitrogen by Discrete An   | lalyser (QCLOI: 2004226)    | 0.1    | ma/l   | <0.1    | 10 mg/l                               | 95.1               | 70       | 108        |  |
|  |                             | 0.1    | ilig/L | -0.1    | To thg/L                              | 35.1               | 10       | 100        |  |
| EK067G: Total Phosphorus as P by Discrete An     | alyser (QCLot: 2084225)     | 0.01   |        | 10.01   | 4.40 mm/                              | 00.0               | 70       | 105        |  |
| EKU67G: Total Phosphorus as P                    |                             | 0.01   | mg/L   | <0.01   | 4.42 mg/L                             | 89.9               | 79       | 105        |  |
| EK071G: Reactive Phosphorus as P by discrete     | analyser (QCLot: 2083110    | ))     |        |         |                                       |                    |          |            |  |
| EK071G: Reactive Phosphorus as P                 | 14265-44-2                  | 0.01   | mg/L   | <0.01   | 0.5 mg/L                              | 96.3               | 88       | 115        |  |

# Matrix Spike (MS) Report

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

| Page       | : 7 of 7                  |
|------------|---------------------------|
| Work Order | : EB1830099               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |
|            |                           |



| Sub-Matrix: WATER    |  |  |            | Ма            | atrix Spike (MS) Report |             |          |
|----------------------|--|--|------------|---------------|-------------------------|-------------|----------|
|                      |  |  |            | Spike         | SpikeRecovery(%)        | Recovery Li | nits (%) |
| Laboratory sample ID | Client sample ID                                     | Method: Compound                       | CAS Number | Concentration | MS                      | Low         | High     |
| ED041G: Sulfate (    | Furbidimetric) as SO4 2- by DA (QCLot: 2083109)      |  |            |               |                         |             |          |
| EB1830002-004        | Anonymous  | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 20 mg/L       | 112                     | 70          | 130      |
| ED045G: Chloride     | by Discrete Analyser (QCLot: 2083112)                |  |            |               |                         |             |          |
| EB1830002-004        | Anonymous  | ED045G: Chloride                       | 16887-00-6 | 400 mg/L      | 98.1                    | 70          | 130      |
| EG020T: Total Me     | als by ICP-MS (QCLot: 2083997)                       |  |            |               |                         |             |          |
| EB1829787-002        | Anonymous  | EG020A-T: Arsenic                      | 7440-38-2  | 1 mg/L        | 98.6                    | 70          | 130      |
|                      |  | EG020A-T: Beryllium                    | 7440-41-7  | 0.1 mg/L      | 83.5                    | 70          | 130      |
|                      |  | EG020A-T: Barium                       | 7440-39-3  | 1 mg/L        | 98.3                    | 70          | 130      |
|                      |  | EG020A-T: Cadmium                      | 7440-43-9  | 0.5 mg/L      | 89.8                    | 70          | 130      |
|                      |  | EG020A-T: Chromium                     | 7440-47-3  | 1 mg/L        | 94.6                    | 70          | 130      |
|                      |  | EG020A-T: Cobalt                       | 7440-48-4  | 1 mg/L        | 94.2                    | 70          | 130      |
|                      |  | EG020A-T: Lead                         | 7439-92-1  | 1 mg/L        | 88.2                    | 70          | 130      |
|                      |  | EG020A-T: Manganese                    | 7439-96-5  | 1 mg/L        | 88.0                    | 70          | 130      |
|                      |  | EG020A-T: Nickel                       | 7440-02-0  | 1 mg/L        | 90.6                    | 70          | 130      |
|                      |  | EG020A-T: Vanadium                     | 7440-62-2  | 1 mg/L        | 95.8                    | 70          | 130      |
|                      |  | EG020A-T: Zinc                         | 7440-66-6  | 1 mg/L        | 96.5                    | 70          | 130      |
| EG035F: Dissolve     | d Mercury by FIMS (QCLot: 2083838)                   |  |            |               |                         |             |          |
| EB1829556-002        | Anonymous  | EG035F: Mercury                        | 7439-97-6  | 0.01 mg/L     | 87.2                    | 70          | 130      |
| EG035T: Total Re     | coverable Mercury by FIMS (QCLot: 2083995)           |  |            |               |                         |             |          |
| EB1830098-001        | Anonymous  | EG035T: Mercury                        | 7439-97-6  | 0.01 mg/L     | 83.0                    | 70          | 130      |
| EK057G: Nitrite a    | s N by Discrete Analyser (QCLot: 2083111)            |  |            |               |                         |             |          |
| EB1830002-004        | Anonymous  | EK057G: Nitrite as N                   | 14797-65-0 | 0.4 mg/L      | 107                     | 70          | 130      |
| EK061G: Total Kje    | Idahl Nitrogen By Discrete Analyser (QCLot: 2084226) |  |            |               |                         |             |          |
| EB1829364-002        | Anonymous  | EK061G: Total Kjeldahl Nitrogen as N   |            | 5 mg/L        | 108                     | 70          | 130      |
| EK067G: Total Ph     | osphorus as P by Discrete Analyser (QCLot: 2084225)  |  |            |               |                         |             |          |
| EB1829364-002        | Anonymous  | EK067G: Total Phosphorus as P          |            | 1 mg/L        | 107                     | 70          | 130      |
| EK071G: Reactive     | Phosphorus as P by discrete analyser (QCLot: 2083110 |  |            |               |                         |             |          |
| EB1830002-004        | Anonymous  | EK071G: Reactive Phosphorus as P       | 14265-44-2 | 0.4 mg/L      | 101                     | 70          | 130      |



# **QUALITY CONTROL REPORT**

| Work Order              | : EB1903588                    | Page                    | : 1 of 9                                    |
|-------------------------|--------------------------------|-------------------------|---|
| Client                  |                                | Laboratory              | : Environmental Division Brisbane           |
| Contact                 | : MR MITCH McGINNIS            | Contact                 | : Andrew Epps                               |
| Address                 | 32 SHAND STREET                | Address                 | : 2 Byth Street Stafford QLD Australia 4053 |
|                         | BRISBANE QLD, AUSTRALIA 4053   |                         |   |
| Telephone               | : +61 07 3721 5400             | Telephone               | : +61 7 3552 8639                           |
| Project                 | : 1893795 Inland Rail (Pkg 12) | Date Samples Received   | : 13-Feb-2019                               |
| Order number            | :                              | Date Analysis Commenced | : 13-Feb-2019                               |
| C-O-C number            | :                              | Issue Date              | : 20-Feb-2019                               |
| Sampler                 | : ROBERT CUPPER                |                         | Hac-MRA NATA                                |
| Site                    | :                              |                         |   |
| Quote number            | : EN/002/18 National BQ        |                         | Accreditation No. 825                       |
| No. of samples received | : 1                            |                         | Accredited for compliance with              |
| No. of samples analysed | : 1                            |                         | ISO/IEC 17025 - Testing                     |

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

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

## Signatories

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



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

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

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

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

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

#### Laboratory Duplicate (DUP) Report

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

| Sub-Matrix: WATER    |                                |  |             |      |         | Laboratory I    | plicate (DUP) Report |         |                     |  |  |
|----------------------|--------------------------------|--|-------------|------|---------|-----------------|----------------------|---------|---------------------|--|--|
| Laboratory sample ID | Client sample ID               | Method: Compound                         | CAS Number  | LOR  | Unit    | Original Result | Duplicate Result     | RPD (%) | Recovery Limits (%) |  |  |
| EA005P: pH by PC T   | itrator (QC Lot: 2189174)      |  |             |      |         |                 |                      |         |                     |  |  |
| EB1903588-001        | 320-01-BH2103                  | EA005-P: pH Value                        |             | 0.01 | pH Unit | 7.72            | 7.76                 | 0.517   | 0% - 20%            |  |  |
| EA010P: Conductivit  | ty by PC Titrator (QC Lot: 2   | 189173)                                  |             |      |         |                 |                      |         |                     |  |  |
| EB1903588-001        | 320-01-BH2103                  | EA010-P: Electrical Conductivity @ 25°C  |             | 1    | µS/cm   | 1460            | 1440                 | 0.820   | 0% - 20%            |  |  |
| EA015: Total Dissolv | ved Solids dried at 180 ± 5 °C | C (QC Lot: 2184942)                      |             |      |         |                 |                      |         |                     |  |  |
| EB1903487-001        | Anonymous                      | EA015H: Total Dissolved Solids @180°C    |             | 10   | mg/L    | 1230            | 1190                 | 3.77    | 0% - 20%            |  |  |
| EB1903545-002        | Anonymous                      | EA015H: Total Dissolved Solids @180°C    |             | 10   | mg/L    | 693             | 671                  | 3.13    | 0% - 20%            |  |  |
| ED037P: Alkalinity b | y PC Titrator (QC Lot: 2189    | 172)                                     |             |      |         |                 |                      |         |                     |  |  |
| EB1903001-001        | Anonymous                      | ED037-P: Hydroxide Alkalinity as CaCO3   | DMO-210-001 | 1    | mg/L    | <1              | <1                   | 0.00    | No Limit            |  |  |
|                      |                                | ED037-P: Carbonate Alkalinity as CaCO3   | 3812-32-6   | 1    | mg/L    | 168             | 150                  | 11.1    | 0% - 20%            |  |  |
|                      |                                | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3     | 1    | mg/L    | 532             | 551                  | 3.56    | 0% - 20%            |  |  |
|                      |                                | ED037-P: Total Alkalinity as CaCO3       |             | 1    | mg/L    | 700             | 701                  | 0.221   | 0% - 20%            |  |  |
| EB1903588-001        | 320-01-BH2103                  | ED037-P: Hydroxide Alkalinity as CaCO3   | DMO-210-001 | 1    | mg/L    | <1              | <1                   | 0.00    | No Limit            |  |  |
|                      |                                | ED037-P: Carbonate Alkalinity as CaCO3   | 3812-32-6   | 1    | mg/L    | <1              | <1                   | 0.00    | No Limit            |  |  |
|                      |                                | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3     | 1    | mg/L    | 430             | 432                  | 0.432   | 0% - 20%            |  |  |
|                      |                                | ED037-P: Total Alkalinity as CaCO3       |             | 1    | mg/L    | 430             | 432                  | 0.432   | 0% - 20%            |  |  |
| ED041G: Sulfate (Tu  | rbidimetric) as SO4 2- by DA   | A (QC Lot: 2184260)                      |             |      |         |                 |                      |         |                     |  |  |
| EB1903541-022        | Anonymous                      | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8  | 1    | mg/L    | 282             | 278                  | 1.66    | 0% - 20%            |  |  |
| ED045G: Chloride by  | / Discrete Analyser (QC Lot    | :: 2184259)                              |             |      |         |                 |                      |         |                     |  |  |
| EB1903541-022        | Anonymous                      | ED045G: Chloride                         | 16887-00-6  | 1    | mg/L    | 374             | 373                  | 0.305   | 0% - 20%            |  |  |
| ED093F: Dissolved    | lajor Cations (QC Lot: 2184    | 561)                                     |             |      |         |                 |                      |         |                     |  |  |
| EB1903549-002        | Anonymous                      | ED093F: Calcium                          | 7440-70-2   | 1    | mg/L    | 48              | 50                   | 3.58    | 0% - 20%            |  |  |
|                      |                                | ED093F: Magnesium                        | 7439-95-4   | 1    | mg/L    | 20              | 20                   | 0.00    | 0% - 20%            |  |  |
|                      |                                | ED093F: Sodium                           | 7440-23-5   | 1    | mg/L    | 19              | 20                   | 0.00    | 0% - 50%            |  |  |
|                      |                                | ED093F: Potassium                        | 7440-09-7   | 1    | mg/L    | 3               | 3                    | 0.00    | No Limit            |  |  |

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|------------|--------------------------------|
| Work Order | : EB1903588                    |
| Client     | : GOLDER ASSOCIATES            |
| Project    | : 1893795 Inland Rail (Pkg 12) |



| Sub-Matrix: WATER    |                            |                     |            | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                     |
|----------------------|----------------------------|---------------------|------------|-----------------------------------|------|-----------------|------------------|---------|---------------------|
| Laboratory sample ID | Client sample ID           | Method: Compound    | CAS Number | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |
| ED093F: Dissolved M  | ajor Cations (QC Lot: 2184 | 561) - continued    |            |                                   |      |                 |                  |         |                     |
| EB1903588-001        | 320-01-BH2103              | ED093F: Calcium     | 7440-70-2  | 1                                 | mg/L | 78              | 78               | 0.00    | 0% - 20%            |
|                      |                            | ED093F: Magnesium   | 7439-95-4  | 1                                 | mg/L | 82              | 84               | 1.49    | 0% - 20%            |
|                      |                            | ED093F: Sodium      | 7440-23-5  | 1                                 | mg/L | 94              | 94               | 0.00    | 0% - 20%            |
|                      |                            | ED093F: Potassium   | 7440-09-7  | 1                                 | mg/L | 1               | 1                | 0.00    | No Limit            |
| EG020F: Dissolved M  | etals by ICP-MS (QC Lot: 2 | 184563)             |            |                                   |      |                 |                  |         |                     |
| EB1903584-005        | Anonymous                  | EG020A-F: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
|                      |                            | EG020A-F: Arsenic   | 7440-38-2  | 0.001                             | mg/L | 0.002           | 0.002            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Beryllium | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                            | EG020A-F: Barium    | 7440-39-3  | 0.001                             | mg/L | 0.003           | 0.003            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Chromium  | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                            | EG020A-F: Cobalt    | 7440-48-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                            | EG020A-F: Copper    | 7440-50-8  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                            | EG020A-F: Lead      | 7439-92-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                            | EG020A-F: Manganese | 7439-96-5  | 0.001                             | mg/L | 0.161           | 0.160            | 0.00    | 0% - 20%            |
|                      |                            | EG020A-F: Nickel    | 7440-02-0  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                            | EG020A-F: Zinc      | 7440-66-6  | 0.005                             | mg/L | 0.007           | 0.008            | 16.2    | No Limit            |
|                      |                            | EG020A-F: Selenium  | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Vanadium  | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Boron     | 7440-42-8  | 0.05                              | mg/L | 0.05            | 0.05             | 0.00    | No Limit            |
|                      |                            | EG020A-F: Iron      | 7439-89-6  | 0.05                              | mg/L | 1.21            | 1.22             | 0.00    | 0% - 20%            |
| EB1903588-001        | 320-01-BH2103              | EG020A-F: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
|                      |                            | EG020A-F: Arsenic   | 7440-38-2  | 0.001                             | mg/L | 0.001           | 0.001            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Beryllium | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                            | EG020A-F: Barium    | 7440-39-3  | 0.001                             | mg/L | 0.111           | 0.112            | 0.00    | 0% - 20%            |
|                      |                            | EG020A-F: Chromium  | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                            | EG020A-F: Cobalt    | 7440-48-4  | 0.001                             | mg/L | 0.004           | 0.004            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Copper    | 7440-50-8  | 0.001                             | mg/L | <0.001          | 0.001            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Lead      | 7439-92-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                            | EG020A-F: Manganese | 7439-96-5  | 0.001                             | mg/L | 0.467           | 0.471            | 0.925   | 0% - 20%            |
|                      |                            | EG020A-F: Nickel    | 7440-02-0  | 0.001                             | mg/L | 0.005           | 0.005            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Zinc      | 7440-66-6  | 0.005                             | mg/L | 0.010           | 0.009            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Selenium  | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Vanadium  | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Boron     | 7440-42-8  | 0.05                              | mg/L | <0.05           | <0.05            | 0.00    | No Limit            |
|                      |                            | EG020A-F: Iron      | 7439-89-6  | 0.05                              | mg/L | 0.11            | 0.12             | 0.00    | No Limit            |
| EG020T: Total Metals | by ICP-MS (QC Lot: 21846   | 57)                 |            |                                   |      |                 |                  |         |                     |
| EB1903541-071        | Anonymous                  | EG020A-T: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | <0.1 µg/L       | <0.0001          | 0.00    | No Limit            |
|                      |                            | EG020A-T: Arsenic   | 7440-38-2  | 0.001                             | mg/L | 2 µg/L          | 0.001            | 0.00    | No Limit            |
|                      |                            | EG020A-T: BervIlium | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                            | EG020A-T: Barium    | 7440-39-3  | 0.001                             | mg/L | 85 µg/L         | 0.082            | 2.68    | 0% - 20%            |

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|------------|--------------------------------|
| Work Order | : EB1903588                    |
| Client     | : GOLDER ASSOCIATES            |
| Project    | : 1893795 Inland Rail (Pkg 12) |



| Sub-Matrix: WATER     |                             |                                | [          | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                     |
|-----------------------|-----------------------------|--------------------------------|------------|-----------------------------------|------|-----------------|------------------|---------|---------------------|
| Laboratory sample ID  | Client sample ID            | Method: Compound               | CAS Number | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |
| EG020T: Total Metals  | by ICP-MS (QC Lot: 21846    | 57) - continued                |            |                                   |      |                 |                  |         |                     |
| EB1903541-071         | Anonymous                   | EG020A-T: Chromium             | 7440-47-3  | 0.001                             | mg/L | 2 µg/L          | 0.002            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Cobalt               | 7440-48-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                       |                             | EG020A-T: Copper               | 7440-50-8  | 0.001                             | mg/L | 3 µg/L          | 0.003            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Lead                 | 7439-92-1  | 0.001                             | mg/L | <1 µg/L         | <0.001           | 0.00    | No Limit            |
|                       |                             | EG020A-T: Manganese            | 7439-96-5  | 0.001                             | mg/L | 36 µg/L         | 0.035            | 3.38    | 0% - 20%            |
|                       |                             | EG020A-T: Nickel               | 7440-02-0  | 0.001                             | mg/L | 3 µg/L          | 0.004            | 27.7    | No Limit            |
|                       |                             | EG020A-T: Zinc                 | 7440-66-6  | 0.005                             | mg/L | 32 µg/L         | 0.032            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Selenium             | 7782-49-2  | 0.01                              | mg/L | <10 µg/L        | <0.01            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Vanadium             | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Boron                | 7440-42-8  | 0.05                              | mg/L | <50 µg/L        | <0.05            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Iron                 | 7439-89-6  | 0.05                              | mg/L | 1370 µg/L       | 1.39             | 1.75    | 0% - 20%            |
| EB1903581-002         | Anonymous                   | EG020A-T: Cadmium              | 7440-43-9  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
|                       |                             | EG020A-T: Arsenic              | 7440-38-2  | 0.001                             | mg/L | 0.003           | 0.003            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Beryllium            | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                       |                             | EG020A-T: Barium               | 7440-39-3  | 0.001                             | mg/L | 0.167           | 0.173            | 3.15    | 0% - 20%            |
|                       |                             | EG020A-T: Chromium             | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                       |                             | EG020A-T: Cobalt               | 7440-48-4  | 0.001                             | mg/L | 0.001           | 0.001            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Copper               | 7440-50-8  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                       |                             | EG020A-T: Lead                 | 7439-92-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                       |                             | EG020A-T: Manganese            | 7439-96-5  | 0.001                             | mg/L | 0.023           | 0.024            | 0.00    | 0% - 20%            |
|                       |                             | EG020A-T: Nickel               | 7440-02-0  | 0.001                             | mg/L | 0.004           | 0.003            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Zinc                 | 7440-66-6  | 0.005                             | mg/L | <0.005          | <0.005           | 0.00    | No Limit            |
|                       |                             | EG020A-T: Selenium             | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Vanadium             | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                       |                             | EG020A-T: Boron                | 7440-42-8  | 0.05                              | mg/L | 0.30            | 0.32             | 8.10    | No Limit            |
|                       |                             | EG020A-T: Iron                 | 7439-89-6  | 0.05                              | mg/L | 0.10            | 0.06             | 52.4    | No Limit            |
| EG035F: Dissolved M   | ercury by FIMS (QC Lot: 21  | 84562)                         |            |                                   |      |                 |                  |         |                     |
| EB1903563-001         | Anonymous                   | EG035F: Mercury                | 7439-97-6  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
| EG035T: Total Recov   | erable Mercury by FIMS (Q   | C Lot: 2184654)                |            |                                   |      |                 |                  |         |                     |
| EB1903541-071         | Anonymous                   | EG035T: Mercury                | 7439-97-6  | 0.0001                            | mg/L | <0.1 µg/L       | <0.0001          | 0.00    | No Limit            |
| EK040P: Fluoride by I | PC Titrator (QC Lot: 218917 | (1)                            |            |                                   |      |                 |                  |         |                     |
| EB1903001-001         | Anonymous                   | EK040P: Fluoride               | 16984-48-8 | 0.1                               | mg/L | 0.3             | 0.3              | 0.00    | No Limit            |
| EK055G: Ammonia as    | N by Discrete Analyser (Q   | C Lot: 2186057)                |            |                                   |      |                 |                  |         |                     |
| EB1903588-001         | 320-01-BH2103               | EK055G: Ammonia as N           | 7664-41-7  | 0.01                              | mg/L | 0.89            | 0.82             | 7.73    | 0% - 20%            |
| EB1903620-010         | Anonymous                   | EK055G: Ammonia as N           | 7664-41-7  | 0.01                              | mg/L | 0.05            | <0.01            | 133     | No Limit            |
| EK057G: Nitrite as N  | by Discrete Analyser (QC L  | ot: 2184257)                   |            |                                   |      |                 |                  |         |                     |
| EB1903541-007         | Anonymous                   | EK057G: Nitrite as N           | 14797-65-0 | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
| EB1903588-001         | 320-01-BH2103               | EK057G: Nitrite as N           | 14797-65-0 | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
| EK059G: Nitrite plus  | Nitrate as N (NOx) by Discr | ete Analyser (QC Lot: 2186058) |            |                                   |      |                 |                  |         |                     |

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|------------|--------------------------------|
| Work Order | : EB1903588                    |
| Client     | : GOLDER ASSOCIATES            |
| Project    | : 1893795 Inland Rail (Pkg 12) |



| Sub-Matrix: WATER  |                             |   |            |      | Laboratory Duplicate (DUP) Report |                 |                  |         |                     |  |  |  |
|--|-----------------------------|---|------------|------|-----------------------------------|-----------------|------------------|---------|---------------------|--|--|--|
| Laboratory sample ID   | Client sample ID            | Method: Compound                            | CAS Number | LOR  | Unit                              | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |  |  |  |
| EK059G: Nitrite plus   | Nitrate as N (NOx) by Discr | rete Analyser (QC Lot: 2186058) - continued |            |      |                                   |                 |                  |         |                     |  |  |  |
| EB1903588-001  | 320-01-BH2103               | EK059G: Nitrite + Nitrate as N              |            | 0.01 | mg/L                              | 0.08            | 0.08             | 0.00    | No Limit            |  |  |  |
| EB1903620-010  | Anonymous                   | EK059G: Nitrite + Nitrate as N              |            | 0.01 | mg/L                              | <0.01           | <0.01            | 0.00    | No Limit            |  |  |  |
| EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2187209) |                             |   |            |      |                                   |                 |                  |         |                     |  |  |  |
| EB1903370-001  | Anonymous                   | EK061G: Total Kjeldahl Nitrogen as N        |            | 0.1  | mg/L                              | 4.0             | 3.9              | 0.00    | No Limit            |  |  |  |
| EB1903566-004  | Anonymous                   | EK061G: Total Kjeldahl Nitrogen as N        |            | 0.1  | mg/L                              | 1.0             | 1.0              | 0.00    | No Limit            |  |  |  |
| EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2187208)   |                             |   |            |      |                                   |                 |                  |         |                     |  |  |  |
| EB1903370-001  | Anonymous                   | EK067G: Total Phosphorus as P               |            | 0.01 | mg/L                              | 0.85            | 0.80             | 5.39    | 0% - 50%            |  |  |  |
| EB1903566-004  | Anonymous                   | EK067G: Total Phosphorus as P               |            | 0.01 | mg/L                              | <0.01           | <0.01            | 0.00    | No Limit            |  |  |  |
| EK071G: Reactive Ph  | osphorus as P by discrete a | analyser (QC Lot: 2184261)                  |            |      |                                   |                 |                  |         |                     |  |  |  |
| EB1903588-001  | 320-01-BH2103               | EK071G: Reactive Phosphorus as P            | 14265-44-2 | 0.01 | mg/L                              | 0.01            | <0.01            | 0.00    | No Limit            |  |  |  |



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

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

| Report   Spike   Spike Recovery (%)   Recovery Limits (     Method: Compound   CAS Number   LOR   Unit   Result   Concentration   LCS   Low      EA005P: pH by PC Titrator (QCLot: 2189174)    pH Unit    4 pH Unit   101   98      EA010P: Conductivity by PC Titrator (QCLot: 2189173)    pH Unit    7 pH Unit   100   98      EA010P: Conductivity by PC Titrator (QCLot: 2189173)   | %)<br>High<br>102<br>102<br>107<br>107<br>107<br>112<br>112  |
|---|--|
| Internet:   CAS Number   LOR   Unit   Result   Concentration   LCS   Low     EA005P: pH by PC Titrator (QCLot: 2189174)   EA005-P: pH Value   | High<br>102<br>102<br>107<br>107<br>107<br>112<br>112<br>112 |
| EA005P: pH by PC Titrator (QCLot: 2189174) PH Unit PH Unit 101 98   EA005-P: pH Value  7 pH Unit 100 98   EA010P: Conductivity by PC Titrator (QCLot: 2189173)   EA010-P: Electrical Conductivity @ 25°C  1 µS/cm <1 2100 µS/cm 104 91   EA015-P: Electrical Conductivity @ 25°C  1 µS/cm <1 2100 µS/cm 102 91   EA015-P: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 2184942)  10 mg/L <10 293 mg/L 107 88   EA015H: Total Dissolved Solids @180°C  10 mg/L <10 2000 mg/L 103 88   ED037P: Alkalinity by PC Titrator (QCLot: 2184972) E  mg/L  200 mg/L 98.1 80 5   ED037P: Alkalinity as CaCO3   mg/L  200 mg/L 98.1 80 5   ED041G: Sulfate as SO4 - Turbidimetric) as SO4 2- by DA (QCLot: 2184260) E  20 mg/L 103 85 5   ED041G: Sulfate as SO4 - Turbidimetric 14808-79-8   | 102<br>102<br>107<br>107<br>112<br>112<br>112                |
| EA005-P: pH Value  PH Unit  4 pH Unit 101 98   EA010P: Conductivity by PC Titrator (QCLot: 2189173)   EA010-P: Electrical Conductivity @ 25°C  1 µS/cm <1   | 102<br>102<br>107<br>107<br>112<br>112<br>112                |
| EA010P: Conductivity by PC Titrator (QCLot: 2189173)    7 pH Unit   100   98     EA010-P: Electrical Conductivity @ 25°C    1   μS/cm   <1  | 102<br>107<br>107<br>112<br>112<br>112                       |
| EA010P: Conductivity by PC Titrator (QCLot: 2189173)   EA010-P: Electrical Conductivity @ 25°C  1 μS/cm <1  | 107<br>107<br>112<br>112                                     |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $   | 107<br>107<br>112<br>112<br>112                              |
| Image: Constraint of the sector of  | 107<br>112<br>112  |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 2184942)   EA015H: Total Dissolved Solids @180°C  10 mg/L <10   | 112  |
| EA015H: Total Dissolved Solids @180°C  10 mg/L <10  | 112  |
| Image: Constraint of the second sec | 112  |
| ED037P: Alkalinity by PC Titrator (QCLot: 2189172)   ED037-P: Total Alkalinity as CaCO3  mg/L  200 mg/L 98.1 80   ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2184260) ED041G: Sulfate as SO4 - Turbidimetric 14808-79-8 1 mg/L <1  | 120  |
| ED037-P: Total Alkalinity as CaCO3  mg/L  200 mg/L 98.1 80   ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2184260)  mg/L  200 mg/L 98.1 80   ED041G: Sulfate as SO4 - Turbidimetric 14808-79-8 1 mg/L <1 25 mg/L 103 85  | 120  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2184260)     ED041G: Sulfate as SO4 - Turbidimetric   14808-79-8   1   mg/L   <1  | 120  |
| ED041G: Sulfate as SO4 - Turbidimetric   14808-79-8   1   mg/L   <1   25 mg/L   103   85     1   100 mg/L   100 mg   |  |
|   | 118  |
| <1 100 mg/L 98.7 85   | 118  |
| ED045G: Chloride by Discrete Analyser (QCL of: 2184259)   |  |
| ED045G: Chloride 10 mg/L <1 10 mg/L 106 90  | 115  |
| <1 1000 mg/L 107 90   | 115  |
| ED093F: Dissolved Major Cations (QCLot: 2184561)  |  |
| ED093E: Calcium 7440-70-2 1 mg/L <1   |  |
| ED093F: Magnesium 7439-95-4 1 mg/L <1   |  |
| ED093F: Sodium 7440-23-5 1 mg/L <1  |  |
| ED093F: Potassium 7440-09-7 1 mg/L <1   |  |
| EG020F: Dissolved Metals by ICP-MS (OCLot: 2184563)   |  |
| EG020A-F: Arsenic 7440-38-2 0.001 mg/L <0.001 0.1 mg/L 100 88   | 116  |
| EG020A-F: Bervllium 7440-41-7 0.001 mg/L <0.001 0.1 mg/L 100 81   | 117  |
| EG020A-F: Barium 7440-39-3 0.001 mg/L <0.001 0.5 mg/L 103 70  | 130  |
| EG020A-F: Cadmium 7440-43-9 0.0001 mg/L <0.0001 0.1 mg/L 98.8 88  | 108  |
| EG020A-F: Chromium 7440-47-3 0.001 mg/L <0.001 0.1 mg/L 102 87  | 113  |
| EG020A-F: Cobalt 7440-48-4 0.001 mg/L <0.001 0.1 mg/L 101 86  | 112  |
| EG020A-F: Copper 7440-50-8 0.001 mg/L <0.001 0.2 mg/L 97.1 88   | 114  |
| EG020A-F: Lead 7439-92-1 0.001 mg/L <0.001 0.1 mg/L 94.2 89   | 110  |
| EG020A-F: Manganese 7439-96-5 0.001 mg/L <0.001 0.1 mg/L 92.9 89  | 120  |
| EG020A-F: Nickel 7440-02-0 0.001 mg/L <0.001 0.1 mg/L 98.4 89   | 113  |
| EG020A-F: Selenium 7782-49-2 0.01 mg/L <0.01 0.1 mg/L 102 83  | 112  |
| EG020A-F: Vanadium 7440-62-2 0.01 mg/L <0.01 0.1 mg/L 102 88  |  |

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|------------|--------------------------------|
| Work Order | : EB1903588                    |
| Client     | : GOLDER ASSOCIATES            |
| Project    | : 1893795 Inland Rail (Pkg 12) |



| Sub-Matrix: WATER                                   |                      |        |       | Method Blank (MB) | Laboratory Control Spike (LCS) Report |                    |          |            |
|---|----------------------|--------|-------|-------------------|---------------------------------------|--------------------|----------|------------|
|   |                      |        |       | Report            | Spike                                 | Spike Recovery (%) | Recovery | Limits (%) |
| Method: Compound                                    | CAS Number           | LOR    | Unit  | Result            | Concentration                         | LCS                | Low      | High       |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 21845    | 63) - continued      |        |       |                   |                                       |                    |          |            |
| EG020A-F: Zinc                                      | 7440-66-6            | 0.005  | mg/L  | <0.005            | 0.2 mg/L                              | 96.4               | 87       | 113        |
| EG020A-F: Boron                                     | 7440-42-8            | 0.05   | mg/L  | <0.05             | 0.5 mg/L                              | 102                | 81       | 125        |
| EG020A-F: Iron                                      | 7439-89-6            | 0.05   | mg/L  | <0.05             | 0.5 mg/L                              | 106                | 82       | 114        |
| EG020T: Total Metals by ICP-MS (QCLot: 2184657)     |                      |        |       |                   |                                       |                    |          |            |
| EG020A-T: Arsenic                                   | 7440-38-2            | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 107                | 88       | 112        |
| EG020A-T: Beryllium                                 | 7440-41-7            | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 100                | 81       | 119        |
| EG020A-T: Barium                                    | 7440-39-3            | 0.001  | mg/L  | <0.001            | 0.5 mg/L                              | 101                | 70       | 130        |
| EG020A-T: Cadmium                                   | 7440-43-9            | 0.0001 | mg/L  | <0.0001           | 0.1 mg/L                              | 106                | 88       | 111        |
| EG020A-T: Chromium                                  | 7440-47-3            | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 107                | 89       | 115        |
| EG020A-T: Cobalt                                    | 7440-48-4            | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 112                | 89       | 115        |
| EG020A-T: Copper                                    | 7440-50-8            | 0.001  | mg/L  | <0.001            | 0.2 mg/L                              | 111                | 88       | 116        |
| EG020A-T: Lead                                      | 7439-92-1            | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 104                | 89       | 112        |
| EG020A-T: Manganese                                 | 7439-96-5            | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 108                | 88       | 114        |
| EG020A-T: Nickel                                    | 7440-02-0            | 0.001  | mg/L  | <0.001            | 0.1 mg/L                              | 110                | 88       | 116        |
| EG020A-T: Selenium                                  | 7782-49-2            | 0.01   | mg/L  | <0.01             | 0.1 mg/L                              | 106                | 79       | 111        |
| EG020A-T: Vanadium                                  | 7440-62-2            | 0.01   | mg/L  | <0.01             | 0.1 mg/L                              | 108                | 87       | 114        |
| EG020A-T: Zinc                                      | 7440-66-6            | 0.005  | mg/L  | <0.005            | 0.2 mg/L                              | 108                | 84       | 114        |
| EG020A-T: Boron                                     | 7440-42-8            | 0.05   | mg/L  | <0.05             | 0.5 mg/L                              | 97.1               | 82       | 128        |
| EG020A-T: Iron                                      | 7439-89-6            | 0.05   | mg/L  | <0.05             | 0.5 mg/L                              | 108                | 82       | 118        |
| EG035F: Dissolved Mercury by FIMS (QCLot: 21845)    | 62)                  |        |       |                   |                                       |                    |          |            |
| EG035F: Mercury                                     | 7439-97-6            | 0.0001 | mg/L  | <0.0001           | 0.01 mg/L                             | 105                | 84       | 118        |
| EG035T: Total Recoverable Mercury by FIMS (QCLo     | ot: 2184654)         |        |       |                   |                                       |                    |          |            |
| EG035T: Mercury                                     | 7439-97-6            | 0.0001 | mg/L  | <0.0001           | 0.01 mg/L                             | 93.7               | 84       | 118        |
| EK040P: Fluoride by PC Titrator (QCLot: 2189171)    |                      |        |       |                   |                                       |                    |          |            |
| EK040P: Fluoride                                    | 16984-48-8           | 0.1    | mg/L  | <0.1              | 5 mg/L                                | 97.6               | 80       | 117        |
| EK055G: Ammonia as N by Discrete Analyser (OCL      | ot: 2186057)         |        |       |                   |                                       |                    |          |            |
| EK055G: Ammonia as N                                | 7664-41-7            | 0.01   | mg/L  | <0.01             | 0.5 mg/L                              | 90.3               | 86       | 112        |
| EK057G: Nitrite as N by Discrete Analyser (OCL ot 1 | 2184257)             |        |       |                   |                                       |                    |          |            |
| EK057G: Nitrite as N                                | 14797-65-0           | 0.01   | ma/L  | <0.01             | 0.5 ma/L                              | 101                | 90       | 110        |
| EK050CL Nitrite plue Nitrete es N (NOv) by Discrete | Analyzar (OCI at 219 | 00059) | 5     |                   | <b>J</b>                              |                    |          | -          |
| EK059G: Nitrite + Nitrate as N                      |                      | 0.01   | ma/l  | <0.01             | 0.5 mg/l                              | 99.4               | 89       | 115        |
|   |                      | 0.01   | ing/2 | .0.01             | 0.0 mg/2                              | 00.1               | 00       |            |
| EK061G: Total Kjeldani Nitrogen By Discrete Analyse | er (QCLot: 2187209)  | 0.1    | ma/l  | <0.1              | 1 mg//                                | 70 0               | 70       | 109        |
| EKU61G: Total Kjeldani Nitrogen as N                |                      | 0.1    | mg/L  | SU. 1             | T mg/L                                | 10.0               | 70       | 106        |
| EK067G: Total Phosphorus as P by Discrete Analyse   | er (QCLot: 2187208)  | 0.61   |       | -0.01             | 0.440                                 | 00.0               | 70       | 405        |
| EK067G: Total Phosphorus as P                       |                      | 0.01   | mg/L  | <0.01             | 0.442 mg/L                            | 88.2               | 79       | 105        |
| EK071G: Reactive Phosphorus as P by discrete anal   | yser (QCLot: 2184261 | )      |       |                   |                                       |                    |          |            |
| EK071G: Reactive Phosphorus as P                    | 14265-44-2           | 0.01   | mg/L  | <0.01             | 0.5 mg/L                              | 89.2               | 88       | 115        |


## Matrix Spike (MS) Report

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

| Laboratory sample ID         Client sample ID         Method: Compound         CAS Number           ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2184260)         ED041G: Sulfate as SO4 - Turbidimetric         14808-79-8           ED045G: Chloride by Discrete Analyser (QCLot: 2184259)         ED041G: Sulfate as SO4 - Turbidimetric         14808-79-8           EB1903588-001         320-01-BH2103         ED045G: Chloride by Discrete Analyser (QCLot: 2184259)         ED045G: Chloride           EB1903588-001         320-01-BH2103         ED045G: Chloride         16887-00-6           EG020F: Dissolved Metals by ICP-MS (QCLot: 2184563)         ED045G: Chloride         7440-38-2           EB1903584-006         Anonymous         EG020A-F: Arsenic         7440-38-2           EG020A-F: Benvilium         7440-41-7 | Spike           Concentration           20 mg/L           400 mg/L           0.1 mg/L | SpikeRecovery(%)           MS           97.9           105 | Recovery<br>Low<br>70<br>70 | Limits (%)<br>High<br>130 |
|--|---|--|-----------------------------|---------------------------|
| Laboratory sample ID         Client sample ID         Client sample ID         Method: Compound         CAS Number           ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2184260)         ED041G: Sulfate as SO4 - Turbidimetric         14808-79-8           ED045G: Chloride by Discrete Analyser (QCLot: 2184259)         ED041G: Sulfate as SO4 - Turbidimetric         14808-79-8           EB1903588-001         320-01-BH2103         ED045G: Chloride         16887-00-6           EB1903588-001         320-01-BH2103         ED045G: Chloride         16887-00-6           EG020F: Dissolved Metals by ICP-MS (QCLot: 2184563)         ED045G: Chloride         7440-38-2           EB1903584-006         Anonymous         EG020A-F: Arsenic         7440-38-2           EG020A-F: Benvilium         7440-41-7                    | Concentration 20 mg/L 400 mg/L 0.1 mg/L   | MS<br>97.9<br>105  | <i>Low</i><br>70<br>70      | High 130                  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2184260)           EB1903588-001         320-01-BH2103         ED041G: Sulfate as SO4 - Turbidimetric         14808-79-8           ED045G: Chloride by Discrete Analyser (QCLot: 2184259)         ED045G: Chloride         16887-00-6           EB1903588-001         320-01-BH2103         ED045G: Chloride         16887-00-6           EG020F: Dissolved Metals by ICP-MS (QCLot: 2184563)         EG020A-F: Arsenic         7440-38-2           EB1903584-006         Anonymous         EG020A-F: Arsenic         7440-41-7  | 20 mg/L<br>400 mg/L   | 97.9   | 70<br>70                    | 130                       |
| EB1903588-001         320-01-BH2103         ED041G: Sulfate as SO4 - Turbidimetric         14808-79-8           ED045G: Chloride by Discrete Analyser (QCLot: 2184259)         ED045G: Chloride         16887-00-6           EB1903588-001         320-01-BH2103         ED045G: Chloride         16887-00-6           EG020F: Dissolved Metals by ICP-MS (QCLot: 2184563)         EG020A-F: Arsenic         7440-38-2           EB1903584-006         Anonymous         EG020A-F: Arsenic         7440-41-7   | 20 mg/L<br>400 mg/L<br>0.1 mg/L   | 97.9   | 70<br>70                    | 130                       |
| ED045G: Chloride by Discrete Analyser (QCLot: 2184259)           EB1903588-001         320-01-BH2103         ED045G: Chloride         16887-00-6           EG020F: Dissolved Metals by ICP-MS (QCLot: 2184563)         EG020A-F: Arsenic         7440-38-2           EB1903584-006         Anonymous         EG020A-F: Arsenic         7440-41-7   | 400 mg/L  | 105  | 70                          |                           |
| EB1903588-001         320-01-BH2103         ED045G: Chloride         16887-00-6           EG020F: Dissolved Metals by ICP-MS (QCLot: 2184563)         EG020A-F: Arsenic         7440-38-2           EB1903584-006         Anonymous         EG020A-F: Arsenic         7440-41-7  | 400 mg/L<br>0.1 mg/L  | 105  | 70                          |                           |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 2184563)           EB1903584-006         Anonymous         EG020A-F: Arsenic         7440-38-2           EG020A-F: Benyllium         7440-41-7  | 0.1 mg/L  | 1  |                             | 130                       |
| EB1903584-006         Anonymous         EG020A-F: Arsenic         7440-38-2           EG020A-F: Bepdlium         7440-41-7   | 0.1 mg/L  |  |                             |                           |
| EG0204_F: Benyllium 7440-41-7  |   | 105  | 70                          | 130                       |
|  | 0.1 mg/L  | 101  | 70                          | 130                       |
| EG020A-F: Barium 7440-39-3   | 0.5 mg/L  | 106  | 70                          | 130                       |
| EG020A-F: Cadmium 7440-43-9  | 0.1 mg/L  | 99.7   | 70                          | 130                       |
| EG020A-F: Chromium 7440-47-3   | 0.1 mg/L  | 101  | 70                          | 130                       |
| EG020A-F: Cobalt 7440-48-4   | 0.1 mg/L  | 101  | 70                          | 130                       |
| EG020A-F: Copper 7440-50-8   | 0.2 mg/L  | 98.8   | 70                          | 130                       |
| EG020A-F: Lead 7439-92-1   | 0.1 #ngdt   |  | 70                          | 130                       |
|  | 0.1 mg// //   | Determined   | 70                          | 120                       |
| EG020A-F: Manganese 7439-96-5  | 0.1 mg/L #1   | Not<br>Determined  | 70                          | 130                       |
| EG020A-F: Nickel 7440-02-0   | 0.1 mg/L  | 96.0   | 70                          | 130                       |
| EG020A-F: Selenium 7782-49-2   | 0.1 mg/L  | 102  | 70                          | 130                       |
| EG020A-F: Vanadium 7440-62-2   | 0.1 mg/L  | 99.5   | 70                          | 130                       |
| EG020A-F: Zinc 7440-66-6   | 0.2 mg/L  | 98.0   | 70                          | 130                       |
| EG020A-F: Boron 7440-42-8  | 0.5 mg/L  | 99.0   | 70                          | 130                       |
| EG020T: Total Metals by ICP-MS (QCLot: 2184657)  |   |  |                             |                           |
| EB1903541-074 Anonymous EG020A-T: Arsenic 7440-38-2  | 1 mg/L  | 102  | 70                          | 130                       |
| EG020A-T: Beryllium 7440-41-7  | 0.1 mg/L  | 93.2   | 70                          | 130                       |
| EG020A-T: Barium 7440-39-3   | 1 mg/L  | 93.6   | 70                          | 130                       |
| EG020A-T: Cadmium 7440-43-9  | 0.5 mg/L  | 98.1   | 70                          | 130                       |
| EG020A-T: Chromium 7440-47-3   | 1 mg/L  | 98.2   | 70                          | 130                       |
| EG020A-T: Cobalt 7440-48-4   | 1 mg/L  | 97.2   | 70                          | 130                       |
| EG020A-T: Copper 7440-50-8   | 1 mg/L  | 93.5   | 70                          | 130                       |
| EG020A-T: Lead 7439-92-1   | 1 mg/L  | 93.7   | 70                          | 130                       |
| EG020A-T: Manganese 7439-96-5  | 1 mg/L  | 92.5   | 70                          | 130                       |
| EG020A-T: Nickel 7440-02-0   | 1 mg/L  | 97.4   | 70                          | 130                       |
| EG020A-T: Vanadium 7440-62-2   | 1 mg/L  | 103  | 70                          | 130                       |
| EG020A-T: Zinc 7440-66-6   | 1 mg/L  | 93.5   | 70                          | 130                       |
| EG035F: Dissolved Mercury by FIMS (QCLot: 2184562)   |   |  |                             |                           |

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|--------------------------------|
| : EB1903588                    |
| : GOLDER ASSOCIATES            |
| : 1893795 Inland Rail (Pkg 12) |
|                                |



| Sub-Matrix: WATER  |  |                                      |                             |           | Matrix Spike (MS) Report |            |           |  |
|--|--|--------------------------------------|-----------------------------|-----------|--------------------------|------------|-----------|--|
|  |  |                                      |                             | Spike     | SpikeRecovery(%)         | Recovery L | imits (%) |  |
| Laboratory sample ID                                       | Client sample ID                                       | Method: Compound                     | Method: Compound CAS Number |           |                          |            | High      |  |
| EG035F: Dissolved  | I Mercury by FIMS (QCLot: 2184562) - continued         |                                      |                             |           |                          |            |           |  |
| EB1903630-001  | Anonymous  | EG035F: Mercury                      | 7439-97-6                   | 0.01 mg/L | 87.6                     | 70         | 130       |  |
| EG035T: Total Recoverable Mercury by FIMS (QCLot: 2184654) |  |                                      |                             |           |                          |            |           |  |
| EB1903541-074  | Anonymous  | EG035T: Mercury                      | 7439-97-6                   | 0.01 mg/L | 87.6                     | 70         | 130       |  |
| EK040P: Fluoride by PC Titrator (QCLot: 2189171)           |  |                                      |                             |           |                          |            |           |  |
| EB1903001-003  | Anonymous  | EK040P: Fluoride                     | EK040P: Fluoride 16984-48-8 |           | 87.2                     | 70         | 130       |  |
| EK055G: Ammonia  | as N by Discrete Analyser (QCLot: 2186057)             |                                      |                             |           |                          |            |           |  |
| EB1903620-001  | Anonymous  | EK055G: Ammonia as N                 | 7664-41-7                   | 2 mg/L    | 80.8                     | 70         | 130       |  |
| EK057G: Nitrite as   | N by Discrete Analyser (QCLot: 2184257)                |                                      |                             |           |                          |            |           |  |
| EB1903541-021  | Anonymous  | EK057G: Nitrite as N                 | 14797-65-0                  | 0.4 mg/L  | 96.4                     | 70         | 130       |  |
| EK059G: Nitrite pl   | us Nitrate as N (NOx) by Discrete Analyser (QCLot: 218 | 6058)                                |                             |           |                          |            |           |  |
| EB1903620-001  | Anonymous  | EK059G: Nitrite + Nitrate as N       |                             | 0.4 mg/L  | 94.0                     | 70         | 130       |  |
| EK061G: Total Kjel   | dahl Nitrogen By Discrete Analyser (QCLot: 2187209)    |                                      |                             |           |                          |            |           |  |
| EB1903370-002  | Anonymous  | EK061G: Total Kjeldahl Nitrogen as N |                             | 5 mg/L    | 92.3                     | 70         | 130       |  |
| EK067G: Total Pho  | sphorus as P by Discrete Analyser (QCLot: 2187208)     |                                      |                             |           |                          |            |           |  |
| EB1903370-002  | Anonymous  | EK067G: Total Phosphorus as P        |                             | 1 mg/L    | 98.6                     | 70         | 130       |  |



## **QUALITY CONTROL REPORT**

| Work Order                | EB1904979   | Page                         | : 1 of 9   |
|---------------------------|---|------------------------------|--|
| Client                    |   | Laboratory                   | : Environmental Division Brisbane  |
| Contact                   | : MR SUSANTHA KUMARAPELI  | Contact                      | : Andrew Epps  |
| Address                   | : C/- GOLDING CONTRACTORS PTY LTD LEVEL 3 8 GARDNER<br>CLOSE<br>MILTON OLD 4064 | Address                      | : 2 Byth Street Stafford QLD Australia 4053  |
| Telephone                 | : +61 07 3721 5400  | Telephone                    | : +61 7 3552 8639  |
| Project                   | : 1893795 Inland Rail P/2   | Date Samples Received        | : 27-Feb-2019  |
| Order number              | :   | Date Analysis Commenced      | : 27-Feb-2019  |
| C-O-C number              |   | Issue Date                   | 04-Mar-2019  |
| Sampler                   | : ROBERT CUPPER   |                              | HALA NAIA  |
| Site                      | :   |                              |  |
| Quote number              | : EN/002/18 National BQ   |                              | The state of the second st |
| No. of samples received   | : 1   |                              | Accreditation No. 825<br>Accredited for compliance with  |
| No. of samples analysed   | : 1   |                              | ISO/IEC 17025 - Testing  |
| This report supersedes an | v previous report(s) with this reference. Results apply to the sample(s) as     | submitted. This document sha | all not be reproduced, except in full.   |

This Quality Control Report contains the following information:

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

#### Signatories

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

Signatories

Kim McCabe

Senior Inorganic Chemist

Position

Brisbane Inorganics, Stafford, QLD

Accreditation Category



#### **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

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

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

#### Laboratory Duplicate (DUP) Report

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

| Sub-Matrix: WATER                           |                               |   |                   | Laboratory Duplicate (DUP) Report |         |                 |                  |         |                     |  |
|---|-------------------------------|---|-------------------|-----------------------------------|---------|-----------------|------------------|---------|---------------------|--|
| Laboratory sample ID                        | Client sample ID              | Method: Compound                          | CAS Number        | LOR                               | Unit    | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |  |
| EA005P: pH by PC Titrator (QC Lot: 2208558) |                               |   |                   |                                   |         |                 |                  |         |                     |  |
| EB1904665-001                               | Anonymous                     | EA005-P: pH Value                         | EA005-P: pH Value |                                   | pH Unit | 7.08            | 7.10             | 0.282   | 0% - 20%            |  |
| EB1904676-006                               | Anonymous                     | EA005-P: pH Value                         |                   | 0.01                              | pH Unit | 7.98            | 7.99             | 0.125   | 0% - 20%            |  |
| EA010P: Conductivity                        | y by PC Titrator (QC Lot: 22  | 08557)                                    |                   |                                   |         |                 |                  |         |                     |  |
| EB1904665-001                               | Anonymous                     | EA010-P: Electrical Conductivity @ 25°C   |                   | 1                                 | µS/cm   | 30300           | 30200            | 0.331   | 0% - 20%            |  |
| EB1904676-006                               | Anonymous                     | EA010-P: Electrical Conductivity @ 25°C   |                   | 1                                 | µS/cm   | 3460            | 3470             | 0.288   | 0% - 20%            |  |
| EA015: Total Dissolv                        | ed Solids dried at 180 ± 5 °C | (QC Lot: 2209488)                         |                   |                                   |         |                 |                  |         |                     |  |
| EB1902060-003                               | Anonymous                     | EA015H: Total Dissolved Solids @180°C     |                   | 10                                | mg/L    | 165             | 164              | 0.00    | 0% - 50%            |  |
| ED037P: Alkalinity by                       | PC Titrator (QC Lot: 22085    | 56)                                       |                   |                                   |         |                 |                  |         |                     |  |
| EB1904407-001                               | Anonymous                     | ED037-P: Hydroxide Alkalinity as CaCO3    | DMO-210-001       | 1                                 | mg/L    | <1              | <1               | 0.00    | No Limit            |  |
|   |                               | ED037-P: Carbonate Alkalinity as CaCO3 38 |                   | 1                                 | mg/L    | 12              | 15               | 26.5    | 0% - 50%            |  |
|   |                               | ED037-P: Bicarbonate Alkalinity as CaCO3  | 71-52-3           | 1                                 | mg/L    | 271             | 303              | 11.3    | 0% - 20%            |  |
|   |                               | ED037-P: Total Alkalinity as CaCO3        |                   | 1                                 | mg/L    | 282             | 318              | 12.0    | 0% - 20%            |  |
| EB1904676-006                               | Anonymous                     | ED037-P: Hydroxide Alkalinity as CaCO3    | DMO-210-001       | 1                                 | mg/L    | <1              | <1               | 0.00    | No Limit            |  |
|   |                               | ED037-P: Carbonate Alkalinity as CaCO3    | 3812-32-6         | 1                                 | mg/L    | <1              | <1               | 0.00    | No Limit            |  |
|   |                               | ED037-P: Bicarbonate Alkalinity as CaCO3  | 71-52-3           | 1                                 | mg/L    | 1220            | 1220             | 0.202   | 0% - 20%            |  |
|   |                               | ED037-P: Total Alkalinity as CaCO3        |                   | 1                                 | mg/L    | 1220            | 1220             | 0.202   | 0% - 20%            |  |
| ED041G: Sulfate (Tur                        | bidimetric) as SO4 2- by DA   | (QC Lot: 2208937)                         |                   |                                   |         |                 |                  |         |                     |  |
| EB1904971-001                               | Anonymous                     | ED041G: Sulfate as SO4 - Turbidimetric    | 14808-79-8        | 1                                 | mg/L    | 367             | 374              | 1.90    | 0% - 20%            |  |
| ED045G: Chloride by                         | Discrete Analyser (QC Lot:    | 2208934)                                  |                   |                                   |         |                 |                  |         |                     |  |
| EB1904948-001                               | Anonymous                     | ED045G: Chloride                          | 16887-00-6        | 1                                 | mg/L    | <1              | <1               | 0.00    | No Limit            |  |
| ED093F: Dissolved M                         | ajor Cations (QC Lot: 22092   | 254)                                      |                   |                                   |         |                 |                  |         |                     |  |
| EB1904819-001                               | Anonymous                     | ED093F: Calcium                           | 7440-70-2         | 1                                 | mg/L    | 15              | 15               | 0.00    | 0% - 50%            |  |
|   |                               | ED093F: Magnesium                         | 7439-95-4         | 1                                 | mg/L    | 8               | 8                | 0.00    | No Limit            |  |
|   |                               | ED093F: Sodium                            | 7440-23-5         | 1                                 | mg/L    | 29              | 29               | 0.00    | 0% - 20%            |  |

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|---------------------------|
| : EB1904979               |
| : GOLDER ASSOCIATES       |
| : 1893795 Inland Rail P/2 |
|                           |



| Sub-Matrix: WATER    |                             |                     |            | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                     |
|----------------------|-----------------------------|---------------------|------------|-----------------------------------|------|-----------------|------------------|---------|---------------------|
| Laboratory sample ID | Client sample ID            | Method: Compound    | CAS Number | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |
| ED093F: Dissolved N  | ajor Cations (QC Lot: 2209  | 254) - continued    |            |                                   |      |                 |                  |         |                     |
| EB1904819-001        | Anonymous                   | ED093F: Potassium   | 7440-09-7  | 1                                 | mg/L | 6               | 6                | 0.00    | No Limit            |
| EG020F: Dissolved N  | letals by ICP-MS (QC Lot: 2 | 2209256)            |            |                                   |      |                 |                  |         |                     |
| EB1905027-002        | Anonymous                   | EG020A-F: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
|                      |                             | EG020A-F: Arsenic   | 7440-38-2  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Beryllium | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Barium    | 7440-39-3  | 0.001                             | mg/L | 0.097           | 0.099            | 1.68    | 0% - 20%            |
|                      |                             | EG020A-F: Chromium  | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Cobalt    | 7440-48-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Copper    | 7440-50-8  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Lead      | 7439-92-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Manganese | 7439-96-5  | 0.001                             | mg/L | 0.007           | 0.007            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Nickel    | 7440-02-0  | 0.001                             | mg/L | 0.001           | 0.001            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Zinc      | 7440-66-6  | 0.005                             | mg/L | <0.005          | <0.005           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Selenium  | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Vanadium  | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Boron     | 7440-42-8  | 0.05                              | mg/L | 0.27            | 0.26             | 0.00    | No Limit            |
|                      |                             | EG020A-F: Iron      | 7439-89-6  | 0.05                              | mg/L | <0.05           | <0.05            | 0.00    | No Limit            |
| EB1904909-001        | Anonymous                   | EG020A-F: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |
|                      |                             | EG020A-F: Arsenic   | 7440-38-2  | 0.001                             | mg/L | 0.008           | 0.008            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Beryllium | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Barium    | 7440-39-3  | 0.001                             | mg/L | 0.510           | 0.513            | 0.490   | 0% - 20%            |
|                      |                             | EG020A-F: Chromium  | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Cobalt    | 7440-48-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Copper    | 7440-50-8  | 0.001                             | mg/L | 0.002           | 0.002            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Lead      | 7439-92-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-F: Manganese | 7439-96-5  | 0.001                             | mg/L | 0.014           | 0.014            | 0.00    | 0% - 50%            |
|                      |                             | EG020A-F: Nickel    | 7440-02-0  | 0.001                             | mg/L | 0.040           | 0.040            | 0.00    | 0% - 20%            |
|                      |                             | EG020A-F: Zinc      | 7440-66-6  | 0.005                             | mg/L | 0.059           | 0.058            | 0.00    | 0% - 50%            |
|                      |                             | EG020A-F: Selenium  | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Vanadium  | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |
|                      |                             | EG020A-F: Boron     | 7440-42-8  | 0.05                              | mg/L | 1.64            | 1.72             | 5.26    | 0% - 20%            |
|                      |                             | EG020A-F: Iron      | 7439-89-6  | 0.05                              | mg/L | <0.05           | <0.05            | 0.00    | No Limit            |
| EG020T: Total Metals | by ICP-MS (QC Lot: 22093    | 861)                |            |                                   |      |                 |                  |         |                     |
| EB1904909-002        | Anonymous                   | EG020A-T: Cadmium   | 7440-43-9  | 0.0001                            | mg/L | 0.0001          | <0.0001          | 0.00    | No Limit            |
|                      |                             | EG020A-T: Arsenic   | 7440-38-2  | 0.001                             | mg/L | 0.009           | 0.010            | 0.00    | No Limit            |
|                      |                             | EG020A-T: Beryllium | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Barium    | 7440-39-3  | 0.001                             | mg/L | 0.465           | 0.462            | 0.560   | 0% - 20%            |
|                      |                             | EG020A-T: Chromium  | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Cobalt    | 7440-48-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |
|                      |                             | EG020A-T: Copper    | 7440-50-8  | 0.001                             | mg/L | 0.003           | 0.003            | 0.00    | No Limit            |

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|------------|---|
| Work Order | : EB1904979                                 |
| Client     | : GOLDER ASSOCIATES                         |
| Project    | <ul> <li>1893795 Inland Rail P/2</li> </ul> |



| Sub-Matrix: WATER    |                             |                                      |            | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                     |  |
|----------------------|-----------------------------|--------------------------------------|------------|-----------------------------------|------|-----------------|------------------|---------|---------------------|--|
| Laboratory sample ID | Client sample ID            | Method: Compound                     | CAS Number | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |  |
| EG020T: Total Metals | by ICP-MS (QC Lot: 22093    | 61) - continued                      |            |                                   |      |                 |                  |         |                     |  |
| EB1904909-002        | Anonymous                   | EG020A-T: Lead                       | 7439-92-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Manganese                  | 7439-96-5  | 0.001                             | mg/L | 0.016           | 0.016            | 0.00    | 0% - 50%            |  |
|                      |                             | EG020A-T: Nickel                     | 7440-02-0  | 0.001                             | mg/L | 0.045           | 0.046            | 3.19    | 0% - 20%            |  |
|                      |                             | EG020A-T: Zinc                       | 7440-66-6  | 0.005                             | mg/L | 0.063           | 0.062            | 2.03    | 0% - 50%            |  |
|                      |                             | EG020A-T: Selenium                   | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Vanadium                   | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Boron                      | 7440-42-8  | 0.05                              | mg/L | 1.84            | 1.74             | 4.99    | 0% - 20%            |  |
|                      |                             | EG020A-T: Iron                       | 7439-89-6  | 0.05                              | mg/L | 0.08            | 0.08             | 0.00    | No Limit            |  |
| EB1904909-001        | Anonymous                   | EG020A-T: Cadmium                    | 7440-43-9  | 0.0001                            | mg/L | 0.0001          | <0.0001          | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Arsenic                    | 7440-38-2  | 0.001                             | mg/L | 0.010           | 0.010            | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Beryllium                  | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Barium                     | 7440-39-3  | 0.001                             | mg/L | 0.565           | 0.584            | 3.28    | 0% - 20%            |  |
|                      |                             | EG020A-T: Chromium                   | 7440-47-3  | 0.001                             | mg/L | 0.002           | 0.002            | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Cobalt                     | 7440-48-4  | 0.001                             | mg/L | 0.001           | 0.002            | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Copper                     | 7440-50-8  | 0.001                             | mg/L | 0.006           | 0.007            | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Lead                       | 7439-92-1  | 0.001                             | mg/L | 0.002           | 0.002            | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Manganese                  | 7439-96-5  | 0.001                             | mg/L | 0.026           | 0.026            | 0.00    | 0% - 20%            |  |
|                      |                             | EG020A-T: Nickel                     | 7440-02-0  | 0.001                             | mg/L | 0.041           | 0.040            | 0.00    | 0% - 20%            |  |
|                      |                             | EG020A-T: Zinc                       | 7440-66-6  | 0.005                             | mg/L | 0.178           | 0.185            | 3.52    | 0% - 20%            |  |
|                      |                             | EG020A-T: Selenium                   | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Vanadium                   | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |  |
|                      |                             | EG020A-T: Boron                      | 7440-42-8  | 0.05                              | mg/L | 1.69            | 1.77             | 4.25    | 0% - 20%            |  |
|                      |                             | EG020A-T: Iron                       | 7439-89-6  | 0.05                              | mg/L | 1.09            | 1.12             | 2.23    | 0% - 20%            |  |
| EG035F: Dissolved M  | ercury by FIMS (QC Lot: 22  | 209257)                              |            |                                   |      |                 |                  |         |                     |  |
| EB1904979-001        | 320-01-BH2216               | EG035F: Mercury                      | 7439-97-6  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |  |
| EG035T: Total Recov  | verable Mercury by FIMS (Q  | C Lot: 2209365)                      |            |                                   |      |                 |                  |         |                     |  |
| EB1904979-001        | 320-01-BH2216               | EG035T: Mercury                      | 7439-97-6  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |  |
| EB1905049-003        | Anonymous                   | EG035T: Mercury                      | 7439-97-6  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.00    | No Limit            |  |
| EK055G: Ammonia as   | s N by Discrete Analyser(Q  | C Lot: 2209285)                      |            |                                   |      |                 |                  |         |                     |  |
| EB1904909-001        | Anonymous                   | EK055G: Ammonia as N                 | 7664-41-7  | 0.01                              | mg/L | 2.77            | 2.92             | 5.35    | 0% - 20%            |  |
| EK057G: Nitrite as N | by Discrete Analyser (QC I  | _ot: 2208938)                        |            |                                   |      |                 |                  |         |                     |  |
| EB1904971-001        | Anonymous                   | EK057G: Nitrite as N                 | 14797-65-0 | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |  |
| EK059G: Nitrite plus | Nitrate as N (NOx) by Disci | rete Analyser (QC Lot: 2209286)      |            |                                   |      |                 |                  |         |                     |  |
| EB1904909-001        | Anonymous                   | EK059G: Nitrite + Nitrate as N       |            | 0.01                              | mg/L | <0.01           | <0.01            | 0.00    | No Limit            |  |
| EK061G: Total Kjelda | hl Nitrogen By Discrete Ana | alyser (QC Lot: 2209188)             |            |                                   |      |                 |                  |         |                     |  |
| EB1904902-001        | Anonymous                   | EK061G: Total Kjeldahl Nitrogen as N |            | 0.1                               | mg/L | 0.4             | 0.4              | 0.00    | No Limit            |  |
| EK067G: Total Phosp  | horus as P by Discrete Ana  | lyser (QC Lot: 2209187)              |            |                                   |      |                 |                  |         |                     |  |
| EB1904902-001        | Anonymous                   | EK067G: Total Phosphorus as P        |            | 0.01                              | mg/L | 0.02            | 0.02             | 0.00    | No Limit            |  |
| EK071G: Reactive Ph  | osphorus as P by discrete a | analyser (QC Lot: 2208935)           |            |                                   |      |                 |                  |         |                     |  |

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|------------|---------------------------|
| Work Order | : EB1904979               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 Inland Rail P/2 |



| Sub-Matrix: WATER   |           |                                  |            |      | Laboratory D    | ouplicate (DUP) Report |         |                     |          |
|---|-----------|----------------------------------|------------|------|-----------------|------------------------|---------|---------------------|----------|
| Laboratory sample ID Client sample ID Method: Compound CAS Numi                     |           | CAS Number                       | LOR        | Unit | Original Result | Duplicate Result       | RPD (%) | Recovery Limits (%) |          |
| EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 2208935) - continued |           |                                  |            |      |                 |                        |         |                     |          |
| EB1904948-001   | Anonymous | EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L            | <0.01                  | <0.01   | 0.00                | No Limit |



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

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

| Sub-Matrix: WATER   |            |        |         | Method Blank (MB) | Laboratory Control Spike (LCS) Report |                    |          |            |  |
|---|------------|--------|---------|-------------------|---------------------------------------|--------------------|----------|------------|--|
|   |            |        |         | Report            | Spike                                 | Spike Recovery (%) | Recovery | Limits (%) |  |
| Method: Compound  | CAS Number | LOR    | Unit    | Result            | Concentration                         | LCS                | Low      | High       |  |
| EA005P: pH by PC Titrator (QCLot: 2208558)                  |            |        |         |                   |                                       |                    |          |            |  |
| EA005-P: pH Value   |            |        | pH Unit |                   | 4 pH Unit                             | 100                | 98       | 102        |  |
|   |            |        |         |                   | 7 pH Unit                             | 100                | 98       | 102        |  |
| EA010P: Conductivity by PC Titrator (QCLot: 2208557)        |            |        |         |                   |                                       |                    |          |            |  |
| EA010-P: Electrical Conductivity @ 25°C                     |            | 1      | μS/cm   | <1                | 4000 µS/cm                            | 103                | 91       | 107        |  |
|   |            |        |         | <1                | 12890 µS/cm                           | 99.4               | 91       | 107        |  |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C(QCLot: 22 | 209488)    |        |         |                   |                                       |                    |          |            |  |
| EA015H: Total Dissolved Solids @180°C                       |            | 10     | mg/L    | <10               | 293 mg/L                              | 101                | 88       | 112        |  |
|   |            |        |         | <10               | 2000 mg/L                             | 100                | 88       | 112        |  |
| ED037P: Alkalinity by PC Titrator (QCLot: 2208556)          |            |        |         |                   |                                       |                    |          |            |  |
| ED037-P: Total Alkalinity as CaCO3                          |            |        | mg/L    |                   | 200 mg/L                              | 90.1               | 80       | 120        |  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 22  | 08937)     |        |         |                   |                                       |                    |          |            |  |
| ED041G: Sulfate as SO4 - Turbidimetric                      | 14808-79-8 | 1      | mg/L    | <1                | 25 mg/L                               | 105                | 85       | 118        |  |
|   |            |        | -       | <1                | 100 mg/L                              | 107                | 85       | 118        |  |
| ED045G: Chloride by Discrete Analyser (OCLot: 2208934)      |            |        |         |                   |                                       |                    |          |            |  |
| ED045G: Chloride  | 16887-00-6 | 1      | mg/L    | <1                | 10 mg/L                               | 95.9               | 90       | 115        |  |
|   |            |        | C C     | <1                | 1000 mg/L                             | 103                | 90       | 115        |  |
| ED093F: Dissolved Maior Cations (QCLot: 2209254)            |            |        |         |                   |                                       |                    |          |            |  |
| ED093F: Calcium   | 7440-70-2  | 1      | mg/L    | <1                |                                       |                    |          |            |  |
| ED093F: Magnesium   | 7439-95-4  | 1      | mg/L    | <1                |                                       |                    |          |            |  |
| ED093F: Sodium  | 7440-23-5  | 1      | mg/L    | <1                |                                       |                    |          |            |  |
| ED093F: Potassium   | 7440-09-7  | 1      | mg/L    | <1                |                                       |                    |          |            |  |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 2209256)         |            |        |         |                   |                                       |                    |          |            |  |
| EG020A-F: Arsenic   | 7440-38-2  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 99.9               | 88       | 116        |  |
| EG020A-F: Beryllium   | 7440-41-7  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 99.8               | 81       | 117        |  |
| EG020A-F: Barium  | 7440-39-3  | 0.001  | mg/L    | <0.001            | 0.5 mg/L                              | 103                | 70       | 130        |  |
| EG020A-F: Cadmium   | 7440-43-9  | 0.0001 | mg/L    | <0.0001           | 0.1 mg/L                              | 95.6               | 88       | 108        |  |
| EG020A-F: Chromium  | 7440-47-3  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 96.0               | 87       | 113        |  |
| EG020A-F: Cobalt  | 7440-48-4  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 98.2               | 86       | 112        |  |
| EG020A-F: Copper  | 7440-50-8  | 0.001  | mg/L    | <0.001            | 0.2 mg/L                              | 106                | 88       | 114        |  |
| EG020A-F: Lead  | 7439-92-1  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 96.8               | 89       | 110        |  |
| EG020A-F: Manganese   | 7439-96-5  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 102                | 89       | 120        |  |
| EG020A-F: Nickel  | 7440-02-0  | 0.001  | mg/L    | <0.001            | 0.1 mg/L                              | 100                | 89       | 113        |  |
| EG020A-F: Selenium  | 7782-49-2  | 0.01   | mg/L    | <0.01             | 0.1 mg/L                              | 104                | 83       | 112        |  |
| EG020A-F: Vanadium  | 7440-62-2  | 0.01   | mg/L    | <0.01             | 0.1 mg/L                              | 102                | 88       | 114        |  |

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|------------|---|
| Work Order | : EB1904979                                 |
| Client     | : GOLDER ASSOCIATES                         |
| Project    | <ul> <li>1893795 Inland Rail P/2</li> </ul> |



| Sub-Matrix: WATER                               |                                  |        |      | Method Blank (MB) | Laboratory Control Spike (LCS) Report |                    |          |            |  |
|---|----------------------------------|--------|------|-------------------|---------------------------------------|--------------------|----------|------------|--|
|   |                                  |        |      | Report            | Spike                                 | Spike Recovery (%) | Recovery | Limits (%) |  |
| Method: Compound                                | CAS Number                       | LOR    | Unit | Result            | Concentration                         | LCS                | Low      | High       |  |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 2    | 2209256) - continued             |        |      |                   |                                       |                    |          |            |  |
| EG020A-F: Zinc                                  | 7440-66-6                        | 0.005  | mg/L | <0.005            | 0.2 mg/L                              | 99.4               | 87       | 113        |  |
| EG020A-F: Boron                                 | 7440-42-8                        | 0.05   | mg/L | <0.05             | 0.5 mg/L                              | 98.3               | 81       | 125        |  |
| EG020A-F: Iron                                  | 7439-89-6                        | 0.05   | mg/L | <0.05             | 0.5 mg/L                              | 101                | 82       | 114        |  |
| EG020T: Total Metals by ICP-MS (QCLot: 22093    | 361)                             |        |      |                   |                                       |                    |          |            |  |
| EG020A-T: Arsenic                               | 7440-38-2                        | 0.001  | mg/L | <0.001            | 0.1 mg/L                              | 99.5               | 88       | 112        |  |
| EG020A-T: Beryllium                             | 7440-41-7                        | 0.001  | mg/L | <0.001            | 0.1 mg/L                              | 95.8               | 81       | 119        |  |
| EG020A-T: Barium                                | 7440-39-3                        | 0.001  | mg/L | <0.001            | 0.5 mg/L                              | 98.8               | 70       | 130        |  |
| EG020A-T: Cadmium                               | 7440-43-9                        | 0.0001 | mg/L | <0.0001           | 0.1 mg/L                              | 94.7               | 88       | 111        |  |
| EG020A-T: Chromium                              | 7440-47-3                        | 0.001  | mg/L | <0.001            | 0.1 mg/L                              | 99.0               | 89       | 115        |  |
| EG020A-T: Cobalt                                | 7440-48-4                        | 0.001  | mg/L | <0.001            | 0.1 mg/L                              | 99.1               | 89       | 115        |  |
| EG020A-T: Copper                                | 7440-50-8                        | 0.001  | mg/L | <0.001            | 0.2 mg/L                              | 99.3               | 88       | 116        |  |
| EG020A-T: Lead                                  | 7439-92-1                        | 0.001  | mg/L | <0.001            | 0.1 mg/L                              | 97.9               | 89       | 112        |  |
| EG020A-T: Manganese                             | 7439-96-5                        | 0.001  | mg/L | <0.001            | 0.1 mg/L                              | 98.8               | 88       | 114        |  |
| EG020A-T: Nickel                                | 7440-02-0                        | 0.001  | mg/L | <0.001            | 0.1 mg/L                              | 99.0               | 88       | 116        |  |
| EG020A-T: Selenium                              | 7782-49-2                        | 0.01   | mg/L | <0.01             | 0.1 mg/L                              | 93.7               | 79       | 111        |  |
| EG020A-T: Vanadium                              | 7440-62-2                        | 0.01   | mg/L | <0.01             | 0.1 mg/L                              | 99.8               | 87       | 114        |  |
| EG020A-T: Zinc                                  | 7440-66-6                        | 0.005  | mg/L | <0.005            | 0.2 mg/L                              | 94.3               | 84       | 114        |  |
| EG020A-T: Boron                                 | 7440-42-8                        | 0.05   | mg/L | <0.05             | 0.5 mg/L                              | 96.6               | 82       | 128        |  |
| EG020A-T: Iron                                  | 7439-89-6                        | 0.05   | mg/L | <0.05             | 0.5 mg/L                              | 100                | 82       | 118        |  |
| EG035F: Dissolved Mercury by FIMS (QCLot: 2     | 209257)                          |        |      |                   |                                       |                    |          |            |  |
| EG035F: Mercury                                 | 7439-97-6                        | 0.0001 | mg/L | <0.0001           | 0.01 mg/L                             | 97.3               | 84       | 118        |  |
| EG035T: Total Recoverable Mercury by FIMS (     | QCLot: 2209365)                  |        |      |                   |                                       |                    |          |            |  |
| EG035T: Mercury                                 | 7439-97-6                        | 0.0001 | mg/L | <0.0001           | 0.01 mg/L                             | 100                | 84       | 118        |  |
| EK055G: Ammonia as N by Discrete Analyser(      | QCLot: 2209285)                  |        |      |                   |                                       |                    |          |            |  |
| EK055G: Ammonia as N                            | 7664-41-7                        | 0.01   | mg/L | <0.01             | 0.5 mg/L                              | 99.0               | 86       | 112        |  |
| EK057G: Nitrite as N by Discrete Analyser (QC   | Lot: 2208938)                    |        |      |                   |                                       |                    |          |            |  |
| EK057G: Nitrite as N                            | 14797-65-0                       | 0.01   | mg/L | <0.01             | 0.5 mg/L                              | 97.2               | 90       | 110        |  |
| EK059G: Nitrite plus Nitrate as N (NOx) by Disc | crete Analyser (QCLot: 220       | 9286)  |      |                   |                                       |                    |          |            |  |
| EK059G: Nitrite + Nitrate as N                  |                                  | 0.01   | mg/L | <0.01             | 0.5 mg/L                              | 99.3               | 89       | 115        |  |
| EK061G: Total Kieldahl Nitrogen By Discrete Ar  | nalvser (QCLot: 2209188)         |        |      |                   |                                       |                    |          |            |  |
| EK061G: Total Kjeldahl Nitrogen as N            |                                  | 0.1    | mg/L | <0.1              | 1 mg/L                                | 76.6               | 70       | 108        |  |
| EK067G: Total Phosphorus as P by Discrete An    | alvser (QCLot: 2209187)          |        |      |                   |                                       |                    |          |            |  |
| EK067G: Total Phosphorus as P                   |                                  | 0.01   | mg/L | <0.01             | 0.442 mg/L                            | 85.3               | 79       | 105        |  |
| EK071G: Reactive Phosphorus as P by discrete    | analyser (QCLot: 2 <u>208935</u> | )      |      |                   |                                       |                    |          |            |  |
| EK071G: Reactive Phosphorus as P                | 14265-44-2                       | 0.01   | mg/L | <0.01             | 0.5 mg/L                              | 104                | 88       | 115        |  |

## Matrix Spike (MS) Report

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|------------|---------------------------|
| Work Order | : EB1904979               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 Inland Rail P/2 |



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

| Sub-Matrix: WATER    |  |  | Ma         |                                 |                     |            |           |
|----------------------|--|--|------------|---------------------------------|---------------------|------------|-----------|
|                      |  |  |            | Spike SpikeRecovery(%) Recovery |                     | Recovery L | imits (%) |
| Laboratory sample ID | Client sample ID                               | Method: Compound                       | CAS Number | Concentration                   | MS                  | Low        | High      |
| ED041G: Sulfate (T   | urbidimetric) as SO4 2- by DA (QCLot: 2208937) |  |            |                                 |                     |            |           |
| EB1904963-001        | Anonymous                                      | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 20 mg/L                         | # Not<br>Determined | 70         | 130       |
| ED045G: Chloride     | by Discrete Analyser (QCLot: 2208934)          |  |            |                                 |                     |            |           |
| EB1904963-001        | Anonymous                                      | ED045G: Chloride                       | 16887-00-6 | 400 mg/L                        | # Not               | 70         | 130       |
| EG020F: Dissolved    | I Metals by ICP-MS (QCLot: 2209256)            |  |            |                                 | Botominou           |            |           |
| EB1904909-002        | Anonymous                                      | EG020A-F: Arsenic                      | 7440-38-2  | 0.1 mg/L                        | 105                 | 70         | 130       |
|                      |  | EG020A-F: Bervllium                    | 7440-41-7  | 0.1 mg/L                        | 103                 | 70         | 130       |
|                      |  | EG020A-F: Barium                       | 7440-39-3  | 0.5 mg/L                        | 104                 | 70         | 130       |
|                      |  | EG020A-F: Cadmium                      | 7440-43-9  | 0.1 mg/L                        | 96.4                | 70         | 130       |
|                      |  | EG020A-F: Chromium                     | 7440-47-3  | 0.1 mg/L                        | 91.7                | 70         | 130       |
|                      |  | EG020A-F: Cobalt                       | 7440-48-4  | 0.1 mg/L                        | 93.1                | 70         | 130       |
|                      |  | EG020A-F: Copper                       | 7440-50-8  | 0.2 mg/L                        | 90.9                | 70         | 130       |
|                      |  | EG020A-F: Lead                         | 7439-92-1  | 0.1 mg/L                        | 91.5                | 70         | 130       |
|                      |  | EG020A-F: Manganese                    | 7439-96-5  | 0.1 mg/L                        | 96.3                | 70         | 130       |
|                      |  | EG020A-F: Nickel                       | 7440-02-0  | 0.1 mg/L                        | 92.0                | 70         | 130       |
|                      |  | EG020A-F: Selenium                     | 7782-49-2  | 0.1 mg/L                        | 109                 | 70         | 130       |
|                      |  | EG020A-F: Vanadium                     | 7440-62-2  | 0.1 mg/L                        | 99.1                | 70         | 130       |
|                      |  | EG020A-F: Zinc                         | 7440-66-6  | 0.2 mg/L                        | 95.2                | 70         | 130       |
|                      |  | EG020A-F: Boron                        | 7440-42-8  | 0.5 mg/L                        | 99.4                | 70         | 130       |
| EG020T: Total Meta   | als by ICP-MS (QCLot: 2209361)                 |  |            |                                 |                     |            |           |
| EB1904819-001        | Anonymous                                      | EG020A-T: Arsenic                      | 7440-38-2  | 1 mg/L                          | 98.4                | 70         | 130       |
|                      |  | EG020A-T: Beryllium                    | 7440-41-7  | 0.1 mg/L                        | 98.1                | 70         | 130       |
|                      |  | EG020A-T: Barium                       | 7440-39-3  | 1 mg/L                          | 98.7                | 70         | 130       |
|                      |  | EG020A-T: Cadmium                      | 7440-43-9  | 0.5 mg/L                        | 94.7                | 70         | 130       |
|                      |  | EG020A-T: Chromium                     | 7440-47-3  | 1 mg/L                          | 97.0                | 70         | 130       |
|                      |  | EG020A-T: Cobalt                       | 7440-48-4  | 1 mg/L                          | 93.7                | 70         | 130       |
|                      |  | EG020A-T: Copper                       | 7440-50-8  | 1 mg/L                          | 95.4                | 70         | 130       |
|                      |  | EG020A-T: Lead                         | 7439-92-1  | 1 mg/L                          | 96.8                | 70         | 130       |
|                      |  | EG020A-T: Manganese                    | 7439-96-5  | 1 mg/L                          | 93.6                | 70         | 130       |
|                      |  | EG020A-T: Nickel                       | 7440-02-0  | 1 mg/L                          | 95.1                | 70         | 130       |
|                      |  | EG020A-T: Vanadium                     | 7440-62-2  | 1 mg/L                          | 96.3                | 70         | 130       |
|                      |  | EG020A-T: Zinc                         | 7440-66-6  | 1 mg/L                          | 93.2                | 70         | 130       |
| EG035F: Dissolved    | I Mercury by FIMS (QCLot: 2209257)             |  |            |                                 |                     |            |           |
| EB1905016-013        | Anonymous                                      | EG035F: Mercury                        | 7439-97-6  | 0.01 mg/L                       | 78.5                | 70         | 130       |
| EG035T: Total Rec    | coverable Mercury by FIMS (QCLot: 2209365)     |  |            |                                 |                     |            |           |

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|------------|---------------------------|
| Work Order | : EB1904979               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 Inland Rail P/2 |
|            |                           |



| Sub-Matrix: WATER  |  |                                      | Γ          | Matrix Spike (MS) Report |                  |             |          |
|--|--|--------------------------------------|------------|--------------------------|------------------|-------------|----------|
|  |  |                                      |            | Spike                    | SpikeRecovery(%) | Recovery Li | mits (%) |
| Laboratory sample ID   | Client sample ID                                       | Method: Compound                     | CAS Number | Concentration            | MS               | Low         | High     |
| EG035T: Total Recoverable Mercury by FIMS (QCLot: 2209365) - continued |  |                                      |            |                          |                  |             |          |
| EB1905016-013  | Anonymous  | EG035T: Mercury                      | 7439-97-6  | 0.01 mg/L                | 79.3             | 70          | 130      |
| EK055G: Ammonia as N by Discrete Analyser (QCLot: 2209285)             |  |                                      |            |                          |                  |             |          |
| EB1904909-002  | Anonymous  | EK055G: Ammonia as N                 | 7664-41-7  | 0.4 mg/L                 | 103              | 70          | 130      |
| EK057G: Nitrite as   | N by Discrete Analyser (QCLot: 2208938)                |                                      |            |                          |                  |             |          |
| EB1904963-001  | Anonymous  | EK057G: Nitrite as N                 | 14797-65-0 | 0.4 mg/L                 | 91.4             | 70          | 130      |
| EK059G: Nitrite plu  | us Nitrate as N (NOx) by Discrete Analyser (QCLot: 220 | 9286)                                |            |                          |                  |             |          |
| EB1904909-002  | Anonymous  | EK059G: Nitrite + Nitrate as N       |            | 0.4 mg/L                 | 94.2             | 70          | 130      |
| EK061G: Total Kjel   | dahl Nitrogen By Discrete Analyser (QCLot: 2209188)    |                                      |            |                          |                  |             |          |
| EB1904902-002  | Anonymous  | EK061G: Total Kjeldahl Nitrogen as N |            | 5 mg/L                   | 95.8             | 70          | 130      |
| EK067G: Total Pho  | sphorus as P by Discrete Analyser (QCLot: 2209187)     |                                      |            |                          |                  |             |          |
| EB1904902-002  | Anonymous  | EK067G: Total Phosphorus as P        |            | 1 mg/L                   | 95.9             | 70          | 130      |
| EK071G: Reactive I   | Phosphorus as P by discrete analyser (QCLot: 2208935   |                                      |            |                          |                  |             |          |
| EB1904963-001  | Anonymous  | EK071G: Reactive Phosphorus as P     | 14265-44-2 | 0.4 mg/L                 | 92.7             | 70          | 130      |



| QA/QC Compliance Assessment to assist with Quality Review |                     |                         |                                   |  |  |
|---|---------------------|-------------------------|-----------------------------------|--|--|
| Work Order  | : EB1826458         | Page                    | : 1 of 8                          |  |  |
| Client  | : GOLDER ASSOCIATES | Laboratory              | : Environmental Division Brisbane |  |  |
| Contact   | : MR MITCH McGINNIS | Telephone               | : +61 7 3552 8639                 |  |  |
| Project   | : 1893795           | Date Samples Received   | : 01-Nov-2018                     |  |  |
| Site  | : INLAND RAIL (P12) | Issue Date              | : 06-Nov-2018                     |  |  |
| Sampler   | ROBERT CUPPER       | No. of samples received | : 2                               |  |  |
| Order number  | : 17893795          | No. of samples analysed | : 2                               |  |  |

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

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

## **Summary of Outliers**

### **Outliers : Quality Control Samples**

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

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

### **Outliers : Analysis Holding Time Compliance**

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

### **Outliers : Frequency of Quality Control Samples**

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

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|------------|---------------------|
| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | : 1893795           |



#### **Outliers : Analysis Holding Time Compliance**

| Matrix: WATER                   |               |    |                          |                    |         |               |                  |         |
|---------------------------------|---------------|----|--------------------------|--------------------|---------|---------------|------------------|---------|
| Method                          |               |    | Extraction / Preparation |                    |         | Analysis      |                  |         |
| Container / Client Sample ID(s) |               | Da | Date extracted           | Due for extraction | Days    | Date analysed | Due for analysis | Days    |
|                                 |               |    |                          |                    | overdue |               |                  | overdue |
| EA005P: pH by PC Titrator       |               |    |                          |                    |         |               |                  |         |
| Clear Plastic Bottle - Natural  |               |    |                          |                    |         |               |                  |         |
| 310-01-BH2217,                  | 310-01-BH2201 |    |                          |                    |         | 02-Nov-2018   | 30-Oct-2018      | 3       |

### Analysis Holding Time Compliance

Matrix: WATER

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

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

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

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

Evaluation: \* = Holding time breach ;  $\checkmark$  = Within holding time.

|               |   |   |   |  | · · · · · · · · · · · · · · · · · · ·   |  |   |
|---------------|---|---|---|--|---|--|---|
| Method        |   | Extraction / Preparation  |   | Analysis   |   |  |   |
|               |   | Date extracted  | Due for extraction  | Evaluation   | Date analysed   | Due for analysis   | Evaluation  |
|               |   |   |   |  |   |  |   |
| 310-01-BH2201 | 30-Oct-2018   |   |   |  | 02-Nov-2018   | 30-Oct-2018  | x   |
|               |   |   |   |  |   |  |   |
| 310-01-BH2201 | 30-Oct-2018   |   |   |  | 02-Nov-2018   | 27-Nov-2018  | ~   |
|               |   |   |   |  |   |  |   |
| 310-01-BH2201 | 30-Oct-2018   |   |   |  | 02-Nov-2018   | 06-Nov-2018  | ~   |
|               |   |   |   |  |   |  |   |
| 310-01-BH2201 | 30-Oct-2018   |   |   |  | 02-Nov-2018   | 13-Nov-2018  | ~   |
|               |   |   |   |  |   |  |   |
| 310-01-BH2201 | 30-Oct-2018   |   |   |  | 01-Nov-2018   | 27-Nov-2018  | ~   |
|               |   |   |   |  |   |  |   |
| 310-01-BH2201 | 30-Oct-2018   |   |   |  | 01-Nov-2018   | 27-Nov-2018  | ~   |
|               |   |   |   |  |   |  |   |
| 310-01-BH2201 | 30-Oct-2018   |   |   |  | 02-Nov-2018   | 27-Nov-2018  | ✓   |
|               | 310-01-BH2201<br>310-01-BH2201<br>310-01-BH2201<br>310-01-BH2201<br>310-01-BH2201<br>310-01-BH2201<br>310-01-BH2201 | Sample Date         310-01-BH2201       30-Oct-2018         310-01-BH2201       30-Oct-2018 | Sample Date         Ex           Date extracted         Date extracted           310-01-BH2201         30-Oct-2018            310-01-BH2201         30-Oct-2018 | Sample Date         Extraction / Preparation           Date extracted         Due for extraction           310-01-BH2201         30-Oct-2018            310-01-BH2201         30-Oct-2018 | Sample Date         Extraction / Preparation           Date extracted         Due for extraction         Evaluation           310-01-BH2201         30-Oct-2018             310-01-BH2201         30-Oct-2018 | Sample Date         Extraction / Preparation         Control of the straction of the stractin of the straction of the | Sample Date         Extraction / Preparation         Image of the straction of the stractin of the straction of the st |

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| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | : 1893795           |



| Matrix: WATER   |               |             |                          |                    | Evaluation | uation: × = Holding time breach ; ✓ = Within holding time |                  |            |  |
|---|---------------|-------------|--------------------------|--------------------|------------|---|------------------|------------|--|
| Method  |               | Sample Date | Extraction / Preparation |                    |            | Analysis  |                  |            |  |
| Container / Client Sample ID(s)   |               |             | Date extracted           | Due for extraction | Evaluation | Date analysed   | Due for analysis | Evaluation |  |
| ED093F: SAR and Hardness Calculations                                       |               |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>310-01-BH2217,     | 310-01-BH2201 | 30-Oct-2018 |                          |                    |            | 02-Nov-2018   | 27-Nov-2018      | ✓          |  |
| EG020F: Dissolved Metals by ICP-MS  |               |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)<br>310-01-BH2217,   | 310-01-BH2201 | 30-Oct-2018 |                          |                    |            | 02-Nov-2018   | 28-Apr-2019      | ~          |  |
| EG020T: Total Metals by ICP-MS  |               |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)<br>310-01-BH2217, | 310-01-BH2201 | 30-Oct-2018 | 02-Nov-2018              | 28-Apr-2019        | ~          | 02-Nov-2018   | 28-Apr-2019      | ~          |  |
| EG035F: Dissolved Mercury by FIMS   |               |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)<br>310-01-BH2217,     | 310-01-BH2201 | 30-Oct-2018 |                          |                    |            | 02-Nov-2018   | 27-Nov-2018      | ~          |  |
| EG035T: Total Recoverable Mercury by FIMS                                   |               |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)<br>310-01-BH2217,   | 310-01-BH2201 | 30-Oct-2018 |                          |                    |            | 02-Nov-2018   | 27-Nov-2018      | ~          |  |
| EK040P: Fluoride by PC Titrator   |               |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Natural (EK040P)<br>310-01-BH2217,                   | 310-01-BH2201 | 30-Oct-2018 |                          |                    |            | 02-Nov-2018   | 27-Nov-2018      | ~          |  |
| EK055G: Ammonia as N by Discrete Analyser                                   |               |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Sulfuric Acid (EK055G)<br>310-01-BH2217,             | 310-01-BH2201 | 30-Oct-2018 |                          |                    |            | 01-Nov-2018   | 27-Nov-2018      | ~          |  |
| EK057G: Nitrite as N by Discrete Analyser                                   |               |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Natural (EK057G)<br>310-01-BH2217,                   | 310-01-BH2201 | 30-Oct-2018 |                          |                    |            | 01-Nov-2018   | 01-Nov-2018      | ~          |  |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete An                      | alyser        | -           |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Sulfuric Acid (EK059G)<br>310-01-BH2217,             | 310-01-BH2201 | 30-Oct-2018 |                          |                    |            | 01-Nov-2018   | 27-Nov-2018      | ~          |  |
| EK061G: Total Kjeldahl Nitrogen By Discrete Analyser                        |               |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Sulfuric Acid (EK061G)<br>310-01-BH2217,             | 310-01-BH2201 | 30-Oct-2018 | 01-Nov-2018              | 27-Nov-2018        | ~          | 01-Nov-2018   | 27-Nov-2018      | ~          |  |
| EK067G: Total Phosphorus as P by Discrete Analyser                          |               |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Sulfuric Acid (EK067G)<br>310-01-BH2217,             | 310-01-BH2201 | 30-Oct-2018 | 01-Nov-2018              | 27-Nov-2018        | ~          | 01-Nov-2018   | 27-Nov-2018      | ~          |  |
| EK071G: Reactive Phosphorus as P by discrete analyse                        | er            |             |                          |                    |            |   |                  |            |  |
| Clear Plastic Bottle - Natural (EK071G)<br>310-01-BH2217                    | 310-01-BH2201 | 30-Oct-2018 |                          |                    |            | 01-Nov-2018   | 01-Nov-2018      | 1          |  |



## **Quality Control Parameter Frequency Compliance**

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

| Matrix: WATER Evaluation: * = Quality Control frequency not within specification; $\checkmark$ = Quality Control frequency within specification |          |    |         |        |          |            |                                |
|---|----------|----|---------|--------|----------|------------|--------------------------------|
| Quality Control Sample Type   |          | Сс | ount    |        | Rate (%) |            | Quality Control Specification  |
| Analytical Methods  | Method   | QC | Reaular | Actual | Expected | Evaluation |                                |
| Laboratory Duplicates (DUP)   |          |    |         |        |          |            |                                |
| Alkalinity by PC Titrator   | ED037-P  | 1  | 7       | 14.29  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Ammonia as N by Discrete analyser   | EK055G   | 2  | 16      | 12.50  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser   | ED045G   | 2  | 13      | 15.38  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Conductivity by PC Titrator   | EA010-P  | 1  | 10      | 10.00  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Mercury by FIMS   | EG035F   | 1  | 4       | 25.00  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A  | EG020A-F | 1  | 7       | 14.29  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Fluoride by PC Titrator   | EK040P   | 1  | 7       | 14.29  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved   | ED093F   | 2  | 11      | 18.18  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser   | EK059G   | 2  | 16      | 12.50  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser   | EK057G   | 2  | 13      | 15.38  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| pH by PC Titrator   | EA005-P  | 1  | 10      | 10.00  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Reactive Phosphorus as P-By Discrete Analyser   | EK071G   | 1  | 7       | 14.29  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser  | ED041G   | 2  | 13      | 15.38  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Dissolved Solids (High Level)   | EA015H   | 1  | 7       | 14.29  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser   | EK061G   | 2  | 16      | 12.50  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Mercury by FIMS   | EG035T   | 1  | 10      | 10.00  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Metals by ICP-MS - Suite A  | EG020A-T | 2  | 19      | 10.53  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Phosphorus as P By Discrete Analyser  | EK067G   | 2  | 16      | 12.50  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Laboratory Control Samples (LCS)  |          |    |         |        |          |            |                                |
| Alkalinity by PC Titrator   | ED037-P  | 1  | 7       | 14.29  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Ammonia as N by Discrete analyser   | EK055G   | 1  | 16      | 6.25   | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser   | ED045G   | 2  | 13      | 15.38  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Conductivity by PC Titrator   | EA010-P  | 2  | 10      | 20.00  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Mercury by FIMS   | EG035F   | 1  | 4       | 25.00  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A  | EG020A-F | 1  | 7       | 14.29  | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |
| Fluoride by PC Titrator   | EK040P   | 1  | 7       | 14.29  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser   | EK059G   | 1  | 16      | 6.25   | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser   | EK057G   | 1  | 13      | 7.69   | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| pH by PC Titrator   | EA005-P  | 2  | 10      | 20.00  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Reactive Phosphorus as P-By Discrete Analyser   | EK071G   | 1  | 7       | 14.29  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser  | ED041G   | 2  | 13      | 15.38  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Dissolved Solids (High Level)   | EA015H   | 2  | 7       | 28.57  | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser   | EK061G   | 1  | 16      | 6.25   | 5.00     | ~          | NEPM 2013 B3 & ALS QC Standard |
| Total Mercury by FIMS   | EG035T   | 1  | 10      | 10.00  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Metals by ICP-MS - Suite A  | EG020A-T | 1  | 19      | 5.26   | 5.00     | ~          | NEPM 2013 B3 & ALS QC Standard |
| Total Phosphorus as P By Discrete Analyser  | EK067G   | 1  | 16      | 6.25   | 5.00     | √          | NEPM 2013 B3 & ALS QC Standard |

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|------------|---------------------|
| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | : 1893795           |



| Matrix: WATER  |          |       |         | Evaluatio | n: × = Quality Co | ontrol frequency | not within specification ; $\checkmark$ = Quality Control frequency within specification. |  |
|--|----------|-------|---------|-----------|-------------------|------------------|---|--|
| Quality Control Sample Type                            |          | Count |         | Rate (%)  |                   |                  | Quality Control Specification   |  |
| Analytical Methods                                     | Method   | QC    | Reaular | Actual    | Expected          | Evaluation       |   |  |
| Method Blanks (MB)                                     |          |       |         |           |                   |                  |   |  |
| Ammonia as N by Discrete analyser                      | EK055G   | 1     | 16      | 6.25      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Chloride by Discrete Analyser                          | ED045G   | 1     | 13      | 7.69      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Conductivity by PC Titrator                            | EA010-P  | 1     | 10      | 10.00     | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Dissolved Mercury by FIMS                              | EG035F   | 1     | 4       | 25.00     | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1     | 7       | 14.29     | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Fluoride by PC Titrator                                | EK040P   | 1     | 7       | 14.29     | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Major Cations - Dissolved                              | ED093F   | 1     | 11      | 9.09      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1     | 16      | 6.25      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1     | 13      | 7.69      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1     | 7       | 14.29     | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 1     | 13      | 7.69      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Total Dissolved Solids (High Level)                    | EA015H   | 1     | 7       | 14.29     | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1     | 16      | 6.25      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Total Mercury by FIMS                                  | EG035T   | 1     | 10      | 10.00     | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1     | 19      | 5.26      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1     | 16      | 6.25      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Matrix Spikes (MS)                                     |          |       |         |           |                   |                  |   |  |
| Ammonia as N by Discrete analyser                      | EK055G   | 1     | 16      | 6.25      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Chloride by Discrete Analyser                          | ED045G   | 1     | 13      | 7.69      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Dissolved Mercury by FIMS                              | EG035F   | 1     | 4       | 25.00     | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1     | 7       | 14.29     | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Fluoride by PC Titrator                                | EK040P   | 1     | 7       | 14.29     | 5.00              | 1                | NEPM 2013 B3 & ALS QC Standard  |  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1     | 16      | 6.25      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1     | 13      | 7.69      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1     | 7       | 14.29     | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 1     | 13      | 7.69      | 5.00              | ✓                | NEPM 2013 B3 & ALS QC Standard  |  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1     | 16      | 6.25      | 5.00              | ~                | NEPM 2013 B3 & ALS QC Standard  |  |
| Total Mercury by FIMS                                  | EG035T   | 1     | 10      | 10.00     | 5.00              | ~                | NEPM 2013 B3 & ALS QC Standard  |  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1     | 19      | 5.26      | 5.00              | ~                | NEPM 2013 B3 & ALS QC Standard  |  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1     | 16      | 6 25      | 5.00              | 1                | NEPM 2013 B3 & ALS QC Standard  |  |



## **Brief Method Summaries**

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

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



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

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|------------|---------------------|
| Work Order | : EB1826458         |
| Client     | : GOLDER ASSOCIATES |
| Project    | : 1893795           |



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



| QA/QC Compliance Assessment to assist with Quality Review |                           |                         |                                   |  |  |
|---|---------------------------|-------------------------|-----------------------------------|--|--|
| Work Order  | : EB1828548               | Page                    | : 1 of 9                          |  |  |
| Client  |                           | Laboratory              | : Environmental Division Brisbane |  |  |
| Contact   | : MR MITCH McGINNIS       | Telephone               | : +61 7 3552 8639                 |  |  |
| Project   | : 1893795 INLAND RAIL P12 | Date Samples Received   | : 22-Nov-2018                     |  |  |
| Site  | :                         | Issue Date              | : 26-Nov-2018                     |  |  |
| Sampler   | : SUSANTHA KUMARAPELI     | No. of samples received | : 1                               |  |  |
| Order number  | :                         | No. of samples analysed | : 1                               |  |  |

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

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

## **Summary of Outliers**

### **Outliers : Quality Control Samples**

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

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

#### **Outliers : Analysis Holding Time Compliance**

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

### **Outliers : Frequency of Quality Control Samples**

• Quality Control Sample Frequency Outliers exist - please see following pages for full details.



#### **Outliers : Quality Control Samples**

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

#### Matrix: WATER

| Compound Group Name                             | Laboratory Sample ID | Client Sample ID | Analyte          | CAS Number | r Data | Limits | Comment                          |
|---|----------------------|------------------|------------------|------------|--------|--------|----------------------------------|
| Matrix Spike (MS) Recoveries                    |                      |                  |                  |            |        |        |                                  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA | EB1828101001         | Anonymous        | Sulfate as SO4 - | 14808-79-8 | Not    |        | MS recovery not determined,      |
|   |                      |                  | Turbidimetric    |            |        |        | background level greater than or |
|   |                      |                  |                  |            |        |        | equal to 4x spike level.         |

#### **Outliers : Frequency of Quality Control Samples**

#### Matrix: WATER

Motrix: WATED

| Quality Control Sample Type                   | Count Rate (%) |         | e (%)  | Quality Control Specification |                                |
|---|----------------|---------|--------|-------------------------------|--------------------------------|
| Method  | QC             | Regular | Actual | Expected                      |                                |
| Matrix Spikes (MS)                            |                |         |        |                               |                                |
| Nitrite as N by Discrete Analyser             | 0              | 1       | 0.00   | 5.00                          | NEPM 2013 B3 & ALS QC Standard |
| Reactive Phosphorus as P-By Discrete Analyser | 0              | 1       | 0.00   | 5.00                          | NEPM 2013 B3 & ALS QC Standard |

## Analysis Holding Time Compliance

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

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

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

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

Evaluation: \* = Holding time breach ;  $\checkmark$  = Within holding time.

|   |             |                |                        | Evaluation | . Holding allo | broadin, what    | in noraling arrie. |
|---|-------------|----------------|------------------------|------------|----------------|------------------|--------------------|
| Method  | Sample Date | Ex             | traction / Preparation |            |                | Analysis         |                    |
| Container / Client Sample ID(s)                           |             | Date extracted | Due for extraction     | Evaluation | Date analysed  | Due for analysis | Evaluation         |
| EA005P: pH by PC Titrator                                 |             |                |                        |            |                |                  |                    |
| Clear Plastic Bottle - Natural (EA005-P)<br>320-01-BH2218 | 22-Nov-2018 |                |                        |            | 22-Nov-2018    | 22-Nov-2018      | ✓                  |
| EA010P: Conductivity by PC Titrator                       |             |                |                        |            |                |                  |                    |
| Clear Plastic Bottle - Natural (EA010-P)<br>320-01-BH2218 | 22-Nov-2018 |                |                        |            | 22-Nov-2018    | 20-Dec-2018      | ~                  |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C         |             |                |                        |            |                |                  |                    |
| Clear Plastic Bottle - Natural (EA015H)<br>320-01-BH2218  | 22-Nov-2018 |                |                        |            | 22-Nov-2018    | 29-Nov-2018      | ~                  |
| ED037P: Alkalinity by PC Titrator                         |             |                |                        |            |                |                  |                    |
| Clear Plastic Bottle - Natural (ED037-P)<br>320-01-BH2218 | 22-Nov-2018 |                |                        |            | 22-Nov-2018    | 06-Dec-2018      | ✓                  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA           |             |                |                        |            |                |                  |                    |
| Clear Plastic Bottle - Natural (ED041G)<br>320-01-BH2218  | 22-Nov-2018 |                |                        |            | 22-Nov-2018    | 20-Dec-2018      | ~                  |

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|------------|---------------------------|
| Work Order | : EB1828548               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



| Matrix: WATER  |             | Evaluation: $\times$ = Holding time breach ; $\checkmark$ = Within holding time. |                          |            |               |                  |            |  |  |
|--|-------------|--|--------------------------|------------|---------------|------------------|------------|--|--|
| Method   | Sample Date | Ex   | Extraction / Preparation |            |               | Analysis         |            |  |  |
| Container / Client Sample ID(s)  |             | Date extracted   | Due for extraction       | Evaluation | Date analysed | Due for analysis | Evaluation |  |  |
| ED045G: Chloride by Discrete Analyser                                      |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Natural (ED045G)<br>320-01-BH2218                   | 22-Nov-2018 |  |                          |            | 22-Nov-2018   | 20-Dec-2018      | ~          |  |  |
| ED093F: Dissolved Major Cations  |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>320-01-BH2218     | 22-Nov-2018 |  |                          |            | 23-Nov-2018   | 20-Dec-2018      | ~          |  |  |
| ED093F: SAR and Hardness Calculations                                      |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>320-01-BH2218     | 22-Nov-2018 |  |                          |            | 23-Nov-2018   | 20-Dec-2018      | ~          |  |  |
| EG020F: Dissolved Metals by ICP-MS   |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)<br>320-01-BH2218   | 22-Nov-2018 |  |                          |            | 23-Nov-2018   | 21-May-2019      | ~          |  |  |
| EG020T: Total Metals by ICP-MS   |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)<br>320-01-BH2218 | 22-Nov-2018 | 23-Nov-2018  | 21-May-2019              | 1          | 23-Nov-2018   | 21-May-2019      | ~          |  |  |
| EG035F: Dissolved Mercury by FIMS  |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)<br>320-01-BH2218     | 22-Nov-2018 |  |                          |            | 23-Nov-2018   | 20-Dec-2018      | ~          |  |  |
| EG035T: Total Recoverable Mercury by FIMS                                  |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)<br>320-01-BH2218   | 22-Nov-2018 |  |                          |            | 23-Nov-2018   | 20-Dec-2018      | ~          |  |  |
| EK040P: Fluoride by PC Titrator  |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Natural (EK040P)<br>320-01-BH2218                   | 22-Nov-2018 |  |                          |            | 22-Nov-2018   | 20-Dec-2018      | ~          |  |  |
| EK055G: Ammonia as N by Discrete Analyser                                  |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Sulfuric Acid (EK055G)<br>320-01-BH2218             | 22-Nov-2018 |  |                          |            | 22-Nov-2018   | 20-Dec-2018      | ~          |  |  |
| EK057G: Nitrite as N by Discrete Analyser                                  |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Natural (EK057G)<br>320-01-BH2218                   | 22-Nov-2018 |  |                          |            | 22-Nov-2018   | 24-Nov-2018      | ~          |  |  |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser               |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Sulfuric Acid (EK059G)<br>320-01-BH2218             | 22-Nov-2018 |  |                          |            | 22-Nov-2018   | 20-Dec-2018      | ~          |  |  |
| EK061G: Total Kjeldahl Nitrogen By Discrete Analyser                       |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Sulfuric Acid (EK061G)<br>320-01-BH2218             | 22-Nov-2018 | 23-Nov-2018  | 20-Dec-2018              | ~          | 23-Nov-2018   | 20-Dec-2018      | ✓          |  |  |
| EK067G: Total Phosphorus as P by Discrete Analyser                         |             |  |                          |            |               |                  |            |  |  |
| Clear Plastic Bottle - Sulfuric Acid (EK067G)<br>320-01-BH2218             | 22-Nov-2018 | 23-Nov-2018  | 20-Dec-2018              | 1          | 23-Nov-2018   | 20-Dec-2018      | 1          |  |  |

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| Work Order | EB1828548               |
| Client     | GOLDER ASSOCIATES       |
| Project    | 1893795 INLAND RAIL P12 |



| -<br>Matrix: WATER Evaluation: ★ = Holding time breach ; ✓ = Within holding time |             |                          |                    |            |               |                  |            |
|--|-------------|--------------------------|--------------------|------------|---------------|------------------|------------|
| Method   | Sample Date | Extraction / Preparation |                    |            | Analysis      |                  |            |
| Container / Client Sample ID(s)  |             | Date extracted           | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| EK071G: Reactive Phosphorus as P by discrete analyser                            |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EK071G)  |             |                          |                    |            |               |                  |            |
| 320-01-BH2218  | 22-Nov-2018 |                          |                    |            | 22-Nov-2018   | 24-Nov-2018      |            |



# **Quality Control Parameter Frequency Compliance**

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

| Matrix: WATER  |          |    |         | Evaluatio | n: × = Quality Co | ntrol frequency i | not within specification ; $\checkmark$ = Quality Control frequency within specification. |
|--|----------|----|---------|-----------|-------------------|-------------------|---|
| Quality Control Sample Type                            |          | Co | ount    |           | Rate (%)          |                   | Quality Control Specification   |
| Analytical Methods                                     | Method   | QC | Reaular | Actual    | Expected          | Evaluation        |   |
| Laboratory Duplicates (DUP)                            |          |    |         |           |                   |                   |   |
| Alkalinity by PC Titrator                              | ED037-P  | 2  | 18      | 11.11     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Ammonia as N by Discrete analyser                      | EK055G   | 1  | 3       | 33.33     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Chloride by Discrete Analyser                          | ED045G   | 2  | 20      | 10.00     | 10.00             | $\checkmark$      | NEPM 2013 B3 & ALS QC Standard  |
| Conductivity by PC Titrator                            | EA010-P  | 2  | 14      | 14.29     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Mercury by FIMS                              | EG035F   | 1  | 2       | 50.00     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1  | 2       | 50.00     | 10.00             | $\checkmark$      | NEPM 2013 B3 & ALS QC Standard  |
| Fluoride by PC Titrator                                | EK040P   | 2  | 13      | 15.38     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Major Cations - Dissolved                              | ED093F   | 1  | 7       | 14.29     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1  | 3       | 33.33     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1  | 1       | 100.00    | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| pH by PC Titrator                                      | EA005-P  | 2  | 18      | 11.11     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1  | 1       | 100.00    | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 2  | 20      | 10.00     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Dissolved Solids (High Level)                    | EA015H   | 1  | 8       | 12.50     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 2  | 18      | 11.11     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Mercury by FIMS                                  | EG035T   | 1  | 7       | 14.29     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1  | 7       | 14.29     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 2  | 19      | 10.53     | 10.00             | $\checkmark$      | NEPM 2013 B3 & ALS QC Standard  |
| Laboratory Control Samples (LCS)                       |          |    |         |           |                   |                   |   |
| Alkalinity by PC Titrator                              | ED037-P  | 1  | 18      | 5.56      | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Ammonia as N by Discrete analyser                      | EK055G   | 1  | 3       | 33.33     | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Chloride by Discrete Analyser                          | ED045G   | 2  | 20      | 10.00     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Conductivity by PC Titrator                            | EA010-P  | 2  | 14      | 14.29     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Mercury by FIMS                              | EG035F   | 1  | 2       | 50.00     | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1  | 2       | 50.00     | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Fluoride by PC Titrator                                | EK040P   | 1  | 13      | 7.69      | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1  | 3       | 33.33     | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1  | 1       | 100.00    | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| pH by PC Titrator                                      | EA005-P  | 2  | 18      | 11.11     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1  | 1       | 100.00    | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 2  | 20      | 10.00     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Dissolved Solids (High Level)                    | EA015H   | 2  | 8       | 25.00     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1  | 18      | 5.56      | 5.00              | ~                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Mercury by FIMS                                  | EG035T   | 1  | 7       | 14.29     | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1  | 7       | 14.29     | 5.00              | ~                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1  | 19      | 5.26      | 5.00              | √                 | NEPM 2013 B3 & ALS QC Standard  |

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|------------|-------------------------|
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| Matrix: WATER  |          | Evaluation: * = Quality Control frequency not within specification; ✓ = Quality Control frequency within specification. |         |        |          |            |                                |  |
|--|----------|---|---------|--------|----------|------------|--------------------------------|--|
| Quality Control Sample Type                            |          | Сс  | ount    |        | Rate (%) | -          | Quality Control Specification  |  |
| Analytical Methods                                     | Method   | QC  | Reaular | Actual | Expected | Evaluation |                                |  |
| Method Blanks (MB)                                     |          |   |         |        |          |            |                                |  |
| Ammonia as N by Discrete analyser                      | EK055G   | 1   | 3       | 33.33  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Chloride by Discrete Analyser                          | ED045G   | 1   | 20      | 5.00   | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Conductivity by PC Titrator                            | EA010-P  | 1   | 14      | 7.14   | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Dissolved Mercury by FIMS                              | EG035F   | 1   | 2       | 50.00  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1   | 2       | 50.00  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Fluoride by PC Titrator                                | EK040P   | 1   | 13      | 7.69   | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Major Cations - Dissolved                              | ED093F   | 1   | 7       | 14.29  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1   | 3       | 33.33  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1   | 1       | 100.00 | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1   | 1       | 100.00 | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 1   | 20      | 5.00   | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Dissolved Solids (High Level)                    | EA015H   | 1   | 8       | 12.50  | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1   | 18      | 5.56   | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Mercury by FIMS                                  | EG035T   | 1   | 7       | 14.29  | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1   | 7       | 14.29  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1   | 19      | 5.26   | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Matrix Spikes (MS)                                     |          |   |         |        |          |            |                                |  |
| Ammonia as N by Discrete analyser                      | EK055G   | 1   | 3       | 33.33  | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Chloride by Discrete Analyser                          | ED045G   | 1   | 20      | 5.00   | 5.00     | ~          | NEPM 2013 B3 & ALS QC Standard |  |
| Dissolved Mercury by FIMS                              | EG035F   | 1   | 2       | 50.00  | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1   | 2       | 50.00  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Fluoride by PC Titrator                                | EK040P   | 1   | 13      | 7.69   | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1   | 3       | 33.33  | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 0   | 1       | 0.00   | 5.00     | x          | NEPM 2013 B3 & ALS QC Standard |  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 0   | 1       | 0.00   | 5.00     | 22         | NEPM 2013 B3 & ALS QC Standard |  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 1   | 20      | 5.00   | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1   | 18      | 5.56   | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Mercury by FIMS                                  | EG035T   | 1   | 7       | 14.29  | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1   | 7       | 14.29  | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1   | 19      | 5 26   | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |



## **Brief Method Summaries**

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

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

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| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



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

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



|              | QA/QC Compliance Assessment to assist with Quality Review |                         |                                   |  |  |  |  |  |
|--------------|---|-------------------------|-----------------------------------|--|--|--|--|--|
| Nork Order   | EB1830099   | Page                    | : 1 of 8                          |  |  |  |  |  |
| Client       | : GOLDER ASSOCIATES                                       | Laboratory              | : Environmental Division Brisbane |  |  |  |  |  |
| Contact      | : MR SUSANTHA KUMARAPELI                                  | Telephone               | : +61 7 3552 8639                 |  |  |  |  |  |
| Project      | : 1893795 INLAND RAIL P12                                 | Date Samples Received   | : 07-Dec-2018                     |  |  |  |  |  |
| Site         | :   | Issue Date              | : 12-Dec-2018                     |  |  |  |  |  |
| Sampler      | : HANNAH GROVES   | No. of samples received | : 1                               |  |  |  |  |  |
| Order number | :   | No. of samples analysed | : 1                               |  |  |  |  |  |
|              |   |                         |                                   |  |  |  |  |  |

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

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

## **Summary of Outliers**

### **Outliers : Quality Control Samples**

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

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

### **Outliers : Analysis Holding Time Compliance**

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

### **Outliers : Frequency of Quality Control Samples**

• Quality Control Sample Frequency Outliers exist - please see following pages for full details.



#### **Outliers : Analysis Holding Time Compliance**

Matrix: WATER

| Method                          | Ex             | traction / Preparation |         |               | Analysis         |         |
|---------------------------------|----------------|------------------------|---------|---------------|------------------|---------|
| Container / Client Sample ID(s) | Date extracted | Due for extraction     | Days    | Date analysed | Due for analysis | Days    |
|                                 |                |                        | overdue |               |                  | overdue |
| EA005P: pH by PC Titrator       |                |                        |         |               |                  |         |
| Clear Plastic Bottle - Natural  |                |                        |         |               |                  |         |
| 320-01-BH2301                   |                |                        |         | 10-Dec-2018   | 08-Dec-2018      | 2       |

#### **Outliers : Frequency of Quality Control Samples**

#### Matrix: WATER

| Quality Control Sample Type                         | Count |         | Rate   | : (%)    | Quality Control Specification  |
|---|-------|---------|--------|----------|--------------------------------|
| Method  | QC    | Regular | Actual | Expected |                                |
| Matrix Spikes (MS)                                  |       |         |        |          |                                |
| Ammonia as N by Discrete analyser                   | 0     | 1       | 0.00   | 5.00     | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A                | 0     | 1       | 0.00   | 5.00     | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | 0     | 1       | 0.00   | 5.00     | NEPM 2013 B3 & ALS QC Standard |

## Analysis Holding Time Compliance

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

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

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

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

| Matrix: WATER   |                   |                |                    | Evaluation | i: × = Holding time | breach ; ✓ = With | in holding time |
|---|-------------------|----------------|--------------------|------------|---------------------|-------------------|-----------------|
| Method  | Sample Date Extra |                |                    |            |                     |                   |                 |
| Container / Client Sample ID(s)                           |                   | Date extracted | Due for extraction | Evaluation | Date analysed       | Due for analysis  | Evaluation      |
| EA005P: pH by PC Titrator                                 |                   |                |                    |            |                     |                   |                 |
| Clear Plastic Bottle - Natural (EA005-P)<br>320-01-BH2301 | 07-Dec-2018       |                |                    |            | 10-Dec-2018         | 08-Dec-2018       | ×               |
| EA010P: Conductivity by PC Titrator                       |                   |                |                    |            |                     |                   |                 |
| Clear Plastic Bottle - Natural (EA010-P)<br>320-01-BH2301 | 07-Dec-2018       |                |                    |            | 10-Dec-2018         | 04-Jan-2019       | ✓               |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C         |                   |                |                    |            |                     |                   |                 |
| Clear Plastic Bottle - Natural (EA015H)<br>320-01-BH2301  | 07-Dec-2018       |                |                    |            | 08-Dec-2018         | 14-Dec-2018       | ~               |
| ED037P: Alkalinity by PC Titrator                         |                   |                |                    |            |                     |                   |                 |
| Clear Plastic Bottle - Natural (ED037-P)<br>320-01-BH2301 | 07-Dec-2018       |                |                    |            | 10-Dec-2018         | 21-Dec-2018       | ✓               |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA           |                   |                |                    |            |                     |                   |                 |
| Clear Plastic Bottle - Natural (ED041G)<br>320-01-BH2301  | 07-Dec-2018       |                |                    |            | 08-Dec-2018         | 04-Jan-2019       | $\checkmark$    |



| Matrix: WATER  |             |                |                        | Evaluation | n: × = Holding time | breach ; ✓ = Withi | in holding time | ۶. |
|--|-------------|----------------|------------------------|------------|---------------------|--------------------|-----------------|----|
| Method   | Sample Date | Ex             | traction / Preparation |            | Analysis            |                    |                 |    |
| Container / Client Sample ID(s)  |             | Date extracted | Due for extraction     | Evaluation | Date analysed       | Due for analysis   | Evaluation      |    |
| ED045G: Chloride by Discrete Analyser                                      |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Natural (ED045G)<br>320-01-BH2301                   | 07-Dec-2018 |                |                        |            | 08-Dec-2018         | 04-Jan-2019        | $\checkmark$    |    |
| ED093F: Dissolved Major Cations  |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>320-01-BH2301     | 07-Dec-2018 |                |                        |            | 10-Dec-2018         | 04-Jan-2019        | ✓               |    |
| ED093F: SAR and Hardness Calculations                                      |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>320-01-BH2301     | 07-Dec-2018 |                |                        |            | 10-Dec-2018         | 04-Jan-2019        | 1               |    |
| EG020F: Dissolved Metals by ICP-MS   |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)<br>320-01-BH2301   | 07-Dec-2018 |                |                        |            | 10-Dec-2018         | 05-Jun-2019        | ✓               |    |
| EG020T: Total Metals by ICP-MS   |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)<br>320-01-BH2301 | 07-Dec-2018 | 10-Dec-2018    | 05-Jun-2019            | 1          | 10-Dec-2018         | 05-Jun-2019        | 1               |    |
| EG035F: Dissolved Mercury by FIMS  |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)<br>320-01-BH2301     | 07-Dec-2018 |                |                        |            | 10-Dec-2018         | 04-Jan-2019        | ~               |    |
| EG035T: Total Recoverable Mercury by FIMS                                  |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)<br>320-01-BH2301   | 07-Dec-2018 |                |                        |            | 10-Dec-2018         | 04-Jan-2019        | ✓               |    |
| EK055G: Ammonia as N by Discrete Analyser                                  |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Sulfuric Acid (EK055G)<br>320-01-BH2301             | 07-Dec-2018 |                |                        |            | 11-Dec-2018         | 04-Jan-2019        | ~               |    |
| EK057G: Nitrite as N by Discrete Analyser                                  |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Natural (EK057G)<br>320-01-BH2301                   | 07-Dec-2018 |                |                        |            | 08-Dec-2018         | 09-Dec-2018        | 1               |    |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser               |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Sulfuric Acid (EK059G)<br>320-01-BH2301             | 07-Dec-2018 |                |                        |            | 11-Dec-2018         | 04-Jan-2019        | ~               |    |
| EK061G: Total Kjeldahl Nitrogen By Discrete Analyser                       |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Sulfuric Acid (EK061G)<br>320-01-BH2301             | 07-Dec-2018 | 10-Dec-2018    | 04-Jan-2019            | 1          | 10-Dec-2018         | 04-Jan-2019        | ✓               |    |
| EK067G: Total Phosphorus as P by Discrete Analyser                         |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Sulfuric Acid (EK067G)<br>320-01-BH2301             | 07-Dec-2018 | 10-Dec-2018    | 04-Jan-2019            | 1          | 10-Dec-2018         | 04-Jan-2019        | 1               |    |
| EK071G: Reactive Phosphorus as P by discrete analyser                      |             |                |                        |            |                     |                    |                 |    |
| Clear Plastic Bottle - Natural (EK071G)<br>320-01-BH2301                   | 07-Dec-2018 |                |                        |            | 08-Dec-2018         | 09-Dec-2018        | 1               | 1  |



# **Quality Control Parameter Frequency Compliance**

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

| Matrix: WATER  |          |    |         | Evaluation | n: × = Quality Co | ntrol frequency r | not within specification ; $\checkmark$ = Quality Control frequency within specification. |
|--|----------|----|---------|------------|-------------------|-------------------|---|
| Quality Control Sample Type                            |          | С  | ount    | Rate (%)   |                   |                   | Quality Control Specification   |
| Analytical Methods                                     | Method   | QC | Reaular | Actual     | Expected          | Evaluation        |   |
| Laboratory Duplicates (DUP)                            |          |    |         |            |                   |                   |   |
| Alkalinity by PC Titrator                              | ED037-P  | 1  | 3       | 33.33      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Ammonia as N by Discrete analyser                      | EK055G   | 1  | 1       | 100.00     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Chloride by Discrete Analyser                          | ED045G   | 2  | 15      | 13.33      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Conductivity by PC Titrator                            | EA010-P  | 1  | 8       | 12.50      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Mercury by FIMS                              | EG035F   | 2  | 16      | 12.50      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1  | 1       | 100.00     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Major Cations - Dissolved                              | ED093F   | 2  | 11      | 18.18      | 10.00             | $\checkmark$      | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1  | 1       | 100.00     | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 2  | 15      | 13.33      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| pH by PC Titrator                                      | EA005-P  | 1  | 8       | 12.50      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1  | 6       | 16.67      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 2  | 15      | 13.33      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Dissolved Solids (High Level)                    | EA015H   | 1  | 6       | 16.67      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 2  | 13      | 15.38      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Mercury by FIMS                                  | EG035T   | 1  | 3       | 33.33      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 2  | 11      | 18.18      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 2  | 18      | 11.11      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Laboratory Control Samples (LCS)                       |          |    |         |            |                   |                   |   |
| Alkalinity by PC Titrator                              | ED037-P  | 1  | 3       | 33.33      | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Ammonia as N by Discrete analyser                      | EK055G   | 1  | 1       | 100.00     | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Chloride by Discrete Analyser                          | ED045G   | 2  | 15      | 13.33      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Conductivity by PC Titrator                            | EA010-P  | 2  | 8       | 25.00      | 10.00             | 1                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Mercury by FIMS                              | EG035F   | 1  | 16      | 6.25       | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1  | 1       | 100.00     | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1  | 1       | 100.00     | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1  | 15      | 6.67       | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| pH by PC Titrator                                      | EA005-P  | 2  | 8       | 25.00      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1  | 6       | 16.67      | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 2  | 15      | 13.33      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Dissolved Solids (High Level)                    | EA015H   | 2  | 6       | 33.33      | 10.00             | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1  | 13      | 7.69       | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Mercury by FIMS                                  | EG035T   | 1  | 3       | 33.33      | 5.00              | ~                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1  | 11      | 9.09       | 5.00              | ~                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1  | 18      | 5.56       | 5.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Method Blanks (MB)                                     |          |    |         |            |                   |                   |   |
| Ammonia as N by Discrete analyser                      | EK055G   | 1  | 1       | 100.00     | 5.00              | 1                 | NEPM 2013 B3 & ALS QC Standard  |

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|------------|---------------------------|
| Work Order | EB1830099                 |
| Client     | GOLDER ASSOCIATES         |
| Project    | : 1893795 INLAND RAIL P12 |



| Matrix: WATER  |          |                |         | Evaluatio | on: × = Quality Co | ontrol frequency              | not within specification ; ✓ = Quality Control frequency within specification. |
|--|----------|----------------|---------|-----------|--------------------|-------------------------------|--|
| Quality Control Sample Type                            |          | Count Rate (%) |         |           |                    | Quality Control Specification |  |
| Analytical Methods                                     | Method   | QC             | Reaular | Actual    | Expected           | Evaluation                    |  |
| Method Blanks (MB) - Continued                         |          |                |         |           |                    |                               |  |
| Chloride by Discrete Analyser                          | ED045G   | 1              | 15      | 6.67      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Conductivity by PC Titrator                            | EA010-P  | 1              | 8       | 12.50     | 5.00               | ~                             | NEPM 2013 B3 & ALS QC Standard   |
| Dissolved Mercury by FIMS                              | EG035F   | 1              | 16      | 6.25      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1              | 1       | 100.00    | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Major Cations - Dissolved                              | ED093F   | 1              | 11      | 9.09      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1              | 1       | 100.00    | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1              | 15      | 6.67      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1              | 6       | 16.67     | 5.00               | ~                             | NEPM 2013 B3 & ALS QC Standard   |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 1              | 15      | 6.67      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Total Dissolved Solids (High Level)                    | EA015H   | 1              | 6       | 16.67     | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1              | 13      | 7.69      | 5.00               | 1                             | NEPM 2013 B3 & ALS QC Standard   |
| Total Mercury by FIMS                                  | EG035T   | 1              | 3       | 33.33     | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1              | 11      | 9.09      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1              | 18      | 5.56      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Matrix Spikes (MS)                                     |          |                |         |           |                    |                               |  |
| Ammonia as N by Discrete analyser                      | EK055G   | 0              | 1       | 0.00      | 5.00               | <u>sc</u>                     | NEPM 2013 B3 & ALS QC Standard   |
| Chloride by Discrete Analyser                          | ED045G   | 1              | 15      | 6.67      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Dissolved Mercury by FIMS                              | EG035F   | 1              | 16      | 6.25      | 5.00               | ~                             | NEPM 2013 B3 & ALS QC Standard   |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 0              | 1       | 0.00      | 5.00               | 32                            | NEPM 2013 B3 & ALS QC Standard   |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 0              | 1       | 0.00      | 5.00               | x                             | NEPM 2013 B3 & ALS QC Standard   |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1              | 15      | 6.67      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1              | 6       | 16.67     | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 1              | 15      | 6.67      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1              | 13      | 7.69      | 5.00               | 1                             | NEPM 2013 B3 & ALS QC Standard   |
| Total Mercury by FIMS                                  | EG035T   | 1              | 3       | 33.33     | 5.00               | 1                             | NEPM 2013 B3 & ALS QC Standard   |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1              | 11      | 9.09      | 5.00               | ✓                             | NEPM 2013 B3 & ALS QC Standard   |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1              | 18      | 5 56      | 5.00               | 1                             | NEPM 2013 B3 & ALS QC Standard   |



## **Brief Method Summaries**

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

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



| Analytical Methods                                      | Method      | Matrix | Method Descriptions   |
|---|-------------|--------|---|
| Dissolved Mercury by FIMS                               | EG035F      | WATER  | In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS)<br>Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique.<br>A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic<br>mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell.<br>Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM<br>(2013) Schedule B(3) |
| Total Mercury by FIMS                                   | EG035T      | WATER  | In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS)<br>FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise<br>any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic<br>mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing<br>absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)   |
| Ammonia as N by Discrete analyser                       | EK055G      | WATER  | In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser.<br>This method is compliant with NEPM (2013) Schedule B(3)  |
| Nitrite as N by Discrete Analyser                       | EK057G      | WATER  | In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)  |
| Nitrate as N by Discrete Analyser                       | EK058G      | WATER  | In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)  |
| Nitrite and Nitrate as N (NOx) by Discrete<br>Analyser  | EK059G      | WATER  | In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)  |
| Total Kjeldahl Nitrogen as N By Discrete<br>Analyser    | EK061G      | WATER  | In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)   |
| Total Nitrogen as N (TKN + Nox) By<br>Discrete Analyser | EK062G      | WATER  | In house: Referenced to APHA 4500-Norg / 4500-NO3 This method is compliant with NEPM (2013) Schedule B(3)   |
| Total Phosphorus as P By Discrete<br>Analyser           | EK067G      | WATER  | In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)  |
| Reactive Phosphorus as P-By Discrete<br>Analyser        | EK071G      | WATER  | In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)   |
| lonic Balance by PCT DA and Turbi SO4<br>DA             | EN055 - PG  | WATER  | In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)   |
| Preparation Methods                                     | Method      | Matrix | Method Descriptions   |
| TKN/TP Digestion  | EK061/EK067 | WATER  | In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)  |

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|------------|---------------------------|
| Work Order | : EB1830099               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 INLAND RAIL P12 |



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


| Work OrderEB1903588Page: 1 of 9Client: GOLDER ASSOCIATESLaboratory: Environmental Division BrisbaneContact: MR MITCH McGINNISTelephone: +61 7 3552 8639Project: 1893795 Inland Rail (Pkg 12)Date Samples Received: 13-Feb-2019Site:Issue Date: 20-Feb-2019Sampler: ROBERT CUPPERNo. of samples received: 1          | QA/QC Compliance Assessment to assist with Quality Review |                                |                         |                                   |  |  |  |  |
|---|---|--------------------------------|-------------------------|-----------------------------------|--|--|--|--|
| Client: GOLDER ASSOCIATESLaboratory: Environmental Division BrisbaneContact: MR MITCH McGINNISTelephone: +61 7 3552 8639Project: 1893795 Inland Rail (Pkg 12)Date Samples Received: 13-Feb-2019Site:Issue Date: 20-Feb-2019Sampler: ROBERT CUPPERNo. of samples received: 1Order number: No. of samples analysed: 1 | Nork Order  | : EB1903588                    | Page                    | : 1 of 9                          |  |  |  |  |
| Contact: MR MITCH McGINNISTelephone: +61 7 3552 8639Project: 1893795 Inland Rail (Pkg 12)Date Samples Received: 13-Feb-2019Site:Issue Date: 20-Feb-2019Sampler: ROBERT CUPPERNo. of samples received: 1Order number:No. of samples analysed: 1  | Client  |                                | Laboratory              | : Environmental Division Brisbane |  |  |  |  |
| Project       : 1893795 Inland Rail (Pkg 12)       Date Samples Received       : 13-Feb-2019         Site       :       Issue Date       : 20-Feb-2019         Sampler       : ROBERT CUPPER       No. of samples received       : 1         Order number        No. of samples analysed       : 1                  | Contact   | : MR MITCH McGINNIS            | Telephone               | : +61 7 3552 8639                 |  |  |  |  |
| Site     Issue Date     : 20-Feb-2019       Sampler     : ROBERT CUPPER     No. of samples received     : 1       Order number     No. of samples analysed     : 1  | Project   | : 1893795 Inland Rail (Pkg 12) | Date Samples Received   | : 13-Feb-2019                     |  |  |  |  |
| Sampler     : ROBERT CUPPER     No. of samples received     : 1       Order number     No. of samples analysed     : 1  | Site  | :                              | Issue Date              | : 20-Feb-2019                     |  |  |  |  |
| Order number No. of samples analysed 1  | Sampler   | : ROBERT CUPPER                | No. of samples received | : 1                               |  |  |  |  |
|   | Order number  | :                              | No. of samples analysed | : 1                               |  |  |  |  |

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

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

#### **Summary of Outliers**

#### **Outliers : Quality Control Samples**

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

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

#### **Outliers : Analysis Holding Time Compliance**

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

#### **Outliers : Frequency of Quality Control Samples**

• Quality Control Sample Frequency Outliers exist - please see following pages for full details.



#### **Outliers : Quality Control Samples**

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

#### Matrix: WATER

| Compound Group Name                | Laboratory Sample ID | Client Sample ID | Analyte   | CAS Number | Data       | Limits | Comment                          |
|------------------------------------|----------------------|------------------|-----------|------------|------------|--------|----------------------------------|
| Matrix Spike (MS) Recoveries       |                      |                  |           |            |            |        |                                  |
| EG020F: Dissolved Metals by ICP-MS | EB1903584006         | Anonymous        | Lead      | 7439-92-1  | Not        |        | MS recovery not determined,      |
|                                    |                      |                  |           |            | Determined |        | background level greater than or |
|                                    |                      |                  |           |            |            |        | equal to 4x spike level.         |
| EG020F: Dissolved Metals by ICP-MS | EB1903584006         | Anonymous        | Manganese | 7439-96-5  | Not        |        | MS recovery not determined,      |
|                                    |                      |                  |           |            | Determined |        | background level greater than or |
|                                    |                      |                  |           |            |            |        | equal to 4x spike level.         |

#### **Outliers : Analysis Holding Time Compliance**

#### Matrix: WATER

| Ex             | traction / Preparation |  | Analysis   |  |  |
|----------------|------------------------|--|--|--|--|
| Date extracted | Due for extraction     | Days   | Date analysed  | Due for analysis   | Days   |
|                |                        | overdue  |  |  | overdue  |
|                |                        |  |  |  |  |
|                |                        |  |  |  |  |
|                |                        |  | 15-Feb-2019  | 11-Feb-2019  | 4  |
|                | Ex<br>Date extracted   | Extraction / Preparation       Date extracted     Due for extraction | Extraction / Preparation       Date extracted     Due for extraction     Days<br>overdue | Extraction / Preparation     Date analysed       Date extracted     Due for extraction     Days overdue              15-Feb-2019 | Extraction / Preparation     Analysis       Date extracted     Due for extraction     Days overdue     Date analysed     Due for analysis          15-Feb-2019     11-Feb-2019 |

#### **Outliers : Frequency of Quality Control Samples**

#### Matrix: WATER

| Quality Control Sample Type                   |    | Count   |                       | : (%) | Quality Control Specification  |
|---|----|---------|-----------------------|-------|--------------------------------|
| Method  | QC | Regular | Jular Actual Expected |       |                                |
| Matrix Spikes (MS)                            |    |         |                       |       |                                |
| Reactive Phosphorus as P-By Discrete Analyser | 0  | 1       | 0.00                  | 5.00  | NEPM 2013 B3 & ALS QC Standard |

#### Analysis Holding Time Compliance

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

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

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

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

| Matrix: WATER   |             |                |                        | Evaluation | : × = Holding time | breach ; ✓ = Withir | n holding time. |
|---|-------------|----------------|------------------------|------------|--------------------|---------------------|-----------------|
| Method  | Sample Date | Ex             | traction / Preparation |            |                    | Analysis            |                 |
| Container / Client Sample ID(s)                           |             | Date extracted | Due for extraction     | Evaluation | Date analysed      | Due for analysis    | Evaluation      |
| EA005P: pH by PC Titrator                                 |             |                |                        |            |                    |                     |                 |
| Clear Plastic Bottle - Natural (EA005-P)<br>320-01-BH2103 | 11-Feb-2019 |                |                        |            | 15-Feb-2019        | 11-Feb-2019         | x               |
| EA010P: Conductivity by PC Titrator                       |             |                |                        |            |                    |                     |                 |
| Clear Plastic Bottle - Natural (EA010-P)<br>320-01-BH2103 | 11-Feb-2019 |                |                        |            | 15-Feb-2019        | 11-Mar-2019         | ~               |
|   |             |                |                        |            |                    |                     |                 |



| Matrix: WATER  |             |                | Evaluation             | ition: $\star$ = Holding time breach ; $\checkmark$ = Within holding time |               |                  |            |  |
|--|-------------|----------------|------------------------|---|---------------|------------------|------------|--|
| Matrix: WATER Method Container / Client Sample ID(s)                       | Sample Date | Ex             | traction / Preparation |   |               | Analysis         |            |  |
| Container / Client Sample ID(s)  |             | Date extracted | Due for extraction     | Evaluation  | Date analysed | Due for analysis | Evaluation |  |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C                          |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Natural (EA015H)<br>320-01-BH2103                   | 11-Feb-2019 |                |                        |   | 14-Feb-2019   | 18-Feb-2019      | ~          |  |
| ED037P: Alkalinity by PC Titrator  |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Natural (ED037-P)<br>320-01-BH2103                  | 11-Feb-2019 |                |                        |   | 15-Feb-2019   | 25-Feb-2019      | ✓          |  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA                            |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Natural (ED041G)<br>320-01-BH2103                   | 11-Feb-2019 |                |                        |   | 13-Feb-2019   | 11-Mar-2019      | ~          |  |
| ED045G: Chloride by Discrete Analyser                                      |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Natural (ED045G)<br>320-01-BH2103                   | 11-Feb-2019 |                |                        |   | 13-Feb-2019   | 11-Mar-2019      | ~          |  |
| ED093F: Dissolved Major Cations  |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>320-01-BH2103     | 11-Feb-2019 |                |                        |   | 16-Feb-2019   | 11-Mar-2019      | ~          |  |
| ED093F: SAR and Hardness Calculations                                      |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>320-01-BH2103     | 11-Feb-2019 |                |                        |   | 16-Feb-2019   | 11-Mar-2019      | ~          |  |
| EG020F: Dissolved Metals by ICP-MS   |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)<br>320-01-BH2103   | 11-Feb-2019 |                |                        |   | 16-Feb-2019   | 10-Aug-2019      | ~          |  |
| EG020T: Total Metals by ICP-MS   |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)<br>320-01-BH2103 | 11-Feb-2019 | 16-Feb-2019    | 10-Aug-2019            | ~   | 16-Feb-2019   | 10-Aug-2019      | ~          |  |
| EG035F: Dissolved Mercury by FIMS  |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)<br>320-01-BH2103     | 11-Feb-2019 |                |                        |   | 16-Feb-2019   | 11-Mar-2019      | ~          |  |
| EG035T: Total Recoverable Mercury by FIMS                                  |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)<br>320-01-BH2103   | 11-Feb-2019 |                |                        |   | 18-Feb-2019   | 11-Mar-2019      | ~          |  |
| EK040P: Fluoride by PC Titrator  |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Natural (EK040P)<br>320-01-BH2103                   | 11-Feb-2019 |                |                        |   | 15-Feb-2019   | 11-Mar-2019      | ~          |  |
| EK055G: Ammonia as N by Discrete Analyser                                  |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Sulfuric Acid (EK055G)<br>320-01-BH2103             | 11-Feb-2019 |                |                        |   | 15-Feb-2019   | 11-Mar-2019      | ~          |  |
| EK057G: Nitrite as N by Discrete Analyser                                  |             |                |                        |   |               |                  |            |  |
| Clear Plastic Bottle - Natural (EK057G)<br>320-01-BH2103                   | 11-Feb-2019 |                |                        |   | 13-Feb-2019   | 13-Feb-2019      | 1          |  |

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| Work Order | : EB1903588                    |
| Client     | : GOLDER ASSOCIATES            |
| Project    | : 1893795 Inland Rail (Pkg 12) |



| Matrix: WATER  |             |                |                        | Evaluation | : × = Holding time | breach ; ✓ = Withi | n holding time |
|--|-------------|----------------|------------------------|------------|--------------------|--------------------|----------------|
| Method   | Sample Date | Ex             | traction / Preparation |            | Analysis           |                    |                |
| Container / Client Sample ID(s)                                |             | Date extracted | Due for extraction     | Evaluation | Date analysed      | Due for analysis   | Evaluation     |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser   |             |                |                        |            |                    |                    |                |
| Clear Plastic Bottle - Sulfuric Acid (EK059G)<br>320-01-BH2103 | 11-Feb-2019 |                |                        |            | 15-Feb-2019        | 11-Mar-2019        | ~              |
| EK061G: Total Kjeldahl Nitrogen By Discrete Analyser           |             |                |                        |            |                    |                    |                |
| Clear Plastic Bottle - Sulfuric Acid (EK061G)<br>320-01-BH2103 | 11-Feb-2019 | 15-Feb-2019    | 11-Mar-2019            | ~          | 15-Feb-2019        | 11-Mar-2019        | ~              |
| EK067G: Total Phosphorus as P by Discrete Analyser             |             |                |                        |            |                    |                    |                |
| Clear Plastic Bottle - Sulfuric Acid (EK067G)<br>320-01-BH2103 | 11-Feb-2019 | 15-Feb-2019    | 11-Mar-2019            | 1          | 15-Feb-2019        | 11-Mar-2019        | ~              |
| EK071G: Reactive Phosphorus as P by discrete analyser          |             |                |                        |            |                    |                    |                |
| Clear Plastic Bottle - Natural (EK071G)<br>320-01-BH2103       | 11-Feb-2019 |                |                        |            | 13-Feb-2019        | 13-Feb-2019        | ~              |



#### **Quality Control Parameter Frequency Compliance**

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

| Matrix: WATER Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within spe |                            |    |         |                               |          |            | not within specification ; $\checkmark$ = Quality Control frequency within specification. |
|---|----------------------------|----|---------|-------------------------------|----------|------------|---|
| Quality Control Sample Type   | Sample Type Count Rate (%) |    |         | Quality Control Specification |          |            |   |
| Analytical Methods  | Method                     | QC | Reaular | Actual                        | Expected | Evaluation |   |
| Laboratory Duplicates (DUP)   |                            |    |         |                               |          |            |   |
| Alkalinity by PC Titrator   | ED037-P                    | 2  | 12      | 16.67                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Ammonia as N by Discrete analyser   | EK055G                     | 2  | 16      | 12.50                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Chloride by Discrete Analyser   | ED045G                     | 1  | 7       | 14.29                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Conductivity by PC Titrator   | EA010-P                    | 1  | 9       | 11.11                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Mercury by FIMS   | EG035F                     | 1  | 6       | 16.67                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Metals by ICP-MS - Suite A  | EG020A-F                   | 2  | 16      | 12.50                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Fluoride by PC Titrator   | EK040P                     | 1  | 7       | 14.29                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Major Cations - Dissolved   | ED093F                     | 2  | 12      | 16.67                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser   | EK059G                     | 2  | 16      | 12.50                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite as N by Discrete Analyser   | EK057G                     | 2  | 18      | 11.11                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| pH by PC Titrator   | EA005-P                    | 1  | 3       | 33.33                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Reactive Phosphorus as P-By Discrete Analyser   | EK071G                     | 1  | 1       | 100.00                        | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser  | ED041G                     | 1  | 7       | 14.29                         | 10.00    | ~          | NEPM 2013 B3 & ALS QC Standard  |
| Total Dissolved Solids (High Level)   | EA015H                     | 2  | 18      | 11.11                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser   | EK061G                     | 2  | 12      | 16.67                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Total Mercury by FIMS   | EG035T                     | 1  | 8       | 12.50                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Total Metals by ICP-MS - Suite A  | EG020A-T                   | 2  | 18      | 11.11                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Total Phosphorus as P By Discrete Analyser  | EK067G                     | 2  | 20      | 10.00                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Laboratory Control Samples (LCS)  |                            |    |         |                               |          |            |   |
| Alkalinity by PC Titrator   | ED037-P                    | 1  | 12      | 8.33                          | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Ammonia as N by Discrete analyser   | EK055G                     | 1  | 16      | 6.25                          | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Chloride by Discrete Analyser   | ED045G                     | 2  | 7       | 28.57                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Conductivity by PC Titrator   | EA010-P                    | 2  | 9       | 22.22                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Mercury by FIMS   | EG035F                     | 1  | 6       | 16.67                         | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Metals by ICP-MS - Suite A  | EG020A-F                   | 1  | 16      | 6.25                          | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Fluoride by PC Titrator   | EK040P                     | 1  | 7       | 14.29                         | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser   | EK059G                     | 1  | 16      | 6.25                          | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite as N by Discrete Analyser   | EK057G                     | 1  | 18      | 5.56                          | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| pH by PC Titrator   | EA005-P                    | 2  | 3       | 66.67                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Reactive Phosphorus as P-By Discrete Analyser   | EK071G                     | 1  | 1       | 100.00                        | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser  | ED041G                     | 2  | 7       | 28.57                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Total Dissolved Solids (High Level)   | EA015H                     | 2  | 18      | 11.11                         | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser   | EK061G                     | 1  | 12      | 8.33                          | 5.00     | ~          | NEPM 2013 B3 & ALS QC Standard  |
| Total Mercury by FIMS   | EG035T                     | 1  | 8       | 12.50                         | 5.00     | ~          | NEPM 2013 B3 & ALS QC Standard  |
| Total Metals by ICP-MS - Suite A  | EG020A-T                   | 1  | 18      | 5.56                          | 5.00     | ~          | NEPM 2013 B3 & ALS QC Standard  |
| Total Phosphorus as P By Discrete Analyser  | EK067G                     | 1  | 20      | 5.00                          | 5.00     | ~          | NEPM 2013 B3 & ALS QC Standard  |

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|------------|--------------------------------|
| Work Order | : EB1903588                    |
| Client     | : GOLDER ASSOCIATES            |
| Project    | : 1893795 Inland Rail (Pkg 12) |



| Matrix: WATER Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within sp |          |       |         |          |          |            |                                |  |
|--|----------|-------|---------|----------|----------|------------|--------------------------------|--|
| Quality Control Sample Type  |          | Count |         | Rate (%) |          |            | Quality Control Specification  |  |
| Analytical Methods   | Method   | QC    | Reaular | Actual   | Expected | Evaluation |                                |  |
| Method Blanks (MB)   |          |       |         |          |          |            |                                |  |
| Ammonia as N by Discrete analyser  | EK055G   | 1     | 16      | 6.25     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Chloride by Discrete Analyser  | ED045G   | 1     | 7       | 14.29    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Conductivity by PC Titrator  | EA010-P  | 1     | 9       | 11.11    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Dissolved Mercury by FIMS  | EG035F   | 1     | 6       | 16.67    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Dissolved Metals by ICP-MS - Suite A   | EG020A-F | 1     | 16      | 6.25     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Fluoride by PC Titrator  | EK040P   | 1     | 7       | 14.29    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Major Cations - Dissolved  | ED093F   | 1     | 12      | 8.33     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser  | EK059G   | 1     | 16      | 6.25     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Nitrite as N by Discrete Analyser  | EK057G   | 1     | 18      | 5.56     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Reactive Phosphorus as P-By Discrete Analyser  | EK071G   | 1     | 1       | 100.00   | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser   | ED041G   | 1     | 7       | 14.29    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Dissolved Solids (High Level)  | EA015H   | 1     | 18      | 5.56     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser  | EK061G   | 1     | 12      | 8.33     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Mercury by FIMS  | EG035T   | 1     | 8       | 12.50    | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Metals by ICP-MS - Suite A   | EG020A-T | 1     | 18      | 5.56     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Phosphorus as P By Discrete Analyser   | EK067G   | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Matrix Spikes (MS)   |          |       |         |          |          |            |                                |  |
| Ammonia as N by Discrete analyser  | EK055G   | 1     | 16      | 6.25     | 5.00     | ~          | NEPM 2013 B3 & ALS QC Standard |  |
| Chloride by Discrete Analyser  | ED045G   | 1     | 7       | 14.29    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Dissolved Mercury by FIMS  | EG035F   | 1     | 6       | 16.67    | 5.00     | ~          | NEPM 2013 B3 & ALS QC Standard |  |
| Dissolved Metals by ICP-MS - Suite A   | EG020A-F | 1     | 16      | 6.25     | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |
| Fluoride by PC Titrator  | EK040P   | 1     | 7       | 14.29    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser  | EK059G   | 1     | 16      | 6.25     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Nitrite as N by Discrete Analyser  | EK057G   | 1     | 18      | 5.56     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Reactive Phosphorus as P-By Discrete Analyser  | EK071G   | 0     | 1       | 0.00     | 5.00     | x          | NEPM 2013 B3 & ALS QC Standard |  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser   | ED041G   | 1     | 7       | 14.29    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser  | EK061G   | 1     | 12      | 8.33     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Mercury by FIMS  | EG035T   | 1     | 8       | 12.50    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Metals by ICP-MS - Suite A   | EG020A-T | 1     | 18      | 5.56     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |  |
| Total Phosphorus as P By Discrete Analyser   | EK067G   | 1     | 20      | 5.00     | 5.00     | 1          | NEPM 2013 B3 & ALS QC Standard |  |



#### **Brief Method Summaries**

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

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



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

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|------------|--------------------------------|
| Work Order | : EB1903588                    |
| Client     | : GOLDER ASSOCIATES            |
| Project    | : 1893795 Inland Rail (Pkg 12) |



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



| QA/QC Compliance Assessment to assist with Quality Review |                           |                         |                                   |  |  |  |  |
|---|---------------------------|-------------------------|-----------------------------------|--|--|--|--|
| Nork Order  | EB1904979                 | Page                    | : 1 of 9                          |  |  |  |  |
| Client  |                           | Laboratory              | : Environmental Division Brisbane |  |  |  |  |
| Contact   | : MR SUSANTHA KUMARAPELI  | Telephone               | : +61 7 3552 8639                 |  |  |  |  |
| Project   | : 1893795 Inland Rail P/2 | Date Samples Received   | : 27-Feb-2019                     |  |  |  |  |
| Site  | :                         | Issue Date              | : 04-Mar-2019                     |  |  |  |  |
| Sampler   | : ROBERT CUPPER           | No. of samples received | : 1                               |  |  |  |  |
| Order number  | :                         | No. of samples analysed | :1                                |  |  |  |  |

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

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

#### **Summary of Outliers**

#### **Outliers : Quality Control Samples**

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

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

#### **Outliers : Analysis Holding Time Compliance**

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

#### **Outliers : Frequency of Quality Control Samples**

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



#### **Outliers : Quality Control Samples**

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

#### Matrix: WATER

| Compound Group Name                             | Laboratory Sample ID | Client Sample ID | Analyte                           | CAS Number | Data              | Limits | Comment   |
|---|----------------------|------------------|-----------------------------------|------------|-------------------|--------|---|
| Matrix Spike (MS) Recoveries                    |                      |                  |                                   |            |                   |        |   |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA | EB1904963001         | Anonymous        | Sulfate as SO4 -<br>Turbidimetric | 14808-79-8 | Not<br>Determined |        | MS recovery not determined,<br>background level greater than or<br>equal to 4x spike level. |
| ED045G: Chloride by Discrete Analyser           | EB1904963001         | Anonymous        | Chloride                          | 16887-00-6 | Not<br>Determined |        | MS recovery not determined,<br>background level greater than or<br>equal to 4x spike level. |

#### Outliers : Analysis Holding Time Compliance

| Matrix: WATER  |  |                        |         |               |                  |         |
|--|--|------------------------|---------|---------------|------------------|---------|
| Method   | Ex                                     | traction / Preparation |         |               | Analysis         |         |
| Container / Client Sample ID(s)  | Date extracted Due for extraction Days |                        |         | Date analysed | Due for analysis | Days    |
|  |  |                        | overdue |               |                  | overdue |
| EA005P: pH by PC Titrator  |  |                        |         |               |                  |         |
| Clear Plastic Bottle - Natural   |  |                        |         |               |                  |         |
| 320-01-BH2216  |  |                        |         | 27-Feb-2019   | 26-Feb-2019      | 1       |
| EA005P: pH by PC Titrator<br>Clear Plastic Bottle - Natural<br>320-01-BH2216 |  |                        | overdue | 27-Feb-2019   | 26-Feb-2019      | overdue |

#### Analysis Holding Time Compliance

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

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

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

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

| Matrix: WATER   |             |                |                        | Evaluation | : × = Holding time | breach ; ✓ = Withi | n holding time. |
|---|-------------|----------------|------------------------|------------|--------------------|--------------------|-----------------|
| Method  | Sample Date | Ex             | traction / Preparation |            |                    | Analysis           |                 |
| Container / Client Sample ID(s)                           |             | Date extracted | Due for extraction     | Evaluation | Date analysed      | Due for analysis   | Evaluation      |
| EA005P: pH by PC Titrator                                 |             |                |                        |            |                    |                    |                 |
| Clear Plastic Bottle - Natural (EA005-P)<br>320-01-BH2216 | 26-Feb-2019 |                |                        |            | 27-Feb-2019        | 26-Feb-2019        | ×               |
| EA010P: Conductivity by PC Titrator                       |             |                |                        |            |                    |                    |                 |
| Clear Plastic Bottle - Natural (EA010-P)<br>320-01-BH2216 | 26-Feb-2019 |                |                        |            | 27-Feb-2019        | 26-Mar-2019        | ~               |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C         |             |                |                        |            |                    |                    |                 |
| Clear Plastic Bottle - Natural (EA015H)<br>320-01-BH2216  | 26-Feb-2019 |                |                        |            | 28-Feb-2019        | 05-Mar-2019        | ~               |
| ED037P: Alkalinity by PC Titrator                         |             |                |                        |            |                    |                    |                 |
| Clear Plastic Bottle - Natural (ED037-P)<br>320-01-BH2216 | 26-Feb-2019 |                |                        |            | 27-Feb-2019        | 12-Mar-2019        | ~               |



| Matrix: WATER  |             |                |                        | Evaluation | : × = Holding time | breach ; ✓ = Withi | n holding time |  |  |
|--|-------------|----------------|------------------------|------------|--------------------|--------------------|----------------|--|--|
| Method   | Sample Date | Ex             | traction / Preparation |            | Analysis           |                    |                |  |  |
| Container / Client Sample ID(s)  |             | Date extracted | Due for extraction     | Evaluation | Date analysed      | Due for analysis   | Evaluation     |  |  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA                            |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Natural (ED041G)<br>320-01-BH2216                   | 26-Feb-2019 |                |                        |            | 27-Feb-2019        | 26-Mar-2019        | ~              |  |  |
| ED045G: Chloride by Discrete Analyser                                      |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Natural (ED045G)<br>320-01-BH2216                   | 26-Feb-2019 |                |                        |            | 27-Feb-2019        | 26-Mar-2019        | 1              |  |  |
| ED093F: Dissolved Major Cations  |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>320-01-BH2216     | 26-Feb-2019 |                |                        |            | 28-Feb-2019        | 26-Mar-2019        | 1              |  |  |
| ED093F: SAR and Hardness Calculations                                      |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>320-01-BH2216     | 26-Feb-2019 |                |                        |            | 28-Feb-2019        | 26-Mar-2019        | ✓              |  |  |
| EG020F: Dissolved Metals by ICP-MS   |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)<br>320-01-BH2216   | 26-Feb-2019 |                |                        |            | 28-Feb-2019        | 25-Aug-2019        | ✓              |  |  |
| EG020T: Total Metals by ICP-MS   |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)<br>320-01-BH2216 | 26-Feb-2019 | 28-Feb-2019    | 25-Aug-2019            | ~          | 28-Feb-2019        | 25-Aug-2019        | ~              |  |  |
| EG035F: Dissolved Mercury by FIMS  |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)<br>320-01-BH2216     | 26-Feb-2019 |                |                        |            | 28-Feb-2019        | 26-Mar-2019        | 1              |  |  |
| EG035T: Total Recoverable Mercury by FIMS                                  |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)<br>320-01-BH2216   | 26-Feb-2019 |                |                        |            | 28-Feb-2019        | 26-Mar-2019        | ✓              |  |  |
| EK055G: Ammonia as N by Discrete Analyser                                  |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Sulfuric Acid (EK055G)<br>320-01-BH2216             | 26-Feb-2019 |                |                        |            | 28-Feb-2019        | 26-Mar-2019        | ~              |  |  |
| EK057G: Nitrite as N by Discrete Analyser                                  |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Natural (EK057G)<br>320-01-BH2216                   | 26-Feb-2019 |                |                        |            | 27-Feb-2019        | 28-Feb-2019        | 1              |  |  |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser               |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Sulfuric Acid (EK059G)<br>320-01-BH2216             | 26-Feb-2019 |                |                        |            | 28-Feb-2019        | 26-Mar-2019        | ~              |  |  |
| EK061G: Total Kjeldahl Nitrogen By Discrete Analyser                       |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Sulfuric Acid (EK061G)<br>320-01-BH2216             | 26-Feb-2019 | 28-Feb-2019    | 26-Mar-2019            | ~          | 28-Feb-2019        | 26-Mar-2019        | ~              |  |  |
| EK067G: Total Phosphorus as P by Discrete Analyser                         |             |                |                        |            |                    |                    |                |  |  |
| Clear Plastic Bottle - Sulfuric Acid (EK067G)<br>320-01-BH2216             | 26-Feb-2019 | 28-Feb-2019    | 26-Mar-2019            | 1          | 28-Feb-2019        | 26-Mar-2019        | 1              |  |  |

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| Work Order | : EB1904979               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 Inland Rail P/2 |



| Matrix: WATER   |             |                |                        | Evaluation | : × = Holding time | breach ; ✓ = Withi | n holding time |
|---|-------------|----------------|------------------------|------------|--------------------|--------------------|----------------|
| Method  | Sample Date | Ex             | traction / Preparation |            |                    | Analysis           |                |
| Container / Client Sample ID(s)                       |             | Date extracted | Due for extraction     | Evaluation | Date analysed      | Due for analysis   | Evaluation     |
| EK071G: Reactive Phosphorus as P by discrete analyser |             |                |                        |            |                    |                    |                |
| Clear Plastic Bottle - Natural (EK071G)               |             |                |                        |            |                    |                    |                |
| 320-01-BH2216   | 26-Feb-2019 |                |                        |            | 27-Feb-2019        | 28-Feb-2019        | $\checkmark$   |



#### **Quality Control Parameter Frequency Compliance**

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

| Matrix: WATER  |          |    |         | Evaluatio | n: × = Quality Cor | ntrol frequency r | not within specification ; $\checkmark$ = Quality Control frequency within specification. |
|--|----------|----|---------|-----------|--------------------|-------------------|---|
| Quality Control Sample Type                            |          | С  | ount    |           | Rate (%)           |                   | Quality Control Specification   |
| Analytical Methods                                     | Method   | QC | Reaular | Actual    | Expected           | Evaluation        |   |
| Laboratory Duplicates (DUP)                            |          |    |         |           |                    |                   |   |
| Alkalinity by PC Titrator                              | ED037-P  | 2  | 13      | 15.38     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Ammonia as N by Discrete analyser                      | EK055G   | 1  | 10      | 10.00     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Chloride by Discrete Analyser                          | ED045G   | 1  | 7       | 14.29     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Conductivity by PC Titrator                            | EA010-P  | 2  | 19      | 10.53     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Mercury by FIMS                              | EG035F   | 1  | 10      | 10.00     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 2  | 12      | 16.67     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Major Cations - Dissolved                              | ED093F   | 1  | 4       | 25.00     | 10.00              | $\checkmark$      | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1  | 10      | 10.00     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1  | 7       | 14.29     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| pH by PC Titrator                                      | EA005-P  | 2  | 16      | 12.50     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1  | 6       | 16.67     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 1  | 5       | 20.00     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Dissolved Solids (High Level)                    | EA015H   | 1  | 7       | 14.29     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1  | 7       | 14.29     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Mercury by FIMS                                  | EG035T   | 2  | 11      | 18.18     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 2  | 14      | 14.29     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1  | 7       | 14.29     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Laboratory Control Samples (LCS)                       |          |    |         |           |                    |                   |   |
| Alkalinity by PC Titrator                              | ED037-P  | 1  | 13      | 7.69      | 5.00               | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Ammonia as N by Discrete analyser                      | EK055G   | 1  | 10      | 10.00     | 5.00               | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Chloride by Discrete Analyser                          | ED045G   | 2  | 7       | 28.57     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Conductivity by PC Titrator                            | EA010-P  | 2  | 19      | 10.53     | 10.00              | 1                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Mercury by FIMS                              | EG035F   | 1  | 10      | 10.00     | 5.00               | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1  | 12      | 8.33      | 5.00               | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1  | 10      | 10.00     | 5.00               | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1  | 7       | 14.29     | 5.00               | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| pH by PC Titrator                                      | EA005-P  | 2  | 16      | 12.50     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1  | 6       | 16.67     | 5.00               | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 2  | 5       | 40.00     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Dissolved Solids (High Level)                    | EA015H   | 2  | 7       | 28.57     | 10.00              | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1  | 7       | 14.29     | 5.00               | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Mercury by FIMS                                  | EG035T   | 1  | 11      | 9.09      | 5.00               | ✓                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1  | 14      | 7.14      | 5.00               | ~                 | NEPM 2013 B3 & ALS QC Standard  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1  | 7       | 14.29     | 5.00               | ~                 | NEPM 2013 B3 & ALS QC Standard  |
| Method Blanks (MB)                                     |          |    |         |           |                    |                   |   |
| Ammonia as N by Discrete analyser                      | EK055G   | 1  | 10      | 10.00     | 5.00               | 1                 | NEPM 2013 B3 & ALS QC Standard  |

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|------------|---------------------------|
| Work Order | : EB1904979               |
| Client     | : GOLDER ASSOCIATES       |
| Project    | : 1893795 Inland Rail P/2 |



| Matrix: WATER  |          |    |         | Evaluatio | on: × = Quality Co | ntrol frequency | not within specification ; $\checkmark$ = Quality Control frequency within specification. |
|--|----------|----|---------|-----------|--------------------|-----------------|---|
| Quality Control Sample Type                            |          | С  | ount    |           | Rate (%)           |                 | Quality Control Specification   |
| Analytical Methods                                     | Method   | QC | Reaular | Actual    | Expected           | Evaluation      |   |
| Method Blanks (MB) - Continued                         |          |    |         |           |                    |                 |   |
| Chloride by Discrete Analyser                          | ED045G   | 1  | 7       | 14.29     | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Conductivity by PC Titrator                            | EA010-P  | 1  | 19      | 5.26      | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Mercury by FIMS                              | EG035F   | 1  | 10      | 10.00     | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1  | 12      | 8.33      | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Major Cations - Dissolved                              | ED093F   | 1  | 4       | 25.00     | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1  | 10      | 10.00     | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1  | 7       | 14.29     | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1  | 6       | 16.67     | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 1  | 5       | 20.00     | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Total Dissolved Solids (High Level)                    | EA015H   | 1  | 7       | 14.29     | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1  | 7       | 14.29     | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Total Mercury by FIMS                                  | EG035T   | 1  | 11      | 9.09      | 5.00               | ✓               | NEPM 2013 B3 & ALS QC Standard  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1  | 14      | 7.14      | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1  | 7       | 14.29     | 5.00               | 1               | NEPM 2013 B3 & ALS QC Standard  |
| Matrix Spikes (MS)                                     |          |    |         |           |                    |                 |   |
| Ammonia as N by Discrete analyser                      | EK055G   | 1  | 10      | 10.00     | 5.00               | 1               | NEPM 2013 B3 & ALS QC Standard  |
| Chloride by Discrete Analyser                          | ED045G   | 1  | 7       | 14.29     | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Mercury by FIMS                              | EG035F   | 1  | 10      | 10.00     | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | 1  | 12      | 8.33      | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G   | 1  | 10      | 10.00     | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Nitrite as N by Discrete Analyser                      | EK057G   | 1  | 7       | 14.29     | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G   | 1  | 6       | 16.67     | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | 1  | 5       | 20.00     | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G   | 1  | 7       | 14.29     | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Total Mercury by FIMS                                  | EG035T   | 1  | 11      | 9.09      | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Total Metals by ICP-MS - Suite A                       | EG020A-T | 1  | 14      | 7.14      | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |
| Total Phosphorus as P By Discrete Analyser             | EK067G   | 1  | 7       | 14.29     | 5.00               | ~               | NEPM 2013 B3 & ALS QC Standard  |



#### **Brief Method Summaries**

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

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

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| Work Order | : EB1904979               |
| Client     | : GOLDER ASSOCIATES       |
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| Analytical Methods                                      | Method      | Matrix | Method Descriptions   |
|---|-------------|--------|---|
| Dissolved Mercury by FIMS                               | EG035F      | WATER  | In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS)<br>Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique.<br>A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic<br>mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell.<br>Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM<br>(2013) Schedule B(3) |
| Total Mercury by FIMS                                   | EG035T      | WATER  | In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS)<br>FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise<br>any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic<br>mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing<br>absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)   |
| Ammonia as N by Discrete analyser                       | EK055G      | WATER  | In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)   |
| Nitrite as N by Discrete Analyser                       | EK057G      | WATER  | In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)  |
| Nitrate as N by Discrete Analyser                       | EK058G      | WATER  | In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)  |
| Nitrite and Nitrate as N (NOx) by Discrete<br>Analyser  | EK059G      | WATER  | In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)  |
| Total Kjeldahl Nitrogen as N By Discrete<br>Analyser    | EK061G      | WATER  | In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)   |
| Total Nitrogen as N (TKN + Nox) By<br>Discrete Analyser | EK062G      | WATER  | In house: Referenced to APHA 4500-Norg / 4500-NO3 This method is compliant with NEPM (2013) Schedule B(3)   |
| Total Phosphorus as P By Discrete<br>Analyser           | EK067G      | WATER  | In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)  |
| Reactive Phosphorus as P-By Discrete<br>Analyser        | EK071G      | WATER  | In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)   |
| Ionic Balance by PCT DA and Turbi SO4<br>DA             | EN055 - PG  | WATER  | In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)   |
| Preparation Methods                                     | Method      | Matrix | Method Descriptions   |
| TKN/TP Digestion  | EK061/EK067 | WATER  | In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)  |

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

# APPENDIX

### Geotechnical

## Appendix J Important information

**GOWRIE TO HELIDON** ENVIRONMENTAL IMPACT STATEMENT





The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

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The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

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Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

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