1021

Isabella Weir Upgrade Design and Construction Monitoring

Site Investigations
Factual and Interpretive Report

Revision A

Project Number 3002402

Prepared for: ACT Government Shared Services Procurement

Date: 28-05-15

DOCUMENT CONTROL

Title	Isabella Weir Upgrade -			
Prepared for	ACT Government – Shared Services Procurement			
Project Ref	3002402			
	Name	**Position**	**Signed/Approved**	**Date**
Originator	[redacted]	Snr Geotechnical Engineer	[redacted]	28-5-2015
Review	[redacted]	Chief Technical Principal - Dams		
Approval	[redacted]	Project Director		

Details of Revisions

Rev	Date	Description	WVR No.	Approved
A	28/05/2015	Isabella Weir Upgrade - Geotechnical Investigation Report		

CONTACT DETAILS

SMEC Australia Pty Ltd | www.smec.com

Suite 2, Level 1, 243 Northbourne Avenue
Lyneham, ACT, 2602
Tel: 02 6234 1900
Fax: 02 6234 1966

Representative:
Name: [redacted]
P: [redacted]
E: [redacted]

TABLE OF CONTENTS

1. INTRODUCTION

Isabella Weir is located on Tuggeranong Creek in Canberra, ACT. The weir was constructed in the mid to late 1980's to form the Isabella Pondage and regulate flows into Lake Tuggeranong.

The weir has been the subject of a number of recent studies due to the downstream development of the South Quay in the Greenway Estate. The results of these studies require the weir to be upgraded to enable the passing of the 1 in 10,000 AEP flood due to a revised Flood Consequence Category now assigned to the weir. The required discharge capacity of the weir is 1020m^3/sec.

It is understood that the upgrade works will comprise doubling the width of the overflow (labyrinth) section of the weir and potentially raising the level of the flanking embankments on either side of the weir to accommodate the 1 in 10,000 AEP flood.

As part of the design inputs for upgrading the weir structure, site investigations were undertaken, comprising:

- Desktop review of existing geotechnical information;
- Site survey;
- Underground services potholing;
- Test pit excavations;
- Geological mapping of exposed rock structure; and
- Laboratory testing of soil samples recovered from test pits.

This report has been prepared to present details of the site investigations and comprises:

- Discussion of background information;
- Conduct of site investigations;
- Factual results of investigations; and
- Interpretation of geotechnical model.

2. BACKGROUND INFORMATION

2.1 Weir Description

Isabella Weir is located on Tuggeranong Creek in Canberra. The weir impounds Isabella Pond and receives water from Tuggeranong Creek and the Upper Stranger Pond via a diversion under Isabella Drive. Flow from the Isabella Weir discharges into the storage pond formed by the Tuggeranong Weir, which is located approximately one kilometre downstream. The primary purpose of the weir is to control the quality of storm water runoff from the surrounding area and provide a recreational facility.

A copy of the "Works as Executed" (W.A.E.) weir design drawings that were reviewed as part of the current geotechnical investigations are provided in Appendix 2.01.

The general arrangement of the structure comprises:

- Centrally located reinforced concrete weir labyrinth overflow section; and
- Embankment dams on the flanks of overflow section.

The centrally located concrete over flow section of the weir comprises a 2.5 cycle concrete labyrinth spillway structure with:

  - Crest level of EL575m (FSL);
  - Height of 5.5m;
  - Width between abutment walls of 29.5m; and
  - Labyrinth weir crest length of 94m.

The zoned embankment dam sections flank the concrete overflow section of the weir. Coffey (1985), and Jacob/SKM (2014) in Figure 2 of their report, have indicated that the typical embankment sections comprise:

- Zoned embankment with:
  - Zone 1 – impervious clay core;
  - Zone 1 – impervious clay key trench cut off into foundation below clay core and founded in rock;
  - Zone 2 – general semi-impervious fill both upstream and downstream of the clay core material;
  - Zone 3 – 0.5m thick filter blanket at downstream toe; and
  - Zone 4 – graded rock fill with D50 of 13mm to 150mm size overlying the Zone 3 at the downstream toe of the bank.
- Embankment crest length of:
  - 120m length from spillway to left abutment; and
  - 50m length from spillway to right abutment.
- Crest level in the range of EL577.2m to EL578.0m; and a crest width of nominally 3m.
- Height at maximum section of nominally 8m.

- Batter slopes of 4H:1V.

Drawing W.A.E. 88/124323 shows the alignment of an abandoned 1050mm diameter sewer and a relocated 1050mm diameter sewer. Both of these sewers are shown to pass through the foundations of the left embankment. Special treatment of the embankment at the sewer locations is shown on the drawings to comprise:

- Special treatment of the abandoned 1050 dia. sewer trench includes:
  - Sewer line removed and ends of pipe blanked off with concrete blocks;
  - Zone 1 upstream seepage cut off;
  - Anchored mass concrete beneath the abutment return walls;
  - Zone 2 general back fill between upstream seepage cut-off and anchored concrete block; and
  - Widened Zone 1 clay core downstream of weir crest.
- Special treatment of the relocated 1050mm dia. sewer pipe and includes:
  - Concrete scour stop collars around pipe; and
  - Widening of Zone 1 backfill material upstream to a depth of nominally 6.4m below the crest of the clay core.

Drawing WAE88/12415 in Appendix 2.01 shows that the alignment of the weir crest has been set out relative to a control line between survey control points No. 7 at Ch 00m and No. 6 at Ch 210m.

2.2 Regional Geology

The regional geological conditions at the Isabella Weir are indicated on the Canberra Geological Map 1:100,000 Series Sheet 8727, (BMR 1992). The map indicates the rock to be near surface and is described as Deakin Volcanics of Late Silurian Age.

The Deakin Volcanics are described on the geological map as:

- Rhyodacite, dacitic and rhyodacitic crystal tuff, tuff, minor agglomerate, ashstone, tuffaceous ashstone & shale.

Generally the rock at the site comprises Dacite. Dacite is a fine grained quartz rich volcanic extrusive rock.

2.3 Previous Geotechnical Investigations

2.3.1 General

Geotechnical investigations were undertaken at the Isabella Weir site prior to construction, during construction and as part of the SKM/Jacobs risk and options assessments. The available reports that provide the details of the prior geotechnical investigations comprise:

1. Coffey & Partners Pty Ltd, 1985, "Geotechnical Investigation for the Proposed Isabella Drive – Stage 5, Tuggeranong, ACT."

2. Coffey & Partners Pty Ltd, 1987, “Results of Geological Mapping of Rock Foundation Isabella Weir, Isabella Drive, Stage 5A, Tuggeranong Creek, ACT”
3. Jacobs/SKM, 30 Apr 2014, “Isabella Weir Risk and Options Assessment”.

Details regarding the results of the previous investigations are given below.

2.3.2 Coffey (1985) Borehole Investigations

The Coffey (1985) report provides details of the geotechnical investigations which were undertaken prior to the design and construction of the weir. The weir construction formed part of the Isabella Drive Stage 5A Contract and this report provides details of the geotechnical information obtained for the Isabella Drive construction.

The geotechnical investigations of the foundation of the weir in Coffey (1985) comprise drilling of 4 cored boreholes namely:

- BH11 – Left abutment of overflow labyrinth section;
- BH12 – Right embankment;
- BH15 – Left embankment; and
- BH16 – Right abutment of overflow labyrinth section.

Typically the logs of the Coffey (1985) boreholes indicate that originally the site subsurface profile comprised:

Right and Left Embankment Foundations

- 0.0m to 1.5m depth – **FILL** – Gravelly Sandy CLAY/ Clayey SAND
- 1.5m to 2.5m depth – **ALLUVIAL SOIL** – Sandy CLAY/ Clayey-gravelly SAND
- 2.5m to 10.25m depth – **EW to MW ROCK – DACITE**: fine to medium grained, mauve, yellow brown and orange brown, highly weathered and medium strength, the Dacite typically increases in rock strength and decrease in degree of weathering with depth

Overflow Section Abutment Foundations

- 0.0m to 0.4m depth – **FILL** – Gravelly sandy CLAY
- 0.4m to 13.0m depth – **HW to SW ROCK – DACITE**: fine to medium grained, blue and mauve with green epidote veins, highly to moderately weathered, medium to very high strength, the Dacite typically increases in rock strength and decrease in degree of weathering with depth

Laboratory testing of the Dacite rock cores was reported in Coffey (1985).

Unconfined compressive strength (UCS) testing of rock core samples was undertaken during the 1985 investigations, but the samples tested were not from the boreholes located in the weir foundations.

Although the reported test results were not located at the weir, it is considered that the results obtained may be useful in assessing the intact rock strength and deformation characteristic of the rock at the weir site.

Typically the UCS and modulus of elasticity (E) results for intact Dacite reported by Coffey (1985) indicate the following:

- Highly to moderately weathered Dacite:
  - UCS = 15 MPa;
  - E = 1650 MPa.
- Moderately weathered Dacite:
  - UCS = 40 MPa;
  - E = 5000 MPa.
- Moderately to slightly weathered Dacite:
  - UCS = 75 to 200 MPa;
  - E = 10000 to 13000 MPa.

Point load testing of the rock cores from the weir foundations has been reported in Coffey (1985). These point load test results are summarised in Table 2.01.

Table 2.01 – Summary of Relevant Point Load Tests from Coffey 1985 Report

BH	Sample Depth	Material Description	Is(50)	Classification
BH11	1.90m to 2.00m	Dacitic TUFF: Fine to medium grained, mauve, moderately to slightly weathered	5.5 MPa	Very High Strength
BH11	6.10m to 6.20m	Dacitic TUFF: fine to medium grained, mauve slightly weathered	8.0 MPa	Very High Strength
BH12	3.20m to 3.25m	Rhyodacitic TUFF: fine to medium grained, grey & orange brown, highly weathered	0.7 MPa	Medium strength
BH12	3.75m to 3.80m	Dacitic TUFF: fine to medium grained, mauve, highly weathered	1.0 MPa	Medium to high strength
BH12	5.45m to 5.60m	Dacitic TUFF: fine to medium grained, mauve, slightly weathered	8.0 MPa	Very high strength
BH15	2.90m to 3.00m	Rhyodacitic TUFF: fine to medium grained, orange-brown and cream, highly weathered	2.0 MPa	High strength
BH15	5.15m to 5.30m	Rhyodacitic TUFF: fine to medium grained, orange-brown and cream, highly weathered	1.0 MPa	Medium to high strength
BH15	7.10m to 7.15m	Rhyodacitic TUFF: fine to medium grained, orange-brown and cream, highly weathered	1.5 MPa	High strength
BH15	7.50m to 7.60m	Rhyodacitic TUFF: fine to medium grained, orange-brown and cream, highly weathered	1.8 MPa	High strength
BH15	8.50m to 8.55m	Rhyodacitic TUFF: fine to medium grained, orange-brown and cream, highly weathered	2.0 MPa	High strength
BH15	9.15m to 9.30m	Rhyodacitic TUFF: fine to medium grained, orange-brown and cream, highly weathered	2.7 MPa	High strength
BH16	3.00m to 3.30m	Dacitic TUFF: fine to medium grained, mauve, moderately weathered to slightly weathered	6.0 MPa	Very high strength
BH16	5.40m to 5.55m	Dacitic TUFF: fine to medium grained, mauve, highly weathered	0.75 MPa	Medium strength

The results in Table 2.01 indicate that rock strength varies from medium strength to very high strength.

Copies of the relevant Coffey (1985) borehole logs, together with the UCS and Point Load test results are provided in Appendix 2.02.

Coffey (1985) also provides the earthfill material specification and design soil grading envelopes that were adopted for the construction of the embankment sections of the weir. Copies of the Coffey (1985) embankment material design grading envelopes are provided in Appendix 2.03.

2.3.3 Coffey (1987) Geological Mapping

Geological mapping was undertaken at the time of the weir construction. It is understood that this mapping was undertaken to obtain a construction record of the geological foundation conditions for the concrete section of the weir structure. A copy of the geological map prepared as part of the mapping was not made available in the PDF copy of Coffey (1987) report provided to SMEC.

The areas where mapping was undertaken comprise:

- Weir embankment foundations;
- Cut-off trench;
- Labyrinth wall and wing wall foundations; and
- Left abutment sewer trench cut-off.

The rock observed in the foundations during the mapping is described by Coffey (1987) as:

"…dacite of the lower Silurian age Deakin Volcanics unit. Extremely to highly weathered dacite is yellow-brown, to grey-brown and the moderately weathered to slightly weathered dacite is purple-brown, grey-brown and blue-grey. The rock has porphyritic texture with crystals of quartz and feldspar to about 5mm size. Quartz, epidote, zeolite and chlorite veins to widths of about 10mm occur throughout the rock mass".

It is reported in Coffey (1987) that the foundations where concrete was placed comprise predominately moderately to slightly weathered rock with extremely to highly weathered materials associated with faulting and shears zones or zones of hydrothermal alteration.

Stereographic projections of rock joint defects are presented by Coffey (1987). Three principal joint sets were reported for the weir site, namely:

- Joint set 1 = dipping 80 to 90 towards 130 to 150 degrees;
- Joint set 2 = dipping 65 to 90 degrees towards 240 to 250 degrees; and
- Joint Set 3 = dipping 20 to 50 degrees towards 070 to 090 degrees;

A copy of the Coffey (1987) report, which includes the stereonet plots and photographs of the foundations, is attached in Appendix 2.04.

2.3.4 Jacobs/SKM 2014 Risk and Options Assessment

As part of the Risk and Options Assessment Study by Jacobs/SKM (2014), geotechnical drilling investigations were undertaken. Details regarding these investigations are presented in Jacobs/SKM (2014).

The drilling investigations were undertaken in December 2013 and comprised:

- 6 boreholes using auger drilling techniques;

- SPT testing within the boreholes;
- Vane shear testing undertaken within U63 tubes; and
- Laboratory testing of disturbed soil samples.

The location and depth of the boreholes are summarised here in Table 2.02. Drawing 3002402-00-300-2001 attached in Appendix 3.03 shows the location Jacobs/SKM boreholes.

Table 2.02 – Summary Jacobs/SKM Borehole Details

BH	Location	Easting	Northing	EL	Depth
SKM-BH01	RH Embankment – Crest	318491	5835404	577.235	6.8
SKM-BH02A	LH Embankment – Crest	318644	5835415	577.715	1.2
SKM-BH02B	LH Embankment – Crest	318644	5835415	577.715	8.8
SKM-BH03	RH Embankment toe	318674	5835153	573.865	2.9
SKM-BH04	LH Embankment – Crest outer	318718	5835023	577.955	4.9
SKM-BH05	RH Embankment – Crest outer	318582	5835021	577.780	6.5

Typically the Jacobs/SKM boreholes were drilled through materials comprising:

- Zone 2 – general semi-impervious fill material;
- Zone 1 – impervious clay core and key trench fill material; and
- Refusal of auger drilling on bedrock.

In borehole SKM-BH03, it is reported that Zone 3 filter material was encountered at the toe of the right hand embankment. This filter material is overlying natural soil, which overlies the Dacite bedrock.

Copies of the Jacobs/SKM borehole logs are provided in Appendix 2.05.

Samples of the soil materials obtained from the boreholes were submitted for laboratory testing. The laboratory testing comprised:

- Moisture Content;
- Atterberg Limits;
- Particle size distribution with hydrometer;
- Emerson Classification; and

- Bulk Density.

A summary of the results of these laboratory tests is provided in Table 2.03.

Copies of the laboratory test certificates extracted from Jacobs/ SKM (2014) are provided in Appendix 2.06.

Table 2.03 – Summary Jacobs/SKM Laboratory Testing Results

BH	Depth	Material Zone	MC %	Dry Density	LL %	PL %	Emerson Class		Gravel %	Sand %	<0.075mm %
							Distilled Water	Pond Water			
SKM-BH01	1.5 – 1.91	Zone 1	23.3	1.64	82	58	2	5	8	26	66
SKM-BH01	3.5 – 3.94	Zone 1	27.2	-	74	50	2	5	7	18	75
SKM-BH02B	1.2	Zone 2	11.3	-	-	-	2	5	29	40	31
SKM-BH02B	5.5 – 5.95	Zone 1	29.1	1.5	78	54	2	5	5	26	69
SKM-BH03	1.5	Zone 3	-	-	-	-	-	-	20	48	32
SKM-BH03	2.0 – 2.3	Alluvial soil	10.7	-	28	13	-	-	16	43	41
SKM-BH04	1.5	Zone 2	10	-	-	-	-	-	17	43	40
SKM-BH05	2.0 – 2.5	Zone 2	7.1	-	-	-	3	5	31	46	23
SKM-BH05	4.3 – 4.74	Zone 1	16.8	1.83	39	25	2	5	7	45	48

These results indicate the embankment material properties typically comprise:

- Zone 1:
  - Medium to high plasticity sandy CLAY;
  - Greater than nominally 50% passing 0.075mm(fines);
  - Dispersive in distilled water but not dispersive in pond water;
  - Insitu moisture content in the range of nominally 20% to 30%.
- Zone 2:
  - Gravelly Clayey SAND;
  - Greater than nominally 30% passing 0.075mm(fines); and
  - Insitu moisture content of 7% to 12%.

- Zone 3:
  - Gravelly SAND with some silt and clay; and
  - Nominally 30% passing 0.075mm (fines) and 20% passing 0.002mm (CLAY).

3. SMEC SITE INVESTIGATIONS

3.1 General

As part of the detailed design of the Isabella Weir Upgrade Design, site investigations were undertaken. The scope of the site investigations comprised:

- Site survey;
- Potholing of underground services; and
- Geotechnical investigations comprising:
  - Test pit excavations in the crest of the flanking embankments;
  - Test pit excavations at the end of the concrete return walls;
  - Test pit excavation at the upstream toe of embankment; and
  - Laboratory testing of representative soil samples.

The results of the site investigations were used to:

- Develop a site topographic plan;
- Provide details on the levels and nominal depth of the gas main and associated Telstra conduit services that traverse through the site;
- Identify the nominal level of rock along the upstream toe of the weir embankment;
- Confirm the nominal depth to the Zone 1 clay core below the weir crest;
- Obtain soil samples of Zone 1 and Zone 2 materials and undertake associated laboratory testing and classification of embankment materials; and
- Assess the potential presence of adversely orientated joint defects in the foundation of the weir.

3.2 Conduct of Investigations

3.2.1 Site Survey

SMEC engaged local survey Leach-Steger to provide survey of the site. The survey provided covers an area approximately 200m by 200m, extending from the west side of Drakeford Drive, incorporating the weir and approach channel, the creek and adjacent banks downstream of the weir. The survey is based on the SGC/AGC grid, which is the local survey grid used for municipal development in the ACT. All levels are to Australian Height Datum (AHD).

The survey model provides the following:

- Topographical details;
- Alignment of overhead and underground services;
- Location of roads and access tracks;

- Location of dam monitoring instrumentation;
- Details of the vegetation; and
- Structure features of the weir.

It should be noted that magnetic north is approximately 12° east of grid north.

A copy of the survey plan of the site is provided in Appendix 3.01.

3.2.2 Potholing of Services

Following the construction of the weir, a 200mm diameter gas main was installed through both flanking embankments for the weir, and across the creek channel downstream of the weir. As part of the gas main installation, telecom (Telstra) cables were also installed in a separate conduit adjacent to the gas main.

Potholing of the gas main was undertaken in January 2015 by Leach-Steger to determine the depth at which the services have been installed.

A total of 16 potholes were excavated by vacuum excavation/non-destructive digging methods to expose both the Telstra and gas main conduits. The services conduits were observed to comprise:

- Gas main – yellow 200mm diameter steel pipe; and
- Telstra – white 2 x 100mm to 110mm diameter PVC pipe.

A summary of the potholing results is provided in Table 3.01, which includes:

- Eastings and northings of the pothole locations;
- Depths, in metres, to the top of the conduits below existing ground surface; and
- Elevation of the top of the service conduits

A copy of the report on the potholing survey is provided in Appendix 3.02. The locations of the potholes are shown on the geotechnical investigations location plan, drawing number 3002402-00-300-2001. A copy of this drawing is included in Appendix 3.03.

Table 3.01 – Summary of Potholing Results

Pothole No.	Conduit	Easting	Northing	Depth	Surveyed EL Top of conduit
1.0	Gas Main – Steel 200mm	206037.812	588132.526	0.9m	EL576.107
1.1	Telstra – PVC – 2 x 110mm	206037.748	588132.620	0.72m	EL576.254
2.0	Gas Main – Steel 200mm	206021.802	588122.231	1.00m	EL576.538
2.1	Telstra – PVC – 2 x 110mm	206021.813	588122.185	0.89m	EL576.663
3.0	Gas Main – Steel 200mm	206008.496	588113.371	1.03m	EL575.393
3.1	Telstra – PVC – 2 x 110mm	206008.499	588113.372	0.81m	EL575.611
4.0	Gas Main – Steel 200mm	205978.631	588094.010	0.65m	EL574.876
5.0	Gas Main – Steel 200mm	205966.034	588109.480	0.95m	EL571.084
6.0	Gas Main – Steel 200mm	205942.782	588148.729	1.25m	EL569.235
7.0	Gas Main – Polyethylene 200mm	205931.604	588154.101	0.80m	EL571.190
8.0	Gas Main – Steel 200mm	205918.112	588171.447	0.90m	EL573.029
8.1	Telstra – PVC – 2 x 100mm	205917.550	588171.644	0.60m	EL573.298
9.0	Gas Main – Steel 200mm	205932.033	588185.469	0.85m	EL573.581
9.1	Telstra – PVC – 2 x 100mm	205932.035	588185.468	0.55m	EL573.860
10.0	Gas Main – Steel 200mm	205952.186	588205.248	1.40m	EL576.361
10.1	Telstra – PVC – 2 x 100mm	205952.122	588205.330	0.85m	EL576.883

3.2.3 Test Pit Excavations

Test pit excavations were undertaken in the embankment over the period of 18th to 19th of March 2015. A total of 10 test pits, designated TP01 to TP10, were excavated in the earthfill materials of the embankment sections of the weir. The test pits were excavated using a 21 tonne excavator, Hyundai 210LC-7 model, with a 1.2m wide ripper toothed bucket. The excavations were undertaken in the full-time presence of a senior geotechnical engineer from SMEC.

Details of the test pit excavations are summarised in Table 3.02, which includes:

- Test pit number;
- Test pit location with respect to the weir;
- Chainage of the test pit, with respect to original crest set out control line;
- Easting and northing of the upstream limit of the test pit excavations;
- Depth of test pit; and
- Test pit dimensions.

Table 3.02 – Summary of 2015 Test Pit Excavations

TP No.	Location	Chainage Pt 7 to Pt 6	Easting	Northing	Max. Depth	Size Length x width
TP01	Left embankment, left abutment	_	206071.40	588058.30	2.4m	5.5m x 1.4m
TP02	U/S toe of left embankment	57.5m	206037.20	588113.60	3.2m	6.5m x 1.4m
TP03	Left embankment across crest	64.0m	206030.24	588116.62	3.7m	6.9m x 1.4m
TP04	Left side end of concrete return wall, U/S of left embankment	87.0m	206018.70	588136.14	3.6m	4.7m x 1.4m
TP05	Left embankment across crest	93.5m	206010.56	588138.46	4.5m	8.5m x 1.4m
TP06	Right embankment across crest	156.0m	205971.11	588187.49	3.3m	10.5m x 1.4m
TP07	Right side of concrete return wall U/S of right embankment	171.0m	205965.02	588203.44	4.8m	6.2m x 1.4m
TP08	Right embankment across crest at location of the R/H end of Zone 1 clay core	188.5m	205950.37	588208.05	2.0m	6.0m x 1.4m
TP09	U/S side of the right embankment between concrete return wall and right abutment	177.5m	205963.54	588205.55	4.0m	5.5m x 1.4m
TP10	U/S side of the abutment of the right embankment	195.5m	205952.10	588218.90	1.4m	5.5m x 1.4m

The location of the upstream end of each of the test pits is shown on the plan of the geotechnical investigations drawing number 3002402-00-300-2001. A copy of this drawing is provided in Appendix 3.03.

The test pit locations were initially measured using a hand held GPS with an accuracy of +/-5m. The positions of the pits were also measured using a tape and compass relative to the crest of the embankment and the weir concrete training walls to more accurately locate the test pits relative to the weir structures.

The elevation of the test pits were estimated from the 0.2m topographical survey contours.

Each of the test pits was logged, sketched and photographed by SMEC's Senior Geotechnical Engineer. Copies of the test pit logs, sketches and photographs are included in Appendix 3.04.

Bulk soil samples of the representative materials encountered in the test pit excavations were obtained. Undisturbed soil samples were obtained from the top of the Zone 1 clay core material in test pits TP03 and TP06 using a U-50 tube. The U-50 tube samplers were driven using force applied by the excavator bucket. Some damage to the ends of the steel tubes occurred but it was assessed that the damage to the tube was limited in extent and would not impact on the undisturbed nature of the sample within the body of the tube.

The test pit excavations were reinstated by backfilling the pit with the excavated spoil in lifts of nominally 300mm, then achieving compaction of the layer using a vibrating compaction plate that was attached to the excavator.

3.2.4 Geological Mapping

Geological mapping of rock exposures on the left and right hand side of the creek downstream of the weir was undertaken on the 19th of March 2015. Measurements of the orientation and characteristic features of rock joint defects were taken using a tape and geological compass.

The location of the rock exposures where mapping was undertaken is indicated in drawing 3002402-00-300-2001, a copy of which is presented in Appendix 3.03.

4. GEOTECHNICAL INVESTIGATION RESULTS

4.1.1 General

The results of the SMEC geotechnical investigations undertaken for the project are presented below as follows:

- Test pits in the crest of the embankment;
- Test pits in the upstream toe of the embankment;
- Laboratory testing results; and
- Downstream geological mapping.

4.1.2 Results of Test Pits in Crest of Embankment

Test pit were excavated across crest of the weir embankment to confirm the zoning of material in the upper section of the embankment. These test pits were designated:

- Left embankment:
  - TP01
  - TP03
  - TP05
- Right embankment:
  - TP06
  - TP08

The sketches of the observed distribution of materials within the test pits included in Appendix 3.04 graphically represent the distribution of materials observed in these test pits.

Sub-surface conditions observed in the test pits excavated in the crest of the embankments are summarised in Table 4.01 and Table 4.02, which detail:

- Depth below ground level;
- Description of materials encountered directly beneath the crest of the embankment; and
- Description of materials encountered on the upstream flank of the clay core.

Table 4.01 – Sub-surface Conditions Below Crest of Left Embankment

Depth (m BGL)	Material Below Crest	Material Upstream of Crest
0.0m to 0.2	**Sandy SILT [TOPSOIL]:** Light brown with grass roots	
0.2m to -1.5m	**Silty Gravelly CLAY and Clayey SAND [FILL}:** Brown grey, low plasticity with fine grained sand, gravel and some cobbles, material has been placed in layers and typically dense to very dense and dry **(Zone 2 – General Fill)**	
1.5m to 4.5m	**Silty Sandy CLAY [FILL]:** Grey green to yellow, medium to high plasticity, very stiff, moist to wet, **(Zone 1 – Clay Core Fill)**	**Silty Gravelly CLAY and Clayey SAND [FILL]:** Same as above, **(Zone 2 – General Fill)**

Table 4.02 – Sub-surface Conditions Below Crest Right Embankment

Depth (m BGL)	Material Below Crest	Material Upstream of Crest
0.0m to 0.2	**Sandy SILT [TOPSOIL]:** Light brown with grass roots	
0.2m to 1.3m	**Silty Gravelly CLAY and Clayey SAND [FILL]:** Brown grey, low plasticity with fine grained sand, gravel and some cobbles, material has been placed in layers and typically dense to very dense and dry, **(Zone 2 – General Fill)**	
1.3m to 3.3m	**Silty Sandy CLAY [FILL]:** Grey green to yellow, medium to high plasticity, very stiff, moist to wet, **(Zone 1 – Clay Core Fill)**	**Silty Gravelly CLAY and Clayey SAND [FILL]:** Same as above, **(Zone 2 – General Fill)**

In general terms beneath the crest of the test pits a layer of Zone 2 material comprising Silty gravelly CLAY to Clayey SAND was observed to be overlying Zone 1 Silty CLAY.

Variation from the general crest arrangement described in Table 4.01 and Table 4.02 was observed in test pits TP01 and TP08. These test pits were nominally excavated near the left abutment of the left embankment and right abutment of the right embankment, respectively.

The subsurface conditions encountered in TP01, excavated on the left abutment of the embankment, is summarised in Table 4.03. Notably, this test pit encountered an old road pavement below an initial cover of fill comprised Silty sandy CLAY. Material that could be considered to represent Zone 1 clay core material was not observed in the embankment at the location of TP01.

Table 4.03 – Sub-surface Conditions in Test Pit TP01 at Crest of Left Abutment

Depth (m BGL)	Material Description
0.0m to 0.2	**Sandy SILT [TOPSOIL]:** Light brown with grass roots
0.2m to 0.7m	**Sandy Silty CLAY and Clayey GRAVEL mix [FILL]:** Yellow brown, very dense fill, **(Zone 2 – General Fill)**
0.7m to 0.8m	**Road Pavement:** Bitumen seal and road base material
0.8m to 1.7m	**Sandy silty CLAY [Residual]:** Mottled orange grey with some iron staining
1.7m to 2.4m	**DACITE [BEDROCK]:** Mottled yellow and grey, medium grained, extremely to highly weathered, extremely low to low strength

The conditions TP08, which was excavated near the right abutment of the right embankment, is summarised in Table 4.04. Notably, this test pit encountered the right hand end of the Zone 1 clay core. At this location highly weathered Dacite rock was encountered below the Zone 1 clay core material on the right hand side of the pit at nominally 1.4m depth below the crest of the weir.

Table 4.04 – Sub-surface Conditions in Test Pit TP08 at Crest of Right Abutment

Depth (m BGL)	Material Description
0.0m to 0.2	**Sandy SILT [TOPSOIL]:** Light brown with grass roots Topsoil
0.2m to 1.3m	**Sandy Silty CLAY [FILL]:** Brown grey, hard with some gravel, **(Zone 2 – General Fill)**
1.3m to 1.9m	**Silty Sandy CLAY [FILL]:** Grey green to yellow, medium to high plasticity, very stiff, moist to wet, **(Zone 1 – Clay Core Fill)**
1.9m to 2.0m	**DACITE [BEDROCK]:** Brown with white speckles, fine grained, extremely to highly weathered, extremely low to very low strength

4.1.3 Results of Test Pits in Upstream Toe of Embankment

Test pit excavations were undertaken along the upstream toe of the weir embankments. The purpose of these excavations was to confirm the nominal depth to rock and the materials overlying the rock.

The test pits excavated at the upstream toe of the embankment comprised:

- Left embankment:
  - TP02
  - TP04
- Right embankment:
  - TP07
  - TP09
  - TP10

Sketches of these test pits are included in Appendix 3.04 to graphically represent the distribution of materials observed in these test pits.

Variable subsurface conditions were observed in the two test pits, TP02 and TP04, excavated at the upstream toe of the left embankment. The results of these test pits are summarised in Table 4.05 and Table 4.06 respectively. These tables show:

- Depth below ground level; and
- Description of materials encountered at the upstream toe of the embankment.

Table 4.05 – Sub-surface Conditions in TP02 at Upstream Toe of Left Embankment

Depth (m BGL)	Material Description
0.0m to 0.2m	**Sandy SILT [TOPSOIL]:** Light brown with grass roots Topsoil
0.2m to 2.0m	**Sandy Silty CLAY [FILL]:** Brown grey, hard with some gravel, **(Zone 2 – General Fill)**
2.0m to 2.6m	**Sandy Gravelly CLAY [RESIDUAL]:** Dark grey brown, low plasticity, moist, hard
2.6m to 3.0m	**Dacite [BEDROCK]:** Yellow grey with white specks, extremely weathered, extremely low to very low strength
3.0m to 3.2m	**Dacite [BEDROCK]:** grey purple with white specks, highly weathered, low strength

Table 4.06 – Sub-surface Conditions in TP04 at Left End of Concrete Return Wall

Depth (m BGL)	Material Description
0.0m to 0.2m	**Sandy SILT [TOPSOIL]:** Light brown with grass roots Topsoil
0.2m to 2.3m	**Sandy Silty CLAY [FILL]:** Brown grey, hard with some gravel, **(Zone 2 – General Fill)**
2.3m to 3.5m	**Silty Gravelly SAND [FILL – crusher dust]: G**reen grey, coarse grained poorly graded with some gravel and silt
3.5m to 3.6m	**Dacite [BEDROCK]:** Pink grey , highly to moderately weathered, medium to high strength

The test pit TP04 is located on the upstream toe of the embankment adjacent to the ends of the left hand concrete weir return wall. In this test pit green grey Silty Gravelly SAND was encountered between 2.3m and 3.5m depth in TP04. This material is interpreted to be a crusher dust quarry sand type product. Fill material comprising Silty Gravelly SAND with clay was observed to be overlying the crusher dust sand. The overlying fill material is considered to have been derived compaction of residual or extremely weathered Dacite, which has been placed and compacted in the embankment toe as Zone 2 material.

TP07 and TP09 are located on the upstream toe of the right embankment adjacent to the ends of the concrete weir return wall. At the right hand end of the right concrete return wall Silty Gravelly SAND (crusher dust) material was encountered in test pit TP07 at a depth of 3.0m to 3.8m. Fill comprising Gravelly Clayey SILT was observed to be overlying the crusher dust sand.

Underlying the crusher dust sand, high plasticity silty CLAY was observed in these test pits, with Dacite rock observed to be underlying the clay.

The Silty CLAY material in TP07 and TP09 was observed to be similar to the Zone 1 clay core material observed in test pits TP06 and TP08. It is noted that the test pits TP07 and TP09 are located in the area where the diversion channel used to divert creek flows around the weir site during construction of the weir as shown on the W.A.E. drawing W.A.E.88/12423. It is considered that the Silty CLAY encountered in these test pits is Zone 1 material that was used to back fill the diversion channel as indicated on the drawing.

Test pit TP10 was excavated near where the toe of the right hand embankment meets the right abutment. This test pit excavation encountered extremely weathered Dacite at 0.4m depth. The test pit was excavated to 1.4m depth through 0.7m of extremely weathered Dacite and then a further 0.3m into highly weathered Dacite.

Rock joint defects were observed in test pit TP10 and measured using a geological compass. The orientation of the joint sets measured in TP10 comprises:

- 30° to 36° dip angle and 085° to 088° dip direction; and
- 85° dip angle and 150° dip direction.

The observed or interpreted depth and elevation of bedrock along the upstream toe of the embankment of the rock where encountered in the test pits is summarised in Table 4.07.

Table 4.07 – Rock levels Observed along Upstream Toe of Embankments

Test Pit	EW Dacite		HW Dacite	
	Depth	Elevation	Depth	Elevation
TP01	1.7m	576.3m	2.0m	576.0m
TP02	2.6m	574.8m	3.0m	574.4m
TP04			3.5m	573.5m
TP07			4.8m*	572.3m*
TP09	3.0m	574.0m	3.9m	573.1m
TP10	0.4m	577.3m	1.1m	576.6m

**Interpreted to be HW rock to be at the base of the test pit TP07 but due to the limit of the excavator the rock level indicated was not confirmed by the observation of the excavated spoil*

The bed rock levels detailed in Table 4.07 indicate that the rock levels decrease from the abutments of the embankment towards the creek. It is also observed that the thickness of extremely weathered overlying highly weathered Dacite is in the range of 0.3m to 0.9m. Extremely weathered Dacite rock was not encountered in the test pits at the ends of the concrete weir return walls. It is considered that the extremely weathered rock was removed at the locations of test pits TP04 and TP07 during foundation preparation works for construction of the weir.

4.1.4 Seepage Water Observations

Seepage water inflow into the test pit excavations was observed in a number of test pits. The location, depth and level of the observed seepage water inflows comprise:

- TP04 at 3.2m (EL573.8m);
- TP05 at 4.0m (EL573.45m);
- TP07 at 3.0m (EL574.1m); and
- TP09 at 3.0m (EL574.1m).

4.1.5 Laboratory Testing Results

Representative bulk samples and undisturbed tube samples were submitted for laboratory testing. The testing schedule was developed to provide soil classification of grading, plasticity, dispersive characteristics and shear strength. These tests comprised:

- Moisture content;
- Atterberg Limits and linear shrinkage;
- Particle size distribution with hydrometer;
- Standard Compaction (MDD & OMC);
- Emerson Classification;
- Pinhole Dispersion; and
- Consolidated undrained with pore pressure measurement triaxial test (CUPP).

Copies of the laboratory testing certificates are included in Appendix 4.01. The results of the laboratory testing are summarised in Table 4.08. This table details:

- Test pit number;
- Depth of sample;
- Interpreted embankment material zone;
- Field Moisture content (MC %);
- Maximum dry density (MDD t/m^3);
- Optimum moisture content (OMC %);
- Liquid limit (LL %);
- Plastic limit (PL %);
- Linear shrinkage limit (LS %);
- Emerson Class;
- Percent dispersion;
- Gravel sized fraction of the soil sample (Gravel %);
- Sand sized fraction of the soil sample (Sand %); and

- Silt and Clay sized fraction of the soil sample (<75μm %);

Table 4.08 – Summary 2015 Test Pit Laboratory Testing Results

TP No.	Depth	Interpreted Material Zone	MC %	MDD t/m^3	OMC %	LL %	PL %	LS %	Emerson Class	Pinhole Dispersion	Gravel %	Sand %	<75μm %
									Distilled Water				
TP03	1.5m-1.8m	Zone 1	19.5			71	22	17.5	2	D1	2.1	19.8	78.1
TP03	1.6m-1.9m	Zone 1		1.63	21.8	72	19	15	1		5.2	29.2	65.6
TP04	2.3m-2.6m	Zone 3	18.7								19	52.8	28.7
TP05 (U/S)	1.5m-2.5m	Zone 2		1.982	11.1	40	13	10	1		22	49	29
TP05 (D/S)	1.5m-2.5m	Zone 1		1.576	23.2	75	21	16	1		7.5	22	70.5
TP06	0.5m-1.0m	Zone 2		1.976	10.9	29	12	6	1		17.1	48.5	34.4
TP06 (Centre)	1.0m-1.6m	Zone 1		1.688	19.5	71	19	15.5	1		6.2	31.5	62.3
TP06	1.6m-1.95m	Zone 1	21.6			64	19	13	2	D1	5.9	32.9	61.2
TP06 (U/S)	2.0m-2.5m	Zone 2		2.05	9.9	27	13	7	4		35.5	43.7	20.8
TP07	3.0m-3.4m	Zone 3	12.9								32.2	43.2	24.6
TP07	4.0m-4.8m	Zone 1		1.668	19.7	68	20	16	1		4.9	29.3	65.8
TP08	1.6m-2.0m	Zone 1		1.655	20.8	69	20	16	1		4.8	27.7	67.5

Plots of the grading curves from the test pit soil samples are provided in Figure 4.01, together with the designed embankment zone grading envelopes specified by Coffey (1985) for the embankment design.

The results of the Atterberg Limits tests for plasticity undertaken on the test pit soil samples are plotted on a Casagrande Chart in Figure 4.02.

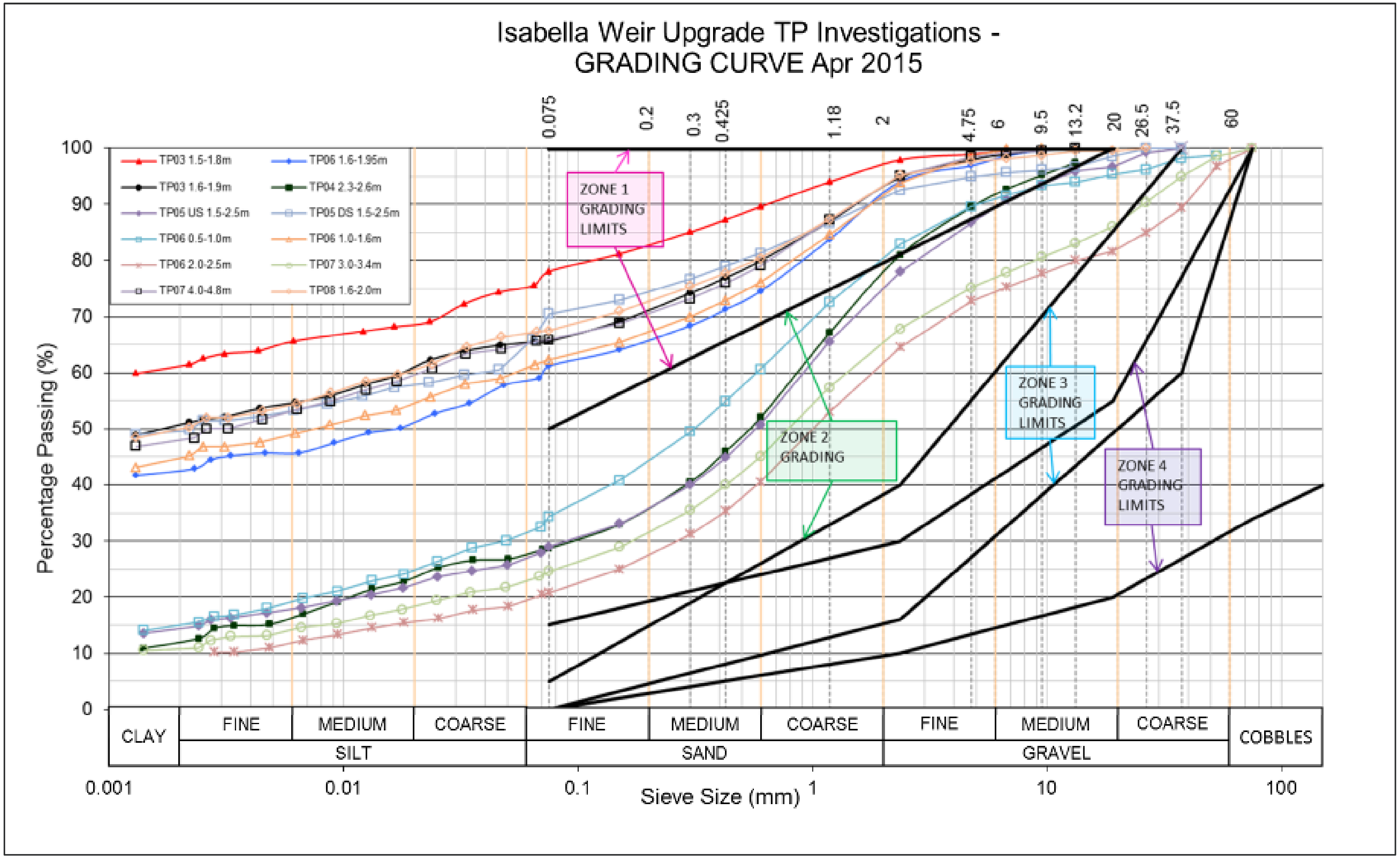


Figure 4.01 – Particle Size Distribution Grading Curves, with Design Grading Envelopes, SMEC 2015 Test Pits.

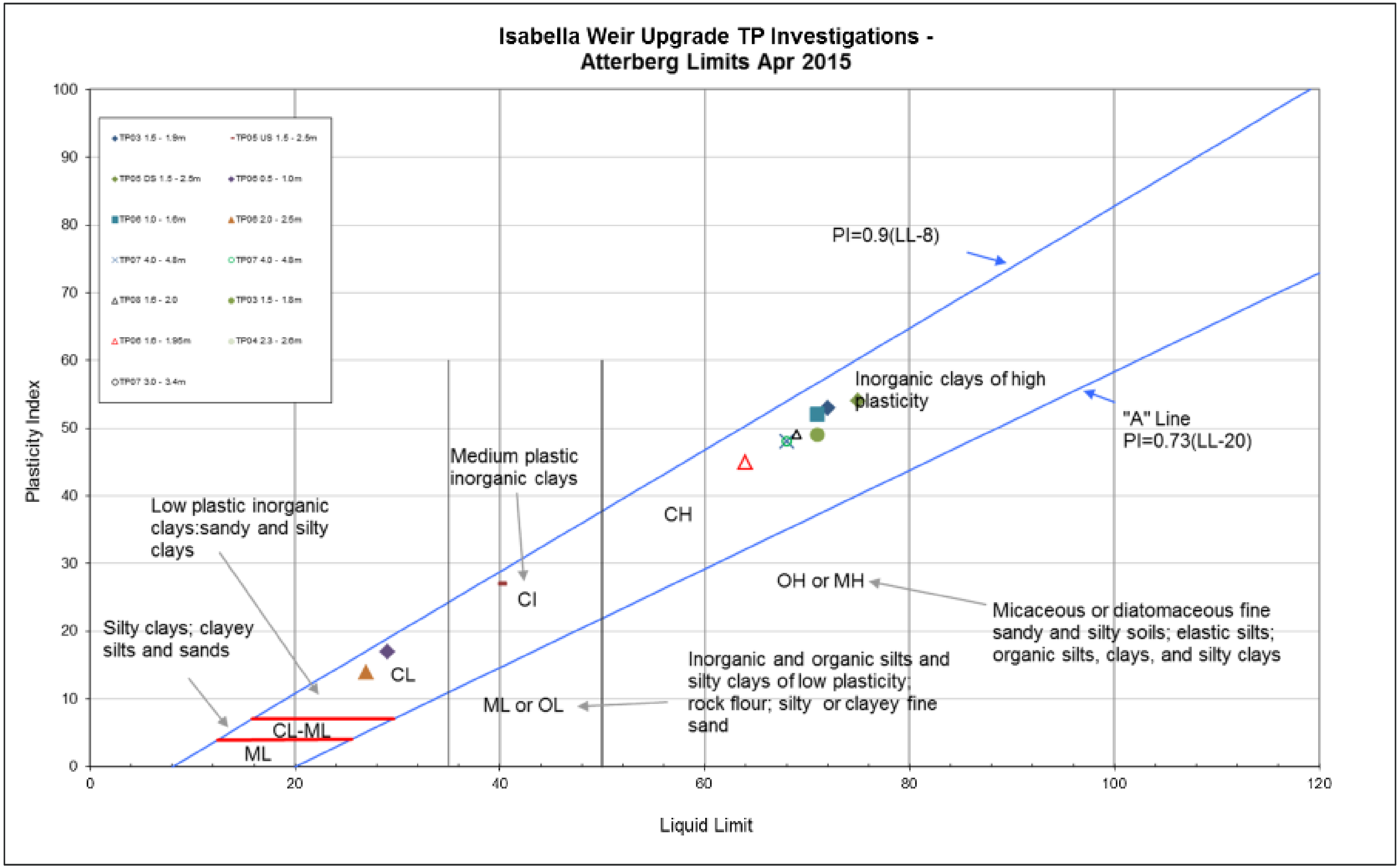


Figure 4.02 – Atterberg Limits from SMEC 2015 Test Pits

Figure 4.01 indicates that the Zone 1 samples tested have a typical particle size distribution that meets the Coffey (1985) design grading envelope, with particle size distribution characteristics of:

- 50% passing 0.075mm sieve;
- 100% passing 19mm; and
- 40% and 60% is clay sized particles, <0.002mm.

The results of the Atterberg limit tests on the test pit samples presented in Figure 4.02 shows that the Zone 1 material is clay of high plasticity with:

- Liquid limit in the range of 60% to 80%; and
- Shrinkage limits in the range of 15% to 18%.

The dispersion characteristics of the Zone 1 materials have been classified as highly dispersive in distilled water. The Jacobs/SKM (2014) Emerson Class test results were undertaken in both distilled and pond water. These results indicated that the Zone 1 material is Emerson Class 5 when subjected to pond water. This variation in dispersive characteristics is possibly due to the salinity of the water in the Isabella Pond. Higher salinity water can restrict cat-ion exchange potential between the water and clay particles and hence restrict soil dispersion.

The particle size distribution of Zone 2 materials is shown in Figure 4.01. The results indicate that the Zone 2 materials tested generally met the Coffey (1985) design grading, although the soils tested deviate from the design grading in that a greater percentage of 2mm to 6mm sized soil particles was measured.

The grading of the Zone 2 material tested characteristically comprises:

- 20% to 80% of sand size particles, <2mm and >0.075mm;
- 20% and 35% is clay and silt size particles, <0.075mm size;
- 10% and 15% is clay size particles, <0.002mm size; and
- Maximum particle size between 37mm and 75mm.

Dispersive characteristics of the Zone 2 materials tested indicate that it is dispersive to potentially dispersive in distilled water.

Zone 3 materials tested do not meet the design grading envelopes specified by Coffey (1985). The Zone 3 samples tested are significantly finer than the design grading and generally fit within the Zone 2 design grading envelope. The grading of the Zone 3 samples obtained from the SMEC test pits on the upstream side of the weir are similar to the particle size distribution reported by Jacobs/SKM (2014) for samples of Zone 3 obtained from borehole BH03 located in the downstream toe of the embankment.

Standard compaction testing was undertaken on bulk samples of Zone 1 and Zone 2 materials obtained from the test pits. The results of these tests are presented in Figure 4.03.

The compaction characteristics of the Zone 1 test pit samples comprise:

- Maximum Dry Density (MDD) in the range of 1.58t/m^3 to 1.68t/m^3;
- OMC in the range of 19% to 25%; and
- OMC is slightly wet of plastic limit for this material.

The compaction characteristics of the Zone 2 test pit samples comprise:

- Maximum Dry Density (MDD) in the range of 1.98t/m^3 to 2.05t/m^3;
- OMC in the range of 9.9% to 11.1%; and
- OMC is typically 1% to 2 % dry of the plastic limit for this material.

Undisturbed U-50 tube samples of Silty CLAY material were obtained from test pits TP03 and TP06. The tube samples were taken from the zone of the embankment that is considered to be Zone 1 impervious clay core material. These undisturbed samples were submitted for consolidated undrained triaxial tests with pore pressure measurement, (CUPP). The results of the effective shear strength testing are provided on a p'q plot in Figure 4.04.

The effective shear strength and deformation characteristics of the Zone 1 material based upon these triaxial test results comprise:

- Effective shear strength, c' = 2 kPa; ϕ' = 27°
- Young Modulus, $E'_{(tangent)}$ = 37,500kPa

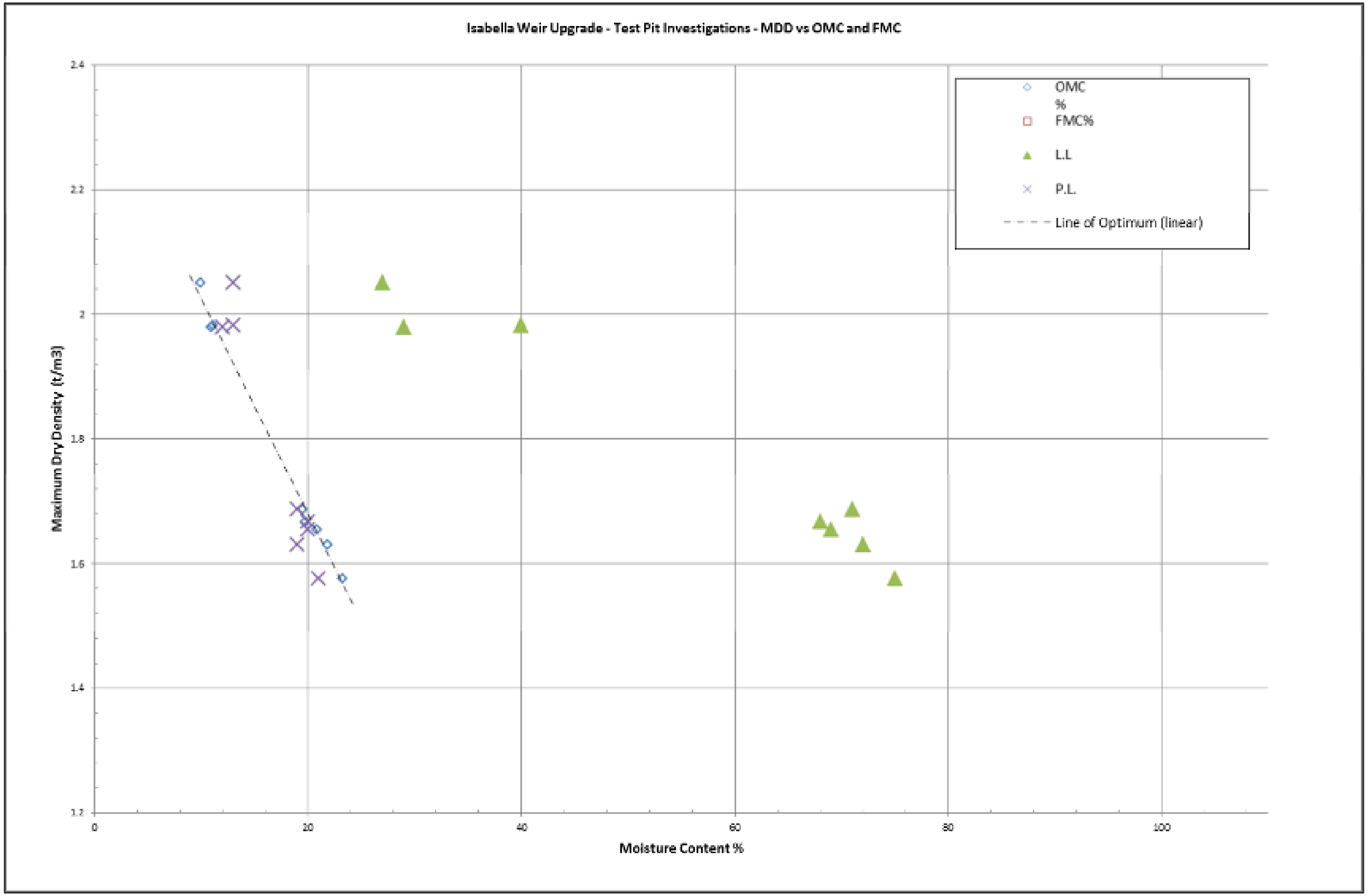


Figure 4.03 – Results of Compaction Testing, SMEC 2015 Test Pits

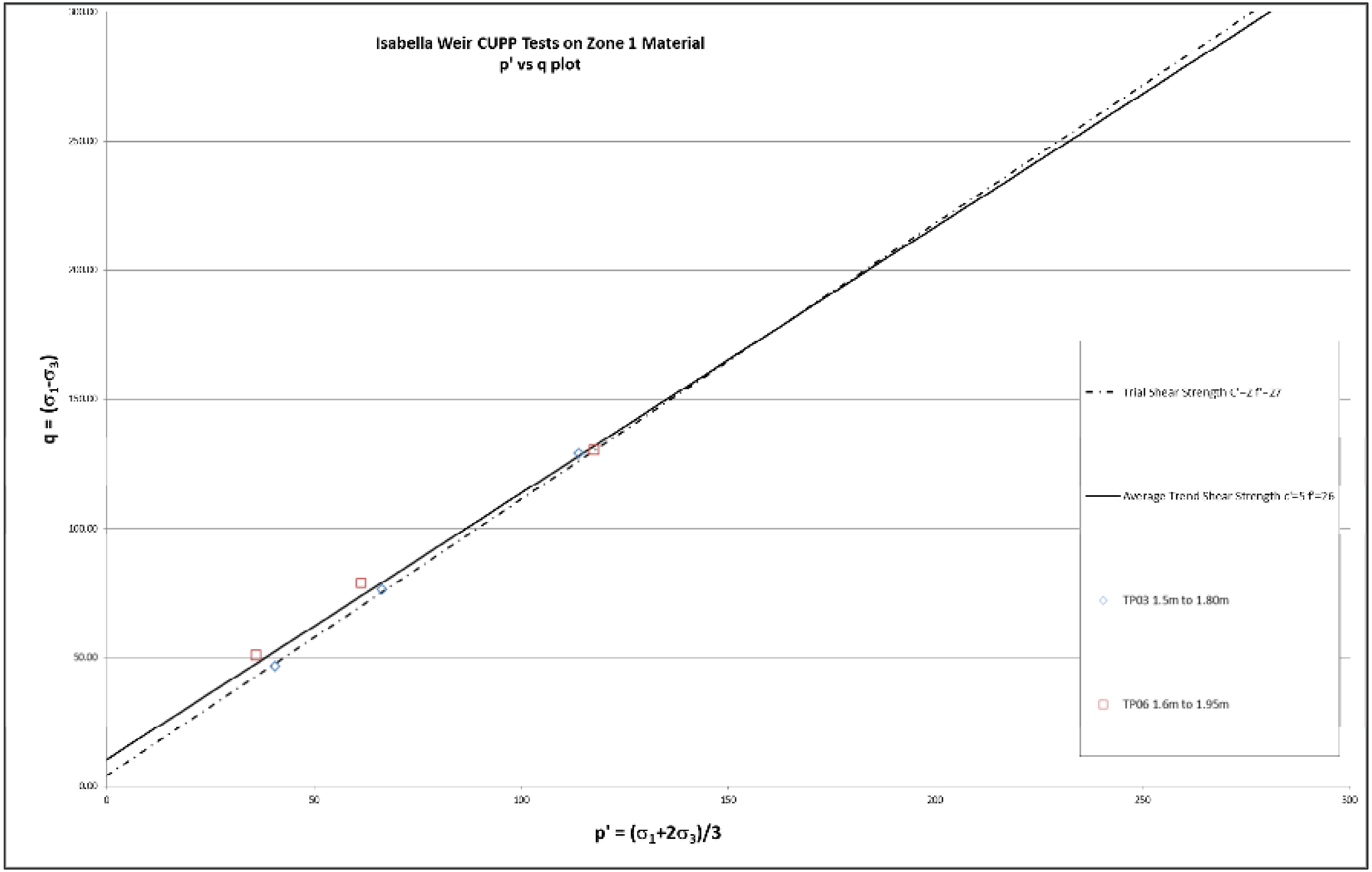


Figure 3.04 – p'q Plot of Consolidated Undrained Triaxial Testing Results

4.1.6 Results of Downstream Geological Mapping

Geological mapping of rock mass joint defects was undertaken on the rock exposures observed directly downstream of the left and right training walls. The measurement of the defect orientation, spacing and persistence was made by tape and geological compass. Observations of the surface characteristics of joint defect including roughness waviness and infill materials were made.

The results of the defect orientation data were plotted onto lower hemisphere pole plots. In general the results show that the principal joint sets interpreted from the stereonet pole plots comprise:

- Joint Set 1 - Steeply dipping joints, with an angle of around 80° to 90°, dipping nominally towards the right abutment of the weir at 315°, (north-westerly direction).
- Joint Set 2 - Moderate to steeply dipping joints with an angle of around 30° to 70°, dipping nominally downstream at 240°, (south-westerly direction); and
- Joint Set 3 - Shallow dipping joints, with an angle of around 20° to 40°, dipping nominally upstream at 080° , (north-easterly direction);

Predominantly the observed continuity of the exposed jointing is in the order of 1m to 5m persistence. Perpendicular joint spacing between joints of the same set is observed to be in the order of 150mm to 500mm.

Typically, the observed surface condition of the rock joints is smooth, planar to undulating, with epidote and carbonate mineral veneers and infills.

Observations of the rock mass exposed directly downstream of the weir made by SMEC are typically in accordance with the rock mass characteristics described by Coffey (1987).

Copies of these stereonet pole plots are provided in Appendix 4.02 and are also presented on the Drawing 3002402-00-300-2001, a copy of which is included in Appendix 3.03.

5. INTERPRETED GEOTECHNICAL MODEL

5.1 General

An interpreted geotechnical model for the embankment and the embankment foundations has been developed based upon the results of the geotechnical site investigations completed at the Isabella weir which comprise:

- Test pits TP01 to TP10 excavated by SMEC in March 2015;
- Boreholes logs provided in Jacobs/SKM (2014);
- Geological mapping provided in Coffey (1987); and
- Boreholes logs provided in Coffey (1985).

Aspects of the interpreted geotechnical model comprise:

- Geotechnical material units;
- Interpreted geotechnical design parameters;
- Interpretation of geological mapping; and
- Interpreted geotechnical long-section drawings.

The interpreted of the adopted geotechnical model has been used as a basis for the detailed design of the Isabella Weir Upgrade works.

5.2 Geotechnical Material Units

The terminology for the material units adopted in the geotechnical model for the Isabella Weir Upgrade Design are based on the terminology specified for the embankment design in Coffey (1985).

The geotechnical material units adopted in the geotechnical model comprise:

- **Topsoil** – Sandy SILT: light brown with grass roots, typically only 0.2m thickness.
- **Zone 1** – Impervious Clay Core – Silty Sandy CLAY: grey green to yellow, medium to high plasticity, very stiff, moist to wet.
- **Zone 2** – Semi Impervious General Fill – Silty Gravelly CLAY and Clayey SAND: Brown grey, low plasticity with fine grained sand, gravel and some cobbles, dense to very dense, dry.
- **Zone 3** – Filter/Working Platform Material – Silty gravelly SAND: green grey, coarse grained poorly graded sand with some gravel and silt, loose to medium dense, saturated.
- **Residual Soil** – Silty Sandy/Gravelly CLAY: mottled orange grey to dark grey brown, low plasticity, hard.
- **Bedrock** – DACITE: mauve, pink grey to yellow brown, highly to moderately weathered medium to high strength at the ends of the concrete return walls. Away from the concrete walls and the embankment core trench foundations, highly to moderately weathered Dacite is overlain by a thin cover of very low strength extremely weathered to highly weathered Dacite.

5.3 Interpreted Geotechnical Design Parameters

Interpretation of geotechnical design parameters has been undertaken based upon the laboratory test results and industry recognised correlations between material descriptions and the laboratory test results. The interpreted parameters recommended for design of the concrete weir retaining walls and weir embankments are summarised in Table 5.01, which provides:

- Unit name;
- Materials description;
- Maximum dry density (MDD in t/m^3);
- Optimum moisture content (OMC %);
- Bulk unit weight (γ_{bulk} in t/m^3);
- Effective shear strength, (cohesion = c' in kPa & friction angle = ϕ' °); and
- Ultimate bearing capacity (q_{ult} in MPa).

Table 5.01 – Interpreted Geotechnical Design Parameters

Unit Name.	Description	MDD (t/m^3)	OMC %	Bulk Unit Weight (t/m^3)	Effective Shear Strength		Ultimate bearing pressure (MPa)
					c'	ϕ'	
Zone 1	Impervious Clay Core Fill – Silty Sandy CLAY	1.67	20	2.0	2	27	0.5
Zone 2	Semi Impervious General Fill – Silty Gravelly CLAY and Clayey SAND	1.99	10	2.2	5	30	1
Zone 3	Filter/Working Platform Fill – Silty gravelly SAND			2.0	0	35	
Residual Soils	Silty Sandy/Gravelly CLAY			1.9			1
EW Dacite	Yellow brown with white speck			2.5			2
HW Dacite	Yellow grey to purple grey			2.5			15
MW-SW Dacite	Purple grey			2.6			40

5.4 Interpreted Geotechnical Long-sections

Geotechnical long-sections drawings depicting the interpreted subsurface conditions along the weir alignment have been developed which comprise:

- Geological Section 1 – Along Control Line Pt. 7 at Ch 0m to Pt. 6 at Ch 270m.
- Geological Section 2 – Along upstream face of concrete return walls at 11.9m upstream of the Control Line.

Drawing 3002402-00-300-2201 presents both these geological sections. A copy of this drawing is provided in Appendix 3.03.

The interpreted geological sections are correlated with the design details presented on the original design drawings and show:

- Along the weir centreline (Geological Section 1):
  - the central overflow (labyrinth) section of the weir is founded on highly to slightly weathered Dacite;
  - the flanking embankments are also founded on highly to slightly weathered Dacite, and with Zone 1 material comprising the bulk of the embankment but with a "capping" layer of about 1m to 1.5m thickness of Zone 2 material extending the length of the embankment.
- Along the upstream face of the approach walls (Geological Section 2), the embankments comprise entirely Zone 2 material (in the upstream shoulder) overlying Dacite.

Along the upstream toe of the embankment, a layer of Silty SAND (crusher dust) was encounter immediately above foundation level. The original design drawings do not show such zoning and the reason for its inclusion within the embankment is not known; probably for some construction benefit, acting as a working platform. In terms of the performance of the embankment, such a localised zone of sandy soil is not significant. Geological Section 2 also shows the backfilling of the diversion channel with Zone 1 material, as detailed in the design drawings.

The interpreted sections indicate that the surface of the rock slopes from high on the abutments towards the creek, with rock levels higher on the right abutment than the upper left abutment. Furthermore, the surface of the rock appears to dip downstream, particularly so on the left abutment.

The interpreted position of the Telstra and gas main services are indicated on the geological sections. These details have been interpreted from the survey report on the pot holing investigations. The gas main is located below the twin Telstra conduits. The interpreted levels of the conduits as shown in both geological long section drawings is summarised in Table 5.03.

Table 5.03 – Summary of Services at Geological Section Lines

Position	Chainage	Conduit	Anticipated Elevation to top of conduit	Anticipated depth
Left Embankment – Section 1	Ch 74.377m	Gas main	EL 576.778m	1.0m
Left Embankment – Section 1	Ch 74.463m	Telstra	EL 576.977m	0.8m
Right Embankment – Section 1	Ch 181.684m	Gas Main	EL 576.140m	1.1m
Right Embankment – Section 1	Ch 181.772m	Telstra	EL 576.566m	0.7m
Left Embankment – Section 2	Ch 73.123m	Telstra	EL 576.564m	0.8m
Left Embankment – Section 2	Ch 73.216m	Gas Main	EL 576.414m	1.5m
Right Embankment – Section 2	Ch 182.437m	Gas Main	EL 576.061m	1.2m
Right Embankment – Section 2	Ch 182.519m	Telstra	EL 576.583m	0.7m

5.5 Interpretation of Geological Mapping

Interpretation of the principal rock joint defect orientations has been undertaken to assess the potential for adversely dipping rock joints in the weir foundation.

Flat or shallow dipping joint defects that are diiping in the downstream direction were not observed in the geological mapping. Interpretation of the stereonet pole plots indicate that a there is potential for a wedge of rock formed by intersecting joint surfaces that are shallow dipping in the upstream direction.

The principal intersecting rock joint sets that form this upstream dipping block of rock comprise:

- Joint Set 3 (J1) – (83°/315°); and
- Joint Set 1 (J3) – (35°/080°).

The line of intersection of these joint defects is orientated with a plunge and trend of:

- Intersection of J1 and J3 = 25° plunge which trends towards 044°, i.e. shallow dipping upstream direction.

The downstream direction of the weir is orientated with a magnetic bearing of nominally 220° and the pole to the line of the J1-J3 intersection has a trend of 224°.

It is therefore considered that the direction of the river and that of the J1-J3 intersection are essentially in the same direction and if sliding in the downstream direction occurred it would be along a surface inclined at nominally 25°.

It is interpreted that the shear strength parameters for assessing sliding stability of the foundation along a rock joint surface would comprise the basic friction angle of the rock surface plus angle of joint dip. The basic friction angle (ϕ_b) of the joint surface is considered to be equivalent to the residual friction angle of the rock joints. Typically the residual friction angle of joint defects for volcanic rock such as Dacite may be about 35°. Therefore the resisting load against sliding in the downstream direction along continuous intersecting rock joints may be assessed using the equation:

- $S = N \times \tan(\phi_b + i)$, where S = sliding resistance, N = normal load, ϕ_b = 35° and i = 25°.

6. SUMMARY AND CONCLUSIONS

Geotechnical investigations were undertaken at the Isabella Weir site prior to and during construction of the weir in the mid to late 1980s. More recently geotechnical drilling investigations were completed as part of the risk assessment works undertaken by Jacobs/SKM in 2014.

Since the Jacobs/SKM investigations, and as part of the detailed design services for the upgrade works for the weir, test pit investigations were undertaken in February 2015 to confirm details of embankment zoning and foundation conditions along the upstream toe of the embankment section of the weir.

The crest of the Zone 1 impervious clay core within the embankment was exposed at a number of locations as part of these test pit investigations. Representative soil samples of the embankment materials were recovered from the test pit excavations. Selected samples were subsequently submitted for laboratory testing. Potholing of the gas main and telecom (Telstra) service conduits that traverse through the site and embankment has also been undertaken.

The findings from the test pits indicate that the embankment zoning is typically in accordance with the available "Work as Executed" drawings. Bedrock comprising highly to less weathered Dacite was observed in the test pits excavated along the upstream toe of the embankment.

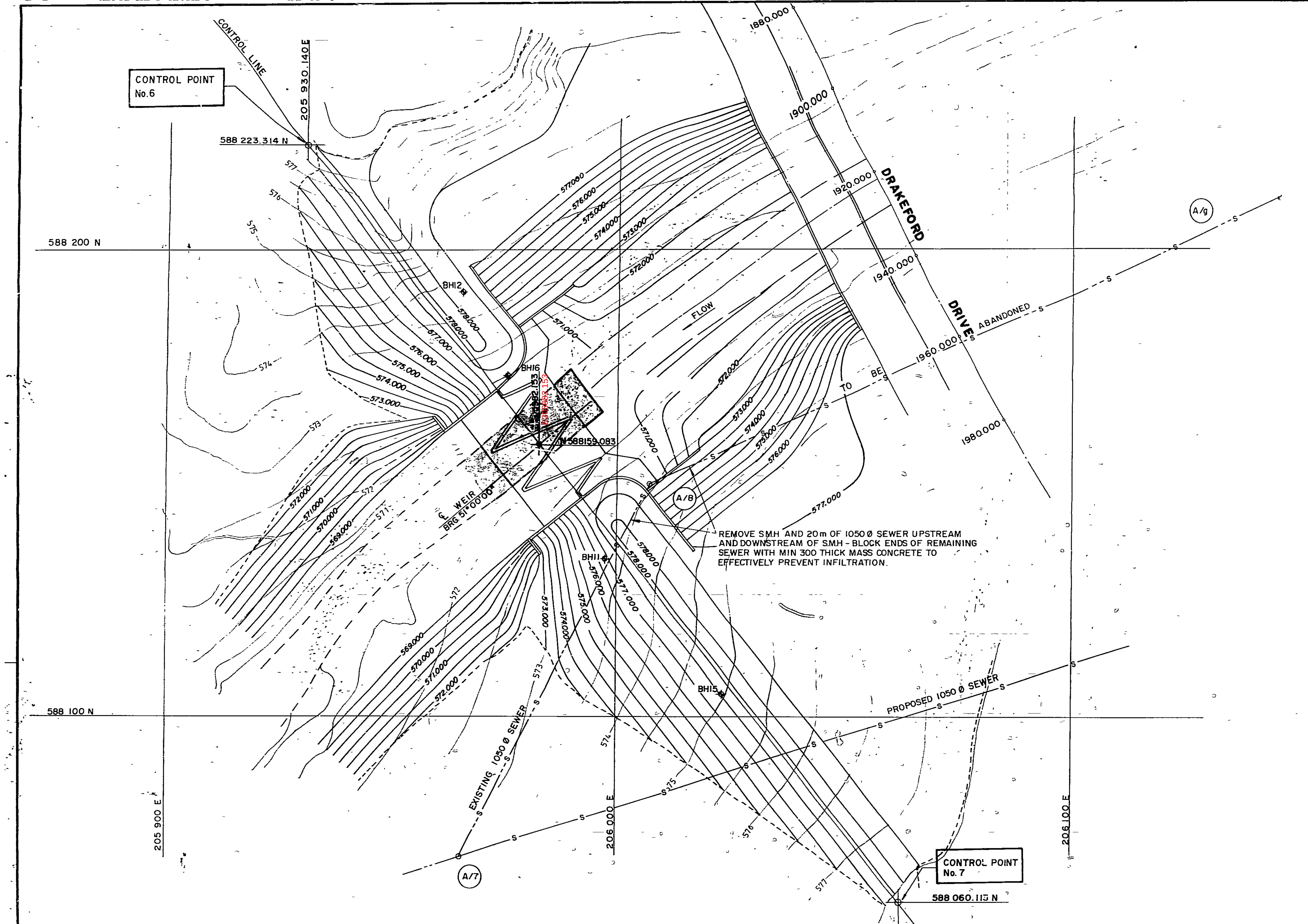
Zone 1 impervious clay core material was exposed at nominally 1.5m below the existing surface of the embankment crest.

Laboratory testing of the soil samples recovered from the test pit excavations has been undertaken. The results of these tests indicate that the Zone 1 and Zone 2 earth fill materials are nominally in accordance with the Coffey (1985) embankment design specifications. Triaxial testing of the Zone 1 core material indicates that the samples tested exhibit strength and deformation properties that would be in the normal range for embankment dam clay core. The classification properties of the Zone 1 material demonstrate that the material is of high plasticity and highly dispersive in distilled water.

Geological mapping of Dacite rock exposures downstream of the weir was undertaken with stereo net pole plots presenting the joint defect mapping results. These plots indicate that shallow dipping joints, which dip nominally in the upstream direction, were observed together with steeply dipping joints that dip across the creek and moderately to steeply dipping joints that dip downstream. The assessment of the jointing geometry has identified a potential rock block that may release when loaded in the downstream direction, albeit with a high friction angle of 60° against sliding.

Geotechnical plan and long-section drawings have been prepared. These drawings show the locations of the borehole and test pit investigation; the alignment and depth of gas main and telecom (Telstra) service conduits at the site. They also indicate the relative relationship between the embankment fill and foundation materials along the alignment of the weir. These drawings together with relevant extracts from previous geotechnical reports and results of the laboratory testing certificates are included as Appendices to this report.

APPENDIX 2.01: ISABELLA WEIR – "AS-CONSTRUCTED" DRAWINGS



REMOVE EXISTING CONCRETE CHANNEL

DENOTES LOCATION OF BOREHOLES.
NOTE: BORELOGS MAY BE INSPECTED AT THE OFFICE OF THE SUPERINTENDENT

FOR WEIR EMBANKMENT DETAILS SEE DRAWING NO. 39169
FOR CHANNEL LONGITUDINAL AND CROSS SECTION DETAILS SEE DRAWING NO 39191

GENERAL NOTES

CONCRETE AND ASSOCIATED WORKS

FOUNDATION MATERIAL SHALL BE APPROVED FOR A SAFE BEARING CAPACITY OF 500 kPa BEFORE PLACING CONCRETE

ALL CONCRETE WORK SHALL COMPLY WITH SAA CONCRETE STRUCTURES CODE AS 1480

CONCRETE SHALL HAVE A CHARACTERISTIC COMPRESSIVE STRENGTH F'c OF 25 MPa AT 28 DAYS

NOMINAL MAXIMUM AGGREGATE SIZE SHALL BE 20mm UNLESS NOTED OTHERWISE

CONCRETE IN WALLS SHALL HAVE A SLUMP OF 80mm MAX
ALL OTHER CONCRETE SHALL HAVE A SLUMP OF 60mm MAX

ADMIXTURES SHALL NOT BE USED WITHOUT THE APPROVAL OF THE SUPERINTENDENT

CONSTRUCTION JOINTS SHALL BE MADE ONLY WHERE SHOWN ON THE DRAWINGS OR WHERE APPROVED BY THE SUPERINTENDENT

CONCRETE SHALL BE COMPACTED BY MECHANICAL VIBRATION

ALL CONCRETE SURFACES SHALL BE CURED AS SPECIFIED FOR A MINIMUM OF SEVEN DAYS

ACCEPTANCE CRITERIA SHALL BE SPECIFIED IN SAA CONCRETE STRUCTURES CODE AS 1480

MINIMUM CONCRETE COVER TO ANY REINFORCEMENT INCLUDING FITMENTS SHALL BE :
FOOTINGS – 75mm CAST AGAINST EXCAVATION
– 50mm CAST AGAINST FORM
– 50mm TOP
WALLS – 65mm GENERALLY; 50mm FOR REAR FACE OF RETAINING WALL
SLABS – 65 TOP; 65 BOTTOM

KEY TO REINFORCEMENT NOTATION
R = PLAIN BAR STRUCTURAL GRADE
Y = DEFORMED BAR GRADE 410 TO AS 1302
F = HARD DRAWN WIRE FABRIC
– THE NUMBER BEFORE THE REINFORCEMENT TYPE INDICATES THE NUMBER OF BARS IN THE GROUP
– THE NUMBER AFTER THE REINFORCEMENT TYPE INDICATES THE BAR SIZE IN MILLIMETRES
– THE NUMBER FOLLOWING THE BAR SIZE INDICATES THE BAR SPACING IN MILLIMETRES

THE STRUCTURE HAS BEEN DESIGNED TO CARRY THE FOLLOWING SUPERIMPOSED LOADS: A COMBINED HYDROSTATIC PRESSURE LOADING DUE TO 1:10 000 AEP FLOOD AND A UNIFORM AERATION PRESSURE LOADING OF - 3.0 m HEAD OF WATER

ADJACENT POURS SHALL NOT BE PERMITTED AT INTERVALS OF LESS THAN SEVEN DAYS

EXPOSED EDGES SHALL BE CHAMFERED 25mm AND RE-ENTRANT ANGLES FILLETED 25mm UNLESS OTHERWISE SHOWN

W.A.E.88/12415

WILLING & PARTNERS PTY. LTD.
CONSULTING ENGINEERS
PHARMACY HOUSE
44 THESIGER COURT,
WEST DEAKIN A.C.T. 2600 TEL. 81 5811
PRINCIPAL [redacted] DATE 30-8-85

SCALE metres 0 25

PROJECT NO 84-5023
DRG NO 39272

	REVISIONS	By	Date	
A				DESIGN
B				DRAFT
C				TRACE
D				~~CHECK~~
E				

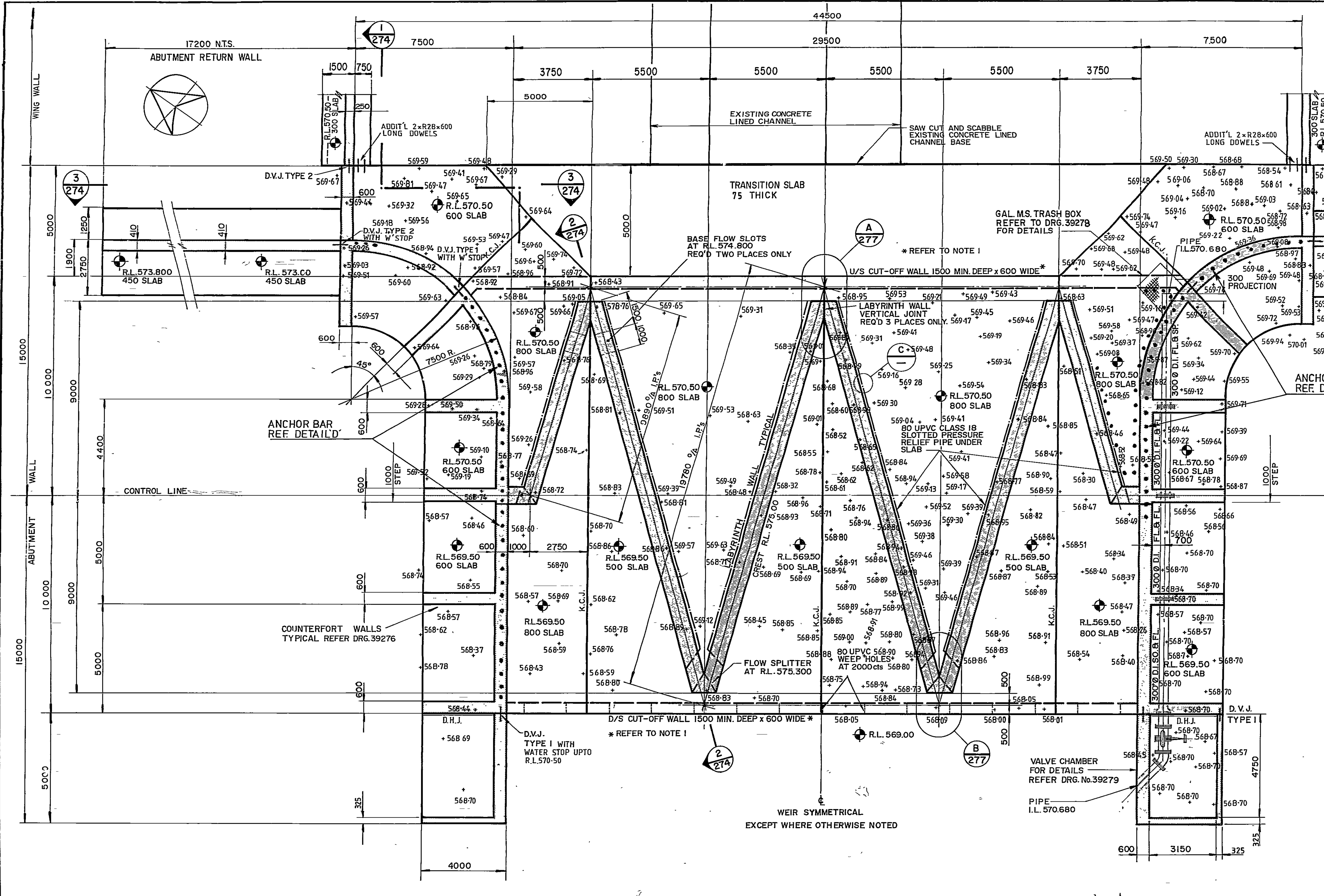
Cameron McNamara
Cameron McNamara Pty Ltd
APPROVED [redacted]
Date 30/8/85

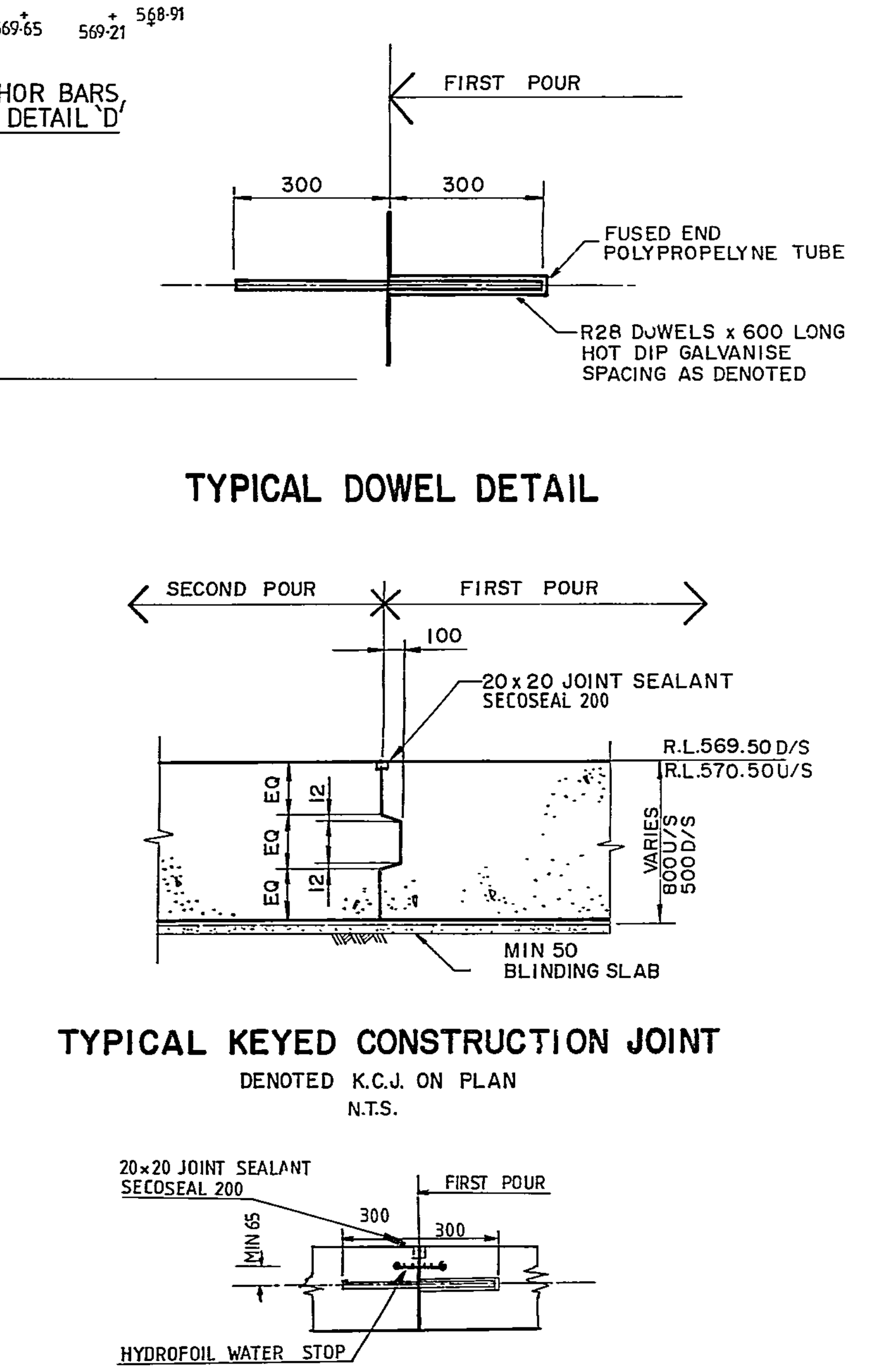
ISABELLA DRIVE STAGE 5A
ISABELLA WEIR
LOCATION PLAN AND GENERAL NOTES

National Capital Development Commission

DRG NO
REV

1061





TYPICAL DOWEL DETAIL

TYPICAL KEYED CONSTRUCTION JOINT

DENOTED K.C.J. ON PLAN

N.T.S.

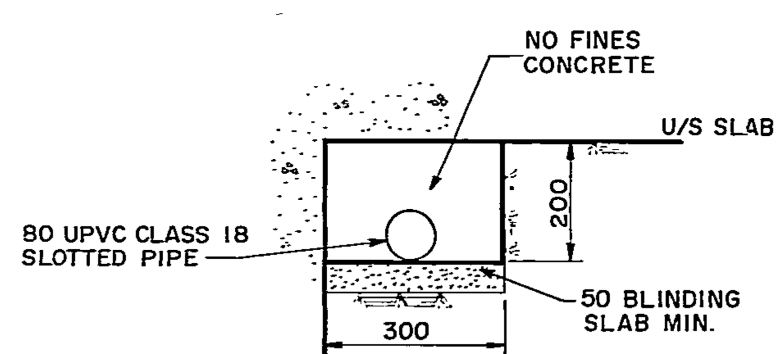
TYPICAL VERTICAL DOWELLED JOINT WITH WATERSTOP

N.T.S.

NOTES

I. UPSTREAM AND DOWNSTREAM CUT-OFF WALLS TO BE EXCAVATED TO DIMENSIONS SHOWN. ANY OVER EXCAVATION IS TO BE BACKFILLED WITH CONCRETE TO FORM AN EFFECTIVE SEAL WITH UNDISTURBED GROUND. EXCAVATION TO BE INSPECTED BY SUPERINTENDENT PRIOR TO PLACEMENT OF REINFORCEMENT. TRENCH SO FORMED TO BE AIR BLASTED AND DEWATERED IF NECESSARY FOR GEOTECHNICAL INSPECTION

2. WATERSTOP PLACED FOR ALL VERTICAL AND HORIZONTAL CONSTRUCTION JOINTS OTHER THAN WINGWALLS AND ABUTMENT RETURN WALLS.



DETAIL C

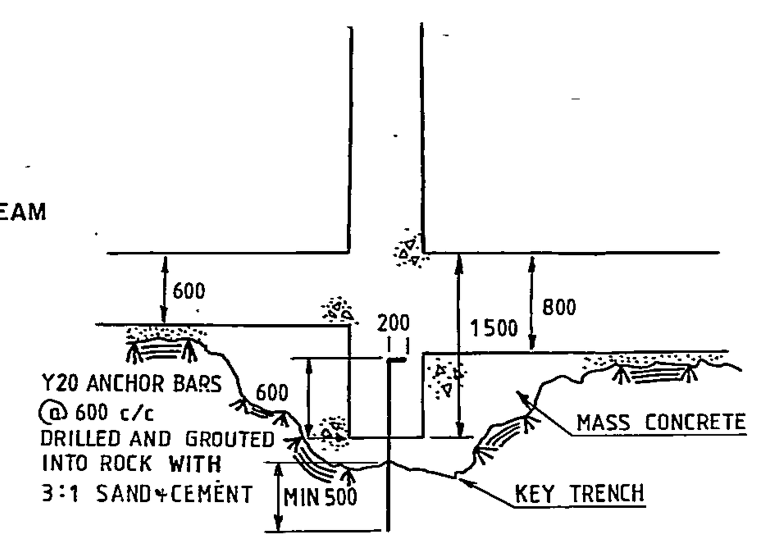
PRESSURE RELIEF PIPE

SCALE B

FLOOR PLAN R.L.570.50 UPSTREAM R.L.569.50 DOWNSTREAM

SCALE A

K.C.J. DENOTES KEYED CONSTRUCTION JOINT
D.V.J. DENOTES DOWELLED VERTICAL JOINT
TYPE I. R28 @ 225 x 600 LONG
TYPE 2. R28 @ 450 x 600 LONG
DENOTES R.L. TOP OF SLAB (T.O.S)
D.H.J. DENOTES DOWELLED HORIZONTAL JOINTS R28 @ 225 x 600 LONG.
+568·70 DENOTES EXCAVATED LEVELS. OVER EXCAVATION REPLACED WITH 20MPa MASS CONCRETE.



DETAIL 'D'

SCALE 1:50

FOR GENERAL NOTES REFER TO DWG. No. 39272

W.A.E.88/12416

WILLING & PARTNERS PTY. LTD. CONSULTING ENGINEERS PHARMACY HOUSE 44 THESIGER COURT, WEST DEAKIN A.C.T. 2600 TEL. 81 5811	SCALE metres 0 5A / 0 0.5B	REVISIONS: A AS EXECUTED [redacted] 2/88; B; C; D; E	DESIGN [redacted] DRAFT TRACE CHECK	Cameron McNamara, Cameron McNamara Pty Ltd
PRINCIPAL [redacted] Schedule 2.2 (a)(ii) DATE 30-8-85	PROJECT NO 84-5023	DRG NO 39273		APPROVED [redacted] Schedule 2.2 (a)(ii) Date 8/85

ISABELLA DRIVE STAGE 5A

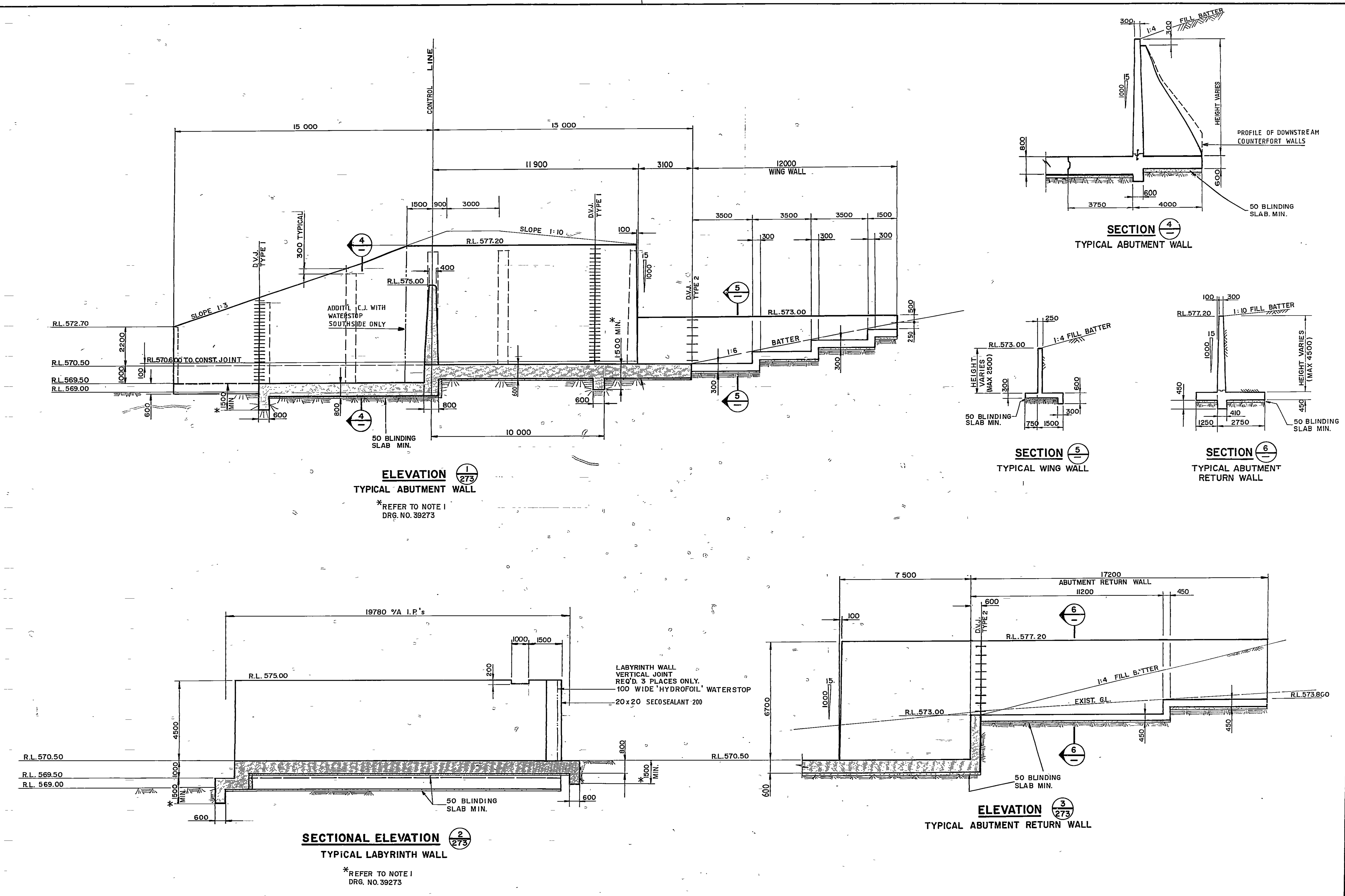
ISABELLA WEIR

FLOOR PLAN-CONCRETE OUTLINES

National Capital Development Commission

N.C.D.C. DRG NO

REV A



FOR GENERAL NOTES REFER TO DWG. No. 39272

W.A.E.88/12417

WILLING & PARTNERS PTY. LTD. CONSULTING ENGINEERS PHARMACY HOUSE 44 THESIGER COURT, WEST DEAKIN A.C.T. 2600 TEL. 81 5811	SCALE metres 0 5	REVISIONS	By	Date
		A DIM. ON ELEV'N 3 AMENDED	[redacted]	3.2.86
		B AS EXECUTED		2/88
	PROJECT NO 84-5023	C		
	DRG NO 39274	D		
PRINCIPAL [redacted] Schedule 2.2 (a)(ii) DATE 30-8-85		E		

DESIGN / DRAFT / TRACE / CHECK [redacted]

Cameron McNamara
Cameron McNamara Pty Ltd

APPROVED [redacted] Schedule 2.2 (a)(ii)
Date

ISABELLA DRIVE STAGE 5 A

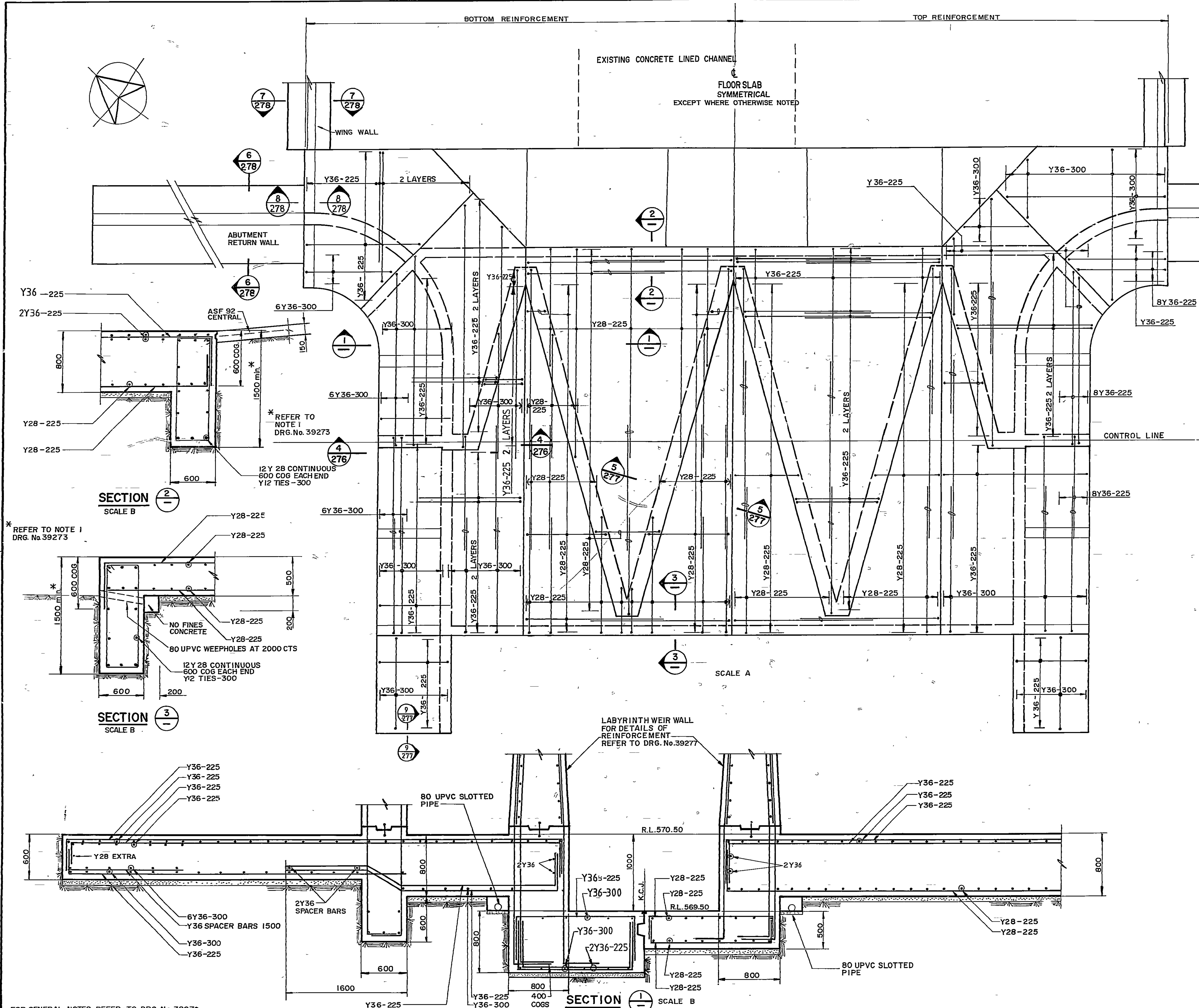
ISABELLA WEIR

WALL ELEVATIONS—CONCRETE OUTLINES

National Capital Development Commission

N.C.D.C. DRG NO

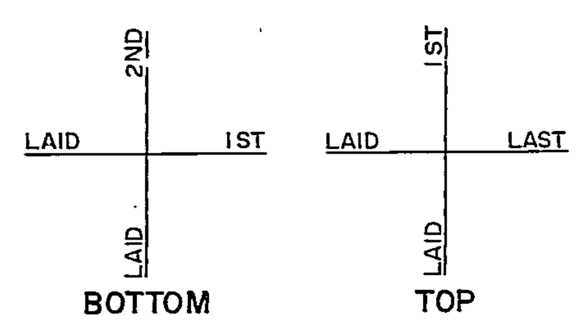
REV B



FLOOR PLAN SCALE 1:100

TOP AND BOTTOM REINFORCEMENT
REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY. IT IS NOT NECESSARILY SHOWN IN TRUE PROJECTION. SPLICES IN REINFORCEMENT TO BE MADE ONLY IN THE POSITIONS SHOWN. THE WRITTEN APPROVAL OF THE SUPERINTENDENT TO BE OBTAINED FOR ANY OTHER SPLICE LOCATION. WELDING OR MECHANICAL SPLICING MAY BE PERMITTED WITH PRIOR WRITTEN APPROVAL OF THE SUPERINTENDENT. REFER TO SCHEDULE FOR SPLICE LENGTHS REFER TO GENERAL NOTES FOR MINIMUM CONCRETE COVER. ALL REINFORCEMENT SHALL BE PROVIDED WITH SUFFICIENT CHAIR SUPPORTS AND ADDITIONAL TIE BARS WHERE NECESSARY SO THAT CORRECT POSITION IS MAINTAINED DURING CONCRETING. CHAIRS TO BE SPACED AT 900 MAXIMUM CENTRES EACH WAY.

KEY TO REINFORCEMENT LAYING



UNLESS NOTED OTHERWISE REINFORCEMENT TO BE LAPPED AS SCHEDULED BELOW.

BAR DIA.	LAP LENGTH	
Y28	1650 BOTTOM	2300 TOP
Y36	2700 BOTTOM	3800 TOP
SPACERS	NONE	NONE

W.A.E. 88/12418

WILLING & PARTNERS PTY. LTD.
CONSULTING ENGINEERS
PHARMACY HOUSE
44 THESIGER COURT,
WEST DEAKIN A.C.T. 2600
TEL. 81 5811
PRINCIPAL [redacted] Schedule 2.2 (a)(ii)
DATE 30-8-85

SCALE metres 0 5 A 0 1.25 B

PROJECT NO	DRG NO
84-5023	39275

	REVISIONS	By	Date	m
A	BARS ON PLAN, SEC.1 & 2 AMEND.	[redacted]	3.2.86	
B	AS EXECUTED		2/88	
C				
D				
E				

DESIGN [redacted]
DRAFT
TRACE
CHECK

Cameron McNamara
Cameron McNamara Pty Ltd
APPROVED [redacted] Schedule 2.2 (a)(ii)
Date

ISABELLA DRIVE STAGE 5A
ISABELLA WEIR FLOOR SLAB
TOP AND BOTTOM REINFORCEMENT

National Capital Development Commission

N.C.D.C. DRG NO

REV B

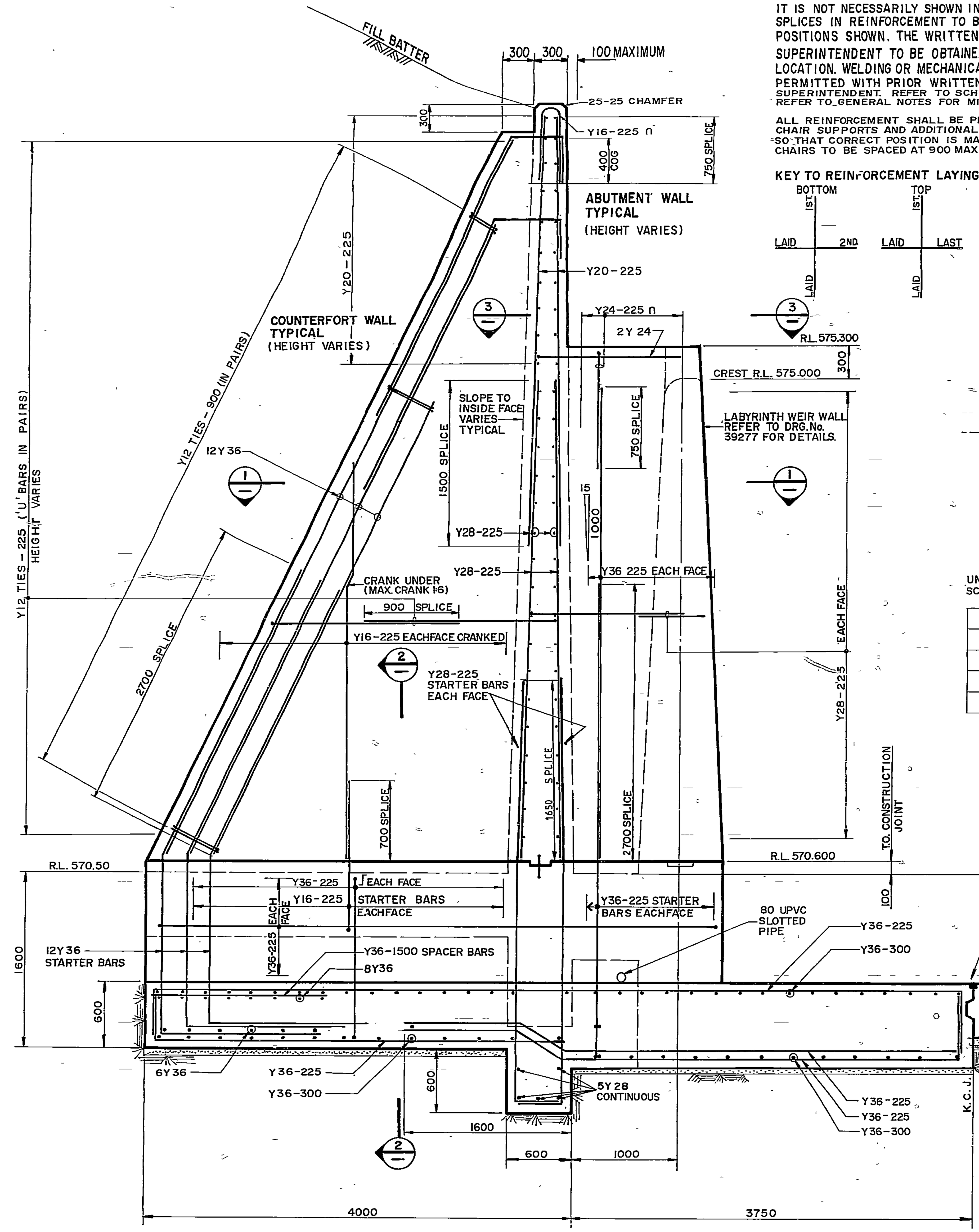
NOTE

REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY. IT IS NOT NECESSARILY SHOWN IN TRUE PROJECTION. SPLICES IN REINFORCEMENT TO BE MADE ONLY IN THE POSITIONS SHOWN. THE WRITTEN APPROVAL OF THE SUPERINTENDENT TO BE OBTAINED FOR ANY OTHER SPLICE LOCATION. WELDING OR MECHANICAL SPLICING MAY BE PERMITTED WITH PRIOR WRITTEN APPROVAL OF THE SUPERINTENDENT. REFER TO SCHEDULE FOR SPLICE LENGTHS REFER TO GENERAL NOTES FOR MINIMUM CONCRETE COVER.

ALL REINFORCEMENT SHALL BE PROVIDED WITH SUFFICIENT CHAIR SUPPORTS AND ADDITIONAL TIE BARS WHERE NECESSARY SO THAT CORRECT POSITION IS MAINTAINED DURING CONCRETING. CHAIRS TO BE SPACED AT 900 MAXIMUM CENTRES EACH WAY.

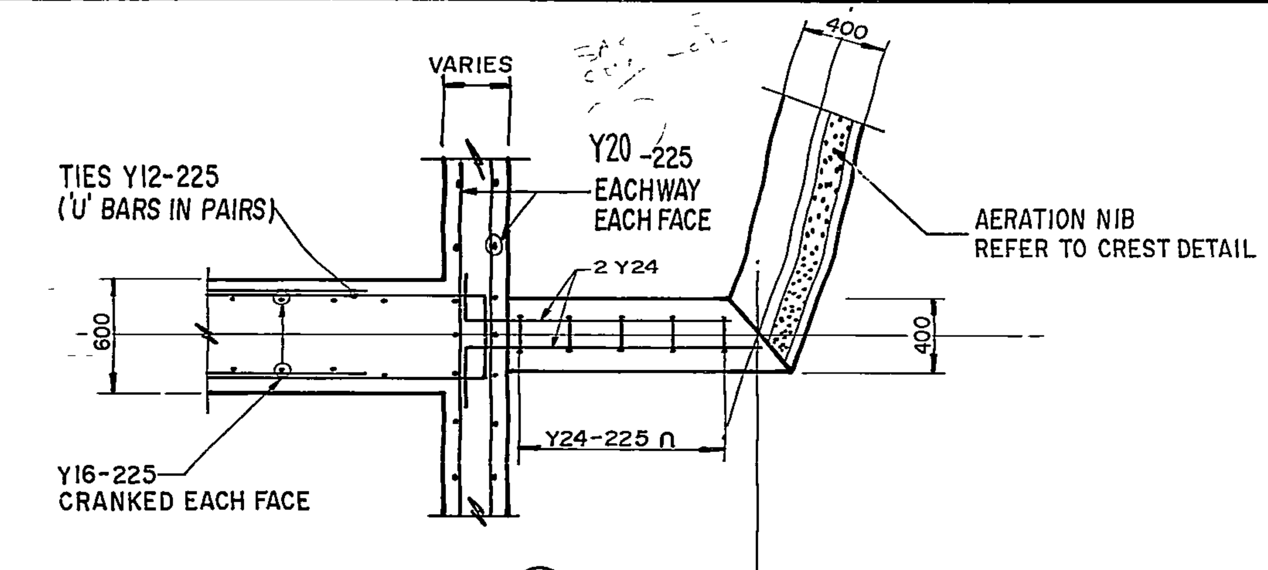
KEY TO REINFORCEMENT LAYING

BOTTOM 1ST. 2ND LAID — TOP 1ST. LAID LAST

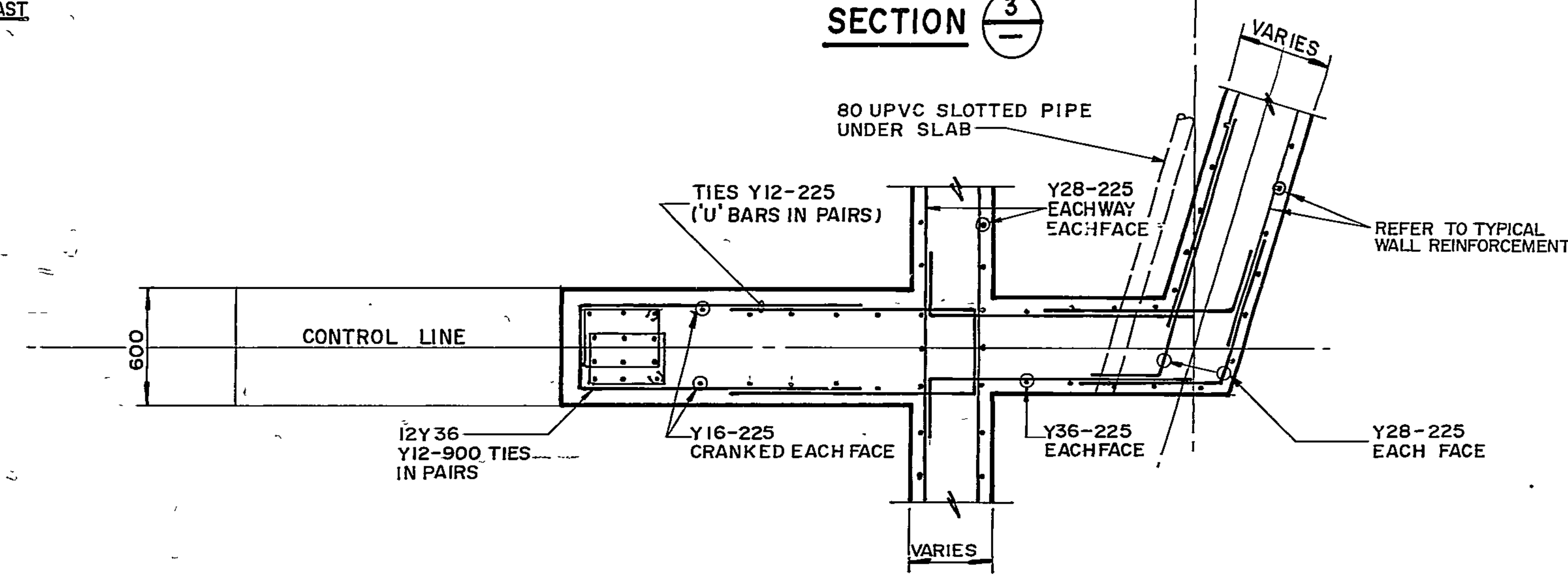


SECTION 4/275

TYPICAL COUNTERFORT WALL ABUTMENT WALL AND FOOTING SLAB



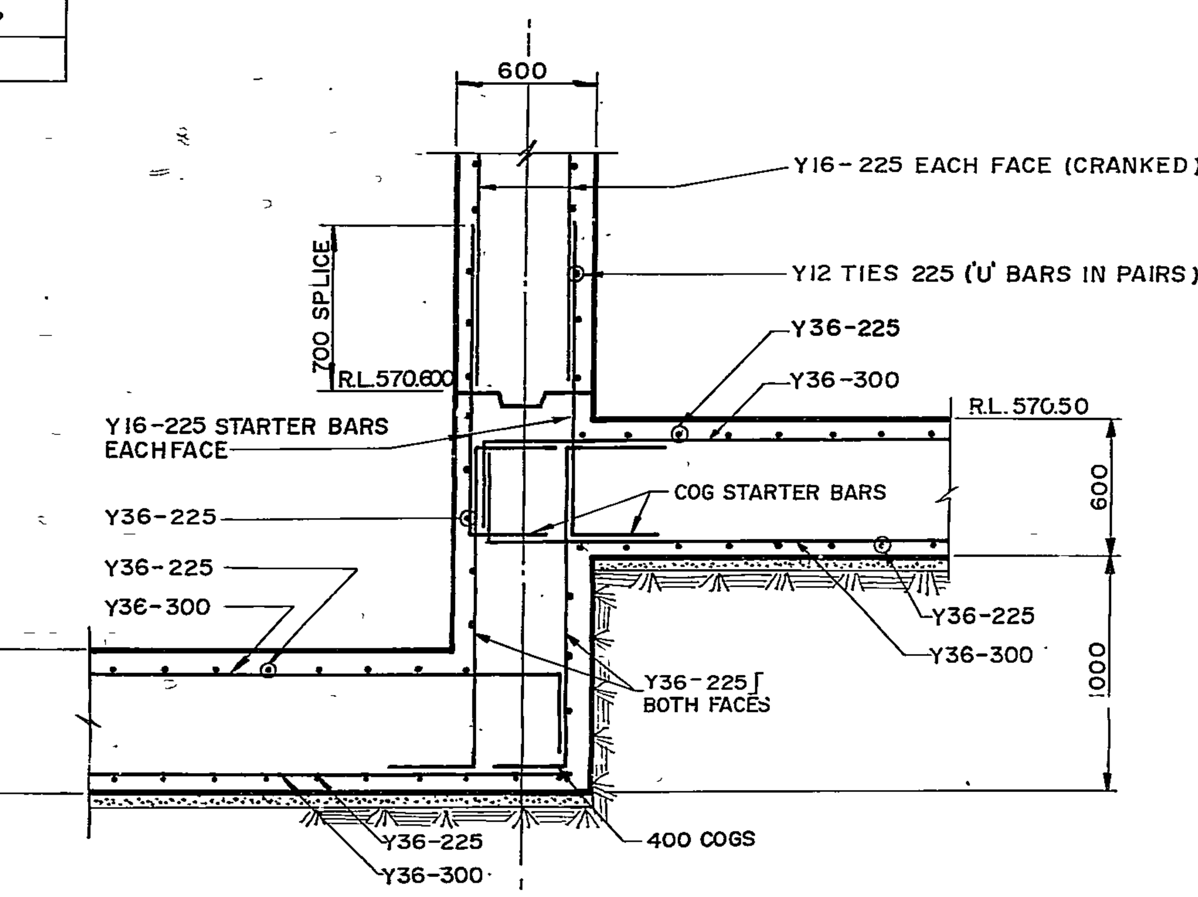
SECTION 3



SECTION 1

UNLESS NOTED OTHERWISE REINFORCEMENT TO BE LAPPED AS SCHEDULED BELOW

BAR DIA.	LAP LENGTH	
Y28	1650 BOTTOM	2300 TOP
Y36	2700 BOTTOM	3800 TOP
Y16	650 BOTTOM	925 TOP
SPACERS	NONE	NONE



SECTION 2

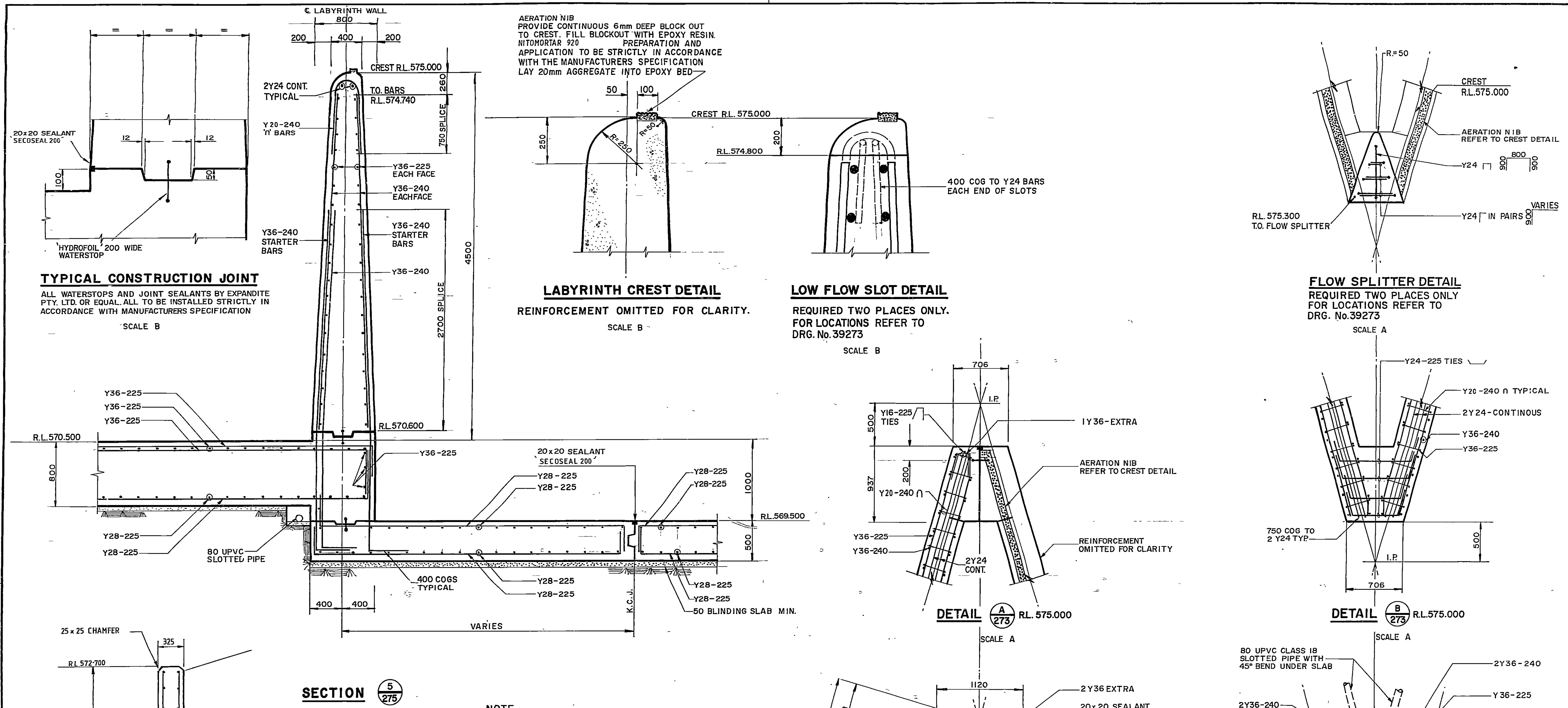
FOR GENERAL NOTES REFER DRG.No. 39272

N.B. Amended dwg not issued

W.A.E.88/12419

WILLING & PARTNERS PTY. LTD. CONSULTING ENGINEERS PHARMACY HOUSE 44 THESIGER COURT, WEST DEAKIN A.C.T. 2600 TEL. 81 5811 PRINCIPAL [redacted] Schedule 2.2 (a)(ii) DATE 30-8-85	SCALE metres 0 1.25 PROJECT NO 84-5023 DRG NO 39276	REVISIONS: A BAR ON SECTION 3 AMEND. [redacted] 3.2.86; B AS EXECUTED [redacted] 3/88; C; D; E	DESIGN DRAFT TRACE CHECK [redacted]	Cameron McNamara — Cameron McNamara Pty Ltd — APPROVED [redacted] Schedule 2.2 (a)(ii) Date
ISABELLA DRIVE STAGE 5 A ISABELLA WEIR ABUTMENT AND COUNTERFORT WALL TYPICAL DETAILS	National Capital Development Commission	N.C.D.C. DRG NO	REV B	

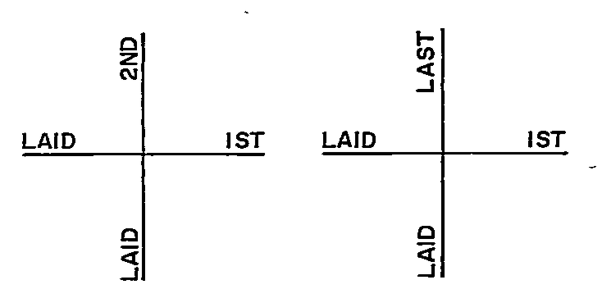
1065



NOTE

REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY. IT IS NOT NECESSARILY SHOWN IN TRUE PROJECTION. SPLICES IN REINFORCEMENT TO BE MADE ONLY IN THE POSITIONS SHOWN. THE WRITTEN APPROVAL OF THE SUPERINTENDENT TO BE OBTAINED FOR ANY OTHER SPLICE LOCATION. WELDING OR MECHANICAL SPLICING MAY BE PERMITTED WITH PRIOR WRITTEN APPROVAL OF THE SUPERINTENDENT. REFER TO SCHEDULE FOR SPLICE LENGTHS. REFER TO GENERAL NOTES FOR MINIMUM CONCRETE COVER. STARTER BARS TO BE JOGGLED AS REQUIRED TO CLEAR TOP REINFORCING. ALL REINFORCEMENT SHALL BE PROVIDED WITH SUFFICIENT CHAIR SUPPORTS AND ADDITIONAL TIE BARS WHERE NECESSARY SO THAT CORRECT POSITION IS MAINTAINED DURING CONCRETING. CHAIRS TO BE SPACED AT 900 MAXIMUM CENTRES EACH WAY.

KEY TO REINFORCEMENT LAYING



BOTTOM TOP

BAR DIA.	LAP LENGTH	
Y36	2700 BOTTOM	3800 TOP
Y28	1650 BOTTOM	2300 TOP
Y24	1200 BOTTOM	1675 TOP
SPACERS	NONE	NONE

W.A.E.88/12420

FOR GENERAL NOTES REFER DWG.No.39272

WILLING & PARTNERS PTY. LTD.
CONSULTING ENGINEERS
PHARMACY HOUSE
44 THESIGER COURT
WEST DEAKIN A.C.T. 2600 TEL. 81 5811

PRINCIPAL [redacted] Schedule 2.2 (a)(ii) DATE 30-8-85

SCALE metres 0 1.25 A / 0 0.5 B

PROJECT NO 84-5023 | DRG NO 39277

	REVISIONS	By	Date	m
A	AS EXECUTED	[redacted]	2/88	
B				
C				
D				
E				

DESIGN / DRAFT / TRACE / CHECK

Cameron McNamara
Cameron McNamara Pty Ltd

APPROVED [redacted] Schedule 2.2 (a)(ii)
Date 30/8/85

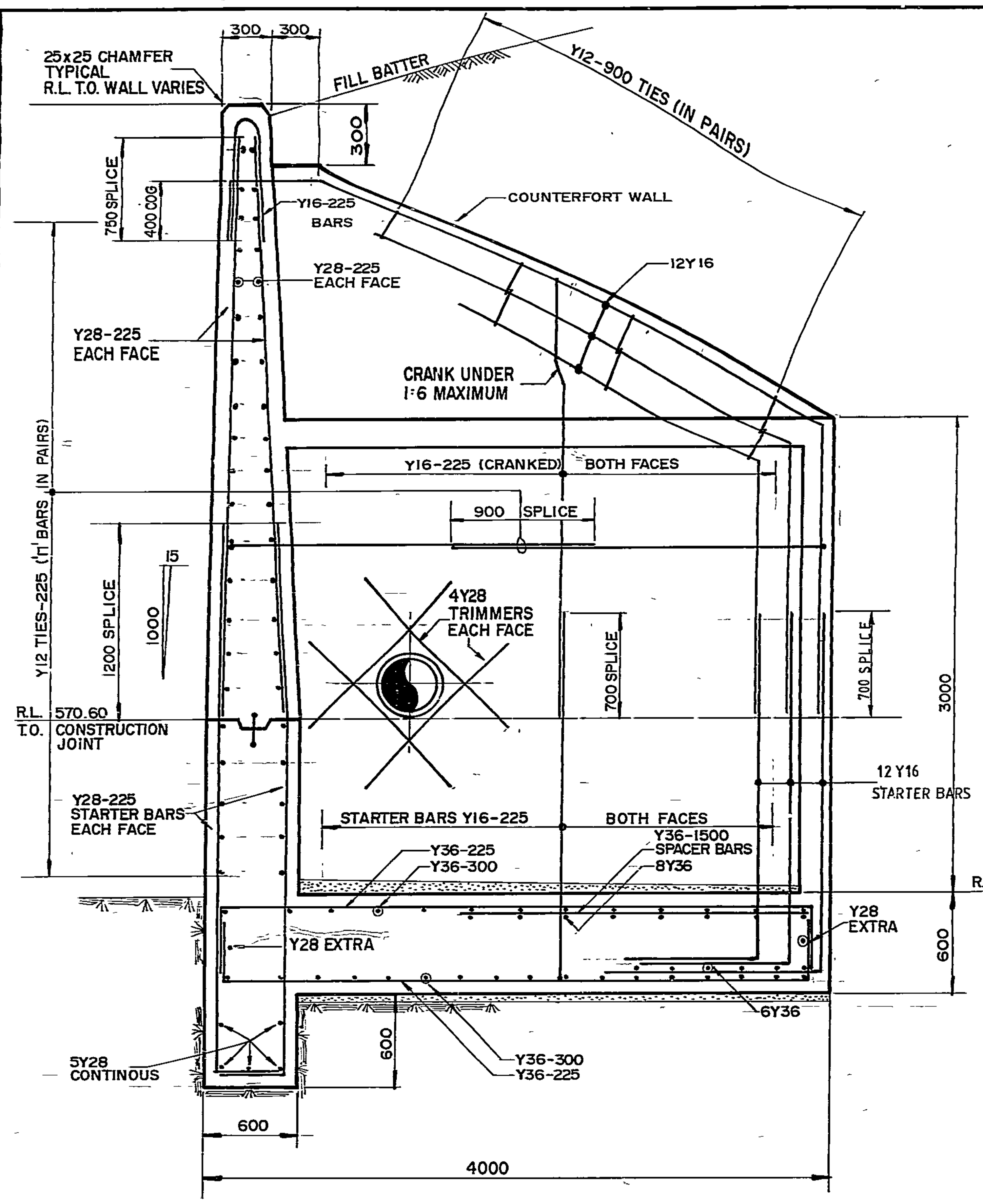
ISABELLA DRIVE STAGE 5A
ISABELLA WEIR
LABYRINTH WALL - TYPICAL DETAILS

National Capital Development Commission

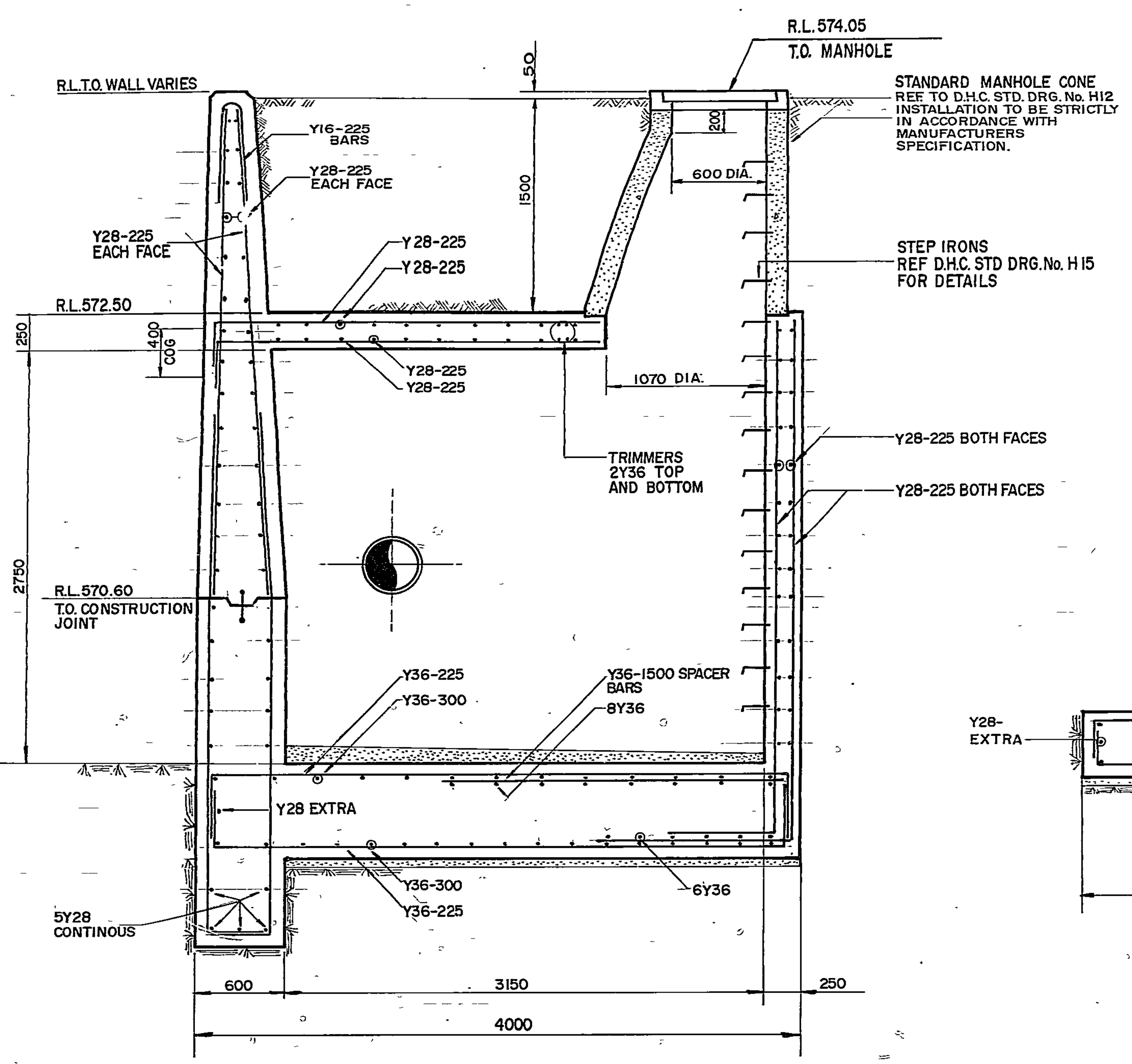
N.C.D.C. DRG NO

REV A

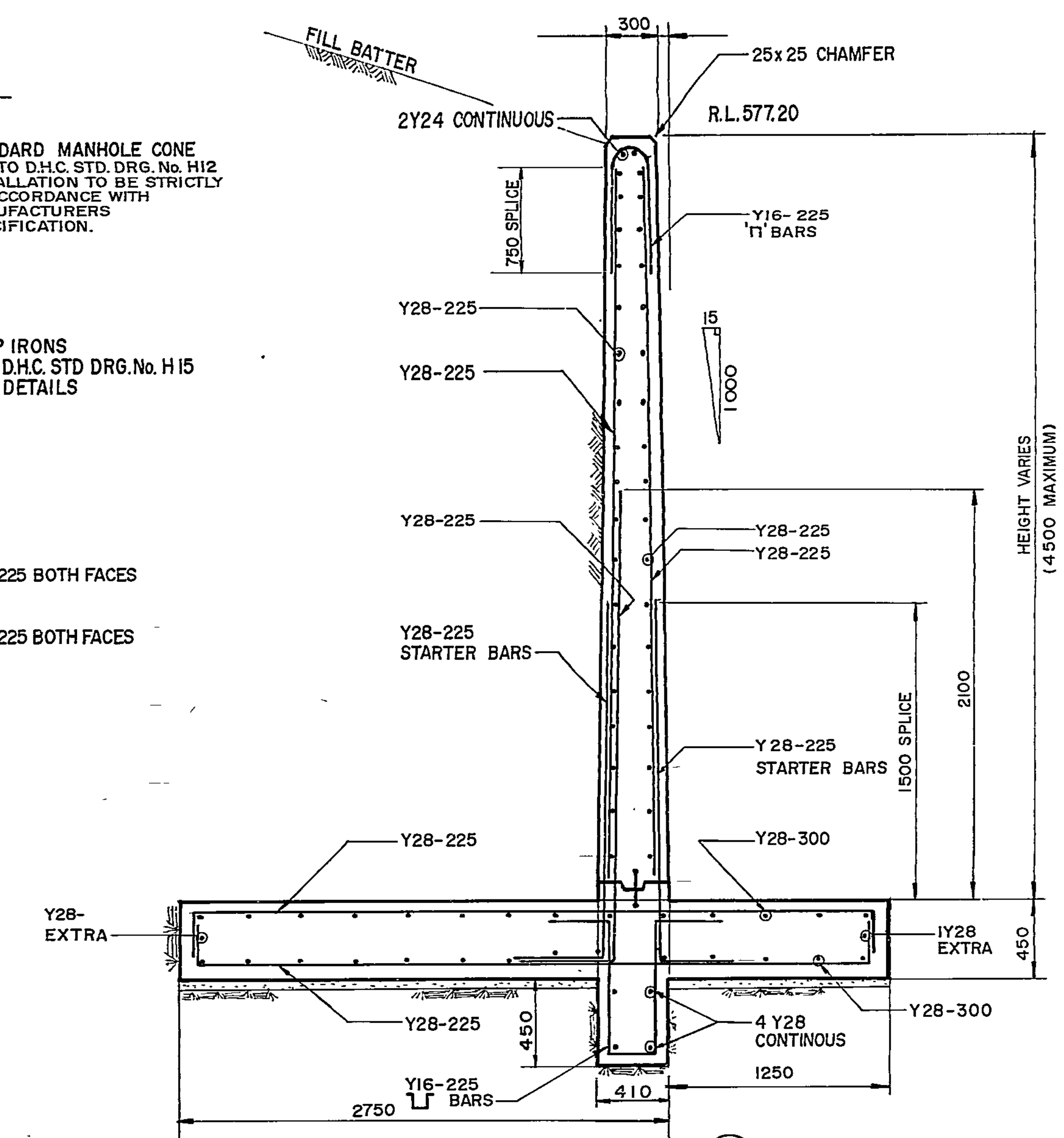
1066



SECTION 2/279



SECTION 3/279



SECTION 6/275

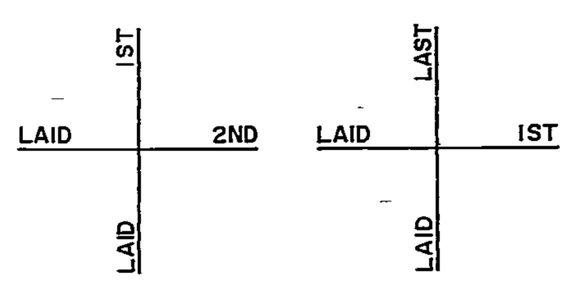
TYPICAL ABUTMENT RETURN WALL

NOTE

REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY. IT IS NOT NECESSARILY SHOWN IN TRUE PROJECTION. SPLICES IN REINFORCEMENT TO BE MADE ONLY IN THE POSITIONS SHOWN. THE WRITTEN APPROVAL OF THE SUPERINTENDENT TO BE OBTAINED FOR ANY OTHER SPLICE LOCATION. WELDING OR MECHANICAL SPLICING MAY BE PERMITTED WITH PRIOR WRITTEN APPROVAL OF THE SUPERINTENDENT. REFER TO SCHEDULE FOR SPLICE LENGTHS REFER TO GENERAL NOTES FOR MINIMUM CONCRETE COVER. ALL REINFORCEMENT SHALL BE PROVIDED WITH SUFFICIENT CHAIR SUPPORTS AND ADDITIONAL TIE BARS WHERE NECESSARY SO THAT CORRECT POSITION IS MAINTAINED DURING CONCRETING. CHAIRS TO BE SPACED AT 900 MAXIMUM CENTRES EACH WAY.

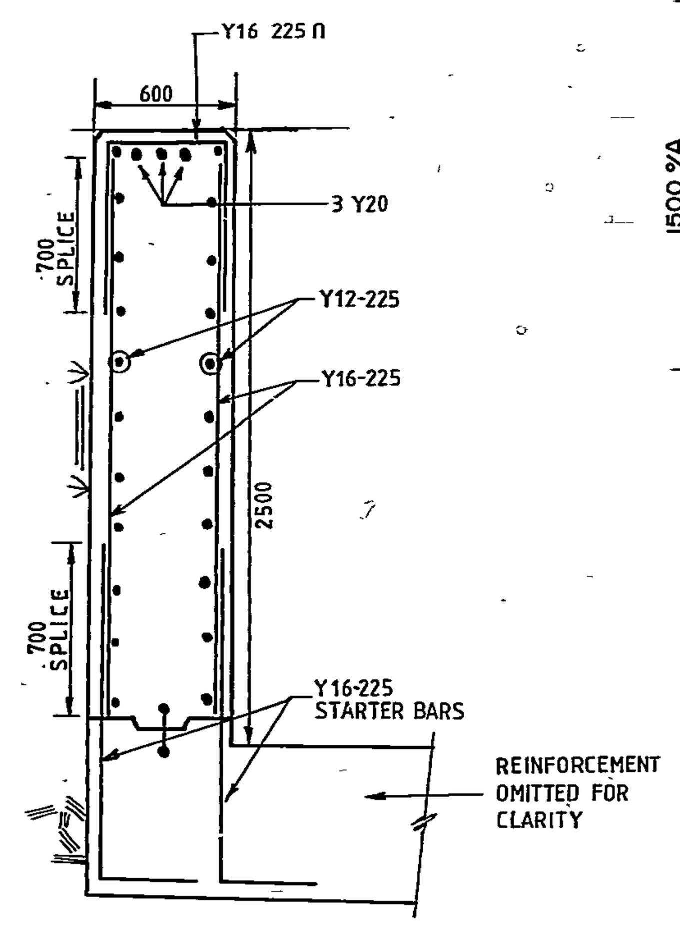
KEY TO REINFORCEMENT LAYING

LAYER DENOTED:

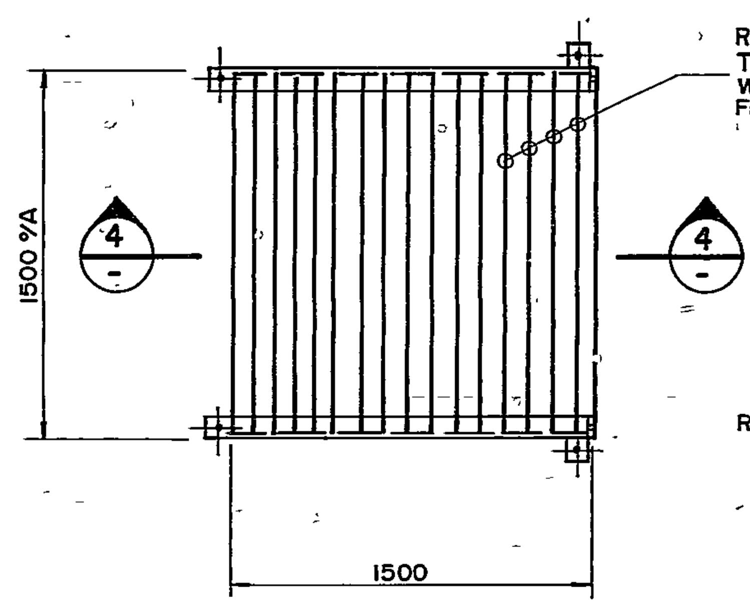


BOTTOM TOP

BAR DIA.	LAP LENGTH	
Y28	1650 BOTTOM	2300 TOP
Y36	2700 BOTTOM	3800 TOP
SPACERS	NONE	NONE

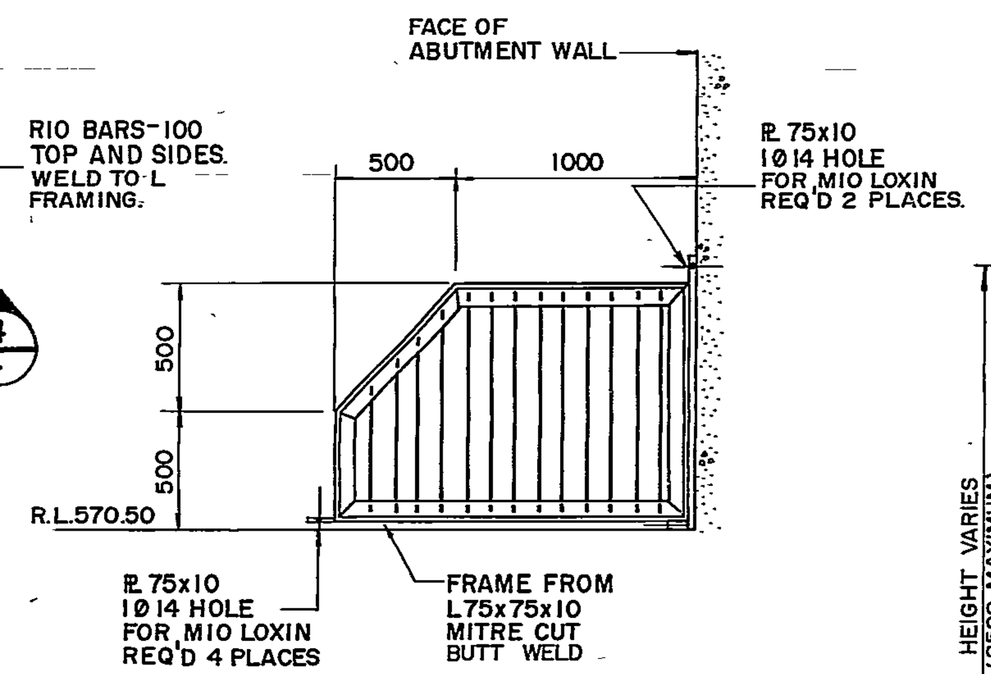


SECTION 8/275

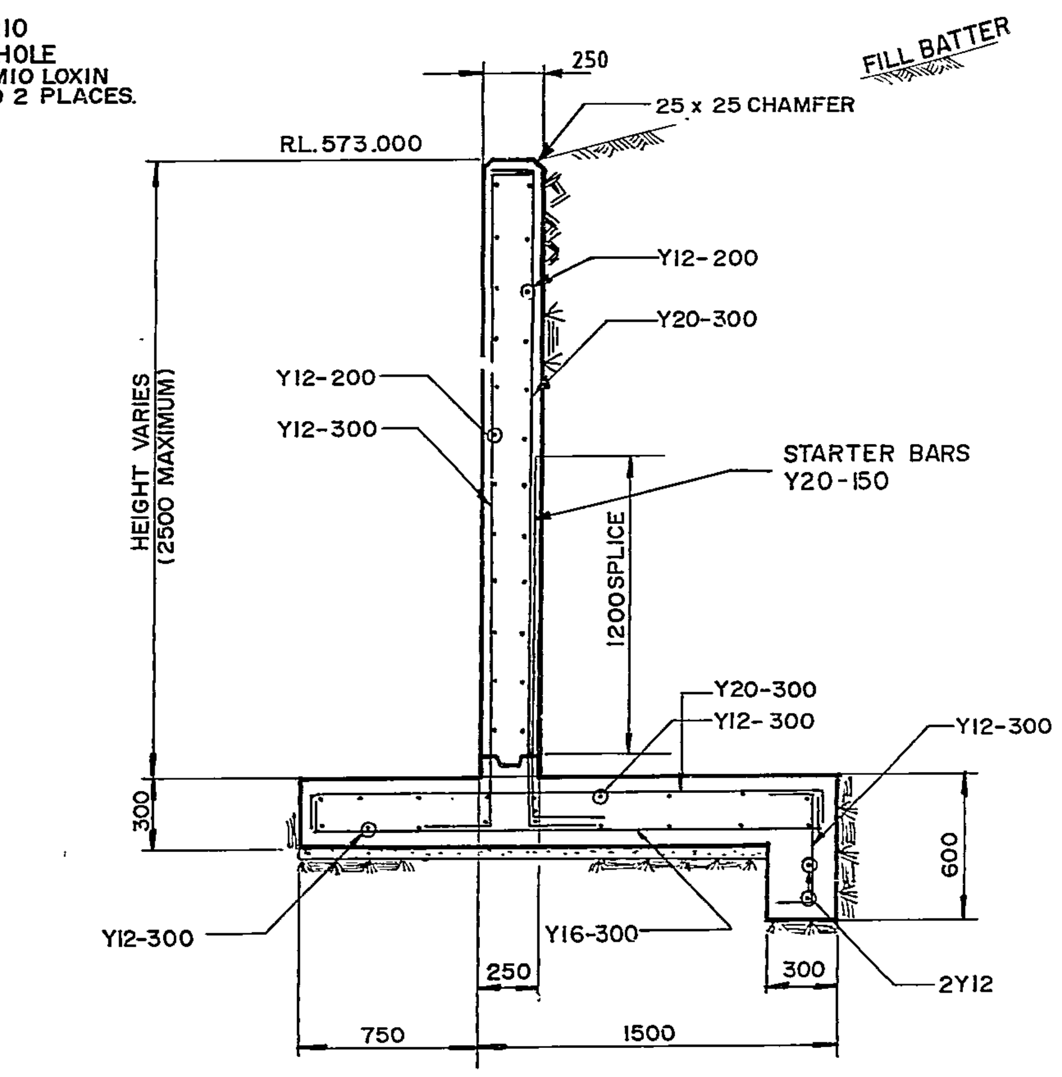


PLAN TRASH BOX

HOT DIP TRASH BOX AND ALL FITTINGS AFTER FABRICATION



SECTION 4/-



SECTION 7/275

TYPICAL WING WALL

W.A.E.88/12421

FOR GENERAL NOTES REFER TO DRG. No. 39272

WILLING & PARTNERS PTY. LTD.
CONSULTING ENGINEERS
PHARMACY HOUSE
44 THESIGER COURT,
WEST DEAKIN A.C.T. 2600
TEL. 81 5811

PRINCIPAL [redacted] DATE 20-8-85

SCALE metres 1:25

PROJECT NO 84-5023

DRG NO 39278

	REVISIONS	By	Date	m
A	AS EXECUTED	[redacted]	3/88	
B				
C				
D				
E				

DESIGN [redacted]
DRAFT
TRACE
CHECK

Cameron McNamara
Cameron McNamara Pty Ltd

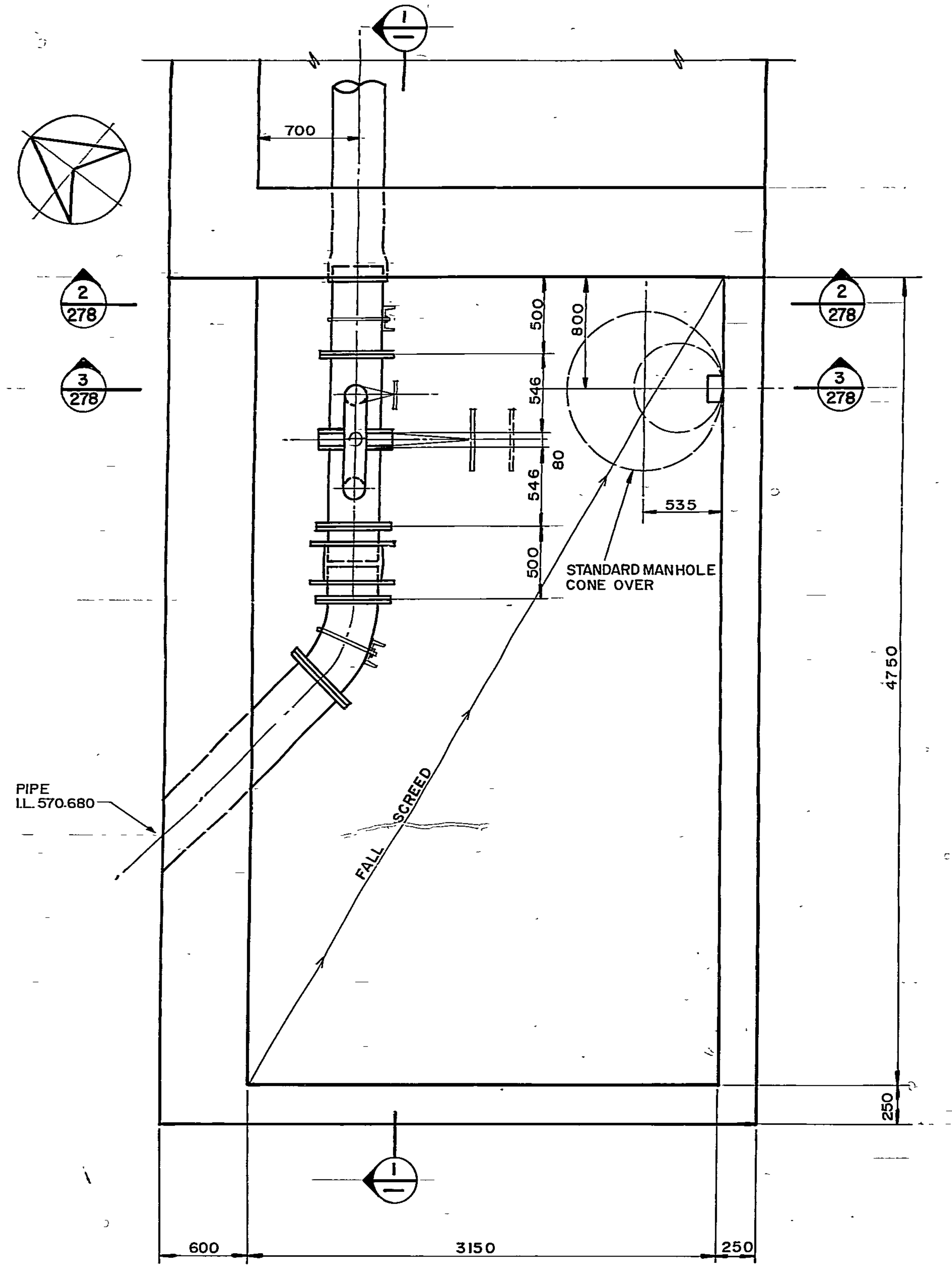
APPROVED [redacted]
Date 20/8/85

ISABELLA DRIVE STAGE 5A
ISABELLA WEIR
ABUTMENT RETURN WALL AND WING WALL
TYPICAL DETAILS AND VALVE CHAMBER SECTIONS

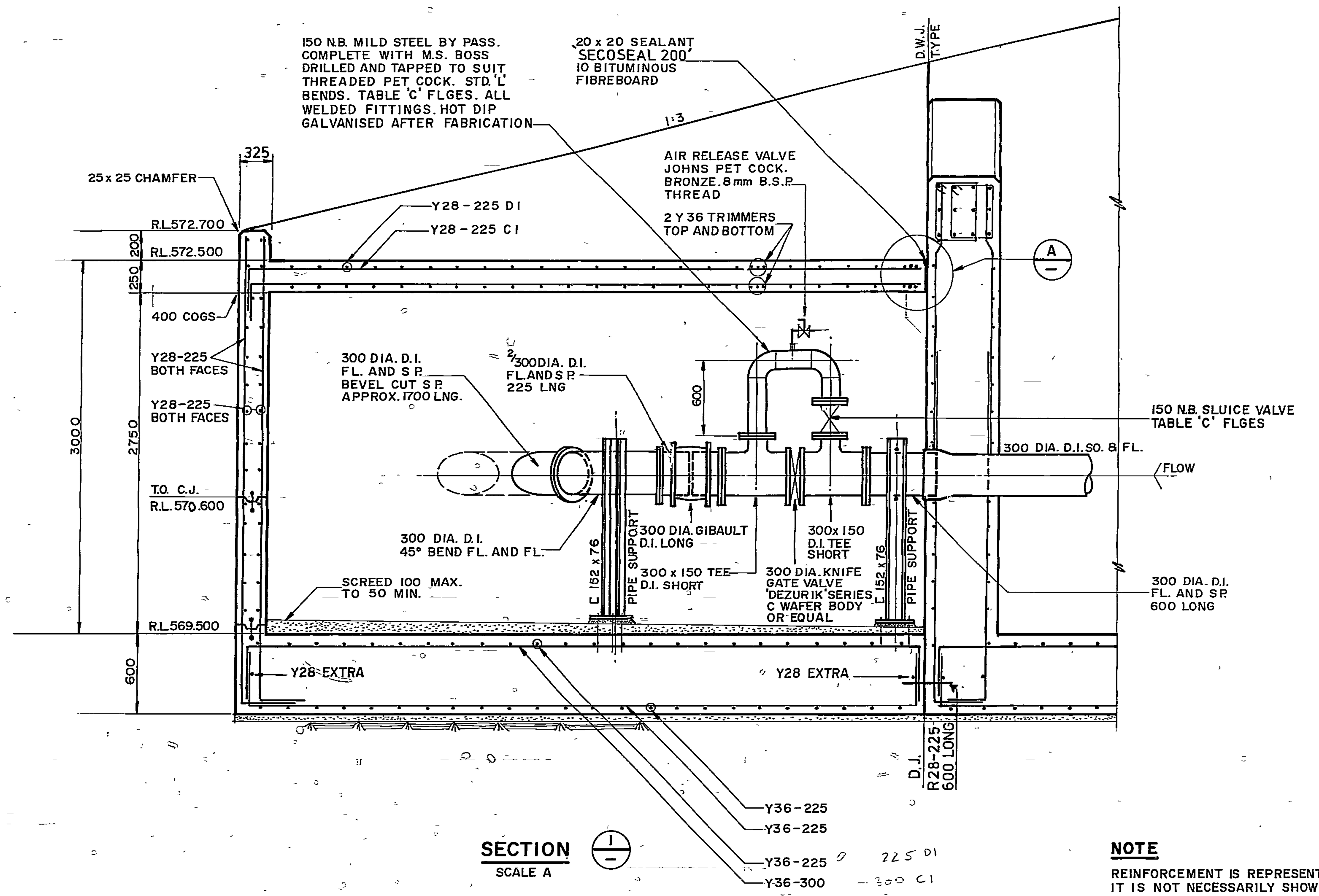
National Capital Development Commission

N.C.D.C. DRG NO

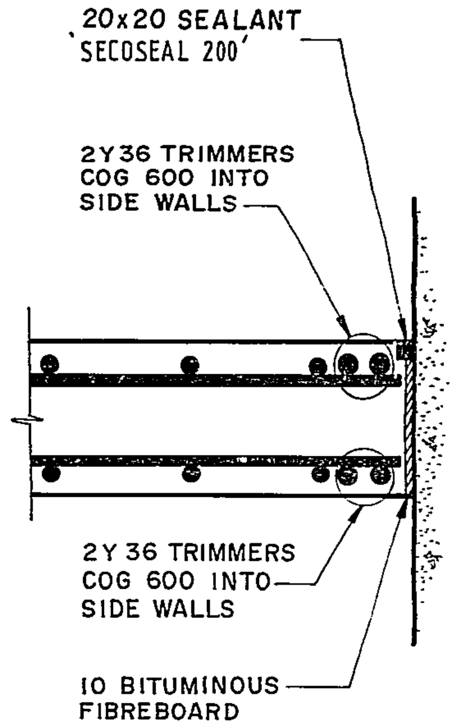
REV A



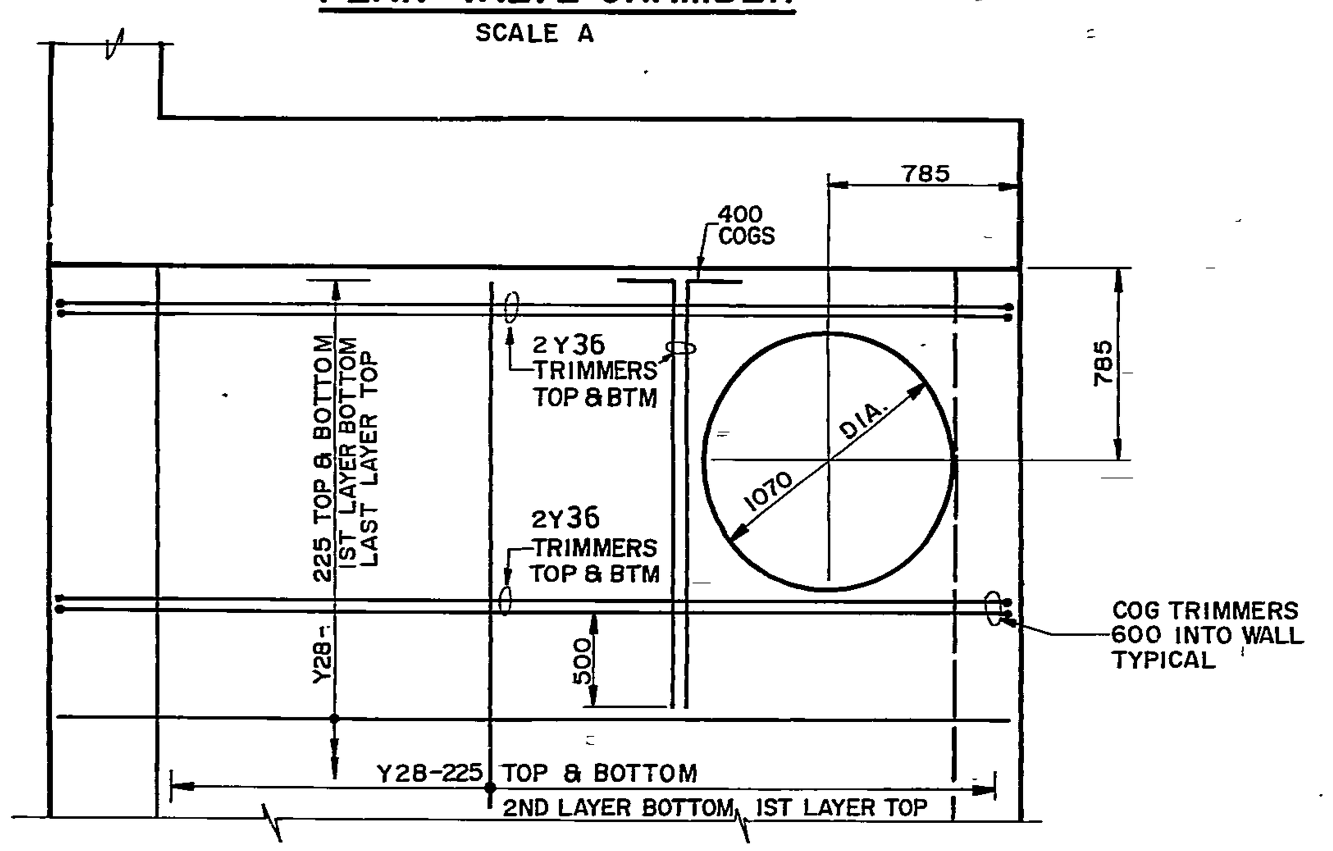
PLAN VALVE CHAMBER
SCALE A



SECTION (1)
SCALE A

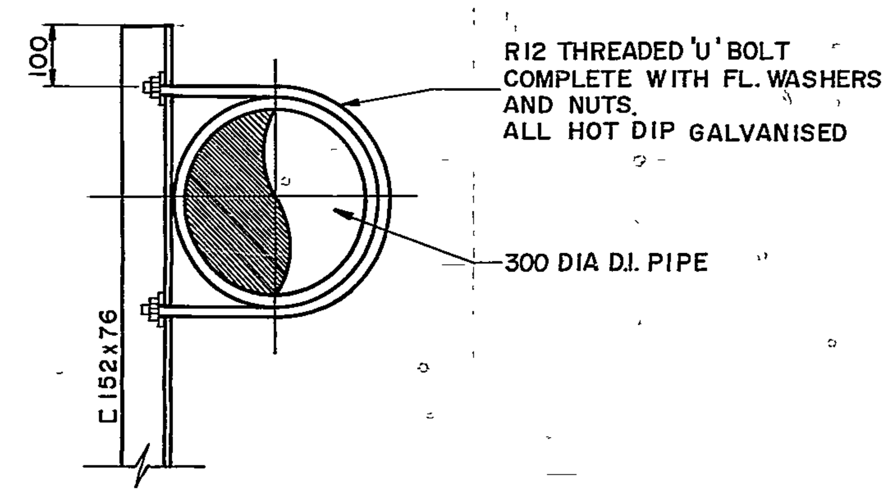


DETAIL (A)
SCALE B

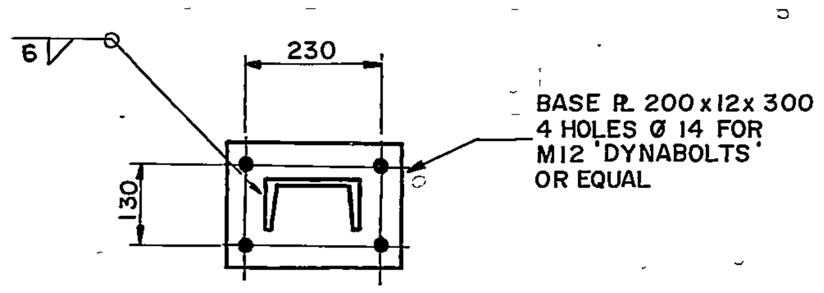


PART PLAN ROOF SLAB
SCALE A
SHOWING ARRANGEMENT OF TRIMMER BARS AROUND MANHOLE OPENING

FOR GENERAL NOTES REFER TO DRG. No. 39272



PIPE SUPPORT DETAIL

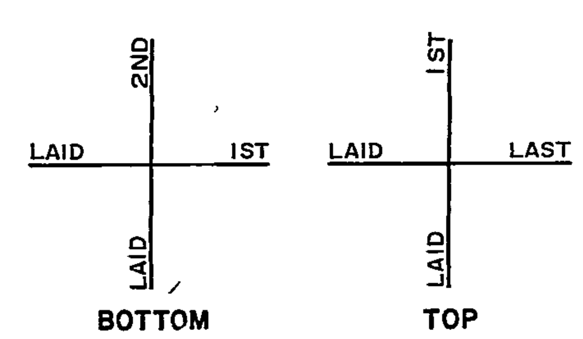


BASE P. DETAIL

PIPE SUPPORT STAND
2 REQ'D AS DETAILED
COMPLETED STANDS AND ALL FITTINGS TO BE HOT DIP GALVANISED AFTER FABRICATION
SCALE B

NOTE
REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY. IT IS NOT NECESSARILY SHOWN IN TRUE PROJECTION. SPLICES IN REINFORCEMENT TO BE MADE ONLY IN THE POSITIONS SHOWN. THE WRITTEN APPROVAL OF THE SUPERINTENDENT IS TO BE OBTAINED FOR ANY OTHER SPLICE LOCATION. WELDING OR MECHANICAL SPLICING MAY BE PERMITTED WITH PRIOR WRITTEN APPROVAL OF THE SUPERINTENDENT. REFER TO SCHEDULE FOR SPLICE LENGTHS. REFER TO GENERAL NOTES FOR MINIMUM CONCRETE COVER. ALL REINFORCEMENT SHALL BE PROVIDED WITH SUFFICIENT CHAIR SUPPORTS AND ADDITIONAL TIE BARS WHEN NECESSARY SO THAT CORRECT POSITION IS MAINTAINED DURING CONCRETING. CHAIRS TO BE SPACED AT 900 MAXIMUM CENTRES EACH WAY.

KEY TO REINFORCEMENT LAYING. FLOOR SLAB ONLY
LAYER DENOTED:



FLOOR SLAB ONLY

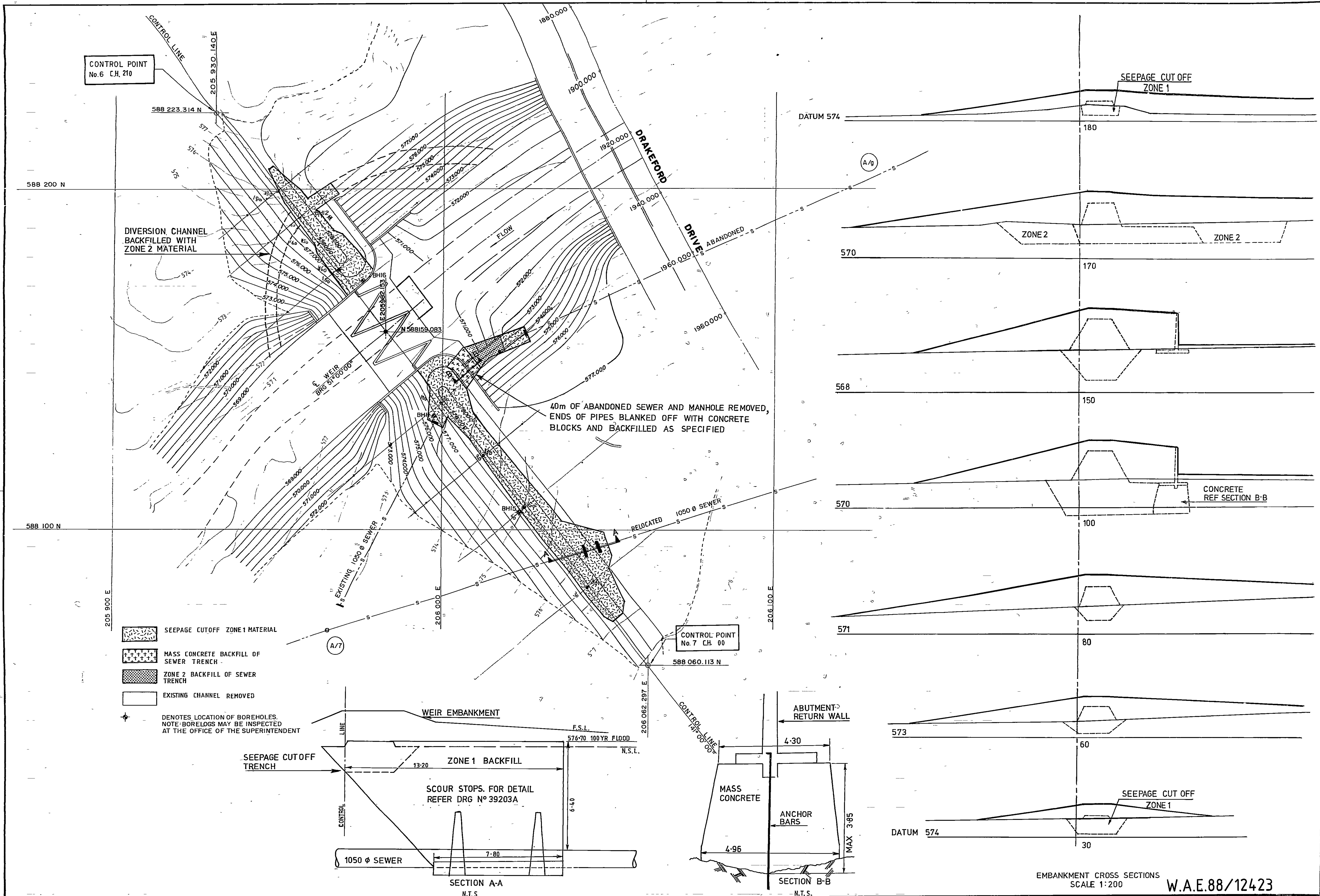
UNLESS NOTED OTHERWISE REINFORCEMENT TO BE LAPPED AS SCHEDULED BELOW

BAR DIA.	LAP LENGTH	
Y28	1650 BOTTOM	2300 TOP
Y36	2700 BOTTOM	3800 TOP
SPACERS	NONE	NONE

W.A.E.88/12422

WILLING & PARTNERS PTY. LTD. CONSULTING ENGINEERS PHARMACY HOUSE 44 THESIGER COURT, WEST DEAKIN A.C.T. 2600 TEL. 81 5811	SCALE metres 0 0.5 B 1:25 A	REVISIONS	By	Date	DESIGN [redacted]	Cameron McNamara Pty Ltd	ISABELLA DRIVE STAGE 5A	National Capital Development Commission	N.C.D.C. DRG NO
PRINCIPAL [redacted] Schedule 2.2 (a)(ii) DATE 30-8-85	PROJECT NO 84-5023 / DRG NO 39279	A AS EXECUTED	[redacted]	3/88	DRAFT	APPROVED [redacted] Schedule 2.2 (a)(ii) Date 30/8/85	ISABELLA WEIR VALVE CHAMBER SECTION AND DETAILS		REV A
		B			TRACE				
		C							
		D			CHECK				
		E							

1068



WILLING & PARTNERS PTY. LTD.
CONSULTING ENGINEERS
PHARMACY HOUSE
44 THESIGER COURT,
WEST DEAKIN A.C.T. 2600
TEL. 81 5811

PRINCIPAL [redacted] Schedule 2.2 (a)(ii)
DATE 30-8-85

SCALE metres 0 25

PROJECT NO 84-5023
DRG NO 40518

REVISIONS		By	Date	m
A				
B				
C				
D				
E				

DESIGN [redacted]
DRAFT
TRACE
CHECK

Cameron McNamara
Cameron McNamara Pty Ltd
APPROVED [redacted] Schedule 2.2 (a)(ii)
Date 30/8/85

ISABELLA DRIVE STAGE 5A
ISABELLA WEIR
WATER RETAINING EMBANKMENT DETAIL
AS EXECUTED

National Capital Development Commission

N.C.D.C. DRG NO

REV

APPENDIX 2.02: COFFEY 1985 – RELEVANT BH LOGS, UCS AND POINT LAD TEST RESULTS

1070

Coffey & Partners Pty. Ltd.

Incorporated

engineering log borehole

COFFEY

borehole no.: B.H.11

sheet 1 of 2

office and job no: CANBERRA: C.3166

project:	GEOTECHNICAL INVESTIGATION - ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.
borehole location:	SEE DRAWING C.3166/2.
hole commenced:	13.12.84
hole completed:	13.12.84
supervised by:	Schedule 2.2 (a)(ii) [redacted]
checked by:	[redacted]

drill model and mounting:	Truck: Edson 3000	slope:	90 deg.	R.L. surface:	[redacted] m
hole diameter:	110 mm	bearing:	– deg.	datum:	–

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
ADT		NIL	NONE ENCOUNTERED		0.40		CL	Gravelly-sandy CLAY; yellow-brown, medium plast., sand fine to coarse, gravel to 50 mm.	D/M	St		FILL
					1			Borehole B.H.11 cored from 0.40 m - See Sheet 2.				

method
AS auger screwing*
AD auger drilling*
R roller/tricone
W washbore
CT cable tool
*bit shown by suffix
B blank bit
V "V" bit
T TC bit
e.g. ADT

support
C casing
M mud

penetration 1 2 3
no resistance ranging to refusal

water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50 mm diameter
D disturbed sample
N standard penetration test figure = result
N* SPT + sample
Nc cone penetrometer

classification symbols and soil description
based on unified classification system

moisture
D dry
M moist
W wet

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

B—OC

1071

Coffey & Partners Pty. Ltd.

Incorporated In Qld.

engineering log — cored borehole

COFFEY

borehole no: B.H.11

sheet 2 of 2

office and job no: CANBERRA: C.3166

project: borehole location:	GEOTECHNICAL INVESTIGATION - ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T. SEE DRAWING C.3166/2.	hole commenced:	13.12.84
		hole completed:	13.12.84
		supervised by:	Schedule 2.2 (a)(ii) [redacted]
		log checked by:	

drill model and mounting: Truck: Edson 3000	slope: 90 deg.	R.L. surface:	[redacted] m
barrel type and length: 1.5 m D.T.	fluid water bearing: – deg.	datum:	–

drilling information / rock substance / rock mass defects

method	case-lift	water	pressure test lugeons (3, 10, 30, 100)	R.L.	depth metres	graphic log core loss	substance description (rock type: grain characteristics, colour, structure, minor components)	weathering	strength Is (50)	defect spacing mm	defect description (thickness, type, inclination, planarity, roughness, coating)
NMLC				piezometer, 0.8-2.8 m	0.40		B.H.11 auger drilled to 0.40 m.				
					0.75		DACITE; fine to medium grained, mauve.	HW			joints subvertical, planar, rough, clay veneer
					1.53		NO CORE 0.78 m				
					6.55		DACITE; fine to medium grained, mauve, fine calcite seams.	MW / SW, SW (from approx. 4.2 m)			joints 20° & 60°, planar, rough & smooth, clay veneer; 60° + 20° joints
							Borehole B.H.11 terminated at required depth.				

key

method		case-lift	pressure test	weathering	strength (indirect tensile strength)
AS	auger screwing	casing used	(350) maximum effective pressure in test (kPa)	Fr – fresh	EL – extremely low
AD	auger drilling	barrel withdrawn	graphic log/core loss	SW – slightly weathered	VL – very low
R	roller/tricone	water: 10 Oct. 73 water level date shown	core recovered (hatching indicates material)	MW – moderately weathered	L – low
W	washbore	water inflow	no core recovered	HW – highly weathered	M – medium
NMLC	NMLC core drilling	partial drilling water loss		EW – extremely weathered	H – high
		complete drilling water loss			VH – very high
					EH – extremely high

-09

1072

Coffey & Partners Pty. Ltd.

Incorporated in Qld.

engineering log borehole

COFFEY

borehole no.:	B.H.12
sheet	1 of 1

office and job no: CANBERRA: C.3166

project:	GEOTECHNICAL INVESTIGATION – ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.	hole commenced:	14.12.84
borehole location:	SEE DRAWING C.3166/2.	hole completed:	14.12.84
		supervised by:	Schedule 2.2 (a)(ii) [redacted]
		checked by:	

drill model and mounting:	Truck: Edson 3000	slope:	90 deg.	R.L. surface:	[redacted] m
hole diameter:	110 mm	bearing:	– deg.	datum:	–

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
AST		Piezometer 0.8 m – 3.8 m	slow seepage		0 – 0.40		SC	Clayey SAND; brown, medium plast., sand fine to coarse, gravel to 50 mm.	M	MD		FILL
					0.40 – 1.80 (1)		CL / CH	Gravelly-sandy CLAY; brown, black & yellow-brown, medium to high plast., sand fine to coarse, gravel to 50 mm.	M	St		
					1.80 – 2.50 (2)		CL	Sandy CLAY; black, medium plast., sand fine to coarse, trace of gravel to 15 mm.	M	F / St		ALLUVIAL SOIL
					2.50 – 2.85		SC / CL	Clayey-gravelly SAND-Sandy-gravelly CLAY; yellow-brown & grey, low to medium plast., sand fine to coarse, gravel to 30 mm.	M / W	L/MD / F		
ADT					2.85 – 3.80 (3)				D / M			HW ROCK
					3.80 – (4)			DACITE; fine to medium grained, yellow-brown & orange-brown, highly weathered, medium strength.				
								Borehole B.H.12 terminated at required depth.				

method
AS auger screwing*
AD auger drilling*
R roller/tricone
W washbore
CT cable tool
*bit shown by suffix
B blank bit
V "V" bit
T TC bit
e.g. ADT

support
C casing
M mud

penetration 1 2 3
no resistance ranging to refusal

water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50 mm diameter
D disturbed sample
N standard penetration test figure = result
N* SPT + sample
Nc cone penetrometer

classification symbols and soil description
based on unified classification system

moisture
D dry
M moist
W wet

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

8–0

1073

Coffey & Partners Pty. Ltd.

Incorporated in Qld.

engineering log — cored borehole

COFFEY

borehole no: B.H.12A

sheet 1 of 2

office and job no: CANBERRA: C.3166

project: GEOTECHNICAL INVESTIGATION - ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

borehole location: SEE DRAWING C.3166/2.

hole commenced: 14.12.84

hole completed: 17.12.84

supervised by: Schedule 2.2 (a)(ii) [redacted]

log checked by: [redacted]

drill model and mounting: Truck: Edson 3000 slope: 90 deg.

R.L. surface: [redacted] m

barrel type and length: 1.5 m T.T. fluid: water bearing: - deg.

datum: -

drilling information / rock substance / rock mass defects

method	R.L. / depth metres	piezometer	substance description (rock type: grain characteristics, colour, structure, minor components)	weathering	defect description (thickness, type, inclination, planarity, roughness, coating)
ADT	0 – 2.90		Borehole B.H.12A auger drilled to 2.90 m.		
	2.90 – 3.12	3.0 m - 4.8 m piezometer	NO CORE 0.22 m		
NMLC	3.12		DACITE; fine & medium grained, mauve	HW	joints 45°-60°, planar; smooth, stepped & slickensided, stained & clay veneered
				HW-MW	joints 70° to sub-vertical, smooth, planar, clay veneered
			becoming dark blue & mauve.	MW	joints/partings 20°-30°, planar rough, clay veneer
				MW-SW	calcite seam 2 mm thick at 60°
	7.95				

Column headings also include: case-lift, water, pressure test lugeons (3, 1, 3, 10, 30, 100), graphic log / core loss, strength Is (50) (EL, VL, L, M, H, VH, EH), defect spacing mm (30, 100, 300, 1000, 3000), particular / general. Depth scale: 2, 4, 5, 6, 7, 8.

key

method

AS auger screwing
AD auger drilling
R roller/tricone
W washbore
NMLC NMLC core drilling

case lift

casing used

barrel withdrawn

water

10 Oct. 73 water level date shown

water inflow

partial drilling water loss

complete drilling water loss

pressure test

(350) maximum effective pressure in test (kPa)

graphic log/core loss

core recovered (hatching indicates material)

no core recovered

weathering

Fr - fresh
SW - slightly weathered
MW - moderately weathered
HW - highly weathered
EW - extremely weathered

strength (indirect tensile strength)

EL - extremely low
VL - very low
L - low
M - medium
H - high
VH - very high
EH - extremely high

'60-

1074

Coffey & Partners Pty. Ltd.

Incorporated In Qld.

engineering log – cored borehole

COFFEY

borehole no: B.H.12A

sheet 2 of 2

office and job no: CANBERRA: C.3166

project: GEOTECHNICAL INVESTIGATION - ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

borehole location: SEE DRAWING C.3166/2.

hole commenced: 14.12.84

hole completed: 17.12.84

supervised by: [redacted]

log checked by:

drill model and mounting: Truck: Edson 3000 slope: 90 deg. R.L. surface: [redacted] m

barrel type and length: 1.5 m T.T. fluid water bearing: – deg. datum: –

drilling information					rock substance					rock mass defects	
method	case-lift	water	pressure test lugeons (.3 1 3 10 30 100)	R.L. depth metres	graphic log core loss	substance description rock type: grain characteristics, colour, structure, minor components	weathering	strength Is (50) (EL VL L M H VH EH)	defect spacing mm (30 100 300 1000 3000)	defect description thickness, type, inclination, planarity, roughness, coating. particular	general
				8.10		NO CORE 0.15 m.					
						Borehole B.H.12 terminated at required depth.					
				9							

key

method
- AS auger screwing
- AD auger drilling
- R roller/tricone
- W washbore
- NMLC NMLC core drilling

case lift
- casing used
- barrel withdrawn

water
- 10 Oct. 73 water level date shown
- water inflow
- partial drilling water loss
- complete drilling water loss

pressure test
- (350) maximum effective pressure in test (kPa)

graphic log/core loss
- core recovered (hatching indicates material)
- no core recovered

weathering
- Fr fresh
- SW slightly weathered
- MW moderately weathered
- HW highly weathered
- EW extremely weathered

strength (indirect tensile strength)
- EL – extremely low
- VL – very low
- L – low
- M – medium
- H – high
- VH – very high
- EH – extremely high

... –60'

1075

Coffey & Partners Pty. Ltd.

Incorporated in Qld.

engineering log borehole

COFFEY

borehole no.: B.H.15

sheet 1 of 3

office and job no: CANBERRA: C.3166

project: GEOTECHNICAL INVESTIGATION - ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

borehole location: SEE DRAWING C.3166/2.

hole commenced: 18.12.84

hole completed: 18.12.84

Schedule 2.2 (a)(ii)

supervised by: [redacted]

checked by:

drill model and mounting: Truck: Edson 3000

hole diameter: 110 mm

slope: 90 deg.

bearing: – deg.

R.L. surface: [redacted] m

datum: –

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
AST		NIL			0.70		ML	Sandy SILT; brown, sand is fine.	D	MD (Fb)		FILL
				D	1 1.80		CH	Sandy CLAY; yellow-brown, high plast., sand fine to coarse, some gravel to 5 mm.	M	St		ALLUVIAL SOIL
ADT				D	2 2.20		SC	Clayey SAND; brown, low plast., sand fine to coarse,	M	MD		EW ROCK
					2.60			DACITE; fine & medium grained, mauve, highly weathered, low strength.	D/M			↓ HW ROCK
					3			Borehole B.H.15 cored from 2.6 m - See Sheet 2.				

method
AS auger screwing*
AD auger drilling*
R roller/tricone
W washbore
CT cable tool
*bit shown by suffix
B blank bit
V "V" bit
T TC bit
e.g. ADT

support
C casing
M mud

penetration 1 2 3
no resistance ranging to refusal

water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50 mm diameter
D disturbed sample
N standard penetration test figure = result
N* SPT + sample
Nc cone penetrometer

classification symbols and soil description
based on unified classification system

moisture
D dry
M moist
W wet

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

78–C

1076

Coffey & Partners Pty. Ltd.

Incorporated In Qld.

engineering log — cored borehole

COFFEY

borehole no: B.H.15

sheet 2 of 3

office and job no: CANBERRA: C.3166

project:	GEOTECHNICAL INVESTIGATION - ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.	hole commenced:	18.12.84
borehole location:	SEE DRAWING C.3166/2.	hole completed:	18.12.84
		supervised by:	Schedule 2.2 (a)(ii) [redacted]
		log checked by:	

drill model and mounting: Truck: Edson 3000 slope: 90 deg. R.L. surface: [redacted] m

barrel type and length: 1.5 m T.T. fluid: water bearing: - deg. datum: -

method	case-lift	water	pressure test lugeons	R.L. depth metres	graphic log / core loss	substance description (rock type: grain characteristics, colour, structure, minor components)	weathering	strength Is (50)	defect spacing mm	defect description (thickness, type, inclination, planarity, roughness, coating; particular / general)
				0–2.60		Borehole B.H.15 auger drilled to 2.60 m.				
NMLC				2.60–4.05		Rhyodacitic TUFF; fine to medium grained, orange brown, cream	HW			joints 20°-70°, planar, rough & smooth, stained zeolite & clay veneered subvertical joints, planar & irregular, rough
				4.05–4.15		NO CORE 0.10 m				
				4.15–8						

key

method

AS	auger screwing
AD	auger drilling
R	roller/tricone
W	washbore
NMLC	NMLC core drilling

case-lift

casing used

barrel withdrawn

water

10 Oct, 73 water level date shown

water inflow

partial drilling water loss

complete drilling water loss

pressure test

(350) maximum effective pressure in test (kPa)

graphic log/core loss

core recovered (hatching indicates material)

no core recovered

weathering

Fr	-	fresh
SW	-	slightly weathered
MW	-	moderately weathered
HW	-	highly weathered
EW	-	extremely weathered

strength (indirect tensile strength)

EL	-	extremely low
VL	-	very low
L	-	low
M	-	medium
H	-	high
VH	-	very high
EH	-	extremely high

-097

1077

Coffey & Partners Pty. Ltd.

Incorporated in Qld.

engineering log — cored borehole

COFFEY

borehole no:	B.H.15
sheet 3 of 3	

office and job no: CANBERRA: C.3166

project: GEOTECHNICAL INVESTIGATION - ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

borehole location: SEE DRAWING C.3166/2.

hole commenced: 18.12.84

hole completed: 18.12.84

supervised by: Schedule 2.2 (a)(ii) [redacted]

log checked by:

drill model and mounting: Truck: Edson 3000 slope: 90 deg.

barrel type and length: 1.5 m T.T. fluidwaterbearing: - deg.

R.L. surface: [redacted] m

datum: -

drilling information: method	case-lift	water	pressure test lugeons (3, 10, 30, 100)	R.L.	depth metres	graphic log / core loss	rock substance: substance description (rock type: grain characteristics, colour, structure, minor components)	weathering	strength Is (50) (EL VL L M H VH EH)	defect spacing mm (30, 100, 300, 1000, 3000)	rock mass defects: defect description (thickness, type, inclination, planarity, roughness, coating) particular / general
NMLC					8 – 10.25		Rhyo-Dacitic TUFF; fine to medium grained, cream, orange brown, green, mauve, zeolitic veins.	HW-MW			
					10.25 – 11		Borehole B.H.15 terminated at required depth.	HW			

key

method

- AS auger screwing
- AD auger drilling
- R roller/tricone
- W washbore
- NMLC NMLC core drilling

case-lift

- casing used
- barrel withdrawn

water

- 10 Oct, 73 water level date shown
- water inflow
- partial drilling water loss
- complete drilling water loss

pressure test

- (350) maximum effective pressure in test (kPa)

graphic log/core loss

- core recovered (hatching indicates material)
- no core recovered

weathering

- Fr — fresh
- SW — slightly weathered
- MW — moderately weathered
- HW — highly weathered
- EW — extremely weathered

strength (indirect tensile strength)

- EL — extremely low
- VL — very low
- L — low
- M — medium
- H — high
- VH — very high
- EH — extremely high

T78-097

1078

Coffey & Partners Pty. Ltd.

Incorporated In Qld.

engineering log — cored borehole

COFFEY

borehole no: B.H.16

sheet 1 of 2

office and job no: CANBERRA: C.3166

project:	GEOTECHNICAL INVESTIGATION - ISABELLA DRIVE, STAGE 2, TUGGERANONG	hole commenced:	19.12.84
borehole location:	TUGGERANONG, A.C.T. SEE DRAWING C.3166/2.	hole completed:	19.12.84
		supervised by:	Schedule 2.2 (a)(ii) [redacted]
		log checked by:	

drill model and mounting: Truck: Edson 3000 slope: 90 deg. R.L. surface: [redacted] m

barrel type and length: 1.5 m T.T. fluid water bearing: - deg. datum: -

drilling information | rock substance | rock mass defects

method	case-lift	water	pressure test lugeons (3, 10, 30, 100)		R.L. / depth metres	graphic log / core loss	substance description (rock type: grain characteristics, colour, structure, minor components)	weathering	strength Is (50) (EL VL L M H VH EH)	defect spacing mm (30, 100, 300, 1000, 3000)	defect description (thickness, type, inclination, planarity, roughness, coating. particular / general)
					0 – 2.50 (2)		Borehole B.H.16 wash bored to 2.5 m				
NMLC				Piezometer No.2 2.5 to 7.0 m.	2.50 – 3		Dacitic TUFF; fine & medium grained, blue & mauve, containing epidote veins.	HW / MW			joints 60°-70°, planar, curvilinear, smooth, rough, clay veneer
					3 – 4			MW / SW			crush seam 0°-5°
					4 – 5			HW / MW			subhorizontal, planar, stained partings joint 20°
					5 – 6			MW / SW			joints 60-70°, planar, rough & smooth, polished surfaces; joint 50°, planar, rough
					6			HW			jointsubvertical, irregular, rough
					6 – 8			MW / SW			healed joint, planar, 70°, joint 30°, planar, clay veneer, polished & healed subvertical joints; planar parting 10-15°, clay veneer

key

method		case lift	pressure test	weathering		strength (indirect tensile strength)		
AS	auger screwing	casing used	(350) maximum effective pressure in test (kPa)	Fr	fresh	EL	-	extremely low
AD	auger drilling	barrel withdrawn	graphic log/core loss	SW	slightly weathered	VL	-	very low
R	roller/tricone	water: 10 Oct. 73 water level date shown	core recovered (hatching indicates material)	MW	moderately weathered	L	-	low
W	washbore	water inflow	no core recovered	HW	highly weathered	M	-	medium
NMLC	NMLC core drilling	partial drilling water loss		EW	extremely weathered	H	-	high
		complete drilling water loss				VH	-	very high
						EH	-	extremely high

T78-097

Coffey & Partners Pty. Ltd. 1079

Incorporated In Qld.

engineering log — cored borehole

COFFEY

borehole no: B.H.16

sheet 2 of 2

office and job no: CANBERRA: C.3166

project: GEOTECHNICAL INVESTIGATION - ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

borehole location: SEE DRAWING C.3166/2.

hole commenced: 19.12.84

hole completed: 19.12.84

supervised by: Schedule 2.2 (a)(ii) [redacted]

log checked by: [redacted]

drill model and mounting: Truck: Edson 3000 slope: 90 deg. R.L. surface: [redacted] m

barrel type and length: 1.5 m T.T. fluid: water bearing: - deg. datum: -

drilling information: method	case-lift	water	pressure test lugeons		R.L. depth metres	graphic log / core loss	rock substance: substance description (rock type: grain characteristics, colour, structure, minor components)	weathering	strength Is (50)	defect spacing mm	rock mass defects: defect description (thickness, type, inclination, planarity, roughness, coating)
NMLC				Piezometer No.1 8.2 to 12.95 m	8		Dacitite TUFF; as above	MW SW			joint 70°, planar rough, clean
					9						joint 30°, planar rough, clean; joints 10°, intersect; joint 70-80°, planar rough, clay veneer
					10		Rhyodacitic TUFF; fine to medium grained, orange-brown, cream & green, epidotic zeolite mineralization along joints, alteration zone.	HW / MW SW			joint planar polished 60°, clay veneer; joints 45-70°, planar, smooth polished, clay infill & veneer, shear zone
					11						
					12		Dacitic TUFF; fine & medium grained, mauve.				joints 10-30°, planar, rough smooth
					12.95 13		Borehole B.H.16 terminated at required depth.				

key

method		case-lift	pressure test	weathering		strength (indirect tensile strength)	
AS	auger screwing	casing used	(350) maximum effective pressure in test (kPa)	Fr	fresh	EL	extremely low
AD	auger drilling	barrel withdrawn	graphic log/core loss	SW	slightly weathered	VL	very low
R	roller/tricone	water: 10 Oct. 73 water level date shown	core recovered (hatching indicates material)	MW	moderately weathered	L	low
W	washbore	water inflow	no core recovered	HW	highly weathered	M	medium
NMLC	NMLC core drilling	partial drilling water loss		EW	extremely weathered	H	high
		complete drilling water loss				VH	very high
						EH	extremely high

150-8/71

Coffey & Partners Pty. Ltd.
Incorporated In Qld.
1080

unconfined compressive strength test results

sheet 1 of 1

office and job no: CANBERRA: C.3166

date: 11.2.85
tested by: Schedule 2.2 (a)(ii) [redacted]
checked by:

project: GEOTECHNICAL INVESTIGATION -
location: ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

sample details: location	depth m: from – to	sample type	moisture condition	rock substance description (rock type: grain characteristics, colour, structure, minor components, weathering)	unconfined compressive strength q_u (MPa)	modulus of elasticity E (MPa)	ratio $\frac{E}{q_u}$	dry density γ_d (t/m³)
B.H.1	5.45 - 5.75		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	150	12000	80	2.65
B.H.2	2.75 - 3.00		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	74	13000	176	2.62
B.H.6	1.70 - 1.90		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	3.3 (failed along joint)			2.53
B.H.7	1.75 - 2.00	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	93	10000	108	2.59
B.H.8	2.70 - 2.90		D	Dacitic TUFF; fine to medium grained, mauve, moderately weathered.	42	5000	119	2.55
B.H.9	1.00 - 1.30		D	Dacitic TUFF & DACITE; fine to medium grained, mauve, moderately to slightly weathered.	205	11000	55	2.59
B.H.9	3.50 - 3.70		D	Dacitic TUFF & DACITE; fine to medium grained, mauve, highly to moderately weathered.	14.8	1645	110	2.54

Schedule 2.2 (a)(ii) [redacted]

Coffey & Partners Pty. Ltd.
Incorporated in Qld.

point load strength test results

office and job no: CANBERRA: C.3166

project: GEOTECHNICAL INVESTIGATION -
location: ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

date:
tested by: [redacted]
checked by:

location	depth (m) from to	sample type	moisture condition	rock substance description rock type, grain charactistics, colour, structure, minorcomponents, weathering	failure mode S-substance M-mass	point load index $I_s(50)$ MPa	point load strength classification
B.H.1	3.25 - 3.35	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, highly weathered.	M	2.0	High Strength
B.H.1	5.75 - 5.80	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	M	5.0	Very High Strength
B.H.2	3.50 - 3.60	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	M	4.0	Very High Strength
B.H.3	4.30 - 4.40	NMLC CORE	D	Dacitic TUFF; fine to medium grained, orange & red-brown, highly to moderately weathered.	M	1.0	Medium to High Strength
B.H.3	6.00 - 6.15	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, moderately weathered.	M/S	4.0	Very High Strength
B.H.4	4.75 - 4.85	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve & cream, highly weathered.	M	1.0	Medium to High Strength
B.H.4	5.30 - 5.40	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve & cream, highly weathered.	M	3.5	Very High Strength
B.H.4	5.50 - 5.60	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, moderately weathered.	M	2.3	High Strength
B.H.4	6.60 - 6.70	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, moderately weathered.	M/S	0.9	Medium Strength

[redacted]

Coffey & Partners Pty. Ltd. 1082

Incorporated in Qld.

point load strength test results

sheet 2 of 5

office and job no: CANBERRA: C.3166

project: GEOTECHNICAL INVESTIGATION -

location: ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

date:

tested by:

checked by: Schedule 2.2 (a)(ii) [redacted]

sample details: location	depth (m) from to	sample type	moisture condition	rock substance description: rock type, grain charactistics, colour, structure, minorcomponents, weathering	failure mode S-substance M-mass	point load index $I_s(50)$ MPa	point load strength classification
B.H.4	7.30 - 7.40		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	S	3.8	Very High Strength
B.H.6	1.35 - 1.45		D	Dacitic TUFF; fine to medium grained, mauve, highly weathered.	M	0.3	Low to Medium Strength
B.H.6	2.00 - 2.10		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	M	1.8	High Strength
B.H.7	2.00 - 2.15		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	S	8.0	Very High Strength
B.H.7	2.75 - 2.85	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	S	7.0	Very High Strength
B.H.8	2.90 - 3.00		D	Dacitic TUFF; fine to medium grained, mauve, moderately weathered.	S	4.0	Very High Strength
B.H.8	3.55 - 3.70		D	Dacitic TUFF; fine to medium grained, mauve, moderately weathered.	S	4.0	Very High Strength
B.H.8	4.65 - 4.85		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	M	6.0	Very High Strength

Schedule 2.2 (a)(ii) [redacted]

Coffey & Partners Pty. Ltd.
Incorporated In Qld.

point load strength test results

office and job no: CANBERRA: C.3166

project: GEOTECHNICAL INVESTIGATION -
location: ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

date:
tested by:
checked by:
Schedule 2.2 (a)(ii) [redacted]

sample details					rock substance description	failure mode	point load index	point load strength classification
location	depth (m) from	to	sample type	moisture condition	rock type, grain charactistics, colour, structure, minorcomponents, weathering	S-substance M-mass	$I_s(50)$ MPa	
B.H.8	5.10 -	5.30		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	S	6.0	Very High Strength
B.H.9	0.70 -	0.85		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	M	3.0	High to Very High Strength
B.H.9	1.70 -	1.95		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	M	6.0	Very High Strength
B.H.9	2.35 -	2.45		D	Dacitic TUFF; fine to medium grained, mauve, highly weathered.	M	0.8	Medium Strength
B.H.9	4.15 -	4.30	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, highly to moderately weathered.	M	1.0	Medium to High Strength
B.H.11	1.90 -	2.00		D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	S	5.5	Very High Strength
B.H.11	6.10 -	6.20		D	Dacitic TUFF; fine to medium grained, mauve, slightly weathered.	S	8.0	Very High Strength
B.H.12	3.20 -	3.25		D	Rhyodacitic TUFF; fine to medium grained, grey & orange-brown, highly weathered.	M	0.7	Medium Strength

Schedule 2.2 (a)(ii) [redacted]

Coffey & Partners Pty. Ltd.
Incorporated in Qld.

point load strength test results

office and job no: CANBERRA: C.3166

project: GEOTECHNICAL INVESTIGATION -
location: ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

date:
tested by:
checked by:
Schedule 2.2 (a)(ii) [redacted]

sample details: location	depth (m) from to	sample type	moisture condition	rock substance description: rock type, grain charactistics, colour, structure, minorcomponents, weathering	failure mode: S-substance, M-mass	point load index $I_s(50)$ MPa	point load strength classification
B.H.12	3.75 - 3.80	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, highly weathered.	M	1.0	Medium to High Strength
B.H.12	5.45 - 5.60	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, slightly weathered.	M/S	8.0	Very High Strength
B.H.13	8.05 - 8.15	NMLC CORE	D	Dacitic TUFF; fine to medium grained, orange-brown & cream, highly weathered.	S	< 0.1	Very Low Strength
B.H.13	8.95 - 9.00	NMLC CORE	D	Dacitic TUFF; fine to medium grained, orange-brown & cream, highly weathered.	S	0.4	Low to Medium Strength
B.H.13	9.75 - 9.80	NMLC CORE	D	Dacitic TUFF; fine to medium grained, orange-brown & cream, highly weahtered.	S	< 0.1	Very Low Strength
B.H.13	10.10 - 10.20	NMLC CORE	D	Dacitic TUFF; fine to medium grained, orange-brown, highly weathered.	S	0.75	Medium Strength
B.H.15	2.90 - 3.00	NMLC CORE	D	Rhyodacite TUFF; fine to medium grained, orange-brown & cream, highly weathered.	S	2.0	High Strength
B.H.15	5.15 - 5.30	NMLC CORE	D	Rhyodacite TUFF; fine to medium grained, orange-brown & cream, highly weathered.	M	1.5	High Strength

Schedule 2.2 (a)(ii) [redacted]

Coffey & Partners Pty. Ltd.
Incorporated In Qld.

point load strength test results

office and job no: CANBERRA: C.3166

project: GEOTECHNICAL INVESTIGATION –
location: ISABELLA DRIVE, STAGE 5, TUGGERANONG, A.C.T.

date:
tested by:
checked by:

Schedule 2.2 (a)(ii) [redacted]

sample details: location	depth (m) from to	sample type	moisture condition	rock substance description: rock type, grain charactistics, colour, structure, minorcomponents, weathering	failure mode S-substance M-mass	point load index $I_s(50)$ MPa	point load strength classification
B.H.15	7.10 – 7.15	NMLC CORE	D	Rhyodacitic TUFF; fine to medium grained, orange-brown & cream, highly weathered.	S	1.5	High Strength
B.H.15	7.50 – 7.60	NMLC CORE	D	Rhyodacitic TUFF; fine to medium grained, orange-brown & cream, highly weathered.	S	1.8	High Strength
B.H.15	8.50 – 8.55	NMLC CORE	D	Rhyodacitic TUFF; fine to medium grained, ornage-brown & cream, highly weathered.	S	2.0	High Strength
B.H.15	9.15 – 9.30	NMLC CORE	D	Rhyodacitic TUFF; fine to medium grained, orange-brown & cream, highly weathered.	S	2.7	High Strength
B.H.16	3.00 – 3.30	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, moderately to slightly weathered.	S	6.0	Very High Strength
B.H.16	5.40 – 5.55	NMLC CORE	D	Dacitic TUFF; fine to medium grained, mauve, highly weathered.	M	0.75	Medium Strength

Schedule 2.2 (a)(ii) [redacted]

APPENDIX 2.03:
COFFEY 1985 – EMBANKMENT MATERIAL DESIGN GRADINGS

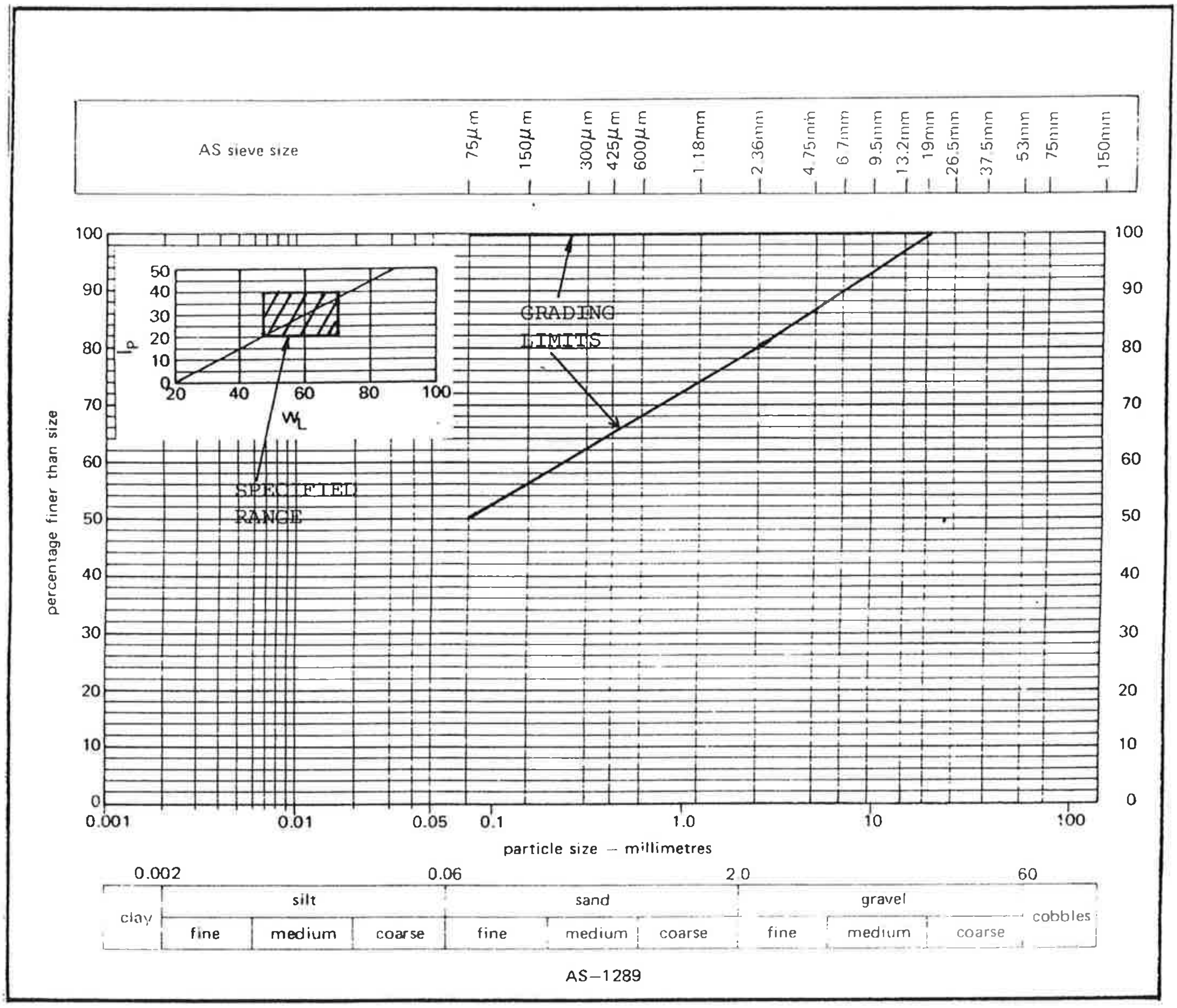


FIGURE 4: IMPERVIOUS CLAY FILL MATERIALS - ZONE 1

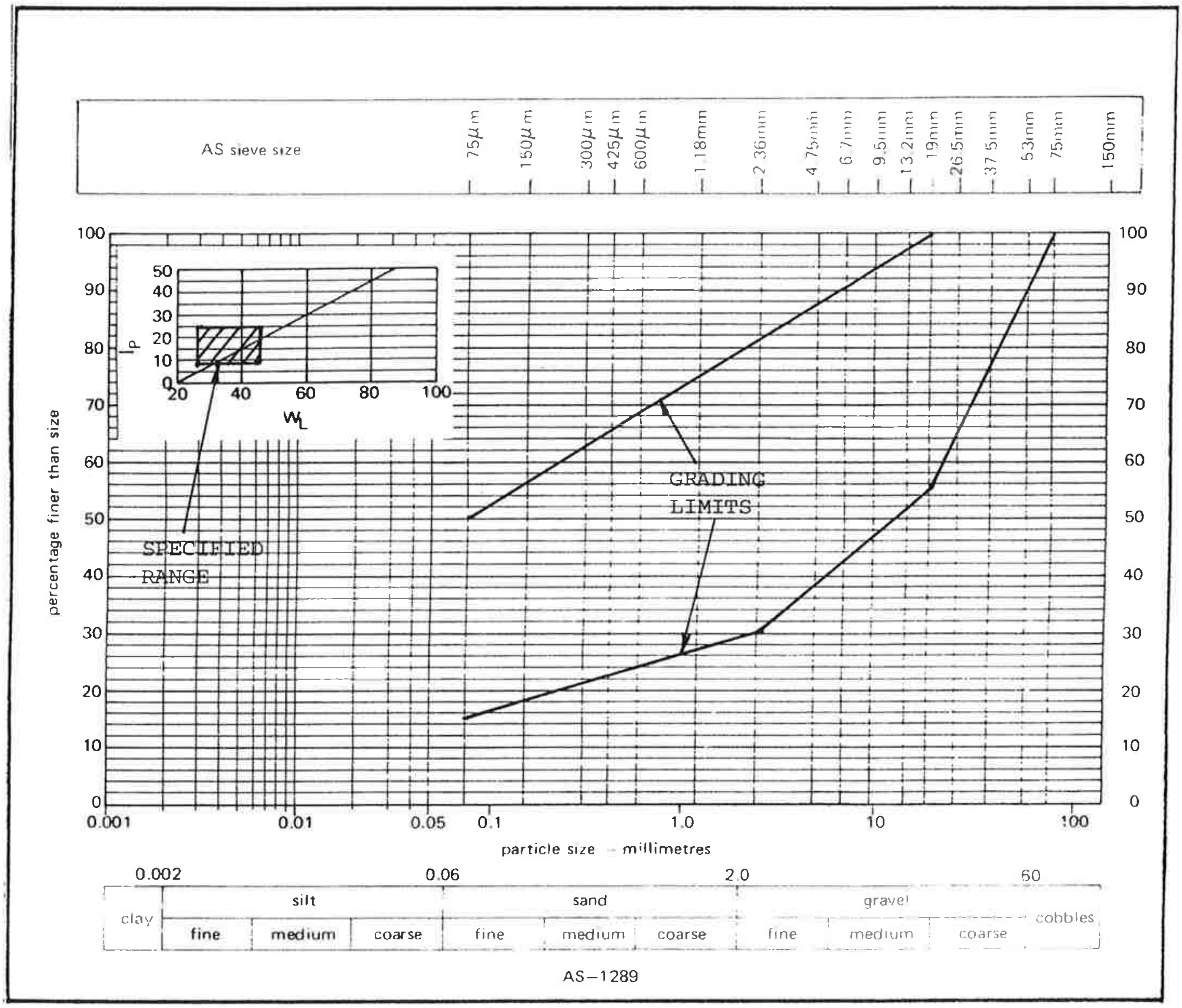


FIGURE 5: SEMI-IMPERVIOUS CLAY FILL MATERIALS - ZONE 2

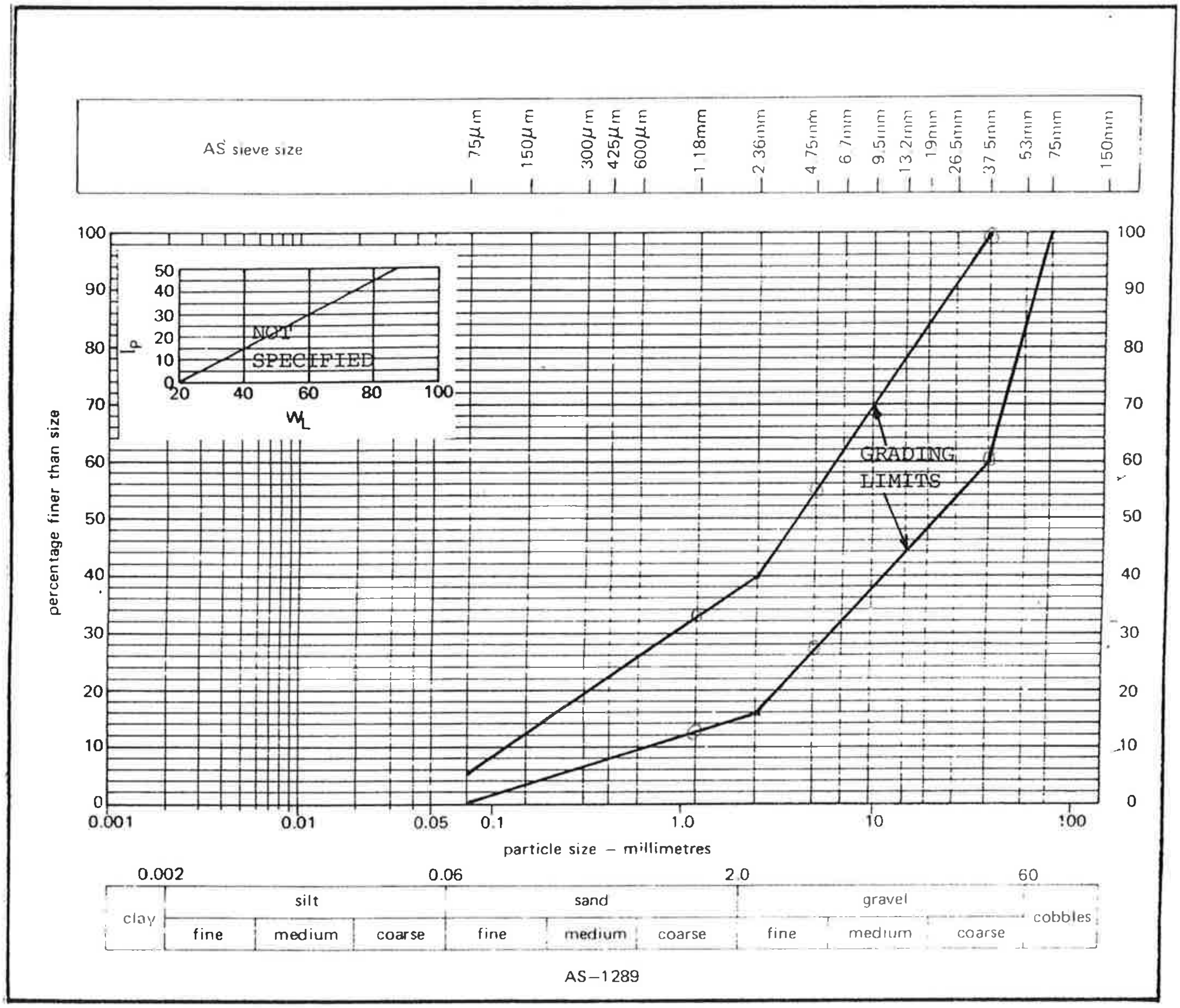


FIGURE 6: FILTER MATERIALS - ZONE 3

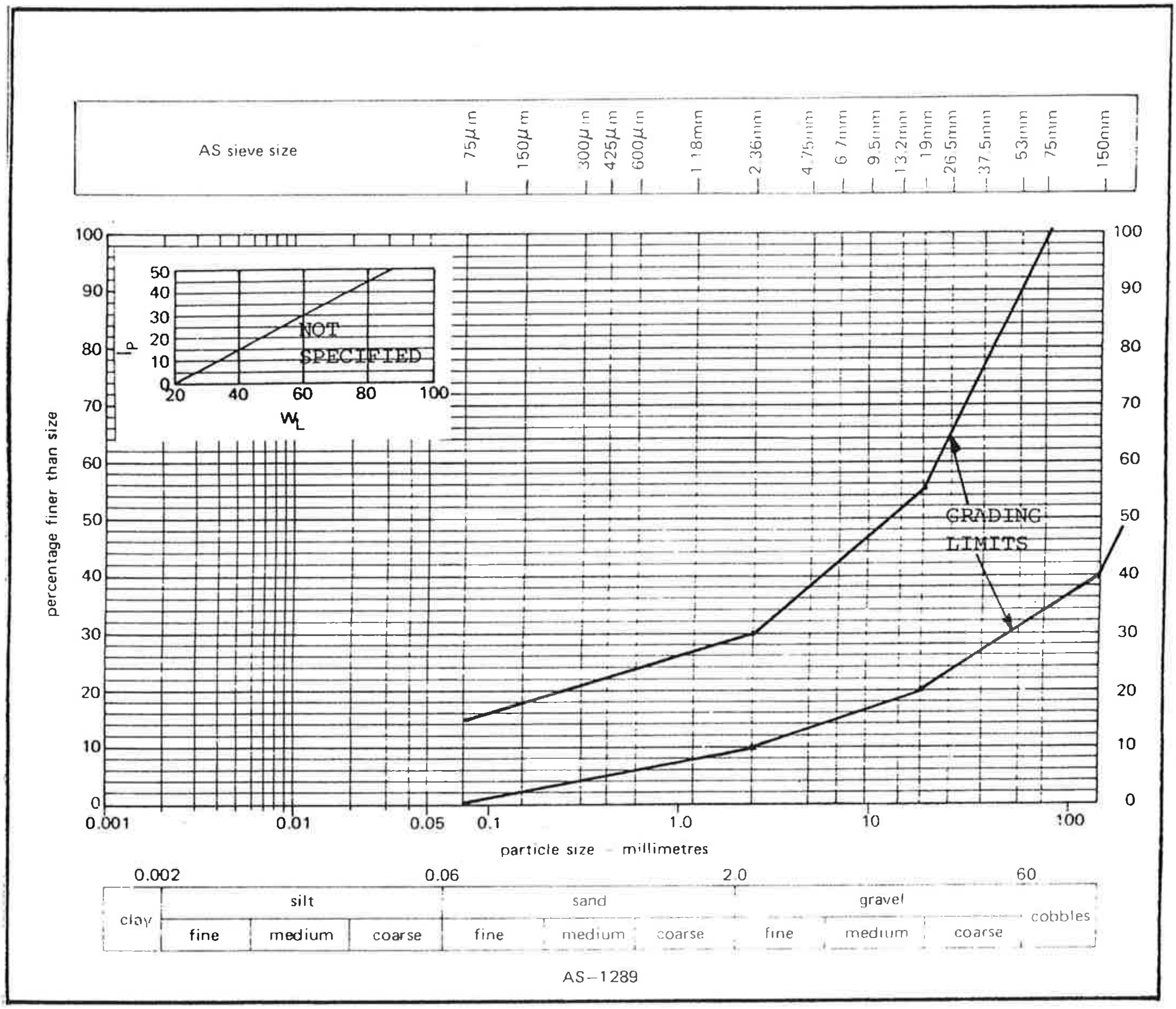


FIGURE 7: EARTH-ROCKFILL MATERIALS - ZONE 4

APPENDIX 2.04: COFFEY 1987 – RESULTS OF GEOLOGICAL MAPPING OF ROCK FOUNDATION ISABELLA WEIR

1092

RESULTS OF GEOLOGICAL MAPPING
OF ROCK FOUNDATION
ISABELLA WEIR
ISABELLA DRIVE, STAGE 5A,
TUGGERANONG CREEK, A.C.T.

THEISS CONTRACTORS PTY LTD

Schedule 2.2 (a)(ii) [redacted]

COFFEY

Coffey & Partners Pty Ltd

Consulting Engineers
in the geotechnical sciences

Incorporated in Queensland

8c Wiluna Street
Fyshwick Canberra

PO Box 152
Fyshwick ACT
Australia 2609

Telephone (062) 80 4732

Soil and rock engineering
engineering geology
groundwater hydrology
foundation engineering
mining geotechnics
dam engineering
computer applications
construction control & monitoring

your reference

our reference RCMG:TM - C.3445/1-AC

date 23rd September, 1987

The Manager
Theiss Contractors Pty Ltd
P O Box 98
MANUKA A.C.T. 2603

Attention: Schedule 2.2 (a)(ii) [redacted]

Dear Sir,

RE: **RESULTS OF GEOLOGICAL MAPPING OF ROCK FOUNDATION, ISABELLA WEIR, ISABELLA DRIVE, STAGE 5A, TUGGERANONG CREEK, A.C.T.**

We are pleased to present our report on the engineering geological mapping of rock foundations at the above site. Your attention is drawn to Attachment A included at the end of this report for your information. Please do not hesitate to contact this office for any questions you may have regarding this report.

Yours faithfully
COFFEY & PARTNERS PTY LTD

Schedule 2.2 (a)(ii) [redacted]

ACEA

Offices and NATA Registered Laboratories
Adelaide
Albury-Wodonga
Ballina
Brisbane
Canberra
Darwin
Melbourne
Moruya
Newcastle
Perth
Sydney
Townsville
Woodridge
Rangoon, Burma
Mandalay, Burma

RESULTS OF GEOLOGICAL MAPPING OF ROCK FOUNDATION ISABELLA WEIR, ISABELLA DRIVE, STAGE 5A, TUGGERANONG CREEK, A.C.T.

In accordance with the Australian National Committee on Large Dams (ANCOLD), the Isabella Weir is a referable structure. To satisfy the requirements for the construction record of the structure, Coffey & Partners Pty Ltd have produced an engineering geological map of the weir foundations, including the cut-off trench, labyrinth wall and wing wall foundations, and the sewer trench cut-off on the left or southern abutment.

The mapping was performed over a period of about thirteen months between June, 1986 and July, 1987. The general mapping programme is outlined below:-

* 11th June to 13th June, 1986, mapping of left abutment (north side) cut-off and wing wall foundation area;

* 19th June to 24th June, 1986, mapping of right abutment (south side) cut-off and wing wall foundation area;

* 20th February to 20th March, 1987, mapping of labyrinth wall foundation, left hand side;

* 21st May to 22nd May, 1987, mapping of left abutment extension and sewer trench cut-off;

* 16th July to 20th July, 1987, mapping of labyrinth wall foundation, right hand side.

The geological mapping was carried out at a scale of 1:100, and involved recording the rock weathering and strength properties and details of structural defects in the excavated rock foundations after preparation and clean-up. The majority of defects are joints with a smaller proportion of sheared zones and/or faults. Major defects and the general trend of joint sets have been plotted graphically on the engineering geology plan of the foundations presented on Drawing C.3445/1-1. The defect features were located by tape measurements on a grid pattern using surveyed construction stations as base locations. An explanation sheet outlining the weathering and strength classifications is included in the Appendix to this report.

The rock is dacite of the lower Silurian age Deakin Volcanics unit. Extremely to highly weathered dacite is yellow-brown, to grey-brown,and the moderately to slightly weathered dacite is purple-brown, grey-brown and blue-grey. The rock has a porphyritic texture with crystals of quartz and feldspar to about 5mm in size. Quartz, epidote, zeolite and chlorite veins to widths of about 10mm occur throughout the rock mass.

The rock surface is erosional, forming the base of the Tuggeranong Creek channel. Therefore much of the more deeply weathered rock has been removed from the profile by erosion, exposing predominantly moderately to slightly weathered rock close to the soil/rock contact. Foundation levels occured at depths of up to about 2m below this rock surface. The prepared foundation generally comprised moderately weathered and slightly weathered rock of high to very high strength, containing some zones of fresh rock of extremely high strength. Pockets of extremely to highly weathered rock were observed at foundation level, being associated with faulted and sheared zones, or zones of hydrothermal alteration. The more prevalent highly to moderately weathered rock zones of low to medium strength on the northern abutment are mainly related to the natural weathering.

The joint measurements, as marked on the engineering geology plan, have been represented by stereographic projections on Drawings C.3445/1-2 to 1-5. The three joint sets for each of the four delineated foundation areas are presented in Table 1, and it can be seen that the three joint sets are reasonably consistent over the site, particularly Joint Set 1. Joint Set 2 is generally more shallow dipping towards the eastern side of the foundation area, and Joint Set 3 is generally more shallow dipping over the central channel area and southern abutment. In the northern abutment area, Joint Set 3 is much less prominent due to the presence of large undulating erosional surfaces. Other random joints occur throughout the foundation area.

Joint spacings generally range between 100mm and 500mm for the more steeply dipping sets, resulting in a blocky, angular excavated profile. Where the more gently dipping joints are close to the design excavation level, large flat or undulating slabby faces are common. Several weathered seams or sheared zones cross the site. The most prominent sheared zone strikes north-west to south-east across at least 18m of the central channel area and dips 40° to 50° upstream. The rock is deeply weathered or altered up to a distance of about 1m adjacent to this sheared zone. Other shorter and narrower seams strike approximately north-south across the site.

In general the excavated, prepared and cleaned rock surfaces were mostly tight, with the deeply weathered seams or sheared zones and the more closely jointed zones being hand cleaned to remove soft and loosened materials.

A photographic record was obtained during the mapping programme and a representative selection is presented in the Appendix to this report.

Schedule 2.2 (a)(ii)

[redacted]

COFFEY & PARTNERS PTY LTD

TABLE 1 - JOINT SETS OVER WEIR FOUNDATION AREA

AREA	JOINT SET, showing range in dip and dip direction (degrees)		
	1	2	3
Northern Abutment	80 to 90/135 to 145	80 to 90/240 to 250	40 to 50/080 to 090
Central Channel	80 to 90/145 to 165	80 to 90/250 to 270	20 to 40/080 to 090
Southern Abutment	80 to 90/130 to 140	70 to 80/245 to 255	25 to 45/070 to 090
North-eastern Area	80 to 90/140 to 150	65 to 75/240 to 250	30 to 50/070 to 090

descriptive terms soil and rock

COFFEY

Explanation Sheet 1

SOIL DESCRIPTIONS

Classification of Material based on Unified Classification System (refer SAA Site Investigation Code AS1726—1975 Add. No. 1 Table D1).

Moisture Condition based on appearance of soil

dry Looks and feels dry; cohesive soils usually hard, powdery or friable, granular soils run freely through hands.

moist Soil feels cool, darkened in colour; cohesive soils usually weakened by moisture, granular soils tend to cohere, but one gets no free water on hands on remoulding.

wet Soil feels cool, darkened in colour; cohesive soils weakened, granular soils tend to cohere, free water collects on hands when remoulding.

Consistency based on unconfined compressive strength (Qu) (generally estimated or measured by hand penetrometer).

term	very soft	soft	firm	stiff	very stiff	hard
Qu kPa	25	50	100	200	400	

If soil crumbles on test without meaningful result, it is described as **friable**.

Density Index (generally estimated or based on penetrometer results).

term	very loose	loose	medium dense	dense	very dense
density index I_D %	15	35	65	85	

ROCK DESCRIPTIONS

Weathering based on visual assessment

term	criterion
Fresh:	Rock substance unaffected by weathering.
Slightly Weathered:	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
Moderately Weathered:	Rock substance affected by weathering to the extent that staining extends throughout whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Highly Weathered:	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and signs of chemical or physical decomposition of individual minerals are usually evident. Porosity and strength may be increased or decreased when compared to the fresh rock substance, usually as a result of the leaching or deposition of iron. The colour and strength of the original fresh rock substance is no longer recognisable.
Extremely Weathered:	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.

Strength based on point load strength index, corrected to 50 mm diameter - Is(50) (refer I.S.R.M., Commission on Standardisation of Laboratory and Field Tests, Suggested Methods for Determining the Uniaxial Compressive Strength of Rock Materials and the Point Load Strength Index, Committee on Laboratory Tests Document No. 1). (Generally estimated: x indicates test result).

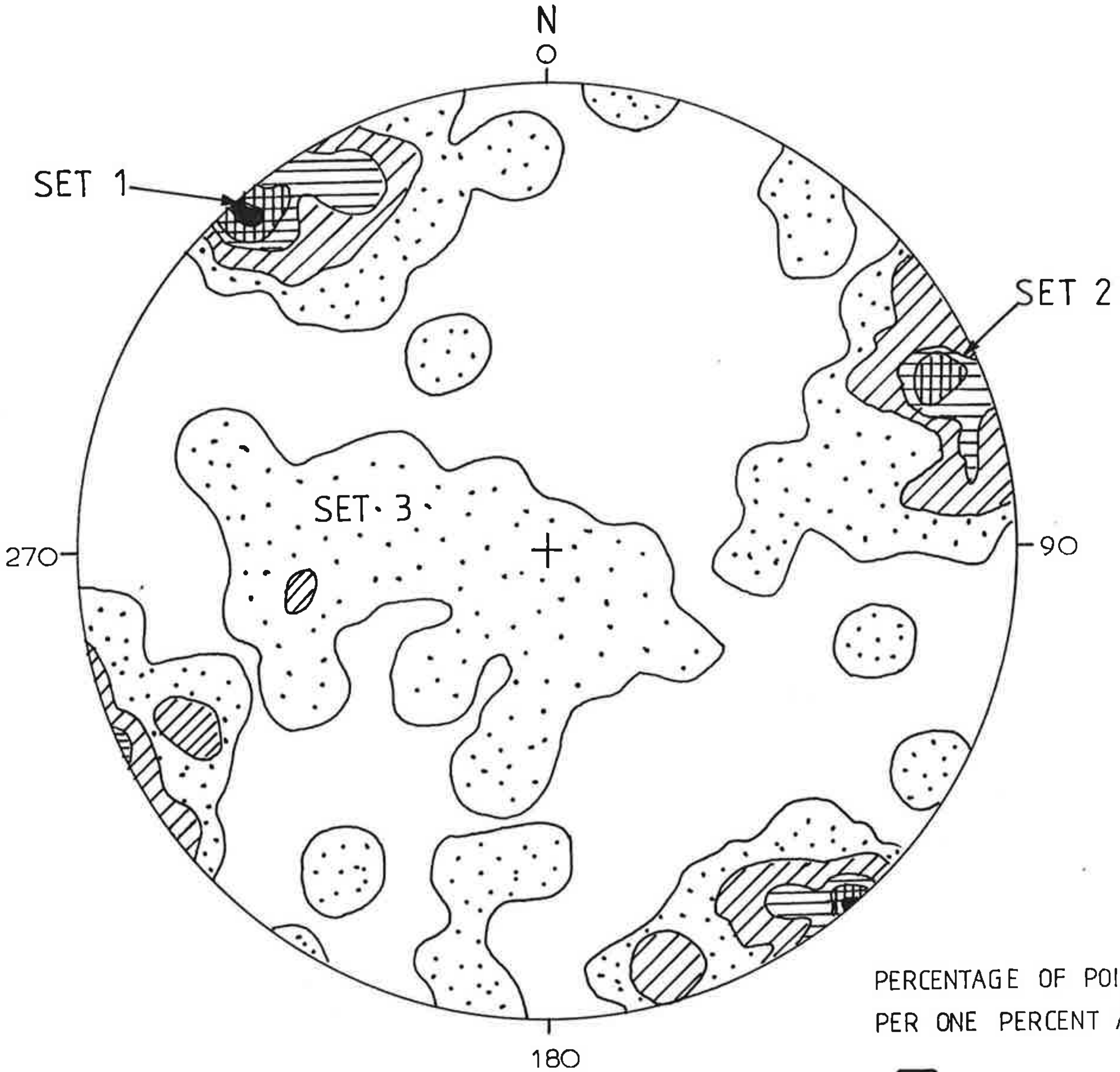
classification	extremely low	very low	low	medium	high	very high	extremely high
Is (50) MPa	0.03	0.1	0.3	1	3	10	

The unconfined compressive strength is typically about 20 x I_{S50} but the multiplier may range, for different rock types, from as low as 4 to as high as 30.

Defect Spacing

classification	extremely close	very close	close	medium	wide	very wide	extremely wide
spacing m	0.03	0.1	0.3	1	3	10	

Defect description uses terms contained on AS1726 table D2 to describe nature of defect (fault, joint, crushed zone, clay seam (etc.) and character (roughness, extent, coating etc.).



PERCENTAGE OF POINTS PER ONE PERCENT AREA

- 1%
- 3%
- 5%
- 7%
- >9%

90 READINGS

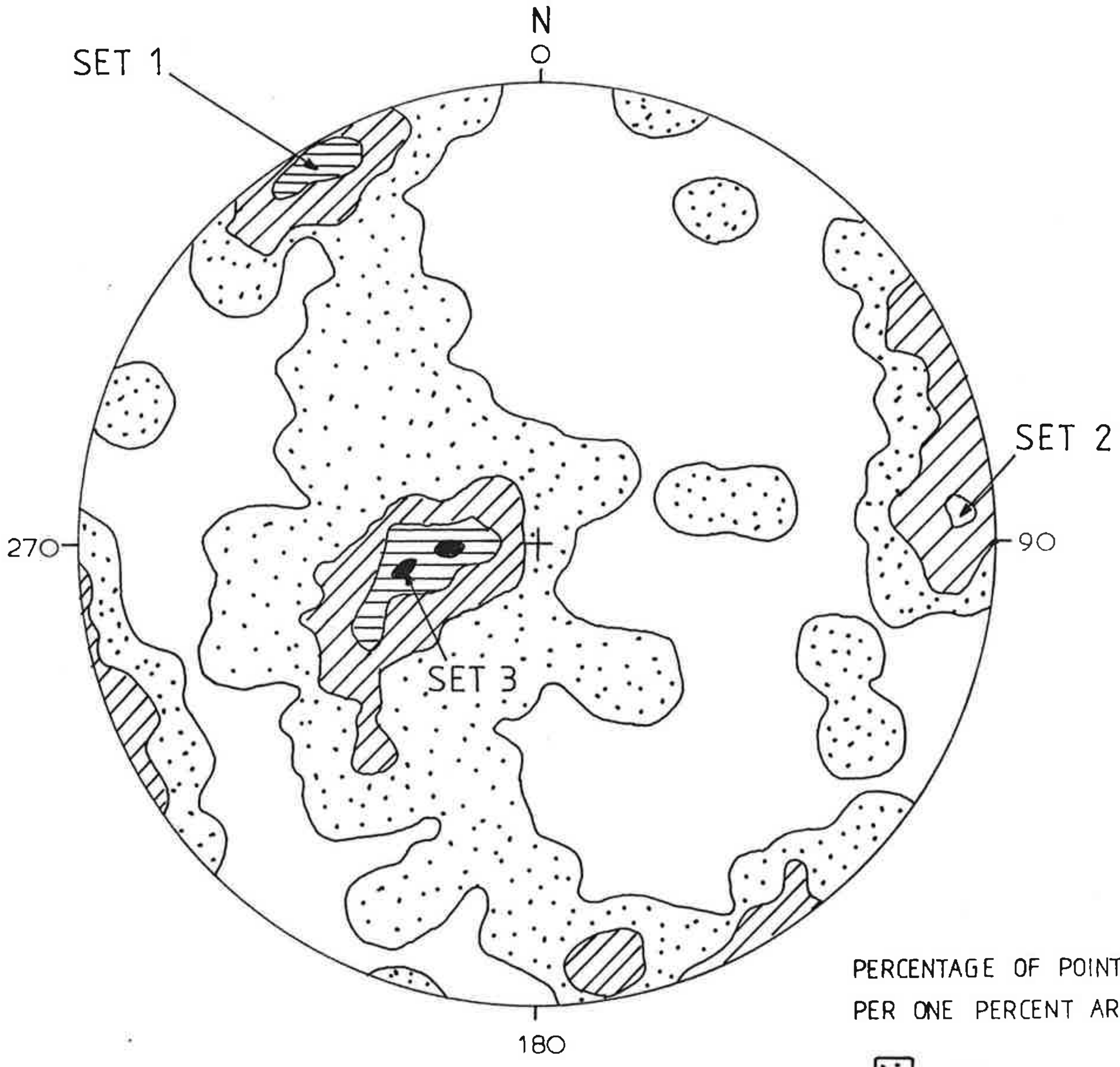
STEREOGRAPHIC PROJECTION OF POLES TO JOINT PLANES.

NORTHERN ABUTMENT

Coffey & Partners Pty Ltd Consulting Engineers in the geotechnical sciences

drawn	Schedule 2.2 (a)(ii) [redacted]	THEISS CONTRACTORS PTY. LTD.	COFFEY	drawing no: C.3445/1-2
approved		ISABELLA WEIR,		
date	19·8·87	ISABELLA DRIVE STAGE 5A,		
scale		TUGGERANONG CREEK, A.C.T.		job no: C.3445/1

1101



PERCENTAGE OF POINTS PER ONE PERCENT AREA

(dotted)	1%
(diagonal hatching)	3%
(horizontal hatching)	6%
(solid)	>9%

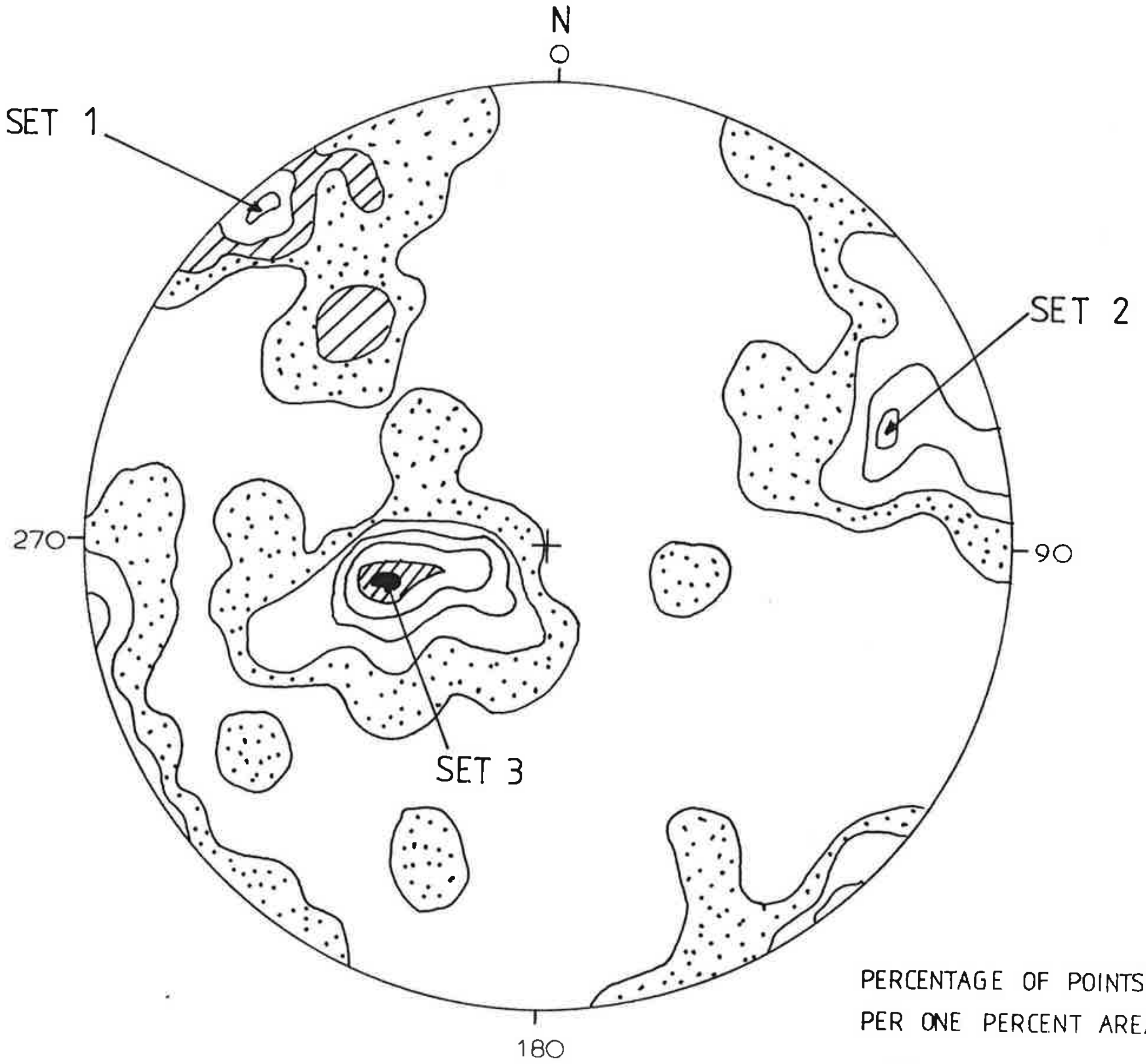
128 READINGS

STEREOGRAPHIC PROJECTION OF POLES TO JOINT PLANES.

CENTRAL CHANNEL

Coffey & Partners Pty Ltd Consulting Engineers in the geotechnical sciences

drawn	Schedule 2.2 (a)(ii) [redacted]	THEISS CONTRACTORS PTY. LTD.	COFFEY	drawing no:
approved		ISABELLA WEIR,		C. 34475/1-3
date	19·8·87	ISABELLA DRIVE STAGE 5A,		
scale		TUGGERANONG CREEK, A.C.T.		job no C 3445/1



PERCENTAGE OF POINTS PER ONE PERCENT AREA

(dotted)	1%
	3%
	5%
	7%
(hatched)	9%
(solid)	>12%

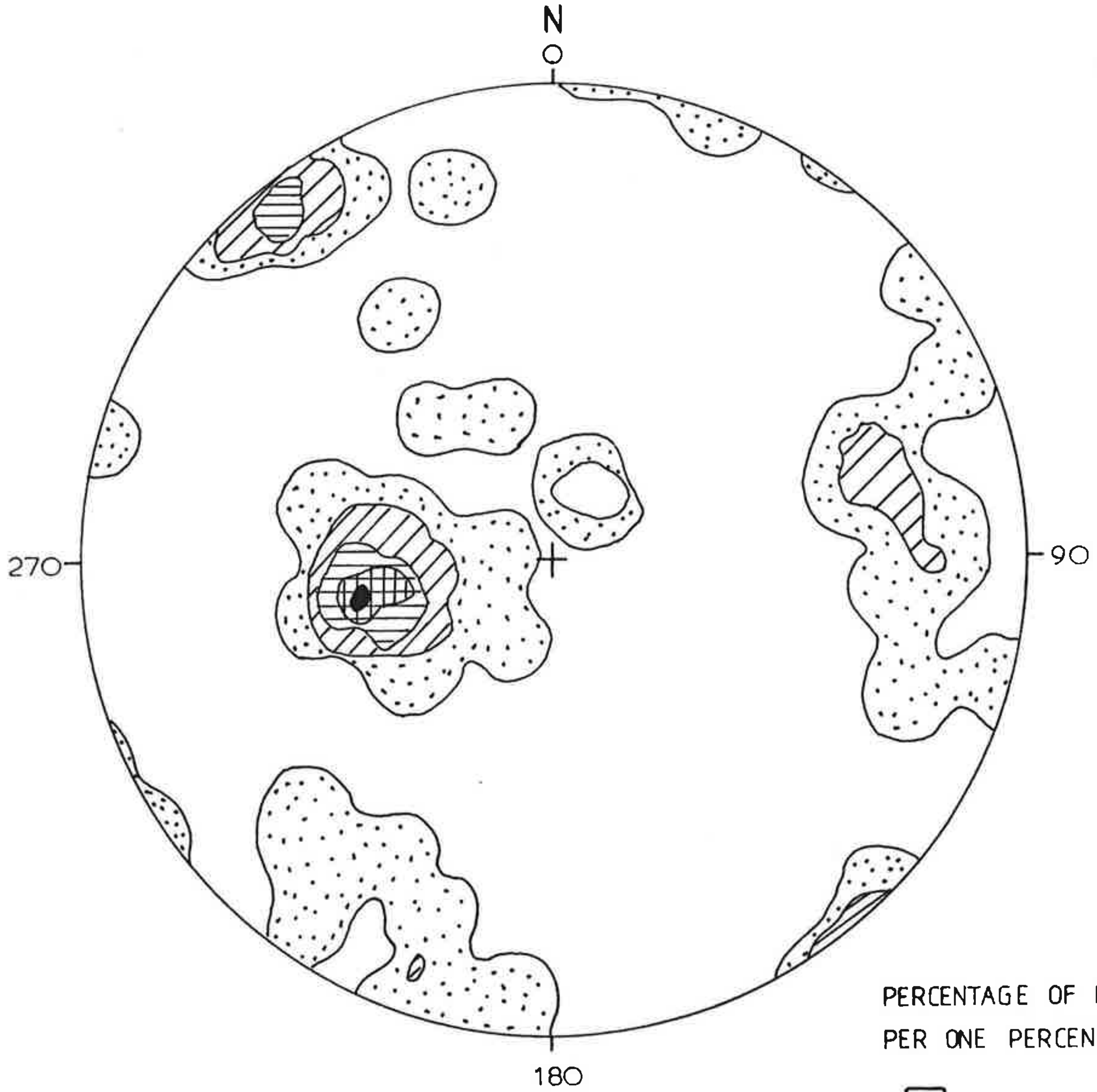
STEREOGRAPHIC PROJECTION OF POLES TO JOINT PLANES.

SOUTHERN ABUTMENT

96 READINGS

Coffey & Partners Pty Ltd Consulting Engineers in the geotechnical sciences

drawn	Schedule 2.2 (a)(ii) [redacted]	THEISS CONTRACTORS PTY. LTD.	COFFEY	drawing no:
approved		ISABELLA WEIR,		C.3445/1-4
date	19·8·87	ISABELLA DRIVE STAGE 5A,		
scale		TUGGERANONG CREEK, A.C.T.		job no. C.3445/1



PERCENTAGE OF POINTS PER ONE PERCENT AREA

- 2%
- 6%
- 10%
- 14%
- 16%

51 READINGS

STEREOGRAPHIC PROJECTION OF POLES TO JOINT PLANES.

NORTH EASTERN AREA AND SEWER TRENCH.

Coffey & Partners Pty Ltd Consulting Engineers in the geotechnical sciences

drawn	Schedule 2.2 (a)(ii) [redacted]	THEISS CONTRACTORS PTY. LTD.	COFFEY	drawing no: C. 3445/1-5
approved		ISABELLA WEIR, ISABELLA DRIVE STAGE 5A, TUGGERANONG CREEK, A.C.T.		
date	19·8·87			
scale				job no C. 3445/1

PHOTOGRAPH 1 View from northern abutment, showing clean up of cut-off trench and adjacent foundations. June, 1986

1104

PHOTOGRAPH 2 Northern Abutment, view downstream.
June, 1986

PHOTOGRAPH 3 Northern Abutment, detail of abutment
foundation. June, 1986

PHOTOGRAPH 4 Southern Abutment, upstream of cut-off trench. June, 1986

PHOTOGRAPH 5 Southern Abutment, view upstream across cut-off trench. June, 1986

PHOTOGRAPH 6 Southern Abutment, general foundations downstream of cut-off trench. June, 1986

PHOTOGRAPH 7 Central Channel, east side, clean up in progress. February, 1987

PHOTOGRAPH 8 Central Channel, east site, clean up of upper levels. February, 1987

PHOTOGRAPH 9 Central Channel, east side, clean up of foundation trenches. February, 1987

PHOTOGRAPH 10 Central Channel, labyrinth wall foundations during clean up. February, 1987

PHOTOGRAPH 11 Central Channel, closely jointed zones in foundation area. February, 1987

PHOTOGRAPH 12 Southern Abutment, showing large gently dipping joints, view south. May, 1987

PHOTOGRAPH 13 Central Channel, west side, general foundation clean up. July, 1987

1111

PHOTOGRAPH 14 Central Channel, west side, detail of shallow dipping joints. July, 1987

PHOTOGRAPH 15 Central Channel, west side, clean up of clay seam across site. July, 1987

APPENDIX 2.05:
JACOBS/SKM 2014, BOREHOLE LOGS

1113

SOIL LOG

SKM

HOLE NO: **SKM-BH01**

PROJECT : Isabella Weir	JOB NO : VW07289.02	PAGE : 1 OF 1
POSITION : E: 205974, N: 588176 (55H MGA94)	SURFACE ELEVATION : 577.2 (AHD)	LOCATION : RH Crest
RIG TYPE : Innovative E50	CONTRACTOR : Macquarie Drilling	DIP / AZIMUTH : 90°
DATE DRILLED : 12/12/13 to 12/12/13	LOGGED BY : [redacted] CHECKED BY : [redacted]	STANDARD : AS1726 - 1993

Drilling & water detail: AD/V (0.00 – 6.80 m); water level 13/12/13 - 1100 at 5.0 m

Depth (m)	Moisture Content	Dry Density	% Fines	Atterberg Limits	Samples & SPT Data	Material Description	Moisture	Consistency / Density	Comments
0.00 – 0.65					0.50m SPT 10, 3, 6 N=9 0.95m	Silty Gravelly SAND: (SW) brown, fine to medium grained, fine to medium gravel	D	L	0.00: Inferred Zone 2 material
0.65 – 2.50	23.3	1.64	68	LL=82 PL=24 LS=17.5	1.20m SPT 9, 2, 3 N=5 1.50m; U 1.65m; 1.91m	Sandy CLAY: (CH) dark brown, high plasticity, mottled yellow - brown, fine to coarse sand, trace fine to medium gravel	D to M; M to W	F to St; F	0.65: Inferred Zone 1 material; 1.91: VS Result: Sup = 56kPa Sur = 16kPa
2.50 – 6.80	27.2		75	LL=74 PL=24 LS=16.5	2.50m D 2.70m; 3.50m U 3.94m; 5.00m SPT 3, 3, 3 N=6 5.45m; 6.50m D	Silty CLAY: (CH) yellow - red to dark yellow brown, high plasticity, trace fine to medium sand, trace fine gravel; mottled yellow brown, grey	M	F to St	3.94: VS Result: Sup = 103kPa Sur = 16kPa; 5.00: Ground water level measured at 5.0 metres below ground level
6.80						Borehole Terminated at 6.8m (Refusal on Rock)			

RL (m): 576.2 at 1.0; 575.2 at 2.0; 574.2 at 3.0; 573.2 at 4.0; 572.2 at 5.0; 571.2 at 6.0; 570.2 at 7.0; 569.2 at 8.0

DRILLING
HA Hand Auger
AS Auger
WB Washbore
RR Rock Rolling
AD/V Auger Drilling - V bit
HQ HQ Coring
NQ NQ Coring
PQ PQ Coring
NMLC NMLC Coring

GROUNDWATER SYMBOLS
= Water level (static)
= Water level (during drilling)
= Water inflow
= Water outflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
ES Env Soil Sample
EW Env Water Sample
SPT SPT Sample
U Undisturbed Tube Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight

MOISTURE CONDITION
D = Dry M = Moist W = Wet

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (Su) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

1114

SOIL LOG

HOLE NO: **SKM-BH02A**

PROJECT : Isabella Weir	JOB NO : VW07289.02	PAGE : 1 OF 1
POSITION :	SURFACE ELEVATION :	LOCATION : LH Crest
RIG TYPE : Innovative E50	CONTRACTOR : Macquarie Drilling	DIP / AZIMUTH : 90°
DATE DRILLED : 12/12/13 to 12/12/13	LOGGED BY : [redacted] CHECKED BY [redacted]	STANDARD : AS1726 - 1993

DRILLING & WATER DETAIL		LAB DATA: Moisture Content	Dry Density	% Fines	Atterberg Limits	SAMPLES & SPT DATA	RL (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION SOIL TYPE: plasticity or particle characteristic, colour secondary and minor components	MOISTURE	CONSISTENCY / DENSITY	COMMENTS Field Test Data & Other Observations
AD/V	Not Encountered					0.50m SPT 11, 13, 11 N=24 0.95m		0.0 – 1.20m		Clayey Gravelly SAND: (SW) dark brown, fine to medium grained, fine to medium gravel, low plasticity fines	D	MD	0.90: Early termination of borehole at 1.2m depth due to obstruction in fill material
								1.20m		Borehole Terminated at 1.2m (Refusal on Obstruction)			

Depth scale: 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0

DRILLING

HA	Hand Auger	HQ	HQ Coring
AS	Auger	NQ	NQ Coring
WB	Washbore	PQ	PQ Coring
RR	Rock Rolling	NMLC	NMLC Coring
AD/V	Auger Drilling - V bit		

GROUNDWATER SYMBOLS

- = Water level (static)
- = Water level (during drilling)
- = Water inflow
- = Water outflow

SAMPLES & FIELD TESTS

D	Disturbed Sample	SPT	SPT Sample
B	Bulk Sample	U	Undisturbed Tube Sample
ES	Env Soil Sample	W	Water Sample
EW	Env Water Sample		

HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight

MOISTURE CONDITION

D = Dry M = Moist W = Wet

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (Su) {N-value}

VS	Very Soft	< 12 kPa	{0-2}
S	Soft	12 - 25	{2-4}
F	Firm	25 - 50	{4-8}
St	Stiff	50 - 100	{8-15}
VSt	Very Stiff	100 - 200	{15-30}
H	Hard	> 200 kPa	{>30}

SKM AGS REV05 (WORKING TR).GLB Log SKM SOIL LOG ISABELLA WEIR BH LOGS.GPJ <<DrawingFile>> 16/01/2014 16:49

1115

SOIL LOG

HOLE NO: **SKM-BH02B**

PROJECT : Isabella Weir	JOB NO : VW07289.02	PAGE : 1 OF 1
POSITION : E: 206002, N: 588141 (55H MGA94)	SURFACE ELEVATION : 577.7 (AHD)	LOCATION : LH Crest
RIG TYPE : Innovative E50	CONTRACTOR : Macquarie Drilling	DIP / AZIMUTH : 90°
DATE DRILLED : 12/12/13 to 12/12/13	LOGGED BY : [redacted] CHECKED BY : [redacted]	STANDARD : AS1726 - 1993

Drilling & water detail: AD/V (0.00 – 8.80 m); water level (during drilling) 13/12/13 - 0900

Depth (m)	RL (m)	Samples & SPT Data	Moisture Content	Dry Density	% Fines	Atterberg Limits	Graphic Log / Material Description (Soil type: plasticity or particle characteristic, colour, secondary and minor components)	Moisture	Consistency / Density	Comments (Field Test Data & Other Observations)
0.00 – 1.80							Clayey Gravelly SAND: (SW) dark brown, fine grained, fine to medium gravel, intermediate to low plasticity fines	D	MD	0.00: Inferred Zone 2 material
1.0	576.7	1.20m SPT 6, 3, 3 N=6 1.65m	11.3		34		fine to medium grained		L	
1.80m – 2.40		2.00m U 2.45m					Silty Sandy CLAY: (CI) yellow - red, intermediate plasticity, fine to medium sand, trace fine gravel	D to M	F	1.80: Inferred Zone 1 material 2.45: VS Result: Unable to penetrate soil in push tube with vane shear, Su > = 222kPa
2.0	575.7									
2.40m – 4.00		2.80m D; 3.00m SPT 2, 3, 5 N=8 3.45m					Sandy Gravelly CLAY: (CI - CH) yellow - red to dark brown, fine to medium sand, fine to medium gravel		VSt; F to St	2.45: VS Result: Unable to penetrate soil in push tube with vane shear 3.70: Material collapsed in hole overnight and required minor redrilling in order to measure the ground water level. 3.90: Ground water level measured at 3.9 metres below ground level
3.0	574.7									
4.00m – 4.90	573.7	4.00m D; 4.50m SPT 4, 4, 6 N=10 4.95m					Silty Gravelly CLAY (CI - CH) dark red - brown, intermediate to high plasticity, fine to medium gravel	M	St	
4.90m – 8.80							Silty CLAY: (CH) dark yellow - brown to yellow - red, high plasticity, some fine to medium gravel	M to W	F to St	
5.0	572.7	5.50m U 5.95m	29.1	1.5	70	LL=78 PL=24 LS=17				5.95: VS Result: Sup = 73kPa Sur = 16kPa
6.0	571.7									
7.0	570.7	7.00m D; 7.50m SPT 3, 3, 3 N=6 7.95m						W		
8.0	569.7	8.80m D								
8.80m							Borehole Terminated at 8.8m (Refusal on Rock)			

DRILLING

HA Hand Auger; AS Auger; WB Washbore; RR Rock Rolling; AD/V Auger Drilling - V bit; HQ HQ Coring; NQ NQ Coring; PQ PQ Coring; NMLC NMLC Coring

GROUNDWATER SYMBOLS

- = Water level (static)
- = Water level (during drilling)
- = Water inflow
- = Water outflow

SAMPLES & FIELD TESTS

D Disturbed Sample; B Bulk Sample; ES Env Soil Sample; EW Env Water Sample; SPT SPT Sample; U Undisturbed Tube Sample; W Water Sample

HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight

MOISTURE CONDITION

D = Dry M = Moist W = Wet

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (Su) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

SKM AGS REV05 (WORKING TR).GLB Log SKM SOIL LOG ISABELLA WEIR BH LOGS.GPJ <<DrawingFile>> 16/01/2014 16:49

1116

SOIL LOG

HOLE NO: SKM-BH03

PROJECT : Isabella Weir	JOB NO : VW07289.02	PAGE : 1 OF 1
POSITION : E: 205949, N: 588171 (55H MGA94)	SURFACE ELEVATION : 573.9 (AHD)	LOCATION : RH D/S Toe
RIG TYPE : Innovative E50	CONTRACTOR : Macquarie Drilling	DIP / AZIMUTH : 90°
DATE DRILLED : 12/12/13 to 12/12/13	LOGGED BY : [redacted] CHECKED BY : [redacted]	STANDARD : AS1726 - 1993

DRILLING & WATER DETAIL	LAB DATA: Moisture Content	LAB DATA: Dry Density	LAB DATA: % Fines	LAB DATA: Atterberg Limits	SAMPLES & SPT DATA	RL (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION SOIL TYPE: plasticity or particle characteristic, colour secondary and minor components	MOISTURE	CONSISTENCY / DENSITY	COMMENTS Field Test Data & Other Observations
AD/V; Not Encountered							0.0		Gravelly SAND: (SW) brown, fine sand fine to medium gravel, some silt	D	MD	0.00: Roots in top 100mm
					0.50m SPT 12, 13, 10 N=23 0.95m				dark brown, medium grained, sub-rounded grains, fine to coarse gravel	D to M		
						572.9	1.0					1.00: Inferred Zone 3 filter material between 1.0 metres to 2.0 metres below ground level
					1.50m SPT 16, 18, 15 N=33 1.95m						D	1.33: VS Result: Unable to penetrate soil in sample tube with vane shear
	10.7		41	LL=28 PL=15 LS=9	2.00m D 2.30m	571.9	2.0		2.00m Gravelly Clayey SAND: (SC) dark brown to dark grey, fine to medium grained, low plasticity fines, some fine to medium gravel			
									2.85m Borehole Terminated at 2.85m (Refusal on Rock)			
						570.9	3.0					
						569.9	4.0					
						568.9	5.0					
						567.9	6.0					
						566.9	7.0					
						565.9	8.0					

DRILLING

HA	Hand Auger	HQ	HQ Coring
AS	Auger	NQ	NQ Coring
WB	Washbore	PQ	PQ Coring
RR	Rock Rolling	NMLC	NMLC Coring
AD/V	Auger Drilling - V bit		

GROUNDWATER SYMBOLS

- = Water level (static)
- = Water level (during drilling)
- = Water inflow
- = Water outflow

SAMPLES & FIELD TESTS

D	Disturbed Sample	SPT	SPT Sample
B	Bulk Sample	U	Undisturbed Tube Sample
ES	Env Soil Sample	W	Water Sample
EW	Env Water Sample		

HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight

MOISTURE CONDITION

D = Dry M = Moist W = Wet

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (Su) {N-value}

VS	Very Soft	< 12 kPa	{0-2}
S	Soft	12 - 25	{2-4}
F	Firm	25 - 50	{4-8}
St	Stiff	50 - 100	{8-15}
VSt	Very Stiff	100 - 200	{15-30}
H	Hard	> 200 kPa	{>30}

SKM AGS REV05 (WORKING TR).GLB Log SKM SOIL LOG ISABELLA WEIR BH LOGS.GPJ <<DrawingFile>> 16/01/2014 16:49

SKM

SOIL LOG

HOLE NO: **SKM-BH04**

PROJECT : Isabella Weir	JOB NO : VW07289.02	PAGE : 1 OF 1
POSITION : E: 206029, N: 588108 (55H MGA94)	SURFACE ELEVATION : 578.0 (AHD)	LOCATION : LH Crest
RIG TYPE : Innovative E50	CONTRACTOR : Macquarie Drilling	DIP / AZIMUTH : 90°
DATE DRILLED : 13/12/13 to 13/12/13	LOGGED BY : [redacted] CHECKED BY : [redacted]	STANDARD : AS1726 - 1993

DRILLING & WATER DETAIL	LAB DATA: Moisture Content	LAB DATA: Dry Density	LAB DATA: % Fines	LAB DATA: Atterberg Limits	SAMPLES & SPT DATA	RL (m)	DEPTH (m)	MATERIAL DESCRIPTION (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	MOISTURE	CONSISTENCY / DENSITY	COMMENTS (Field Test Data & Other Observations)
AD/V; Not Encountered	10		40		0.50m SPT 14, 15, 13 N=28 (0.50m–0.95m); 1.20m D; 1.50m SPT 7, 8, 7 N=15 (1.50m–1.95m)	578.0–576.0	0.00–2.00	Silty Gravelly SAND: (SW) yellow - red, brown, fine grained, fine to medium gravel; fine to medium grained	D; D to M	MD	
					2.50m U (2.50m–2.89m)	576.0–575.0	2.00–3.00	Sandy CLAY: (CI) dark brown, intermediate plasticity, fine to medium sand, some medium gravel		St	2.89: VS Result: Unable to penetrate soil in sample tube with vane shear
					4.00m SPT 7, 12, 26 N=38 (4.00m–4.45m)	575.0–573.7	3.00–4.30	Silty CLAY: (CI - CH) yellow - red to dark yellow brown, intermediate to high plasticity, trace fine to medium sand and gravel		St to VSt; H	
					4.80m D	573.7–573.1	4.30–4.90	Sandy CLAY: (CI - CL) red - brown, mottled grey, intermediate to low plasticity, medium to coarse sand, sub-rounded, fine to coarse gravel			4.30: Possible cobble in fill, hard drilling
							4.90	Borehole Terminated at 4.9m (Refusal on Rock)			

RL scale: 577.0 (1.0), 576.0 (2.0), 575.0 (3.0), 574.0 (4.0), 573.0 (5.0), 572.0 (6.0), 571.0 (7.0), 570.0 (8.0)

DRILLING

HA Hand Auger; AS Auger; WB Washbore; RR Rock Rolling; AD/V Auger Drilling - V bit; HQ HQ Coring; NQ NQ Coring; PQ PQ Coring; NMLC NMLC Coring

GROUNDWATER SYMBOLS

- ▼ = Water level (static)
- ▽ = Water level (during drilling)
- ►— = Water inflow
- —◄ = Water outflow

SAMPLES & FIELD TESTS

D Disturbed Sample; B Bulk Sample; ES Env Soil Sample; EW Env Water Sample; SPT SPT Sample; U Undisturbed Tube Sample; W Water Sample

HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight

MOISTURE CONDITION

D = Dry M = Moist W = Wet

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (Su) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

SKM

SOIL LOG

HOLE NO: **SKM-BH05**

PROJECT : Isabella Weir	JOB NO : VW07289.02	PAGE : 1 OF 1
POSITION : E: 205964, N: 588189 (55H MGA94)	SURFACE ELEVATION : 577.8 (AHD)	LOCATION : RH Crest
RIG TYPE : Innovative E50	CONTRACTOR : Macquarie Drilling	DIP / AZIMUTH : 90°
DATE DRILLED : 13/12/13 to 13/12/13	LOGGED BY : [redacted] CHECKED BY : [redacted]	STANDARD : AS1726 - 1993

DRILLING & WATER DETAIL	LAB DATA: Moisture Content	Dry Density	% Fines	Atterberg Limits	SAMPLES & SPT DATA	RL (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION SOIL TYPE: plasticity or particle characteristic, colour secondary and minor components	MOISTURE	CONSISTENCY / DENSITY	COMMENTS Field Test Data & Other Observations
AD/V					0.50m				Gravelly SAND: (SW) yellow red to brown, fine to medium grained, fine to coarse gravel, some silt	D	MD	0.00: Inferred Zone 2 material
						576.8	1.0	1.00m	Sandy CLAY: (CI) / Clayey SAND: (SC) dark brown, intermediate plasticity, fine to medium sand, trace fine to medium gravel	D to M	MD / VSt	
					1.50m SPT 5, 8, 10 N=18 1.95m							
	7.1		26		2.00m D 2.50m	575.8	2.0	2.00m	Clayey SAND: (SC) yellow - red, fine to coarse sand, sub-rounded, some fine to coarse gravel		MD	
					3.00m SPT 8, 7, 10 N=17 3.45m	574.8	3.0					
					4.00m D	573.8	4.0	3.50m	Gravelly Sandy CLAY: (CI) dark brown, intermediate plasticity, fine to coarse sand, medium to coarse gravel		St to VSt	3.50: Inferred Zone 1 material 3.80: Four 30mm sized cobbles within clay strata
	16.8	1.83		LL=39 PL=14 LS=11	4.30m U 4.74m							4.74: VS Result: Sup = 135kPa Sur = 16kPa
					5.50m D	572.8	5.0	5.00m	Silty CLAY: (CH) dark green - brown to green - grey, trace fine gravel	M		
13/12/13 - 1300					6.00m U 6.26m	571.8	6.0			M to W	St	6.00: Ground water level measured at 6.2 metres below ground level 6.26: VS Result: Sup = 79kPa Sur = 16kPa 6.30: U63 push tube sample did not advance to full depth, likely refusal on floaters / rock
								6.50m	Borehole Terminated at 6.5m (Refusal on Rock)			
						570.8	7.0					
						569.8	8.0					

SKM AGS REV05 (WORKING TR).GLB Log SKM SOIL LOG ISABELLA WEIR BH LOGS.GPJ <<DrawingFile>> 16/01/2014 16:49

DRILLING
HA Hand Auger
AS Auger
WB Washbore
RR Rock Rolling
AD/V Auger Drilling - V bit
HQ HQ Coring
NQ NQ Coring
PQ PQ Coring
NMLC NMLC Coring

GROUNDWATER SYMBOLS
= Water level (static)
= Water level (during drilling)
= Water inflow
= Water outflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
ES Env Soil Sample
EW Env Water Sample
SPT SPT Sample
U Undisturbed Tube Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight

MOISTURE CONDITION
D = Dry M = Moist W = Wet

DENSITY (N-value)
VL Very Loose 0 - 4
L Loose 4 - 10
MD Medium Dense 10 - 30
D Dense 30 - 50
VD Very Dense 50 - 100

CONSISTENCY (Su) {N-value}
VS Very Soft < 12 kPa {0-2}
S Soft 12 - 25 {2-4}
F Firm 25 - 50 {4-8}
St Stiff 50 - 100 {8-15}
VSt Very Stiff 100 - 200 {15-30}
H Hard > 200 kPa {>30}

APPENDIX 2.06: JACOBS/SKM 2014, LABORATORY TESTING CERTIFICATES

1120

CGS

TEST RESULTS

AS 1289.2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1, 3.8.1 & 6.4.1 (Clauses 4 and 5a)

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

Job No 13221
Report No 13221/R061
Date of Issue 08/01/13

Client SINCLAIR KNIGHT MERZ (MELBOURNE)
Project VW07289.02 ISABELLA WEIR
Location ACT

Tested by Schedule 2.2 [redacted]
Date tested 19/12/13-7/1/14
Checked by Schedule 2.2 [redacted]

Sample Identification	*Soil Description*	*Field Moisture Content* %	*Dry Density* t/m³	*Liquid Limit* %	*Plastic Limit* %	*Plasticity Index* %	*Linear Shrinkage* %	*% Passing 75µm sieve*	*Emerson Class No**	*Emerson Class No***
13221050 SKM-BH01 1.5 - 1.91m	CLAY, high plasticity, brown with grey and orange-brown, with fine to coarse sand, trace of fine to medium gravel.	23.3	1.64	82	24	58	17.5	68	2	5
13221051 SKM-BH01 3.5 - 3.94m	CLAY, high plasticity, orange-brown some grey, with fine to coarse sand, trace of fine to coarse gravel.	27.2	-	74	24	50	16.5	75	2	5
13221052 SKM-BH02 1.2m	clayey SAND, fine to coarse, pale yellow-brown, brown and grey, fines of low plasticity, trace of fine to coarse gravel.	11.3	-	-	-	-	-	34	2	5
13221053 SKM-BH02 5.5 - 5.95m	CLAY, high plasticity, pale brown with grey and brown, with fine to coarse sand, trace of fine gravel.	29.1	1.50	78	24	54	17.0	70	2	5
13221054 SKM-BH03 2.0 - 2.3m	clayey SAND, fine to coarse, grey/brown, fines of low plasticity, with fine to medium gravel.	10.7	-	28	15	13	9.0	41	-	-
13221055 SKM-BH04 1.5m	clayey SAND, fine to coarse, brown with some white, low to medium plasticity, trace of fine to medium gravel.	10.0	-	-	-	-	-	40	-	-
13221056 SKM-BH05 2.0 - 2.5m	clayey SAND, fine to coarse, brown, fines of low plasticity, with fine to medium gravel.	7.1	-	-	-	-	-	26	3	5
13221057 SKM-BH05 4.3 - 4.74m	sandy CLAY / clayey SAND, fine to coarse, grey, fines of medium plasticity, trace of fine to medium gravel.	16.8	1.83	39	14	25	11.0	50	2	5

AS 1289.3.1.2,3.2.1,3.4.1

Method of drying: Air dried
Dry/Wet sieve: Dry
Curing time: >24hrs

AS 1289.3.8.1 *Water used:* * Distilled water ** Pond water
Temperature: 19.3 °C 19.8 °C
Date sampled: 12-13/12/13

SUMMARY4 V1.3 MAR 13

NATA ACCREDITED FOR TECHNICAL COMPETENCE

The results of the tests, calibration[redacted] and/or measurements included i[redacted] this document are traceable to Australian/National standards. Accredited for compliance to ISO/IEC 17025. **Accreditation No 9909**

Schedule 2.2 (a)(ii) [redacted]

1121

CGS

PARTICLE SIZE DISTRIBUTION

Job No	13221
Report No	13221/R053
Date of Issue	08/01/14

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

Client	SINCLAIR KNIGHT MERZ (MELBOURNE)	*Tested by*	[redacted]
Project	VW07289.02 ISABELLA WEIR	*Date tested*	07/01/14
Location	ACT	*Checked by*	[redacted]

Sample Identification SKM-BH01 1.5 - 1.91m *Sample No* 13221050

Sample Description

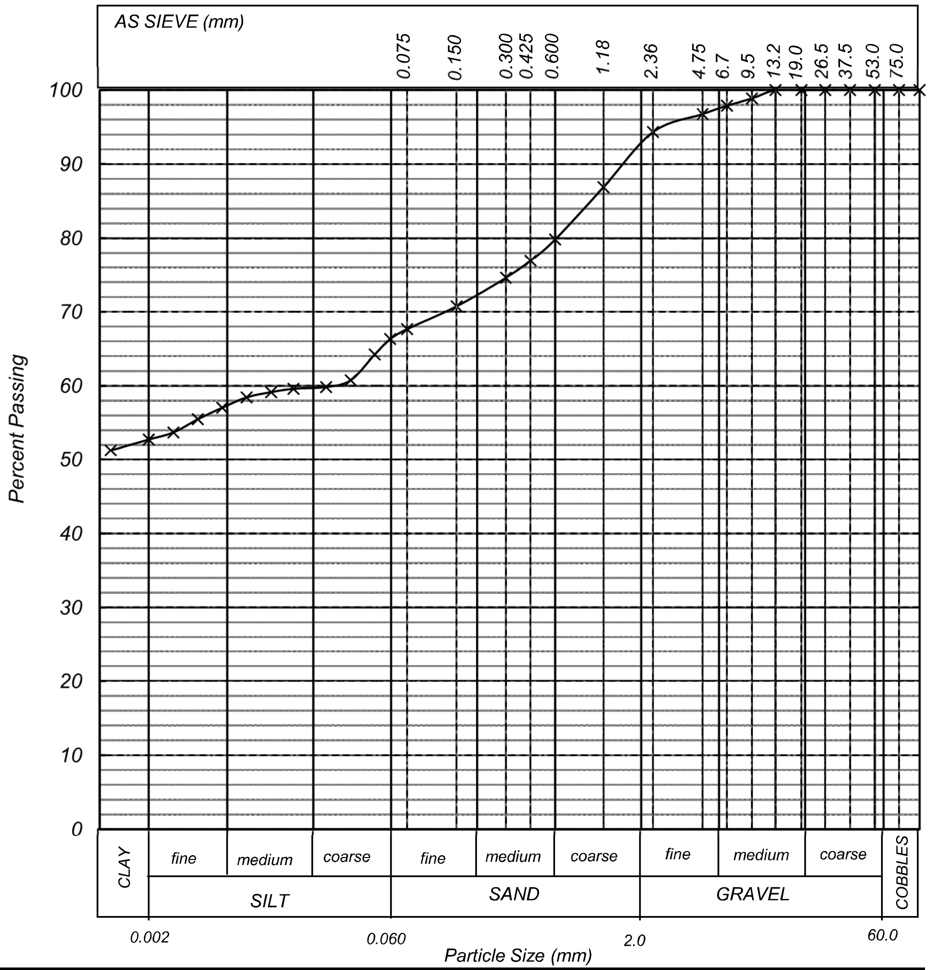
CLAY, high plasticity, brown with grey and orange-brown, with fine to coarse sand, trace of fine to medium gravel.

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Standard method of fine analysis using a Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	99
6.7	98
4.75	97
2.36	94
1.18	87
0.600	80
0.425	77
0.300	75
0.150	71
0.075	68
0.059	66
0.048	64
0.034	61
0.024	60
0.015	60
0.011	59
0.0079	58
0.0056	57
0.0040	55
0.0028	54
0.0020	53
0.0012	51



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	12.7%	*coarse*	6.7%	*Gravel*	7.5%
medium	2.5%	*medium*	7.5%	*medium*	2.4%	*Sand*	26.1%
fine	5.0%	*fine*	5.9%	*fine*	4.6%	*Silt*	13.7%
Total	7.5%	*Total*	26.1%	*Total*	13.7%	*Clay*	52.7%
						Total	100.0%

A362 V1.1 MAR 13

Schedule 2.2 (a)(ii) [redacted]

1122

PARTICLE SIZE DISTRIBUTION

AS 1289.3.6.1

Job No	13221
Report No	13221/R054
Date of Issue	08/01/14

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

Client	SINCLAIR KNIGHT MERZ (MELBOURNE)	*Tested by*	[redacted]
Project	VW07289.02 ISABELLA WEIR	*Date tested*	19/12/13
Location	ACT	*Checked by*	[redacted]

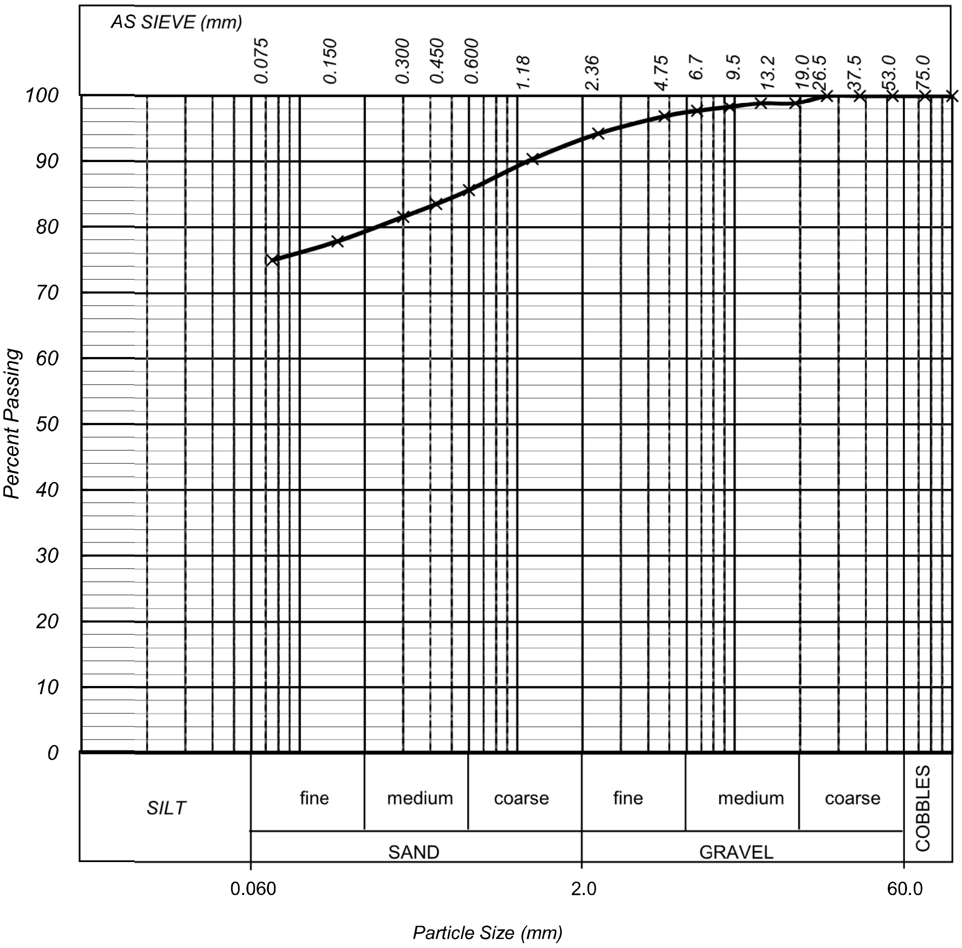
Sample Identification	SKM-BH01 3.5 - 3.94m	*Sample No*	13221051
Sampling method	By Client	*Sampled by*	Client
		Sampling date	12/12/13

Sample Description

CLAY, high plasticity, orange-brown some grey, with fine to coarse sand, trace of fine to coarse gravel.

Particle Size Distribution

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	99
13.2	99
9.5	98
6.7	98
4.75	97
2.36	94
1.18	90
0.600	86
0.425	84
0.300	82
0.150	78
0.075	75



Gravel		*Sand*		*Cobbles*	0.0%
coarse	1.0%	*coarse*	7.7%	*Gravel*	6.7%
medium	1.6%	*medium*	6.2%	*Sand*	18.3%
fine	4.1%	*fine*	4.4%	*Fines*	75.0%
Total	6.7%	*Total*	18.3%	*Total*	100.0%

A361 V1.5 MAR 13

NATA ACCREDITED FOR TECHNICAL COMPETENCE

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards. Accredited for compliance to ISO/IEC 17025.
Accreditation No 9909

Schedule 2.2 (a)(ii)

[redacted]

1123

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

Job No	13221
Report No	13221/R055
Date of Issue	08/01/14

Client	SINCLAIR KNIGHT MERZ (MELBOURNE)	*Tested by*	[redacted]
Project	VW07289.02 ISABELLA WEIR	*Date tested*	07/01/14
Location	ACT	*Checked by*	[redacted]

Sample Identification SKM-BH02 @ 1.2m — *Sample No* 13221052

Sample Description

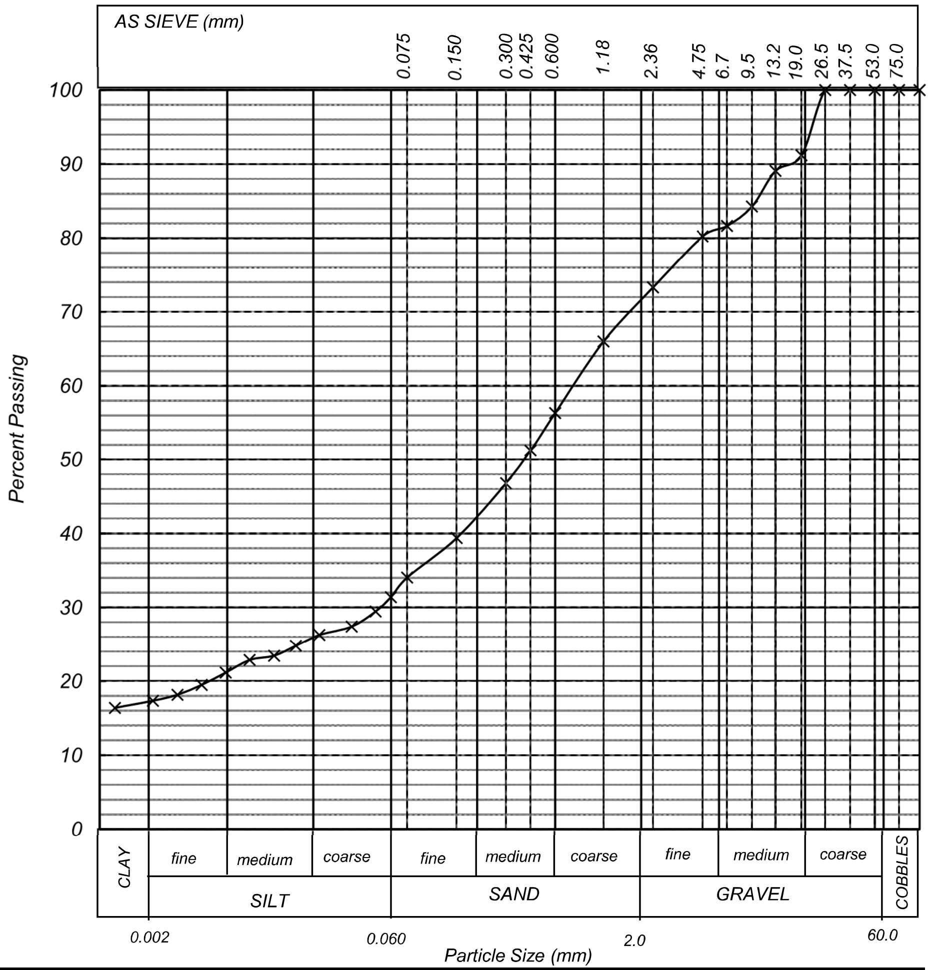
clayey SAND, fine to coarse, pale yellow-brown, brown some dark grey,, fines of low plasticity, trace of fine to coarse gravel.

Soil particle density (-2.36mm sieve) 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Standard method of fine analysis using a Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	91
13.2	89
9.5	84
6.7	82
4.75	80
2.36	73
1.18	66
0.600	56
0.425	51
0.300	47
0.150	39
0.075	34
0.060	31
0.048	29
0.035	27
0.022	26
0.016	25
0.012	23
0.0082	23
0.0059	21
0.0042	19
0.0030	18
0.0021	17
0.0012	16



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	7.5%	*coarse*	15.2%	*coarse*	5.6%	*Gravel*	28.5%
medium	11.4%	*medium*	13.9%	*medium*	4.6%	*Sand*	40.1%
fine	9.6%	*fine*	11.0%	*fine*	4.0%	*Silt*	14.2%
Total	28.5%	*Total*	40.1%	*Total*	14.2%	*Clay*	17.2%
						Total	100.0%

A362 V1.1 MAR 13

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards. Accredited for compliance to ISO/IEC 17025.
Accreditation No 9909

Schedule 2.2 (a)(ii) [redacted]

1124

PARTICLE SIZE DISTRIBUTION

Job No	13221
Report No	13221/R056
Date of Issue	08/01/14

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

Client	SINCLAIR KNIGHT MERZ (MELBOURNE)	*Tested by*	[redacted]
Project	VW07289.02 ISABELLA WEIR	*Date tested*	07/01/14
Location	ACT	*Checked by*	[redacted]

Sample Identification SKM-BH02 5.5 - 5.95m *Sample No* 13221053

Sample Description

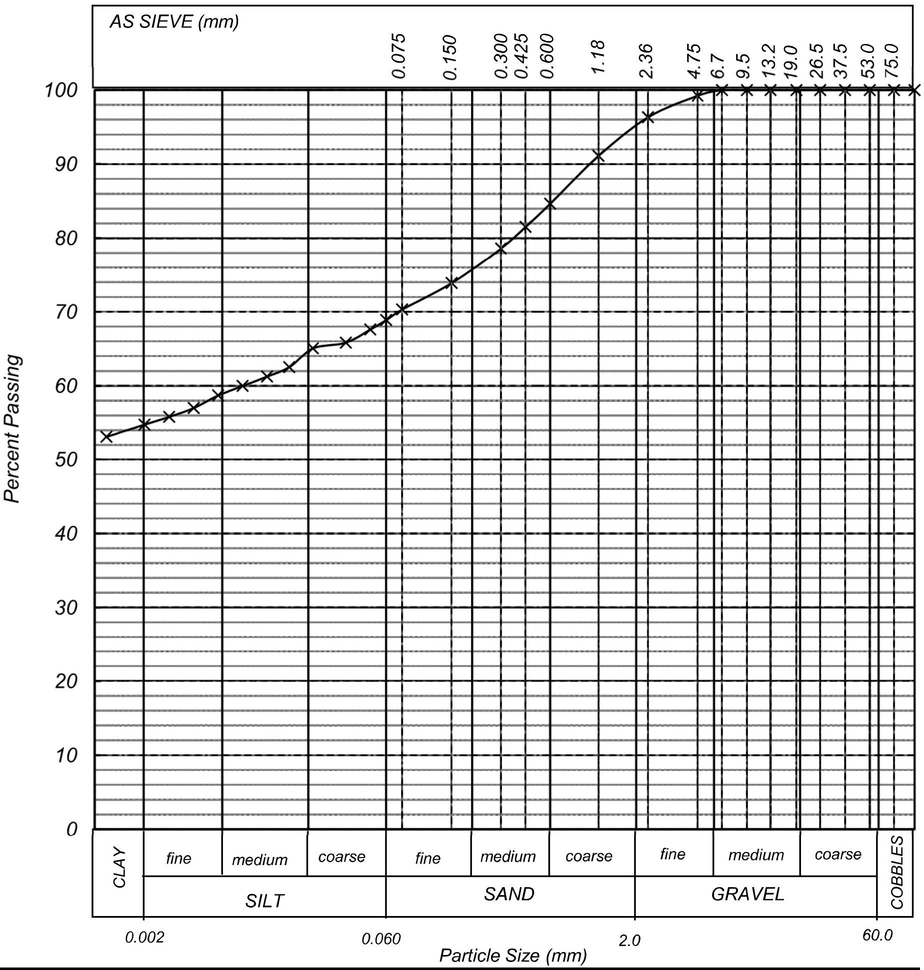
CLAY, high plasticity, pale brown with grey and brown, with fine to coarse sand, trace of fine gravel.

Soil particle density (-2.36mm sieve) 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Standard method of fine analysis using a Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	100
6.7	100
4.75	99
2.36	96
1.18	91
0.600	85
0.425	82
0.300	79
0.150	74
0.075	70
0.060	69
0.048	68
0.034	66
0.021	65
0.015	63
0.011	61
0.0080	60
0.0057	59
0.0040	57
0.0029	56
0.0020	55
0.0012	53



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	10.4%	*coarse*	4.4%	*Gravel*	4.9%
medium	0.2%	*medium*	8.8%	*medium*	5.6%	*Sand*	26.2%
fine	4.7%	*fine*	7.0%	*fine*	4.2%	*Silt*	14.2%
Total	4.9%	*Total*	26.2%	*Total*	14.2%	*Clay*	54.7%
						Total	100.0%

A362 V1.1 MAR 13

Schedule 2.2 (a)(ii)

[redacted]

1125

CGS

PARTICLE SIZE DISTRIBUTION

AS 1289.3.6.1

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

Job No	13221
Report No	13221/R062
Date of Issue	17/01/14

Client	SINCLAIR KNIGHT MERZ (MELBOURNE)	_Tested by_	Schedule 2.2 [redacted]
Project	VW07289.02 ISABELLA WEIR	_Date tested_	15/01/14
Location	ACT	_Checked by_	Schedule 2.2 [redacted]

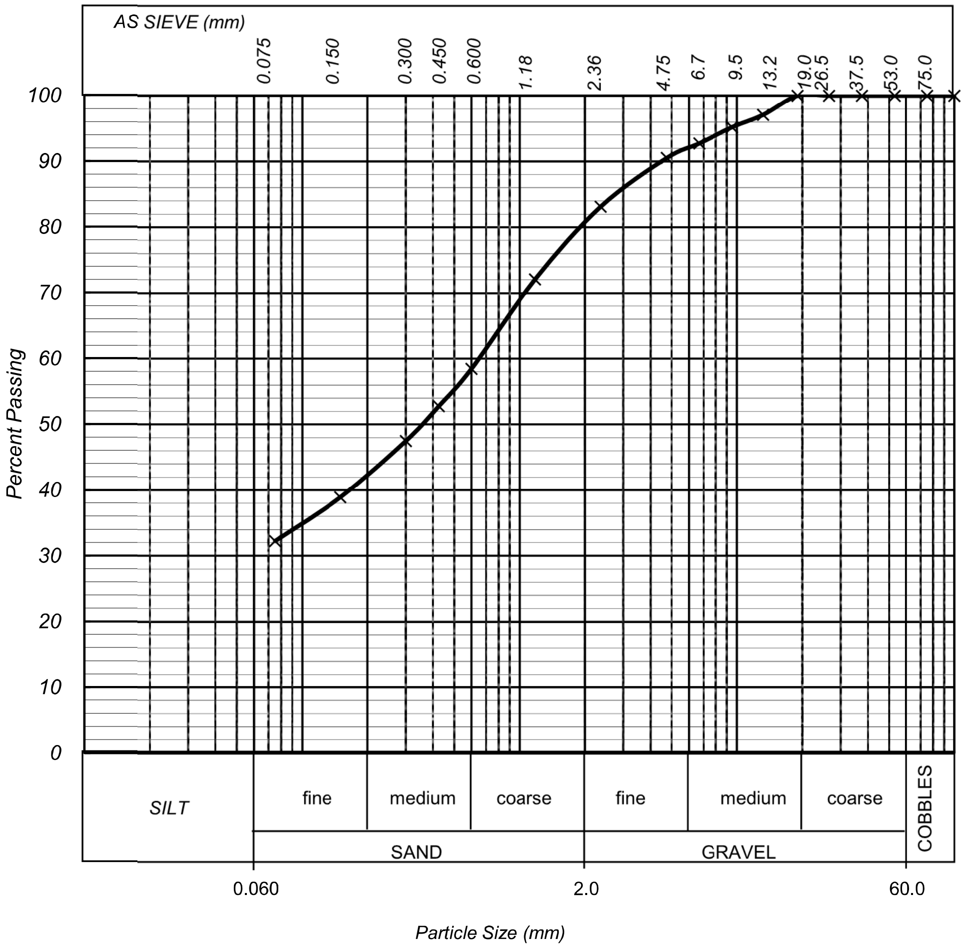
Sample Identification	BH03 1.5m	_Sample No_	13221058
Sampling method	By Client	_Sampled by_	Client
		Sampling date	12/12/13

Sample Description

clayey SAND, fine to coarse grey-brown, fines of low plasticity, with fine to medium gravel

Particle Size Distribution

Particle Size (mm)	_Percent Passing_
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	97
9.5	95
6.7	93
4.75	91
2.36	83
1.18	72
0.600	58
0.425	53
0.300	47
0.150	39
0.075	32



Gravel		_Sand_		_Cobbles_	0.0%
coarse	0.0%	_coarse_	22.0%	_Gravel_	19.5%
medium	8.0%	_medium_	16.0%	_Sand_	48.3%
fine	11.5%	_fine_	10.3%	_Fines_	32.2%
Total	19.5%	_Total_	48.3%	_Total_	100.0%

Schedule 2.2 (a)(ii)

[redacted]

A361 V1.5 MAR 13

NATA ACCREDITED FOR TECHNICAL COMPETENCE

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards. Accredited for compliance to ISO/IEC 17025.
Accreditation No 9909

1126

PARTICLE SIZE DISTRIBUTION

AS 1289.3.6.1

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

Job No	13221
Report No	13221/R057
Date of Issue	08/01/14

Client	SINCLAIR KNIGHT MERZ (MELBOURNE)	*Tested by*	[redacted]
Project	VW07289.02 ISABELLA WEIR	*Date tested*	18/12/13
Location	ACT	*Checked by*	[redacted]

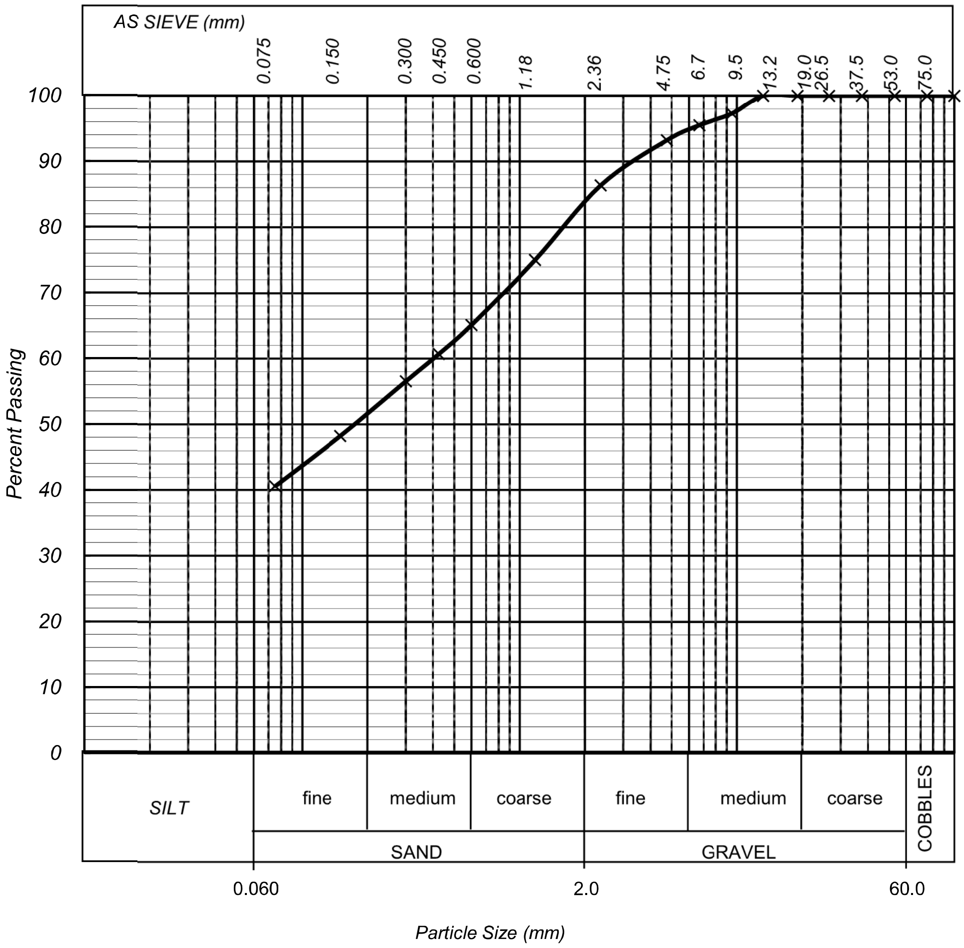
Sample Identification	SKM-BH03 2.0 - 2.3m	*Sample No*	13221054
Sampling method	By Client	*Sampled by*	Client
		Sampling date	2013

Sample Description

clayey SAND, fine to coarse, brown/grey, fines of low plasticity, with fine to medium gravel.

Particle Size Distribution

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	97
6.7	95
4.75	93
2.36	86
1.18	75
0.600	65
0.425	61
0.300	57
0.150	48
0.075	41



Gravel		*Sand*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	18.6%	*Gravel*	16.3%
medium	5.2%	*medium*	13.4%	*Sand*	43.1%
fine	11.1%	*fine*	11.1%	*Fines*	40.6%
Total	16.3%	*Total*	43.1%	*Total*	100.0%

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards. Accredited for compliance to ISO/IEC 17025. **Accreditation No 9909**

Schedule 2.2 (a)(ii)

[redacted]

1127

PARTICLE SIZE DISTRIBUTION

AS 1289.3.6.1

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

Job No	13221
Report No	13221/R058
Date of Issue	08/01/14

Client	SINCLAIR KNIGHT MERZ (MELBOURNE)	*Tested by*	Schedule 2 [redacted]
Project	VW07289.02 ISABELLA WEIR	*Date tested*	18/12/13 Schedule 2.2 (a)(ii)
Location	ACT	*Checked by*	[redacted]

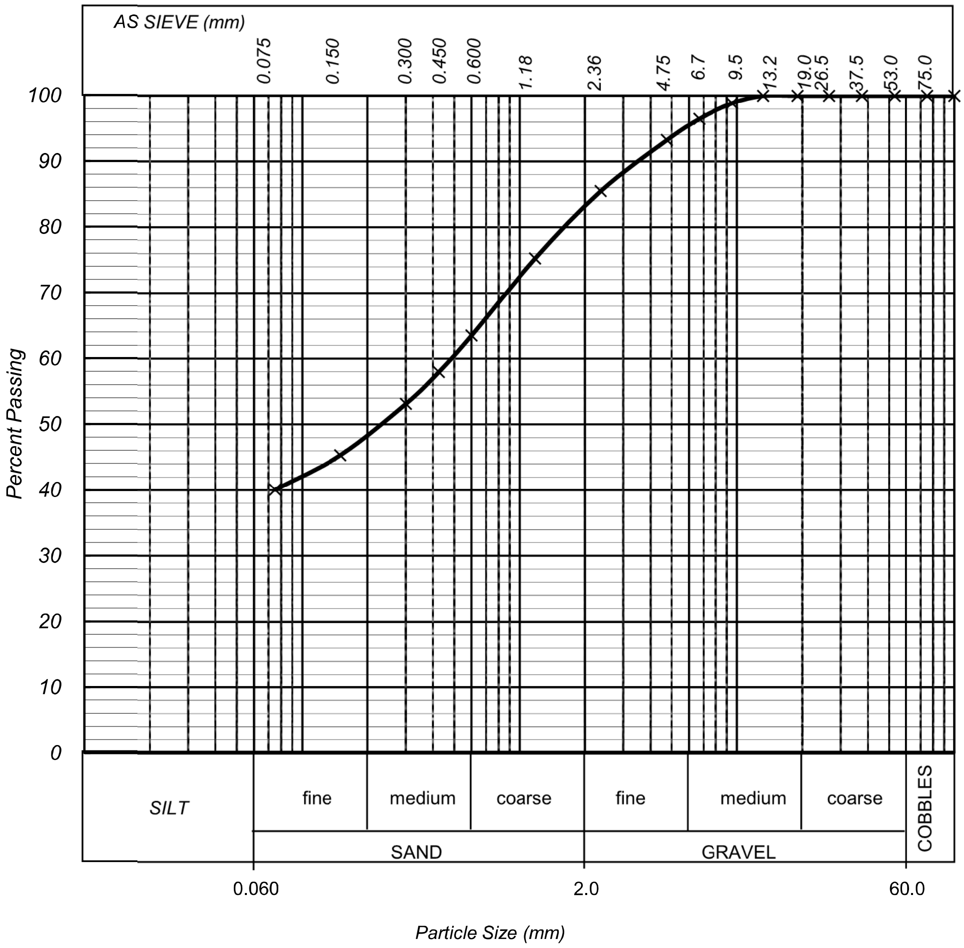
Sample Identification	SKM-BH04 @ 1.5m	*Sample No*	13221055
Sampling method	By Client	*Sampled by*	Client
		Sampling date	2013

Sample Description

clayey SAND, fine to coarse, brown with some white, fines of low to medium plasticity, trace of fine to medium gravel.

Particle Size Distribution

Particle Size (mm)	Percent Passing
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	99
6.7	96
4.75	93
2.36	86
1.18	75
0.600	64
0.425	58
0.300	53
0.150	45
0.075	40



Gravel		*Sand*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	19.5%	*Gravel*	17.0%
medium	4.6%	*medium*	14.9%	*Sand*	42.9%
fine	12.4%	*fine*	8.5%	*Fines*	40.1%
Total	17.0%	*Total*	42.9%	*Total*	100.0%

NATA ACCREDITED FOR TECHNICAL COMPETENCE

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards. Accredited for compliance to ISO/IEC 17025. **Accreditation No 9909**

Schedule 2.2 (a)(ii)

[redacted]

1128

PARTICLE SIZE DISTRIBUTION

Job No 13221
CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136
Report No 13221/R059
Date of Issue 08/01/14

Client	SINCLAIR KNIGHT MERZ (MELBOURNE)	*Tested by*	[redacted]
Project	VW07289.02 ISABELLA WEIR	*Date tested*	07/01/14
Location	ACT	*Checked by*	[redacted]

Sample Identification SKM-BH05 2.0 - 2.5m *Sample No* 13221056

Sample Description

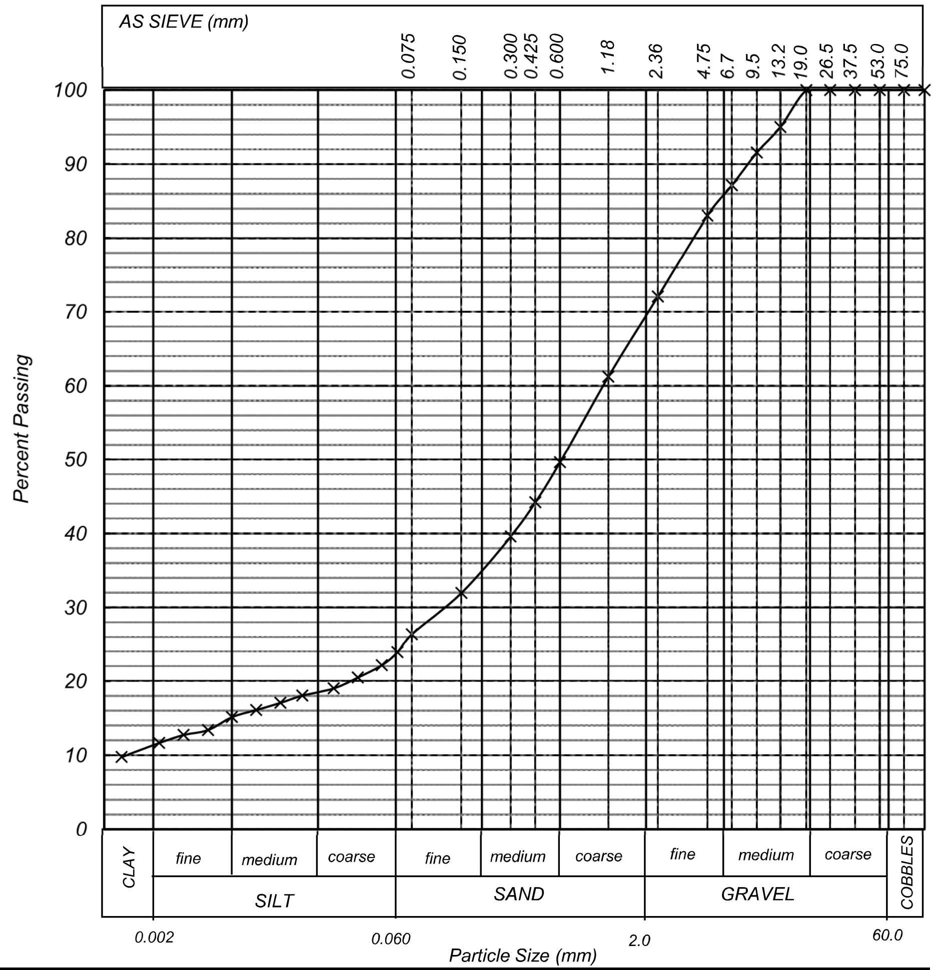
clayey SAND, fine to coarse, brown, fines of low plasticity, with fine to medium gravel.

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Standard method of fine analysis using a Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	95
9.5	92
6.7	87
4.75	83
2.36	72
1.18	61
0.600	50
0.425	44
0.300	40
0.150	32
0.075	26
0.061	24
0.049	22
0.035	21
0.025	19
0.016	18
0.012	17
0.0084	16
0.0060	15
0.0043	13
0.0031	13
0.0022	12
0.0013	10



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	19.8%	*coarse*	5.1%	*Gravel*	30.6%
medium	14.2%	*medium*	14.5%	*medium*	3.4%	*Sand*	45.8%
fine	16.4%	*fine*	11.5%	*fine*	3.7%	*Silt*	12.2%
Total	30.6%	*Total*	45.8%	*Total*	12.2%	*Clay*	11.4%
						Total	100.0%

A362 V1.1 MAR 13

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards. Accredited for compliance to ISO/IEC 17025. **Accreditation No 9909**

Schedule 2.2 (a)(ii)

[redacted]

1129

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

Job No	13221
Report No	13221/R060
Date of Issue	08/01/14

Client	SINCLAIR KNIGHT MERZ (MELBOURNE)	*Tested by*	[redacted]
Project	VW07289.02 ISABELLA WEIR	*Date tested*	07/01/14
Location	ACT	*Checked by*	[redacted]

Sample Identification SKM-BH05 4.3 - 4.74m *Sample No* 13221057

Sample Description

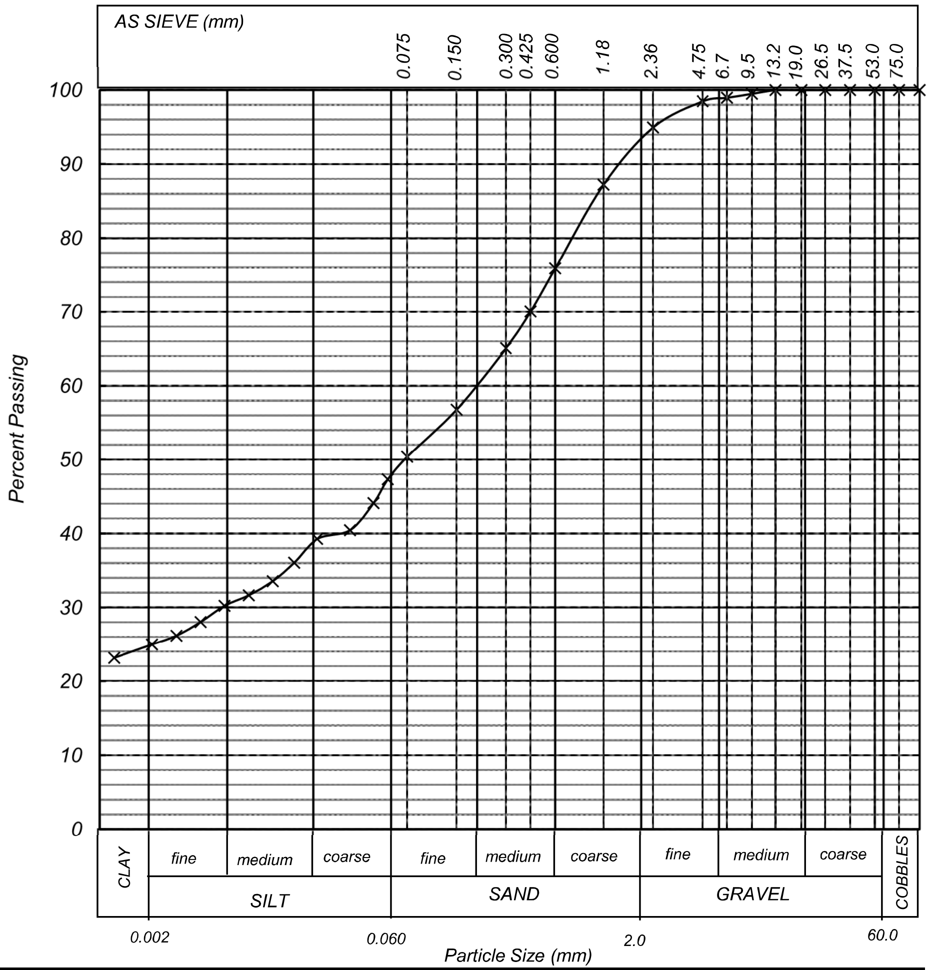
sandy CLAY / clayey SAND, fine to coarse, grey, fines of medium plasticity, trace of fine to medium gravel.

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Standard method of fine analysis using a Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	100
6.7	99
4.75	98
2.36	95
1.18	87
0.600	76
0.425	70
0.300	65
0.150	57
0.075	50
0.057	47
0.047	44
0.034	40
0.021	39
0.015	36
0.011	34
0.0081	32
0.0058	30
0.0041	28
0.0029	26
0.0021	25
0.0012	23



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	17.2%	*coarse*	9.2%	*Gravel*	6.9%
medium	1.2%	*medium*	15.6%	*medium*	8.3%	*Sand*	45.2%
fine	5.7%	*fine*	12.4%	*fine*	5.6%	*Silt*	23.1%
Total	6.9%	*Total*	45.2%	*Total*	23.1%	*Clay*	24.8%
						Total	100.0%

A362 V1.1 MAR 13

Schedule 2.2 (a)(ii)

[redacted]

APPENDIX 3.01:
ISABELLA WEIR SITE SURVEY, LEACH STEGER 2015

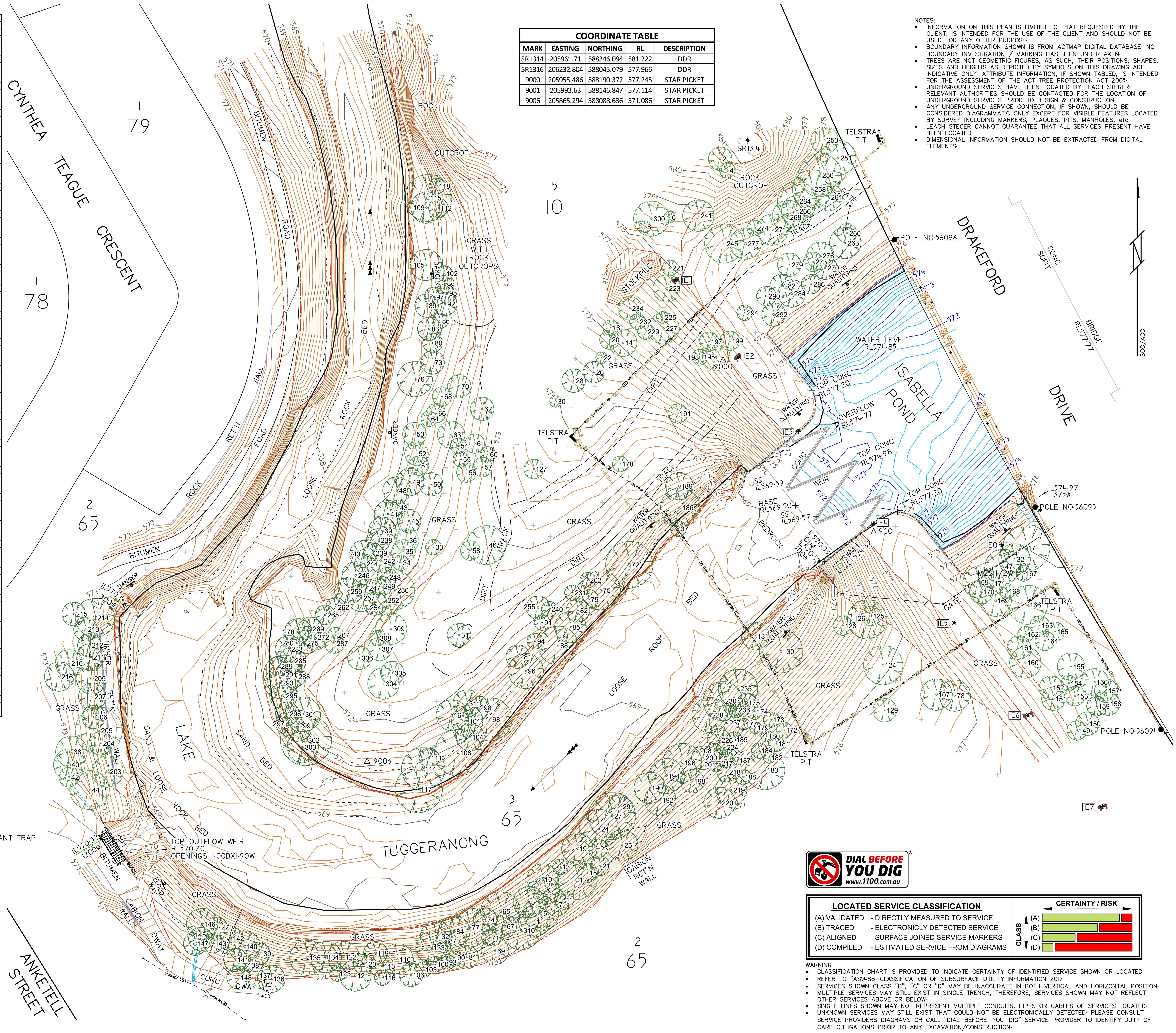
TREE LEGEND

Tree No.	Trunk Dia.()	Canopy Dia.()	Type	Height	No.Trunks	Tree No.	Trunk Dia.()	Canopy Dia.()	Type	Height	No.Trunks	Tree No.	Trunk Dia.()	Canopy Dia.()	Type	Height	No.Trunks
1	0.30	8.0	CASUARINA	15.0	1	105	0.50	8.0	CASUARINA	16.6	1	209	0.75	8.0	CASUARINA	14.7	3
2	0.40	6.0	EUCALYPT	10.6	2	106	0.30	6.0	CASUARINA	9.7	1	210	0.35	7.0	EUCALYPT	13.5	1
3	0.35	8.0	CASUARINA	14.0	1	107	0.45	8.0	CASUARINA	9.5	2	211	0.35	7.0	CASUARINA	14.7	1
4	0.30	4.0	EUCALYPT	7.8	2	108	0.48	12.0	CASUARINA	17.6	1	212	0.35	6.0	CASUARINA	14.2	1
5	0.45	9.0	CASUARINA	13.0	1	109	0.50	8.0	CASUARINA	16.6	1	213	0.30	6.0	CASUARINA	13.0	1
6	0.20	3.0	EUCALYPT	10.0	1	110	0.35	8.0	CASUARINA	15.0	1	214	1.00	10.0	CASUARINA	15.5	4
7	0.25	6.0	CASUARINA	12.0	1	111	0.33	5.0	CASUARINA	10.0	2	215	0.30	6.0	CASUARINA	12.7	1
8	0.20	3.0	EUCALYPT	10.8	1	112	0.30	5.0	CASUARINA	13.2	1	216	0.35	7.5	CASUARINA	12.1	1
9	0.30	7.0	CASUARINA	12.8	1	113	0.30	6.0	CASUARINA	16.5	1	217	0.20	4.0	CONIFER	10.0	1
10	0.45	8.0	CASUARINA	15.5	1	114	0.95	11.0	CASUARINA	16.2	4	218	0.20	5.0	CONIFER	11.5	1
11	0.25	5.0	CASUARINA	15.0	1	115	0.95	12.0	CASUARINA	14.8	3	219	0.25	8.0	CONIFER	11.5	1
12	0.90	10.0	EUCALYPT	16.5	3	116	0.20	4.0	CASUARINA	12.5	1	220	0.60	8.0	CONIFER	11.0	4
13	0.20	4.0	CASUARINA	11.0	1	117	0.45	12.0	CASUARINA	16.5	1	221	0.50	4.0	EUCALYPT	8.3	4
14	0.45	7.0	EUCALYPT	10.0	3	118	0.20	4.0	CASUARINA	8.0	1	222	0.20	4.0	CONIFER	10.0	1
15	0.25	5.0	CASUARINA	0.0	-	119	0.65	6.0	CASUARINA	12.0	1	223	0.60	7.0	EUCALYPT	8.5	4
16	0.45	8.0	CASUARINA	16.8	1	120	0.25	5.0	CASUARINA	15.0	1	224	0.20	4.0	CONIFER	14.0	1
17	0.70	12.0	CASUARINA	10.8	4	121	0.40	8.0	CASUARINA	11.0	1	225	0.20	3.0	EUCALYPT	5.5	2
18	0.20	4.0	EUCALYPT	8.4	1	122	0.40	8.0	CASUARINA	16.5	1	226	0.30	6.0	CONIFER	12.3	1
19	0.40	8.0	CASUARINA	18.0	1	123	0.30	4.0	CASUARINA	11.0	1	227	0.45	8.0	EUCALYPT	8.4	2
20	0.20	5.0	EUCALYPT	8.7	1	124	0.55	10.0	EUCALYPT	10.6	2	228	0.60	9.0	CONIFER	14.0	2
21	0.30	5.0	CASUARINA	11.0	1	125	0.25	5.0	EUCALYPT	7.3	2	229	0.30	4.0	EUCALYPT	7.9	3
22	0.20	3.0	EUCALYPT	5.8	2	126	0.65	10.0	CASUARINA	10.0	4	230	0.45	10.0	CONIFER	17.0	1
23	0.20	5.0	CASUARINA	13.0	1	127	0.35	5.0	EUCALYPT	4.0	3	231	0.20	4.0	CASUARINA	8.0	1
24	0.40	10.0	CASUARINA	17.0	1	128	0.25	5.0	EUCALYPT	10.0	1	232	0.20	4.0	EUCALYPT	10.5	1
25	0.35	8.0	CASUARINA	13.0	1	129	0.25	6.0	EUCALYPT	9.0	1	233	0.45	10.0	CONIFER	0.0	-
26	0.25	5.5	CASUARINA	7.8	1	130	0.55	11.0	CASUARINA	14.1	2	234	0.28	6.0	EUCALYPT	11.7	1
27	0.45	12.0	CASUARINA	14.5	1	131	0.33	7.0	CASUARINA	12.3	1	235	0.40	10.0	CONIFER	13.3	1
28	0.25	6.0	CASUARINA	7.4	1	132	0.45	8.0	CASUARINA	15.0	1	236	0.25	4.0	CONIFER	13.0	1
29	0.25	6.0	CASUARINA	12.5	1	133	0.40	8.0	CASUARINA	19.0	1	237	0.45	9.0	CONIFER	14.5	1
30	0.35	3.0	EUCALYPT	6.9	3	134	0.60	8.0	CASUARINA	15.2	3	238	0.30	6.0	CASUARINA	20.0	1
31	0.30	6.0	EUCALYPT	9.2	1	135	0.40	9.0	CASUARINA	16.5	1	239	0.30	5.0	CASUARINA	20.0	1
32	0.30	8.0	CASUARINA	14.0	1	136	0.30	7.0	CASUARINA	15.0	1	240	0.30	4.0	CASUARINA	7.5	2
33	0.20	4.0	EUCALYPT	10.2	1	137	0.30	7.0	CASUARINA	13.5	1	241	0.30	8.0	EUCALYPT	10.2	1
34	0.20	4.0	EUCALYPT	10.6	1	138	0.20	4.0	CASUARINA	13.5	1	242	0.40	6.0	CASUARINA	21.6	1
35	0.20	6.0	EUCALYPT	7.5	2	139	0.50	6.0	CASUARINA	13.0	4	243	0.55	7.0	CASUARINA	21.9	1
36	0.25	6.0	WATTLE	7.5	1	140	0.45	8.0	CASUARINA	17.0	1	244	0.30	5.0	CASUARINA	20.4	1
37	0.20	4.0	CASUARINA	8.1	1	141	0.35	6.0	CASUARINA	14.0	1	245	0.30	10.0	EUCALYPT	11.7	1
38	0.35	8.0	EUCALYPT	14.2	1	142	0.40	6.0	CASUARINA	15.5	1	246	0.50	7.0	CASUARINA	17.8	1
39	0.40	7.0	CASUARINA	16.8	1	143	0.30	5.0	CASUARINA	14.2	1	247	0.30	5.0	CASUARINA	19.0	1
40	0.73	8.0	EUCALYPT	14.5	3	144	0.30	6.0	CASUARINA	14.4	1	248	0.25	5.0	CASUARINA	16.5	1
41	0.40	7.0	CASUARINA	16.8	1	145	0.30	6.0	CASUARINA	15.4	1	249	0.35	5.0	CASUARINA	17.2	1
42	0.45	5.0	EUCALYPT	11.2	3	146	0.40	8.0	CASUARINA	14.5	1	250	0.30	10.0	EUCALYPT	15.9	1
43	0.25	4.0	CASUARINA	13.0	1	147	0.90	6.0	CASUARINA	15.5	8	251	0.33	9.0	EUCALYPT	10.7	1
44	0.33	10.0	EUCALYPT	11.6	1	148	0.30	6.0	CASUARINA	14.0	1	252	0.25	8.0	EUCALYPT	15.4	1
45	0.40	6.0	CASUARINA	13.8	1	149	0.35	5.0	EUCALYPT	9.5	2	253	0.38	7.0	EUCALYPT	15.0	1
46	0.35	10.0	EUCALYPT	13.5	1	150	0.40	6.0	EUCALYPT	10.4	2	254	0.50	6.0	CASUARINA	15.9	2
47	0.55	9.0	CASUARINA	15.9	1	151	0.38	6.0	EUCALYPT	8.7	2	255	0.45	6.0	CASUARINA	10.0	2
48	0.40	7.0	CASUARINA	16.0	1	152	0.25	6.0	EUCALYPT	11.9	1	256	0.60	11.0	EUCALYPT	17.5	2
49	0.45	7.0	CASUARINA	13.8	1	153	0.30	5.0	EUCALYPT	8.5	2	257	0.30	7.0	CASUARINA	15.9	1
50	0.25	6.0	CASUARINA	10.5	1	154	0.35	4.0	EUCALYPT	7.0	4	258	0.37	10.0	EUCALYPT	14.5	1
51	0.25	5.0	EUCALYPT	9.9	1	155	0.25	7.0	EUCALYPT	11.3	1	259	0.40	7.0	CASUARINA	18.9	1
52	0.30	6.0	EUCALYPT	9.4	1	156	0.40	7.0	EUCALYPT	9.4	3	260	0.35	5.0	EUCALYPT	9.8	2
53	0.45	6.0	EUCALYPT	8.2	2	157	0.20	6.0	EUCALYPT	11.3	1	261	0.30	7.0	EUCALYPT	9.8	2
54	0.25	4.0	CASUARINA	7.1	1	158	0.35	6.0	EUCALYPT	11.4	3	262	0.30	5.0	CASUARINA	13.8	1
55	0.25	4.0	CASUARINA	9.6	1	159	0.30	5.0	CASUARINA	9.0	2	263	0.30	8.0	CASUARINA	10.8	1
56	0.30	5.0	EUCALYPT	8.2	2	160	0.40	8.0	EUCALYPT	11.6	1	264	0.55	10.0	EUCALYPT	12.9	2
57	0.25	5.0	EUCALYPT	7.0	2	161	0.80	6.0	EUCALYPT	11.2	4	265	0.40	5.0	CASUARINA	15.9	1
58	0.25	5.0	EUCALYPT	5.5	1	162	0.40	4.0	EUCALYPT	12.3	2	266	0.50	8.0	EUCALYPT	15.2	2
59	0.45	8.0	CASUARINA	11.2	2	163	0.20	5.0	EUCALYPT	8.0	1	267	0.20	4.0	EUCALYPT	11.1	1
60	0.25	4.0	CASUARINA	7.0	1	164	0.28	5.0	EUCALYPT	12.1	2	268	0.45	8.0	EUCALYPT	15.3	2
61	0.40	5.0	EUCALYPT	7.0	3	165	0.24	5.0	EUCALYPT	13.1	1	269	0.35	6.0	CASUARINA	14.9	1
62	0.40	6.0	EUCALYPT	7.3	3	166	0.42	10.0	EUCALYPT	12.5	1	270	0.30	6.0	CASUARINA	11.2	1
63	0.35	7.0	EUCALYPT	5.4	3	167	0.36	4.0	CASUARINA	7.6	2	271	0.40	8.0	EUCALYPT	12.4	1
64	0.20	4.0	EUCALYPT	6.7	2	168	0.22	4.0	EUCALYPT	12.6	1	272	0.45	6.0	CASUARINA	14.9	2
65	0.60	10.0	CASUARINA	17.0	1	169	0.50	8.0	EUCALYPT	15.6	2	273	0.28	5.0	EUCALYPT	10.1	2
66	0.20	5.0	EUCALYPT	6.4	1	170	0.35	6.0	EUCALYPT	11.2	2	274	0.47	4.0	EUCALYPT	7.7	4
67	0.40	6.0	CASUARINA	18.0	1	171	0.25	6.0	EUCALYPT	13.1	1	275	0.30	7.0	CASUARINA	16.9	1
68	0.25	5.0	EUCALYPT	7.7	1	172	0.20	4.0	EUCALYPT	10.0	1	276	0.35	7.0	EUCALYPT	11.1	2
69	0.30	7.0	CASUARINA	15.0	1	173	0.22	4.0	CASUARINA	10.2	1	277	0.65	8.0	EUCALYPT	12.6	3
70	0.45	6.0	EUCALYPT	8.0	3	174	0.20	4.0	CASUARINA	12.6	1	278	0.30	7.0	CASUARINA	16.9	1
71	0.20	4.0	CASUARINA	14.0	1	175	0.38	5.0	CASUARINA	13.1	2	279	0.20	6.0	EUCALYPT	8.9	1
72	0.75	12.0	CASUARINA	11.8	2	176	0.26	3.0	CASUARINA	13.9	2	280	0.20	4.0	CASUARINA	12.9	1
73	0.30	6.0	CASUARINA	12.6	1	177	0.27	3.0	CASUARINA	11.2	2	281	0.35	6.0	CASUARINA	10.0	2
74	0.26	6.0	CASUARINA	17.0	1	178	0.20	4.0	EUCALYPT	6.0	1	282	0.35	6.0	CASUARINA	9.4	2
75	0.38	10.0	CASUARINA	10.8	1	179	0.20	3.0	CASUARINA	11.0	1	283	0.45	7.0	CASUARINA	16.8	1
76	0.50	9.0	CASUARINA	15.9	1	180	0.20	3.0	CASUARINA	10.9	1	284	0.50	7.0	CASUARINA	9.0	4
77	0.50	10.0	CASUARINA	20.0	1	181	0.22	4.0	CASUARINA	10.5	1	285	0.35	7.0	CASUARINA	16.8	1
78	0.40	8.0	CASUARINA	10.9	2	182	0.20	3.0	EUCALYPT	9.9	1	286	0.30	5.0	CASUARINA	7.1	2
79	0.35	5.0	CASUARINA	11.9	2	183	0.30	10.0	CASUARINA	11.8	1	287	0.30	5.0	EUCALYPT	10.0	2
80	0.25	5.0	CASUARINA	12.3	1	184	0.20	4.0	CASUARINA	9.9	1	288	0.25	5.0	CASUARINA	11.4	1
81	0.30	6.0	CASUARINA	15.3	1	185	0.23	4.0	CASUARINA	12.1	1	289	0.25	5.0	CASUARINA	10.3	1
82	0.35	6.0	CASUARINA	10.8	2	186	0.40	10.0	CASUARINA	14.3	1	290	0.50	5.0	CASUARINA	8.9	5
83	0.45	6.0	CASUARINA	14.1	1	187	0.28	3.0	CASUARINA	10.4	2	291	0.50	10.0	CASUARINA	17.4	1
84	0.50	8.0	CASUARINA	16.4	1	188	0.22	4.0	CASUARINA	10.8	1	292	0.50	6.0	CASUARINA	8.2	5
85	0.30	8.0	CASUARINA	14.8	1	189	0.60	7.0	CASUARINA	10.3	3	293	0.40	8.0	CASUARINA	15.6	1
86	0.20	4.0	CASUARINA	11.7	1	190	0.35	8.0	CONIFER	12.0	1	294	0.20	4.0	CASUARINA	8.2	1
87	0.25	5.0	CASUARINA	15.8	1	191	0.40	5.0	EUCALYPT	5.0	2	295	0.35	7.0	CASUARINA	17.5	1
88	0.40	10.0	CASUARINA	16.4	1	192	0.35	8.0	CONIFER	13.5	1	296	0.30	6.0	CASUARINA	19.5	1
89	0.35	6.0	CASUARINA	12.1	1	193	0.25	4.0	EUCALYPT	5.1	3	297	0.30	6.0	CASUARINA	9.2	2
90	0.30	4.0	CASUARINA	16.7	3	194	0.40	9.0	CONIFER	15.0	1	298	0.30	6.0	CASUARINA	8.0	3
91	0.25	4.0	CASUARINA	9.9	1	195	0.30	7.0	EUCALYPT	9.1	1	299	0.50	8.0	CASUARINA	20.0	1
92	0.35	6.0	CASUARINA	13.0	1	196	0.40	10.0	CONIFER	15.0	1	300	0.40	9.0	EUCALYPT	10.8	2
93	0.25	4.0	CASUARINA	18.0	1	197	0.27	5.0	EUCALYPT	7.7	1	301	0.40	9.0	CASUARINA	18.8	1
94	0.20	4.0	CASUARINA	7.5	1	198	0.20	6.0	CONIFER	13.0	1	302	0.90	13.0	CASUARINA	16.3	3
95	0.35	5.0	CASUARINA	12.0	1	199	0.55	5.0	EUCALYPT	6.8	4	303	0.35	8.0	CASUARINA	19.1	1
96	0.37	9.0	CASUARINA	13.5	1	200	0.20	6.0	CONIFER	0.0		304	0.30	8.0	EUCALYPT	10.0	1
97	0.30	5.0	CASUARINA	13.7	1	201	0.20	4.0	CONIFER	12.5	1	305	0.25	6.0	EUCALYPT	7.8	1
98	0.38	11.0	CASUARINA	14.2	1	202	0.20	4.0	CASUARINA	10.0	1	306	0.35	6.0	EUCALYPT	11.8	2
99	0.25	5.0	CASUARINA	12.2	1	203	0.80	8.0	EUCALYPT	9.5	4	307	0.35	6.0	EUCALYPT	10.8	1
100	0.20	4.0	CASUARINA	15.0	1	204	0.25	6.0	CASUARINA	12.5	1	308	0.25	4.0	EUCALYPT	11.2	1
101	0.32	8.0	CASUARINA	16.9	1	205	0.40	12.0	EUCALYPT	14.4	1	309	0.40	8.0	EUCALYPT	12.5	2
102	0.20	4.0	CASUARINA	13.0	1	206	0.25	6.0	CASUARINA	10.5	1	310	0.50	10.0	CASUARINA	14.3	4
103	0.24	4.0	CASUARINA	11.5	1	207	0.30	7.0	CASUARINA	14.3	1	311	0.35	7.0	CASUARINA	13.8	1
104	0.38	7.0	CASUARINA	19.3	1	208	0.20	4.0	CONIFER	11.0	1						

LEGEND

- COMMUNICATION–PIT
- ELECTRICITY–POLE
- GAS–MARKER POST
- GAS–MARKER SIGN
- MINOR STRUCTURE–BOLLARD
- SIGNAGE–ONE POST
- STORM WATER–GRATED PIT
- STORM WATER–MANHOLE
- STORM WATER–SUBSOIL
- VEGETATION–TREE
- BUILDING–RAILING
- COMMUNICATION–TELSTRA LINE U/G
- COMMUNICATION–TRANSACT LINE U/G
- ELECTRICITY–LINE A/G
- GAS–PIPE U/G
- MINOR STRUCTURE–FENCE
- MINOR STRUCTURE–GATE
- ROAD–TRACK
- STORM WATER–CHAMBER U/G
- STORM WATER–CULVERT, BOX
- STORM WATER–PIPE U/G
- STORM WATER–SPOON DRAIN
- STORM WATER–WATER COURSE
- TOPOGRAPHIC–BOTTOM OF BANK
- TOPOGRAPHIC–TOP OF BANK

GPT – GROSS POLLUTANT TRAP



COORDINATE TABLE

MARK	EASTING	NORTHING	RL	DESCRIPTION
SR1314	205961.71	588246.094	581.222	DDR
SR1316	206232.804	588045.079	577.966	DDR
9000	205955.486	588190.372	577.245	STAR PICKET
9001	205993.63	588146.847	577.114	STAR PICKET
9006	205865.294	588088.636	571.086	STAR PICKET

NOTES:
- INFORMATION ON THIS PLAN IS LIMITED TO THAT REQUESTED BY THE CLIENT, IS INTENDED FOR THE USE OF THE CLIENT AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE.
- BOUNDARY INFORMATION SHOWN IS FROM ACTMAP DIGITAL DATABASE. NO BOUNDARY INVESTIGATION / MARKING HAS BEEN UNDERTAKEN.
- TREES ARE NOT GEOMETRIC FIGURES, AS SUCH, THEIR POSITIONS, SHAPES, SIZES AND HEIGHTS AS DEPICTED BY SYMBOLS ON THIS DRAWING ARE INDICATIVE ONLY. ATTRIBUTE INFORMATION, IF SHOWN TABLED, IS INTENDED FOR THE ASSESSMENT OF THE ACT TREE PROTECTION ACT 2005.
- UNDERGROUND SERVICES HAVE BEEN LOCATED BY LEACH STEGER. RELEVANT AUTHORITIES SHOULD BE CONTACTED FOR THE LOCATION OF UNDERGROUND SERVICES PRIOR TO DESIGN & CONSTRUCTION.
- ANY UNDERGROUND SERVICE CONNECTION, IF SHOWN, SHOULD BE CONSIDERED DIAGRAMMATIC ONLY EXCEPT FOR VISIBLE FEATURES LOCATED BY SURVEY INCLUDING MARKERS, PLAQUES, PITS, MANHOLES, etc.
- LEACH STEGER CANNOT GUARANTEE THAT ALL SERVICES PRESENT HAVE BEEN LOCATED.
- DIMENSIONAL INFORMATION SHOULD NOT BE EXTRACTED FROM DIGITAL ELEMENTS.

DIAL BEFORE YOU DIG® www.1100.com.au

LOCATED SERVICE CLASSIFICATION

(A) VALIDATED	- DIRECTLY MEASURED TO SERVICE	(A)
(B) TRACED	- ELECTRONICLY DETECTED SERVICE	(B)
(C) ALIGNED	- SURFACE JOINED SERVICE MARKERS	(C)
(D) COMPILED	- ESTIMATED SERVICE FROM DIAGRAMS	(D)

CERTAINTY / RISK — CLASS

WARNING
- CLASSIFICATION CHART IS PROVIDED TO INDICATE CERTAINTY OF IDENTIFIED SERVICE SHOWN OR LOCATED.
- REFER TO "AS5488–CLASSIFICATION OF SUBSURFACE UTILITY INFORMATION 2013
- SERVICES SHOWN CLASS "B", "C" OR "D" MAY BE INACCURATE IN BOTH VERTICAL AND HORIZONTAL POSITION.
- MULTIPLE SERVICES MAY STILL EXIST IN SINGLE TRENCH, THEREFORE, SERVICES SHOWN MAY NOT REFLECT OTHER SERVICES ABOVE OR BELOW.
- SINGLE LINES SHOWN MAY NOT REPRESENT MULTIPLE CONDUITS, PIPES OR CABLES OF SERVICES LOCATED.
- UNKNOWN SERVICES MAY STILL EXIST THAT COULD NOT BE ELECTRONICALLY DETECTED. PLEASE CONSULT SERVICE PROVIDERS DIAGRAMS OR CALL "DIAL–BEFORE–YOU–DIG" SERVICE PROVIDER TO IDENTIFY DUTY OF CARE OBLIGATIONS PRIOR TO ANY EXCAVATION/CONSTRUCTION.

— AAPT (B) — DENOTES UNDERGROUND SERVICE WITH LOCATION CLASS

	SURVEY	DRAWN	CHECK	APPROVED	ZONE	SURVEY	ISSUE
ORIGINAL ISSUE	[redacted]					23/09/14	07/10/14
AMENDMENTS A							
B							
C							
D							

Notes:

Schedule 2.2 (a)(ii)

..... [redacted] /10/2014
Surveyor Registered Under the ACT Surveyors Act 2007

Prepared By: LEACH·STEGER REGISTERED LAND SURVEYORS ABN 12 920 463 267
PO Box 58
WODEN ACT 2606
P - (02) 6296 4089 E - enquiries@leachsteger.com.au
F - (02) 6296 4090 W - www.leachsteger.com.au

Client: SMEC Celebrating 40 years 1970 - 2010
SUN MICRO BUILDING
SUITE 2 LEVEL1
243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602

Horizontal Datum: SGC/AGC
Vertical Datum:
MARK: SR1314
LEVEL: RL581.222
SYSTEM: AHD 71
Contour Interval: 0.20m

Title:
DETAIL SURVEY
ISABELLA WEIR UPGRADE
DIVISION: GREENWAY
DISTRICT: TUGGERANONG

Job: 14062 | Scale (meters): 1:500 (0 2.5 5 10 15)
Sheet: 1 of 1 | Size: A1 | Drawing: 14062_001.dwg

APPENDIX 3.02:
SERVICES POTHOLING REPORT, LEACH STEGER 2015

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	GAS	**POTHOLE NO.**	1.0
OBSERVATION			
DATE:	15/01/2015	**OBSERVER:**	[redacted] Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	206037.812	**LATITUDE:**	-35.43471710
NORTHING:	588132.526	**LONGITUDE:**	149.09556070
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:	0.90m		
TOP OF SERVICE:	RL576.107		
DESCRIPTION			
MATERIAL:	PIPE - STEEL		
NOTES:	200mm (x1)		
IMAGE			

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	COMM - Telstra	**POTHOLE NO.**	1.1
OBSERVATION			
DATE:	15/01/2015	**OBSERVER:**	[redacted]
POSITION (ACT/GPS)			
EASTING:	206037.748	**LATITUDE:**	-35.42317348
NORTHING:	588132.620	**LONGITUDE:**	149.07704516
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:	0.72m		
TOP OF SERVICE:	RL576.254		
DESCRIPTION			
MATERIAL:	CONDUIT - PVC		
NOTES:	110mm (x2)		
IMAGE			

DETAILS			
SERVICE TYPE:	GAS	**POTHOLE NO.**	2.0
OBSERVATION			
DATE:	15/01/2015	**OBSERVER:**	[redacted] Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	206021.802	**LATITUDE:**	-35.40659930
NORTHING:	588122.231	**LONGITUDE:**	149.07588810
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:		1.00m	
TOP OF SERVICE:		RL576.538	
DESCRIPTION			
MATERIAL:		PIPE - STEEL	
NOTES:		200mm (x1)	
IMAGE			

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	COMM - Telstra	**POTHOLE NO.**	2.1
OBSERVATION			
DATE:	15/01/2015	**OBSERVER:**	[redacted] Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	206021.813	**LATITUDE:**	-35.43471710
NORTHING:	588122.185	**LONGITUDE:**	149.09556070
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:		0.89m	
TOP OF SERVICE:		RL576.663	
DESCRIPTION			
MATERIAL:		CONDUIT - PVC	
NOTES:		110mm (x2)	
IMAGE			

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	GAS	**POTHOLE NO.**	3.0
OBSERVATION			
DATE:	15/01/2015	**OBSERVER:**	[redacted] Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	206008.496	**LATITUDE:**	-35.42482490
NORTHING:	588113.371	**LONGITUDE:**	149.07590290
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:	1.03m		
TOP OF SERVICE:	RL575.393		
DESCRIPTION			
MATERIAL:	PIPE - STEEL		
NOTES:	200mm (x1)		
IMAGE			

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	COMM - Telstra	**POTHOLE NO.**	3.1
OBSERVATION			
DATE:	15/01/2015	**OBSERVER:**	[redacted]
POSITION (ACT/GPS)			
EASTING:	206008.499	**LATITUDE:**	-35.43471710
NORTHING:	588113.372	**LONGITUDE:**	149.09556070
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:		0.81m	
TOP OF SERVICE:		RL575.611	
DESCRIPTION			
MATERIAL:		CONDUIT - PVC	
NOTES:		110mm (x2)	
IMAGE			

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	GAS	**POTHOLE NO.**	4.0
OBSERVATION			
DATE:	16/01/2015	**OBSERVER:**	[redacted] Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	205978.631	**LATITUDE:**	-35.42382680
NORTHING:	588094.010	**LONGITUDE:**	149.07781190
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:		0.65m	
TOP OF SERVICE:		RL574.876	
DESCRIPTION			
MATERIAL:		PIPE - STEEL	
NOTES:		200mm (x1)	
IMAGE			

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	GAS	**POTHOLE NO.**	5.0
OBSERVATION			
DATE:	16/01/2015	**OBSERVER:**	Schedule 2.2 (a)(ii) [redacted]
POSITION (ACT/GPS)			
EASTING:	205966.034	**LATITUDE:**	-35.42382680
NORTHING:	588109.480	**LONGITUDE:**	149.07781190
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:		0.95m	
TOP OF SERVICE:		RL571.084	
DESCRIPTION			
MATERIAL:		PIPE - STEEL	
NOTES:		200mm (x1)	
IMAGE			

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	GAS	**POTHOLE NO.**	6.0
OBSERVATION			
DATE:	15/01/2015	**OBSERVER:**	[redacted] Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	205942.782	**LATITUDE:**	-35.42251940
NORTHING:	588148.729	**LONGITUDE:**	149.07834680
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:		1.25m	
TOP OF SERVICE:		RL569.235	
DESCRIPTION			
MATERIAL:		PIPE - STEEL	
NOTES:		200mm (x1) Note: Water Backfilling	
IMAGE			

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	GAS	**POTHOLE NO.**	7.0
OBSERVATION			
DATE:	15/01/2015	**OBSERVER:**	Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	205931.604	**LATITUDE:**	-35.42334900
NORTHING:	588154.101	**LONGITUDE:**	149.08107570
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:		0.80m	
TOP OF SERVICE:		RL571.190	
DESCRIPTION			
MATERIAL:		PIPE - POLYETHYLENE	
NOTES:		200mm (x1)	
IMAGE			

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	GAS	**POTHOLE NO.**	8.0
OBSERVATION			
DATE:	16/01/2015	**OBSERVER:**	[redacted] Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	205918.112	**LATITUDE:**	-35.42382680
NORTHING:	588171.447	**LONGITUDE:**	149.07781190
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:	0.90m		
TOP OF SERVICE:	RL573.029		
DESCRIPTION			
MATERIAL:	PIPE - STEEL		
NOTES:	200mm (x1)		
IMAGE			

HYDRO EXCAVATION – Pothole Report

Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	COMM - Telstra	**POTHOLE NO.**	8.1
OBSERVATION			
DATE:	16/01/2015	**OBSERVER:**	Schedule 2.2 (a)(ii) [redacted]
POSITION (ACT/GPS)			
EASTING:	205917.550	**LATITUDE:**	-35.42382680
NORTHING:	588171.644	**LONGITUDE:**	149.07781190
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:	0.60m		
TOP OF SERVICE:	RL573.298		
DESCRIPTION			
MATERIAL:	CONDUIT - PVC		
NOTES:	100mm (x2)		
IMAGE			

HYDRO EXCAVATION – Pothole Report

Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	GAS	**POTHOLE NO.**	9.0
OBSERVATION			
DATE:	16/01/2015	**OBSERVER:**	Schedule 2.2 (a)(ii) [redacted]
POSITION (ACT/GPS)			
EASTING:	205932.033	**LATITUDE:**	-35.42313970
NORTHING:	588185.469	**LONGITUDE:**	149.07778570
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:	0.85m		
TOP OF SERVICE:	RL573.581		
DESCRIPTION			
MATERIAL:	PIPE - STEEL		
NOTES:	200mm (x1)		
IMAGE			

HYDRO EXCAVATION – Pothole Report
Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	COMM - Telstra	**POTHOLE NO.**	9.1
OBSERVATION			
DATE:	16/01/2015	**OBSERVER:**	[redacted] Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	205932.035	**LATITUDE:**	-35.42382680
NORTHING:	588185.468	**LONGITUDE:**	149.07781190
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:		0.55m	
TOP OF SERVICE:		RL573.860	
DESCRIPTION			
MATERIAL:		CONDUIT - PVC	
NOTES:		100mm (x2)	
IMAGE			

DETAILS			
SERVICE TYPE:	GAS	**POTHOLE NO.**	10.0
OBSERVATION			
DATE:	15/01/2015	**OBSERVER:**	[redacted] Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	205952.186	**LATITUDE:**	-35.42209410
NORTHING:	588205.248	**LONGITUDE:**	149.07701690
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:		1.40m	
TOP OF SERVICE:		RL576.361	
DESCRIPTION			
MATERIAL:		PIPE - STEEL	
NOTES:		200mm (x1)	
IMAGE			

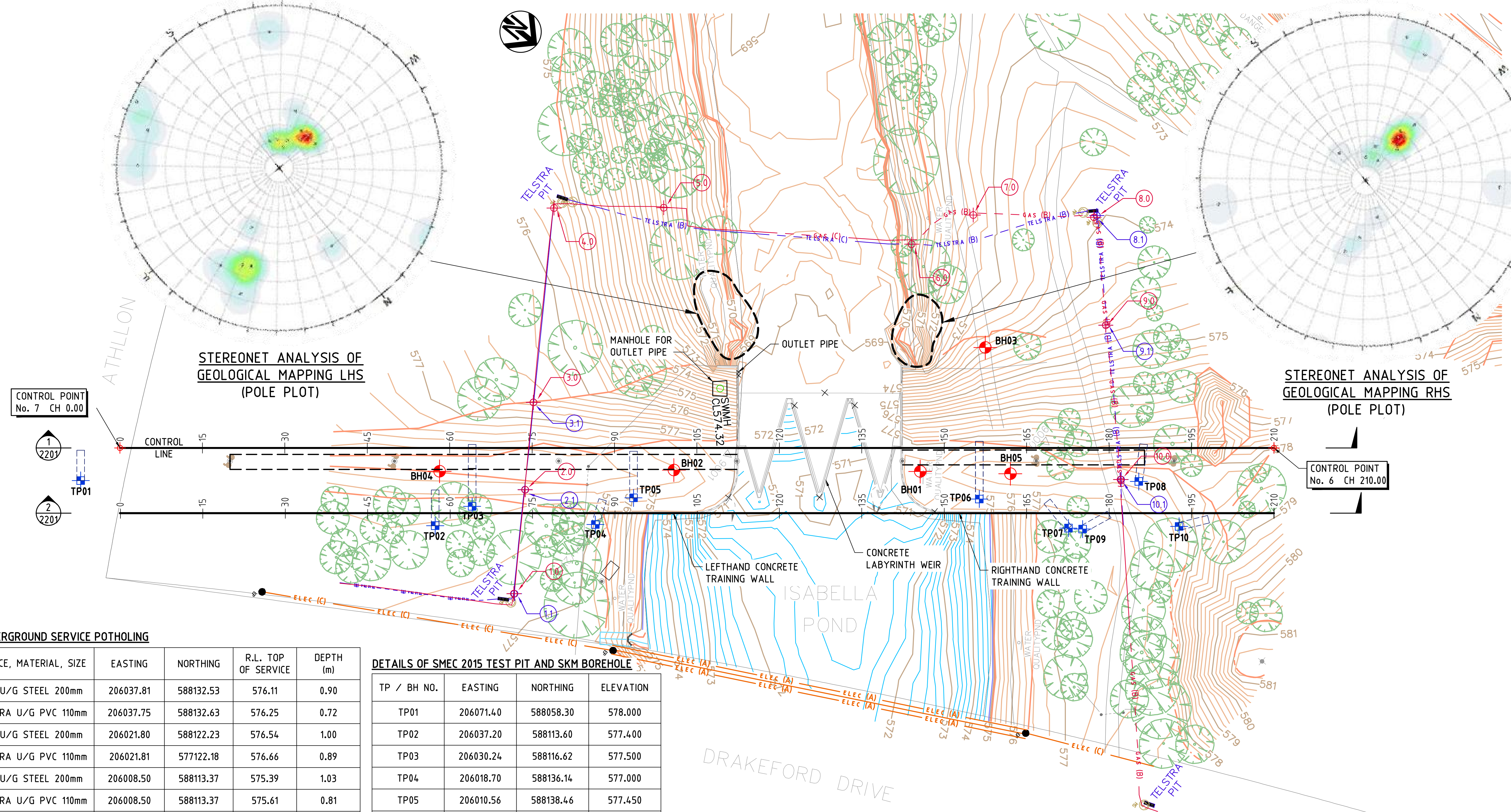
HYDRO EXCAVATION – Pothole Report

Isabella Weir Upgrade – Greenway, Tuggeranong

DETAILS			
SERVICE TYPE:	COMM - Telstra	**POTHOLE NO.**	10.1
OBSERVATION			
DATE:	15/01/2015	**OBSERVER:**	[redacted] Schedule 2.2 (a)(ii)
POSITION (ACT/GPS)			
EASTING:	205952.122	**LATITUDE:**	-35.42245240
NORTHING:	588205.330	**LONGITUDE:**	149.07776010
REDUCED LEVEL (AHD)			
COVER DEPTH OF SERVICE:	0.85m		
TOP OF SERVICE:	RL576.883		
DESCRIPTION			
MATERIAL:	CONDUIT - PVC		
NOTES:	100mm (x2)		
IMAGE			

APPENDIX 3.03:
SMEC GEOTECHNICAL DRAWINGS 2015

1150



DETAILS OF UNDERGROUND SERVICE POTHOLING

POTHOLE NO.	SERVICE, MATERIAL, SIZE	EASTING	NORTHING	R.L. TOP OF SERVICE	DEPTH (m)
1.0	GAS U/G STEEL 200mm	206037.81	588132.53	576.11	0.90
1.1	TELSTRA U/G PVC 110mm	206037.75	588132.63	576.25	0.72
2.0	GAS U/G STEEL 200mm	206021.80	588122.23	576.54	1.00
2.1	TELSTRA U/G PVC 110mm	206021.81	577122.18	576.66	0.89
3.0	GAS U/G STEEL 200mm	206008.50	588113.37	575.39	1.03
3.1	TELSTRA U/G PVC 110mm	206008.50	588113.37	575.61	0.81
4.0	GAS U/G STEEL 200mm	205978.63	588094.01	574.88	0.65
5.0	GAS U/G STEEL 200mm	205966.03	588109.48	571.08	0.95
6.0	GAS U/G STEEL 200mm	205942.78	588148.73	569.24	1.25
7.0	GAS U/G STEEL 200mm	205931.60	588154.10	571.19	0.80
8.0	GAS U/G STEEL 200mm	205918.11	588171.45	573.03	0.90
8.1	TELSTRA U/G PVC 110mm	205917.55	588171.64	573.30	0.60
9.0	GAS U/G STEEL 200mm	205932.03	588185.47	573.58	0.85
9.1	TELSTRA U/G PVC 110mm	205932.04	588185.47	573.86	0.55
10.0	GAS U/G STEEL 200mm	205952.19	588205.25	576.36	1.40
10.1	TELSTRA U/G PVC 110mm	205952.12	588205.33	576.88	0.88

DETAILS OF SMEC 2015 TEST PIT AND SKM BOREHOLE

TP / BH NO.	EASTING	NORTHING	ELEVATION
TP01	206071.40	588058.30	578.000
TP02	206037.20	588113.60	577.400
TP03	206030.24	588116.62	577.500
TP04	206018.70	588136.14	577.000
TP05	206010.56	588138.46	577.450
TP06	205971.11	588187.49	577.300
TP07	205965.02	588203.44	577.100
TP08	205950.37	588208.05	577.700
TP09	205963.54	588205.55	577.100
TP10	205952.10	588218.90	577.700
BH01	205974.00	588176.00	577.235
BH02	206002.00	588141.00	577.715
BH03	205949.00	588171.00	573.865
BH04	206029.00	588108.00	577.955
BH05	205964.00	588189.00	577.780

LEGEND:

- — — — — INTERPRETED CREST OF ZONE 1 CLAYCORE
- BH04 BOREHOLE
- TP-02 TEST PIT (UPSTREAM END OF EXCAVATION)
- MEASURED OUTLINE OF TEST PIT EXCAVATION
- 3.0 3.1 POTHOLE No.

UTILITIES:

- GAS (C) — GAS PIPE (UNDERGROUND) [C]
- GAS (B) — GAS PIPE (UNDERGROUND) [B]
- TELSTRA (C) — TELSTRA LINE (UNDERGROUND) [C]
- TELSTRA (B) — TELSTRA LINE (UNDERGROUND) [B]
- ELEC (C) — ELECTRICAL LINE (AG)
- ELEC (A) — ELECTRICAL LINE (AG) [A]

FOR INFORMATION ONLY

K:\Projects\3002402\CAD\DWG\3002402-00-300-2001[B].dwg

28 May 2015 10:33:30

ISSUE	DATE	AMENDMENT / ISSUE DESCRIPTION	APPROVAL
A	2015.04.08	ISSUED FOR INFORMATION ONLY	D001
B	2015.05.28	RE-ISSUED FOR INFORMATION ONLY	D002

TITLE	NAME
DRAFTSMAN	Schedule [redacted]
DRAFTING CHECK	
DESIGNER	
DESIGN CHECK	
PROJECT MANAGER	
PROJECT DIRECTOR	

SCALES AT A3 SIZE DRAWING

DESIGNER

SMEC

SMEC AUSTRALIA PTY LTD
© ACN 065 475 149
LEVEL 10, 71 QUEENS ROAD
MELBOURNE VIC. 3004
PH 03 9514-1500 FAX 03 9514-1502

CLIENT

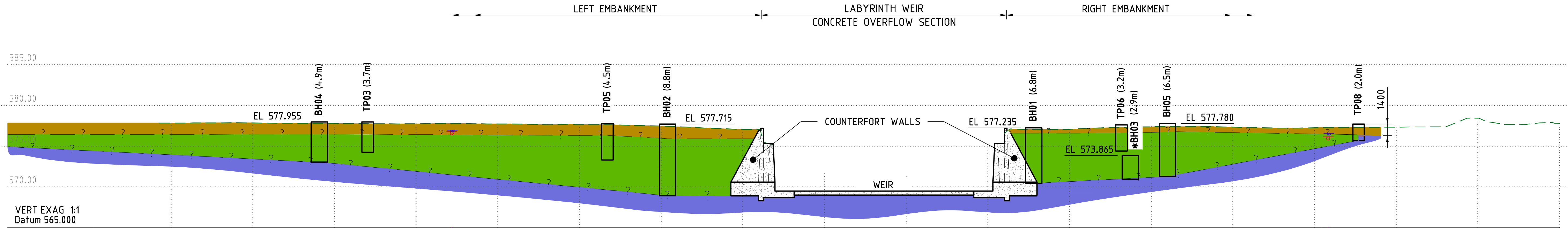
ACT Government
Territory and Municipal Services

APPROVED | DATE

PROJECT TITLE
ACT GOVERNMENT
ISABELLA WEIR UPGRADE
GEOTECHNICAL INVESTIGATIONS
BOREHOLE AND TEST PIT LOCATIONS

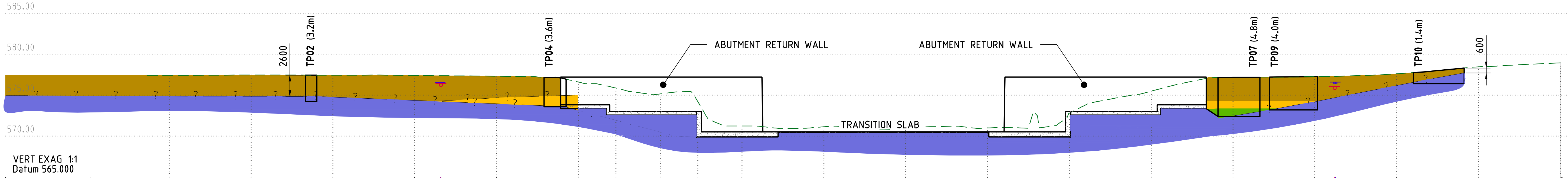
SCALE	DRAWING STATUS	PROJECT / DRAWING No.	ISSUE
AS SHOWN	SKETCH	3002402-00-300-2001	B

1151



EXISTING LEVEL	577.835	577.850	577.781	577.755	576.778	576.977	577.736	577.638	577.458	577.056	571.606	571.245	574.785	577.061	577.381	577.335	577.255	576.140*	576.566*	577.329	578.426	577.791	577.791
CHAINAGE	40.000	50.000	60.000	70.000	74.377	74.463	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	181.684	181.772	190.000	200.000	210.000	210.000

GEOLOGICAL SECTION 1/2001
SCALE 1:500 (H) & 1:500 (V)



EXISTING LEVEL	577.399	577.457	577.429	577.393	576.564	576.414	577.298	576.591	575.138	571.228	571.136	570.992	570.986	572.788	575.471	577.167	577.254	576.061	576.583	577.598	578.448	578.931	578.931
CHAINAGE	40.000	50.000	60.000	70.000	73.123	73.216	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	182.437	182.519	190.000	200.000	210.000	210.000

GEOLOGICAL SECTION 2/2001
SCALE 1:500 (H) & 1:500 (V)

INTERPRETED LOCATION OF SERVICES AT SECTION

- GAS PIPE 200mm DIA. (x1)
- TELSTRA PIPE 110mm DIA. (x2)
- * ASSUMED 0.3m LOWER THAN EXPOSED IN POTHOLES 10.0 & 10.1

LEGEND:

- EXISTING GROUND SURFACE
- ? INTERPRETED GEOLOGICAL CONTACT
- BH01 — BOREHOLE (OFFSET ±4.7m UPSTREAM FROM ALIGNMENT)
- *BH03 — BOREHOLE (OFFSET 18.27m DOWNSTREAM FROM ALIGNMENT)
- TP01 — TEST PIT
- (8.8m) — DEPTH OF BOREHOLE / TEST PIT
- ZONE 1: SILTY CLAY CORE
- GENERAL FILL: GRAVELLY CLAYEY SAND / SANDY CLAY
- WORKING PLATFORM: SILTY SAND / CRUSHER DUST
- BEDROCK: DACITE, HIGHLY TO SLIGHTLY WEATHERED

FOR INFORMATION ONLY

K:\Projects\3002402\CAD\DWG\3002402-00-300-2201(B).dwg 28 May 2015 10:19:39

ISSUE	DATE	AMENDMENT / ISSUE DESCRIPTION	APPROVAL
A	2015.04.08	ISSUED FOR INFORMATION ONLY	D001
B	2015.05.28	RE-ISSUED FOR INFORMATION ONLY	D002

TITLE	NAME
DRAFTSMAN	[redacted]
DRAFTING CHECK	
DESIGNER	
DESIGN CHECK	
PROJECT MANAGER	
PROJECT DIRECTOR	

SCALES AT A3 SIZE DRAWING

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ACN 065 475 149
LEVEL 10, 71 QUEENS ROAD
MELBOURNE VIC. 3004
PH 03 9514-1500 FAX 03 9514-1502

CLIENT
ACT Government
Territory and Municipal Services
APPROVED DATE

PROJECT TITLE
ACT GOVERNMENT
ISABELLA WEIR UPGRADE
GEOTECHNICAL INVESTIGATIONS
SECTIONS

SCALE	DRAWING STATUS	PROJECT / DRAWING No.	ISSUE
AS SHOWN	SKETCH	3002402-00-300-2201	B

150 mm ON ORIGINAL

APPENDIX 3.04:
SMEC TEST PIT LOGS, SKETCHES AND PHOTOS

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP01

FILE / JOB NO : 3002402
SHEET : 1 OF 1

PROJECT : ISABELLA WEIR SPILLWAY UPGRADE	CLIENT : ACT GOVERNMENT
LOCATION : ISABELLA POND, CANBERRA	FEATURE : LEFT EMBANKMENT ABUTMENT
POSITION : E: 688593.000, N: 6077977.000 (55H MGA94)	SURFACE ELEVATION : 578.000 (AHD)
EQUIPMENT TYPE : 210LC-7 EXCAVATOR	METHOD : 1.20m WIDE RIPPER BUCKET
DATE EXCAVATED : 18/3/15	LOGGED BY : [redacted]
EXCAVATION DIMENSIONS : 5.50 m LONG 1.40 m WIDE DIRECTION : 090°	CHECKED BY :

DRILLING / MATERIAL

DEPTH (m)	ELEVATION (RL)	GROUND WATER LEVELS	MATERIAL DESCRIPTION (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
0.0 – 0.20m	578.0	NO FREE GW OBSERVED	TOPSOIL: Sandy SILT; hard, grey brown	D	H	TOPSOIL
0.20m – 0.70m	577.5		FILL: Sandy silty CLAY and GRAVEL mix; very dense, yellow brown	D	VD	FILL
0.70m – 0.80m			Bitumen seal and road pavement; very dense, light grey	D	VD	ROAD SURFACE
0.80m – 1.70m	577.0 / 576.5		Sandy silty CLAY; hard, low plasticity, mottled orange grey with some iron staining	M	H	
1.70m – 2.00m			DACITE; medium grained, mottled yellow and grey, EL strength, EW			BEDROCK
2.00m – 2.40m	576.0		DACITE; pink grey, VL to L strength, HW			
2.40m	575.5		EXCAVATION TP01 TERMINATED AT 2.40 m Target depth			

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
Elevation scale: 578.0, 577.5, 577.0, 576.5, 576.0, 575.5, 575.0, 574.5, 574.0, 573.5, 573.0

Column headings: PENETRATION (VE E F H), SUPPORT, GROUND WATER LEVELS, SAMPLES & FIELD TESTS, ELEVATION (RL) DEPTH (m), GRAPHIC LOG, CLASSIFICATION SYMBOL, MATERIAL DESCRIPTION, MOISTURE CONDITION, CONSISTENCY RELATIVE DENSITY, HAND PENETRO-METER kPa (100 200 300 400), STRUCTURE & Other Observations

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH
No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

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

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

SMEC AUSTRALIA

1154

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP02

PROJECT : ISABELLA WEIR SPILLWAY UPGRADE	CLIENT : ACT GOVERNMENT	FILE / JOB NO : 3002402
LOCATION : ISABELLA POND, CANBERRA	FEATURE : U/S LEFT EMBANKMENT	SHEET : 1 OF 1

POSITION : E: 688560.000, N: 6078033.000 (55H MGA94) — SURFACE ELEVATION : 577.400 (AHD)

EQUIPMENT TYPE : 210LC-7 EXCAVATOR — METHOD : 1.20m WIDE RIPPER BUCKET

DATE EXCAVATED : 18/3/15 — LOGGED BY : [redacted] — CHECKED BY :

EXCAVATION DIMENSIONS : 6.50 m LONG 1.40 m WIDE DIRECTION : 090°

DRILLING: PENETRATION (VE E F H VH)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL)	DEPTH (m)	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETROMETER kPa (100 200 300 400)	STRUCTURE & Other Observations
		NO FREE GW OBSERVED			0.0 – 0.20m		TOPSOIL: Silty SAND/sandy SILT; hard, grey, with tree and grass roots	D	H		TOPSOIL
				577.0 / 576.5 / 576.0	0.20m – 1.90m	GM	FILL: Silty sandy GRAVEL; dark brown grey to light brown grey	D to M	VD		FILL
				575.5 / 575.0	1.90m – 2.60m		Sandy Gravelly CLAY; low plasticity, dark grey brown	M	H		RESIDUAL SOIL
				574.5	2.60m – 3.00m		DACITE; yellow with some grey mottling and white specs, EL strength, EW				BEDROCK
					3.00m – 3.20m		DACITE; grey purple with white specs, VL strength, HW				
				574.0 / 573.5 / 573.0 / 572.5	3.20m – 5.0		EXCAVATION TP02 TERMINATED AT 3.20 m Target depth				

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
- 10 Oct., 73 Water Level on Date shown
- water inflow
- water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

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

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

SMEC AUSTRALIA

1155

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP03

PROJECT : ISABELLA WEIR SPILLWAY UPGRADE
LOCATION : ISABELLA POND, CANBERRA
CLIENT : ACT GOVERNMENT
FEATURE : LEFT EMBANKMENT CREST
FILE / JOB NO : 3002402
SHEET : 1 OF 1

POSITION : E: 688552.000, N: 6078034.000 (55H MGA94)
SURFACE ELEVATION : 577.500 (AHD)
EQUIPMENT TYPE : 210LC-7 EXCAVATOR
METHOD : 1.20m WIDE RIPPER BUCKET
DATE EXCAVATED : 18/3/15
LOGGED BY : [redacted]
CHECKED BY :
EXCAVATION DIMENSIONS : 6.90 m LONG 1.40 m WIDE DIRECTION : 090°

DRILLING / MATERIAL

Depth (m)	Elevation (RL)	Samples & Field Tests	Ground Water Levels	Classification Symbol	Material Description (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	Moisture Condition	Consistency / Relative Density	Structure & Other Observations
0.00–0.20	577.5	B (0.00–0.50m)	NO FREE GW OBSERVED	SM	TOPSOIL & FILL: Silty SAND; very dense, brown grey, with some gravel and tree/grass roots	D	VD	FILL
0.20–1.50				GC	FILL: Silty CLAY and GRAVEL mixture; grey brown, with some EW-MW dacite cobbles	D	VD	
1.50–3.70	576.0	B, U (1.60m–1.90m)			FILL (CORE MATERIAL): Silty CLAY; hard, medium plasticity, yellow green and brown, with some sand	M	H	1.50: U tube (1.50 - 1.80m) 2.50: PP = 500kPa
3.70	573.8				EXCAVATION TP03 TERMINATED AT 3.70 m Target depth			

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
Elevation scale: 577.5, 577.0, 576.5, 576.0, 575.5, 575.0, 574.5, 574.0, 573.5, 573.0, 572.5

Penetration: VE E F H
Hand Penetrometer kPa: 100 200 300 400

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH
No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

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

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

SMEC AUSTRALIA

SMEC

GINT LIBRARY SMEC AGS 3_1_RTA FORMAT 1_1 REVISED.GLB Log SMEC EXCAVATION ISABELLA WEIR TEST PITS.GPJ <<DrawingFile>> 10/04/2015 18:31 8.2.900

1156

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP04

PROJECT : ISABELLA WEIR SPILLWAY UPGRADE	CLIENT : ACT GOVERNMENT
LOCATION : ISABELLA POND, CANBERRA	FEATURE : END OF LEFT RETURN WALL
FILE / JOB NO : 3002402	SHEET : 1 OF 1
POSITION : E: 688542.000, N: 6078057.000 (55H MGA94)	SURFACE ELEVATION : 577.000 (AHD)
EQUIPMENT TYPE : 210LC-7 EXCAVATOR	METHOD : 1.20m WIDE RIPPER BUCKET
DATE EXCAVATED : 18/3/15	LOGGED BY [redacted]
CHECKED BY :	
EXCAVATION DIMENSIONS : 4.70 m LONG 1.40 m WIDE	DIRECTION : 090°

DRILLING / MATERIAL

DEPTH (m)	ELEVATION (RL)	SAMPLES & FIELD TESTS	GROUND WATER LEVELS	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	MOISTURE CONDITION	STRUCTURE & Other Observations
0.0 – 0.20m	577.0			GM	TOPSOIL: Silty GRAVEL/gravelly SILT; grey brown, with grass roots	D	TOPSOIL
0.20m – 2.30m		1.50m B-CNTR; 2.00m	SEEPAGE OBSERVED FROM 3.2m DEPTH	SP	FILL: Silty gravelly SAND; brown grey, very dense decomposed granite fill, with some harder dacite gravels, cobbles to 200mm and tree roots to 1.5m	D / M	FILL
2.30m – 3.50m		2.30m B-CNTR; 2.60m		SP	FILL: Silty gravelly SAND; coarse grained, poorly graded, green grey, with some gravel and silt, 3.00 - LH EXCAVATED FACE: Gravelly CLAY; very stiff, brown yellow, with sand and gravel to 30mm, quartz fill from decomposed claystone and dacite	W	2.30: Collapsed silty SAND in excavation, 300mm thick concrete wall exposed behind collapsed face 2.80: Medium dense drainage material for wall piece perforated sub-soil drainage pipe in fill 3.20: Seepage from silty SAND
3.50m – 3.60m	573.5				DACITE; medium grained, pink grey, medium to high strength, HW to MW, fractured		BEDROCK
					EXCAVATION TP04 TERMINATED AT 3.60 m Target depth		

Depth scale (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
Elevation scale (RL): 577.0, 576.5, 576.0, 575.5, 575.0, 574.5, 574.0, 573.5, 573.0, 572.5, 572.0

Column headings: PENETRATION (VE E F H) | SUPPORT | GROUND WATER LEVELS | SAMPLES & FIELD TESTS | ELEVATION (RL) DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION | MOISTURE CONDITION | CONSISTENCY RELATIVE DENSITY | HAND PENETRO-METER kPa (100 200 300 400) | STRUCTURE & Other Observations

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
- 10 Oct., 73 Water Level on Date shown
- water inflow
- water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

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

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

SMEC AUSTRALIA

GINT LIBRARY SMEC AGS 3_1_RTA FORMAT 1_1 REVISED.GLB Log SMEC EXCAVATION ISABELLA WEIR TEST PITS.GPJ <<DrawingFile>> 10/04/2015 18:31 8.2.900

1157

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP05
FILE / JOB NO : 3002402
SHEET : 1 OF 1

PROJECT : ISABELLA WEIR SPILLWAY UPGRADE
LOCATION : ISABELLA POND, CANBERRA
CLIENT : ACT GOVERNMENT
FEATURE : LEFT EMBANKMENT CENTRE

POSITION : E: 688532.000, N: 6078062.000 (55H MGA94)
SURFACE ELEVATION : 577.450 (AHD)
EQUIPMENT TYPE : 210LC-7 EXCAVATOR
METHOD : 1.20m WIDE RIPPER BUCKET
DATE EXCAVATED : 17/3/15
LOGGED BY [redacted]
CHECKED BY :
EXCAVATION DIMENSIONS : 8.50 m LONG 1.40 m WIDE DIRECTION : 090°

DRILLING					MATERIAL						
PENETRATION (VE E F H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO-METER kPa (100 200 300 400)	STRUCTURE & Other Observations
				0.0			TOPSOIL	D			TOPSOIL
				0.30m			FILL: Gravelly silty CLAY; brown grey, comprising decomposed dacite	D			FILL
			1.50m B-U/S & D/S	576.0 / 1.50m			FILL (CORE MATERIAL): Silty CLAY; yellow with red mottling, with some EW gravel and sand	M to W			
		SEEPAGE OBSERVED FROM 4.0m DEPTH	2.50m	575.0 / 2.50m			Silty CLAY; becoming sandy, grey yellow to yellow	M to W			2.50: PP = 200 to 250kPa
			4.00m B-CNTR	573.5 / 4.0				W			4.00: Seepage
			4.50m	573.0 / 4.50m			EXCAVATION TP05 TERMINATED AT 4.50 m Target depth				

Elevation / depth scale: 577.0 0.5; 576.5 1.0; 576.0 1.5; 575.5 2.0; 575.0 2.5; 574.5 3.0; 574.0 3.5; 573.5 4.0; 573.0 4.5; 572.5 5.0

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH
No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

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

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

SMEC AUSTRALIA

SMEC

1158

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP06

PROJECT : ISABELLA WEIR SPILLWAY UPGRADE
LOCATION : ISABELLA POND, CANBERRA
CLIENT : ACT GOVERNMENT
FEATURE : RIGHT EMBANKMENT
FILE / JOB NO : 3002402
SHEET : 1 OF 1

POSITION : E: 688496.000, N: 6078109.000 (55H MGA94)
SURFACE ELEVATION : 577.300 (AHD)
EQUIPMENT TYPE : 210LC-7 EXCAVATOR
METHOD : 1.20m WIDE RIPPER BUCKET
DATE EXCAVATED : 18/3/15
LOGGED BY : [redacted]
CHECKED BY :
EXCAVATION DIMENSIONS : 10.50 m LONG 1.40 m WIDE DIRECTION : 090°

DRILLING				MATERIAL					
PENETRATION (VE E F H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG / CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
		NO FREE GW OBSERVED		0.0 – 0.20m		TOPSOIL: Silt, sand and gravel mix, grey	M to W		TOPSOIL
				0.20m		FILL CNTR & D/S: Silty gravelly CLAY and SAND placed in 150mm layers, layer discontinues at 1.0m depth			FILL
						0.20 - FILL U/S OF CLAY CORE: Gravelly CLAY; brown grey			
			1.00m B U 1.40m	1.00		1.00 - FILL (CORE MATERIAL) CNTR & D/S: Silty sandy CLAY; very stiff, low to medium plasticity, grey green and yellow, with some fine gravel, moist to wet, layer discontinues at 1.4m depth			1.40: PP = 300 - 400kPa (CNTR & D/S)
			1.60m						
				2.00		2.00 - FILL U/S OF CLAY CORE: Silty gravelly SAND; coarse grained, grey, with silt and 50-200mm cobbles (typical), trace boulder to 500mm			
				3.30m		EXCAVATION TP06 TERMINATED AT 3.30 m Target depth			

Elevation (RL) scale: 577.0, 576.5, 576.0, 575.5, 575.0, 574.5, 574.0, 573.5, 573.0, 572.5
Depth (m) scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
Hand Penetrometer kPa: 100, 200, 300, 400

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH
No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

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

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

SMEC AUSTRALIA

SMEC

1159

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP07

PROJECT : ISABELLA WEIR SPILLWAY UPGRADE
LOCATION : ISABELLA POND, CANBERRA
CLIENT : ACT GOVERNMENT
FEATURE : END OF RIGHT RETURN WALL
FILE / JOB NO : 3002402
SHEET : 1 OF 1

POSITION : E: 688489.000, N: 6078129.000 (55H MGA94) SURFACE ELEVATION : 577.100 (AHD)
EQUIPMENT TYPE : 210LC-7 EXCAVATOR METHOD : 1.20m WIDE RIPPER BUCKET
DATE EXCAVATED : 19/3/15 LOGGED BY : [redacted] CHECKED BY :
EXCAVATION DIMENSIONS : 6.20 m LONG 1.40 m WIDE DIRECTION : 090°

DRILLING | MATERIAL

PENETRATION (VE E F H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETROMETER kPa (100 200 300 400)	STRUCTURE & Other Observations
					0.0 – 0.20m			TOPSOIL: Sandy gravelly SILT; hard, brown grey, with grass and tree roots	D	H		TOPSOIL
		SEEPAGE INFLOW FROM 3.0m DEPTH		577.0 – 574.0	0.20m – 3.00m			FILL: Gravelly clayey SILT; brown grey, placed in layers with dacite gravel, cobbles and trace boulders	D			FILL
			3.00m B 3.50m	574.0 – 573.5	3.00m – 3.80m		SP	FILL (WORKING PLATFORM SAND?): Gravelly silty SAND; poorly graded, coarse grained	W			
			4.00m B 4.80m	573.5 – 572.5	3.80m – 4.80m			FILL (WORKING PLATFORM CLAY?): CLAY; stiff, medium to high plasticity, green yellow	W	St		3.80: CORE MATERIAL IN DIVERSION CHANNEL; 4.30: PP = 200kPa
					4.80m – 5.0			EXCAVATION TP07 TERMINATED AT 4.80 m Machine Limit				

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
Elevation scale: 577.0, 576.5, 576.0, 575.5, 575.0, 574.5, 574.0, 573.5, 573.0, 572.5

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH
No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

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

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

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP08

PROJECT : ISABELLA WEIR SPILLWAY UPGRADE
LOCATION : ISABELLA POND, CANBERRA

CLIENT : ACT GOVERNMENT
FEATURE : RIGHT HAND END OF CLAY CORE

FILE / JOB NO : 3002402
SHEET : 1 OF 1

POSITION : E: 688479.000, N: 607813.000 (55H MGA94)
SURFACE ELEVATION : 577.700 (AHD)

EQUIPMENT TYPE : 210LC-7 EXCAVATOR
METHOD : 1.20m WIDE RIPPER BUCKET

DATE EXCAVATED : 19/3/15
LOGGED BY : [redacted]
CHECKED BY :

EXCAVATION DIMENSIONS : 6.00 m LONG 1.40 m WIDE DIRECTION : 090°

DRILLING					MATERIAL						
PENETRATION (VE E F H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO-METER kPa (100 200 300 400)	STRUCTURE & Other Observations
		NO FREE GW OBSERVED		0.0			TOPSOIL: Sandy gravelly SILT; grey brown	D			TOPSOIL
				0.20m			FILL: Sandy silty CLAY; hard, brown grey, with gravel, LHS discontinues at 1.3m depth and RHS discontinues at 1.4m depth	D to M	H		FILL
			1.80m B 2.00m	1.30m			FILL (CORE MATERIAL) LHS: Silty CLAY; stiff to very stiff, light green yellow, with some sand and fine gravel 1.40 - DACITE (RHS); fine grained, brown and white speckled, EW, EL strength (decomposed dacite)	M	St to VSt		BEDROCK
				2.00m			EXCAVATION TP08 TERMINATED AT 2.00 m Target depth				

Depth scale (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
Elevation scale (RL): 577.5, 577.0, 576.5, 576.0, 575.5, 575.0, 574.5, 574.0, 573.5, 573.0

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH
No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

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

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

SMEC AUSTRALIA

SMEC

1161

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP09

PROJECT : ISABELLA WEIR SPILLWAY UPGRADE
LOCATION : ISABELLA POND, CANBERRA
CLIENT : ACT GOVERNMENT
FEATURE : U/S OF EMBANKMENT RHS
FILE / JOB NO : 3002402
SHEET : 1 OF 1

POSITION : E: 688489.000, N: 6078131.000 (55H MGA94)
SURFACE ELEVATION : 577.010 (AHD)
EQUIPMENT TYPE : 210LC-7 EXCAVATOR
METHOD : 1.20m WIDE RIPPER BUCKET
DATE EXCAVATED : 19/3/15
LOGGED BY : [redacted]
CHECKED BY :
EXCAVATION DIMENSIONS : 5.50 m LONG 1.40 m WIDE DIRECTION : 090°

DRILLING | MATERIAL

Depth (m)	Elevation (RL)	Samples & Field Tests	Ground Water Levels	Classification Symbol	Material Description (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	Moisture Condition	Consistency / Relative Density	Structure & Other Observations
0.0 – 0.20m	577.0				TOPSOIL: Sandy GRAVEL and SAND; very dense, brown grey, with tree roots	D	VD	TOPSOIL
0.20m – 2.90m	576.5 – 574.5	1.80m – 2.00m: B	SEEPAGE INFLOW FROM 3.0m DEPTH		GENERAL FILL: Gravelly sandy CLAY; hard, light brown grey, with cobbles and boulders	D (to 2.0), M	H	FILL
2.90m – 3.00m				SP	FILL (WORKING PLATFORM): Silty gravelly SAND; dense, poorly graded, coarse grained,	M	D	
3.00m – 3.90m	574.0 – 573.5				3.00 - DACITE level D/S	W	D	BEDROCK 3.00: Seepage
3.90m – 4.00m					DACITE; purple grey with white specks, medium to high strength, HW	W		
4.00m	573.0				4.00 - DACITE level U/S EXCAVATION TP09 TERMINATED AT 4.00 m Target depth			

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
Elevation scale: 577.0, 576.5, 576.0, 575.5, 575.0, 574.5, 574.0, 573.5, 573.0, 572.5

Column headings: PENETRATION (VE E F H) | SUPPORT | GROUND WATER LEVELS | SAMPLES & FIELD TESTS | ELEVATION (RL) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION | MOISTURE CONDITION | CONSISTENCY RELATIVE DENSITY | HAND PENETRO-METER kPa (100 200 300 400) | STRUCTURE & Other Observations

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH
No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

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

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

SMEC AUSTRALIA

1162

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP10

PROJECT : ISABELLA WEIR SPILLWAY UPGRADE	CLIENT : ACT GOVERNMENT	FILE / JOB NO : 3002402
LOCATION : ISABELLA POND, CANBERRA	FEATURE : U/S OF RIGHT EMBANKMENT ABUTMENT	SHEET : 1 OF 1

POSITION : E: 688477.000, N: 6078140.000 (55H MGA94)	SURFACE ELEVATION : 577.700 (AHD)
EQUIPMENT TYPE : 210LC-7 EXCAVATOR	METHOD : 1.20m WIDE RIPPER BUCKET
DATE EXCAVATED : 19/3/15	LOGGED BY : [redacted] CHECKED BY :
EXCAVATION DIMENSIONS : 1.40 m WIDE DIRECTION : 090°	

DRILLING | MATERIAL

PENETRATION (VE E F H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO-METER kPa (100 200 300 400)	STRUCTURE & Other Observations
		NO FREE GW OBSERVED			0.0			TOPSOIL: hard, light brown grey, with grass and tree roots	D			TOPSOIL
				577.5	0.20m			Sandy gravelly SILT; grey brown, residual dacite				RESIDUAL SOIL
					0.40m			DACITE; fine grained, brown and white specks, EW, EL-VL strength with some medium strength pieces				BEDROCK
				577.0	0.5							
					1.0							1.00: DEFECTS (35/085), SM, PL, 1.0m length (36/085), SM, PL, 0.6m length (85/150), SM, UN, 1.4m length D/S
				576.5	1.10m			becoming HW, VL strength, with some high strength zones				1.25: DEFECT (30/088), SM, PL, 0.8m length
					1.40m			EXCAVATION TP10 TERMINATED AT 1.40 m Target depth				
				576.0	1.5							
				575.5	2.0							
				575.0	2.5							
				574.5	3.0							
				574.0	3.5							
				573.5	4.0							
				573.0	4.5							
					5.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH
No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

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

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

SMEC AUSTRALIA

SMEC

COMPUTATION SHEET

1163

Project: Isabella Weir Upgrade

Page No.: 01

Project No.:

Date: 09/04/15

Feature/Structure: TP01

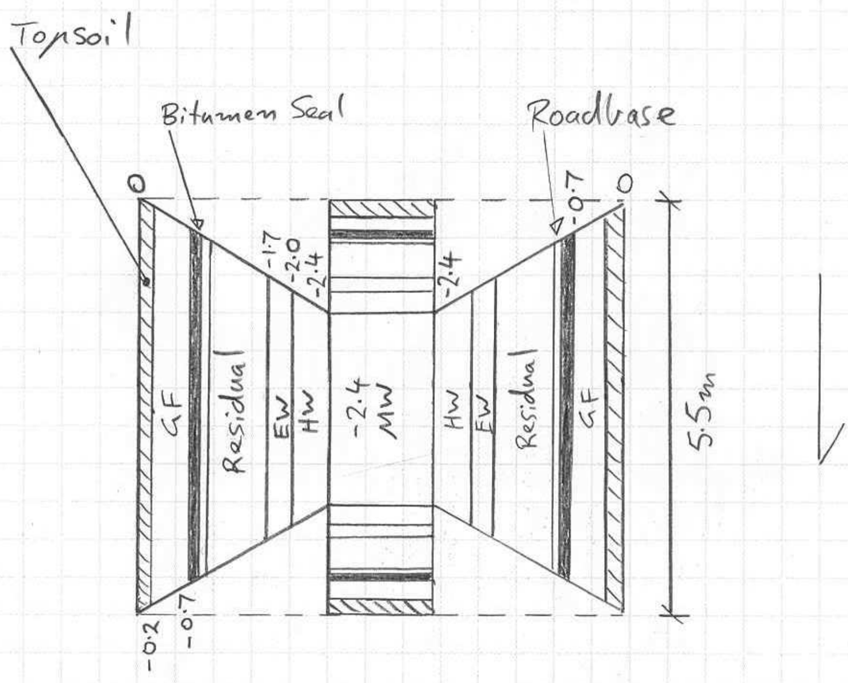
Calcs By: [redacted] Schedule 2.2 (a)(ii)

Details: Plan View

Checked By:

Samples

D/S



U/S

Key

GF - General Fill

EW - Extremely Weathered

HW - Highly Weathered

MW - Moderately Weathered.

Scale 1:100

TP01

UTM 55H

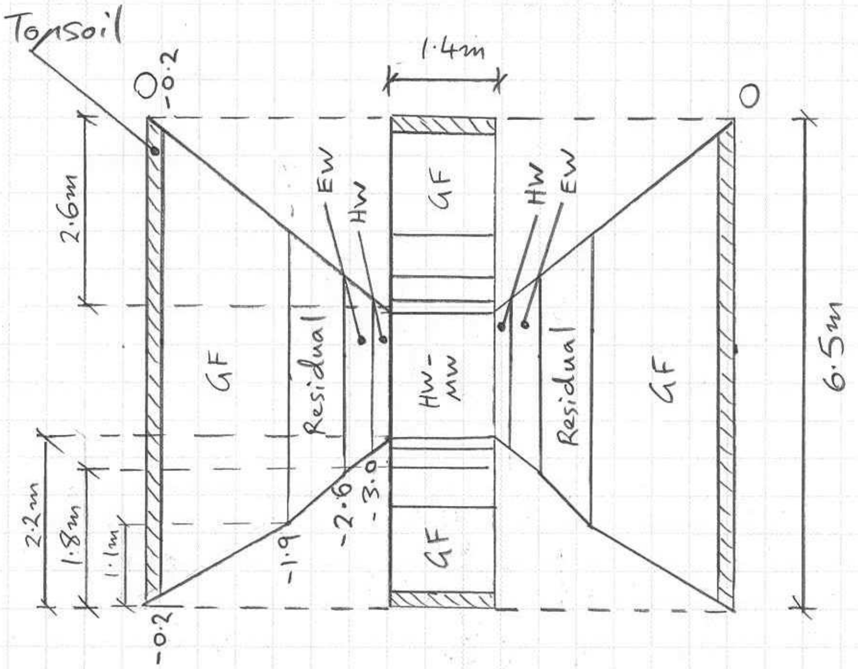
0688593, 6077977

1164

SMEC — COMPUTATION SHEET

Project: Isabella Weir Upgrade
Page No.: 02
Project No.:
Date: 09/04/15
Feature/Structure: TP02
Calcs By: [redacted] Schedule 2.2 (a)(ii)
Details: Plan View
Checked By:

Samples



Scale 1:100

TP02

UTM 55H

0688560, 6078033

Key

GF - General Fill

EW - Extremely weathered

HW - Highly weathered

MW - Moderately weathered

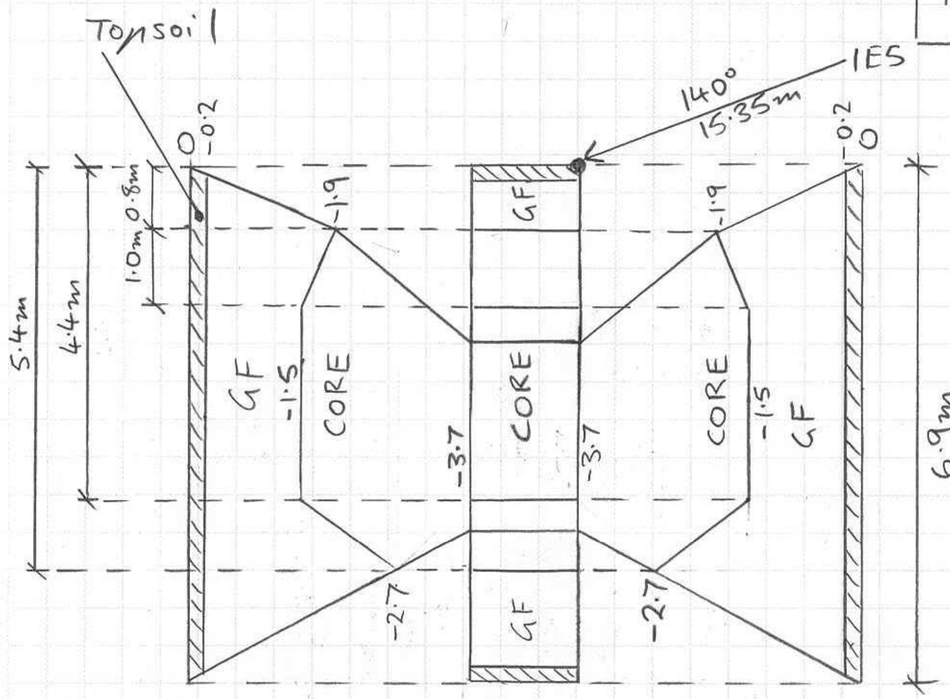
1165

SMEC **COMPUTATION SHEET**

Project: Isabella Weir Upgrade
Page No.: 03
Project No.:
Date: 09/04/15
Feature/Structure: TP03
Calcs By: [redacted] Schedule 2.2 (a)(ii)
Details: Plan View
Checked By:

Samples
TP03/0.0-0.5/B
TP03/1.6-1.9/B

D/S



U/S

Scale 1:100
TP03
UTM 55H
0688552, 6078034

Key
GF - General Fill

SMEC COMPUTATION SHEET

1166

Project: Isabella Weir Upgrade

Page No.: 04

Project No.:

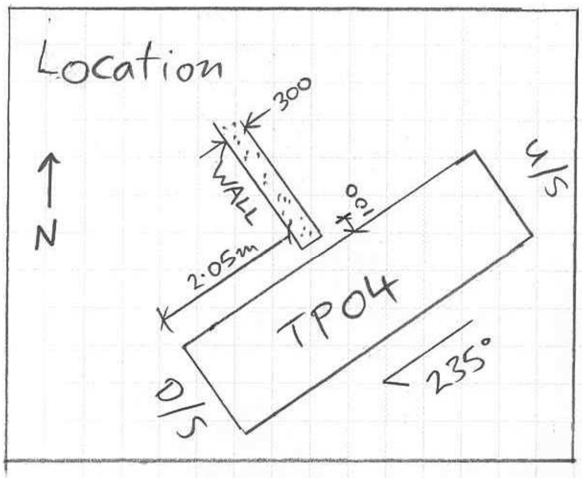
Date: 09/04/15

Feature/Structure: TP04

Calcs By: [redacted] Schedule 2.2 (a)(ii)

Details: Plan View

Checked By:

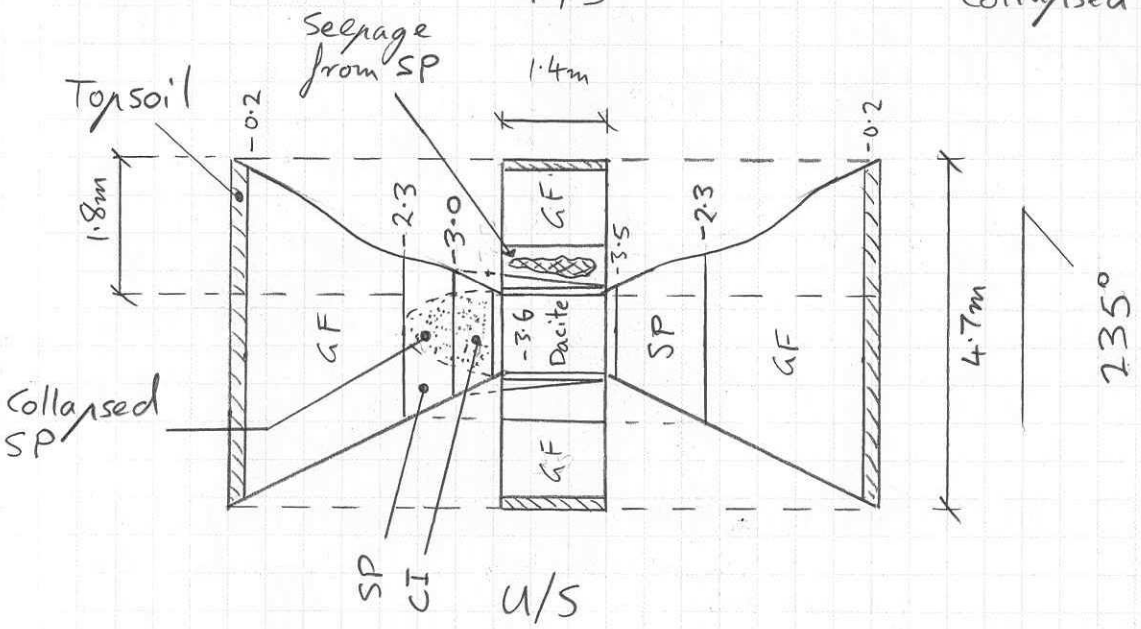


Samples

TP04/1.5-2.0/B

TP04/2.3-2.6/B

Note: Concrete wall exposed behind collapsed face



Key

GF - General Fill

SP - Poorly Graded SAND

CI - Medium plasticity CLAY

Scale 1:100

TP04

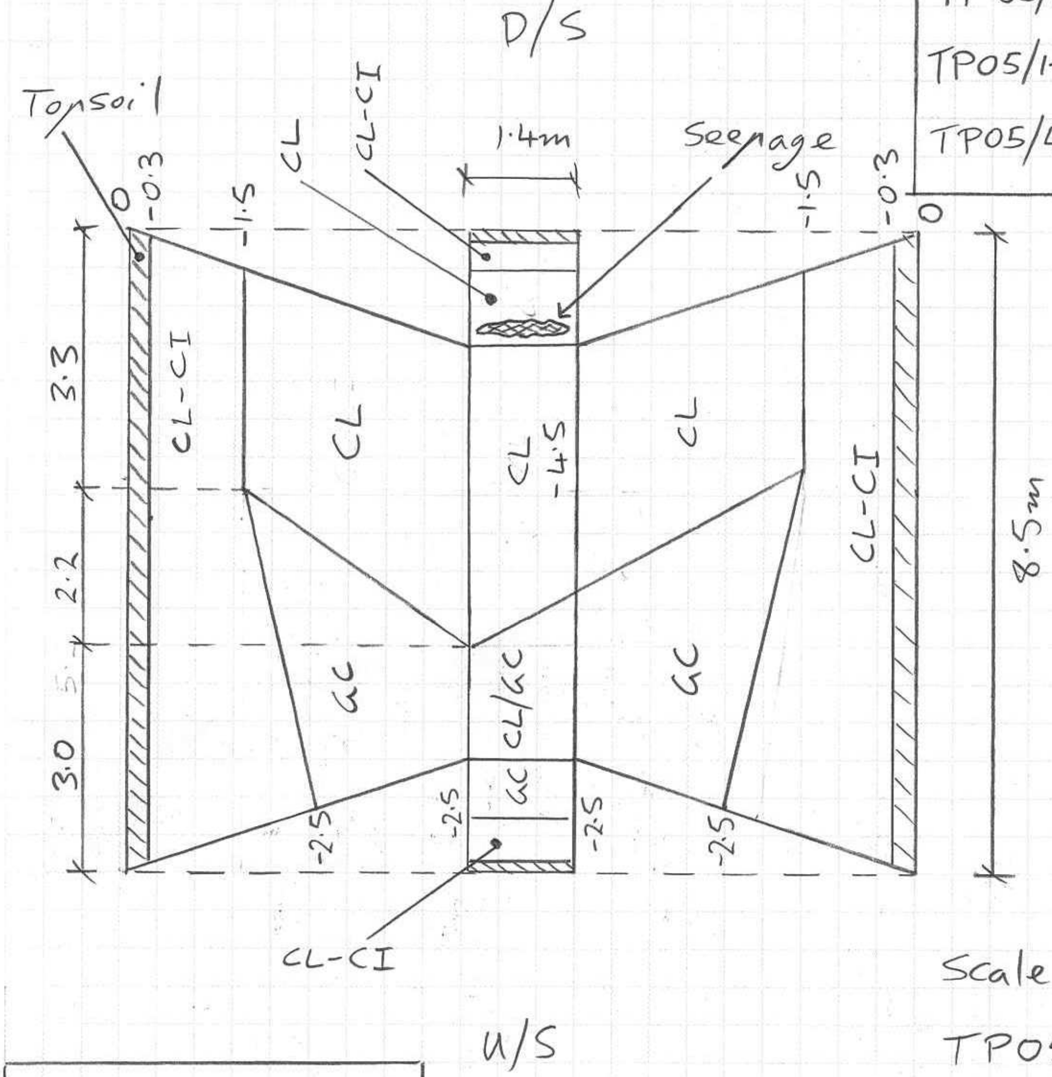
UTM 55H

0688542, 6078057

1167

Project: Isabella Weir Upgrade
Page No.: 05
Project No.:
Date: 09/04/15
Feature/Structure: TP05
Calcs By: [redacted] Schedule 2.2 (a)(ii)
Details: Plan View
Checked By:

Samples
TP05/1.5-2.0 U/S/B
TP05/1.5-2.0 D/S/B
TP05/4.0-4.5/B



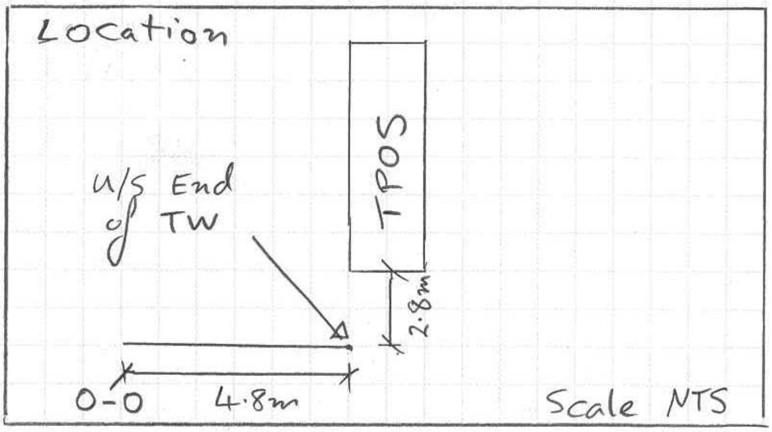
Scale 1:100

TP05

UTM 55H

0688532, 6078062

Key
GC - Gravelly CLAY
CL - Low plasticity CLAY
CI - Medium plasticity CLAY

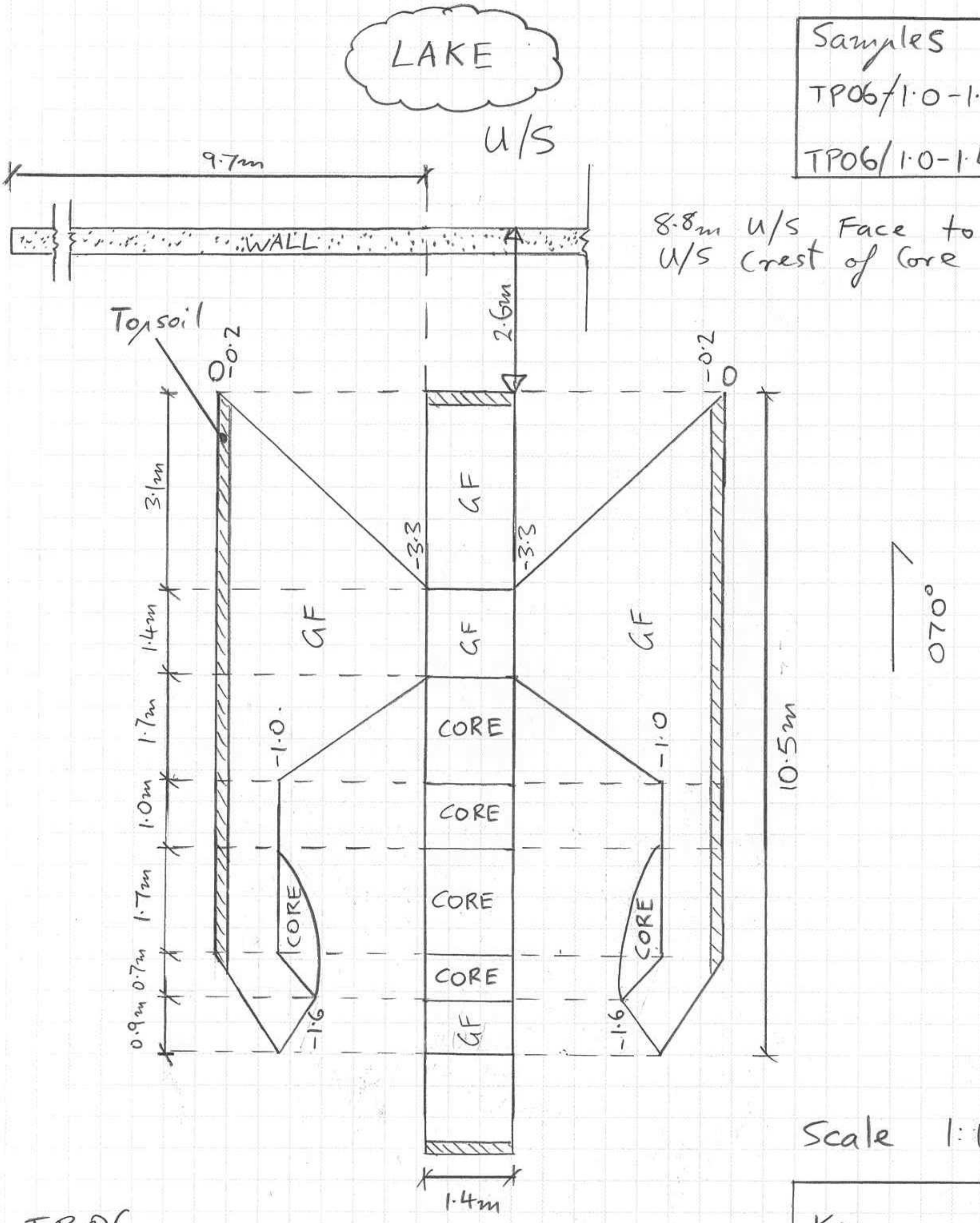


SMEC COMPUTATION SHEET

1168

Project: Isabella Weir Upgrade
Page No. 06
Project No.
Date 09/04/15
Feature/Structure: TP06
Calcs By [redacted] Schedule 2.2 (a)(ii)
Details: Plan View
Checked By

Samples
TP06/1.0-1.6/B
TP06/1.0-1.4/U



Scale 1:100

TP06
UTM 55H
0688496, 6078109

Key
GF - General Fill

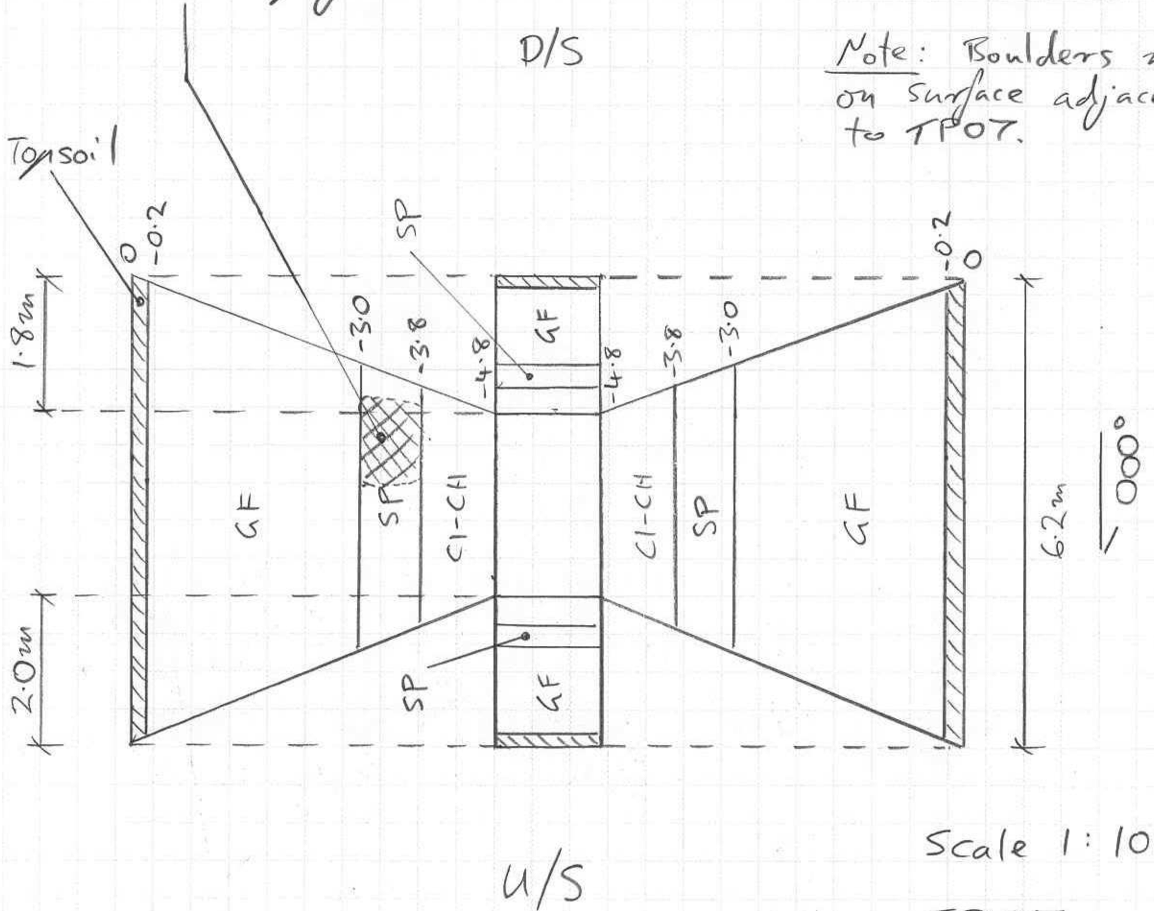
SMEC COMPUTATION SHEET

1169

Project: Isabella Weir Upgrade
Page No.: 07
Project No.:
Date: 09/04/15
Feature/Structure: TP07
Calcs By: [redacted] Schedule 2.2 (a)(ii)
Details: Plan View
Checked By:

Samples
TP07/3.0-3.5/B
TP07/4.0-4.8/B

Note: Boulders noted on surface adjacent to TP07.



Scale 1:100

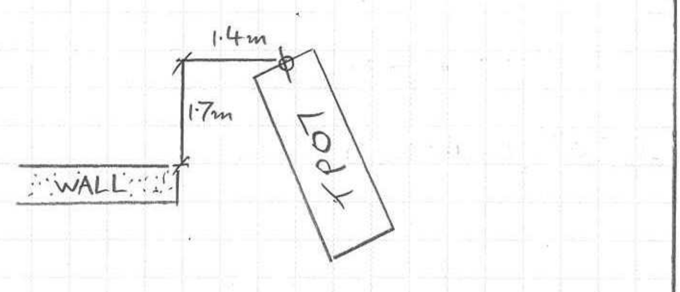
TP07

UTM 55H

0688489, 6078129

Key
GF - General Fill
SP - Poorly Graded SAND
CI-CH ~ Med. to High plasticity CLAY

Location



Scale NTS

SMEC **COMPUTATION SHEET**

1170

Project: Isabella Weir Upgrade
Page No.: 08

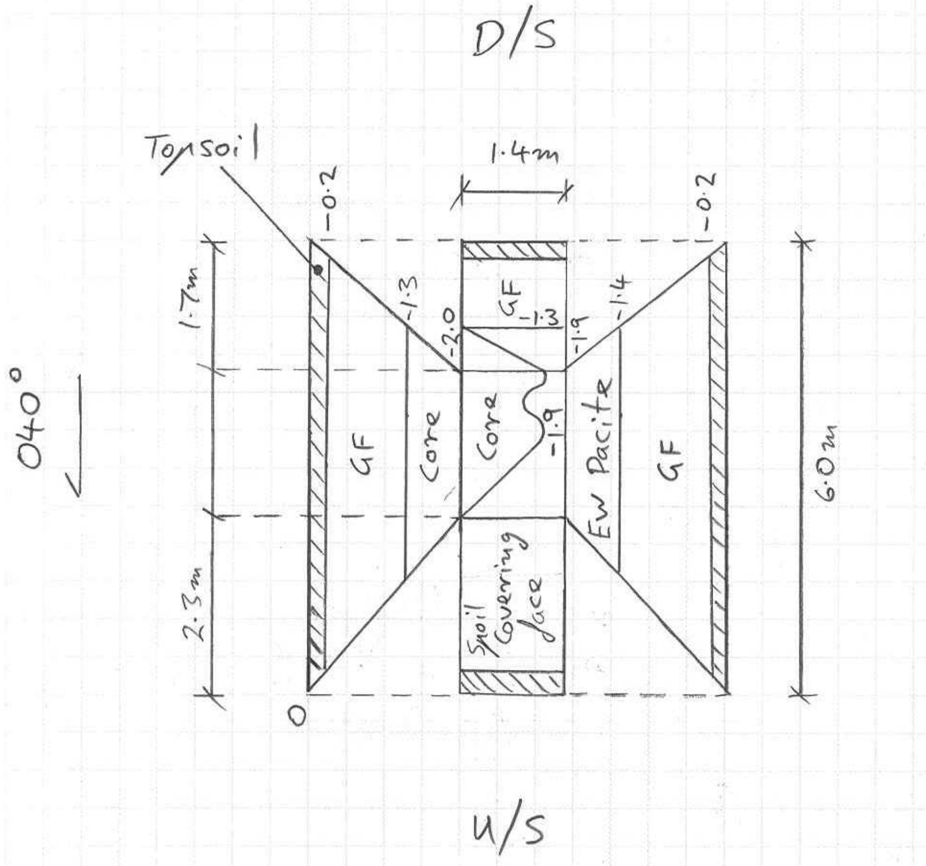
Project No.:
Date: 09/04/15

Feature/Structure: TP08
Calcs By: Schedule 2.2 (a)(ii) [redacted]

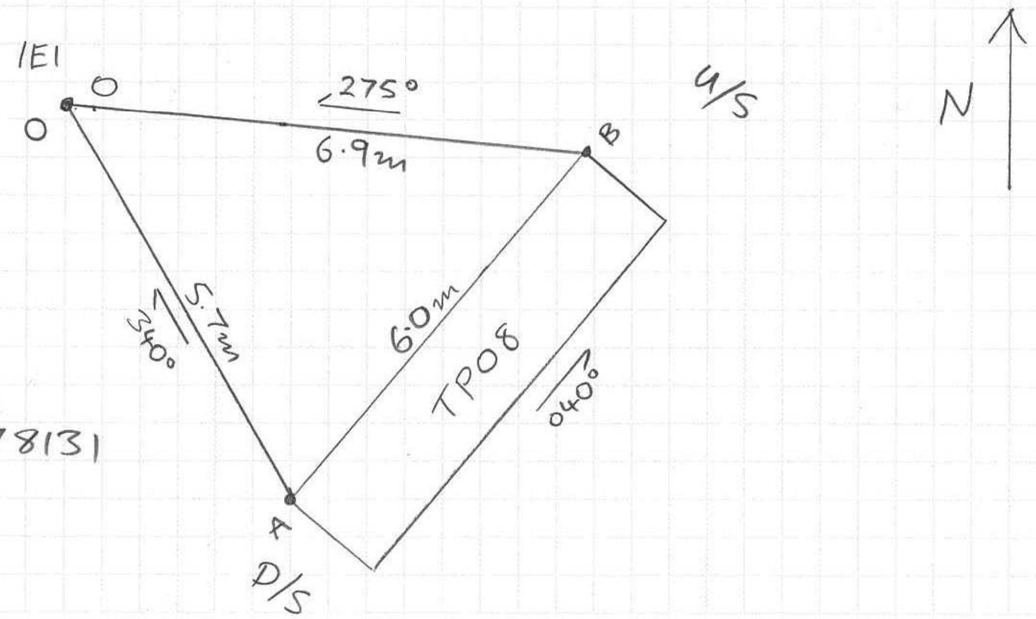
Details: Plan View
Checked By:

Samples
TP08/1.8-2.0/B

Key
GF - General Fill
EW - Extremely weathered



Scale 1:100

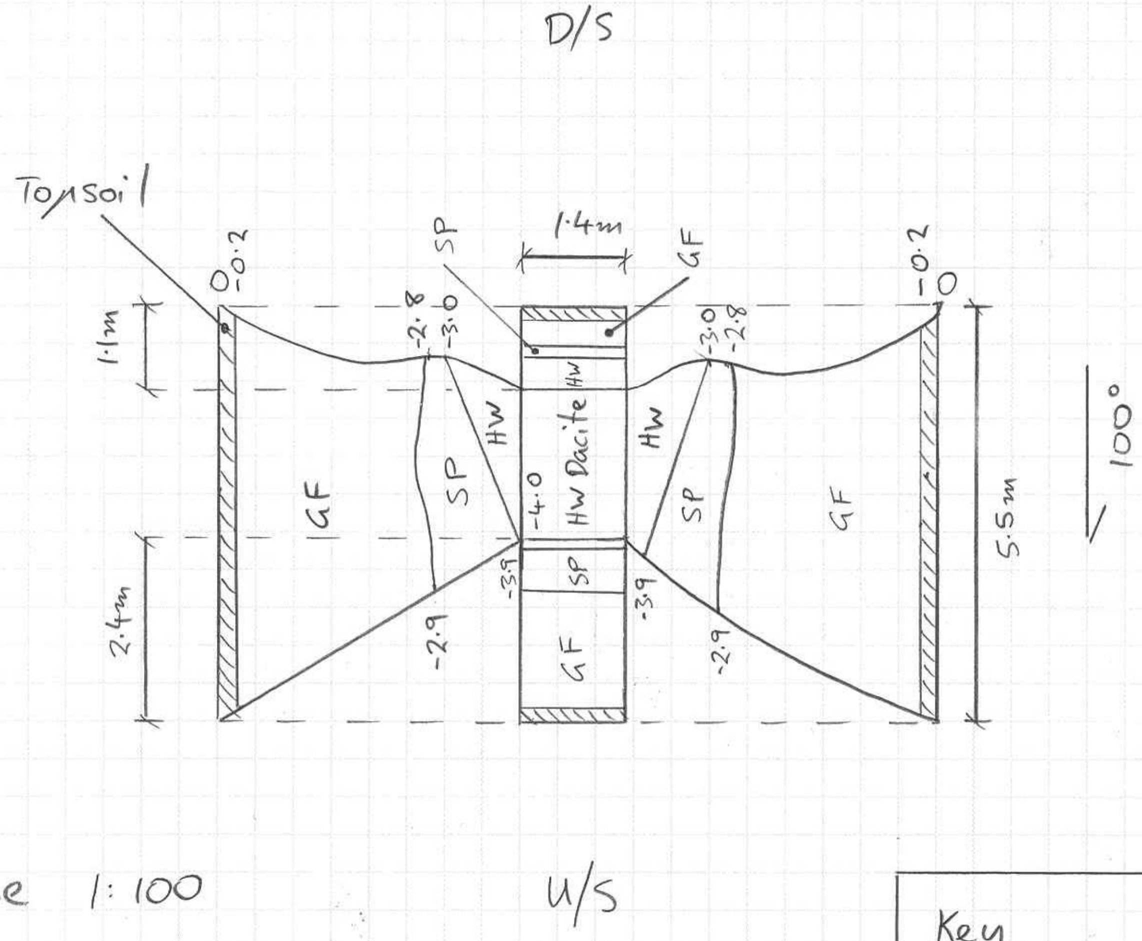


TP08
UTM 55H
0688479, 6078131

1171

Project: Isabella Weir Upgrade
Page No.: 09
Project No.:
Date: 09/04/15
Feature/Structure: TP09
Calcs By: [redacted]
Details: Plan View
Checked By:

Samples
TP09/1·8-2·0/B



Scale 1:100

U/S

TP09
UTM 55 H
0688489, 6078131

Key
GF - General Fill
SP - Poorly Graded Sand
HW - Highly Weathered

SMEC COMPUTATION SHEET

1172

Project: Isabella Weir Upgrade

Page No.: 10

Project No.:

Date: 09/04/15

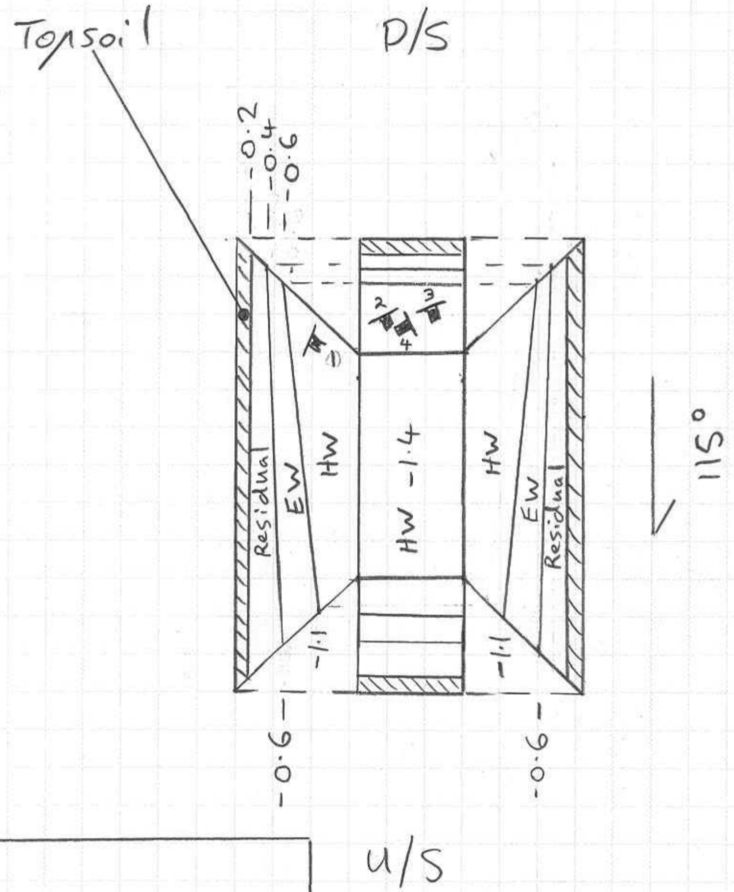
Feature/Structure: TP10

Calcs By: [redacted] Schedule 2.2 (a)(ii)

Details: Plan View

Checked By:

Samples



Defects

1 (30/088) SM PL 0.8m length

2 (35/085) SM PL 1.0m length

3 (36/085) SM PL 0.6m length

4 (85/150) SM UN 1.4m length

Key

EW - Extremely Weathered

HW - Highly Weathered

Scale 1:100

TP10

UTM 55H

0688477, 6078140

Test Pit T01


Test Pit T01 – Pit side wall and U/S end


Test Pit T01 – Pit side wall and D/S end

Test Pit T01 – Excavated spoil and general view


Test Pit T01 – Side wall and U/S end

Test Pit T02

 Test Pit T02 – D/S end and left side wall of pit	 Test Pit T02 –D/S end and right side wall of pit
 Test Pit T02 – D/S end of Pit	 Test Pit T02 –U/S end of pit

Test Pit T03

 Test Pit T03 – D/S end and left side wall of pit	 Test Pit T03 –D/S end and right side wall of pit
 Test Pit T03 – D/S end of Pit	 Test Pit T03 –U/S end of pit

Test Pit T04

 Test Pit T04 – Base of pit looking D/S	 Test Pit T04 –D/S end and right side wall of pit
 Test Pit T04 – Right side wall of pit	 Test Pit T04 –U/S end of pit

Test Pit T05

Test Pit T05 – U/S end and left side wall of pit

Test Pit T05 – D/S end and left side wall of pit

Test Pit T05 – Excavated spoil

Test Pit T05 – Zone 1 Silty CLAY core material spoil

Test Pit T06

 Test Pit T06 – D/S end of pit	 Test Pit T06 – D/S end and right side wall of pit
 Test Pit T06 – U/S end of Pit and crest of Zone 1	 Test Pit T06 – D/S end and right side wall of pit

Test Pit T07


Test Pit T07 – Base of pit and D/S end of pit


Test Pit T07 – D/S end and right side wall of pit


Test Pit T07 – D/S end of pit and excavated spoil

Test Pit T07 – Pit location relative at end of concrete wall

Test Pit T08

<table>
<tr><td>
Test Pit T08 –U/S end and right side wall of pit</td><td>
Test Pit T08 – U/S end and left side wall of pit</td></tr>
<tr><td>
Test Pit T08 – U/S end and base of pit</td><td>
Test Pit T08 – Base of pit looking U/S</td></tr>
</table>

Test Pit T09

 Test Pit T09 –U/S end and right side wall of pit	 Test Pit T09 – U/S end and left side wall of pit
 Test Pit T09 – D/S end and base of pit	

Test Pit T10


Test Pit T10 –R/H end and D/S side wall of pit (1)


Test Pit T10 – R/H end and D/S side wall of pit (2)


Test Pit T10 – U/S Side wall close up of rock depth


Test Pit T10 – U/S Side wall close up of rock depth

APPENDIX 4.01: SMEC LABORATORY TESTING CERTIFICATES, 2015

SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

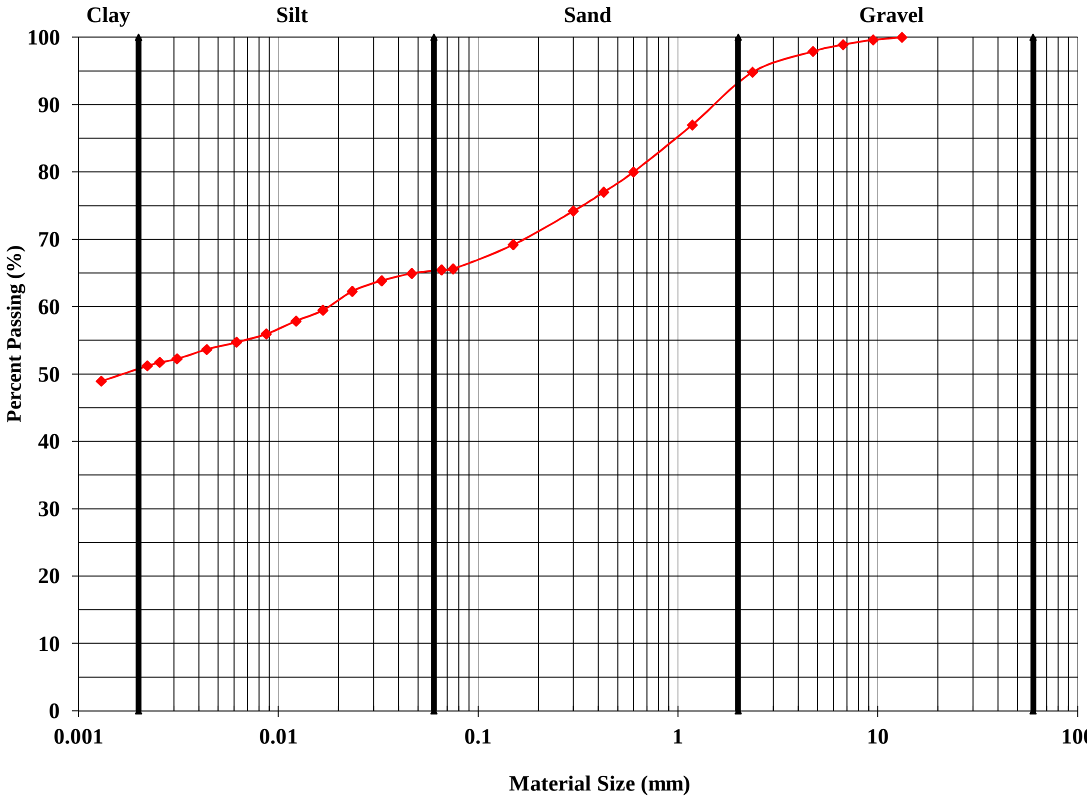
Particle Size Distribution

Pr□□□□□: ISABELLA WEIR UPGRADE
C□□□□□: SMEC A□□□r□□□
Address: Level 5, 20 Berry Street, North Sydney 2060
Test Method: AS1289.3.6.3

STS / S□□ □□□ N□□: 5442C/2
Sample Location: TP03
Depth (m): 1.6 - 1.9
Method of Despersion: Mechanical Stirrer

Project No.: 16309
Report No.: 15/0835
Report Date: 13/04/2015
Page: 1 OF 15
Client Project No: 3002402

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)
Material Description: Silty Sandy Clay, yellow brown, trace of gravel



Sieve Size (mm)	Percent Passing (□)
13.2	100
9.5	99.6
6.7	98.9
4.75	97.9
2.36	94.8
1.18	87.0
0.60	80.0
0.425	77.0
0.30	74.2
0.15	69.2
0.075	65.6
□Particle Size (mm)	Percent Passing (□)
0.0657	65.5
0.0465	64.9
0.0330	63.9
0.0234	62.3
0.0167	59.5
0.0123	57.9
0.0087	55.9
0.0062	54.7
0.0044	53.7
0.0031	52.2
0.0025	51.7
0.0022	51.2
0.0013	48.9

□Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks: C□□□ C□r□

Schedule 2.2 (a)(ii)
Approved Signatory....[redacted]

Technician: [redacted]

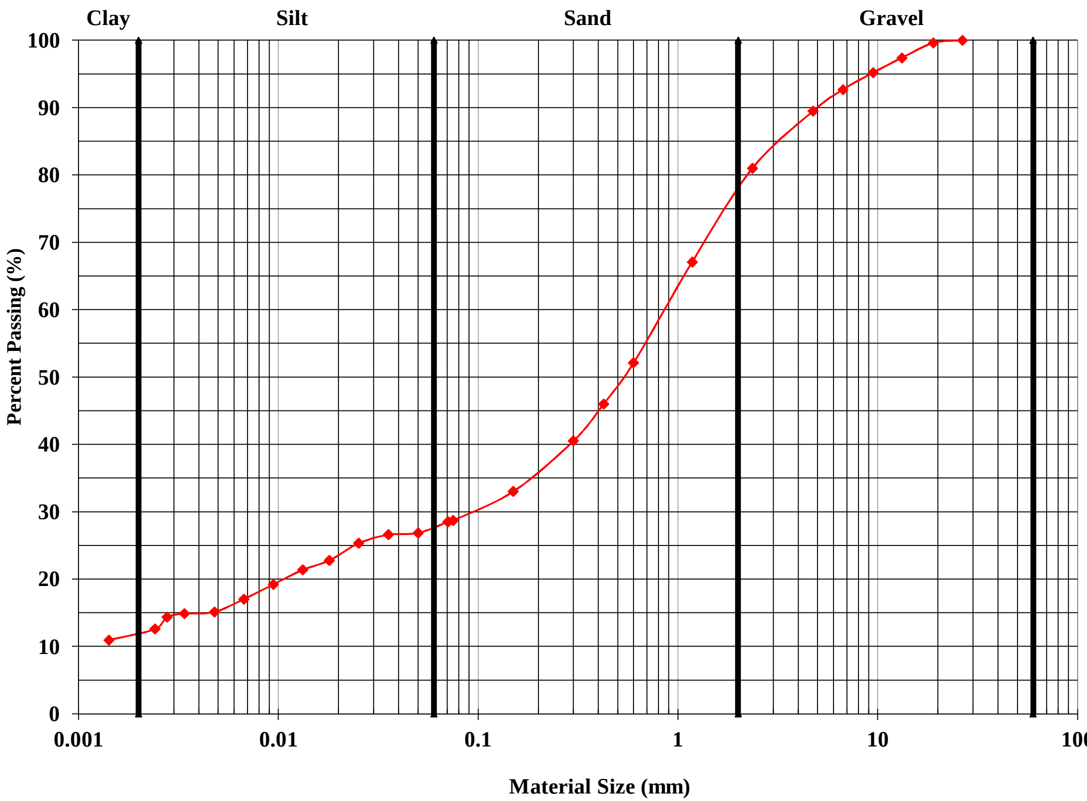
Schedule 2.2 (a)(ii) - Laboratory Manager

1185

SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Particle Size Distribution

Pr□□□□: ISABELLA WEIR UPGRADE | **STS / S□□ □□ N□: 5442C/3** | Project No.: 16309
C□□□□: SMEC A□□r□□□ | Sample Location: TP04 | Report No.: 15/0835
Address: Level 5, 20 Berry Street, North Sydney 2060 | Depth (m): 2.3 - 2.6 | Report Date: 13/04/2015
Test Method: AS1289.3.6.3 | Method of Despersion: Mechanical Stirrer | Page: 2 OF 15
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation) | Client Project No: 3002402
Material Description: Silty Gravelly Sand, grey brown, trace of clay



Sieve Size (mm)	Percent Passing (□)
13.2	97.4
9.5	95.2
6.7	92.7
4.75	89.5
2.36	81.0
1.18	67.1
0.60	52.1
0.425	46.0
0.30	40.5
0.15	33.0
0.075	28.7
□Particle Size (mm)	Percent Passing (□)
0.0706	28.5
0.0502	26.8
0.0355	26.6
0.0253	25.3
0.0180	22.8
0.0132	21.4
0.0094	19.2
0.0067	17.0
0.0048	15.1
0.0034	14.9
0.0028	14.4
0.0024	12.6
0.0014	10.9

□Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks: **S□□d F□□**

Schedule 2.2 (a)(ii) [redacted]
Approved Signatory.....

Technician: [redacted]

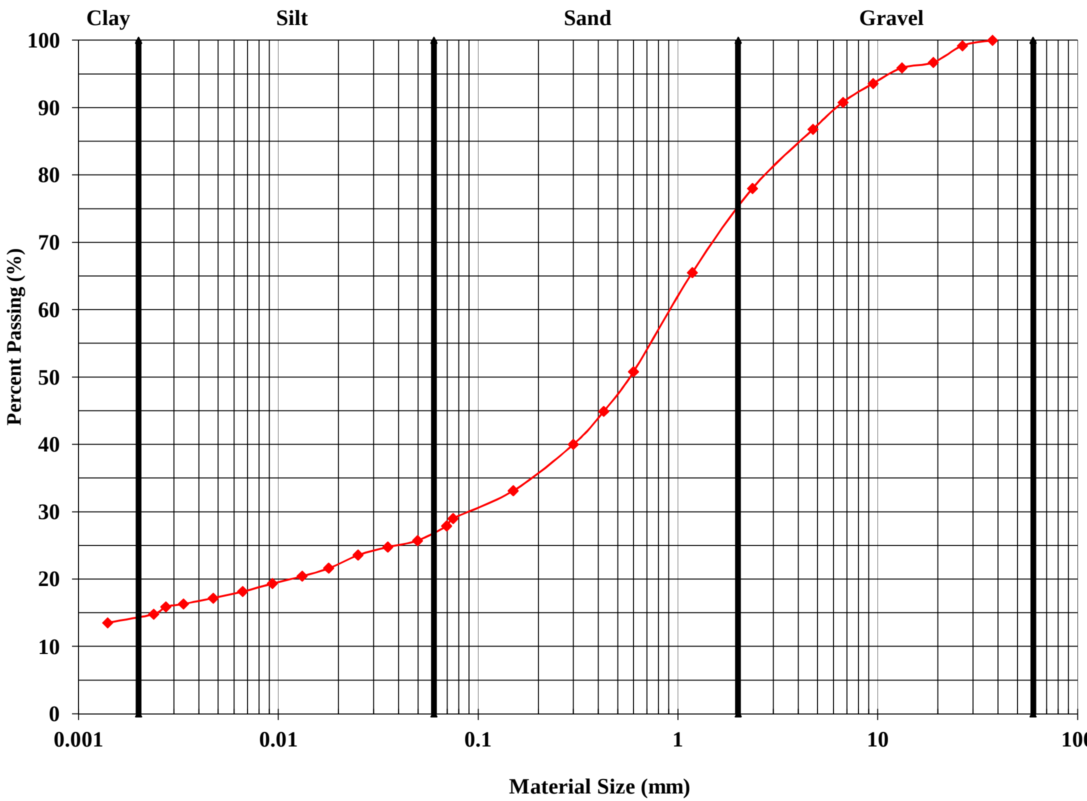
Schedule 2.2 (a)(ii) - Laboratory Manager

SMEC T□□□□□ S□r□□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

NATA Accredited Laboratory Number: 2750
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025.
This Document may not be reproduced except in full.

Particle Size Distribution

Pr□□□□□: ISABELLA WEIR UPGRADE | **STS / S□□ □□ N□: 5442C/4** | Project No.: 16309
C□□□□: SMEC A□□r□□□ | Sample Location: TP05 | Report No.: 15/0835
Address: Level 5, 20 Berry Street, North Sydney 2060 | Depth (m): 1.5 - 2.5 | Report Date: 13/04/2015
Test Method: AS1289.3.6.3 | Method of Despersion: Mechanical Stirrer | Page: 3 OF 15
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation) | Client Project No: 3002402
Material Description: Gravelly Sand, brown, trace of silt/clay



Sieve Size (mm)	Percent Passing (□)
37.5	100.0
26.5	99.2
19.0	96.7
13.2	95.9
9.5	93.6
6.7	90.8
4.75	86.8
2.36	78.0
1.18	65.5
0.60	50.8
0.425	44.9
0.30	40.0
0.15	33.1
0.075	29.0
□Particle Size (mm)	Percent Passing (□)
0.0696	27.9
0.0497	25.7
0.0353	24.7
0.0251	23.6
0.0179	21.6
0.0131	20.4
0.0093	19.3
0.0066	18.1
0.0047	17.2
0.0033	16.3
0.0027	15.9
0.0024	14.8
0.0014	13.5

□Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks: **US G□□□r□□F□□**

Approved Signatory....... [redacted] Schedule 2.2 (a)(ii)

Technician: [redacted]

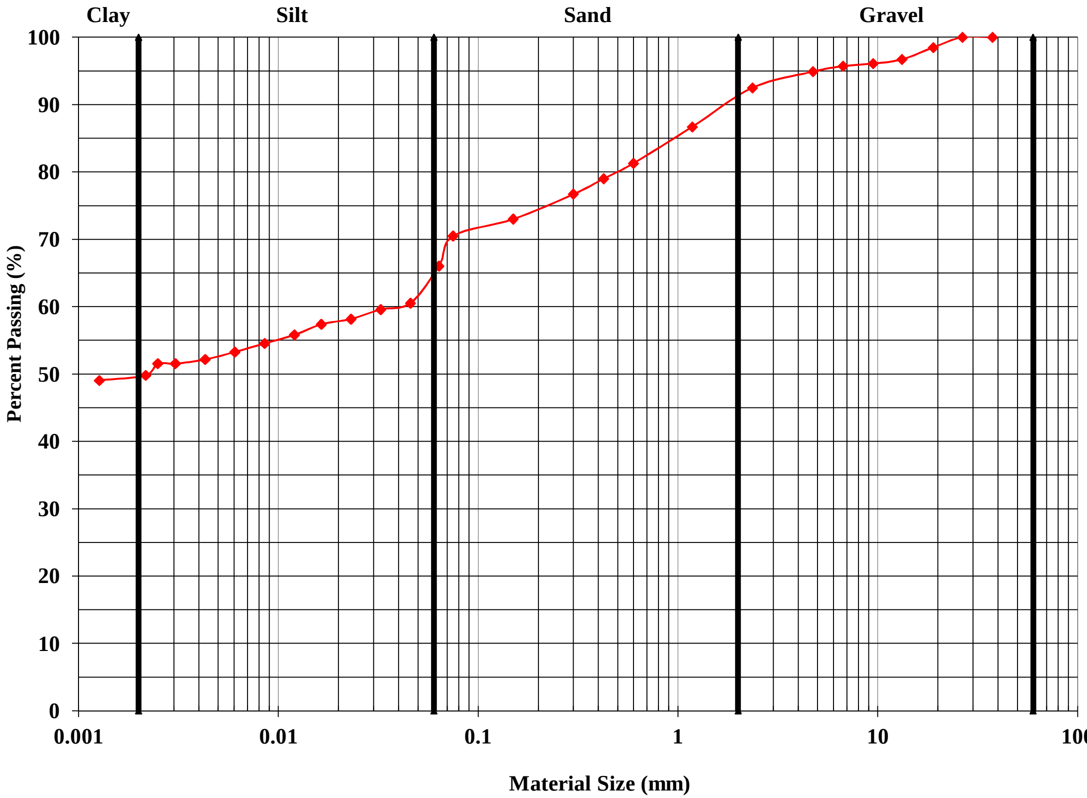
[redacted] Schedule 2.2 (a)(ii) Laboratory Manager

SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Particle Size Distribution

Pr□□□□: ISABELLA WEIR UPGRADE	**STS / S□□ □□ N□: 5442C/5**	Project No.: 16309
C□□□□: SMEC A□□r□□□	Sample Location: TP05	Report No.: 15/0835
Address: Level 5, 20 Berry Street, North Sydney 2060	Depth (m): 1.5 - 2.5	Report Date: 13/04/2015
Test Method: AS1289.3.6.3	Method of Despersion: Mechanical Stirrer	Page: 4 OF 15
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)		Client Project No: 3002402

Material Description: Silty Sandy Clay, brown, yellow brown, trace of gravel



Sieve Size (mm)	Percent Passing (□)
37.5	100
26.5	100
19.0	98.5
13.2	96.7
9.5	96.1
6.7	95.7
4.75	94.9
2.36	92.5
1.18	86.7
0.60	81.3
0.425	79.0
0.30	76.7
0.15	73.0
0.075	70.5
□Particle Size (mm)	Percent Passing (□)
0.0637	66.0
0.0459	60.5
0.0325	59.6
0.0231	58.2
0.0164	57.4
0.0120	55.8
0.0085	54.5
0.0061	53.3
0.0043	52.2
0.0031	51.5
0.0025	51.5
0.0022	49.8
0.0013	49.0

□Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks: **DS C□□□ C□r□**

Schedule 2.2 (a)(ii) [redacted]

Approved Signatory.....

Technician: [redacted] Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

1188

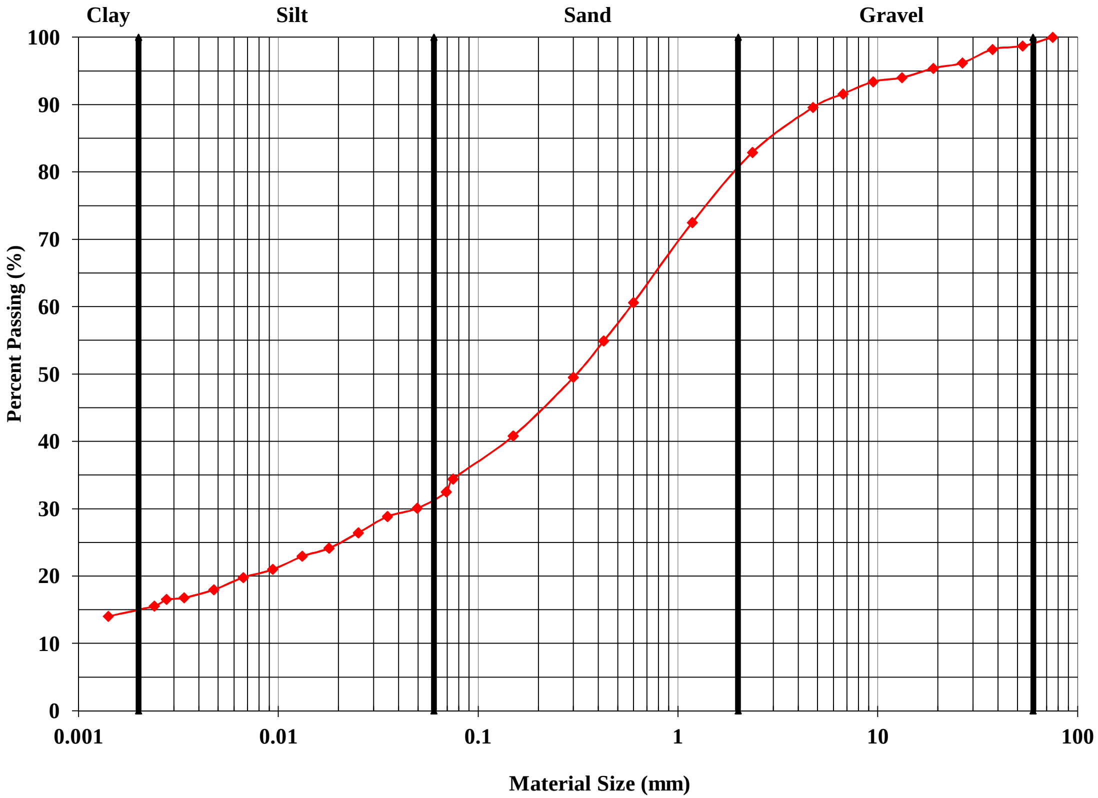
SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Particle Size Distribution

Pr□□□□□: ISABELLA WEIR UPGRADE
C□□□□□: SMEC A□□□r□□□□
Address: Level 5, 20 Berry Street, North Sydney 2060
Test Method: AS1289.3.6.3
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)
Material Description: Silty Gravelly Sand, brown, trace of clay

STS / S□□ □□□ N□□: 5442C/5
Sample Location: TP06
Depth (m): 0.5 - 1.0
Method of Despersion: Mechanical Stirrer

Project No.: 16309
Report No.: 15/0835
Report Date: 13/04/2015
Page: 5 OF 15
Client Project No: 3002402



Sieve Size (mm)	Percent Passing (□)
75.0	100.0
53.0	98.7
37.5	98.2
26.5	96.2
19.0	95.4
13.2	94.0
9.5	93.4
6.7	91.6
4.75	89.6
2.36	82.9
1.18	72.5
0.60	60.6
0.425	54.9
0.30	49.5
0.15	40.8
0.075	34.4
□Particle Size (mm)	Percent Passing (□)
0.0694	32.5
0.0496	30.1
0.0352	28.8
0.0252	26.4
0.0180	24.1
0.0132	22.9
0.0094	21.0
0.0067	19.8
0.0047	18.0
0.0034	16.8
0.0028	16.5
0.0024	15.5
0.0014	14.0

□Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks: G□□□r□□F□□□

Approved Signatory...... Schedule 2.2 (a)(ii) [redacted]

Technician: [redacted]   Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Particle Size Distribution

Pr□□□□: ISABELLA WEIR UPGRADE
STS / S□□ □□ N□: 5442C/7
Project No.: 16309

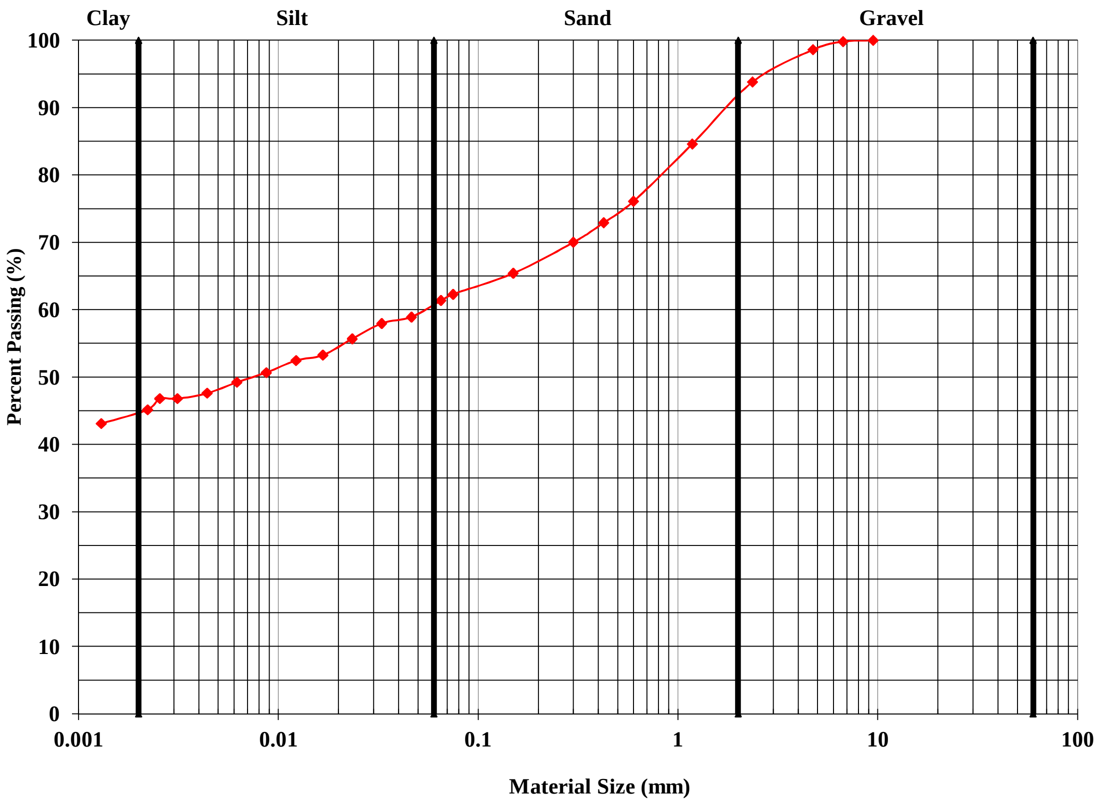
C□□□□: SMEC A□□r□□□
Sample Location: TP06
Report No.: 15/0835

Address: Level 5, 20 Berry Street, North Sydney 2060
Depth (m): 1.0 - 1.6
Report Date: 13/04/2015

Test Method: AS1289.3.6.3
Method of Despersion: Mechanical Stirrer
Page: 6 OF 15

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)
Client Project No: 3002402

Material Description: Silty Sandy Clay, light brown, trace of gravel



Sieve Size (mm)	Percent Passing (□)
9.5	100
6.7	99.8
4.75	98.6
2.36	93.8
1.18	84.6
0.60	76.1
0.425	72.9
0.30	70.0
0.15	65.4
0.075	62.3
□Particle Size (mm)	Percent Passing (□)
0.0653	61.4
0.0465	58.9
0.0330	58.0
0.0235	55.7
0.0167	53.3
0.0123	52.4
0.0087	50.7
0.0062	49.2
0.0044	47.6
0.0031	46.8
0.0025	46.8
0.0022	45.2
0.0013	43.1

□Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks: C□□r□ C□□□C□r□

Approved Signatory...... Schedule 2.2 (a)(ii) [redacted]

Technician: [redacted] Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

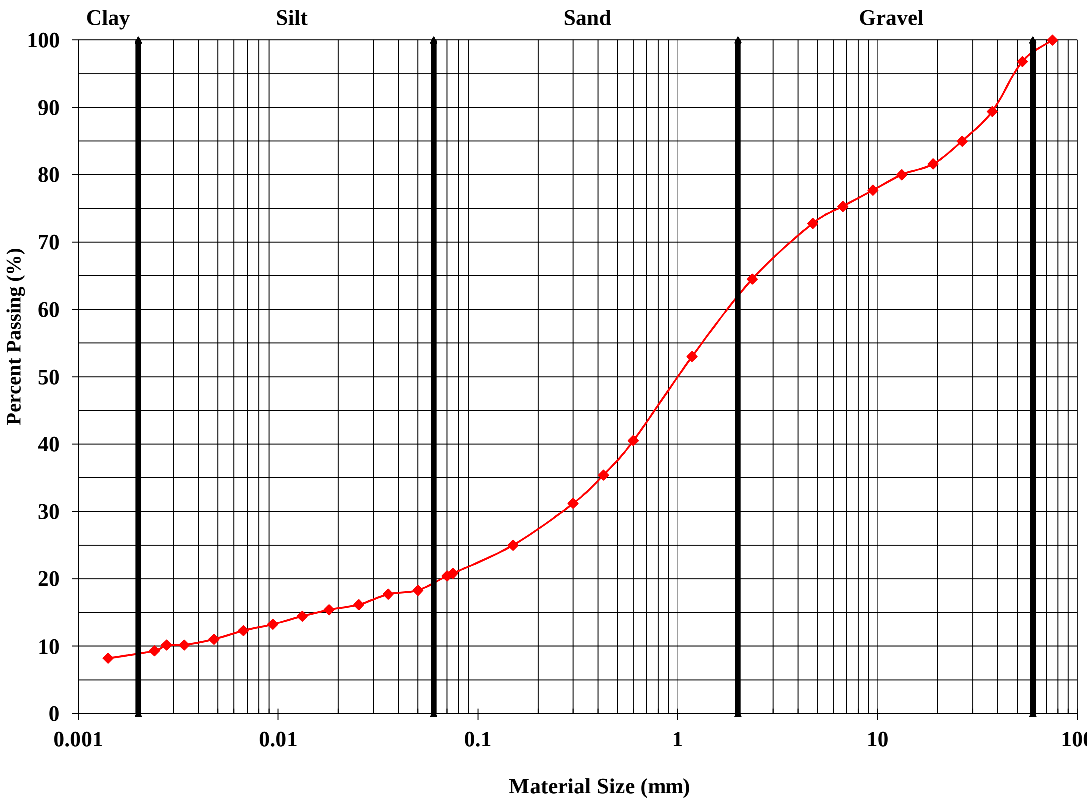
SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Particle Size Distribution

Pr□□□□: ISABELLA WEIR UPGRADE
C□□□□: SMEC A□□□r□□□
Address: Level 5, 20 Berry Street, North Sydney 2060
Test Method: AS1289.3.6.3
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)
Material Description: Gravelly Sand, brown, trace of clay/silt

STS / S□□ □□ N□: 5442C/9
Sample Location: TP06
Depth (m): 2.0 - 2.5
Method of Despersion: Mechanical Stirrer

Project No.: 16309
Report No.: 15/0835
Report Date: 13/04/2015
Page: 7 OF 15
Client Project No: 3002402



Sieve Size (mm)	Percent Passing (□)
75.0	100
53.0	96.8
37.5	89.4
26.5	85.0
19.0	81.6
13.2	80.0
9.5	77.7
6.7	75.3
4.75	72.8
2.36	64.5
1.18	53.0
0.60	40.5
0.425	35.4
0.30	31.2
0.15	25.0
0.075	20.8
□Particle Size (mm)	Percent Passing (□)
0.0701	20.5
0.0501	18.3
0.0356	17.7
0.0254	16.2
0.0180	15.4
0.0132	14.5
0.0094	13.3
0.0067	12.3
0.0048	11.0
0.0034	10.2
0.0028	10.2
0.0024	9.3
0.0014	8.2

□Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks: **US G□□□r□□F□□**

Approved Signatory..... Schedule 2.2 (a)(ii) [redacted]

Technician: [redacted]

Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Particle Size Distribution

Pr□□□□□: ISABELLA WEIR UPGRADE | **STS / S□□ □□ N□: 5442C/10** | Project No.: 16309

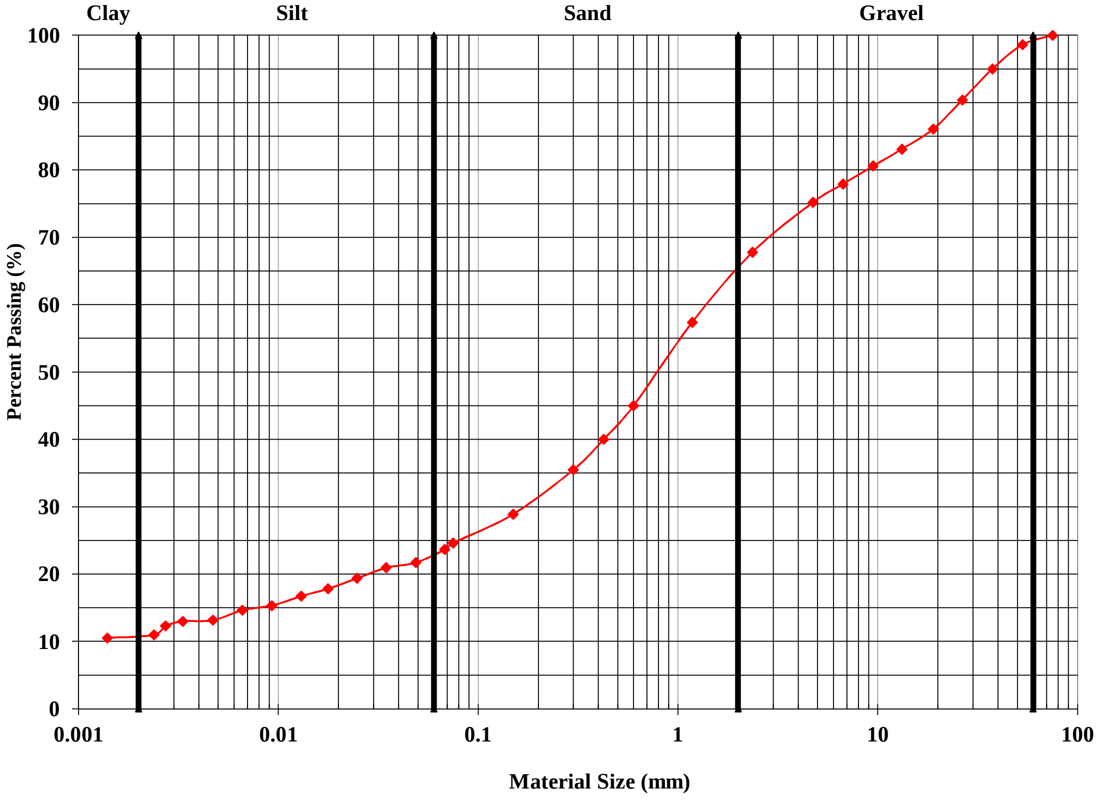
C□□□□: SMEC A□□r□□□ | Sample Location: TP07 | Report No.: 15/0835

Address: Level 5, 20 Berry Street, North Sydney 2060 | Depth (m): 3.0 - 3.4 | Report Date: 13/04/2015

Test Method: AS1289.3.6.3 | Method of Despersion: Mechanical Stirrer | Page: 8 OF 15

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation) | Client Project No: 3002402

Material Description: Gravelly Sand, grey, trace of clay/silt



Sieve Size (mm)	Percent Passing (□)
75.0	100
53.0	98.6
37.5	95
26.5	90.4
19.0	86.1
13.2	83.1
9.5	80.6
6.7	77.9
4.75	75.2
2.36	67.8
1.18	57.4
0.60	45.0
0.425	40.0
0.30	35.5
0.15	28.9
0.075	24.6
□Particle Size (mm)	Percent Passing (□)
0.0682	23.7
0.0489	21.7
0.0347	20.9
0.0248	19.4
0.0177	17.8
0.0130	16.7
0.0093	15.3
0.0066	14.6
0.0047	13.1
0.0033	13.0
0.0027	12.3
0.0024	11.0
0.0014	10.5

□Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks: **S□□d F□□**

Approved Signatory....... [redacted]

Technician: [redacted]

[redacted] - Laboratory Manager

1192

SMEC T□□□□□ S□r□□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

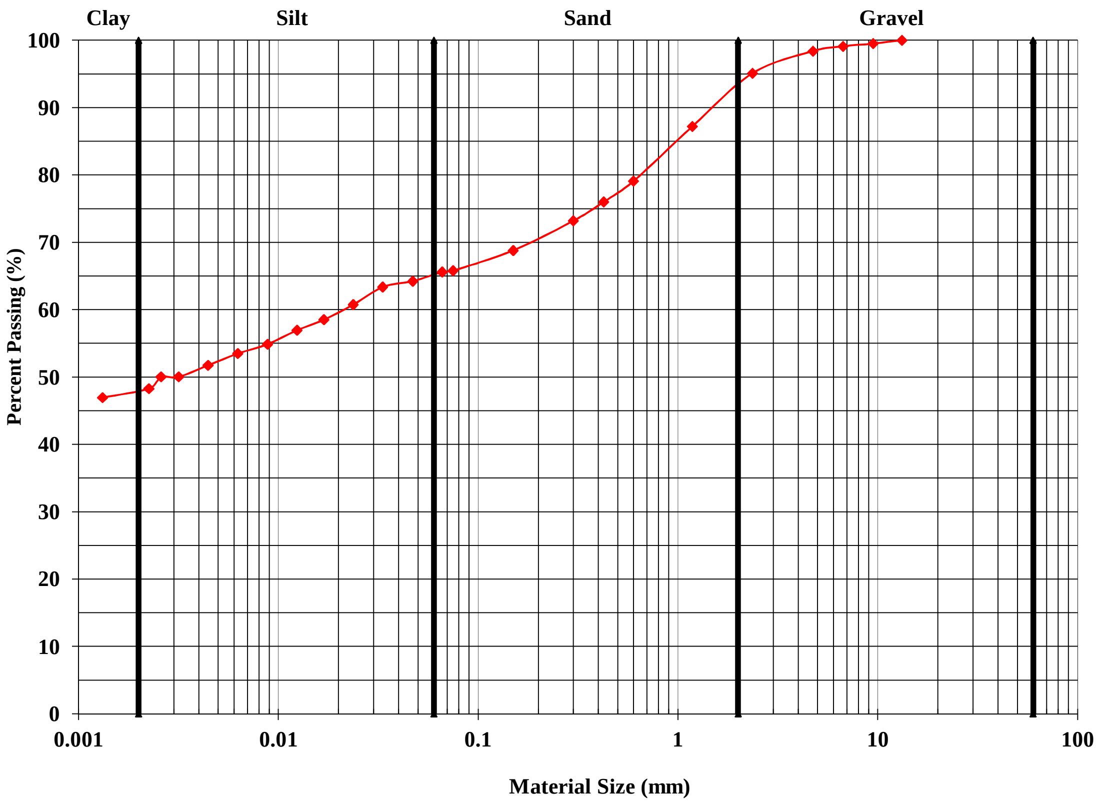
Particle Size Distribution

Pr□□□□□: ISABELLA WEIR UPGRADE
C□□□□□: SMEC A□□□r□□□□
Address: Level 5, 20 Berry Street, North Sydney 2060
Test Method: AS1289.3.6.3

STS / S□□ □□□ N□□: 5442C/11
Sample Location: TP07
Depth (m): 4.0 - 4.8
Method of Despersion: Mechanical Stirrer

Project No.: 16309
Report No.: 15/0835
Report Date: 13/04/2015
Page: 9 OF 15
Client Project No: 3002402

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)
Material Description: Silty Sandy Clay, yellow brown, trace of gravel



Sieve Size (mm)	Percent Passing (□)
13.2	100
9.5	99.5
6.7	99.1
4.75	98.4
2.36	95.1
1.18	87.2
0.60	79.1
0.425	76.0
0.30	73.2
0.15	68.8
0.075	65.8
□Particle Size (mm)	Percent Passing (□)
0.0662	65.6
0.0470	64.2
0.0333	63.4
0.0238	60.8
0.0169	58.5
0.0124	56.9
0.0088	54.9
0.0063	53.5
0.0045	51.7
0.0032	50.0
0.0026	50.0
0.0023	48.3
0.0013	46.9

□Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks: **C□□□□□ F□□□**

Schedule 2.2 (a)(ii) [redacted]
Approved Signatory.......

Technician: [redacted]

Schedule 2.2 (a)(ii) - Laboratory Manager

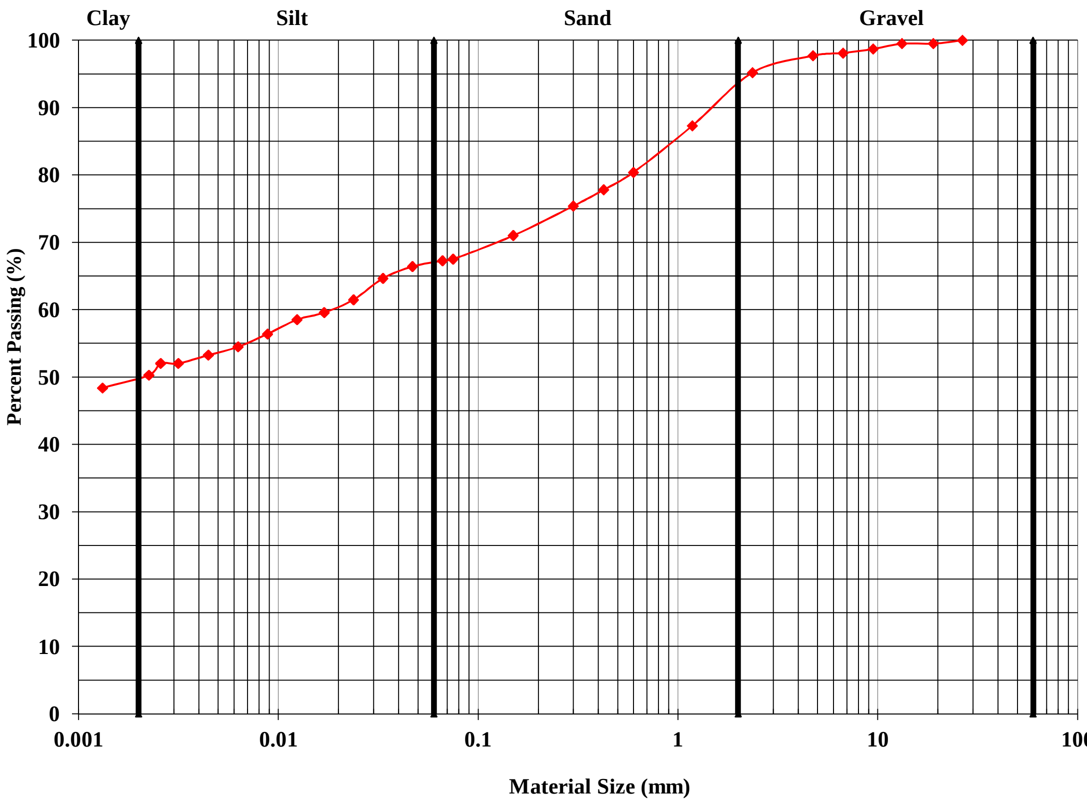
SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Particle Size Distribution

Pr□□□□: ISABELLA WEIR UPGRADE
C□□□□: SMEC A□□r□□□
Address: Level 5, 20 Berry Street, North Sydney 2060
Test Method: AS1289.3.6.3
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)
Material Description: Silty Sandy Clay, brown, trace of gravel

STS / S□□ □□ N□: 5442C/12
Sample Location: TP08
Depth (m): 1.6 - 2.0
Method of Despersion: Mechanical Stirrer

Project No.: 16309
Report No.: 15/0835
Report Date: 13/04/2015
Page: 10 OF 15
Client Project No: 3002402



Sieve Size (mm)	Percent Passing (□)
26.5	100
19.0	99.5
13.2	99.5
9.5	98.7
6.7	98.1
4.75	97.7
2.36	95.2
1.18	87.3
0.60	80.4
0.425	77.8
0.30	75.4
0.15	71.0
0.075	67.5
□Particle Size (mm)	Percent Passing (□)
0.0663	67.3
0.0470	66.4
0.0334	64.6
0.0238	61.5
0.0170	59.6
0.0124	58.5
0.0088	56.4
0.0063	54.5
0.0045	53.2
0.0032	52.0
0.0026	52.0
0.0022	50.3
0.0013	48.4

□Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks: **C□□□□□ F□□**

Approved Signatory....... Schedule 2.2 (a)(ii) [redacted]

Technician: Schedule [redacted] Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

1194

SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Emerson Class No.

Pr□□□□: ISABELLA WEIR UPGRADE	Project No.: 16309
C□□□□: SMEC A□□□r□□□	Report No.: 15/0835
Address: Level 5, 20 Berry Street, North Sydney 2060	Report Date: 13/04/2015
Test Method: AS1289.3.8.1	Page: 11 of 15
Client Request No.: 3002402	

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.	5442C/2	5442C/4	5442C/5	5442C/6	5442C/7	5442C/9
Sample Location	TP03	TP05 US	TP05 DS	TP06	TP06	TP06
Material Description	Silty Sandy Clay, brown, trace of gravel	Gravelly Sand, brown, trace of silt/clay	Silty Sandy Clay, brown, yellow brown, trace of gravel	Silty Gravelly Sand, brown, trace of clay	Silty Sandy Clay, light brown, trace of gravel	Gravelly Sand, brown, trace of clay/silt
Depth (mm)	1.5 - 1.9	1.5 - 2.5	1.5 - 2.5	0.5 - 1.0	1.0 - 1.6	2.0 - 2.5
Sample Date	18/03/2015	18/03/2015	18/03/2015	18/03/2015	18/03/2015	18/03/2015
Date Tested	2/04/2015	2/04/2015	2-Apr-15	2-Apr-15	2-Apr-15	2-Apr-15
Source of Material	Disturbed	Disturbed	Disturbed	Disturbed	Disturbed	Disturbed
Water Temperature (□)	22	22	22	22	22	22
E□ □r□□□ C□□□□ N□□	**1**	**1**	**1**	**1**	**1**	**4**

Emerson Classification

Class 1: Slaking and complete dispersion before remoulding

Class 2: Slaking and some dispersion before remoulding

Class 3: Slaking and no dispersion before remoulding, dispersion after remoulding

Class 4: Slaking and no despersion before remoulding, no dispersion after remoulding, calcite or gypsum present

Class 5: Slaking and no dispersion before remoulding, no dispersion after remoulding, no calcite or gypsum present, dispersion after slaking in a 1:5 soil / water suspension

Class 6: Slaking and no dispersion before remoulding, no dispersion after remoulding, no calcite or gypsum present, flocculation after shaking in a 1:5 soil / water suspension

Class 7: No slaking, swelling occurs

Class 8: No slaking, swelling does not occur

Remarks:

Schedule 2.2 (a)(ii)

Approved Signatory......[redacted]....................

Technician: [redacted]

[redacted] - Laboratory Manager

SMEC T□□□□□ S□r□□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Emerson Class No.

Pr□□□□: ISABELLA WEIR UPGRADE — Project No.: 16309

C□□□□: SMEC A□□□r□□□ — Report No.: 15/0835

Address: Level 5, 20 Berry Street, North Sydney 2060 — Report Date: 13/04/2015

Test Method: AS1289.3.8.1 — Page: 12 of 15

Client Request No.: 3002402

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.	5442C/11	5442C/12				
Sample Location	TP07	TP08				
Material Description	Silty Sandy Clay, yellow brown, trace of gravel	Silty Sandy Clay, brown, trace of gravel				
Depth (mm)	4.0 - 4.8	1.6 - 2.0				
Sample Date	19/03/2015	19/03/2015				
Date Tested	2/04/2015	2/04/2015				
Source of Material	Disturbed	Disturbed				
Water Temperature (□)	22	22				
E□ □r□□□ C□□□□ N□□	**1**	**1**				

Emerson Classification

Class 1: Slaking and complete dispersion before remoulding

Class 2: Slaking and some dispersion before remoulding

Class 3: Slaking and no dispersion before remoulding, dispersion after remoulding

Class 4: Slaking and no despersion before remoulding, no dispersion after remoulding, calcite or gypsum present

Class 5: Slaking and no dispersion before remoulding, no dispersion after remoulding, no calcite or gypsum present, dispersion after slaking in a 1:5 soil / water suspension

Class 6: Slaking and no dispersion before remoulding, no dispersion after remoulding, no calcite or gypsum present, flocculation after shaking in a 1:5 soil / water suspension

Class 7: No slaking, swelling occurs

Class 8: No slaking, swelling does not occur

Remarks:

Approved Signatory......Schedule 2.2 (a)(ii) [redacted]......................

Technician: [redacted] Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

1196

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Atterberg Limits and Linear Shrinkage Report

Project: ISABELLA WEIR UPGRADE — Project No.: 16309
Client: SMEC Australia — Report No.: 15/0835
Address: Level 5, 20 Berry Street, North Sydney 2060 — Report Date: 13/04/2015
Test Method: AS1289.3.1.1, 3.2.1, 3.3.1, 3.4.1, 2.1.1 —
Client Request No.: 3002402

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.	5442C/2	5442C/4	5442C/5	5442C/6	5442C/7	5442C/9
Sample Location	TP03	TP05 US	TP05 DS	TP06	TP06	TP06
Material Description	Silty Sandy Clay, brown, trace of gravel	Gravelly Sand, brown, trace of silt/clay	Silty Sandy Clay, brown, yellow brown, trace of gravel	Silty Gravelly Sand, brown, trace of clay	Silty Sandy Clay, light brown, trace of gravel	Gravelly Sand, brown, trace of clay/silt
Depth (m)	1.5 - 1.9	1.5 - 2.5	1.5 - 2.5	0.5 - 1.0	1.0 - 1.6	2.0 - 2.5
Sample Date	18/03/2015	18/03/2015	18/03/2015	18/03/2015	18/03/2015	18/03/2015
Sample History	Air Dried	Air Dried	Air Dried	Air Dried	Air Dried	Air Dried
Method of Preparation	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved
Liquid Limit (%)	**72**	**40**	**75**	**29**	**71**	**27**
Plastic Limit (%)	**19**	**13**	**21**	**12**	**19**	**13**
Plasticity Index	**53**	**27**	**54**	**17**	**52**	**14**
Linear Shrinkage (%)	**15**	**10**	**16**	**6**	**15.5**	**7**
Mould Size (mm)	250	250	250	250	250	250
Crumbing	Y	Y	Y	N	Y	N
Curling	N	Y	N	Y	N	N

Remarks:

Approved Signatory.... Schedule 2.2 (a)(ii) [redacted] ....

Technician: Schedule 2.2 (a) [redacted]

Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

1197

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Atterberg Limits and Linear Shrinkage Report

Project: ISABELLA WEIR UPGRADE — Project No.: 16309
Client: SMEC Australia — Report No.: 15/0835
Address: Level 5, 20 Berry Street, North Sydney 2060 — Report Date: 13/04/2015
Test Method: AS1289.3.1.1, 3.2.1, 3.3.1, 3.4.1, 2.1.1 —
Client Request No.: 3002402

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.	5442C/11	5442C/12				
Sample Location	TP07	TP08				
Material Description	Silty Sandy Clay, yellow brown, trace of gravel	Silty Sandy Clay, brown, trace of gravel				
Depth (m)	4.0 - 4.8	1.6 - 2.0				
Sample Date	19/03/2015	19/03/2015				
Sample History	Air Dried	Air Dried				
Method of Preparation	Dry Sieved	Dry Sieved				
Liquid Limit (%)	**68**	**69**				
Plastic Limit (%)	**20**	**20**				
Plasticity Index	**48**	**49**				
Linear Shrinkage (%)	**16**	**16**				
Mould Size (mm)	250	250				
Crumbing	Y	Y				
Curling	N	N				

Remarks:

Approved Signatory.....[redacted].................

Technician: [redacted]

[redacted] - Laboratory Manager

1198

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Moisture Content of Soil and Aggregate Samples

Project: ISABELLA WEIR UPGRADE — Project No.: 16309
Client: SMEC Australia — Report No.: 15/0835
Address: Level 5, 20 Berry Street, North Sydney 2060 — Report Date: 13/04/2015
Test Method: AS1289.2.1.1 — Page: 15 of 15
Client Request No.: 3002402

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.	5442C/3	5442C/10				
Sample Location	TP04	TP07				
Material Description	Silty Gravelly Sand, grey brown, trace of clay	Gravelly Sand, grey, trace of clay/silt				
Depth (mm)	2.3 - 2.6	3.0 - 3.4				
Sample Date	18/03/2015	19/03/2015				
Moisture Content %	**18.7**	**12.9**				

Remarks:

Approved Signatory......[redacted].............

Technician: [redacted]

[redacted] - Laboratory Manager

1199

SMEC T□□□□□ S□r□□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Dry Density / Moisture Content Relationship With Zero Air Voids Line

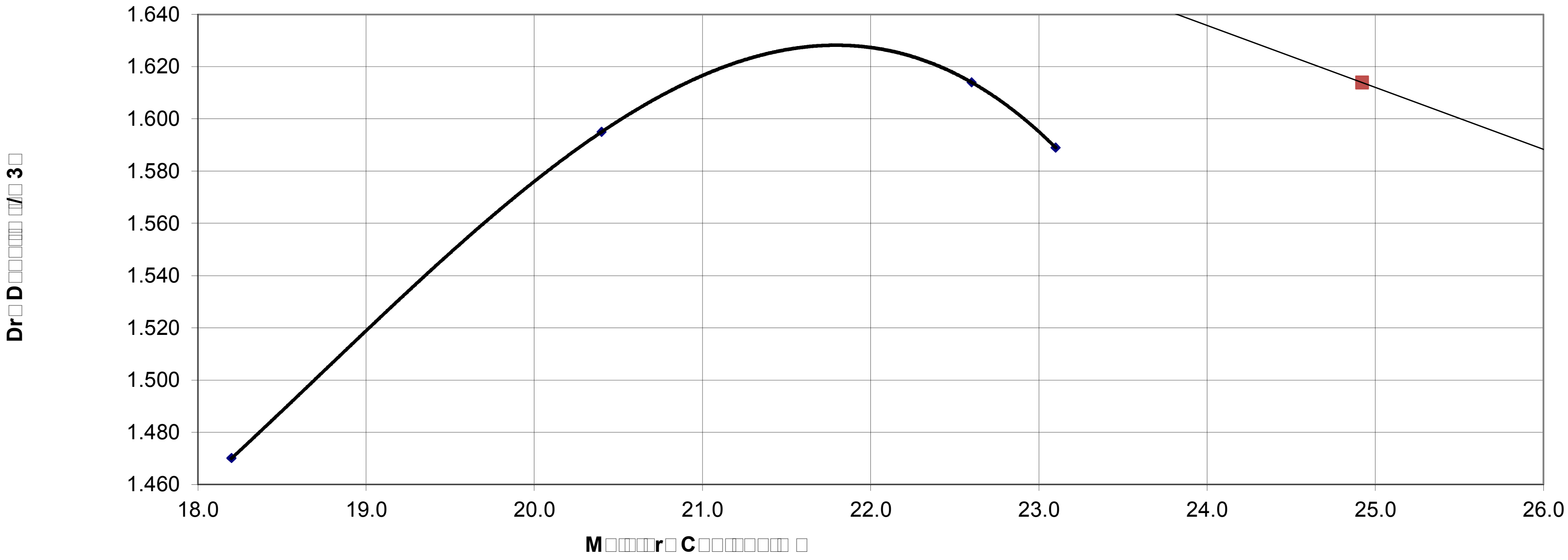
Pr□□□□□: ISABELLA WEIR UPGRADE
C□□□□□: SMEC A□□□r□□□□
Address: Level 5, 20 Berry Street, North Sydney 2060
Test Method: AS1289.5.1.1, 2.1.1
Compactive Effort: Standard
Date Tested: 01/04/15
□19mm Oversize (□): Nil
□37.5mm Oversize (□): Nil

STS / S□□ □□□ N□□: 5442C/2
Depth (mm): 1.6 - 1.9
Date Sampled : 18/3/2015
Sample Location: TP03
Material Description: Silty Sandy Clay, yellow brown, trace of gravel
Tested By: [redacted]

Project No.: 16309
Report No.: 15/0836
Report Date: April 14, 2015
Page: 1 of 8

S□□□d□rd M□□□□ □□ Dr□ D□□□□□ □/□ 3□: 1□630
S□□□d□rd O□□□□ □□ M□□□□□r□ C□□□□□□□ □: 21□8

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)



Remarks:

Approved Signatory.......... Schedule 2.2 (a)(ii) [redacted]

Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

1200

SMEC T□□□□□ S□r□□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Dry Density / Moisture Content Relationship With Zero Air Voids Line

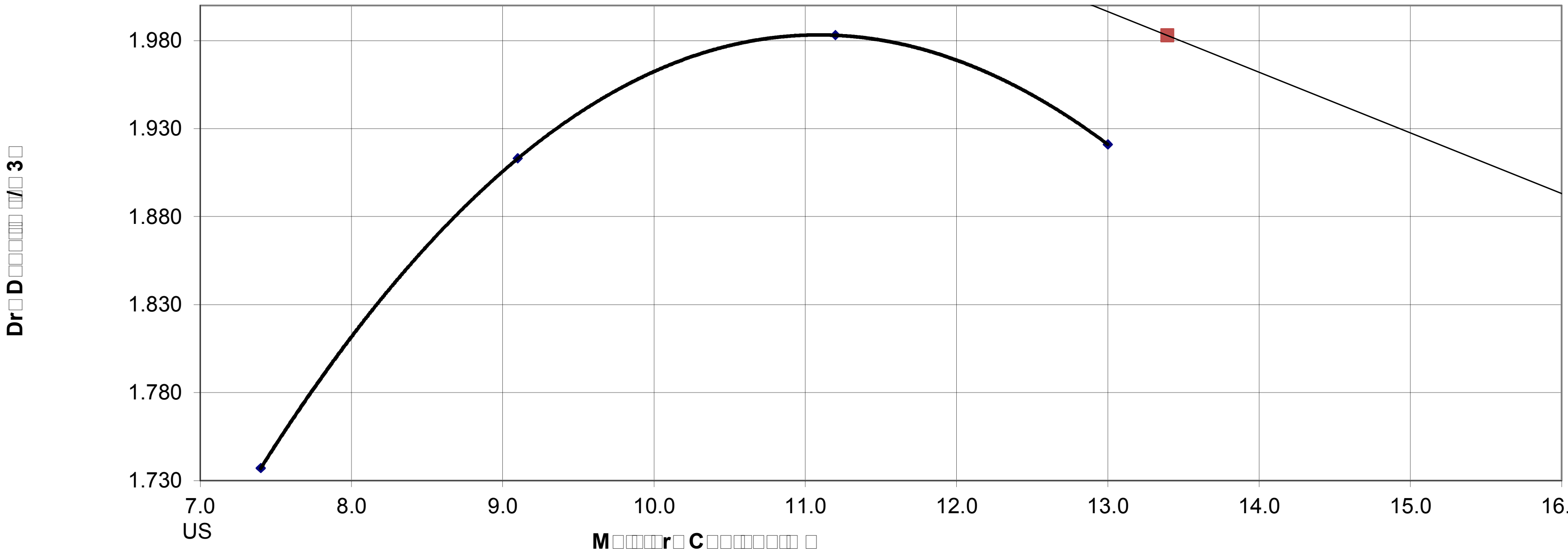
Pr□□□□□: ISABELLA WEIR UPGRADE
C□□□□□: SMEC A□□□r□□□□
Address: Level 5, 20 Berry Street, North Sydney 2060
Test Method: AS1289.5.1.1, 2.1.1
Compactive Effort: Standard
Date Tested: 01/04/15
□19mm Oversize (□): Nil
□37.5mm Oversize (□): Nil

STS / S□□ □□□ N□□: 5442C/4
Depth (mm): 1.5 - 2.5
Date Sampled : 18/3/2015
Sample Location: TP05 US
Material Description: Silty Gravelly Sand, grey brown, trace of clay
Tested By: [redacted]

Project No.: 16309
Report No.: 15/0836
Report Date: April 14, 2015
Page: 2 of 8

S□□□d□rd M□□□□ □□ Dr□ D□□□□□□ □/□ 3□: 1□982
S□□□d□rd O□□□□ □□ M□□□□□r□ C□□□□□□□□ □: 11□1

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)



Remarks:

Approved Signatory.......... [redacted]

Schedule 2.2 (a)(ii) - Laboratory Manager

1201

SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

NATA Accredited Laboratory Number: 2750
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025.
This Document may not be reproduced except in full.

Dry Density / Moisture Content Relationship
With Zero Air Voids Line

Pr□□□□: ISABELLA WEIR UPGRADE
Project No.: 16309

C□□□□: SMEC A□□r□□□
STS / S□□ □□ N□: 5442C/5
Report No.: 15/0836

Address: Level 5, 20 Berry Street, North Sydney 2060
Depth (mm): 1.5 - 2.5
Report Date: April 14, 2015

Test Method: AS1289.5.1.1, 2.1.1
Date Sampled : 18/3/2015
Page: 3 of 8

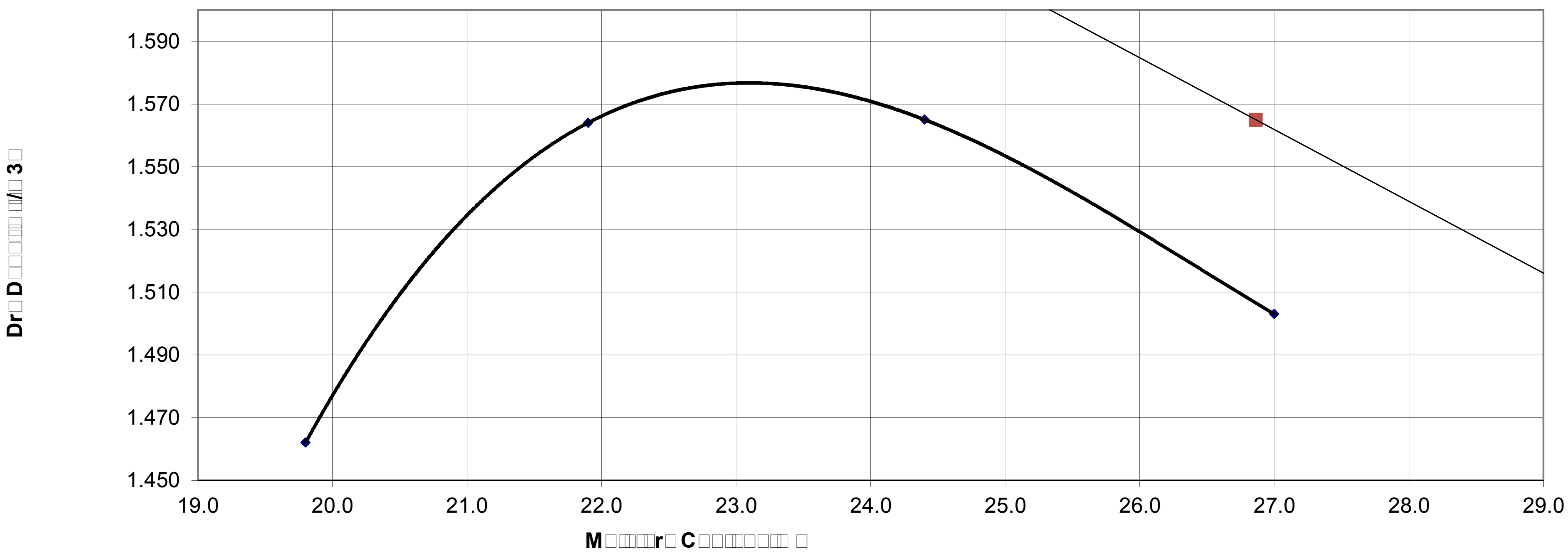
Compactive Effort: Standard
Sample Location: TP05 DS

Date Tested: 01/04/15
Material Description: Gravelly Sand, brown, trace of silt/clay

□19mm Oversize (□): Nil
Tested By: [redacted] Schedule
S□□□d□rd M□□□ □□ Dr□ D□□□□□ □/□ 3□: 1□576

□37.5mm Oversize (□ : Nil
S□□□d□rd O□□□ □□ M□□□□r□ C□□□□□□□ □: 23□2

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)



Remarks:

Approved Signatory.......... [redacted] Schedule 2.2 (a)(ii)

[redacted] Schedule 2.2 (a)(ii) - Laboratory Manager

1202

SMEC T□□□□□ S□r□□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Dry Density / Moisture Content Relationship With Zero Air Voids Line

Pr□□□□□: ISABELLA WEIR UPGRADE
Project No.: 16309

C□□□□□: SMEC A□□□r□□□□
STS / S□□ □□□ N□□: 5442C/6
Report No.: 15/0836

Address: Level 5, 20 Berry Street, North Sydney 2060
Depth (mm): 0.5 - 1.0
Report Date: April 14, 2015

Test Method: AS1289.5.1.1, 2.1.1
Date Sampled : 18/3/2015
Page: 4 of 8

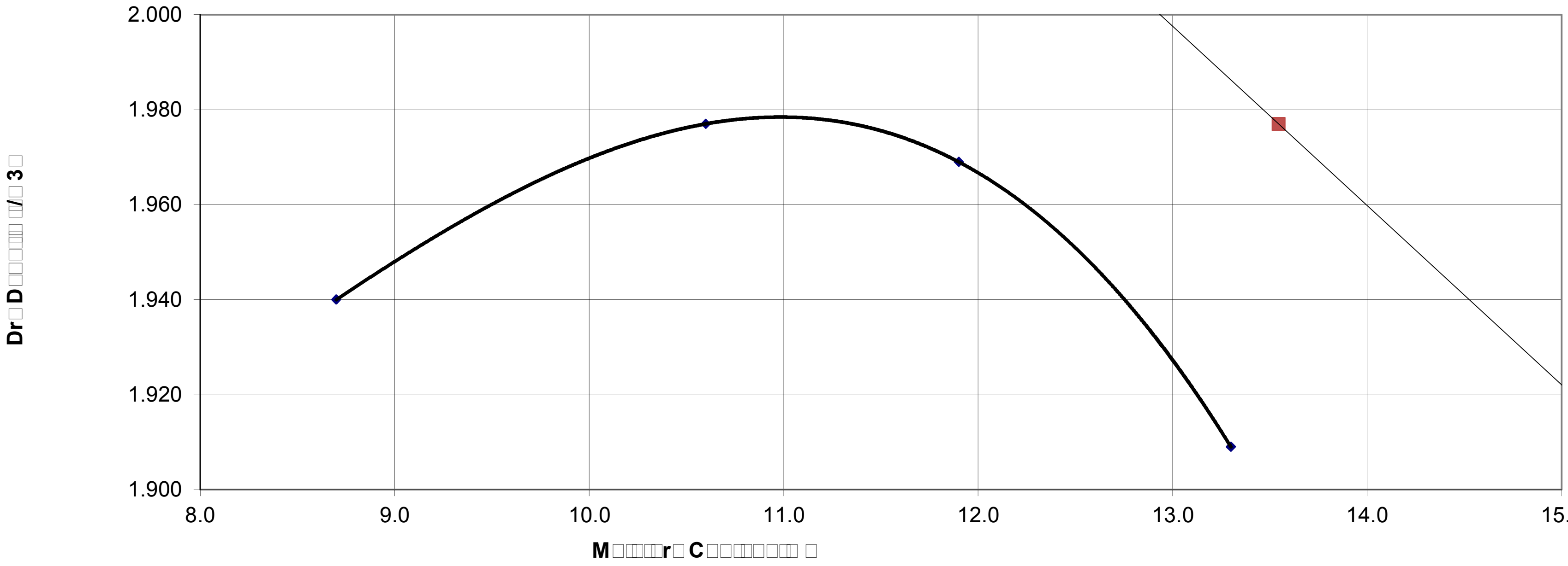
Compactive Effort: Standard
Sample Location: TP06

Date Tested: 01/04/15
Material Description: Silty Gravelly Sand, brown, trace of clay

□19mm Oversize (□): Nil
Tested By: [redacted]
S□□□d□rd M□□□□ □□ Dr□ D□□□□□□ □/□ 3□: 1□979

□37.5mm Oversize (□ : Nil
S□□□d□rd O□□□□ □□ M□□□□□r□ C□□□□□□□□ □: 10□9

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)



Remarks:

Approved Signatory.......... [redacted]

[redacted] - Laboratory Manager

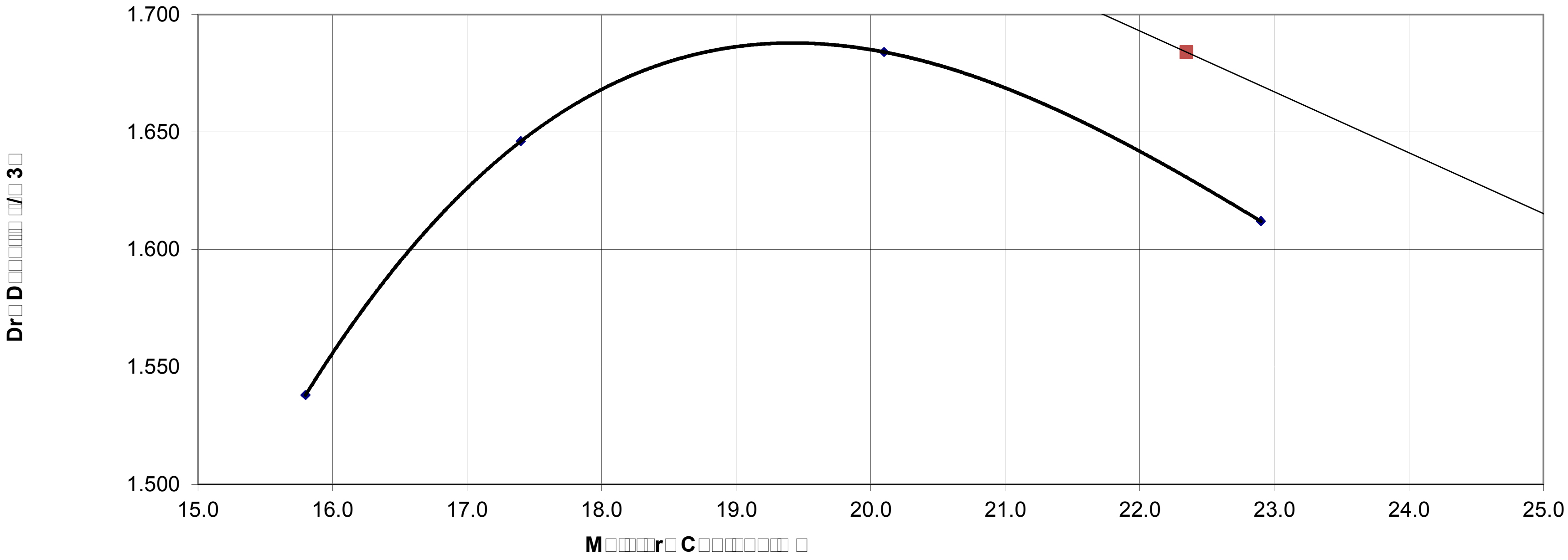
1203

SMEC T□□□□□ S□r□□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Dry Density / Moisture Content Relationship With Zero Air Voids Line

Pr□□□□: ISABELLA WEIR UPGRADE		Project No.: 16309
C□□□□: SMEC A□□r□□□	**STS / S□□ □□□ N□: 5442C/7**	Report No.: 15/0836
Address: Level 5, 20 Berry Street, North Sydney 2060	Depth (mm): 1.0 - 1.6	Report Date: April 14, 2015
Test Method: AS1289.5.1.1, 2.1.1	Date Sampled : 18/3/2015	Page: 5 of 8
Compactive Effort: Standard	Sample Location: TP06	
Date Tested: 01/04/15	Material Description: Silty Sandy Clay, light brown, trace of gravel	
□19mm Oversize (□): Nil	Tested By: Sched [redacted]	**S□□□d□rd M□□□□ □□ Dr□ D□□□□□ □/□ 3□: 1□688**
□37.5mm Oversize (□): Nil		**S□□□d□rd O□□□ □□ M□□□□r□ C□□□□□□□ □: 19□5**

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)



Remarks:

Approved Signatory.......... Schedule 2.2 (a)(ii) [redacted]

Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

1204

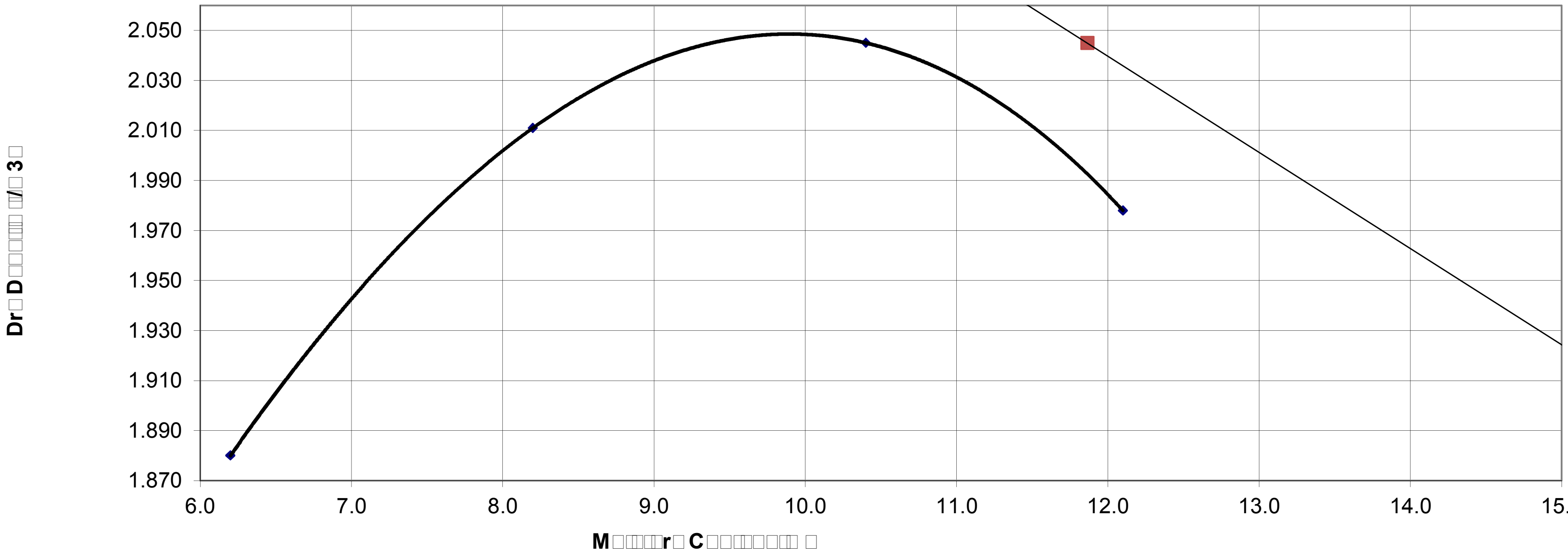
SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

NATA Accredited Laboratory Number: 2750
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025.
This Document may not be reproduced except in full.

Dry Density / Moisture Content Relationship
With Zero Air Voids Line

Pr□□□□: ISABELLA WEIR UPGRADE		Project No.: 16309
C□□□□: SMEC A□□r□□□	**STS / S□□ □□□ N□: 5442C/9**	Report No.: 15/0836
Address: Level 5, 20 Berry Street, North Sydney 2060	Depth (mm): 2.0 - 2.5	Report Date: April 14, 2015
Test Method: AS1289.5.1.1, 2.1.1	Date Sampled : 18/3/2015	Page: 6 of 8
Compactive Effort: Standard	Sample Location: TP06	
Date Tested: 01/04/15	Material Description: Gravelly Sand, brown, trace of clay/silt	
□19mm Oversize (□): Nil	Tested By: [redacted]	**S□□□d□rd M□□□□ □□ Dr□D□□□□□ □/□ 3□: 2□050**
□37.5mm Oversize (□): Nil		**S□□□d□rd O□□□□ □□ M□□□□r□ C□□□□□□□ □: 9□9**

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)



Remarks:

Approved Signatory.......... [redacted]

Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

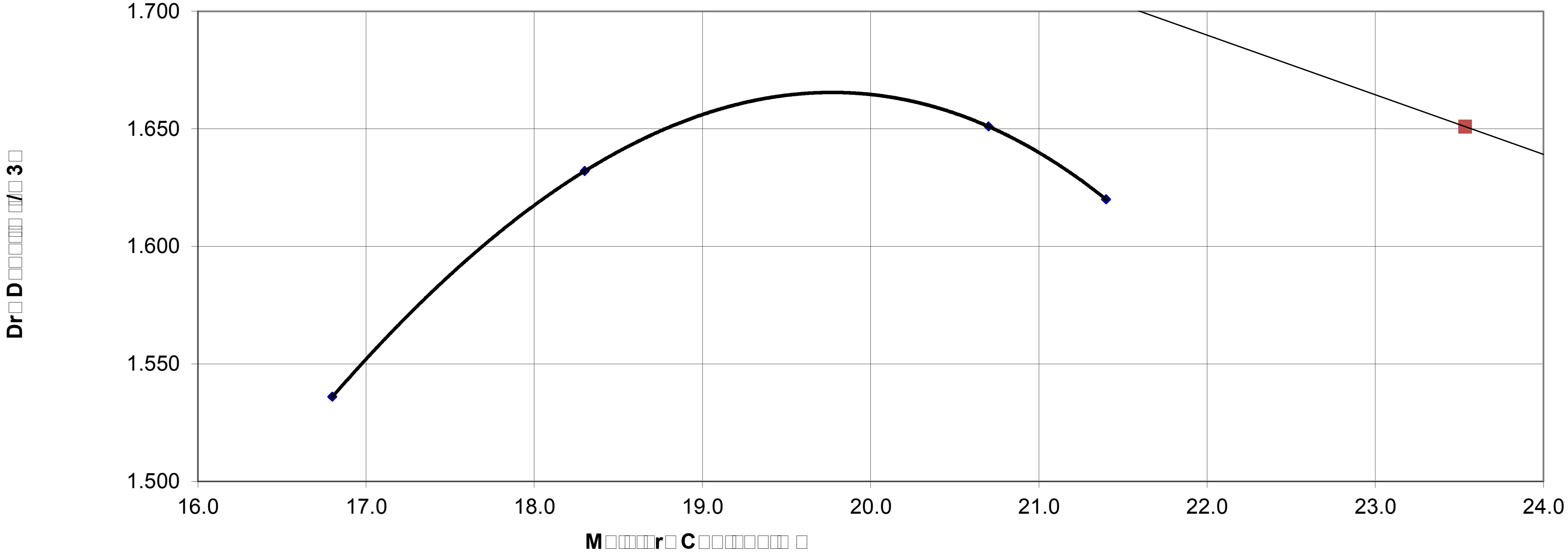
1205

SMEC T□□□□□ S□r□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Dry Density / Moisture Content Relationship With Zero Air Voids Line

Pr□□□□: ISABELLA WEIR UPGRADE		Project No.: 16309
C□□□□: SMEC A□□□r□□□	**STS / S□□ □□□ N□: 5442C/11**	Report No.: 15/0836
Address: Level 5, 20 Berry Street, North Sydney 2060	Depth (mm): 4.0 - 4.8	Report Date: April 14, 2015
Test Method: AS1289.5.1.1, 2.1.1	Date Sampled : 19/3/2015	Page: 7 of 8
Compactive Effort: Standard	Sample Location: TP07	
Date Tested: 01/04/15	Material Description: Silty Sandy Clay, yellow brown, trace of gravel	
□19mm Oversize (□): Nil	Tested By: [redacted]	**S□□□d□rd M□□□□ □□ Dr□ D□□□□□□ □/□ 3□: 1□668**
□37.5mm Oversize (□): Nil		**S□□□d□rd O□□□□ □□ M□□□□□r□ C□□□□□□□□ □: 19□7**

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)



Remarks:

Approved Signatory.......... Schedule 2.2 (a)(ii) [redacted]

Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

1206

SMEC T□□□□□ S□r□□□□□ P□□ L□d
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

NATA Accredited Laboratory Number: 2750
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025.
This Document may not be reproduced except in full.

Dry Density / Moisture Content Relationship With Zero Air Voids Line

Pr□□□□□: ISABELLA WEIR UPGRADE
Project No.: 16309

C□□□□□: SMEC A□□□r□□□□
STS / S□□ □□□ N□□: 5442C/12
Report No.: 15/0836

Address: Level 5, 20 Berry Street, North Sydney 2060
Depth (mm): 1.6 - 2.0
Report Date: April 14, 2015

Test Method: AS1289.5.1.1, 2.1.1
Date Sampled : 19/3/2015
Page: 8 of 8

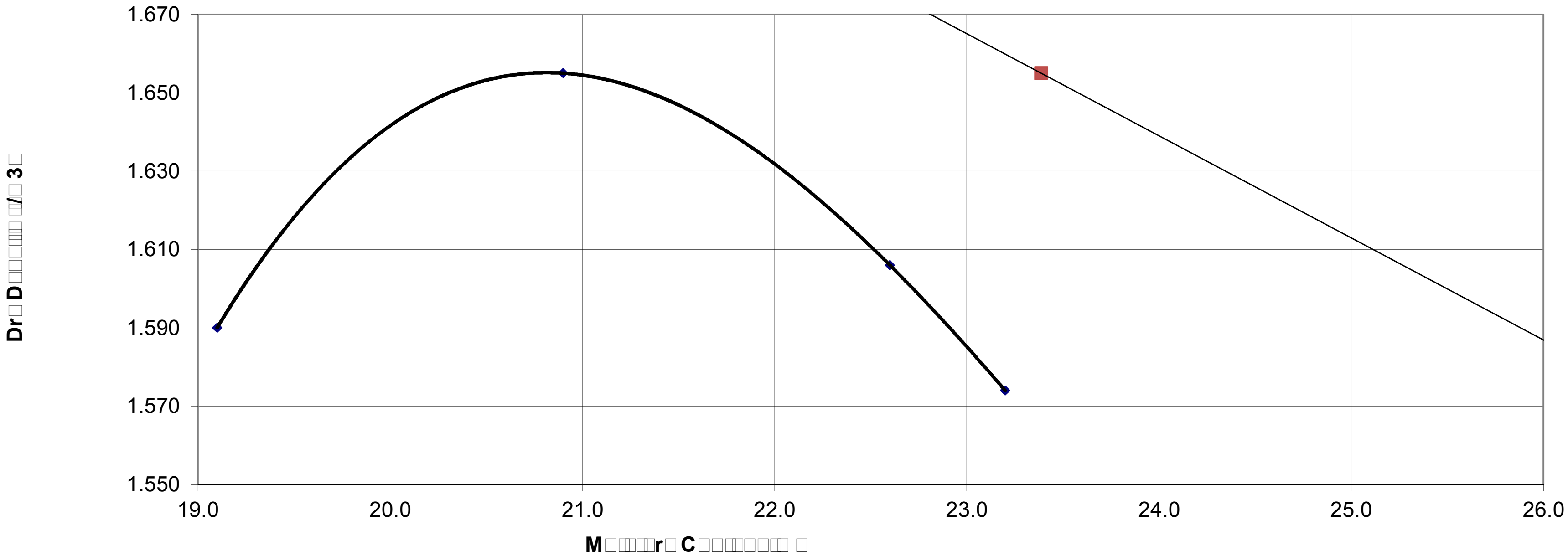
Compactive Effort: Standard
Sample Location: TP08

Date Tested: 01/04/15
Material Description: Silty Sandy Clay, brown, trace of gravel

□19mm Oversize (□): Nil
Tested By: [redacted]
S□□□d□rd M□□□□ □□ Dr□ D□□□□□□ □/□ 3□: 1□655

□37.5mm Oversize (□ : Nil
S□□□d□rd O□□□□ □□ M□□□□□r□ C□□□□□□□□ □: 20□8

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)



Remarks:

Approved Signatory.......... Schedule 2.2 (a)(ii) [redacted]

Schedule 2.2 (a)(ii) [redacted] - Laboratory Manager

coffey 1207

47-49 Carlotta Street Artarmon NSW 2064
T : (61 2) 9437 0137 Fax: (61 2) 9437 0191
ABN 92 114 364 046

triaxial shear test: shear path & Mohr circle plot

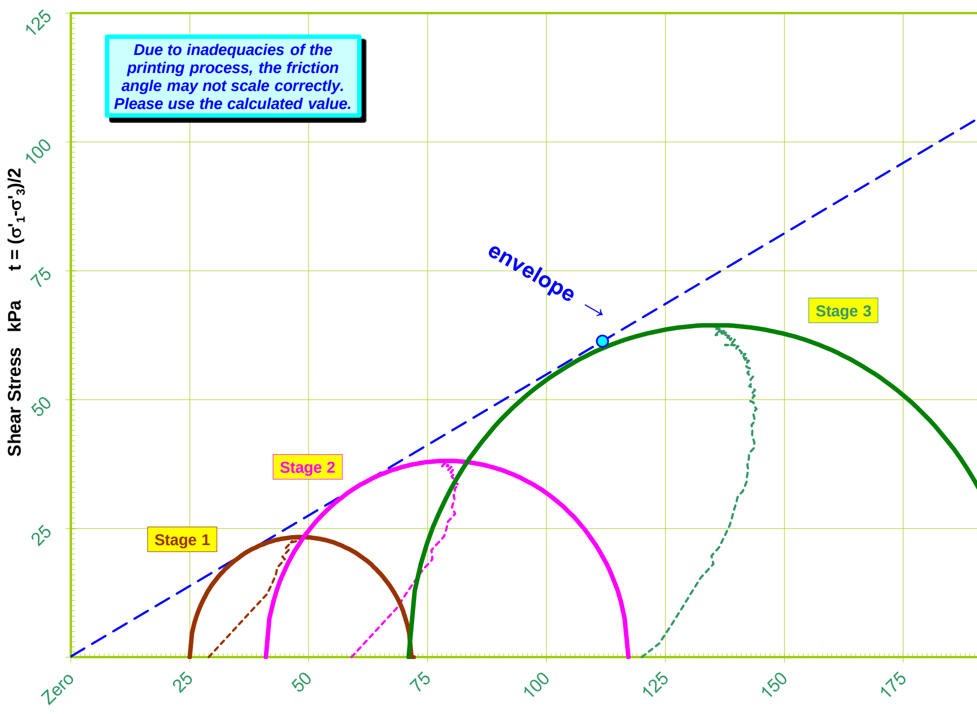
client :	SMEC TESTING SERVICES P/L	job no :	INFOARTA01336AA
principal :		date :	11 April 2015
project :	STS NO.16309/5442C	report number:	IOLT 8470
location :	Site No.3002402, Isabella Weir	laboratory number:	ARTA145-00160
Sample number:	**Sample #1, Test Pit No.3 (1.50 to 1.80 m)**	Test Method :	**AS1289.6.4.2 (Note 4)**
failure criteria:	**Maximum principal effective stress ratio**		

material classification: *(CI/CH) SILTY CLAY - medium to high plasticity, mottled yellow brown, some fine to coarse sand, trace of fine gravel.*

note 1 : *Single Individual Undisturbed Specimen - (Multistage)*

note 2 : *Initial Specimen Dimensions (mm):- 95.1 x 49.5 (Dia) ; Initial Bar B response = 0.95*

note 3 : *Sample submitted by Client, sampled on the 18/03/15*



Type of Test: *Saturated, consolidated, undrained, with pore water measurements.*

Shear Stage Data

Stage	Strain Rate %/min	ε_f %	σ_3' kPa	σ_1' kPa	$(\sigma_1' + \sigma_3')/2$ kPa	$(\sigma_1' - \sigma_3')/2$ kPa	σ_1' / σ_3'	u_0 kPa	u_f kPa	$(\sigma_1 - \sigma_3)\phi$ kPa
1	0.0050	0.458	25.000	71.636	48.318	23.318	2.865	601.000	605.000	46.636
2	0.0050	0.873	41.000	117.193	79.097	38.097	2.858	601.000	619.000	76.193
3	0.0050	1.789	71.000	199.851	135.425	64.425	2.815	600.000	649.000	128.851

Consolidation Stage Data

Stage	$\Delta\sigma_3$ kPa	Drainage Condition
1	29.00	one end and radial boundary
2	59.00	one end and radial boundary
3	120.00	one end and radial boundary

Angle of Friction: 28.5 degrees

Cohesion: 0.1 kPa

Moisture Contents:

Initial:		Stage 1:	19.5 %
Final:	Top:		
	Middle:	Stage 3:	24.2 %
	Bottom:		

Initial Dry Density: 1.63 t/m3

Initial Wet Density: 1.95 t/m3

GLEN TRIAX 1 004 2010

NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/national standards.

Schedule 2.2 (a)(ii) [redacted]

Authorised Signature: Schedule 2.2 (a)(ii) [redacted] 11/04/2015

1208

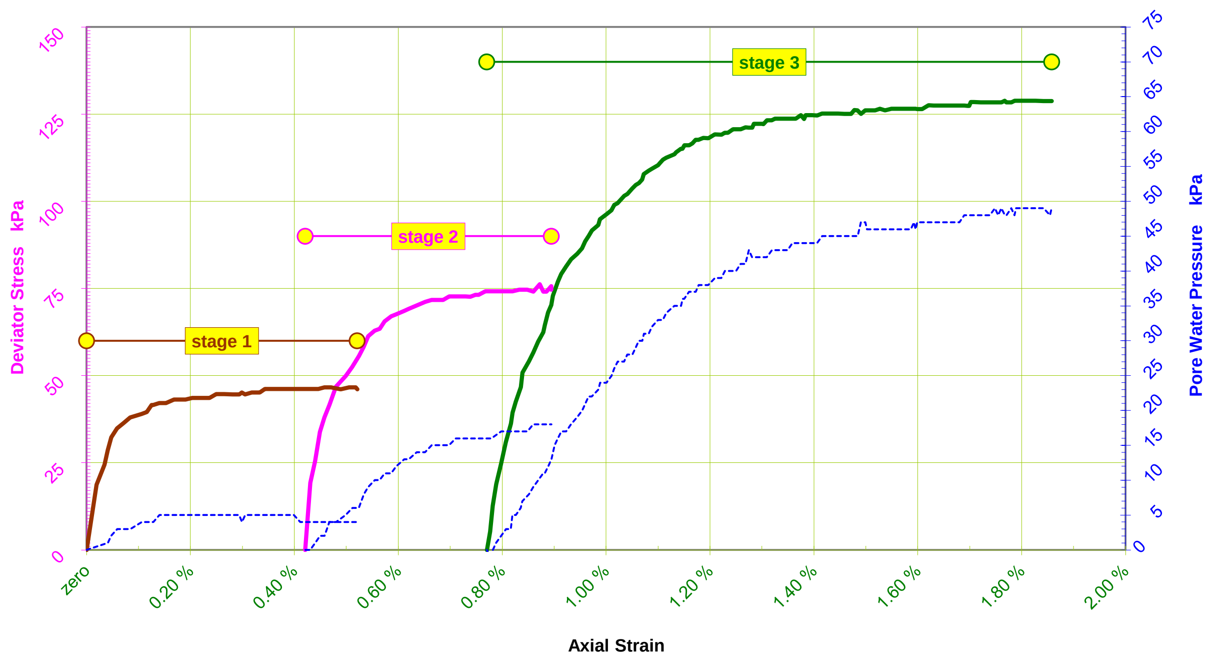
coffey

47-49 Carlotta Street Artarmon NSW 2064
T : (61 2) 9437 0137 Fax: (61 2) 9437 0191
ABN 92 114 364 046

triaxial shear test: stress - strain plots

client :	*SMEC TESTING SERVICES P/L*	job no :	*INFOARTA01336AA*
principal :		date :	*11 April 2015*
project :	*STS NO.16309/5442C*	report number:	*IOLT 8470*
location :	*Site No.3002402, Isabella Weir*	laboratory number:	*ARTA145-00160*
Sample number:	***Sample #1, Test Pit No.3 (1.50 to 1.80 m)***	Test Method :	***AS1289.6.4.2 (Note 4)***
Failure Criteria:	***Maximum principal effective stress ratio***		

Material Classification: *(CI/CH) SILTY CLAY - medium to high plasticity, mottled yellow brown, some fine to coarse sand, trace of fine gravel.*
note 1 : *Single Individual Undisturbed Specimen - (Multistage)*
note 2 : *Initial Specimen Dimensions (mm):- 95.1 x 49.5 (Dia) ; Initial Bar B response = 0.95*
note 3 : *Sample submitted by Client, sampled on the 18/03/15*



Type of Test: *Saturated, consolidated, undrained, with pore water measurements.*

Shear Stage Data

Stage	Strain Rate %/min	ε_f %	σ_3' kPa	u_0 kPa	u_f kPa	$(\sigma_1 - \sigma_3)\phi$ kPa
1	*0.0050*	*0.458*	*25.000*	*601.000*	*605.000*	*46.636*
2	*0.0050*	*0.873*	*41.000*	*601.000*	*619.000*	*76.193*
3	*0.0050*	*1.789*	*71.000*	*600.000*	*649.000*	*128.851*

Back Pressure: *600.0 kPa*

Cell Pressure(s):

Stage 1:	*630.0 kPa*
Stage 2:	*660.0 kPa*
Stage 3:	*720.0 kPa*

Consolidation Stage Data

Stage	$\Delta\sigma_3$ kPa	Drainage Condition
1	*29.00*	*one end and radial boundary*
2	*59.00*	*one end and radial boundary*
3	*120.00*	*one end and radial boundary*

Angle of Friction: ***28.5*** *degrees*
Cohesion: ***0.1*** *kPa*

GLEN TRIAX 2 004 2010

Moisture Contents:

Initial:	*Stage 1:*	*19.5 %*	
Final: Top:			
Middle:	*Stage 3:*		*24.2 %*
Bottom:			

Initial Dry Density: *1.63 t/m3*
Initial Wet Density: *1.95 t/m3*

NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/national standards

Schedule 2.2 (a)(ii) [redacted]

Authorised Signature: Schedule 2.2 (a)(ii) 11/04/2015

Coffey Testing Pty Ltd
47-49 Carlotta Street, Artarmon, NSW 2064
ph: (61 2) 9437 0137 Fax: (61 2) 9437 0191
ABN: 92 114 364 046

test results - pinhole dispersion

client:	***SMEC TESTING SERVICES P/L***	job number:	***INFOARTA01236AA***
principal:			
project:	***STS No. 16309/5442C***	laboratory:	***Artarmon***
		report date:	***11 April 2015***
location:	***Site No.3002402 - Isabella Weir***	Report No.	***IOLT 8472***
test procedure:	**AS1289.3.8.3**	test date:	***11 April 2015***

Sample Identification	***Sample #1, Test Pit No.3 (1.50 to 1.80 m)*** ***ARTA15S-00160***
CLASSIFICATION	
Designation	***D1***
Description	***Highly Dispersive***
BEFORE TEST	
Moisture Content (as received) %	***19.5***
Dry Density (as received) t/m3	***1.63***
Time of Curing	***2 days***
Source of Water	***Distilled***
Material Description	***(CI/CH) SILTY CLAY - medium to high plasticity, mottled yellow brown, some fine to coarse sand, trace of fine gravel.***

remarks: *1. Specimen tested 'as received' Wet Density and 'as received' Moisture Content* *2.*
Sample received from Client, sampled on the 18/03/15

GLEN-PINHOLE-RPT-002-2013

F:\INFO\01. Laboratory\01 - INFOLCOV Jobs\INFOARTA 01336AA - ISABELLA WEIR\[TP3_1.5-1.80_Pinhole.xls]report 1

NATA
ACCREDITED FOR TECHNICAL

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/national

NATA Accredited Laboratory
No 431
Approved Signatory: Schedule 2.2 (a)(ii) [redacted]
Schedule 2.2 (a)(ii) [redacted]
Associate/Laboratory Manager

47-49 Carlotta Street Artarmon NSW 2064
T : (61 2) 9437 0137 Fax: (61 2) 9437 0191
ABN 92 114 364 046

triaxial shear test: shear path & Mohr circle plot

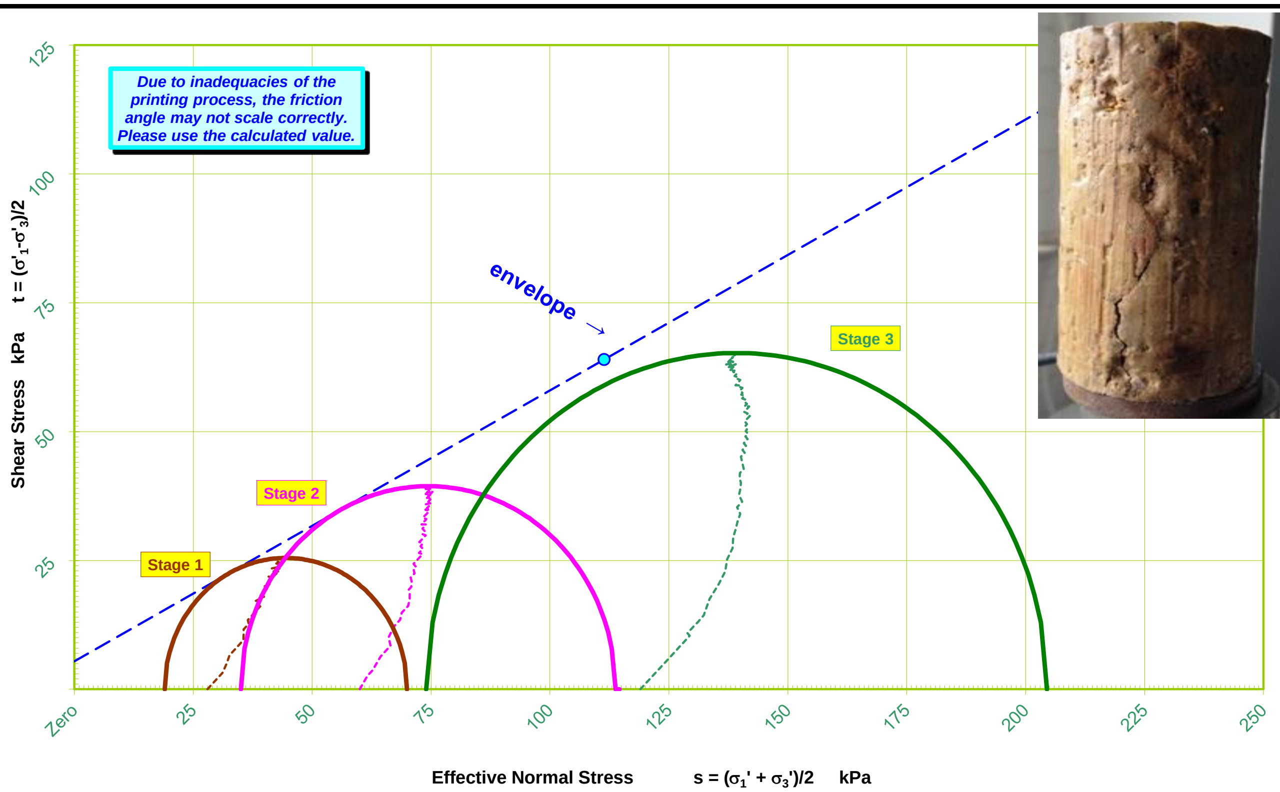
client :	SMEC TESTING SERVICES P/L	job no :	INFOARTA01336AA
principal :		date :	11 April 2015
project :	STS NO.16309/5442C	report number:	IOLT 8471
location :	Site No.3002402, Isabella Weir	laboratory number:	ARTA145-00161
Sample number:	Sample #8, Test Pit No.6 (1.60 to 1.95 m)	Test Method :	AS1289.6.4.2 (Note 4)
failure criteria:	Maximum principal effective stress ratio		

material classification: *(CI/CH) SILTY CLAY - medium to high plasticity, mottled yellow brown, some fine to coarse sand, trace of fine gravel.*

note 1 : *Single Individual Undisturbed Specimen - (Multistage)*

note 2 : *Initial Specimen Dimensions (mm):- 95.2 x 49.2 (Dia) ; Initial Bar B response = 0.95*

note 3 : *Sample submitted by Client, sampled on the 18/03/15*



Type of Test: *Saturated, consolidated, undrained, with pore water measurements.*

Shear Stage Data

Stage	Strain Rate %/min	ε_f %	σ_3' kPa	σ_1' kPa	$(\sigma_1' + \sigma_3')/2$ kPa	$(\sigma_1' - \sigma_3')/2$ kPa	σ1' / σ3'	u_0 kPa	u_f kPa	$(\sigma_1 - \sigma_3)\phi$ kPa
1	0.0050	0.591	19.000	69.953	44.476	25.476	3.682	602.000	611.000	50.953
2	0.0050	1.388	35.000	113.799	74.400	39.400	3.251	600.000	625.000	78.799
3	0.0050	2.416	74.000	204.473	139.237	65.237	2.763	601.000	646.000	130.473

Consolidation Stage Data

Stage	$\Delta\sigma_3$ kPa	Drainage Condition
1	28.00	one end and radial boundary
2	60.00	one end and radial boundary
3	119.00	one end and radial boundary

Angle of Friction: 27.5 degrees

Cohesion: 5.4 kPa

GLEN TRIAX 1 004 2010

Moisture Contents:

Initial:		Stage 1:	21.6 %
Final:	Top:		
	Middle:	Stage 3:	23.9 %
	Bottom:		

Initial Dry Density: 1.57 t/m3

Initial Wet Density: 1.91 t/m3

Schedule 2.2 (a)(ii) [redacted]

Authorised Signature: Schedule 2.2 (a)(ii) [redacted] 11/04/2015

1211

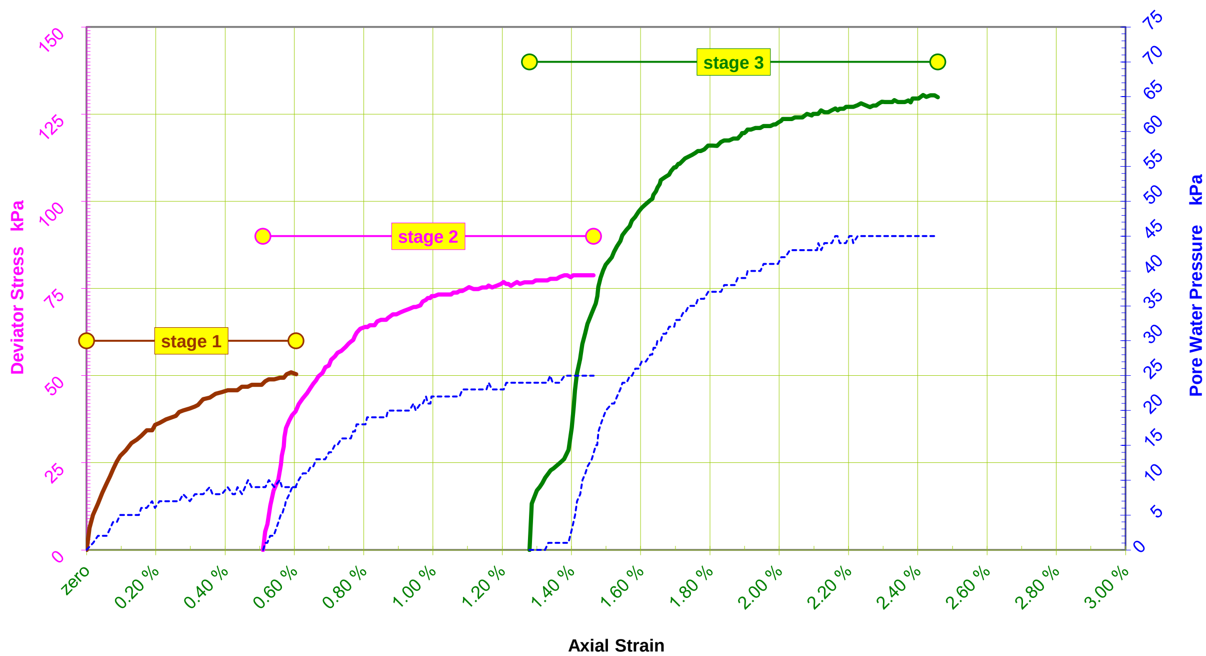
coffey

47-49 Carlotta Street Artarmon NSW 2064
T : (61 2) 9437 0137 Fax: (61 2) 9437 0191
ABN 92 114 364 046

triaxial shear test: stress - strain plots

client :	*SMEC TESTING SERVICES P/L*	job no :	*INFOARTA01336AA*
principal :		date :	*11 April 2015*
project :	*STS NO.16309/5442C*	report number:	*IOLT 8471*
location :	*Site No.3002402, Isabella Weir*	laboratory number:	*ARTA145-00161*
Sample number:	***Sample #8, Test Pit No.6 (1.60 to 1.95 m)***	Test Method :	***AS1289.6.4.2 (Note 4)***
Failure Criteria:	***Maximum principal effective stress ratio***		

Material Classification: *(CI/CH) SILTY CLAY - medium to high plasticity, mottled yellow brown, some fine to coarse sand, trace of fine gravel.*
note 1 : *Single Individual Undisturbed Specimen - (Multistage)*
note 2 : *Initial Specimen Dimensions (mm):- 95.2 x 49.2 (Dia) ; Initial Bar B response = 0.95*
note 3 : *Sample submitted by Client, sampled on the 18/03/15*



Type of Test: *Saturated, consolidated, undrained, with pore water measurements.*

Shear Stage Data

Stage	Strain Rate %/min	ε_f %	σ_3' kPa	u_0 kPa	u_f kPa	$(\sigma_1 - \sigma_3)\phi$ kPa
1	*0.0050*	*0.591*	*19.000*	*602.000*	*611.000*	*50.953*
2	*0.0050*	*1.388*	*35.000*	*600.000*	*625.000*	*78.799*
3	*0.0050*	*2.416*	*74.000*	*601.000*	*646.000*	*130.473*

Back Pressure: *600.0 kPa*

Cell Pressure(s):

Stage 1:	*630.0 kPa*
Stage 2:	*660.0 kPa*
Stage 3:	*720.0 kPa*

Consolidation Stage Data

Stage	$\Delta\sigma_3$ kPa	Drainage Condition
1	*28.00*	*one end and radial boundary*
2	*60.00*	*one end and radial boundary*
3	*119.00*	*one end and radial boundary*

Angle of Friction: ***27.5*** *degrees*
Cohesion: ***5.4*** *kPa*

GLEN TRIAX 2 004 2010

Moisture Contents:

Initial:		*Stage 1:*	*21.6 %*
Final:	**Top:**		
	Middle:	*Stage 3:*	*23.9 %*
	Bottom:		

Initial Dry Density: *1.57 t/m3*
Initial Wet Density: *1.91 t/m3*

Schedule 2.2 (a)(ii) [redacted]

Authorised Signature: Schedule 2.2 (a)(ii) [redacted] 11/04/2015

Coffey Testing Pty Ltd
47-49 Carlotta Street, Artarmon, NSW 2064
ph: (61 2) 9437 0137 Fax: (61 2) 9437 0191
ABN: 92 114 364 046

test results - pinhole dispersion

client:	***SMEC TESTING SERVICES P/L***	job number:	***INFOARTA01236AA***
principal:			
project:	***STS No. 16309/5442C***	laboratory:	***Artarmon***
		report date:	***11 April 2015***
location:	***Site No.3002402 - Isabella Weir***	Report No.	***IOLT 8473***
test procedure:	**AS1289.3.8.3**	test date:	***11 April 2015***

Sample Identification	***Sample #8, Test Pit No.6 (1.60 to 1.95 m)*** ***ARTA15S-00161***
CLASSIFICATION	
Designation	***D1***
Description	***Highly Dispersive***
BEFORE TEST	
Moisture Content (as received) %	***21.6***
Dry Density (as received) t/m3	***1.57***
Time of Curing	***2 days***
Source of Water	***Distilled***
Material Description	***(CI/CH) SILTY CLAY - medium to high plasticity, mottled yellow brown, some fine to coarse sand, trace of fine gravel.***

remarks: *1. Specimen tested 'as received' Wet Density and 'as received' Moisture Content* *2.*
Sample received from Client, sampled on the 18/03/15

GLEN-PINHOLE-RPT-002-2013

F:\INFO\01. Laboratory\01 - INFOLCOV Jobs\INFOARTA 01336AA - ISABELLA WEIR\[TP06_1.60-1.95_Pinhole.xls]report 1

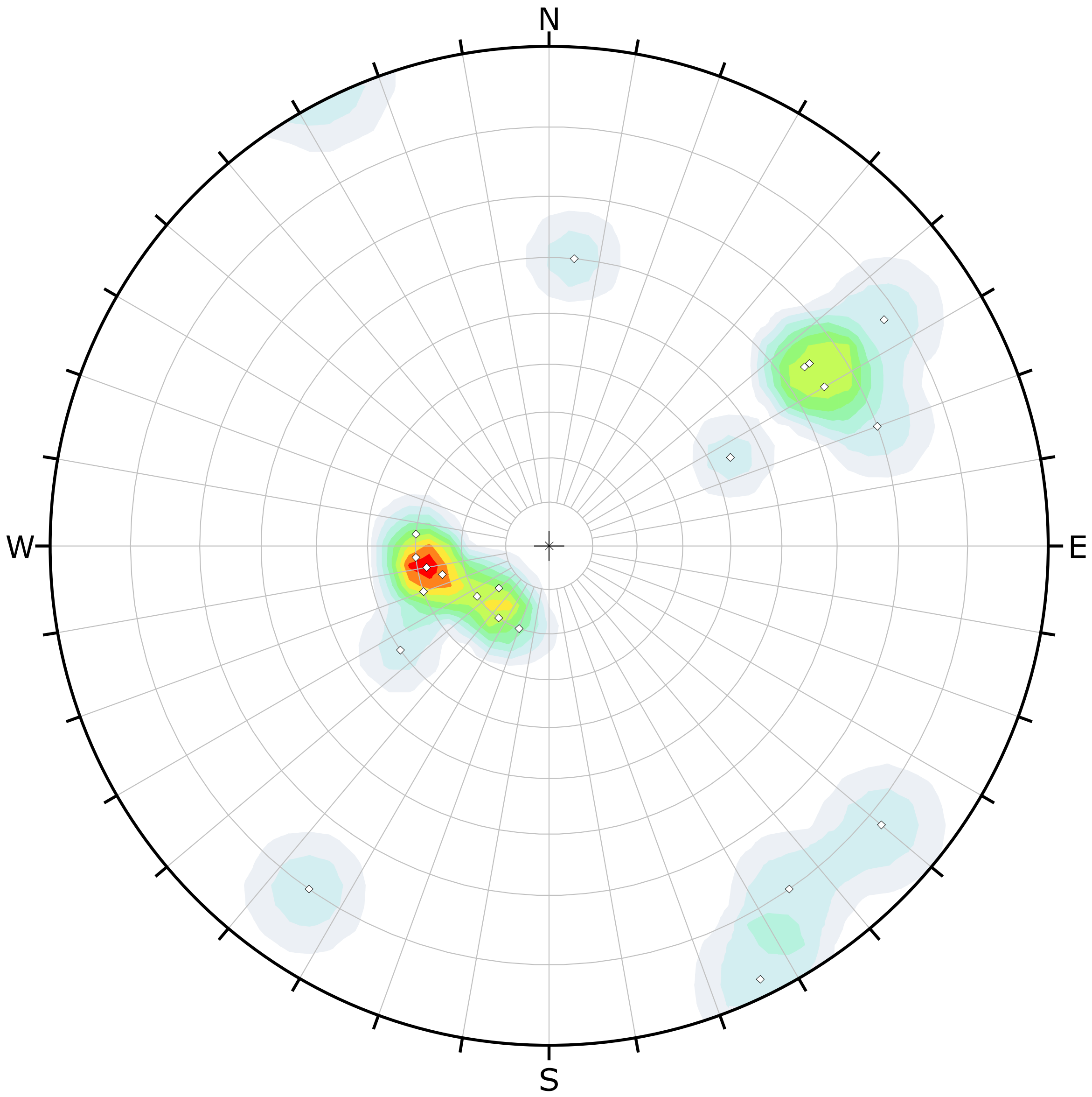
NATA
ACCREDITED FOR TECHNICAL

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/national

NATA Accredited Laboratory
No 431
Approved Signatory: Schedule 2.2 (a)(ii) [redacted]
Schedule 2.2 (a)(ii) [redacted]
Associate/Laboratory Manager

APPENDIX 4.02: SMEC STEREONET POLE PLOTS, 2015

1214



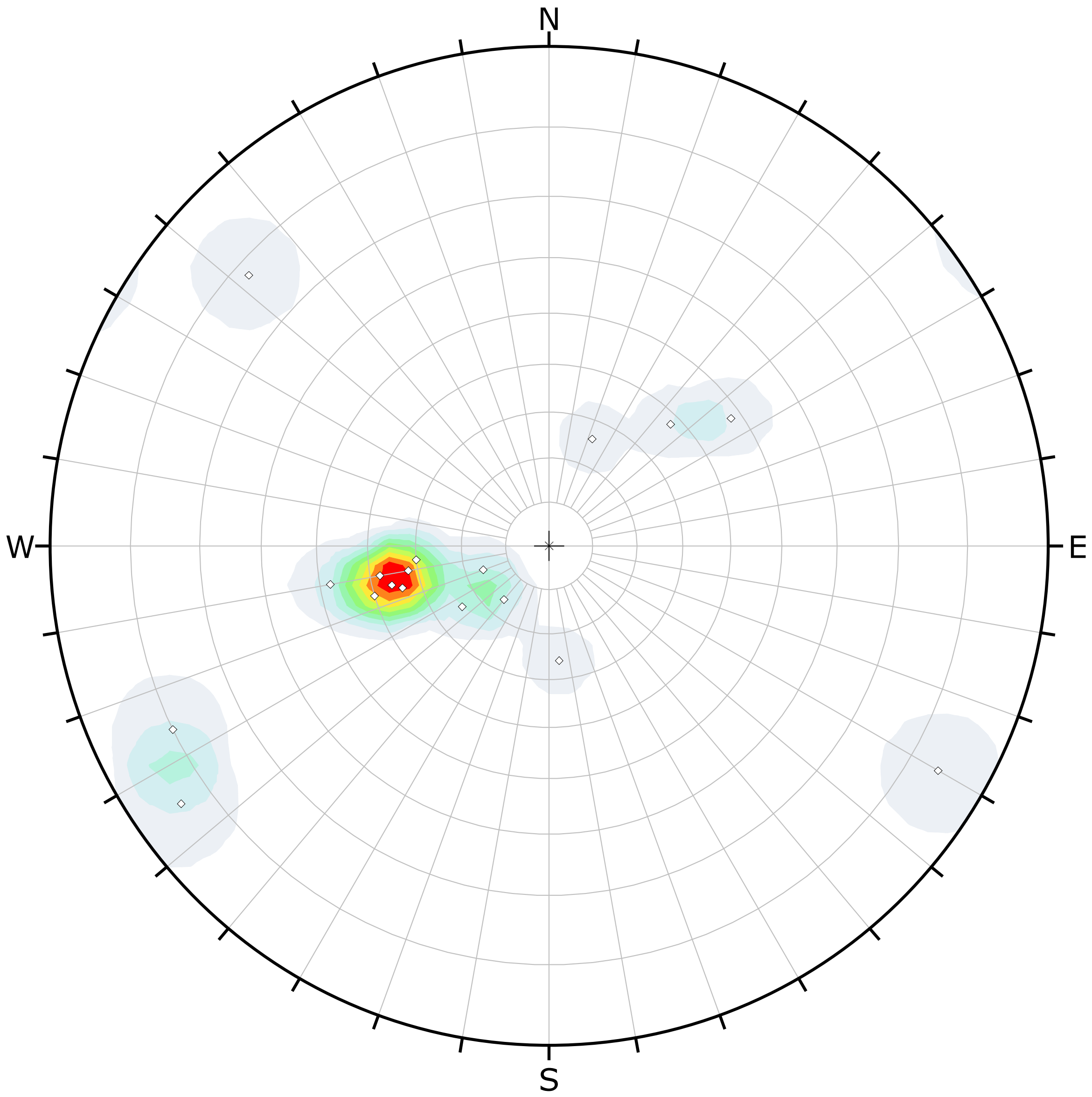
Symbol	Feature
◇	Pole Vectors

Color	Density Concentrations
	0.00 - 2.10
	2.10 - 4.20
	4.20 - 6.30
	6.30 - 8.40
	8.40 - 10.50
	10.50 - 12.60
	12.60 - 14.70
	14.70 - 16.80
	16.80 - 18.90
	18.90 - 21.00

Maximum Density	20.94%
Contour Data	Pole Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	21 (21 Entries)
Hemisphere	Lower
Projection	Equal Angle

1215



Symbol	Feature
◇	Pole Vectors

Color	Density Concentrations
	0.00 - 3.00
	3.00 - 6.00
	6.00 - 9.00
	9.00 - 12.00
	12.00 - 15.00
	15.00 - 18.00
	18.00 - 21.00
	21.00 - 24.00
	24.00 - 27.00
	27.00 - 30.00

Maximum Density	29.67%
Contour Data	Pole Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

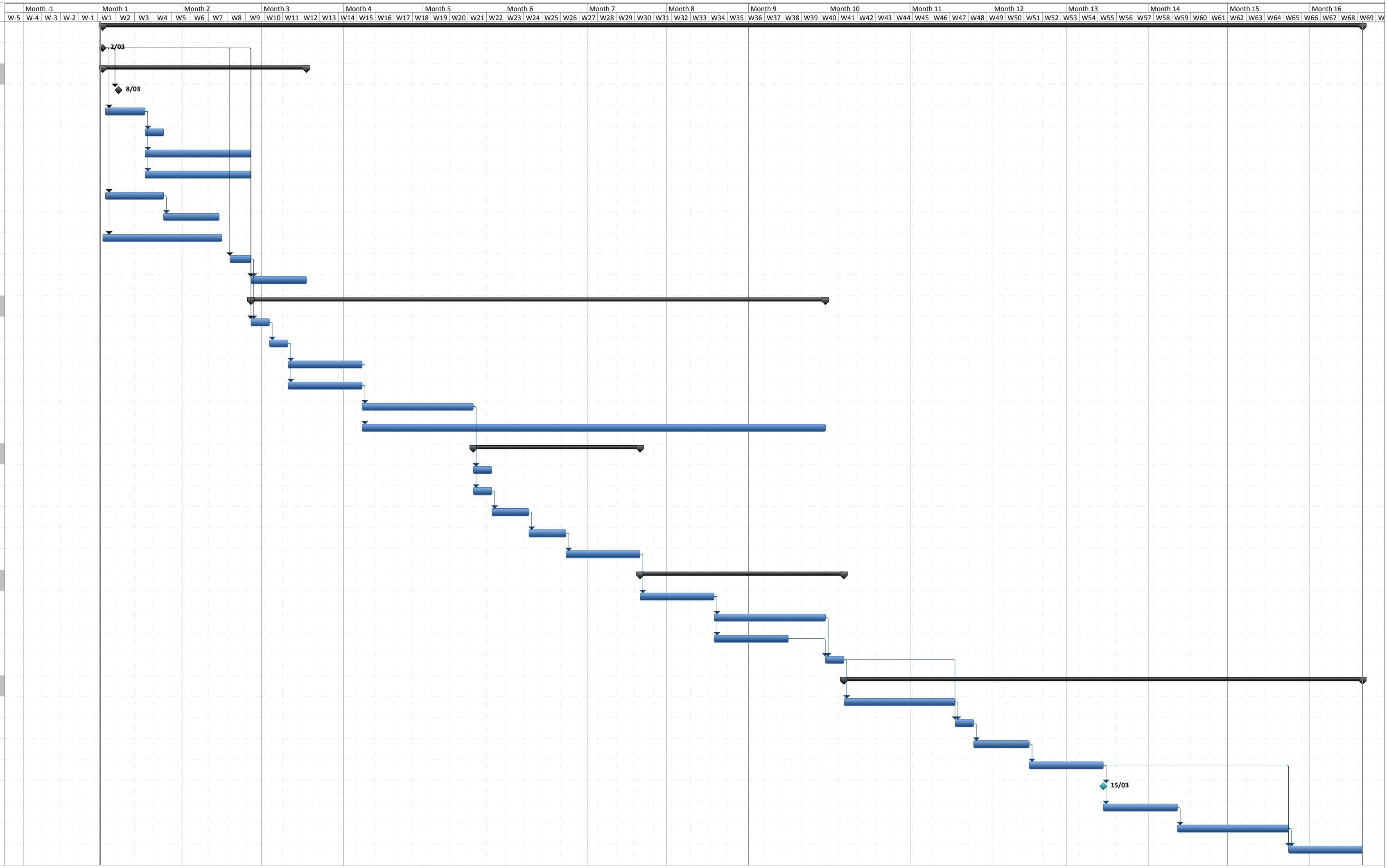
Plot Mode	Pole Vectors
Vector Count	18 (18 Entries)
Hemisphere	Lower
Projection	Equal Angle

APPENDIX E PRELIMINARY CONSTRUCTION PROGRAMME

1217

SMEC

ID	Task Name	Duration
1	**Isabella Weir Upgrade Works**	**340 days**
2	Contract Award	0 days
3	**Preliminaries**	**55 days**
4	Design Workshop	0 days
5	CEMP	11 days
6	Review of CEMP	5 days
7	Lake Draining Permit	28 days
8	Waterway Works Licence	28 days
9	Prepare DSEP	16 days
10	Approval to DSEP	15 days
11	Temporary works design and approval	33 days
12	Mobilization and Site Preparation	6 days
13	Clearing of site	15 days
14	**Left Abutment Construction**	**155 days**
15	Drain the head pond	1 wk
16	Cut slots in existing weir connector walls for temporary diversion	1 wk
17	Excavate for Left Abutment Works	4 wks
18	Construct upstream and downstream levees - Left Abutment	4 wks
19	Construct new Left Abutment concrete works including wing walls	6 wks
20	Construct cutoff walls and embankments	25 wks
21	**Demolition and Temporary Diversion**	**45 days**
22	Demolish existing concrete abutment return wall	1 wk
23	Demolish existing abutment walls and counterfort walls	1 wk
24	Construct temporary diversion channel through gap in left side of weir	2 wks
25	Divert inflows to temporary left side channel	2 wks
26	Construct upstream and downstream levees - Right Abutment	4 wks
27	**Right Abutment Construction**	**55 days**
28	Excavate for Right Abutment Works	4 wks
29	Construct new Right Abutment concrete works including wing walls	6 wks
30	Construct labyrinth weir sill slabs on Right Side	4 wks
31	Transfer diversion to new right side sill slab	1 wk
32	**Completion and Reestablishment**	**140 days**
33	Complete left side Spillway Works and new Outlet Works	6 wks
34	Divert flows through new Outlet Works	1 wk
35	Complete remaining right side spillway weir walls	3 wks
36	Remove temporary works	4 wks
37	Construction Complete	0 days
38	Refill Pond	4 wks
39	Preparation of construction report and approval by designer	6 wks
40	Demobilize and Reinstate site and surrounding areas	4 wks



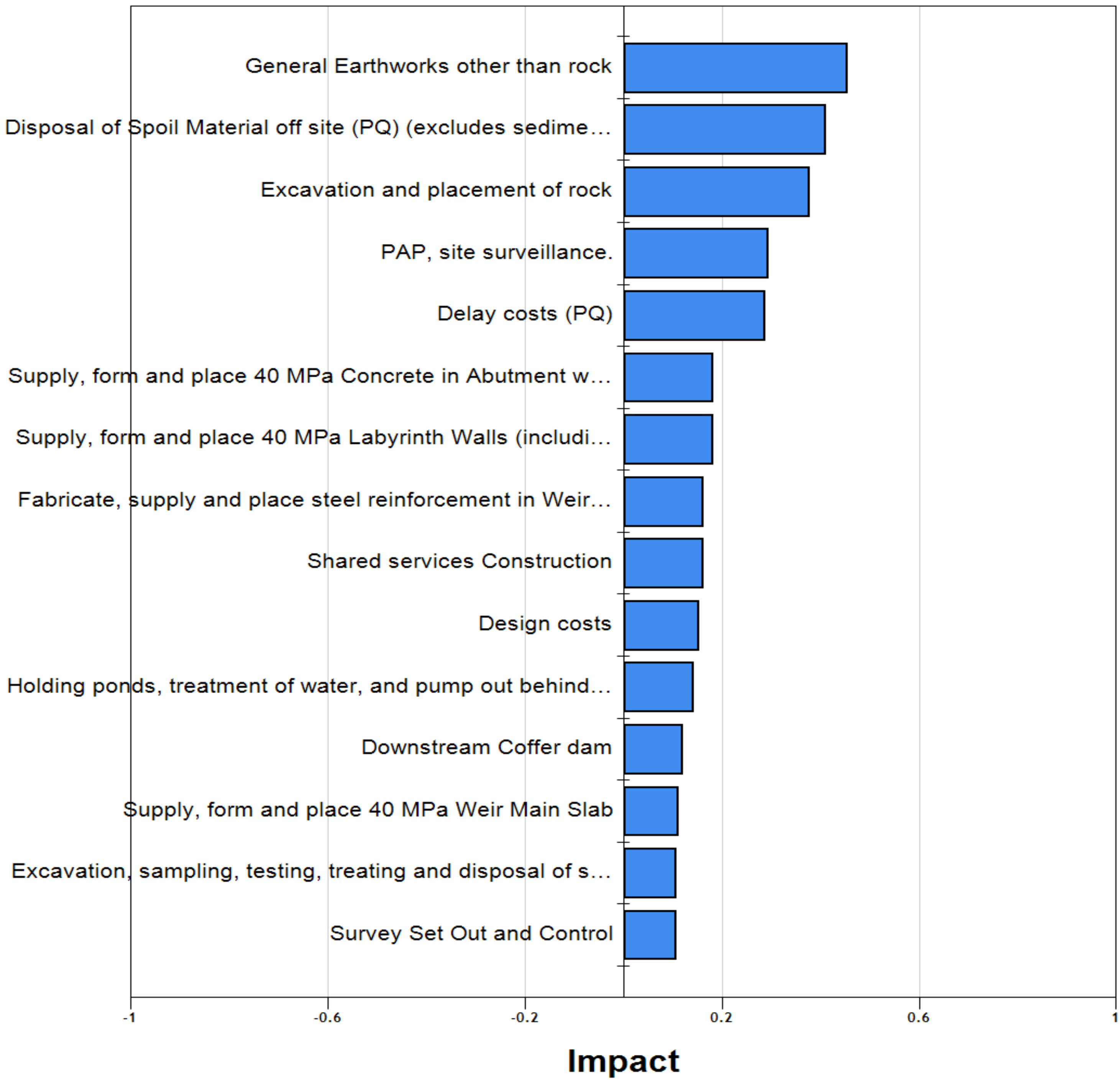
APPENDIX F CONSTRUCTION COST ESTIMATE

1219

Tornado

Printed: **Wednesday, February 24, 2016**
Count iteration: **10000**

Project: **Isabella Weir Cost Estimate FSP Report 24 Feb 2016**



Listing

Project: **Wednesday, February 24, 2016**

Project: **Isabella Weir Cost Estimate FSP Report 24 Feb 2016**

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
Construction Environmental Management Plan	Item	1.00	1.00	1.00	$10,000.00	$30,000.00	$50,000.00
Site Establishment including contractor and PAP facilities, compound, and fencing	Item	1.00	1.00	1.00	$200,000.00	$250,000.00	$300,000.00
Survey Set Out and Control	Item	1.00	1.00	1.00	$200,000.00	$250,000.00	$300,000.00
Coordination with Utility Authorities	item	1.00	1.00	1.00	$18,000.00	$20,000.00	$25,000.00
Project Signs	No	5.00	6.00	8.00	$1,200.00	$1,500.00	$2,000.00
Work-As-Executed Quality Records & Drawings	Item	1.00	1.00	1.00	$15,000.00	$20,000.00	$40,000.00
Construction Report	Item	1.00	1.00	1.00	$30,000.00	$40,000.00	$60,000.00
Protection of over head power cables	Item	1.00	1.00	1.00	$8,000.00	$10,000.00	$15,000.00
Relocation of gas mains	Item	1.00	1.00	1.00	$400,000.00	$450,000.00	$500,000.00
Relocation of Telstra conduits and cables	Item	1.00	1.00	1.00	$28,000.00	$30,000.00	$35,000.00
Protection of Sewer Mains	Item	1.00	1.00	1.00	$15,000.00	$25,000.00	$40,000.00
Provision for unanticipated finds (PS)	Item	1.00	1.00	1.00	$2,000.00	$10,000.00	$20,000.00
Provision for species relocations as required by Environmental Specialist (PS)	Item	1.00	1.00	1.00	$5,000.00	$10,000.00	$20,000.00
Waterway Works Licence	Item	1.00	1.00	1.00	$5,000.00	$5,000.00	$10,000.00
Draining Lake Licence	Item	1.00	1.00	1.00	$5,000.00	$5,000.00	$10,000.00
Monitoring of water quality after rainfall event (25mm within 24hrs or greater)	Item	1.00	1.00	1.00	$0.00	$10,000.00	$20,000.00
Installation of groundwater monitoring borehole (PS)	Item	1.00	1.00	1.00	$0.00	$5,000.00	$10,000.00
Audit Testing (PS)	Item	1.00	1.00	1.00	$10,000.00	$15,000.00	$25,000.00
Geotechnical Engineer advice during construction	Item	1.00	1.00	1.00	$80,000.00	$100,000.00	$150,000.00
Removal of asbestos	Tonne	0.00	20.00	100.00	$150.00	$150.00	$250.00

Group : **Preliminaries**

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
(PQ)							
Delay costs (PQ)	Day	0.00	20.00	50.00	$2,500.00	$5,000.00	$7,000.00
Dam Safety Emergency Plan	Item	1.00	1.00	1.00	$35,000.00	$50,000.00	$75,000.00

Group : **Traffic**

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
Establish including tracks	Item	1.00	1.00	1.00	$20,000.00	$40,000.00	$60,000.00
Remove	Item	1.00	1.00	1.00	$5,000.00	$10,000.00	$20,000.00
Maintenance	wk	40.00	60.00	80.00	$400.00	$500.00	$700.00

Group : **Earthworks**

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
Upstream Coffer dam	Item	1.00	1.00	1.00	$110,000.00	$125,000.00	$150,000.00
Downstream Coffer dam	Item	1.00	1.00	1.00	$50,000.00	$100,000.00	$150,000.00
Coffer dams removal	Item	1.00	1.00	1.00	$0.00	$60,000.00	$100,000.00
Clearing and Grubbing	ha	2.00	4.00	6.00	$4,000.00	$5,000.00	$7,000.00
Removal of Nominated Trees	Each	65.00	70.00	80.00	$90.00	$100.00	$120.00
Removal and stockpiling of topsoil	m3	400.00	600.00	800.00	$12.00	$15.00	$18.00
Holding ponds, treatment of water, and pump out behind cofferdams	Item	1.00	1.00	1.00	$75,000.00	$100,000.00	$200,000.00
Relocate flow gauge	Item	1.00	1.00	1.00	$15,000.00	$20,000.00	$30,000.00
Excavation and placement of rock	m3	4,500.00	4,650.00	6,000.00	$90.00	$100.00	$150.00
Excavation, sampling, testing, treating and disposal of sediment in Isabella Pond (PQ)	m3	0.00	1,000.00	1,200.00	$60.00	$75.00	$90.00
Disposal of Spoil Material off site (PQ) (excludes sediment)	m3	10,000.00	12,000.00	14,000.00	$20.00	$35.00	$50.00
Unsuitable Material (PQ)	m3	800.00	1,000.00	1,500.00	$40.00	$50.00	$60.00
Replacement of unsuitable with general fill (PQ)	m3	800.00	1,000.00	1,500.00	$30.00	$40.00	$50.00
General Earthworks other than rock	m3	12,000.00	13,000.00	15,000.00	$40.00	$50.00	$70.00
Slab	m3	15.00	15.00	15.00	$180.00	$200.00	$230.00
Walls	m3	370.00	370.00	370.00	$250.00	$300.00	$400.00
Labyrinth	m3	40.00	40.00	40.00	$250.00	$300.00	$400.00
Foundation Preparation including excavation, dental cleaning and concrete filling as directed by Geotechnical Engineer on site (PQ)	m2	1,200.00	1,500.00	2,000.00	$15.00	$20.00	$25.00
Drilling of grout holes (PQ)	lm	80.00	100.00	120.00	$100.00	$120.00	$150.00
Hook-up to grout holes (PQ)	No	18.00	20.00	25.00	$450.00	$500.00	$550.00
Grout Cap	lm	40.00	60.00	80.00	$250.00	$300.00	$400.00
Supply and install dental grout (PQ)	m3	75.00	100.00	200.00	$450.00	$500.00	$550.00
Supply and install concrete filling (PQ)	m3	75.00	100.00	200.00	$250.00	$300.00	$350.00
Extra over to 205P2 for Zone 1 - Condition, place and compact Clay Core material from	m3	4,500.00	5,000.00	6,000.00	$8.00	$10.00	$15.00

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
stock pile on site as detailed on drawings							
Extra over to 205P2 for Zone 1 - Supply, condition, place and compact Clay Core material imported on site as detailed on drawings (PQ)	m3	900.00	1,000.00	1,300.00	$20.00	$25.00	$35.00
Extra over to 205P2 for Zone 2 - Condition, place and compact general fill material from stock pile on site as detailed on drawings	m3	7,500.00	8,000.00	10,000.00	$8.00	$10.00	$15.00
Extra over to 205P2 for Zone 2 - Supply, condition, place and compact general fill material imported on site as detailed on drawings (PQ)	m3	900.00	1,000.00	1,300.00	$20.00	$25.00	$35.00
Extra over to 205P2 for Zone 5A fine filter material - Supply condition, place and compact fine filter material as detailed on drawings	m3	250.00	400.00	600.00	$20.00	$25.00	$35.00
Extra over to 205P2 for Zone 5B coarse filter material - Supply condition, place and compact fine filter material as detailed on drawings	m3	150.00	300.00	500.00	$20.00	$25.00	$35.00
Supply, place 20MPa mass concrete for backfilling diversion channel as detailed on drawings (PQ)	m3	100.00	130.00	160.00	$65.00	$71.00	$80.00

Group : **Underground services**

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
Removal of existing gas main and Telstra conduits	m	80.00	100.00	160.00	$80.00	$100.00	$120.00
150mm dia slotted pipe Subsoil drainage beneath embankment and trench as noted on drawing No 3002402-102 in location as directed by Geotechnical Engineer (PQ)	m	100.00	120.00	150.00	$180.00	$200.00	$220.00
Extra over the construction rate for 306P18 for filter sock to the slotted drain	m	100.00	120.00	150.00	$35.00	$40.00	$45.00
Flushing point in locations as directed by Geotechnical Engineer	No	8.00	10.00	15.00	$130.00	$150.00	$170.00
V Notch Headwall in locations as directed by Geotechnical Engineer	No	2.00	2.00	2.00	$800.00	$1,000.00	$1,500.00

Group : **Minor works, settlement**

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
Mower strips (200x200mm)	m	0.00	200.00	300.00	$65.00	$75.00	$90.00
3m wide 150mm thick reinforced concrete including base material (PS)	m2	200.00	250.00	350.00	$140.00	$150.00	$170.00
Mortared stone pitching (150mm thick) (PQ)	m2	180.00	200.00	250.00	$125.00	$150.00	$175.00
Supply, place and compact Rip Rap material as detailed on drawings	m3	200.00	250.00	300.00	$200.00	$220.00	$250.00
Survey settlement monuments on embankment as directed by Geotechnical Engineer	No	4.00	6.00	8.00	$1,800.00	$2,000.00	$2,200.00
Deep survey reference mark off embankment in locations as directed by Geotechnical Engineer	No	0.00	1.00	2.00	$2,000.00	$2,500.00	$3,000.00
Monitoring Borehole as directed by Geotechnical Engineer to include standard pipe Piezometer (PQ)	No	1.00	2.00	3.00	$1,800.00	$2,000.00	$2,200.00
Geotechnical advice for instrumentation within the embankment	item	1.00	1.00	1.00	$10,000.00	$15,000.00	$30,000.00

Group : **Major concrete**

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
Supply and place 15MPa blinding concrete (based on 50mm thick)	m3	75.00	85.00	95.00	$180.00	$200.00	$250.00
Supply, form and place 40 MPa Concrete in Abutment & Wing wall shear keys and base slabs	m3	290.00	310.00	350.00	$550.00	$600.00	$700.00
Fabricate, supply and place steel reinforcement in Abutment & Wing wall shear keys and base slabs (PQ)	T	65.00	74.00	80.00	$2,500.00	$3,000.00	$3,500.00
Supply, form and place 40 MPa Concrete in Wing walls	m3	50.00	55.00	60.00	$1,100.00	$1,250.00	$1,500.00
Fabricate, supply and place steel reinforcement in Wing walls (PQ)	T	3.00	4.00	4.00	$2,500.00	$3,000.00	$3,500.00
Supply, form and place 40 MPa Concrete in Cut-off walls	m3	210.00	250.00	250.00	$550.00	$600.00	$700.00
Fabricate, supply and place steel reinforcement in Cut-off walls (PQ)	T	45.00	60.00	65.00	$2,500.00	$3,000.00	$3,500.00
Supply, form and place 40 MPa Concrete in Abutment walls	m3	330.00	360.00	400.00	$1,100.00	$1,250.00	$1,500.00
Fabricate, supply and place steel reinforcement in Abutment walls (PQ)	T	70.00	80.00	90.00	$2,500.00	$3,000.00	$3,500.00
Supply, form and place 40 MPa Weir Main Slab	m3	580.00	620.00	650.00	$550.00	$600.00	$700.00
Fabricate, supply and place steel reinforcement in Weir Main slab (incl. drilled & epoxied starters)(PQ)	T	140.00	150.00	160.00	$2,500.00	$3,000.00	$3,500.00
Supply, form and place 40 MPa Labyrinth Walls (including return walls)	m3	380.00	400.00	420.00	$1,100.00	$1,250.00	$1,500.00
Fabricate, supply and place steel reinforcement in Labyrinth walls (incl return walls) (PQ)	T	80.00	87.00	95.00	$2,500.00	$3,000.00	$3,500.00
Supply, form and place 40 MPa Abutment Return & end walls	m3	35.00	40.00	45.00	$1,100.00	$1,250.00	$1,500.00
Fabricate, supply and place steel reinforcement in Abutment Return & end walls (PQ)	T	8.00	10.00	12.00	$2,500.00	$3,000.00	$3,500.00

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
Supply, form and place 40 MPa Infill walls	m3	25.00	28.00	35.00	$1,100.00	$1,250.00	$1,500.00
Fabricate, supply and place steel reinforcement in Infill walls (PQ)	T	5.00	6.00	7.00	$2,500.00	$3,000.00	$3,500.00
Supply Galv'd steel Dowel Bars	No	210.00	220.00	230.00	$75.00	$80.00	$90.00
Supply and place 80mm dia slotted pressure relief pipes encased in 300x200mm of no-fines concrete	m	80.00	85.00	95.00	$190.00	$200.00	$220.00
Supply and place all aggregate and epoxy bed for aeration nib at top of new Labyrinth walls	Item	1.00	1.00	1.00	$15,000.00	$20,000.00	$30,000.00
Supply and install suitable galv'd steel handrails/balustrades	m	190.00	200.00	230.00	$190.00	$200.00	$230.00
Supply and install waterstop seals and sealants	Item	1.00	1.00	1.00	$20,000.00	$25,000.00	$30,000.00

1229

Group : **Outlet works**

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
Fabrication, supply and construction of 450 mm dia outlet pipe	Item	1.00	1.00	1.00	$4,700.00	$5,000.00	$5,500.00
Supply and installation of all valves, fittings for the outlet works	Item	1.00	1.00	1.00	$28,000.00	$30,000.00	$35,000.00
Fabrication, supply and installation of trashracks	Item	0.00	0.00	0.00	$4,000.00	$5,000.00	$8,000.00
Fabrication, supply and istallation of access platforms, railing, fencing	Item	1.00	1.00	1.00	$5,000.00	$10,000.00	$15,000.00
Testing and commissioning and handover to TAMS	Item	1.00	1.00	1.00	$20,000.00	$25,000.00	$30,000.00
Operation and maintenance manuals	Item	1.00	1.00	1.00	$8,000.00	$10,000.00	$12,000.00
Supply and install safety equipment and signage	Item	1.00	1.00	1.00	$8,000.00	$10,000.00	$12,000.00

Group : **Owners Costs**

Item	Unit	Q BC	Quantity	Q WC	R BC	Rate	R WC
PAP, site surveillance.	Item	1.00	1.00	1.00	$700,000.00	$800,000.00	$1,000,000.00
Communications management	Item	1.00	1.00	1.00	$75,000.00	$100,000.00	$125,000.00
PCW Design	Item	1.00	1.00	1.00	$17,000.00	$20,000.00	$25,000.00
Insurance	Item	1.00	1.00	1.00	$90,000.00	$100,000.00	$150,000.00
Shared Services Design	Item	1.00	1.00	1.00	$35,000.00	$40,000.00	$50,000.00
Design costs	Item	1.00	1.00	1.00	$1,250,000.00	$1,300,000.00	$1,400,000.00
PCW Construction	Item	1.00	1.00	1.00	$180,000.00	$200,000.00	$220,000.00
Shared services Construction	Item	1.00	1.00	1.00	$550,000.00	$600,000.00	$700,000.00

1231

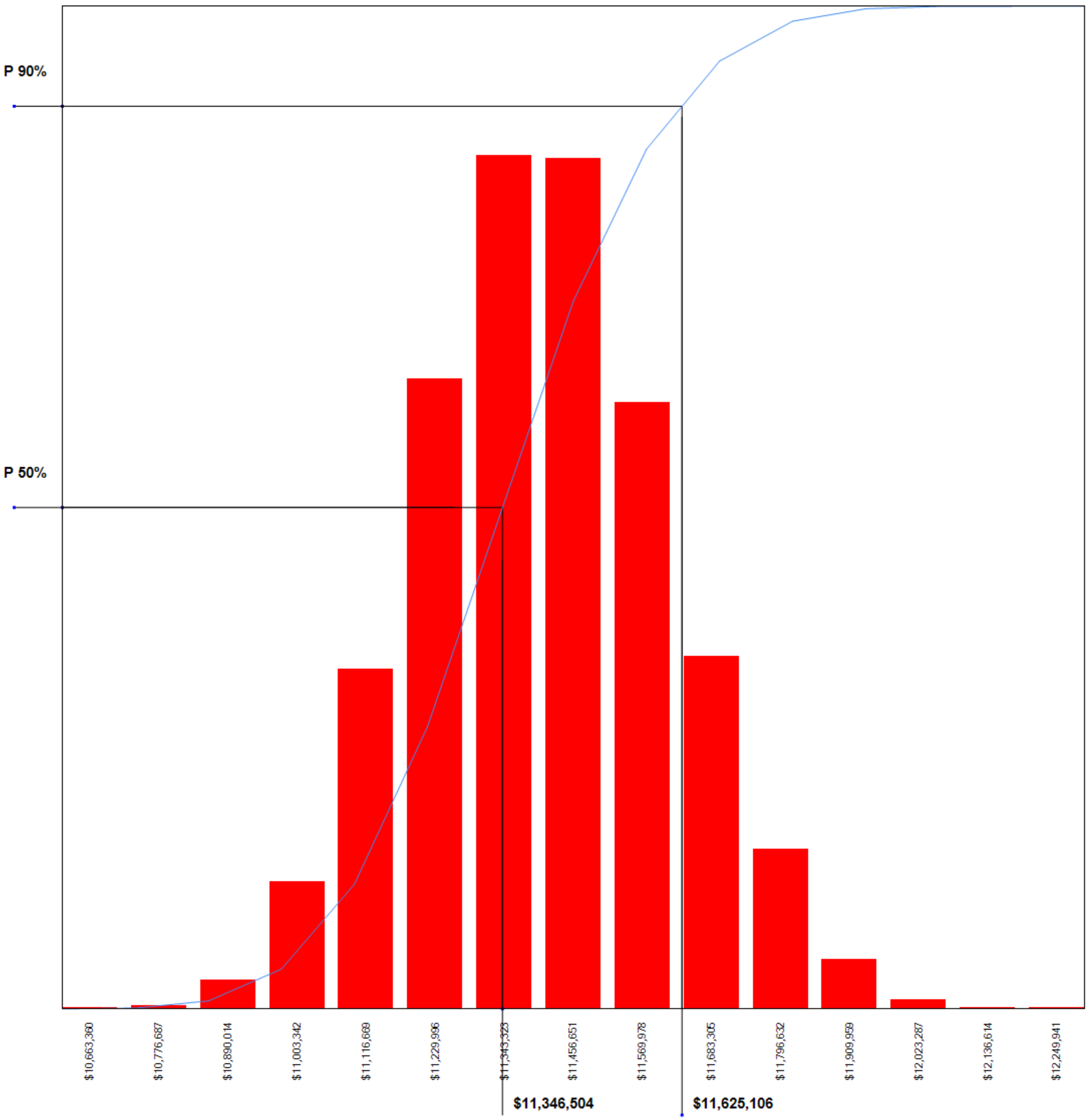
SMEC

Histogram

Printed: **Wednesday, February 24, 2016**

Count iteration: **10000**

Project: **Isabella Weir Cost Estimate FSP Report 24 Feb 2016**



Total of Most Likely values: $10,975,380
P50 Inherent contingency: $371,124
P90 Inherent contingency: $649,726

APPENDIX G RISK REGISTER

By Responsible Person Report

RiskTools

Filter Information:		Date of Report:	**1/11/2015**
Project Type:		Project Status:	**Active**
Project:	**SMEC Isabella Weir Project**		
Project Group:			
Project Manager:			
Risk Area:	**All**	Status:	**All**
Risk Category:	**All**	Risk Profile:	**All**
Risk Question:	**All**		

Risk Name	**Notes**	**Initial Likelihood / Impact** **Risk Treatments**	**Current Likelihood / Impact** **Due Date / Resource Notes**	**Cost**

Responsible Person: **SMEC**

Risk Area = Demolition

Category = D1

1 complexity of anchor design and construction increases length of the work on site increasing the risk of flooding the worksite and associated risks.		Likely / Moderate	Likely / Moderate	
☐ Standard Treatment?	☐ Completed?	review the design to investigate opportunities to simplify the construction process.	31/12/2015	$0

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost
2 complexity of permanent concrete works significantly increases time on site leading to flooding and associated risks		Likely / Moderate	Unlikely / Moderate	
Standard Treatment?	Completed?	review the design to investigate opportunities to optimise the construction process.	31/12/2015 possible low level outlet pipe during co	$0
3 during a flood event equipment is not able to be moved out of working area in time and serious damage to equipment occurs.		Unlikely / Minor	Unlikely / Minor	
Standard Treatment?	Completed?	SMEC to investigate alternatives which eliminate flow from the site.	31/12/2015	$0
4 exposure to flash flooding greater than 60 cum/s before the new abutment walls are complete result in serious injury or death.		Rare / Severe	Rare / Severe	
Standard Treatment?	Completed?	SMEC to further develop the 3D construction sequence model to be used to gain a better understanding of the process and to be used for the tender process.	31/12/2105	$0
5 failure of cofferdam leads to sudden influx of water causing serious injury or death.		Unlikely / Severe	Unlikely / Severe	
Standard Treatment?	Completed?	identify specific high risk temporary works to highlight in tender documents.	31/12/2015	$0
6 personnel are not able to be evacuated in time during a flood leading to serious injury or death.	flood below 60 cu/ms	Rare / Severe	Rare / Severe	

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost
☐ Standard Treatment?	☐ Completed?	SMEC to investigate alternatives which eliminate flow from the site.	31/12/2015	$0
7 the construction workers or the public become sick due to the proximity of the sediment.	including impact of high winds	Possible / Major	Unlikely / Major	
☐ Standard Treatment?	☐ Completed?	incorporate all measures in relation to handling and moving of sediment to be included in the CEMP. A draft CEMP to be developed during the design phase to confirm feasibility.	31/12/2015	$0
8 the demolition/excavation process causes undetected weakening of to the existing remaining structure.	would lead to collapse in the future.	Possible / Major	Unlikely / Major	
☐ Standard Treatment?	☐ Completed?	determine and recommend vibration limits and monitor during construction.	31/12/2015	$0
9 the demolition/excavation weakens the remaining structure once the abutments are removed causing it to collapse during a flood.		Unlikely / Severe	Rare / Severe	
☐ Standard Treatment?	☐ Completed?	determine and recommend vibration limits and monitor during construction.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	detailed structural analysis of the wall as soon as the site is drained.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	inspection of the exposed structure and foundations as soon as possible to confirm design assumptions.	31/12/2015	$0

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost
☐ Standard Treatment?	☐ Completed?	conduct an analysis of the abutmentand labrynths wall in current condition and estimate strength with backfill removed.	15/12/2015	$0
10 there is a confined space access incident leading to serious injury or death during both construction and operations phases.		Unlikely / Major	Rare / Major	
☐ Standard Treatment?	☐ Completed?	the design and construction of the value chamber to be developed and reviewed in consultation with the dam operator and identify it as a confined space to the operator and identify this in the O&M manual.	31/12/2015	$0

RiskTools

Risk Treatment priority Report

Filter Information:

Date of Report: **1/11/2015**

Project Type:

Project Status: **Active**

Project: **SMEC Isabella Weir Project**

Project Group:

Project Manager:

Risk Area: **All**

Status: **All**

Risk Category: **All**

Risk Profile: **All**

Risk Question: **All**

Note: Only Analysed Risk Items / Treatments are listed.

# of	Risk Treatment / Risk Name	Responsible	Risk Profile
7	*Client to investigate ECI style of contract to achieve contractor input into construction solution.*		
	complexity of anchor design and construction increases length of the work on site increasing the risk of flooding the worksite and associated risks.	Client	Significant Risk
	complexity of permanent concrete works significantly increases time on site leading to flooding and associated risks	Client	Moderate Risk
	during a flood event equipment is not able to be moved out of working area in time and serious damage to equipment occurs.	Client	Low Risk
	exposure to flash flooding greater than 60 cum/s before the new abutment walls are complete result in serious injury or death.	Client	Significant Risk
	items that cannot be identified until the water is drained have a significant impact on the scope required to complete the works and extend the duration which leads to compressed timeframe resulting or serious injury.	Client	Significant Risk
	personnel are not able to be evacuated in time during a flood leading to serious injury or death.	Client	Significant Risk
	the tight program will lead to increased safety risks due to requirement to work more quickly leading to serious injury or death.	Client	Significant Risk
3	*Contract requirement for evacuation plans to be provided prior to work commences.*		
	during a flood event equipment is not able to be moved out of working area in time and serious damage to equipment occurs.	Client	Low Risk
	exposure to flash flooding greater than 60 cum/s before the new abutment walls are complete result in serious injury or death.	Client	Significant Risk
	personnel are not able to be evacuated in time during a flood leading to serious injury or death.	Client	Significant Risk
2	*Client to ensure the Contractor follows the established ACT Government WHS protocols including workers having appropriate qualifications.*		
	an overhead power cable is struck leading to serious injury or death	Client	Significant Risk
	there is a confined space access incident leading to serious injury or death during both construction and operations phases.	Client	Significant Risk
2	*Client to review skills and expertise of certifier and include in the tender documents the right to require the engagement of an alternative certifier.*		
	a construction worker falls from a height leading to serious injury or death.	Client	High Risk
	failure of formwork during construction leads to serious injury.	Client	High Risk
2	*conduct first site sampling as soon as dam has been drained.*		

Filter Information: Date of Report: **1/11/2015**

Project Type: Project Status: **Active**

Project: **SMEC Isabella Weir Project**

Project Group:

Project Manager:

Risk Area: **All** Status: **All**

Risk Category: **All** Risk Profile: **All**

Risk Question: **All**

Note: Only Analysed Risk Items / Treatments are listed.

# of Risk Treatment

Risk Name	Responsible	Risk Profile
either a construction worker or a member of the public is exposed to asbestos before it is identified.	Client	Low Risk
the construction workers or the public become sick due to the proximity of the sediment.	Client	Significant Risk
2 determine and recommend vibration limits and monitor during construction.		
the demolition/excavation process causes undetected weakening of to the existing remaining structure.	SMEC	Significant Risk
the demolition/excavation weakens the remaining structure once the abutments are removed causing it to collapse during a flood.	SMEC	Significant Risk
2 develop sampling program for construction works to include in contractor scope of works.		
either a construction worker or a member of the public is exposed to asbestos before it is identified.	Client	Low Risk
the construction workers or the public become sick due to the proximity of the sediment.	Client	Significant Risk
2 If ECI is not used require the tenderers to submit a detailed methodology and weight safety aspects of methodology highly in the tender evaluation.		
exposure to flash flooding greater than 60 cum/s before the new abutment walls are complete result in serious injury or death.	Client	Significant Risk
personnel are not able to be evacuated in time during a flood leading to serious injury or death.	Client	Significant Risk
2 include the vibration limits within the statement of requirements in the tender documets.		
the demolition/excavation process causes undetected weakening of to the existing remaining structure.	Client	Significant Risk
the demolition/excavation weakens the remaining structure once the abutments are removed causing it to collapse during a flood.	Client	Significant Risk
2 SMEC to investigate alternatives which eliminate flow from the site.		
during a flood event equipment is not able to be moved out of working area in time and serious damage to equipment occurs.	SMEC	Low Risk
personnel are not able to be evacuated in time during a flood leading to serious injury or death.	SMEC	Significant Risk

RiskTools

By Responsible Person Report

RiskTools

Filter Information:

Date of Report: **1/11/2015**

Project Type:

Project Status: **Active**

Project: **SMEC Isabella Weir Project**

Project Group:

Project Manager:

Risk Area: **All**

Status: **All**

Risk Category: **All**

Risk Profile: **All**

Risk Question: **All**

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost

Responsible Person: **Client**

Risk Area = Demolition

Category = D1

1 a construction worker falls from a height leading to serious injury or death.		Possible / Severe	Possible / Severe	
☐ Standard Treatment?	☐ Completed?	Client to ensure the Contractor follows the established ACT Government WHS protocols including workers having working from heights qualifications.	31/12/2015	$0

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost
☐ Standard Treatment?	☐ Completed?	Client to review skills and expertise of certifier and include in the tender documents the right to require the engagement of an alternative certifier.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	construct safety barriers at the top of any exposed embankments. Include this requirement in the tender documents.	31/12/2015	$0
2 a maintenance contractor has an incident where a item of machinery enters the water.		Rare / Major	Rare / Major	
☐ Standard Treatment?	☐ Completed?	the interface design to consider creating a buffer between maintanance activities and permanent water zones.	31/12/2015	$0
3 an overhead power cable is struck leading to serious injury or death		Possible / Severe	Rare / Severe	
☐ Standard Treatment?	☐ Completed?	Client to ensure the Contractor follows the established ACT Government WHS protocols including workers having appropriate qualifications.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	fence off power line, and require access permits to enter within the fenced area. Include this requirement in the tender documents.	31/12/2015	$0
4 complexity of anchor design and construction increases length of the work on site increasing the risk of flooding the worksite and associated risks.		Likely / Moderate	Likely / Moderate	
☐ Standard Treatment?	☐ Completed?	Client to investigate ECI style of contract to achieve contractor input into construction solution.	31/12/2015	$0

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost
5 complexity of permanent concrete works significantly increases time on site leading to flooding and associated risks		Likely / Moderate	Unlikely / Moderate	
☐ Standard Treatment?	☐ Completed?	Client to investigate ECI style of contract to achieve contractor input into construction solution.	31/12/2015	$0
6 during a flood event equipment is not able to be moved out of working area in time and serious damage to equipment occurs.		Unlikely / Minor	Unlikely / Minor	
☐ Standard Treatment?	☐ Completed?	Client to investigate ECI style of contract to achieve contractor input into construction solution.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	Contract requirement for evacuation plans to be provided prior to work commences.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	If ECI is not used require the tenderers should be required to submit a detailed methodology and weight safety aspects of methodology highly in the tender evaluation.	31/12/2015	$0
7 either a construction worker or a member of the public is exposed to asbestos before it is identified.		Possible / Minor	Unlikely / Minor	
☐ Standard Treatment?	☐ Completed?	conduct first site sampling as soon as dam has been drained.	31/12/2015 including ACM	$0
☐ Standard Treatment?	☐ Completed?	undertake desktop search of historic records	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	develop sampling program for construction works to include in contractor scope of works.	31/12/2015 for ACM	$0

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost
☐ Standard Treatment?	☐ Completed?	develop unexpected finds protocol.	31/12/2015	$0
8 exposure to flash flooding greater than 60 cum/s before the new abutment walls are complete result in serious injury or death.		Rare / Severe	Rare / Severe	
☐ Standard Treatment?	☐ Completed?	Client to investigate ECI style of contract to achieve contractor input into construction solution.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	Contract requirement for evacuation plans to be provided prior to work commences.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	If ECI is not used require the tenderers to submit a detailed methodology and weight safety aspects of methodology highly in the tender evaluation.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	Consider additional protection for the period whilst the new abutment wall are bieng constructed.	31/12/2015	$0
9 failure of cofferdam leads to sudden influx of water causing serious injury or death.		Unlikely / Severe	Unlikely / Severe	
☐ Standard Treatment?	☐ Completed?	ensure all temporary works are designed to meet the dam regulator and highlight in tender docs.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	include independent inspection regime to monitor quality of temporary works.	31/12/2015	$0
10 failure of formwork during construction leads to serious injury.		Possible / Severe	Unlikely / Severe	

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost
☐ Standard Treatment?	☐ Completed?	Client to review skills and expertise of certifier and include in the tender documents the right to require the engagement of an alternative certifier.	31/12/2015	$0
11 items that cannot be identified until the water is drained have a significant impact on the scope required to complete the works and extend the duration which leads to compressed timeframe resulting or serious injury.		Possible / Major	Possible / Moderate	
☐ Standard Treatment?	☐ Completed?	develop a response action plan for a range of scenarios and possible solutions and include the capability for those solutions to be delivered. Include scenarios within the tender response requirements.	31/12/2015 including securing any approvals.	$0
☐ Standard Treatment?	☐ Completed?	Client to investigate ECI style of contract to achieve contractor input into construction solution.	31/12/2015	$0
12 personnel are not able to be evacuated in time during a flood leading to serious injury or death.	flood below 60 cu/ms	Rare / Severe	Rare / Severe	
☐ Standard Treatment?	☐ Completed?	Client to investigate ECI style of contract to achieve contractor input into construction solution.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	Contract requirement for evacuation plans to be provided prior to work commences.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	If ECI is not used require the tenderers to submit a detailed methodology and weight safety aspects of methodology highly in the tender evaluation.	31/12/2015	$0
13 post completion a member of the public is injured adjacent to the works.		Possible / Major	Possible / Major	

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost
☐ Standard Treatment?	☐ Completed?	install signage and handrails to meet the requirements of the new asset owner (TAMS) and seek sign-off of the complete design by TAMS.	31/12/2015	$0
14 the construction workers or the public become sick due to the proximity of the sediment.	including impact of high winds	Possible / Major	Unlikely / Major	
☐ Standard Treatment?	☐ Completed?	communicate findings or sampling already undertaken and confirm it meets requirements.	31/12/2015 contractors, stakeholders and statutor	$0
☐ Standard Treatment?	☐ Completed?	develop sampling program for construction works to include in contractor scope of works.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	conduct first site sampling as soon as dam has been drained.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	identify appropriate stockpile sites including routes from work site to stockpiling locations and include specific requirements in tender documents.	31/12/2015	$0
☐ Standard Treatment?	☐ Completed?	develop plan to prevent public access to high risk areas.	31/12/2015 including sediment	$0
15 the demolition/excavation process causes undetected weakening of to the existing remaining structure.	would lead to collapse in the future.	Possible / Major	Unlikely / Major	
☐ Standard Treatment?	☐ Completed?	include the vibration limits within the statement of requirements in the tender documets.	31/12/2015	$0
16 the demolition/excavation weakens the remaining structure once the abutments are removed causing it to collapse during a flood.		Unlikely / Severe	Rare / Severe	

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost
Standard Treatment?	Completed?	include the vibration limits within the statement of requirements in the tender documets.	31/12/2015	$0
17 the tight program will lead to increased safety risks due to requirement to work more quickly leading to serious injury or death.	multiple activies within a confined area	Unlikely / Major	Unlikely / Major	
Standard Treatment?	Completed?	Client to investigate ECI style of contract to achieve contractor input into construction solution.	31/12/2015	$0
Standard Treatment?	Completed?	Review opportunities for pre-site activities and include a requirement for tenderers to address this in their methodology response in the tender.	31/12/2015	$0
Standard Treatment?	Completed?	closely manage the program including all preparatory activities that can be undertaken prior to contractor engagement.	31/12/2015	$0
Standard Treatment?	Completed?	refine client construction sequence proposal to assist/guide tenderers.	31/12/2015	$0
Standard Treatment?	Completed?	coordinate the program with the wetlands project to prevent reduced time available to undertake the construction.	31/12/2015	$0
18 there is a confined space access incident leading to serious injury or death during both construction and operations phases.		Unlikely / Major	Rare / Major	
Standard Treatment?	Completed?	Client to ensure the Contractor follows the established ACT Government WHS protocols including workers having appropriate qualifications.	31/12/2015	$0

Risk Name	Notes	Initial Likelihood / Impact Risk Treatments	Current Likelihood / Impact Due Date / Resource Notes	Cost
☐ Standard Treatment?	☐ Completed?	Identify the value chamber as a confined space (in the tender documents)once it is completed and testing is underway.	31/12/2015	$0

RiskTools

All Risks Summary Report

Filter Information:

Date of Report: **1/11/2015**

Project Status: **Active**

Project Type:

Project: **SMEC Isabella Weir Project**

Project Group:

Project Manager:

Risk Area: **All**

Status: **All**

Risk Category: **All**

Risk Profile: **All**

Risk Question: **All**

Open Risk

Area and Category Risk Name	Initial Risk Rating	Current Risk Rating

Risk Area: ***Demolition***

Risk Category: ***D1***

1 **a construction worker falls from a height leading to serious injury or death.**	**High Risk**	**High Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
Client to review skills and expertise of certifier and include in the tender documents the right to require the engagement of an alternative certifier.	Client	31/12/2015	☐
construct safety barriers at the top of any exposed embankments. Include this requirement in the tender documents.	Client	31/12/2015	☐
Client to ensure the Contractor follows the established ACT Government WHS protocols including workers having working from heights qualifications.	Client	31/12/2015	☐

Open Risk

Area and Category Risk Name	Initial Risk Rating	Current Risk Rating

2 failure of cofferdam leads to sudden influx of water causing serious injury or death. — **High Risk** — **High Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
identify specific high risk temporary works to highlight in tender documents.	SMEC	31/12/2015	☐
ensure all temporary works are designed to meet the dam regulator and highlight in tender docs.	Client	31/12/2015	☐
include independent inspection regime to monitor quality of temporary works.	Client	31/12/2015	☐

3 failure of formwork during construction leads to serious injury. — **High Risk** — **High Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
Client to review skills and expertise of certifier and include in the tender documents the right to require the engagement of an alternative certifier.	Client	31/12/2015	☐

4 post completion a member of the public is injured adjacent to the works. — **High Risk** — **High Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
install signage and handrails to meet the requirements of the new asset owner (TAMS) and seek sign-off of the complete design by TAMS.	Client	31/12/2015	☐

Risk Area: ***Demolition***

Risk Category: ***D1***

5 a maintenance contractor has an incident where a item of machinery enters the water. — **Significant Risk** — **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
the interface design to consider creating a buffer between maintanance activities and permanent water zones.	Client	31/12/2015	☐

Open Risk

Area and Category / Risk Name	Initial Risk Rating	Current Risk Rating

6 an overhead power cable is struck leading to serious injury or death — Initial: **High Risk** — Current: **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
Client to ensure the Contractor follows the established ACT Government WHS protocols including workers having appropriate qualifications.	Client	31/12/2015	☐
fence off power line, and require access permits to enter within the fenced area. Include this requirement in the tender documents.	Client	31/12/2015	☐

7 complexity of anchor design and construction increases length of the work on site increasing the risk of flooding the worksite and associated risks. — Initial: **Significant Risk** — Current: **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
Client to investigate ECI style of contract to achieve contractor input into construction solution.	Client	31/12/2015	☐
review the design to investigate opportunities to simplify the construction process.	SMEC	31/12/2015	☐

8 exposure to flash flooding greater than 60 cum/s before the new abutment walls are complete result in serious injury or death. — Initial: **Significant Risk** — Current: **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
Contract requirement for evacuation plans to be provided prior to work commences.	Client	31/12/2015	☐
If ECI is not used require the tenderers to submit a detailed methodology and weight safety aspects of methodology highly in the tender evaluation.	Client	31/12/2015	☐
Consider additional protection for the period whilst the new abutment wall are bieng constructed.	Client	31/12/2015	☐
Client to investigate ECI style of contract to achieve contractor input into construction solution.	Client	31/12/2015	☐
SMEC to further develop the 3D construction sequence model to be used to gain a better understanding of the process and to be used for the tender process.	SMEC	31/12/2105	☐

Open Risk

Area and Category / Risk Name	Initial Risk Rating	Current Risk Rating

9 **items that cannot be identified until the water is drained have a significant impact on the scope required to complete the works and extend the duration which leads to compressed timeframe resulting or serious injury.** — Initial: **High Risk** — Current: **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
Client to investigate ECI style of contract to achieve contractor input into construction solution.	Client	31/12/2015	☐
develop a response action plan for a range of scenarios and possible solutions and include the capability for those solutions to be delivered. Include scenarios within the tender response requirements.	Client	31/12/2015	☐

10 **personnel are not able to be evacuated in time during a flood leading to serious injury or death.** — Initial: **Significant Risk** — Current: **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
SMEC to investigate alternatives which eliminate flow from the site.	SMEC	31/12/2015	☐
If ECI is not used require the tenderers to submit a detailed methodology and weight safety aspects of methodology highly in the tender evaluation.	Client	31/12/2015	☐
Contract requirement for evacuation plans to be provided prior to work commences.	Client	31/12/2015	☐
Client to investigate ECI style of contract to achieve contractor input into construction solution.	Client	31/12/2015	☐

11 **the construction workers or the public become sick due to the proximity of the sediment.** — Initial: **High Risk** — Current: **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
identify appropriate stockpile sites including routes from work site to stockpiling locations and include specific requirements in tender documents.	Client	31/12/2015	☐
communicate findings or sampling already undertaken and confirm it meets requirements.	Client	31/12/2015	☐
develop plan to prevent public access to high risk areas.	Client	31/12/2015	☐
incorporate all measures in relation to handling and moving of sediment to be included in the CEMP. A draft CEMP to be developed during the design phase to confirm feasibility.	SMEC	31/12/2015	☐
conduct first site sampling as soon as dam has been drained.	Client	31/12/2015	☐
develop sampling program for construction works to include in contractor scope of works.	Client	31/12/2015	☐

Open Risk

Area and Category Risk Name	Initial Risk Rating	Current Risk Rating

12 the demolition/excavation process causes undetected weakening of to the existing remaining structure. — Initial: **High Risk** — Current: **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
include the vibration limits within the statement of requirements in the tender documets.	Client	31/12/2015	☐
determine and recommend vibration limits and monitor during construction.	SMEC	31/12/2015	☐

13 the demolition/excavation weakens the remaining structure once the abutments are removed causing it to collapse during a flood. — Initial: **High Risk** — Current: **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
conduct an analysis of the abutmentand labrynths wall in current condition and estimate strength with backfill removed.	SMEC	15/12/2015	☐
determine and recommend vibration limits and monitor during construction.	SMEC	31/12/2015	☐
include the vibration limits within the statement of requirements in the tender documets.	Client	31/12/2015	☐
detailed structural analysis of the wall as soon as the site is drained.	SMEC	31/12/2015	☐
inspection of the exposed structure and foundations as soon as possible to confirm design assumptions.	SMEC	31/12/2015	☐

14 the tight program will lead to increased safety risks due to requirement to work more quickly leading to serious injury or death. — Initial: **Significant Risk** — Current: **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
refine client construction sequence proposal to assist/guide tenderers.	Client	31/12/2015	☐
coordinate the program with the wetlands project to prevent reduced time available to undertake the construction.	Client	31/12/2015	☐
closely manage the program including all preparatory activities that can be undertaken prior to contractor engagement.	Client	31/12/2015	☐
Review opportunities for pre-site activities and include a requirement for tenderers to address this in their methodology response in the tender.	Client	31/12/2015	☐
Client to investigate ECI style of contract to achieve contractor input into construction solution.	Client	31/12/2015	☐

Open Risk

Area and Category / Risk Name	Initial Risk Rating	Current Risk Rating

15 **there is a confined space access incident leading to serious injury or death during both construction and operations phases.** — **Significant Risk** — **Significant Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
Client to ensure the Contractor follows the established ACT Government WHS protocols including workers having appropriate qualifications.	Client	31/12/2015	☐
the design and construction of the value chamber to be developed and reviewed in consultation with the dam operator and identify it as a confined space to the operator and identify this in the O&M manual.	SMEC	31/12/2015	☐
Identify the value chamber as a confined space (in the tender documents)once it is completed and testing is underway.	Client	31/12/2015	☐

Risk Area: ***Demolition***

Risk Category: ***D1***

16 **complexity of permanent concrete works significantly increases time on site leading to flooding and associated risks** — **Significant Risk** — **Moderate Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
Client to investigate ECI style of contract to achieve contractor input into construction solution.	Client	31/12/2015	☐
review the design to investigate opportunities to optimise the construction process.	SMEC	31/12/2015	☐

Risk Area: ***Demolition***

Risk Category: ***D1***

17 **during a flood event equipment is not able to be moved out of working area in time and serious damage to equipment occurs.** — **Low Risk** — **Low Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
SMEC to investigate alternatives which eliminate flow from the site.	SMEC	31/12/2015	☐
If ECI is not used require the tenderers should be required to submit a detailed methodology and weight safety aspects of methodology highly in the tender evaluation.	Client	31/12/2015	☐
Contract requirement for evacuation plans to be provided prior to work commences.	Client	31/12/2015	☐
Client to investigate ECI style of contract to achieve contractor input into construction solution.	Client	31/12/2015	☐

Open Risk

Area and Category Risk Name	Initial Risk Rating	Current Risk Rating
18 **either a construction worker or a member of the public is exposed to asbestos before it is identified.**	**Moderate Risk**	**Low Risk**

Risk Treatment(s):	Responsible Person	Due Date	Completed
conduct first site sampling as soon as dam has been drained.	Client	31/12/2015	☐
undertake desktop search of historic records	Client	31/12/2015	☐
develop unexpected finds protocol.	Client	31/12/2015	☐
develop sampling program for construction works to include in contractor scope of works.	Client	31/12/2015	☐

1254

SMEC

Project No/
Business Unit:

Risk Identification			Risk Analysis				Risk Evaluation		Risk Treatment						Risk Monitoring				
Source of Risk	Identified Risks / Hazards (opportunities & threats)	Leading to . . .	Possible Causes of Identified Risk / Hazard	Existing Controls of Identified Risk / Hazard (If any)	Likelihood (1 - 5)	Consequence (1 - 5)	Risk Rating	Risk Priority	Treatments / Actions	Responsibility	Timing	Residual Likelihood (1 - 5)	Residual Consequence (1 - 5)	Residual Risk Rating	Date Monitored	Monitored by	Risk Mgt Action implemented? Yes / No	Risk Mgt Action effective? Yes / No	Comments
Demolition	A construction worker falls from a height	Serious injury or death.			3	5	15		Client to review skills and expertise of certifier and include in the tender documents the right to require the engagement of an alternative certifier. Construct safety barriers at the top of any exposed embankments. Include this requirement in the tender documents. Client to ensure the contractor follows the established ACT Government WHS protocols including workers having working from heights qualifications.	PCW	1/06/2016	3	5	15	8/12/2015	SMEC PM	No		Include in register of special contract provisions
Demolition/construction	Failure of cofferdam	sudden influx of water causing serious injury or death.		Design to current standards	4	3	12		Identify specific high risk temporary works to highlight in tender documents. Ensure all temporary works are designed to meet the dam regulator and highlight in tender documents. Include independent inspection/certification regime to monitor quality of temporary works.	SMEC PCW PCW	1/06/2016	2	3	6	8/12/2015	SMEC PM	No		
Construction	Failure of formwork during construction	Serious injury/death	Poor design/construction	Design to current standards	3	5	15		Client to review skills and expertise of certifier and include in the tender documents the right to require the engagement of an alternative certifier.	PCW	1/06/2016	2	5	10	8/12/2015	SMEC PM	No		
Operation	A member of the public has an accident adjacent to the works.	Injury/death	Exposed high abutment walls		1	5	5		Install signage and handrails to meet the requirements of the new asset owner (TAMS) and seek sign-off of the complete design by TAMS.	PCW	1/06/2016	1	5	5	8/12/2015	SMEC PM	No		
Operation	A maintenance contractor has an incident close to the water	Machinery entering the water.			1	4	4		The interface design to consider creating a buffer between maintenance activities and permanent water zones.	PCW	1/06/2016	1	4	4	8/12/2015	SMEC PM	No		
Demolition/construction	An overhead power cable is struck	Serious injury or death.	Tight working areas adjacent to power poles/cables		3	5	15		Client to ensure the contractor follows the established ACT Government WHS protocols including workers having appropriate qualifications. Fence off power line and require access permits to enter within the fenced off area. Include this requirement in the tender documents.	PCW	During construction	1	5	5	8/12/2015	SMEC PM	No		
Construction	Complexity of anchor design and construction	Increased length of work on site increasing the risk of flooding the worksite and associated risks.	Design/detailing		4	3	12		Client to investigate ECI style of contract to achieve contractor input into construction solution. Review the design to investigate opportunitiesto simplify the construction process.	PCW SMEC	1/06/2016	4	3	12	8/12/2015	SMEC PM	Yes	Yes	Requirement of anchor design for the weir wall/slab was reviewed.
Construction	Exposure to flash flooding greater than 60cum/s before the abutment walls are complete	Loss of construction plant/Serious injury or death.	Inadequate warning of imminent floods		1	5	5		Contract requirement for evacuation plans to be provided prior to work commencing. If ECI is not used, require the tenderers to submit a detailed methodology and weight safety aspectsof methodology higher in the tender evaluation. Consider additional protection for the period whilst the new abutment walls are being constructed. Client to investigate ECI style of contract to achieve contactor input into the construction solution. SMEC to further develop the 3D construction sequence model to be used to gain a better understanding of the process and to be used for the tender process.	PCW PCW PCW PCW SMEC	1/02/2016	1	5	5	8/12/2015	SMEC PM	No		
Demolition	Items that cannot be identified until the water is drained have a significant impact on the scope required to complete the works and extend the duration	Compressed timeframe resulting in serious injury or death.			3	4	12		Client to investigate ECI style of contract to achieve contactor input into the construction solution. Develop a response action plan for a range of scenarios and possible solutions and include the capability for those solutions to be delivered. Include scenarios within the tender response requirements.	PCW	1/06/2016	3	3	9	8/12/2015	SMEC PM	No		Include in register of special contract provisions

1255

Demolition	Personnel are not able to be evacuated in time during a flood	Serious injury or death.	Flood below 60cum/s		1	5	5		SMEC to investigate alternatives which eliminate flow from the site. If ECI is not used require the tenderers to submit a detailed methodology and weight safety aspects of methodology highly in the tender evaluation. Contract requirement for evacuation plans to be provided prior to work commencing. Client to investigate ECI style of contract to achieve contractor input into construction solution.	SMEC PCW PCW PCW	1/02/2016	1	5	5	8/12/2015	SMEC PM	No		
Construction	Proximity of sediment to construction workers or public	Construction workers or public becoming sick.			3	4	12		Identify appropriate stockpile sites including routes from work site to stockpiling locations and include specific requirements in tender documents. Communicate findings or sampling already undertaken and confirm it meets requirements. Develop a plan to prevent public access to the high risk areas. Incorporate all measures in relation to handling and moving sediment to be included in the CEMP. A draft CEMP to be developed during the design phase to confirm feasibility. Conduct first site sampling as soon as dam has been drained. Develop a sampling program for construction works to include in contractor scope of works.	PCW PCW PCW SMEC PCW PCW	During construction	2	4	8	8/12/2015	SMEC PM	No		
Demolition	The demolition/excavation process causes undetected weakening of the existing remaining structure.	collapse/instability			3	4	12		Include the vibration limits within the statement of requirements in the tender documents. Determine and recommend vibration limits and monoitor during construction.	PCW SMEC		2	4	8	8/12/2015	SMEC PM	No		Include in register of special contract provisions
Demolition	The demolition/excavation process causes weakening of the remaining structure once the abutments are removed	collapse during a flood.			2	5	10		Conduct an analysis of the abutment and labrynth walls in current condition and estimate strength with backfill removed. Determine and recommend vibration limits and monitor during construction. Include the vibration limits within the statement of requirements in the tender documents. Detailed structural analysis of the wall as soon as the site is drained. Inspection of the exposed structure and foundations as soon as possible to confirm design assumptions.	SMEC SMEC PCW SMEC SMEC	1/06/2016	1	5	5	8/12/2015	SMEC PM	No		
Demolition	The tight program will lead to increased safety risks due to the requirement to work more quickly	Serious injury or death.			2	4	8		Refine client construction sequence proposal to assist/guide tenderers. Coordinate the program with the wetlands project to prevent reduced time available to undertake the construction. Closely manage the program including all preparatory activitiesthat can be undertaken prior to the contractor engagement. Review opportunities for pre-site activities and include a requirement for tenderers to address this in their methodology response in the tender. Client to investigate ECI style of contract to achieve contractor input into the solution.	PCW	31/12/2015	2	4	8	8/12/2015	SMEC PM	No		
Construction/operation	There is a confined space access incident	Serious injury or death during both construction and operations phases.			2	4	8		Client to ensure the contractor follows the established ACT Government WHS protocols including workers having appropriate qualifications. The design and construction of the valve chamber to be developed and reviewed in consultation with the dam operator and identify it as a confined space to the operator and identify this in the O&M Manual. Identify the valve chamber as a confined space (in the tender documents) once it is completed and testing is underway.	PCW SMEC PCW	1/06/2016	1	4	4	8/12/2015	SMEC PM	No		

Construction	Complexity of permanent concrete works significantly increases time on site	Flooding and associated risks.			4	3	12		Client to investigate ECI style of contract to achieve contactor input into the construction solution. Review the design to investigate opportunities to optimise the construction process.	PCW SMEC	1/02/2016	2	3	6	8/12/2015	SMEC PM	No		
Demolition/Construction	During a flood event equipment is not able to be moved out of working area in time	Serious damage to equipment			2	2	4		SMEC to investigate alternatives which eliminate flow from the site. If ECI is not used require the tenderers to submit a detailed methodology and weight safety aspects of methodology highly in the tender evaluation. Contract requirement for evacuation plans to be provided prior to work commencing. Client to investigate ECI style of contract to achieve contractor input into the construction solution.	SMEC PCW PCW PCW	1/02/2016	2	2	4	8/12/2015	SMEC PM	No		
Construction	Either a construction worker or a member of the public is exposed to asbestos before it is identified	A member of the public or construction worker becoming sick.			3	2	6		Conduct first site sampling as soon as dam has been drained. Undertake desktop msearch of historic records. Develop unexpected finds protocol. Develop sampling program for construction works to include in contractor scope of works.	PCW	1/06/2016	2	2	4	9/12/2015	SMEC PM	No		
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					
							0							0					

Likelihood	Consequence	Level of Risk	Risk Priority
1 – Very Rare chance of occurence or	1 – Insignificant impact or harm	≥ 21 - 25	1
2 – Rare chance of occurence or causing	2 – Minor impact or harm	≥ 17 - < 21	2
3 – Moderate chance of occurrence or	3 – Moderate impact or harm	≥ 13 - < 17	3
4 – Above average chance of occurrence	4 – Major, but reversible impact or	≥ 10 - < 13	4
5 - Almost certain chance of occurrence	5 – Catastrophic impact or harm.	≥8 - < 10	5

Note: Risk level re-rated as 1 for risks that have happened.

APPENDIX H CONTAMINATION ASSESSMENT LABORATORY RESULTS & QA/QC INFORMATION

1258

ALS Environmental

QA/QC Compliance Assessment for DQO Reporting

Work Order	: **ES1524909**	Page	: 1 of 4
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: [redacted]	Telephone	: +61-2-8784 8555
Project	: ISABELLA	Date Samples Received	: 26-Jun-2015
Site	: ----	Issue Date	: 03-Jul-2015
Sampler	: [redacted]	No. of samples received	: 1
Order number	: 3002402	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

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

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

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

Matrix: **SOIL** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103)							
T01_180615	**26-Jun-2015**	**----**	----	----	**29-Jun-2015**	10-Jul-2015	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
T01_180615	**26-Jun-2015**	**01-Jul-2015**	23-Dec-2015	✓	**02-Jul-2015**	23-Dec-2015	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
T01_180615	**26-Jun-2015**	**01-Jul-2015**	24-Jul-2015	✓	**02-Jul-2015**	24-Jul-2015	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	20	**10.00**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	13	**15.38**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	13	**7.69**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	13	**7.69**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	13	**7.69**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

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*
Moisture Content	EA055-103	SOIL	In-house. A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

1262

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1524909**	Page	: 1 of 4
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: [redacted] Schedule 2.2 (a)(ii)	Contact	:
Address	: P O BOX 1654 FYSHWICK ACT, AUSTRALIA 2609	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: [redacted] Schedule 2.2 (a)(ii)	E-mail	:
Telephone	: +[redacted] Schedule 2.2 (a)(ii)	Telephone	: +61-2-8784 8555
Facsimile	: +[redacted] Schedule 2.2 (a)(ii)	Facsimile	: +61-2-8784 8500
Project	: ISABELLA	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 3002402	Date Samples Received	: 26-Jun-2015
C-O-C number	: 0129	Date Analysis Commenced	: 29-Jun-2015
Sampler	: [redacted] Schedule 2.2 (a)(ii)	Issue Date	: 03-Jul-2015
Site	: ----	No. of samples received	: 1
Quote number	: ----	No. of samples analysed	: 1

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

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

NATA

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
[redacted] Schedule 2.2 (a)(ii)	Senior Spectroscopist	Sydney Inorganics

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**: SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (QC Lot: 139536)									
ES1524899-002	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	51.5	46.3	10.6	0% - 20%
ES1524910-003	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	84.4	84.7	0.274	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 142009)									
ES1524836-004	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	10	9	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	9	8	18.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	6	6	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	8	8	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	17	17	0.00	No Limit
ES1524929-002	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	7	8	12.8	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	27	36	27.6	0% - 50%
		EG005T: Arsenic	7440-38-2	5	mg/kg	6	6	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	41	52	23.9	0% - 50%
		EG005T: Lead	7439-92-1	5	mg/kg	12	11	9.31	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	31	34	9.44	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 142008)									
ES1524815-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
ES1524826-002	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 142009)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	114	92	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	98.4	87	121
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	95.7	80	136
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	97.0	93	127
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	97.6	86	124
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	102	93	131
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	103	81	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 142008)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	82.9	70	105

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: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 142009)							
ES1524836-005	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	115	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	106	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	103	70	130
		EG005T: Copper	7440-50-8	250 mg/kg	104	70	130
		EG005T: Lead	7439-92-1	250 mg/kg	105	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	103	70	130
		EG005T: Zinc	7440-66-6	250 mg/kg	106	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 142008)							
ES1524815-001	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	93.9	70	130

1266

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1524909**	Page	: 1 of 2
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: [redacted]	Contact	:
Address	: P O BOX 1654 FYSHWICK ACT, AUSTRALIA 2609	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: [redacted]	E-mail	:
Telephone	: [redacted]	Telephone	: +61-2-8784 8555
Facsimile	: [redacted]	Facsimile	: +61-2-8784 8500
Project	: ISABELLA	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 3002402	Date Samples Received	: 26-Jun-2015 14:10
C-O-C number	: 0129	Date Analysis Commenced	: 29-Jun-2015
Sampler	: [redacted]	Issue Date	: 03-Jul-2015 10:25
Site	: ----		
		No. of samples received	: 1
Quote number	: ----	No. of samples analysed	: 1

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
[redacted]	Senior Spectroscopist	Sydney Inorganics

General Comments

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

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

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

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

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

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

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**T01_180615**	----	----	----	----
			Client sampling date / time	[26-Jun-2015]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES1524909-001**	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EA055: Moisture Content								
^ **Moisture Content (dried @ 103°C)**	----	1	%	**6.7**	----	----	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	**7**	----	----	----	----
Copper	7440-50-8	5	mg/kg	<5	----	----	----	----
Lead	7439-92-1	5	mg/kg	**12**	----	----	----	----
Nickel	7440-02-0	2	mg/kg	**5**	----	----	----	----
Zinc	7440-66-6	5	mg/kg	**24**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----

SGS

STATEMENT OF QA/QC PERFORMANCE

SE140881 R0

CLIENT DETAILS		LABORATORY DETAILS	
Contact	[redacted]	Manager	[redacted]
Client	SMEC Australia Pty Ltd - ACT	Laboratory	SGS Alexandria Environmental
Address	Sun Micro Building Suite 2, Level 1 243 Northbourne Avenue ACT 2602	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	[redacted]	Telephone	[redacted]
Facsimile	[redacted]	Facsimile	[redacted]
Email	[redacted]	Email	au.environmental.sydney@sgs.com
Project	**Isabella**	SGS Reference	SE140881 R0
Order Number	**0127-0128**	Report Number	0000114603
Samples	7	Date Reported	03 Jul 2015

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS Environmental Services' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document and was supplied by the Client.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Matrix Spike	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	1 item

SAMPLE SUMMARY

Sample counts by matrix	7 Soils	Type of documentation received	COC
Date documentation received	29/6/15@8.57am	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	5.3°C
Sample container provider	Other Lab	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes	Number of eskies/boxes received	

SGS

HOLDING TIME SUMMARY

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Fibre Identification in soil

Method: ME-(AU)-[ENV]AN602

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TPA1_0.5	SE140881.001	LB080018	18 Jun 2015	26 Jun 2015	17 Jun 2016	30 Jun 2015	17 Jun 2016	03 Jul 2015
TPA1_1.0	SE140881.002	LB080018	18 Jun 2015	26 Jun 2015	17 Jun 2016	30 Jun 2015	17 Jun 2016	03 Jul 2015
TPA2_0.2	SE140881.003	LB080018	18 Jun 2015	26 Jun 2015	17 Jun 2016	30 Jun 2015	17 Jun 2016	03 Jul 2015
TPA2_1.0	SE140881.004	LB080018	18 Jun 2015	26 Jun 2015	17 Jun 2016	30 Jun 2015	17 Jun 2016	03 Jul 2015
TP3A_0.5	SE140881.005	LB080018	18 Jun 2015	26 Jun 2015	17 Jun 2016	30 Jun 2015	17 Jun 2016	03 Jul 2015
TP3A_1.0	SE140881.006	LB080018	18 Jun 2015	26 Jun 2015	17 Jun 2016	30 Jun 2015	17 Jun 2016	03 Jul 2015

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TPA1_0.5	SE140881.001	LB080079	18 Jun 2015	26 Jun 2015	16 Jul 2015	01 Jul 2015	16 Jul 2015	01 Jul 2015
TPA1_1.0	SE140881.002	LB080079	18 Jun 2015	26 Jun 2015	16 Jul 2015	01 Jul 2015	16 Jul 2015	01 Jul 2015
TPA2_0.2	SE140881.003	LB080079	18 Jun 2015	26 Jun 2015	16 Jul 2015	01 Jul 2015	16 Jul 2015	01 Jul 2015
TPA2_1.0	SE140881.004	LB080079	18 Jun 2015	26 Jun 2015	16 Jul 2015	01 Jul 2015	16 Jul 2015	01 Jul 2015
TP3A_0.5	SE140881.005	LB080079	18 Jun 2015	26 Jun 2015	16 Jul 2015	01 Jul 2015	16 Jul 2015	01 Jul 2015
TP3A_1.0	SE140881.006	LB080079	18 Jun 2015	26 Jun 2015	16 Jul 2015	01 Jul 2015	16 Jul 2015	01 Jul 2015
D01_180615	SE140881.007	LB080107	18 Jun 2015	26 Jun 2015	16 Jul 2015	01 Jul 2015	16 Jul 2015	02 Jul 2015

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TPA1_0.5	SE140881.001	LB079946	18 Jun 2015	26 Jun 2015	02 Jul 2015	29 Jun 2015	04 Jul 2015	01 Jul 2015
TPA1_1.0	SE140881.002	LB079946	18 Jun 2015	26 Jun 2015	02 Jul 2015	29 Jun 2015	04 Jul 2015	01 Jul 2015
TPA2_0.2	SE140881.003	LB079946	18 Jun 2015	26 Jun 2015	02 Jul 2015	29 Jun 2015	04 Jul 2015	01 Jul 2015
TPA2_1.0	SE140881.004	LB079946	18 Jun 2015	26 Jun 2015	02 Jul 2015	29 Jun 2015	04 Jul 2015	01 Jul 2015
TP3A_0.5	SE140881.005	LB079946	18 Jun 2015	26 Jun 2015	02 Jul 2015	29 Jun 2015	04 Jul 2015	01 Jul 2015
TP3A_1.0	SE140881.006	LB079946	18 Jun 2015	26 Jun 2015	02 Jul 2015	29 Jun 2015	04 Jul 2015	01 Jul 2015
D01_180615	SE140881.007	LB079946	18 Jun 2015	26 Jun 2015	02 Jul 2015	29 Jun 2015	04 Jul 2015	01 Jul 2015

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TPA1_0.5	SE140881.001	LB080140	18 Jun 2015	26 Jun 2015	15 Dec 2015	02 Jul 2015	15 Dec 2015	02 Jul 2015
TPA1_1.0	SE140881.002	LB080140	18 Jun 2015	26 Jun 2015	15 Dec 2015	02 Jul 2015	15 Dec 2015	02 Jul 2015
TPA2_0.2	SE140881.003	LB080140	18 Jun 2015	26 Jun 2015	15 Dec 2015	02 Jul 2015	15 Dec 2015	02 Jul 2015
TPA2_1.0	SE140881.004	LB080140	18 Jun 2015	26 Jun 2015	15 Dec 2015	02 Jul 2015	15 Dec 2015	02 Jul 2015
TP3A_0.5	SE140881.005	LB080140	18 Jun 2015	26 Jun 2015	15 Dec 2015	02 Jul 2015	15 Dec 2015	02 Jul 2015
TP3A_1.0	SE140881.006	LB080140	18 Jun 2015	26 Jun 2015	15 Dec 2015	02 Jul 2015	15 Dec 2015	02 Jul 2015
D01_180615	SE140881.007	LB080140	18 Jun 2015	26 Jun 2015	15 Dec 2015	02 Jul 2015	15 Dec 2015	02 Jul 2015

SURROGATES

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No surrogates were required for this job.

METHOD BLANKS

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Mercury in Soil — Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result
LB080079.001	Mercury	mg/kg	0.01	<0.01
LB080107.001	Mercury	mg/kg	0.01	<0.01

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest — Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result
LB080140.001	Arsenic, As	mg/kg	1	<1
	Cadmium, Cd	mg/kg	0.3	<0.3
	Chromium, Cr	mg/kg	0.5	<0.5
	Copper, Cu	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Nickel, Ni	mg/kg	0.5	<0.5
	Zinc, Zn	mg/kg	2	<2

1272

DUPLICATES

SE140881 R0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE140858.058	LB080107.014	Mercury	mg/kg	0.01	0.0720526470	0.0707261420	100	2
SE140881.003	LB080079.014	Mercury	mg/kg	0.01	0.02	0.02	200	0
SE140881.007	LB080107.021	Mercury	mg/kg	0.01	<0.01	<0.01	200	0
SE140917.002	LB080079.024	Mercury	mg/kg	0.01	0.02	0.01	200	0

Moisture Content

Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE140881.003	LB079946.011	% Moisture	%w/w	1	14.9	16.0	36	7
SE140881.007	LB079946.016	% Moisture	%	1	9.9	8.3	41	17

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE140881.006	LB080140.014	Arsenic, As	mg/kg	1	2	2	81	0
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.5	5.6	6.0	39	8
		Copper, Cu	mg/kg	0.5	3.1	3.1	46	1
		Lead, Pb	mg/kg	1	9	9	41	2
		Nickel, Ni	mg/kg	0.5	3.2	3.2	46	1
		Zinc, Zn	mg/kg	2	14	14	45	2
SE140965.001	LB080140.024	Arsenic, As	mg/kg	1	11.416540284	12.5243396737	38	9
		Cadmium, Cd	mg/kg	0.3	0.3028902737	0.3130451328	127	3
		Chromium, Cr	mg/kg	0.5	18.568012266	16.0438015070	33	15
		Copper, Cu	mg/kg	0.5	17.687791739	20.0161505962	33	12
		Lead, Pb	mg/kg	1	70.212971678	92.3692158450	31	27
		Nickel, Ni	mg/kg	0.5	7.9715292969	7.5362848380	36	6
		Zinc, Zn	mg/kg	2	75.543206677	94.0805895539	32	22

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB080079.002	Mercury	mg/kg	0.01	0.23	0.2	70 - 130	114
LB080107.002	Mercury	mg/kg	0.01	0.20	0.2	70 - 130	100

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB080140.002	Arsenic, As	mg/kg	1	46	50	80 - 120	91
	Cadmium, Cd	mg/kg	0.3	47	50	80 - 120	94
	Chromium, Cr	mg/kg	0.5	47	50	80 - 120	93
	Copper, Cu	mg/kg	0.5	48	50	80 - 120	96
	Lead, Pb	mg/kg	1	46	50	80 - 120	92
	Nickel, Ni	mg/kg	0.5	47	50	80 - 120	93
	Zinc, Zn	mg/kg	2	47	50	80 - 120	93

MATRIX SPIKES

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE140854.001	LB080107.004	Mercury	mg/kg	0.01	0.22	0.04472482598	0.2	85
SE140865.001	LB080079.004	Mercury	mg/kg	0.01	0.21	0.00579042275	0.2	104

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE140867.012	LB080140.004	Lead, Pb	mg/kg	1	41	12	50	59 ④

MATRIX SPIKE DUPLICATES

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here:
http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

*	Non-accredited analysis.
-	Sample not analysed for this analyte.
^	Analysis performed by external laboratory.
IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.
①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to Analytical Report comments for further information.

ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS		LABORATORY DETAILS	
Contact	[redacted]	Manager	[redacted]
Client	SMEC Australia Pty Ltd - ACT	Laboratory	SGS Alexandria Environmental
Address	Sun Micro Building Suite 2, Level 1 243 Northbourne Avenue ACT 2602	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	[redacted]	Telephone	[redacted]
Facsimile	[redacted]	Facsimile	[redacted]
Email	[redacted]	Email	au.environmental.sydney@sgs.com
Project	**Isabella**	SGS Reference	SE140881 R0
Order Number	**0127-0128**	Report Number	0000114602
Samples	6	Date Reported	03 Jul 2015
		Date Received	26 Jun 2015

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

No respirable fibres detected in all samples using trace analysis technique.

Asbestos analysed by Approved Identifier [redacted].

SIGNATORIES

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
Production Manager	Senior Chemist	Asbestos Analyst

SGS

ANALYTICAL REPORT

SE140881 R0

RESULTS

Fibre Identification in soil   Method AN602

Laboratory Reference	Client Reference	Matrix	Sample Description	Date Sampled	Fibre Identification	Est.%w/w*
SE140881.001	TPA1_0.5	Soil	534g Clay,Sand,Rocks	18 Jun 2015	No Asbestos Found	<0.01
SE140881.002	TPA1_1.0	Soil	535g Clay,Sand,Rocks	18 Jun 2015	No Asbestos Found	<0.01
SE140881.003	TPA2_0.2	Soil	430g Clay,Sand,Rocks	18 Jun 2015	No Asbestos Found	<0.01
SE140881.004	TPA2_1.0	Soil	606g Clay,Sand,Rocks	18 Jun 2015	No Asbestos Found	<0.01
SE140881.005	TP3A_0.5	Soil	477g Clay,Sand,Rocks	18 Jun 2015	No Asbestos Found	<0.01
SE140881.006	TP3A_1.0	Soil	515g Clay,Sand,Rocks	18 Jun 2015	No Asbestos Found	<0.01

SGS

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic \`clues\`, which provide a reasonable degree of certainty, dispersion staining is a mandatory \`clue\` for positive identification. If sufficient \`clues\` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned. Fibres/material that cannot be unequivocably identified as one of the three asbestos forms, will be reported as unknown mineral fibres (umf). AS4964.2004 Method for the Qualitative Identification of Asbestos in Bulk Samples , Section 8.4, Trace Analysis Criteria, Note 4 states:"Depending upon sample condition and fibre type, the detection limit of this technique has been found to lie generally in the range of 1 in 1,000 to 1 in 10,000 parts by weight, equivalent to 1 to 0.1 g/kg." The sample can be reported “no asbestos found at the reporting limit of 0.1 g/kg” (<0.01%w/w) where AN602 section 4.5 of this method has been followed, and if- (a) no trace asbestos fibres have been detected (i.e. no ‘respirable’ fibres): (b) the estimated weight of non-respirable asbestos fibre bundles and/or the estimated weight of asbestos in asbestos-containing materials are found to be less than 0.1g/kg: and (c) these non-respirable asbestos fibre bundles and/or the asbestos containing materials are only visible under stereo-microscope viewing conditions.

FOOTNOTES

Amosite	-	Brown Asbestos	NA	-	Not Analysed
Chrysotile	-	White Asbestos	LNR	-	Listed, Not Required
Crocidolite	-	Blue Asbestos	*	-	Not Accredited
Amphiboles	-	Amosite and/or Crocidolite	**	-	Indicative data, theoretical holding time exceeded.

(In reference to soil samples only) This report does not comply with the analytical reporting recommendations in the Western Australian Department of Health Guidelines for the Assessment and Remediation and Management of Asbestos Contaminated sites in Western Australia - May 2009.

Sampled by the client.

Where reported: 'Asbestos Detected': Asbestos detected by polarized light microscopy, including dispersion staining.
Where reported: 'No Asbestos Found': No Asbestos Found by polarized light microscopy, including dispersion staining.
Where reported: 'UMF Detected': Mineral fibres of unknown type detected by polarized light microscopy, including dispersion staining. Confirmation by another independent analytical technique may be necessary.

Even after disintegration it can be very difficult, or impossible, to detect the presence of asbestos in some asbestos-containing bulk materials using polarised light microscopy. This is due to the low grade or small length or diameter of asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS

Contact	[redacted]
Client	SMEC Australia Pty Ltd - ACT
Address	Sun Micro Building Suite 2, Level 1 243 Northbourne Avenue ACT 2602
Telephone	[redacted]
Facsimile	[redacted]
Email	[redacted]
Project	**Isabella**
Order Number	**0127-0128**
Samples	7
Date Received	26/6/2015

LABORATORY DETAILS

Manager	[redacted]
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	[redacted]
Facsimile	[redacted]
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE140881 R0**
Report Number	0000114601
Date Reported	3/7/2015
Date Started	30/6/2015

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

No respirable fibres detected in all samples using trace analysis technique.

Asbestos analysed by Approved Identifier [redacted].

SIGNATORIES

[redacted]	[redacted]	[redacted]
Production Manager	Senior Chemist	Asbestos Analyst

ANALYTICAL RESULTS

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest [AN040/AN320] Tested: 2/7/2015

PARAMETER	UOM	LOR	TPA1_0.5 SOIL - 18/6/2015 SE140881.001	TPA1_1.0 SOIL - 18/6/2015 SE140881.002	TPA2_0.2 SOIL - 18/6/2015 SE140881.003	TPA2_1.0 SOIL - 18/6/2015 SE140881.004	TP3A_0.5 SOIL - 18/6/2015 SE140881.005
Arsenic, As	mg/kg	1	2	2	2	2	2
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	5.9	5.9	15	3.2	5.6
Copper, Cu	mg/kg	0.5	3.5	3.8	4.7	2.1	4.2
Lead, Pb	mg/kg	1	10	10	17	8	12
Nickel, Ni	mg/kg	0.5	2.7	4.0	3.3	2.6	3.2
Zinc, Zn	mg/kg	2	16	16	12	17	13

PARAMETER	UOM	LOR	TP3A_1.0 SOIL - 18/6/2015 SE140881.006	D01_180615 SOIL - 18/6/2015 SE140881.007
Arsenic, As	mg/kg	1	2	2
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	5.6	5.6
Copper, Cu	mg/kg	0.5	3.1	3.5
Lead, Pb	mg/kg	1	9	8
Nickel, Ni	mg/kg	0.5	3.2	3.1
Zinc, Zn	mg/kg	2	14	14

SGS

ANALYTICAL RESULTS

Mercury in Soil [AN312] Tested: 1/7/2015

PARAMETER	UOM	LOR	TPA1_0.5 SOIL - 18/6/2015 SE140881.001	TPA1_1.0 SOIL - 18/6/2015 SE140881.002	TPA2_0.2 SOIL - 18/6/2015 SE140881.003	TPA2_1.0 SOIL - 18/6/2015 SE140881.004	TP3A_0.5 SOIL - 18/6/2015 SE140881.005
Mercury	mg/kg	0.01	<0.01	<0.01	0.02	<0.01	<0.01

PARAMETER	UOM	LOR	TP3A_1.0 SOIL - 18/6/2015 SE140881.006	D01_180615 SOIL - 18/6/2015 SE140881.007
Mercury	mg/kg	0.01	<0.01	<0.01

Moisture Content [AN002] Tested: 29/6/2015

PARAMETER	UOM	LOR	TPA1_0.5 SOIL - 18/6/2015 SE140881.001	TPA1_1.0 SOIL - 18/6/2015 SE140881.002	TPA2_0.2 SOIL - 18/6/2015 SE140881.003	TPA2_1.0 SOIL - 18/6/2015 SE140881.004	TP3A_0.5 SOIL - 18/6/2015 SE140881.005
% Moisture	%w/w	1	8.4	7.9	14.9	6.8	10.5
% Total Solids	%w/w	1	91.6	92.1	85.1	93.2	89.5

PARAMETER	UOM	LOR	TP3A_1.0 SOIL - 18/6/2015 SE140881.006	D01_180615 SOIL - 18/6/2015 SE140881.007
% Moisture	%w/w	1	9.9	9.9
% Total Solids	%w/w	1	90.1	90.1

Fibre Identification in soil [AN602] Tested: 30/6/2015

PARAMETER	UOM	LOR	TPA1_0.5 SOIL - 18/6/2015 SE140881.001	TPA1_1.0 SOIL - 18/6/2015 SE140881.002	TPA2_0.2 SOIL - 18/6/2015 SE140881.003	TPA2_1.0 SOIL - 18/6/2015 SE140881.004	TP3A_0.5 SOIL - 18/6/2015 SE140881.005
Asbestos Detected	No unit	-	No	No	No	No	No
Estimated Fibres*	%w/w	0.01	<0.01	<0.01	<0.01	<0.01	<0.01

PARAMETER	UOM	LOR	TP3A_1.0 SOIL - 18/6/2015 SE140881.006
Asbestos Detected	No unit	-	No
Estimated Fibres*	%w/w	0.01	<0.01

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analysis by ASS or ICP as per USEPA Method 200.8.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500
AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic \`clues\`, which provide a reasonable degree of certainty, dispersion staining is a mandatory \`clue\` for positive identification. If sufficient \`clues\` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned. Fibres/material that cannot be unequivocably identified as one of the three asbestos forms, will be reported as unknown mineral fibres (umf). AS4964.2004 Method for the Qualitative Identification of Asbestos in Bulk Samples, Section 8.4, Trace Analysis Criteria, Note 4 states:"Depending upon sample condition and fibre type, the detection limit of this technique has been found to lie generally in the range of 1 in 1,000 to 1 in 10,000 parts by weight, equivalent to 1 to 0.1 g/kg." The sample can be reported "no asbestos found at the reporting limit of 0.1 g/kg" (<0.01%w/w) where AN602 section 4.5 of this method has been followed, and if- (a) no trace asbestos fibres have been detected (i.e. no 'respirable' fibres): (b) the estimated weight of non-respirable asbestos fibre bundles and/or the estimated weight of asbestos in asbestos-containing materials are found to be less than 0.1g/kg: and (c) these non-respirable asbestos fibre bundles and/or the asbestos containing materials are only visible under stereo-microscope viewing conditions.

FOOTNOTES

*	Analysis not covered by the scope of accreditation.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
^	Performed by outside laboratory.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf source: Scan4345_2906201513585700.pdf page: 1 SGS Ref: SE140881_COC

COC received 29/6/15 @ 8:57 am

1286

SMEC

Local People Global Experience

CHAIN OF CUSTODY FORM

0127

SGS Alexandria Environmental

SE140881 COC

Received: 26 – Jun – 2015

SMEC OFFICE: Canberra

PROJECT: Isabella

PROJECT NUMBER: 3002402

PROJECT MANAGER: Schedule 2.2 (a)(ii) [redacted]

SAMPLED BY: Schedule 2.2 (a)(ii) [redacted]

DATE SAMPLED: 18/6

Email reports to (will default to PM if blank):

Email invoice to (will default to PM if blank):

Special Laboratory Instructions:

TURNAROUND REQUIREMENTS: ☑ Standard – 5 day TAT ☐ Non Standard TAT (List due date):

LAB QUOTE NO:

CONTACT PH:

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

LAB: SGS

ATTENTION:

DISPATCH TO (ADDRESS & PHONE):

RELINQUISHED BY: E

DATE/TIME: 24/6

RECEIVED BY:

DATE/TIME:

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY: Schedule 2.2 (a)(ii) [redacted]

DATE/TIME: 26/06/15 @ 11:30

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Asbestos ID	8 metals							
	TPA1_0.0	18/6	Soil											Hold
	TPA1_0.2													Hold
1	TPA1_0.5					X	X							
2	TPA1_1.0					X	X							
	TPA1_2.0													Hold
	TPA2_0.0													Hold
3	TPA2_0.2					X	X							
	TPA2_0.5													Hold
4	TPA2_1.0					X	X							
	TPA2_2.0													Hold
	TPA3_0.0					~~X~~	~~X~~							Hold
					TOTAL									

WHITE: send to lab. YELLOW: to be placed in project file. PINK: to be retained in CoC book

1287

SMEC
Local People. Global Experience.

CHAIN OF CUSTODY FORM

012

SMEC OFFICE: Canberra

PROJECT: Isabella

PROJECT NUMBER: 3002402

PROJECT MANAGER: Schedule 2.2 (a)(ii) [redacted]

SAMPLED BY: Schedule 2.2 (a)(ii) [redacted]

DATE SAMPLED:

Email reports to (will default to PM if blank):

Email invoice to (will default to PM if blank):

Special Laboratory Instructions:

TURNAROUND REQUIREMENTS: ☑ Standard – 5 day TAT ☐ Non Standard TAT (List due date):

LAB QUOTE NO:

CONTACT PH:

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

LAB: SGS

ATTENTION:

DISPATCH TO (ADDRESS & PHONE NO.):

RELINQUISHED BY:
DATE/TIME:

RECEIVED BY:
DATE/TIME:

RELINQUISHED BY:
DATE/TIME:

RECEIVED BY: Schedule 2.2 (a)(ii) [redacted]
DATE/TIME: 26/06/15 @ 11:30

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Asbestos ID	8 metals							
	TP3A_0.2	18/6	Soil											Hold
5	TP3A_0.5					X	X							
6	TP3A_1.0				X	X	X							
	TP3A_2.0													Hold
7	DOL_180615					X	X							
From	SE137450													
	TP07_0.5					X	X							
	TP07_1.8-2.0					X	X							

RECEIVED
29 JUN 2015

Schedule 2.2 (a)(ii) [redacted]

From: Schedule 2.2 (a)(ii) [redacted]
Sent: Monday, 29 June 2015 1:01 PM
To: AU.SampleReceipt.Sydney (Sydney)
Subject: RE: 3002402

No thank you.

Schedule 2.2 (a)(ii) [redacted] | Environmental Scientist
SMEC – Australia & New Zealand Division
T +Schedule 2.2 (a)(ii) [redacted]

From: AU.SampleReceipt.Sydney (Sydney) [mailto:AU.SampleReceipt.Sydney@sgs.com]
Sent: Monday, 29 June 2015 1:00 PM
To: Schedule 2.2 (a)(ii) [redacted]
Subject: RE: 3002402

Do you need asbestos testing on sample D01_180615.

Schedule 2.2 (a)(ii) [redacted]
Environmental Services
Sample Receipt
Phone: +Schedule 2.2 (a)(ii) [redacted]

From: Schedule 2.2 (a)(ii) [redacted]
Sent: Monday, 29 June 2015 8:57 AM
To: AU.SampleReceipt.Sydney (Sydney)
Subject: RE: 3002402

Hi SGS,

Can you please analyse those samples as attached.

Please note – additional analysis for SE137450 also included in attached COC.

Thanks,

Schedule 2.2 (a)(ii) [redacted] | Environmental Scientist
SMEC – Australia & New Zealand Division
T +Schedule 2.2 (a)(ii) [redacted]

From: AU.SampleReceipt.Sydney (Sydney) [mailto:AU.SampleReceipt.Sydney@sgs.com]
Sent: Friday, 26 June 2015 12:26 PM
To: Schedule 2.2 (a)(ii) [redacted]
Subject: 3002402

Schedule 2.2 (a)(ii) [redacted]

1289

ALS Environmental

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1506748**	Page	: 1 of 5
Client	: SMEC AUSTRALIA PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: [redacted] Schedule 2.2 (a)(ii)	Contact	: Client Services
Address	: P O BOX 1654 FYSHWICK ACT, AUSTRALIA 2609	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	[redacted] Schedule 2.2 (a)(ii)	E-mail	: sydney@alsglobal.com
Telephone	: [redacted] Schedule 2.2 (a)(ii)	Telephone	: +61-2-8784 8555
Facsimile	: [redacted] Schedule 2.2 (a)(ii)	Facsimile	: +61-2-8784 8500
Project	: 3002402 ISABELLA WEIR	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: 0338 & 0342	Date Samples Received	: 23-MAR-2015
Sampler	: ET	Issue Date	: 30-MAR-2015
Order number	: ----		
		No. of samples received	: 1
Quote number	: EN/025/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Work Order : ES1506748
Client : SMEC AUSTRALIA PTY LTD
Project : 3002402 ISABELLA WEIR

Analysis Holding Time Compliance

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

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

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

Matrix: **SOIL**

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*
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103) QA4	**19-MAR-2015**	**----**	----	----	**24-MAR-2015**	02-APR-2015	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) QA4	**19-MAR-2015**	**25-MAR-2015**	15-SEP-2015	✓	**26-MAR-2015**	15-SEP-2015	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) QA4	**19-MAR-2015**	**25-MAR-2015**	16-APR-2015	✓	**27-MAR-2015**	16-APR-2015	✓
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068) QA4	**19-MAR-2015**	**26-MAR-2015**	02-APR-2015	✓	**26-MAR-2015**	05-MAY-2015	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068) QA4	**19-MAR-2015**	**26-MAR-2015**	02-APR-2015	✓	**26-MAR-2015**	05-MAY-2015	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP071) QA4	**19-MAR-2015**	**26-MAR-2015**	02-APR-2015	✓	**26-MAR-2015**	05-MAY-2015	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080) QA4	**19-MAR-2015**	**24-MAR-2015**	02-APR-2015	✓	**27-MAR-2015**	02-APR-2015	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080) QA4	**19-MAR-2015**	**24-MAR-2015**	02-APR-2015	✓	**27-MAR-2015**	02-APR-2015	✓

Work Order : ES1506748
Client : SMEC AUSTRALIA PTY LTD
Project : 3002402 ISABELLA WEIR

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	7	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH - Semivolatile Fraction	EP071	1	10	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	2	17	**11.8**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Pesticides by GCMS	EP068	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH - Semivolatile Fraction	EP071	1	10	**10.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Pesticides by GCMS	EP068	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH - Semivolatile Fraction	EP071	1	10	**10.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Pesticides by GCMS	EP068	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH - Semivolatile Fraction	EP071	1	10	**10.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

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
Moisture Content	EA055-103	SOIL	In-house. A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 21st ed., 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Pesticides by GCMS	EP068	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (2013) Schedule B(3) (Method 504,505)
TRH - Semivolatile Fraction	EP071	SOIL	(USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40.
TRH Volatiles/BTEX	EP080	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve.

Preparation Methods	Method	Matrix	Method Descriptions
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1506748**	Page	: 1 of 11
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: [redacted]	Contact	: Client Services
Address	: P O BOX 1654 FYSHWICK ACT, AUSTRALIA 2609	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: [redacted]	E-mail	: sydney@alsglobal.com
Telephone	: [redacted]	Telephone	: +61-2-8784 8555
Facsimile	: [redacted]	Facsimile	: +61-2-8784 8500
Project	: 3002402 ISABELLA WEIR	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: 0338 & 0342	Date Samples Received	: 23-MAR-2015
Sampler	: ET	Issue Date	: 30-MAR-2015
Order number	: ----		
		No. of samples received	: 1
Quote number	: EN/025/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

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

Signatories	*Position*	*Accreditation Category*
[redacted]	Senior Spectroscopist	Sydney Inorganics
[redacted]	Organic Coordinator	Sydney Organics

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.

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

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

LOR = Limit of reporting

RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (QC Lot: 3872066)									
ES1506695-005	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	16.6	17.4	4.5	0% - 50%
ES1506767-001	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	30.1	31.4	4.4	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 3873890)									
ES1506676-056	Anonymous	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	30	20	47.5	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	7	5	27.7	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	3	2	42.9	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	6	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	6	<5	0.0	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	22	20	11.0	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	11	9	13.2	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	11	6	56.4	No Limit
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.0	No Limit
ES1506748-001	QA4	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	50	60	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	14	15	8.2	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	5	5	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	3	3	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	12	12	0.0	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	403	413	2.4	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	33	31	3.8	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	10	10	0.0	No Limit
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3873891)									
ES1506676-056	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1506748-001	QA4	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 3873862)									
ES1506905-001	Anonymous	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EP068A: Organochlorine Pesticides (OC) (QC Lot: 3873862) - continued									
ES1506905-001	Anonymous	EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 3873862)									
ES1506905-001	Anonymous	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3871489)									
ES1506658-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1506658-043	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3873863)									
ES1506905-001	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3871489)									
ES1506658-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
ES1506658-043	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3873863)									
ES1506905-001	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	<50	0.0	No Limit
EP080: BTEXN (QC Lot: 3871489)									
ES1506658-001	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
ES1506658-043	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 3873890)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	104	92	130
EG005T: Barium	7440-39-3	10	mg/kg	<10	143 mg/kg	100	91	125
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	5.63 mg/kg	107	98	128
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	93.7	87	121
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	95.2	80	136
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16.0 mg/kg	105	89	123
EG005T: Copper	7440-50-8	5	mg/kg	<5	32.0 mg/kg	102	93	127
EG005T: Lead	7439-92-1	5	mg/kg	<5	40.0 mg/kg	93.2	86	124
EG005T: Manganese	7439-96-5	5	mg/kg	<5	130 mg/kg	99.0	97	131
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.0 mg/kg	101	93	131
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	111	75	131
EG005T: Vanadium	7440-62-2	5	mg/kg	<5	29.6 mg/kg	105	98	128
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	98.1	81	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3873891)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	81.4	70	105
EP068A: Organochlorine Pesticides (OC) (QCLot: 3873862)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	104	71	113
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	90.4	66	122
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	76.8	69	119
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	85.0	71	115
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	80.6	65	113
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	86.3	68	116
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	87.9	68	118
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	93.1	68	116
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	75.2	68	120

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 3873862) - continued								
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	84.1	69	119
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	79.8	67	121
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	80.0	66	118
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	91.0	69	117
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	108	67	123
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	80.9	76	120
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	109	76	120
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	74.8	57.3	115
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	105	60	124
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	81.0	67	127
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	79.6	65	123
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	77.8	65	129
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3873862)								
EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	0.5 mg/kg	109	56	126
EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	93.1	64	128
EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	0.5 mg/kg	94.1	54	122
EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	0.5 mg/kg	87.1	64	124
EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	0.5 mg/kg	88.4	73	117
EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	0.5 mg/kg	80.1	55	119
EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	0.5 mg/kg	97.0	69	123
EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	0.5 mg/kg	82.1	70	120
EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	0.5 mg/kg	108	71	115
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	0.5 mg/kg	97.6	68	114
EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	0.5 mg/kg	76.4	68	122
EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	0.5 mg/kg	84.2	69	115
EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	0.5 mg/kg	83.4	70	118
EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	0.5 mg/kg	85.2	68	116
EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	0.5 mg/kg	85.5	64	120
EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	0.5 mg/kg	93.9	68	116

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3873862) - continued								
EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	0.5 mg/kg	84.6	70	118
EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	0.5 mg/kg	82.8	67	123
EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	0.5 mg/kg	66.4	42	126
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3871489)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	98.6	68.4	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3873863)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	114	71	131
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	107	74	138
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	100	64	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3871489)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	97.6	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3873863)								
EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	250 mg/kg	105	70	130
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	114	74	138
EP071: >C34 - C40 Fraction	----	50	mg/kg	<100	150 mg/kg	100	63	131
EP080: BTEXN (QCLot: 3871489)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	97.7	62	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	96.8	62	128
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	95.2	58	118
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	94.1	60	120
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	97.3	60	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	99.0	62	138

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: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	Recovery Limits (%) High
EG005T: Total Metals by ICP-AES (QCLot: 3873890)							
ES1506676-056	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	101	70	130

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 3873890) - continued							
ES1506676-056	Anonymous	EG005T: Cadmium	7440-43-9	50 mg/kg	101	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	106	70	130
		EG005T: Copper	7440-50-8	250 mg/kg	104	70	130
		EG005T: Lead	7439-92-1	250 mg/kg	99.9	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	104	70	130
		EG005T: Zinc	7440-66-6	250 mg/kg	100	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3873891)							
ES1506676-056	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	93.6	70	130
EP068A: Organochlorine Pesticides (OC) (QCLot: 3873862)							
ES1506905-001	Anonymous	EP068: gamma-BHC	58-89-9	0.5 mg/kg	81.5	70	130
		EP068: Heptachlor	76-44-8	0.5 mg/kg	90.1	70	130
		EP068: Aldrin	309-00-2	0.5 mg/kg	87.1	70	130
		EP068: Dieldrin	60-57-1	0.5 mg/kg	82.7	70	130
		EP068: Endrin	72-20-8	2 mg/kg	90.4	70	130
		EP068: 4.4`-DDT	50-29-3	2 mg/kg	88.5	70	130
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3873862)							
ES1506905-001	Anonymous	EP068: Diazinon	333-41-5	0.5 mg/kg	107	70	130
		EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	97.5	70	130
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	90.6	70	130
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	103	70	130
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	103	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3871489)							
ES1506658-001	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	96.4	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3873863)							
ES1506905-001	Anonymous	EP071: C10 - C14 Fraction	----	523 mg/kg	96.4	73	137
		EP071: C15 - C28 Fraction	----	2319 mg/kg	105	53	131
		EP071: C29 - C36 Fraction	----	1714 mg/kg	125	52	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3871489)							
ES1506658-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	96.7	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3873863)							
ES1506905-001	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	860 mg/kg	94.6	73	137
		EP071: >C16 - C34 Fraction	----	3223 mg/kg	124	53	131
		EP071: >C34 - C40 Fraction	----	1058 mg/kg	124	52	132
EP080: BTEXN (QCLot: 3871489)							
ES1506658-001	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	83.2	70	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	Recovery Limits (%) High
EP080: BTEXN (QCLot: 3871489) - continued							
ES1506658-001	Anonymous	EP080: Toluene	108-88-3	2.5 mg/kg	87.0	70	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	85.2	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	83.0	70	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	88.5	70	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	88.4	70	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are 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: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report Spike Concentration	Spike Recovery (%) MS	Spike Recovery (%) MSD	Recovery Limits (%) Low	Recovery Limits (%) High	RPDs (%) Value	RPDs (%) Control Limit
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3871489)										
ES1506658-001	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	96.4	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3871489)										
ES1506658-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	96.7	----	70	130	----	----
EP080: BTEXN (QCLot: 3871489)										
ES1506658-001	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	83.2	----	70	130	----	----
		EP080: Toluene	108-88-3	2.5 mg/kg	87.0	----	70	130	----	----
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	85.2	----	70	130	----	----
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	83.0	----	70	130	----	----
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	88.5	----	70	130	----	----
		EP080: Naphthalene	91-20-3	2.5 mg/kg	88.4	----	70	130	----	----
EP068A: Organochlorine Pesticides (OC) (QCLot: 3873862)										
ES1506905-001	Anonymous	EP068: gamma-BHC	58-89-9	0.5 mg/kg	81.5	----	70	130	----	----
		EP068: Heptachlor	76-44-8	0.5 mg/kg	90.1	----	70	130	----	----
		EP068: Aldrin	309-00-2	0.5 mg/kg	87.1	----	70	130	----	----
		EP068: Dieldrin	60-57-1	0.5 mg/kg	82.7	----	70	130	----	----
		EP068: Endrin	72-20-8	2 mg/kg	90.4	----	70	130	----	----
		EP068: 4.4`-DDT	50-29-3	2 mg/kg	88.5	----	70	130	----	----
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3873862)										
ES1506905-001	Anonymous	EP068: Diazinon	333-41-5	0.5 mg/kg	107	----	70	130	----	----

Sub-Matrix: **SOIL**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3873862) - continued										
ES1506905-001	Anonymous	EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	97.5	----	70	130	----	----
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	90.6	----	70	130	----	----
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	103	----	70	130	----	----
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	103	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3873863)										
ES1506905-001	Anonymous	EP071: C10 - C14 Fraction	----	523 mg/kg	96.4	----	73	137	----	----
		EP071: C15 - C28 Fraction	----	2319 mg/kg	105	----	53	131	----	----
		EP071: C29 - C36 Fraction	----	1714 mg/kg	125	----	52	132	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3873863)										
ES1506905-001	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	860 mg/kg	94.6	----	73	137	----	----
		EP071: >C16 - C34 Fraction	----	3223 mg/kg	124	----	53	131	----	----
		EP071: >C34 - C40 Fraction	----	1058 mg/kg	124	----	52	132	----	----
EG005T: Total Metals by ICP-AES (QCLot: 3873890)										
ES1506676-056	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	101	----	70	130	----	----
		EG005T: Cadmium	7440-43-9	50 mg/kg	101	----	70	130	----	----
		EG005T: Chromium	7440-47-3	50 mg/kg	106	----	70	130	----	----
		EG005T: Copper	7440-50-8	250 mg/kg	104	----	70	130	----	----
		EG005T: Lead	7439-92-1	250 mg/kg	99.9	----	70	130	----	----
		EG005T: Nickel	7440-02-0	50 mg/kg	104	----	70	130	----	----
		EG005T: Zinc	7440-66-6	250 mg/kg	100	----	70	130	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3873891)										
ES1506676-056	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	93.6	----	70	130	----	----

1305

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1506748**	Page	: 1 of 6
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: [redacted]	Contact	: Client Services
Address	: P O BOX 1654 FYSHWICK ACT, AUSTRALIA 2609	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: [redacted]	E-mail	: sydney@alsglobal.com
Telephone	: +[redacted]	Telephone	: +61-2-8784 8555
Facsimile	: [redacted]	Facsimile	: +61-2-8784 8500
Project	: 3002402 ISABELLA WEIR	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: 0338 & 0342	Date Samples Received	: 23-MAR-2015
Sampler	: ET	Issue Date	: 30-MAR-2015
Site	: ----		
		No. of samples received	: 1
Quote number	: EN/025/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
[redacted]	Senior Spectroscopist	Sydney Inorganics
[redacted]	Organic Coordinator	Sydney Organics

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

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	QA4	----	----	----	----
			Client sampling date / time	19-MAR-2015 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1506748-001	----	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**3.6**	----	----	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	----	----	----	----
Barium	7440-39-3	10	mg/kg	**50**	----	----	----	----
Beryllium	7440-41-7	1	mg/kg	<1	----	----	----	----
Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	**14**	----	----	----	----
Cobalt	7440-48-4	2	mg/kg	**5**	----	----	----	----
Copper	7440-50-8	5	mg/kg	<5	----	----	----	----
Lead	7439-92-1	5	mg/kg	**12**	----	----	----	----
Manganese	7439-96-5	5	mg/kg	**403**	----	----	----	----
Nickel	7440-02-0	2	mg/kg	**3**	----	----	----	----
Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
Vanadium	7440-62-2	5	mg/kg	**33**	----	----	----	----
Zinc	7440-66-6	5	mg/kg	**10**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	----	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	----	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	----	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	----	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	----	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	----	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	----	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	----	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	----	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	QA4	----	----	----	----
			Client sampling date / time	19-MAR-2015 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1506748-001	----	----	----	----
EP068A: Organochlorine Pesticides (OC) - Continued								
Endrin	72-20-8	0.05	mg/kg	<0.05	----	----	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	----	----	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	----	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	----	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	----	----	----	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	----	----	----	----
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	----	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	----	----	----	----
^ Sum of DDD + DDE + DDT	----	0.05	mg/kg	<0.05	----	----	----	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	----	----	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	----	----	----	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	----	----	----	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	----	----	----	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	----	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	----	----	----	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	----	----	----	----
Malathion	121-75-5	0.05	mg/kg	<0.05	----	----	----	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	----	----	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	----	----	----	----
Parathion	56-38-2	0.2	mg/kg	<0.2	----	----	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	----	----	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	----	----	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	----	----	----	----
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	----	----	----	----
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	----	----	----	----
Ethion	563-12-2	0.05	mg/kg	<0.05	----	----	----	----
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	----	----	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	----	----	----	----
C10 - C14 Fraction	----	50	mg/kg	<50	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	QA4	----	----	----	----
			Client sampling date / time	19-MAR-2015 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1506748-001	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons - Continued								
C15 - C28 Fraction	----	100	mg/kg	<100	----	----	----	----
C29 - C36 Fraction	----	100	mg/kg	<100	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	----	----	----	----
>C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	----	----	----	----
>C16 - C34 Fraction	----	100	mg/kg	<100	----	----	----	----
>C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	----	----	----	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	----	----	----	----
Toluene	108-88-3	0.5	mg/kg	<0.5	----	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	----	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	----	----	----	----
^ Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	----	----	----	----
Naphthalene	91-20-3	1	mg/kg	<1	----	----	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	**114**	----	----	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	**100**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**91.3**	----	----	----	----
Toluene-D8	2037-26-5	0.1	%	**89.2**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	**87.0**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	Recovery Limits (%) High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0

1311

30/3/15 0338

SMEC
Local People. Global Experience.

CHAIN OF CUSTODY FORM

SMEC OFFICE: Canberra
PROJECT: Isabella Weir
PROJECT NUMBER: 30021602
PROJECT MANAGER: [redacted] 02 6234 1959
SAMPLED BY: [redacted]
DATE SAMPLED: 18/3/15 – 19/3/15.
Email reports to (will default to PM if blank): [redacted]
Email Invoice to (will default to PM if blank): " " "
Special Laboratory Instructions: I will email through Analysis / CoC instructions.

TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT
☐ Non Standard TAT (List due date):

LAB QUOTE NO:

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

LAB: SGS Environmental
ATTENTION: [redacted]
DISPATCH TO (ADDRESS & PHONE NO.): unit 16, 37 maddox St, Alexandria, NSW, 2015.

RELINQUISHED BY: [redacted]
DATE/TIME:

RECEIVED BY:
DATE/TIME:

RELINQUISHED BY:
DATE/TIME:

RECEIVED BY: [redacted]
DATE/TIME: 20/03/15 @ 2.45

Harold
280316 12:30

SAMPLE DETAILS						ANALYSIS REQUIRED	COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	On hold	
1 /	TP01-0.1-0.2	18/3/15	S	Jar + Bag	2	X	
	TP01-0.4			+ Bag	2	X	
	TP01-1.1-1.2				1	X	
	TP01-2.3-2.4				1	X	
	TP02-0.1-0.2			+ Bag	2	X	
2 /	0.5-0.6			+ Bag	2	X	
	1.5-1.6				1	X	
	2.6-2.8				1	X	
	TP03-0.1-0.2			+Bag	2	X	
	0.4-0.5			+Bag	2	X	
3 /	1.0-1.1				1	X	
TOTAL					17.	11.	

Environmental Division
Sydney
Work Order
ES1506748
Telephone : +61-2-8784 8555

SE137450 COC
Received: 20–Mar–2015

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

1312

CHAIN OF CUSTODY FORM

30/3/15 0338

TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT

☐ Non Standard TAT ...

LAB: SGS Environment...

0342

SMEC

Local People. Global Experience.

CHAIN OF CUSTODY FORM

SMEC OFFICE: Canberra	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT		LAB: SGS Environmental
PROJECT: 3002402	☐ Non Standard TAT (List due date):		ATTENTION: As per pg 1
PROJECT NUMBER: Isabella Weir	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.):
PROJECT MANAGER: As per page 1	CONTACT PH: 0262341959.	COC: 1 2 3 4 (5) 6 7	
SAMPLED BY: " "		OF: 1 2 3 4 (5) 6 7	As per page 1
DATE SAMPLED: 28/3/15 19/3/15	RELINQUI[redacted]	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
Email reports to (will default to PM if blank): As per page 1	DATE/TIM	DATE/TIME:	DATE/TIME: / DATE/TIME:
Email invoice to (will default to PM if blank): " "			

Special Laboratory Instructions: * Please send QA2 QA4 to ALS in a chilled condition.

SAMPLE DETAILS						ANALYSIS REQUIRED									COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	On hold									
	QA3 *	19/3/15	S	Jar	1	x									
	QA4 *	↓	S	Jar	1	x									
	Frag 01	↓	1	Bag.	1.	x									Please weigh Frag 01 *
				TOTAL	3.	3									

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Conform WHITE: send to lab, YELLOW: ...

1313

ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Schedule 2.2 (a)(ii) [redacted]	Manager	Schedule 2.2 (a)(ii) [redacted]
Client	SMEC Australia Pty Ltd - ACT	Laboratory	SGS Alexandria Environmental
Address	Sun Micro Building Suite 2, Level 1 243 Northbourne Avenue ACT 2602	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	Schedule 2.2 (a)(ii) [redacted]	Telephone	Schedule 2.2 (a)(ii) [redacted]
Facsimile	Schedule 2.2 (a)(ii) [redacted]	Facsimile	Schedule 2.2 (a)(ii) [redacted]
Email	Schedule 2.2 (a)(ii) [redacted]	Email	au.environmental.sydney@sgs.com
Project	**3002402-Isabella Weir-Additional Testing**	SGS Reference	SE137450A R0
Order Number	**0338--0342**	Report Number	0000111868
Samples	2	Date Reported	03 Jun 2015
		Date Received	20 Mar 2015

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

No respirable fibres detected in all samples using trace analysis technique.

A portion of the sample supplied has been sub-sampled for asbestos according to SGS In-house procedures. We therefore cannot guarantee that the sub-sample is representative of the entire sample supplied. SGS Environmental Services recommends supplying approximately 50-100g of sample in a separate container.
Asbestos analysed by Approved Identifier [redacted]

SIGNATORIES

Schedule 2.2 (a)(ii) [redacted]

Asbestos Analyst

SGS

ANALYTICAL REPORT

RESULTS

Fibre Identification in soil — Method AN602

Laboratory Reference	Client Reference	Matrix	Sample Description	Date Sampled	Fibre Identification	Est.%w/w*
SE137450A.013	TP07_0.5	Soil	90g Clay,Sand,Rocks	18 Mar 2015	No Asbestos Found	<0.01
SE137450A.014	TP07_1.8-2.0	Soil	104g Clay,Sand,Rocks	18 Mar 2015	No Asbestos Found	<0.01

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic `clues`, which provide a reasonable degree of certainty, dispersion staining is a mandatory `clue` for positive identification. If sufficient `clues` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned.
AN602	Fibres/material that cannot be unequivocably identified as one of the three asbestos forms, will be reported as unknown mineral fibres (umf).
AN602	AS4964.2004 Method for the Qualitative Identification of Asbestos in Bulk Samples, Section 8.4, Trace Analysis Criteria, Note 4 states:"Depending upon sample condition and fibre type, the detection limit of this technique has been found to lie generally in the range of 1 in 1,000 to 1 in 10,000 parts by weight, equivalent to 1 to 0.1 g/kg."
AN602	The sample can be reported “no asbestos found at the reporting limit of 0.1 g/kg” (<0.01%w/w) where AN602 section 4.5 of this method has been followed, and if- (a) no trace asbestos fibres have been detected (i.e. no ‘respirable’ fibres): (b) the estimated weight of non-respirable asbestos fibre bundles and/or the estimated weight of asbestos in asbestos-containing materials are found to be less than 0.1g/kg: and (c) these non-respirable asbestos fibre bundles and/or the asbestos containing materials are only visible under stereo-microscope viewing conditions.

FOOTNOTES

Amosite	-	Brown Asbestos	NA	-	Not Analysed
Chrysotile	-	White Asbestos	LNR	-	Listed, Not Required
Crocidolite	-	Blue Asbestos	*	-	Not Accredited
Amphiboles	-	Amosite and/or Crocidolite	**	-	Indicative data, theoretical holding time exceeded.

(In reference to soil samples only) This report does not comply with the analytical reporting recommendations in the Western Australian Department of Health Guidelines for the Assessment and Remediation and Management of Asbestos Contaminated sites in Western Australia - May 2009.

Sampled by the client.

Where reported: 'Asbestos Detected': Asbestos detected by polarized light microscopy, including dispersion staining.
Where reported: 'No Asbestos Found': No Asbestos Found by polarized light microscopy, including dispersion staining.
Where reported: 'UMF Detected': Mineral fibres of unknown type detected by polarized light microscopy, including dispersion staining. Confirmation by another independent analytical technique may be necessary.

Even after disintegration it can be very difficult, or impossible, to detect the presence of asbestos in some asbestos-containing bulk materials using polarised light microscopy. This is due to the low grade or small length or diameter of asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

1316

STATEMENT OF QA/QC PERFORMANCE

SE137450 R0

CLIENT DETAILS

Contact	[redacted]
Client	SMEC Australia Pty Ltd - ACT
Address	Sun Micro Building Suite 2, Level 1 243 Northbourne Avenue ACT 2602
Telephone	[redacted]
Facsimile	[redacted]
Email	[redacted]
Project	**3002402 - Isabella Weir**
Order Number	**0338--0342**
Samples	12

LABORATORY DETAILS

Manager	[redacted]
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	[redacted]
Facsimile	[redacted]
Email	au.environmental.sydney@sgs.com
SGS Reference	SE137450 R0
Report Number	0000106322
Date Reported	27 Mar 2015

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS Environmental Services' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document and was supplied by the Client.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Matrix Spike	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	1 item

SAMPLE SUMMARY

Sample counts by matrix	11 Soils, 1 Material	Type of documentation received	COC
Date documentation received	20/3/2015	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	3.4°C
Sample container provider	ALS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes	Number of eskies/boxes received	

1317

HOLDING TIME SUMMARY

SE137450 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Fibre ID in bulk materials

Method: ME-(AU)-[ENV]AN602

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
Frag 01	SE137450.012	LB074580	19 Mar 2015	20 Mar 2015	18 Mar 2016	26 Mar 2015	18 Mar 2016	27 Mar 2015

Fibre Identification in soil

Method: ME-(AU)-[ENV]AN602

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01_0.1-0.2	SE137450.001	LB074570	18 Mar 2015	20 Mar 2015	17 Mar 2016	26 Mar 2015	17 Mar 2016	27 Mar 2015
TP02_0.5-0.6	SE137450.002	LB074570	18 Mar 2015	20 Mar 2015	17 Mar 2016	26 Mar 2015	17 Mar 2016	27 Mar 2015
TP03_1.0-1.1	SE137450.003	LB074570	18 Mar 2015	20 Mar 2015	17 Mar 2016	26 Mar 2015	17 Mar 2016	27 Mar 2015
TP04_0.1-0.2	SE137450.004	LB074570	18 Mar 2015	20 Mar 2015	17 Mar 2016	26 Mar 2015	17 Mar 2016	27 Mar 2015
TP05_2.0-2.2	SE137450.005	LB074570	18 Mar 2015	20 Mar 2015	17 Mar 2016	26 Mar 2015	17 Mar 2016	27 Mar 2015
TP06_3.0-3.1	SE137450.006	LB074570	18 Mar 2015	20 Mar 2015	17 Mar 2016	26 Mar 2015	17 Mar 2016	27 Mar 2015
TP07_1.0-1.2	SE137450.007	LB074570	19 Mar 2015	20 Mar 2015	18 Mar 2016	26 Mar 2015	18 Mar 2016	27 Mar 2015
TP08_1.1-1.2	SE137450.008	LB074570	19 Mar 2015	20 Mar 2015	18 Mar 2016	26 Mar 2015	18 Mar 2016	27 Mar 2015
TP09_0.4-0.5	SE137450.009	LB074570	19 Mar 2015	20 Mar 2015	18 Mar 2016	26 Mar 2015	18 Mar 2016	27 Mar 2015
TP10_0.1-0.2	SE137450.010	LB074570	19 Mar 2015	20 Mar 2015	18 Mar 2016	26 Mar 2015	18 Mar 2016	27 Mar 2015

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01_0.1-0.2	SE137450.001	LB074476	18 Mar 2015	20 Mar 2015	15 Apr 2015	25 Mar 2015	15 Apr 2015	27 Mar 2015
TP02_0.5-0.6	SE137450.002	LB074476	18 Mar 2015	20 Mar 2015	15 Apr 2015	25 Mar 2015	15 Apr 2015	27 Mar 2015
TP03_1.0-1.1	SE137450.003	LB074476	18 Mar 2015	20 Mar 2015	15 Apr 2015	25 Mar 2015	15 Apr 2015	27 Mar 2015
TP04_0.1-0.2	SE137450.004	LB074476	18 Mar 2015	20 Mar 2015	15 Apr 2015	25 Mar 2015	15 Apr 2015	27 Mar 2015
TP05_2.0-2.2	SE137450.005	LB074476	18 Mar 2015	20 Mar 2015	15 Apr 2015	25 Mar 2015	15 Apr 2015	27 Mar 2015
TP06_3.0-3.1	SE137450.006	LB074476	18 Mar 2015	20 Mar 2015	15 Apr 2015	25 Mar 2015	15 Apr 2015	27 Mar 2015
TP07_1.0-1.2	SE137450.007	LB074476	19 Mar 2015	20 Mar 2015	16 Apr 2015	25 Mar 2015	16 Apr 2015	27 Mar 2015
TP08_1.1-1.2	SE137450.008	LB074476	19 Mar 2015	20 Mar 2015	16 Apr 2015	25 Mar 2015	16 Apr 2015	27 Mar 2015
TP09_0.4-0.5	SE137450.009	LB074476	19 Mar 2015	20 Mar 2015	16 Apr 2015	25 Mar 2015	16 Apr 2015	27 Mar 2015
TP10_0.1-0.2	SE137450.010	LB074476	19 Mar 2015	20 Mar 2015	16 Apr 2015	25 Mar 2015	16 Apr 2015	27 Mar 2015
QA1	SE137450.011	LB074476	19 Mar 2015	20 Mar 2015	16 Apr 2015	25 Mar 2015	16 Apr 2015	27 Mar 2015

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01_0.1-0.2	SE137450.001	LB074485	18 Mar 2015	20 Mar 2015	01 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015
TP02_0.5-0.6	SE137450.002	LB074485	18 Mar 2015	20 Mar 2015	01 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015
TP03_1.0-1.1	SE137450.003	LB074485	18 Mar 2015	20 Mar 2015	01 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015
TP04_0.1-0.2	SE137450.004	LB074485	18 Mar 2015	20 Mar 2015	01 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015
TP05_2.0-2.2	SE137450.005	LB074485	18 Mar 2015	20 Mar 2015	01 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015
TP06_3.0-3.1	SE137450.006	LB074485	18 Mar 2015	20 Mar 2015	01 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015
TP07_1.0-1.2	SE137450.007	LB074485	19 Mar 2015	20 Mar 2015	02 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015
TP08_1.1-1.2	SE137450.008	LB074485	19 Mar 2015	20 Mar 2015	02 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015
TP09_0.4-0.5	SE137450.009	LB074485	19 Mar 2015	20 Mar 2015	02 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015
TP10_0.1-0.2	SE137450.010	LB074485	19 Mar 2015	20 Mar 2015	02 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015
QA1	SE137450.011	LB074485	19 Mar 2015	20 Mar 2015	02 Apr 2015	25 Mar 2015	30 Mar 2015	26 Mar 2015

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01_0.1-0.2	SE137450.001	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP02_0.5-0.6	SE137450.002	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP03_1.0-1.1	SE137450.003	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP04_0.1-0.2	SE137450.004	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP05_2.0-2.2	SE137450.005	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP06_3.0-3.1	SE137450.006	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP07_1.0-1.2	SE137450.007	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP08_1.1-1.2	SE137450.008	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP09_0.4-0.5	SE137450.009	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP10_0.1-0.2	SE137450.010	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
QA1	SE137450.011	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015

OP Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01_0.1-0.2	SE137450.001	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP02_0.5-0.6	SE137450.002	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015

HOLDING TIME SUMMARY

SE137450 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

OP Pesticides in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP03_1.0-1.1	SE137450.003	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP04_0.1-0.2	SE137450.004	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP05_2.0-2.2	SE137450.005	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP06_3.0-3.1	SE137450.006	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP07_1.0-1.2	SE137450.007	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP08_1.1-1.2	SE137450.008	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP09_0.4-0.5	SE137450.009	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP10_0.1-0.2	SE137450.010	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
QA1	SE137450.011	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01_0.1-0.2	SE137450.001	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP02_0.5-0.6	SE137450.002	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP03_1.0-1.1	SE137450.003	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP04_0.1-0.2	SE137450.004	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP05_2.0-2.2	SE137450.005	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP06_3.0-3.1	SE137450.006	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP07_1.0-1.2	SE137450.007	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP08_1.1-1.2	SE137450.008	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP09_0.4-0.5	SE137450.009	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP10_0.1-0.2	SE137450.010	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
QA1	SE137450.011	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01_0.1-0.2	SE137450.001	LB074444	18 Mar 2015	20 Mar 2015	14 Sep 2015	25 Mar 2015	14 Sep 2015	26 Mar 2015
TP02_0.5-0.6	SE137450.002	LB074444	18 Mar 2015	20 Mar 2015	14 Sep 2015	25 Mar 2015	14 Sep 2015	26 Mar 2015
TP03_1.0-1.1	SE137450.003	LB074444	18 Mar 2015	20 Mar 2015	14 Sep 2015	25 Mar 2015	14 Sep 2015	26 Mar 2015
TP04_0.1-0.2	SE137450.004	LB074444	18 Mar 2015	20 Mar 2015	14 Sep 2015	25 Mar 2015	14 Sep 2015	26 Mar 2015
TP05_2.0-2.2	SE137450.005	LB074444	18 Mar 2015	20 Mar 2015	14 Sep 2015	25 Mar 2015	14 Sep 2015	26 Mar 2015
TP06_3.0-3.1	SE137450.006	LB074444	18 Mar 2015	20 Mar 2015	14 Sep 2015	25 Mar 2015	14 Sep 2015	26 Mar 2015
TP07_1.0-1.2	SE137450.007	LB074444	19 Mar 2015	20 Mar 2015	15 Sep 2015	25 Mar 2015	15 Sep 2015	26 Mar 2015
TP08_1.1-1.2	SE137450.008	LB074444	19 Mar 2015	20 Mar 2015	15 Sep 2015	25 Mar 2015	15 Sep 2015	26 Mar 2015
TP09_0.4-0.5	SE137450.009	LB074444	19 Mar 2015	20 Mar 2015	15 Sep 2015	25 Mar 2015	15 Sep 2015	26 Mar 2015
TP10_0.1-0.2	SE137450.010	LB074444	19 Mar 2015	20 Mar 2015	15 Sep 2015	25 Mar 2015	15 Sep 2015	26 Mar 2015
QA1	SE137450.011	LB074444	19 Mar 2015	20 Mar 2015	15 Sep 2015	25 Mar 2015	15 Sep 2015	26 Mar 2015

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01_0.1-0.2	SE137450.001	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP02_0.5-0.6	SE137450.002	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP03_1.0-1.1	SE137450.003	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP04_0.1-0.2	SE137450.004	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP05_2.0-2.2	SE137450.005	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP06_3.0-3.1	SE137450.006	LB074380	18 Mar 2015	20 Mar 2015	01 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP07_1.0-1.2	SE137450.007	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP08_1.1-1.2	SE137450.008	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP09_0.4-0.5	SE137450.009	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
TP10_0.1-0.2	SE137450.010	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015
QA1	SE137450.011	LB074380	19 Mar 2015	20 Mar 2015	02 Apr 2015	24 Mar 2015	03 May 2015	27 Mar 2015

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01_0.1-0.2	SE137450.001	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP02_0.5-0.6	SE137450.002	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP03_1.0-1.1	SE137450.003	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP04_0.1-0.2	SE137450.004	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP05_2.0-2.2	SE137450.005	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP06_3.0-3.1	SE137450.006	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP07_1.0-1.2	SE137450.007	LB074326	19 Mar 2015	20 Mar 2015	02 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP08_1.1-1.2	SE137450.008	LB074326	19 Mar 2015	20 Mar 2015	02 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS “Field Sampling Guide for Containers and Holding Time” (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP09_0.4-0.5	SE137450.009	LB074326	19 Mar 2015	20 Mar 2015	02 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP10_0.1-0.2	SE137450.010	LB074326	19 Mar 2015	20 Mar 2015	02 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
QA1	SE137450.011	LB074326	19 Mar 2015	20 Mar 2015	02 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01_0.1-0.2	SE137450.001	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP02_0.5-0.6	SE137450.002	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP03_1.0-1.1	SE137450.003	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP04_0.1-0.2	SE137450.004	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP05_2.0-2.2	SE137450.005	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP06_3.0-3.1	SE137450.006	LB074326	18 Mar 2015	20 Mar 2015	01 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP07_1.0-1.2	SE137450.007	LB074326	19 Mar 2015	20 Mar 2015	02 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP08_1.1-1.2	SE137450.008	LB074326	19 Mar 2015	20 Mar 2015	02 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP09_0.4-0.5	SE137450.009	LB074326	19 Mar 2015	20 Mar 2015	02 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
TP10_0.1-0.2	SE137450.010	LB074326	19 Mar 2015	20 Mar 2015	02 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015
QA1	SE137450.011	LB074326	19 Mar 2015	20 Mar 2015	02 Apr 2015	23 Mar 2015	02 May 2015	27 Mar 2015

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

OC Pesticides in Soil — Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	TP03_1.0-1.1	SE137450.003	%	60 - 130%	91
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	110
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	106
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	110
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	109
	QA1	SE137450.011	%	60 - 130%	107

OP Pesticides in Soil — Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	TP03_1.0-1.1	SE137450.003	%	60 - 130%	88
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	90
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	88
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	90
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	90
	QA1	SE137450.011	%	60 - 130%	88
d14-p-terphenyl (Surrogate)	TP03_1.0-1.1	SE137450.003	%	60 - 130%	98
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	100
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	98
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	96
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	98
	QA1	SE137450.011	%	60 - 130%	94

PAH (Polynuclear Aromatic Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	TP03_1.0-1.1	SE137450.003	%	70 - 130%	88
	TP04_0.1-0.2	SE137450.004	%	70 - 130%	90
	TP07_1.0-1.2	SE137450.007	%	70 - 130%	88
	TP08_1.1-1.2	SE137450.008	%	70 - 130%	90
	TP09_0.4-0.5	SE137450.009	%	70 - 130%	90
d14-p-terphenyl (Surrogate)	TP03_1.0-1.1	SE137450.003	%	70 - 130%	98
	TP04_0.1-0.2	SE137450.004	%	70 - 130%	100
	TP07_1.0-1.2	SE137450.007	%	70 - 130%	98
	TP08_1.1-1.2	SE137450.008	%	70 - 130%	96
	TP09_0.4-0.5	SE137450.009	%	70 - 130%	98
d5-nitrobenzene (Surrogate)	TP03_1.0-1.1	SE137450.003	%	70 - 130%	86
	TP04_0.1-0.2	SE137450.004	%	70 - 130%	86
	TP07_1.0-1.2	SE137450.007	%	70 - 130%	86
	TP08_1.1-1.2	SE137450.008	%	70 - 130%	86
	TP09_0.4-0.5	SE137450.009	%	70 - 130%	86

VOC's in Soil — Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP01_0.1-0.2	SE137450.001	%	60 - 130%	78
	TP02_0.5-0.6	SE137450.002	%	60 - 130%	75
	TP03_1.0-1.1	SE137450.003	%	60 - 130%	81
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	77
	TP05_2.0-2.2	SE137450.005	%	60 - 130%	81
	TP06_3.0-3.1	SE137450.006	%	60 - 130%	85
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	76
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	83
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	79
	TP10_0.1-0.2	SE137450.010	%	60 - 130%	82
	QA1	SE137450.011	%	60 - 130%	83
d4-1,2-dichloroethane (Surrogate)	TP01_0.1-0.2	SE137450.001	%	60 - 130%	94
	TP02_0.5-0.6	SE137450.002	%	60 - 130%	93
	TP03_1.0-1.1	SE137450.003	%	60 - 130%	104
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	97
	TP05_2.0-2.2	SE137450.005	%	60 - 130%	92
	TP06_3.0-3.1	SE137450.006	%	60 - 130%	108
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	97
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	117
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	109

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d4-1,2-dichloroethane (Surrogate)	TP10_0.1-0.2	SE137450.010	%	60 - 130%	113
	QA1	SE137450.011	%	60 - 130%	111
d8-toluene (Surrogate)	TP01_0.1-0.2	SE137450.001	%	60 - 130%	81
	TP02_0.5-0.6	SE137450.002	%	60 - 130%	78
	TP03_1.0-1.1	SE137450.003	%	60 - 130%	75
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	72
	TP05_2.0-2.2	SE137450.005	%	60 - 130%	74
	TP06_3.0-3.1	SE137450.006	%	60 - 130%	78
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	76
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	74
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	84
	TP10_0.1-0.2	SE137450.010	%	60 - 130%	73
	QA1	SE137450.011	%	60 - 130%	76
Dibromofluoromethane (Surrogate)	TP01_0.1-0.2	SE137450.001	%	60 - 130%	78
	TP02_0.5-0.6	SE137450.002	%	60 - 130%	79
	TP03_1.0-1.1	SE137450.003	%	60 - 130%	76
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	74
	TP05_2.0-2.2	SE137450.005	%	60 - 130%	73
	TP06_3.0-3.1	SE137450.006	%	60 - 130%	81
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	72
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	83
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	78
	TP10_0.1-0.2	SE137450.010	%	60 - 130%	82
	QA1	SE137450.011	%	60 - 130%	83

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP01_0.1-0.2	SE137450.001	%	60 - 130%	78
	TP02_0.5-0.6	SE137450.002	%	60 - 130%	75
	TP03_1.0-1.1	SE137450.003	%	60 - 130%	81
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	77
	TP05_2.0-2.2	SE137450.005	%	60 - 130%	81
	TP06_3.0-3.1	SE137450.006	%	60 - 130%	85
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	76
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	83
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	79
	TP10_0.1-0.2	SE137450.010	%	60 - 130%	82
	QA1	SE137450.011	%	60 - 130%	83
d4-1,2-dichloroethane (Surrogate)	TP01_0.1-0.2	SE137450.001	%	60 - 130%	94
	TP02_0.5-0.6	SE137450.002	%	60 - 130%	93
	TP03_1.0-1.1	SE137450.003	%	60 - 130%	104
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	97
	TP05_2.0-2.2	SE137450.005	%	60 - 130%	92
	TP06_3.0-3.1	SE137450.006	%	60 - 130%	108
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	97
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	117
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	109
	TP10_0.1-0.2	SE137450.010	%	60 - 130%	113
	QA1	SE137450.011	%	60 - 130%	111
d8-toluene (Surrogate)	TP01_0.1-0.2	SE137450.001	%	60 - 130%	81
	TP02_0.5-0.6	SE137450.002	%	60 - 130%	78
	TP03_1.0-1.1	SE137450.003	%	60 - 130%	75
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	72
	TP05_2.0-2.2	SE137450.005	%	60 - 130%	74
	TP06_3.0-3.1	SE137450.006	%	60 - 130%	78
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	76
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	74
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	84
	TP10_0.1-0.2	SE137450.010	%	60 - 130%	73
	QA1	SE137450.011	%	60 - 130%	76
Dibromofluoromethane (Surrogate)	TP01_0.1-0.2	SE137450.001	%	60 - 130%	78

SGS

SURROGATES

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Volatile Petroleum Hydrocarbons in Soil (continued) — Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Dibromofluoromethane (Surrogate)	TP02_0.5-0.6	SE137450.002	%	60 - 130%	79
	TP03_1.0-1.1	SE137450.003	%	60 - 130%	76
	TP04_0.1-0.2	SE137450.004	%	60 - 130%	74
	TP05_2.0-2.2	SE137450.005	%	60 - 130%	73
	TP06_3.0-3.1	SE137450.006	%	60 - 130%	81
	TP07_1.0-1.2	SE137450.007	%	60 - 130%	72
	TP08_1.1-1.2	SE137450.008	%	60 - 130%	83
	TP09_0.4-0.5	SE137450.009	%	60 - 130%	78
	TP10_0.1-0.2	SE137450.010	%	60 - 130%	82
	QA1	SE137450.011	%	60 - 130%	83

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result
LB074476.001	Mercury	mg/kg	0.01	<0.01

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB074380.001		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1
		Alpha BHC	mg/kg	0.1	<0.1
		Lindane	mg/kg	0.1	<0.1
		Heptachlor	mg/kg	0.1	<0.1
		Aldrin	mg/kg	0.1	<0.1
		Beta BHC	mg/kg	0.1	<0.1
		Delta BHC	mg/kg	0.1	<0.1
		Heptachlor epoxide	mg/kg	0.1	<0.1
		Alpha Endosulfan	mg/kg	0.2	<0.2
		Gamma Chlordane	mg/kg	0.1	<0.1
		Alpha Chlordane	mg/kg	0.1	<0.1
		p,p'-DDE	mg/kg	0.1	<0.1
		Dieldrin	mg/kg	0.2	<0.2
		Endrin	mg/kg	0.2	<0.2
		Beta Endosulfan	mg/kg	0.2	<0.2
		p,p'-DDD	mg/kg	0.1	<0.1
		p,p'-DDT	mg/kg	0.1	<0.1
		Endosulfan sulphate	mg/kg	0.1	<0.1
		Endrin Aldehyde	mg/kg	0.1	<0.1
		Methoxychlor	mg/kg	0.1	<0.1
		Endrin Ketone	mg/kg	0.1	<0.1
		Isodrin	mg/kg	0.1	<0.1
		Mirex	mg/kg	0.1	<0.1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	105

OP Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB074380.001		Dichlorvos	mg/kg	0.5	<0.5
		Dimethoate	mg/kg	0.5	<0.5
		Diazinon (Dimpylate)	mg/kg	0.5	<0.5
		Fenitrothion	mg/kg	0.2	<0.2
		Malathion	mg/kg	0.2	<0.2
		Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	<0.2
		Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2
		Bromophos Ethyl	mg/kg	0.2	<0.2
		Methidathion	mg/kg	0.5	<0.5
		Ethion	mg/kg	0.2	<0.2
		Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2
	Surrogates	2-fluorobiphenyl (Surrogate)	%	-	78
		d14-p-terphenyl (Surrogate)	%	-	88

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number	Parameter	Units	LOR	Result
LB074380.001	Naphthalene	mg/kg	0.1	<0.1
	2-methylnaphthalene	mg/kg	0.1	<0.1
	1-methylnaphthalene	mg/kg	0.1	<0.1
	Acenaphthylene	mg/kg	0.1	<0.1
	Acenaphthene	mg/kg	0.1	<0.1
	Fluorene	mg/kg	0.1	<0.1
	Phenanthrene	mg/kg	0.1	<0.1
	Anthracene	mg/kg	0.1	<0.1
	Fluoranthene	mg/kg	0.1	<0.1
	Pyrene	mg/kg	0.1	<0.1
	Benzo(a)anthracene	mg/kg	0.1	<0.1
	Chrysene	mg/kg	0.1	<0.1
	Benzo(a)pyrene	mg/kg	0.1	<0.1

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB074380.001		Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
		Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1
		Benzo(ghi)perylene	mg/kg	0.1	<0.1
		Total PAH	mg/kg	0.8	<0.8
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	80
		2-fluorobiphenyl (Surrogate)	%	-	78
		d14-p-terphenyl (Surrogate)	%	-	88

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number		Parameter	Units	LOR	Result
LB074444.001		Arsenic, As	mg/kg	1	<1
		Beryllium, Be	mg/kg	0.5	<0.5
		Cadmium, Cd	mg/kg	0.3	<0.3
		Chromium, Cr	mg/kg	0.5	<0.5
		Cobalt, Co	mg/kg	0.5	<0.5
		Copper, Cu	mg/kg	0.5	<0.5
		Lead, Pb	mg/kg	1	<1
		Manganese, Mn	mg/kg	1	<1
		Nickel, Ni	mg/kg	0.5	<0.5
		Selenium, Se	mg/kg	3	<3
		Zinc, Zn	mg/kg	2	<2

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result
LB074380.001		TRH C10-C14	mg/kg	20	<20
		TRH C15-C28	mg/kg	45	<45
		TRH C29-C36	mg/kg	45	<45
		TRH C37-C40	mg/kg	100	<100
		TRH C10-C36 Total	mg/kg	110	<110

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB074326.001	Monocyclic Aromatic Hydrocarbons	Benzene	mg/kg	0.1	<0.1
		Toluene	mg/kg	0.1	<0.1
		Ethylbenzene	mg/kg	0.1	<0.1
		m/p-xylene	mg/kg	0.2	<0.2
		o-xylene	mg/kg	0.1	<0.1
	Polycyclic VOCs	Naphthalene	mg/kg	0.1	<0.1
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	96
		d4-1,2-dichloroethane (Surrogate)	%	-	117
		d8-toluene (Surrogate)	%	-	88
		Bromofluorobenzene (Surrogate)	%	-	94
	Totals	Total BTEX*	mg/kg	0.6	<0.6

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result
LB074326.001		TRH C6-C9	mg/kg	20	<20
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	96
		d4-1,2-dichloroethane (Surrogate)	%	-	117
		d8-toluene (Surrogate)	%	-	88

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE137450.010	LB074476.014		Mercury	mg/kg	0.01	0.01	0.01	200	0
SE137500.008	LB074476.024		Mercury	mg/kg	0.01	0.0086396207	0.0277819937	200	0

Moisture Content

Method: ME-(AU)-[ENV]AN002

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE137450.008	LB074485.011		% Moisture	%w/w	0.5	9.3	10	40	8
SE137450.011	LB074485.015		% Moisture	%	0.5	8.0	6.5	44	20

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE137450.011	LB074380.016		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Lindane	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor	mg/kg	0.1	<0.1	<0.1	200	0
			Aldrin	mg/kg	0.1	<0.1	<0.1	200	0
			Beta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Delta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Dieldrin	mg/kg	0.2	<0.2	<0.2	200	0
			Endrin	mg/kg	0.2	<0.2	<0.2	200	0
			o,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			p,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	200	0
			Methoxychlor	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Ketone	mg/kg	0.1	<0.1	<0.1	200	0
			Isodrin	mg/kg	0.1	<0.1	<0.1	200	0
			Mirex	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.16	0.17	30	4

OP Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE137450.004	LB074380.008		Dichlorvos	mg/kg	0.5	<0.5	<0.5	200	0
			Dimethoate	mg/kg	0.5	<0.5	<0.5	200	0
			Diazinon (Dimpylate)	mg/kg	0.5	<0.5	<0.5	200	0
			Fenitrothion	mg/kg	0.2	<0.2	<0.2	200	0
			Malathion	mg/kg	0.2	<0.2	<0.2	200	0
			Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	<0.2	<0.2	200	0
			Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2	<0.2	200	0
			Bromophos Ethyl	mg/kg	0.2	<0.2	<0.2	200	0
			Methidathion	mg/kg	0.5	<0.5	<0.5	200	0
			Ethion	mg/kg	0.2	<0.2	<0.2	200	0
			Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2	<0.2	200	0
		Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	2
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	2

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE137450.004	LB074380.009		Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE137450.004	LB074380.009		Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
			Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
			Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Chrysene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Carcinogenic PAHs, BaP TEQ <LOR=0*	TEQ (mg/kg)	0.2	<0.2	<0.2	200	0
			Carcinogenic PAHs, BaP TEQ <LOR=LOR*	TEQ (mg/kg)	0.3	<0.3	<0.3	134	0
			Carcinogenic PAHs, BaP TEQ <LOR=LOR/2*	TEQ (mg/kg)	0.2	<0.2	<0.2	175	0
			Total PAH	mg/kg	0.8	<0.8	<0.8	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.4	0.4	30	2
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	2
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	2

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE137450.010	LB074444.014	Arsenic, As	mg/kg	1	2	1	85	38
		Beryllium, Be	mg/kg	0.5	<0.5	<0.5	144	0
		Boron, B	mg/kg	5	<5	<5	200	0
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.5	13	13	34	6
		Cobalt, Co	mg/kg	0.5	4.2	5.0	41	16
		Copper, Cu	mg/kg	0.5	3.6	3.4	44	6
		Lead, Pb	mg/kg	1	12	11	39	5
		Manganese, Mn	mg/kg	1	400	390	30	3
		Nickel, Ni	mg/kg	0.5	2.3	2.3	52	1
		Selenium, Se	mg/kg	3	<3	<3	200	0
		Zinc, Zn	mg/kg	2	8	8	56	1
SE137500.004	LB074444.024	Arsenic, As	mg/kg	1	5.9302058529	6.0868369534	47	3
		Cadmium, Cd	mg/kg	0.3	0.3678492574	0.3448758976	114	6
		Chromium, Cr	mg/kg	0.5	17.9519968964	18.9668787209	33	5
		Copper, Cu	mg/kg	0.5	16.6718270765	16.8709117674	33	1
		Lead, Pb	mg/kg	1	23.6277414037	23.8811513720	34	1
		Nickel, Ni	mg/kg	0.5	9.8857927267	9.2497858604	35	7
		Zinc, Zn	mg/kg	2	44.2112973645	45.0698867441	34	2

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE137450.004	LB074380.009		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH C10-C40 Total	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	<25	<25	200	0
			TRH >C10-C16 (F2) - Naphthalene	mg/kg	25	<25	<25	200	0
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Original	Duplicate	Parameter	Units	LOR

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433/AN434

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE137450.008	LB074326.014	Monocyclic Aromatic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
			Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.1	4.0	50	2
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.8	5.6	50	5
			d8-toluene (Surrogate)	mg/kg	-	3.7	3.7	50	1
			Bromofluorobenzene (Surrogate)	mg/kg	-	4.2	4.1	50	3
		Totals	Total Xylenes*	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX*	mg/kg	0.6	<0.6	<0.6	200	0
SE137459.003	LB074326.021	Monocyclic Aromatic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
			Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.9	3.8	50	3
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.1	5.6	50	9
			d8-toluene (Surrogate)	mg/kg	-	3.9	3.6	50	8
			Bromofluorobenzene (Surrogate)	mg/kg	-	4.2	4.2	50	0
		Totals	Total Xylenes*	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX*	mg/kg	0.6	<0.6	<0.6	200	0

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433/AN434/AN410

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE137450.008	LB074326.014		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.1	4.0	30	2
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.8	5.6	30	5
			d8-toluene (Surrogate)	mg/kg	-	3.7	3.7	30	1
			Bromofluorobenzene (Surrogate)	mg/kg	-	4.2	4.1	30	3
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0
SE137459.003	LB074326.021		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.9	3.8	30	3
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.1	5.6	30	9
			d8-toluene (Surrogate)	mg/kg	-	3.9	3.6	30	8
			Bromofluorobenzene (Surrogate)	mg/kg	-	4.2	4.2	30	0
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB074476.002		Mercury	mg/kg	0.01	0.21	0.2	70 - 130	107

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB074380.002		Heptachlor	mg/kg	0.1	0.2	0.2	60 - 140	116
		Aldrin	mg/kg	0.1	0.2	0.2	60 - 140	114
		Delta BHC	mg/kg	0.1	0.2	0.2	60 - 140	104
		Dieldrin	mg/kg	0.2	0.2	0.2	60 - 140	111
		Endrin	mg/kg	0.2	0.2	0.2	60 - 140	118
		p,p'-DDT	mg/kg	0.1	0.2	0.2	60 - 140	116
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.16	0.15	40 - 130	109

OP Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB074380.002		Dichlorvos	mg/kg	0.5	1.9	2	60 - 140	97
		Diazinon (Dimpylate)	mg/kg	0.5	2.4	2	60 - 140	122
		Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	2.0	2	60 - 140	101
		Ethion	mg/kg	0.2	2.2	2	60 - 140	109
	Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	82
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 130	98

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB074380.002		Naphthalene	mg/kg	0.1	4.6	4	60 - 140	114
		Acenaphthylene	mg/kg	0.1	4.4	4	60 - 140	109
		Acenaphthene	mg/kg	0.1	4.6	4	60 - 140	115
		Phenanthrene	mg/kg	0.1	4.7	4	60 - 140	117
		Anthracene	mg/kg	0.1	4.6	4	60 - 140	115
		Fluoranthene	mg/kg	0.1	4.7	4	60 - 140	118
		Pyrene	mg/kg	0.1	4.6	4	60 - 140	115
		Benzo(a)pyrene	mg/kg	0.1	4.4	4	60 - 140	111
	Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	82
		2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	82
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 130	98

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB074444.002		Arsenic, As	mg/kg	1	48	50	80 - 120	96
		Beryllium, Be	mg/kg	0.5	48	50	80 - 120	97
		Boron, B	mg/kg	5	46	50	80 - 120	93
		Cadmium, Cd	mg/kg	0.3	47	50	80 - 120	94
		Chromium, Cr	mg/kg	0.5	47	50	80 - 120	95
		Cobalt, Co	mg/kg	0.5	48	50	80 - 120	96
		Copper, Cu	mg/kg	0.5	50	50	80 - 120	100
		Lead, Pb	mg/kg	1	48	50	80 - 120	97
		Manganese, Mn	mg/kg	1	48	50	80 - 120	96
		Nickel, Ni	mg/kg	0.5	48	50	80 - 120	96
		Selenium, Se	mg/kg	3	48	50	80 - 120	95
		Zinc, Zn	mg/kg	2	48	50	80 - 120	97

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB074380.002		TRH C10-C14	mg/kg	20	40	40	60 - 140	100
		TRH C15-C28	mg/kg	45	<45	40	60 - 140	100
		TRH C29-C36	mg/kg	45	<45	40	60 - 140	85
	TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	40	40	60 - 140	100
		TRH >C16-C34 (F3)	mg/kg	90	<90	40	60 - 140	95
		TRH >C34-C40 (F4)	mg/kg	120	<120	20	60 - 140	85

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number	Parameter	Units	LOR

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB074326.002	Monocyclic Aromatic	Benzene	mg/kg	0.1	2.2	2.9	60 - 140	76
		Toluene	mg/kg	0.1	2.2	2.9	60 - 140	76
		Ethylbenzene	mg/kg	0.1	2.5	2.9	60 - 140	84
		m/p-xylene	mg/kg	0.2	5.0	5.8	60 - 140	87
		o-xylene	mg/kg	0.1	2.3	2.9	60 - 140	80
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.3	5	60 - 140	86
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.8	5	60 - 140	117
		d8-toluene (Surrogate)	mg/kg	-	5.2	5	60 - 140	104
		Bromofluorobenzene (Surrogate)	mg/kg	-	5.1	5	60 - 140	102

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB074326.002		TRH C6-C10	mg/kg	25	<25	24.65	60 - 140	87
		TRH C6-C9	mg/kg	20	<20	23.2	60 - 140	84
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.3	5	60 - 140	86
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.8	5	60 - 140	117
		d8-toluene (Surrogate)	mg/kg	-	5.2	5	60 - 140	104
		Bromofluorobenzene (Surrogate)	mg/kg	-	5.1	5	60 - 140	102
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	7.25	60 - 140	99

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE137450.001	LB074476.004		Mercury	mg/kg	0.01	0.20	0.01	0.2	91

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE137450.003	LB074380.007		Naphthalene	mg/kg	0.1	4.0	<0.1	4	99
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
			Acenaphthylene	mg/kg	0.1	3.8	<0.1	4	95
			Acenaphthene	mg/kg	0.1	4.1	<0.1	4	102
			Fluorene	mg/kg	0.1	<0.1	<0.1	-	-
			Phenanthrene	mg/kg	0.1	3.9	<0.1	4	98
			Anthracene	mg/kg	0.1	4.0	<0.1	4	99
			Fluoranthene	mg/kg	0.1	3.9	<0.1	4	98
			Pyrene	mg/kg	0.1	3.9	<0.1	4	97
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Chrysene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(a)pyrene	mg/kg	0.1	4.7	<0.1	4	117
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	-	-
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	-	-
			Carcinogenic PAHs, BaP TEQ <LOR=0*	TEQ	0.2	4.7	<0.2	-	-
			Carcinogenic PAHs, BaP TEQ <LOR=LOR*	TEQ (mg/kg)	0.3	4.8	<0.3	-	-
			Carcinogenic PAHs, BaP TEQ <LOR=LOR/2*	TEQ (mg/kg)	0.2	4.8	<0.2	-	-
			Total PAH	mg/kg	0.8	32	<0.8	-	-
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.4	0.4	-	86
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	-	88
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	-	96

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE137450.001	LB074444.004		Arsenic, As	mg/kg	1	40	2	50	77
			Beryllium, Be	mg/kg	0.5	2.5	<0.5	2.5	82
			Boron, B	mg/kg	5	13	<5	10	129
			Cadmium, Cd	mg/kg	0.3	40	<0.3	50	79
			Chromium, Cr	mg/kg	0.5	48	8.3	50	80
			Cobalt, Co	mg/kg	0.5	45	3.8	50	82
			Copper, Cu	mg/kg	0.5	48	4.2	50	88
			Lead, Pb	mg/kg	1	52	12	50	81
			Manganese, Mn	mg/kg	1	330	290	50	66 ⑤
			Nickel, Ni	mg/kg	0.5	43	2.5	50	82
			Selenium, Se	mg/kg	3	13	<3	10	130
			Zinc, Zn	mg/kg	2	55	12	50	87

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE137450.003	LB074380.007		TRH C10-C14	mg/kg	20	40	<20	40	100
			TRH C15-C28	mg/kg	45	<45	<45	40	95
			TRH C29-C36	mg/kg	45	<45	<45	40	85
			TRH C37-C40	mg/kg	100	<100	<100	-	-
			TRH C10-C36 Total	mg/kg	110	110	<110	-	-
			TRH C10-C40 Total	mg/kg	210	<210	<210	-	-
		TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	40	<25	40	100
			TRH >C10-C16 (F2) - Naphthalene	mg/kg	25	40	<25	-	-
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	40	93
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	-	-

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

QC Sample	Sample Number	Parameter	Units	LOR

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433/AN434

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE137435.001	LB074326.004	Monocyclic Aromatic	Benzene	mg/kg	0.1	2.2	<0.1	2.9	76
			Toluene	mg/kg	0.1	2.2	<0.1	2.9	76
			Ethylbenzene	mg/kg	0.1	2.5	<0.1	2.9	87
			m/p-xylene	mg/kg	0.2	5.2	<0.2	5.8	90
			o-xylene	mg/kg	0.1	2.5	<0.1	2.9	86
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	-	-
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.8	3.8	5	76
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.8	4.4	5	97
			d8-toluene (Surrogate)	mg/kg	-	4.0	3.6	5	79
			Bromofluorobenzene (Surrogate)	mg/kg	-	4.8	4.3	5	96
		Totals	Total Xylenes*	mg/kg	0.3	7.7	<0.3	-	-
			Total BTEX*	mg/kg	0.6	15	<0.6	-	-

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433/AN434/AN410

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE137435.001	LB074326.004		TRH C6-C10	mg/kg	25	<25	<25	24.65	91
			TRH C6-C9	mg/kg	20	<20	<20	23.2	77
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.8	3.8	5	76
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.8	4.4	5	97
			d8-toluene (Surrogate)	mg/kg	-	4.0	3.6	5	79
			Bromofluorobenzene (Surrogate)	mg/kg	-	4.8	4.3	5	96
		VPH F Bands	Benzene (F0)	mg/kg	0.1	2.2	<0.1	-	-
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	7.25	110

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here:
http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

*	Non-accredited analysis.
-	Sample not analysed for this analyte.
^	Analysis performed by external laboratory.
IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to Analytical Report comments for further information.

SGS

ANALYTICAL REPORT

NATA
WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS

Contact	[redacted]
Client	SMEC Australia Pty Ltd - ACT
Address	Sun Micro Building Suite 2, Level 1 243 Northbourne Avenue ACT 2602
Telephone	[redacted]
Facsimile	[redacted]
Email	[redacted]
Project	**3002402 - Isabella Weir**
Order Number	**0338--0342**
Samples	11

LABORATORY DETAILS

Manager	[redacted]
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	[redacted]
Facsimile	[redacted]
Email	au.environmental.sydney@sgs.com
SGS Reference	SE137450 R0
Report Number	0000106321
Date Reported	27 Mar 2015
Date Received	20 Mar 2015

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

Sample # 3,5,6 : portion of the sample supplied has been sub-sampled for asbestos according to SGS In-house procedures. We therefore cannot guarantee that the sub-sample is representative of the entire sample supplied.
SGS Environmental Services recommends supplying approximately 50-100g of sample in a separate container.
No respirable fibres detected in all samples using trace analysis technique.
Sample # 7 :1-7 mm length fibre bundles found in approx 7x4 cement sheet fragments.
Asbestos analysed by Approved Identifiers [redacted] .

SIGNATORIES

[redacted]
Organic Chemist

[redacted]
Metals/Inorganics Team Leader

[redacted]
Production Manager

[redacted]
Organic Section Head

[redacted]
Asbestos Analyst

ANALYTICAL REPORT

RESULTS

Fibre Identification in soil — Method AN602

Laboratory Reference	Client Reference	Matrix	Sample Description	Date Sampled	Fibre Identification	Est.%w/w
SE137450.001	TP01_0.1-0.2	Soil	548 g clay,sand rocks	18 Mar 2015	No Asbestos Found Organic Fibres Detected	<0.01
SE137450.002	TP02_0.5-0.6	Soil	540 g clay,sand rocks	18 Mar 2015	No Asbestos Found Organic Fibres Detected	<0.01
SE137450.003	TP03_1.0-1.1	Soil	88 g clay,sand rocks	18 Mar 2015	No Asbestos Found Organic Fibres Detected	<0.01
SE137450.004	TP04_0.1-0.2	Soil	446 g clay,sand rocks	18 Mar 2015	No Asbestos Found Organic Fibres Detected	<0.01
SE137450.005	TP05_2.0-2.2	Soil	63 g clay,sand rocks	18 Mar 2015	No Asbestos Found Organic Fibres Detected	<0.01
SE137450.006	TP06_3.0-3.1	Soil	74 g clay,sand rocks	18 Mar 2015	No Asbestos Found Organic Fibres Detected	<0.01
SE137450.007	TP07_1.0-1.2	Soil	558 g clay,sand rocks	19 Mar 2015	Amosite & Chrysotile Asbestos Found Organic Fibres Detected	>0.01
SE137450.008	TP08_1.1-1.2	Soil	602 g clay,sand rocks	19 Mar 2015	No Asbestos Found Organic Fibres Detected	<0.01
SE137450.009	TP09_0.4-0.5	Soil	575 g clay,sand rocks	19 Mar 2015	No Asbestos Found Organic Fibres Detected	<0.01
SE137450.010	TP10_0.1-0.2	Soil	620 g clay,sand rocks	19 Mar 2015	No Asbestos Found Organic Fibres Detected	<0.01

ANALYTICAL REPORT

SE137450 R0

RESULTS

Fibre ID in bulk materials

Method AN602

Laboratory Reference	Client Reference	Matrix	Sample Description	Date Sampled	Fibre Identification
SE137450.012	Frag 01	Other	290x150x25mm Cement sheet fragments	19 Mar 2015	Amosite & Chrysotile Asbestos Detected

SGS

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN002	Weight of as received sample determined on a 2 decimal place balance.
AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic `clues`, which provide a reasonable degree of certainty, dispersion staining is a mandatory `clue` for positive identification. If sufficient `clues` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned.
AN602	Fibres/material that cannot be unequivocably identified as one of the three asbestos forms, will be reported as unknown mineral fibres (umf).
AN602	AS4964.2004 Method for the Qualitative Identification of Asbestos in Bulk Samples , Section 8.4, Trace Analysis Criteria, Note 4 states:"Depending upon sample condition and fibre type, the detection limit of this technique has been found to lie generally in the range of 1 in 1,000 to 1 in 10,000 parts by weight, equivalent to 1 to 0.1 g/kg."
AN602	The sample can be reported “no asbestos found at the reporting limit of 0.1 g/kg” (<0.01%w/w) where AN602 section 4.5 of this method has been followed, and if- (a) no trace asbestos fibres have been detected (i.e. no ‘respirable’ fibres): (b) the estimated weight of non-respirable asbestos fibre bundles and/or the estimated weight of asbestos in asbestos-containing materials are found to be less than 0.1g/kg: and (c) these non-respirable asbestos fibre bundles and/or the asbestos containing materials are only visible under stereo-microscope viewing conditions.

FOOTNOTES

Amosite	-	Brown Asbestos	NA	-	Not Analysed
Chrysotile	-	White Asbestos	LNR	-	Listed, Not Required
Crocidolite	-	Blue Asbestos	*	-	Not Accredited
Amphiboles	-	Amosite and/or Crocidolite	**	-	Indicative data, theoretical holding time exceeded.

(In reference to soil samples only) This report does not comply with the analytical reporting recommendations in the Western Australian Department of Health Guidelines for the Assessment and Remediation and Management of Asbestos Contaminated sites in Western Australia - May 2009.

Sampled by the client.

Where reported: 'Asbestos Detected': Asbestos detected by polarized light microscopy, including dispersion staining.
Where reported: 'No Asbestos Found': No Asbestos Found by polarized light microscopy, including dispersion staining.
Where reported: 'UMF Detected': Mineral fibres of unknown type detected by polarized light microscopy, including dispersion staining. Confirmation by another independent analytical technique may be necessary.

Even after disintegration it can be very difficult, or impossible, to detect the presence of asbestos in some asbestos-containing bulk materials using polarised light microscopy. This is due to the low grade or small length or diameter of asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

SGS

ANALYTICAL REPORT

NATA
WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Schedule 2.2 (a)(ii)	Manager	Schedule 2.2 (a)(ii)
Client	SMEC Australia Pty Ltd - ACT	Laboratory	SGS Alexandria Environmental
Address	Sun Micro Building Suite 2, Level 1 243 Northbourne Avenue ACT 2602	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	Schedule 2.2 (a)(ii)	Telephone	Schedule 2.2 (a)(ii)
Facsimile	Schedule 2.2 (a)(ii)	Facsimile	Schedule 2.2 (a)(ii)
Email	Schedule 2.2 (a)(ii) [redacted]	Email	au.environmental.sydney@sgs.com
Project	**3002402 - Isabella Weir**	SGS Reference	**SE137450 R0**
Order Number	**0338--0342**	Report Number	0000106320
Samples	12	Date Reported	27 Mar 2015
Date Started	25 Mar 2015	Date Received	20 Mar 2015

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

Sample # 3,5,6 : portion of the sample supplied has been sub-sampled for asbestos according to SGS In-house procedures. We therefore cannot guarantee that the sub-sample is representative of the entire sample supplied.
SGS Environmental Services recommends supplying approximately 50-100g of sample in a separate container.
No respirable fibres detected in all samples using trace analysis technique.
Sample # 7 :1-7 mm length fibre bundles found in approx 7x4 cement sheet fragments.
Asbestos analysed by Approved Identifiers [redacted]

SIGNATORIES

Schedule 2.2 (a)(ii)

Schedule 2.2 (a)(ii)
Organic Chemist

Schedule 2.2 (a)(ii)

Schedule 2.2 (a)(ii)
Metals/Inorganics Team Leader

Schedule 2.2 (a)(ii)

Schedule 2.2 (a)(ii)
Production Manager

Schedule 2.2 (a)(ii)

Schedule 2.2 (a)(ii)
Organic Section Head

Schedule 2.2 (a)(ii)

Schedule 2.2 (a)(ii)
Asbestos Analyst

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			18 Mar 2015	18 Mar 2015	18 Mar 2015	18 Mar 2015
Sample Name			TP01_0.1-0.2	TP02_0.5-0.6	TP03_1.0-1.1	TP04_0.1-0.2

VOC's in Soil Method: AN433/AN434 Tested: 23/3/2015

Monocyclic Aromatic Hydrocarbons

Benzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1

Polycyclic VOCs

Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1

Surrogates

Dibromofluoromethane (Surrogate)	%	-	78	79	76	74
d4-1,2-dichloroethane (Surrogate)	%	-	94	93	104	97
d8-toluene (Surrogate)	%	-	81	78	75	72
Bromofluorobenzene (Surrogate)	%	-	78	75	81	77

Totals

Total Xylenes*	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX*	mg/kg	0.6	<0.6	<0.6	<0.6	<0.6

Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410 Tested: 23/3/2015

TRH C6-C10	mg/kg	25	<25	<25	<25	<25
TRH C6-C9	mg/kg	20	<20	<20	<20	<20

Surrogates

Dibromofluoromethane (Surrogate)	%	-	78	79	76	74
d4-1,2-dichloroethane (Surrogate)	%	-	94	93	104	97
d8-toluene (Surrogate)	%	-	81	78	75	72
Bromofluorobenzene (Surrogate)	%	-	78	75	81	77

Parameter	Units	LOR	Sample Number: SE137450.001 Sample Matrix: Soil Sample Date: 18 Mar 2015 Sample Name: TP01_0.1-0.2	SE137450.002 Soil 18 Mar 2015 TP02_0.5-0.6	SE137450.003 Soil 18 Mar 2015 TP03_1.0-1.1	SE137450.004 Soil 18 Mar 2015 TP04_0.1-0.2

Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410 Tested: 23/3/2015 (continued)

VPH F Bands

Parameter	Units	LOR	TP01_0.1-0.2	TP02_0.5-0.6	TP03_1.0-1.1	TP04_0.1-0.2
Benzene (F0)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	<25	<25

TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403 Tested: 24/3/2015

Parameter	Units	LOR	TP01_0.1-0.2	TP02_0.5-0.6	TP03_1.0-1.1	TP04_0.1-0.2
TRH C10-C14	mg/kg	20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45	<45	<45	<45	<45
TRH C29-C36	mg/kg	45	<45	<45	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110
TRH C10-C40 Total	mg/kg	210	<210	<210	<210	<210

TRH F Bands

Parameter	Units	LOR	TP01_0.1-0.2	TP02_0.5-0.6	TP03_1.0-1.1	TP04_0.1-0.2
TRH >C10-C16 (F2)	mg/kg	25	<25	<25	<25	<25
TRH >C10-C16 (F2) - Naphthalene	mg/kg	25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120

PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 Tested: 24/3/2015

Parameter	Units	LOR	TP01_0.1-0.2	TP02_0.5-0.6	TP03_1.0-1.1	TP04_0.1-0.2
Naphthalene	mg/kg	0.1	-	-	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	-	-	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	-	-	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	-	-	<0.1	<0.1
Acenaphthene	mg/kg	0.1	-	-	<0.1	<0.1
Fluorene	mg/kg	0.1	-	-	<0.1	<0.1
Phenanthrene	mg/kg	0.1	-	-	<0.1	<0.1
Anthracene	mg/kg	0.1	-	-	<0.1	<0.1
Fluoranthene	mg/kg	0.1	-	-	<0.1	<0.1
Pyrene	mg/kg	0.1	-	-	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	-	-	<0.1	<0.1
Chrysene	mg/kg	0.1	-	-	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	-	-	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	-	-	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	-	-	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	-	-	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1	-	-	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	-	-	<0.1	<0.1
Carcinogenic PAHs, BaP TEQ <LOR=0*	TEQ	0.2	-	-	<0.2	<0.2
Carcinogenic PAHs, BaP TEQ <LOR=LOR*	TEQ (mg/kg)	0.3	-	-	<0.3	<0.3
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2*	TEQ (mg/kg)	0.2	-	-	<0.2	<0.2
Total PAH	mg/kg	0.8	-	-	<0.8	<0.8

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			18 Mar 2015	18 Mar 2015	18 Mar 2015	18 Mar 2015
Sample Name			TP01_0.1-0.2	TP02_0.5-0.6	TP03_1.0-1.1	TP04_0.1-0.2

PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 Tested: 24/3/2015 (continued)

Surrogates

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
d5-nitrobenzene (Surrogate)	%	-	-	-	86	86
2-fluorobiphenyl (Surrogate)	%	-	-	-	88	90
d14-p-terphenyl (Surrogate)	%	-	-	-	98	100

OC Pesticides in Soil Method: AN400/AN420 Tested: 24/3/2015

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Hexachlorobenzene (HCB)	mg/kg	0.1	-	-	<0.1	<0.1
Alpha BHC	mg/kg	0.1	-	-	<0.1	<0.1
Lindane	mg/kg	0.1	-	-	<0.1	<0.1
Heptachlor	mg/kg	0.1	-	-	<0.1	<0.1
Aldrin	mg/kg	0.1	-	-	<0.1	<0.1
Beta BHC	mg/kg	0.1	-	-	<0.1	<0.1
Delta BHC	mg/kg	0.1	-	-	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.1	-	-	<0.1	<0.1
o,p'-DDE	mg/kg	0.1	-	-	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.2	-	-	<0.2	<0.2
Gamma Chlordane	mg/kg	0.1	-	-	<0.1	<0.1
Alpha Chlordane	mg/kg	0.1	-	-	<0.1	<0.1
trans-Nonachlor	mg/kg	0.1	-	-	<0.1	<0.1
p,p'-DDE	mg/kg	0.1	-	-	<0.1	<0.1
Dieldrin	mg/kg	0.2	-	-	<0.2	<0.2
Endrin	mg/kg	0.2	-	-	<0.2	<0.2
o,p'-DDD	mg/kg	0.1	-	-	<0.1	<0.1
o,p'-DDT	mg/kg	0.1	-	-	<0.1	<0.1
Beta Endosulfan	mg/kg	0.2	-	-	<0.2	<0.2
p,p'-DDD	mg/kg	0.1	-	-	<0.1	<0.1
p,p'-DDT	mg/kg	0.1	-	-	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.1	-	-	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.1	-	-	<0.1	<0.1
Methoxychlor	mg/kg	0.1	-	-	<0.1	<0.1
Endrin Ketone	mg/kg	0.1	-	-	<0.1	<0.1
Isodrin	mg/kg	0.1	-	-	<0.1	<0.1
Mirex	mg/kg	0.1	-	-	<0.1	<0.1

Parameter	Units	LOR	SE137450.001 Soil 18 Mar 2015 TP01_0.1-0.2	SE137450.002 Soil 18 Mar 2015 TP02_0.5-0.6	SE137450.003 Soil 18 Mar 2015 TP03_1.0-1.1	SE137450.004 Soil 18 Mar 2015 TP04_0.1-0.2

OC Pesticides in Soil Method: AN400/AN420 Tested: 24/3/2015 (continued)

Surrogates

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	-	-	91	110

OP Pesticides in Soil Method: AN400/AN420 Tested: 24/3/2015

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Dichlorvos	mg/kg	0.5	-	-	<0.5	<0.5
Dimethoate	mg/kg	0.5	-	-	<0.5	<0.5
Diazinon (Dimpylate)	mg/kg	0.5	-	-	<0.5	<0.5
Fenitrothion	mg/kg	0.2	-	-	<0.2	<0.2
Malathion	mg/kg	0.2	-	-	<0.2	<0.2
Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	-	-	<0.2	<0.2
Parathion-ethyl (Parathion)	mg/kg	0.2	-	-	<0.2	<0.2
Bromophos Ethyl	mg/kg	0.2	-	-	<0.2	<0.2
Methidathion	mg/kg	0.5	-	-	<0.5	<0.5
Ethion	mg/kg	0.2	-	-	<0.2	<0.2
Azinphos-methyl (Guthion)	mg/kg	0.2	-	-	<0.2	<0.2

Surrogates

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
2-fluorobiphenyl (Surrogate)	%	-	-	-	88	90
d14-p-terphenyl (Surrogate)	%	-	-	-	98	100

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest Method: AN040/AN320 Tested: 25/3/2015

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Arsenic, As	mg/kg	1	2	2	1	2
Beryllium, Be	mg/kg	0.5	<0.5	<0.5	0.6	0.7
Boron, B	mg/kg	5	<5	<5	<5	<5
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	8.3	3.8	9.9	13
Cobalt, Co	mg/kg	0.5	3.8	2.4	4.0	6.0
Copper, Cu	mg/kg	0.5	4.2	2.6	3.9	4.9
Lead, Pb	mg/kg	1	12	8	8	11
Manganese, Mn	mg/kg	1	290	130	250	410
Nickel, Ni	mg/kg	0.5	2.5	1.7	2.9	3.1
Selenium, Se	mg/kg	3	<3	<3	<3	<3
Zinc, Zn	mg/kg	2	12	10	13	14

Parameter	Units	LOR	Sample Number / Sample Matrix / Sample Date / Sample Name	SE137450.001 Soil 18 Mar 2015 TP01_0.1-0.2	SE137450.002 Soil 18 Mar 2015 TP02_0.5-0.6	SE137450.003 Soil 18 Mar 2015 TP03_1.0-1.1	SE137450.004 Soil 18 Mar 2015 TP04_0.1-0.2

Mercury in Soil   Method: AN312   Tested: 25/3/2015

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Mercury	mg/kg	0.01	**0.01**	<0.01	**0.01**	**0.01**

Moisture Content   Method: AN002   Tested: 25/3/2015

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
% Moisture	%	0.5	**4.3**	**7.0**	**8.2**	**11**

Fibre Identification in soil   Method: AN602   Tested: 26/3/2015

FibreID

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Asbestos Detected	No unit	-	No	No	No	No

SemiQuant

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Estimated Fibres	%w/w	0.01	<0.01	<0.01	<0.01	<0.01

Fibre ID in bulk materials   Method: AN602   Tested: -

FibreID

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Asbestos Detected	No unit	-	-	-	-	-

Weight of Sample   Method: AN002   Tested: -

Parameter	Units	LOR	SE137450.001	SE137450.002	SE137450.003	SE137450.004
Weight of Sample*	g	0.01	-	-	-	-

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			18 Mar 2015	18 Mar 2015	19 Mar 2015	19 Mar 2015
Sample Name			TP05_2.0-2.2	TP06_3.0-3.1	TP07_1.0-1.2	TP08_1.1-1.2

VOC's in Soil Method: AN433/AN434 Tested: 23/3/2015

Monocyclic Aromatic Hydrocarbons

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Benzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1

Polycyclic VOCs

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1

Surrogates

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Dibromofluoromethane (Surrogate)	%	-	73	81	72	83
d4-1,2-dichloroethane (Surrogate)	%	-	92	108	97	117
d8-toluene (Surrogate)	%	-	74	78	76	74
Bromofluorobenzene (Surrogate)	%	-	81	85	76	83

Totals

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Total Xylenes*	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX*	mg/kg	0.6	<0.6	<0.6	<0.6	<0.6

Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410 Tested: 23/3/2015

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
TRH C6-C10	mg/kg	25	<25	<25	<25	<25
TRH C6-C9	mg/kg	20	<20	<20	<20	<20

Surrogates

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Dibromofluoromethane (Surrogate)	%	-	73	81	72	83
d4-1,2-dichloroethane (Surrogate)	%	-	92	108	97	117
d8-toluene (Surrogate)	%	-	74	78	76	74
Bromofluorobenzene (Surrogate)	%	-	81	85	76	83

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			18 Mar 2015	18 Mar 2015	19 Mar 2015	19 Mar 2015
Sample Name			TP05_2.0-2.2	TP06_3.0-3.1	TP07_1.0-1.2	TP08_1.1-1.2

Volatile Petroleum Hydrocarbons in Soil   Method: AN433/AN434/AN410   Tested: 23/3/2015   (continued)

VPH F Bands

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Benzene (F0)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	<25	<25

TRH (Total Recoverable Hydrocarbons) in Soil   Method: AN403   Tested: 24/3/2015

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
TRH C10-C14	mg/kg	20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45	<45	<45	<45	<45
TRH C29-C36	mg/kg	45	<45	<45	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110
TRH C10-C40 Total	mg/kg	210	<210	<210	<210	<210

TRH F Bands

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
TRH >C10-C16 (F2)	mg/kg	25	<25	<25	<25	<25
TRH >C10-C16 (F2) - Naphthalene	mg/kg	25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120

PAH (Polynuclear Aromatic Hydrocarbons) in Soil   Method: AN420   Tested: 24/3/2015

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Naphthalene	mg/kg	0.1	-	-	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	-	-	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	-	-	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	-	-	<0.1	<0.1
Acenaphthene	mg/kg	0.1	-	-	<0.1	<0.1
Fluorene	mg/kg	0.1	-	-	<0.1	<0.1
Phenanthrene	mg/kg	0.1	-	-	<0.1	<0.1
Anthracene	mg/kg	0.1	-	-	<0.1	<0.1
Fluoranthene	mg/kg	0.1	-	-	<0.1	<0.1
Pyrene	mg/kg	0.1	-	-	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	-	-	<0.1	<0.1
Chrysene	mg/kg	0.1	-	-	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	-	-	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	-	-	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	-	-	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	-	-	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1	-	-	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	-	-	<0.1	<0.1
Carcinogenic PAHs, BaP TEQ <LOR=0*	TEQ	0.2	-	-	<0.2	<0.2
Carcinogenic PAHs, BaP TEQ <LOR=LOR*	TEQ (mg/kg)	0.3	-	-	<0.3	<0.3
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2*	TEQ (mg/kg)	0.2	-	-	<0.2	<0.2
Total PAH	mg/kg	0.8	-	-	<0.8	<0.8

Parameter	Units	LOR	SE137450.005 Soil 18 Mar 2015 TP05_2.0-2.2	SE137450.006 Soil 18 Mar 2015 TP06_3.0-3.1	SE137450.007 Soil 19 Mar 2015 TP07_1.0-1.2	SE137450.008 Soil 19 Mar 2015 TP08_1.1-1.2
PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 Tested: 24/3/2015 (continued)						
Surrogates						
d5-nitrobenzene (Surrogate)	%	-	-	-	86	86
2-fluorobiphenyl (Surrogate)	%	-	-	-	88	90
d14-p-terphenyl (Surrogate)	%	-	-	-	98	96
OC Pesticides in Soil Method: AN400/AN420 Tested: 24/3/2015						
Hexachlorobenzene (HCB)	mg/kg	0.1	-	-	<0.1	<0.1
Alpha BHC	mg/kg	0.1	-	-	<0.1	<0.1
Lindane	mg/kg	0.1	-	-	<0.1	<0.1
Heptachlor	mg/kg	0.1	-	-	<0.1	<0.1
Aldrin	mg/kg	0.1	-	-	<0.1	<0.1
Beta BHC	mg/kg	0.1	-	-	<0.1	<0.1
Delta BHC	mg/kg	0.1	-	-	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.1	-	-	<0.1	<0.1
o,p'-DDE	mg/kg	0.1	-	-	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.2	-	-	<0.2	<0.2
Gamma Chlordane	mg/kg	0.1	-	-	<0.1	<0.1
Alpha Chlordane	mg/kg	0.1	-	-	<0.1	<0.1
trans-Nonachlor	mg/kg	0.1	-	-	<0.1	<0.1
p,p'-DDE	mg/kg	0.1	-	-	<0.1	<0.1
Dieldrin	mg/kg	0.2	-	-	<0.2	<0.2
Endrin	mg/kg	0.2	-	-	<0.2	<0.2
o,p'-DDD	mg/kg	0.1	-	-	<0.1	<0.1
o,p'-DDT	mg/kg	0.1	-	-	<0.1	<0.1
Beta Endosulfan	mg/kg	0.2	-	-	<0.2	<0.2
p,p'-DDD	mg/kg	0.1	-	-	<0.1	<0.1
p,p'-DDT	mg/kg	0.1	-	-	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.1	-	-	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.1	-	-	<0.1	<0.1
Methoxychlor	mg/kg	0.1	-	-	<0.1	<0.1
Endrin Ketone	mg/kg	0.1	-	-	<0.1	<0.1
Isodrin	mg/kg	0.1	-	-	<0.1	<0.1
Mirex	mg/kg	0.1	-	-	<0.1	<0.1

Parameter	Units	LOR	SE137450.005 Soil 18 Mar 2015 TP05_2.0-2.2	SE137450.006 Soil 18 Mar 2015 TP06_3.0-3.1	SE137450.007 Soil 19 Mar 2015 TP07_1.0-1.2	SE137450.008 Soil 19 Mar 2015 TP08_1.1-1.2

Sample Number / Sample Matrix / Sample Date / Sample Name

OC Pesticides in Soil Method: AN400/AN420 Tested: 24/3/2015 (continued)

Surrogates

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	-	-	106	110

OP Pesticides in Soil Method: AN400/AN420 Tested: 24/3/2015

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Dichlorvos	mg/kg	0.5	-	-	<0.5	<0.5
Dimethoate	mg/kg	0.5	-	-	<0.5	<0.5
Diazinon (Dimpylate)	mg/kg	0.5	-	-	<0.5	<0.5
Fenitrothion	mg/kg	0.2	-	-	<0.2	<0.2
Malathion	mg/kg	0.2	-	-	<0.2	<0.2
Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	-	-	<0.2	<0.2
Parathion-ethyl (Parathion)	mg/kg	0.2	-	-	<0.2	<0.2
Bromophos Ethyl	mg/kg	0.2	-	-	<0.2	<0.2
Methidathion	mg/kg	0.5	-	-	<0.5	<0.5
Ethion	mg/kg	0.2	-	-	<0.2	<0.2
Azinphos-methyl (Guthion)	mg/kg	0.2	-	-	<0.2	<0.2

Surrogates

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
2-fluorobiphenyl (Surrogate)	%	-	-	-	88	90
d14-p-terphenyl (Surrogate)	%	-	-	-	98	96

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest Method: AN040/AN320 Tested: 25/3/2015

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Arsenic, As	mg/kg	1	2	1	2	2
Beryllium, Be	mg/kg	0.5	1.1	0.9	0.7	0.5
Boron, B	mg/kg	5	<5	<5	<5	<5
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	11	6.4	13	6.4
Cobalt, Co	mg/kg	0.5	4.2	4.5	3.3	4.2
Copper, Cu	mg/kg	0.5	8.7	6.7	4.1	3.5
Lead, Pb	mg/kg	1	9	9	10	9
Manganese, Mn	mg/kg	1	57	110	200	230
Nickel, Ni	mg/kg	0.5	7.7	6.2	2.6	2.6
Selenium, Se	mg/kg	3	<3	<3	<3	<3
Zinc, Zn	mg/kg	2	10	8	13	12

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			18 Mar 2015	18 Mar 2015	19 Mar 2015	19 Mar 2015
Sample Name			TP05_2.0-2.2	TP06_3.0-3.1	TP07_1.0-1.2	TP08_1.1-1.2

Mercury in Soil   Method: AN312   Tested: 25/3/2015

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Mercury	mg/kg	0.01	0.05	0.04	<0.01	<0.01

Moisture Content   Method: AN002   Tested: 25/3/2015

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
% Moisture	%	0.5	25	23	13	9.3

Fibre Identification in soil   Method: AN602   Tested: 26/3/2015

FibreID

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Asbestos Detected	No unit	-	No	No	Yes	No

SemiQuant

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Estimated Fibres	%w/w	0.01	<0.01	<0.01	>0.01	<0.01

Fibre ID in bulk materials   Method: AN602   Tested: -

FibreID

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Asbestos Detected	No unit	-	-	-	-	-

Weight of Sample   Method: AN002   Tested: -

Parameter	Units	LOR	SE137450.005	SE137450.006	SE137450.007	SE137450.008
Weight of Sample*	g	0.01	-	-	-	-

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Sample Matrix			Soil	Soil	Soil	Material
Sample Date			19 Mar 2015	19 Mar 2015	19 Mar 2015	19 Mar 2015
Sample Name			TP09_0.4-0.5	TP10_0.1-0.2	QA1	Frag 01

VOC's in Soil   Method: AN433/AN434   Tested: 23/3/2015

Monocyclic Aromatic Hydrocarbons

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Benzene	mg/kg	0.1	<0.1	<0.1	<0.1	-
Toluene	mg/kg	0.1	<0.1	<0.1	<0.1	-
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	<0.1	-
m/p-xylene	mg/kg	0.2	<0.2	<0.2	<0.2	-
o-xylene	mg/kg	0.1	<0.1	<0.1	<0.1	-

Polycyclic VOCs

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	-

Surrogates

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Dibromofluoromethane (Surrogate)	%	-	78	82	83	-
d4-1,2-dichloroethane (Surrogate)	%	-	109	113	111	-
d8-toluene (Surrogate)	%	-	84	73	76	-
Bromofluorobenzene (Surrogate)	%	-	79	82	83	-

Totals

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Total Xylenes*	mg/kg	0.3	<0.3	<0.3	<0.3	-
Total BTEX*	mg/kg	0.6	<0.6	<0.6	<0.6	-

Volatile Petroleum Hydrocarbons in Soil   Method: AN433/AN434/AN410   Tested: 23/3/2015

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
TRH C6-C10	mg/kg	25	<25	<25	<25	-
TRH C6-C9	mg/kg	20	<20	<20	<20	-

Surrogates

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Dibromofluoromethane (Surrogate)	%	-	78	82	83	-
d4-1,2-dichloroethane (Surrogate)	%	-	109	113	111	-
d8-toluene (Surrogate)	%	-	84	73	76	-
Bromofluorobenzene (Surrogate)	%	-	79	82	83	-

Parameter	Units	LOR	Sample Number / Sample Matrix / Sample Date / Sample Name	SE137450.009 Soil 19 Mar 2015 TP09_0.4-0.5	SE137450.010 Soil 19 Mar 2015 TP10_0.1-0.2	SE137450.011 Soil 19 Mar 2015 QA1	SE137450.012 Material 19 Mar 2015 Frag 01

Volatile Petroleum Hydrocarbons in Soil Method: AN433/AN434/AN410 Tested: 23/3/2015 (continued)

VPH F Bands

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Benzene (F0)	mg/kg	0.1	<0.1	<0.1	<0.1	-
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	<25	-

TRH (Total Recoverable Hydrocarbons) in Soil Method: AN403 Tested: 24/3/2015

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
TRH C10-C14	mg/kg	20	<20	<20	<20	-
TRH C15-C28	mg/kg	45	<45	<45	<45	-
TRH C29-C36	mg/kg	45	<45	<45	<45	-
TRH C37-C40	mg/kg	100	<100	<100	<100	-
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	-
TRH C10-C40 Total	mg/kg	210	<210	<210	<210	-

TRH F Bands

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
TRH >C10-C16 (F2)	mg/kg	25	<25	<25	<25	-
TRH >C10-C16 (F2) - Naphthalene	mg/kg	25	<25	<25	<25	-
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	-
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	-

PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 Tested: 24/3/2015

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Naphthalene	mg/kg	0.1	<0.1	-	-	-
2-methylnaphthalene	mg/kg	0.1	<0.1	-	-	-
1-methylnaphthalene	mg/kg	0.1	<0.1	-	-	-
Acenaphthylene	mg/kg	0.1	<0.1	-	-	-
Acenaphthene	mg/kg	0.1	<0.1	-	-	-
Fluorene	mg/kg	0.1	<0.1	-	-	-
Phenanthrene	mg/kg	0.1	<0.1	-	-	-
Anthracene	mg/kg	0.1	<0.1	-	-	-
Fluoranthene	mg/kg	0.1	<0.1	-	-	-
Pyrene	mg/kg	0.1	<0.1	-	-	-
Benzo(a)anthracene	mg/kg	0.1	<0.1	-	-	-
Chrysene	mg/kg	0.1	<0.1	-	-	-
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	-	-	-
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	-	-	-
Benzo(a)pyrene	mg/kg	0.1	<0.1	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	-	-	-
Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	-	-	-
Benzo(ghi)perylene	mg/kg	0.1	<0.1	-	-	-
Carcinogenic PAHs, BaP TEQ <LOR=0*	TEQ	0.2	<0.2	-	-	-
Carcinogenic PAHs, BaP TEQ <LOR=LOR*	TEQ (mg/kg)	0.3	<0.3	-	-	-
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2*	TEQ (mg/kg)	0.2	<0.2	-	-	-
Total PAH	mg/kg	0.8	<0.8	-	-	-

Parameter	Units	LOR	SE137450.009 Soil 19 Mar 2015 TP09_0.4-0.5	SE137450.010 Soil 19 Mar 2015 TP10_0.1-0.2	SE137450.011 Soil 19 Mar 2015 QA1	SE137450.012 Material 19 Mar 2015 Frag 01

PAH (Polynuclear Aromatic Hydrocarbons) in Soil Method: AN420 Tested: 24/3/2015 (continued)

Surrogates

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
d5-nitrobenzene (Surrogate)	%	-	86	-	-	-
2-fluorobiphenyl (Surrogate)	%	-	90	-	-	-
d14-p-terphenyl (Surrogate)	%	-	98	-	-	-

OC Pesticides in Soil Method: AN400/AN420 Tested: 24/3/2015

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	-	<0.1	-
Alpha BHC	mg/kg	0.1	<0.1	-	<0.1	-
Lindane	mg/kg	0.1	<0.1	-	<0.1	-
Heptachlor	mg/kg	0.1	<0.1	-	<0.1	-
Aldrin	mg/kg	0.1	<0.1	-	<0.1	-
Beta BHC	mg/kg	0.1	<0.1	-	<0.1	-
Delta BHC	mg/kg	0.1	<0.1	-	<0.1	-
Heptachlor epoxide	mg/kg	0.1	<0.1	-	<0.1	-
o,p'-DDE	mg/kg	0.1	<0.1	-	<0.1	-
Alpha Endosulfan	mg/kg	0.2	<0.2	-	<0.2	-
Gamma Chlordane	mg/kg	0.1	<0.1	-	<0.1	-
Alpha Chlordane	mg/kg	0.1	<0.1	-	<0.1	-
trans-Nonachlor	mg/kg	0.1	<0.1	-	<0.1	-
p,p'-DDE	mg/kg	0.1	<0.1	-	<0.1	-
Dieldrin	mg/kg	0.2	<0.2	-	<0.2	-
Endrin	mg/kg	0.2	<0.2	-	<0.2	-
o,p'-DDD	mg/kg	0.1	<0.1	-	<0.1	-
o,p'-DDT	mg/kg	0.1	<0.1	-	<0.1	-
Beta Endosulfan	mg/kg	0.2	<0.2	-	<0.2	-
p,p'-DDD	mg/kg	0.1	<0.1	-	<0.1	-
p,p'-DDT	mg/kg	0.1	<0.1	-	<0.1	-
Endosulfan sulphate	mg/kg	0.1	<0.1	-	<0.1	-
Endrin Aldehyde	mg/kg	0.1	<0.1	-	<0.1	-
Methoxychlor	mg/kg	0.1	<0.1	-	<0.1	-
Endrin Ketone	mg/kg	0.1	<0.1	-	<0.1	-
Isodrin	mg/kg	0.1	<0.1	-	<0.1	-
Mirex	mg/kg	0.1	<0.1	-	<0.1	-

Parameter	Units	LOR	SE137450.009 Soil 19 Mar 2015 TP09_0.4-0.5	SE137450.010 Soil 19 Mar 2015 TP10_0.1-0.2	SE137450.011 Soil 19 Mar 2015 QA1	SE137450.012 Material 19 Mar 2015 Frag 01

OC Pesticides in Soil   Method: AN400/AN420   Tested: 24/3/2015   (continued)

Surrogates

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	109	-	107	-

OP Pesticides in Soil   Method: AN400/AN420   Tested: 24/3/2015

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Dichlorvos	mg/kg	0.5	<0.5	-	<0.5	-
Dimethoate	mg/kg	0.5	<0.5	-	<0.5	-
Diazinon (Dimpylate)	mg/kg	0.5	<0.5	-	<0.5	-
Fenitrothion	mg/kg	0.2	<0.2	-	<0.2	-
Malathion	mg/kg	0.2	<0.2	-	<0.2	-
Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	<0.2	-	<0.2	-
Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2	-	<0.2	-
Bromophos Ethyl	mg/kg	0.2	<0.2	-	<0.2	-
Methidathion	mg/kg	0.5	<0.5	-	<0.5	-
Ethion	mg/kg	0.2	<0.2	-	<0.2	-
Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2	-	<0.2	-

Surrogates

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
2-fluorobiphenyl (Surrogate)	%	-	90	-	88	-
d14-p-terphenyl (Surrogate)	%	-	98	-	94	-

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest   Method: AN040/AN320   Tested: 25/3/2015

Parameter	Units	LOR	SE137450.009	SE137450.010	SE137450.011	SE137450.012
Arsenic, As	mg/kg	1	2	2	2	-
Beryllium, Be	mg/kg	0.5	0.6	<0.5	0.7	-
Boron, B	mg/kg	5	<5	<5	<5	-
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	-
Chromium, Cr	mg/kg	0.5	5.5	13	13	-
Cobalt, Co	mg/kg	0.5	3.8	4.2	4.9	-
Copper, Cu	mg/kg	0.5	3.3	3.6	5.5	-
Lead, Pb	mg/kg	1	10	12	10	-
Manganese, Mn	mg/kg	1	280	400	280	-
Nickel, Ni	mg/kg	0.5	2.6	2.3	3.3	-
Selenium, Se	mg/kg	3	<3	<3	<3	-
Zinc, Zn	mg/kg	2	12	8	11	-

Parameter	Units	LOR	SE137450.009 Soil 19 Mar 2015 TP09_0.4-0.5	SE137450.010 Soil 19 Mar 2015 TP10_0.1-0.2	SE137450.011 Soil 19 Mar 2015 QA1	SE137450.012 Material 19 Mar 2015 Frag 01

Sample Number / Sample Matrix / Sample Date / Sample Name

Mercury in Soil Method: AN312 Tested: 25/3/2015

Mercury	mg/kg	0.01	<0.01	0.01	0.01	-

Moisture Content Method: AN002 Tested: 25/3/2015

% Moisture	%	0.5	11	5.6	8.0	-

Fibre Identification in soil Method: AN602 Tested: 26/3/2015

FibreID

Asbestos Detected	No unit	-	No	No	-	-

SemiQuant

Estimated Fibres	%w/w	0.01	<0.01	<0.01	-	-

Fibre ID in bulk materials Method: AN602 Tested: -

FibreID

Asbestos Detected	No unit	-	-	-	-	Yes

Weight of Sample Method: AN002 Tested: -

Weight of Sample*	g	0.01	-	-	-	452.00

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Mercury in Soil **Method: ME-(AU)-[ENV]AN312**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Mercury	LB074476	mg/kg	0.01	<0.01	0%	107%	91%

Moisture Content **Method: ME-(AU)-[ENV]AN002**

Parameter	QC Reference	Units	LOR	DUP %RPD
% Moisture	LB074485	%	0.5	8 - 20%

OC Pesticides in Soil **Method: ME-(AU)-[ENV]AN400/AN420**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Hexachlorobenzene (HCB)	LB074380	mg/kg	0.1	<0.1	0%	NA
Alpha BHC	LB074380	mg/kg	0.1	<0.1	0%	NA
Lindane	LB074380	mg/kg	0.1	<0.1	0%	NA
Heptachlor	LB074380	mg/kg	0.1	<0.1	0%	116%
Aldrin	LB074380	mg/kg	0.1	<0.1	0%	114%
Beta BHC	LB074380	mg/kg	0.1	<0.1	0%	NA
Delta BHC	LB074380	mg/kg	0.1	<0.1	0%	104%
Heptachlor epoxide	LB074380	mg/kg	0.1	<0.1	0%	NA
o,p'-DDE	LB074380	mg/kg	0.1	<0.1	0%	NA
Alpha Endosulfan	LB074380	mg/kg	0.2	<0.2	0%	NA
Gamma Chlordane	LB074380	mg/kg	0.1	<0.1	0%	NA
Alpha Chlordane	LB074380	mg/kg	0.1	<0.1	0%	NA
trans-Nonachlor	LB074380	mg/kg	0.1	<0.1	0%	NA
p,p'-DDE	LB074380	mg/kg	0.1	<0.1	0%	NA
Dieldrin	LB074380	mg/kg	0.2	<0.2	0%	111%
Endrin	LB074380	mg/kg	0.2	<0.2	0%	118%
o,p'-DDD	LB074380	mg/kg	0.1	<0.1	0%	NA
o,p'-DDT	LB074380	mg/kg	0.1	<0.1	0%	NA
Beta Endosulfan	LB074380	mg/kg	0.2	<0.2	0%	NA
p,p'-DDD	LB074380	mg/kg	0.1	<0.1	0%	NA
p,p'-DDT	LB074380	mg/kg	0.1	<0.1	0%	116%
Endosulfan sulphate	LB074380	mg/kg	0.1	<0.1	0%	NA
Endrin Aldehyde	LB074380	mg/kg	0.1	<0.1	0%	NA
Methoxychlor	LB074380	mg/kg	0.1	<0.1	0%	NA
Endrin Ketone	LB074380	mg/kg	0.1	<0.1	0%	NA
Isodrin	LB074380	mg/kg	0.1	<0.1	0%	NA
Mirex	LB074380	mg/kg	0.1	<0.1	0%	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Tetrachloro-m-xylene (TCMX) (Surrogate)	LB074380	%	-	105%	4%	109%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

OP Pesticides in Soil **Method: ME-(AU)-[ENV]AN400/AN420**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Dichlorvos	LB074380	mg/kg	0.5	<0.5	0%	97%
Dimethoate	LB074380	mg/kg	0.5	<0.5	0%	NA
Diazinon (Dimpylate)	LB074380	mg/kg	0.5	<0.5	0%	122%
Fenitrothion	LB074380	mg/kg	0.2	<0.2	0%	NA
Malathion	LB074380	mg/kg	0.2	<0.2	0%	NA
Chlorpyrifos (Chlorpyrifos Ethyl)	LB074380	mg/kg	0.2	<0.2	0%	101%
Parathion-ethyl (Parathion)	LB074380	mg/kg	0.2	<0.2	0%	NA
Bromophos Ethyl	LB074380	mg/kg	0.2	<0.2	0%	NA
Methidathion	LB074380	mg/kg	0.5	<0.5	0%	NA
Ethion	LB074380	mg/kg	0.2	<0.2	0%	109%
Azinphos-methyl (Guthion)	LB074380	mg/kg	0.2	<0.2	0%	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
2-fluorobiphenyl (Surrogate)	LB074380	%	-	78%	2%	82%
d14-p-terphenyl (Surrogate)	LB074380	%	-	88%	2%	98%

PAH (Polynuclear Aromatic Hydrocarbons) in Soil **Method: ME-(AU)-[ENV]AN420**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Naphthalene	LB074380	mg/kg	0.1	<0.1	0%	114%	99%
2-methylnaphthalene	LB074380	mg/kg	0.1	<0.1	0%	NA	NA
1-methylnaphthalene	LB074380	mg/kg	0.1	<0.1	0%	NA	NA
Acenaphthylene	LB074380	mg/kg	0.1	<0.1	0%	109%	95%
Acenaphthene	LB074380	mg/kg	0.1	<0.1	0%	115%	102%
Fluorene	LB074380	mg/kg	0.1	<0.1	0%	NA	NA
Phenanthrene	LB074380	mg/kg	0.1	<0.1	0%	117%	98%
Anthracene	LB074380	mg/kg	0.1	<0.1	0%	115%	99%
Fluoranthene	LB074380	mg/kg	0.1	<0.1	0%	118%	98%
Pyrene	LB074380	mg/kg	0.1	<0.1	0%	115%	97%
Benzo(a)anthracene	LB074380	mg/kg	0.1	<0.1	0%	NA	NA
Chrysene	LB074380	mg/kg	0.1	<0.1	0%	NA	NA
Benzo(b&j)fluoranthene	LB074380	mg/kg	0.1	<0.1	0%	NA	NA
Benzo(k)fluoranthene	LB074380	mg/kg	0.1	<0.1	0%	NA	NA
Benzo(a)pyrene	LB074380	mg/kg	0.1	<0.1	0%	111%	117%
Indeno(1,2,3-cd)pyrene	LB074380	mg/kg	0.1	<0.1	0%	NA	NA
Dibenzo(a&h)anthracene	LB074380	mg/kg	0.1	<0.1	0%	NA	NA
Benzo(ghi)perylene	LB074380	mg/kg	0.1	<0.1	0%	NA	NA
Carcinogenic PAHs, BaP TEQ <LOR=0*	LB074380	TEQ	0.2	<0.2	0%	NA	NA
Carcinogenic PAHs, BaP TEQ <LOR=LOR*	LB074380	TEQ (mg/kg)	0.3	<0.3	0%	NA	NA
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2*	LB074380	TEQ (mg/kg)	0.2	<0.2	0%	NA	NA
Total PAH	LB074380	mg/kg	0.8	<0.8	0%	NA	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
d5-nitrobenzene (Surrogate)	LB074380	%	-	80%	2%	82%	86%
2-fluorobiphenyl (Surrogate)	LB074380	%	-	78%	2%	82%	88%
d14-p-terphenyl (Surrogate)	LB074380	%	-	88%	2%	98%	96%

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest Method: ME-(AU)-[ENV]AN040/AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Arsenic, As	LB074444	mg/kg	1	<1	3 - 38%	96%	77%
Beryllium, Be	LB074444	mg/kg	0.5	<0.5	0%	97%	82%
Boron, B	LB074444	mg/kg	5	<5	0%	93%	129%
Cadmium, Cd	LB074444	mg/kg	0.3	<0.3	0 - 6%	94%	79%
Chromium, Cr	LB074444	mg/kg	0.5	<0.5	5 - 6%	95%	80%
Cobalt, Co	LB074444	mg/kg	0.5	<0.5	16%	96%	82%
Copper, Cu	LB074444	mg/kg	0.5	<0.5	1 - 6%	100%	88%
Lead, Pb	LB074444	mg/kg	1	<1	1 - 5%	97%	81%
Manganese, Mn	LB074444	mg/kg	1	<1	3%	96%	66%
Nickel, Ni	LB074444	mg/kg	0.5	<0.5	1 - 7%	96%	82%
Selenium, Se	LB074444	mg/kg	3	<3	0%	95%	130%
Zinc, Zn	LB074444	mg/kg	2	<2	1 - 2%	97%	87%

TRH (Total Recoverable Hydrocarbons) in Soil Method: ME-(AU)-[ENV]AN403

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
TRH C10-C14	LB074380	mg/kg	20	<20	0%	100%	100%
TRH C15-C28	LB074380	mg/kg	45	<45	0%	100%	95%
TRH C29-C36	LB074380	mg/kg	45	<45	0%	85%	85%
TRH C37-C40	LB074380	mg/kg	100	<100	0%	NA	NA
TRH C10-C36 Total	LB074380	mg/kg	110	<110	0%	NA	NA
TRH C10-C40 Total	LB074380	mg/kg	210	<210	0%	NA	NA

TRH F Bands

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
TRH >C10-C16 (F2)	LB074380	mg/kg	25	<25	0%	100%	100%
TRH >C10-C16 (F2) - Naphthalene	LB074380	mg/kg	25	<25	0%	NA	NA
TRH >C16-C34 (F3)	LB074380	mg/kg	90	<90	0%	95%	93%
TRH >C34-C40 (F4)	LB074380	mg/kg	120	<120	0%	85%	NA

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

VOC's in Soil Method: ME-(AU)-[ENV]AN433/AN434

Monocyclic Aromatic Hydrocarbons

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Benzene	LB074326	mg/kg	0.1	<0.1	0%	76%	76%
Toluene	LB074326	mg/kg	0.1	<0.1	0%	76%	76%
Ethylbenzene	LB074326	mg/kg	0.1	<0.1	0%	84%	87%
m/p-xylene	LB074326	mg/kg	0.2	<0.2	0%	87%	90%
o-xylene	LB074326	mg/kg	0.1	<0.1	0%	80%	86%

Polycyclic VOCs

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Naphthalene	LB074326	mg/kg	0.1	<0.1	0%	NA	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Dibromofluoromethane (Surrogate)	LB074326	%	-	96%	2 - 3%	86%	76%
d4-1,2-dichloroethane (Surrogate)	LB074326	%	-	117%	5 - 9%	117%	97%
d8-toluene (Surrogate)	LB074326	%	-	88%	1 - 8%	104%	79%
Bromofluorobenzene (Surrogate)	LB074326	%	-	94%	0 - 3%	102%	96%

Totals

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Total Xylenes*	LB074326	mg/kg	0.3	<0.3	0%	NA	NA
Total BTEX*	LB074326	mg/kg	0.6	<0.6	0%	NA	NA

Volatile Petroleum Hydrocarbons in Soil Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
TRH C6-C10	LB074326	mg/kg	25	<25	0%	87%	91%
TRH C6-C9	LB074326	mg/kg	20	<20	0%	84%	77%

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Dibromofluoromethane (Surrogate)	LB074326	%	-	96%	2 - 3%	86%	76%
d4-1,2-dichloroethane (Surrogate)	LB074326	%	-	117%	5 - 9%	117%	97%
d8-toluene (Surrogate)	LB074326	%	-	88%	1 - 8%	104%	79%
Bromofluorobenzene (Surrogate)	LB074326	%	-	94%	0 - 3%	102%	96%

VPH F Bands

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Benzene (F0)	LB074326	mg/kg	0.1	<0.1	0%	NA	NA
TRH C6-C10 minus BTEX (F1)	LB074326	mg/kg	25	<25	0%	99%	110%

METHOD	METHODOLOGY SUMMARY
AN002	Weight of as received sample determined on a 2 decimal place balance.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analsysis by ASS or ICP as per USEPA Method 200.8.
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN088	Orbital rolling for Organic pollutants are extracted from soil/sediment by transferring an appropriate mass of sample to a clear soil jar and extracting with 1:1 Dichloromethane/Acetone. Orbital Rolling method is intended for the extraction of semi-volatile organic compounds from soil/sediment samples, and is based somewhat on USEPA method 3570 (Micro Organic extraction and sample preparation). Method 3700.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500
AN400	OC and OP Pesticides by GC-ECD: The determination of organochlorine (OC) and organophosphorus (OP) pesticides and polychlorinated biphenyls (PCBs) in soils, sludges and groundwater. (Based on USEPA methods 3510, 3550, 8140 and 8080.)
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the NEPM 1999 (2013), >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). F2 is reported directly and also corrected by subtracting Naphthalene (from VOC method AN433) where available.
AN403	Additionally, the volatile C6-C9 fraction may be determined by a purge and trap technique and GC/MS because of the potential for volatiles loss. Total Petroleum Hydrocarbons (TPH) follows the same method of analysis after silica gel cleanup of the solvent extract. Aliphatic/Aromatic Speciation follows the same method of analysis after fractionation of the solvent extract over silica with differential polarity of the eluent solvents .
AN403	The GC/FID method is not well suited to the analysis of refined high boiling point materials (ie lubricating oils or greases) but is particularly suited for measuring diesel, kerosene and petrol if care to control volatility is taken. This method will detect naturally occurring hydrocarbons, lipids, animal fats, phenols and PAHs if they are present at sufficient levels, dependant on the use of specific cleanup/fractionation techniques. Reference USEPA 3510B, 8015B.
AN420	(SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols (etc) in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN420	SVOC Compounds: Semi-Volatile Organic Compounds (SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN433/AN434	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.

METHOD	METHODOLOGY SUMMARY
AN433/AN434/AN410	VOCs and C6-C9/C6-C10 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.
AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic `clues`, which provide a reasonable degree of certainty, dispersion staining is a mandatory `clue` for positive identification. If sufficient `clues` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned.
AN602	Fibres/material that cannot be unequivocably identified as one of the three asbestos forms, will be reported as unknown mineral fibres (umf).
AN602	AS4964.2004 Method for the Qualitative Identification of Asbestos in Bulk Samples , Section 8.4, Trace Analysis Criteria, Note 4 states:"Depending upon sample condition and fibre type, the detection limit of this technique has been found to lie generally in the range of 1 in 1,000 to 1 in 10,000 parts by weight, equivalent to 1 to 0.1 g/kg."
AN602	The sample can be reported “no asbestos found at the reporting limit of 0.1 g/kg” (<0.01%w/w) where AN602 section 4.5 of this method has been followed, and if- (a) no trace asbestos fibres have been detected (i.e. no ‘respirable’ fibres): (b) the estimated weight of non-respirable asbestos fibre bundles and/or the estimated weight of asbestos in asbestos-containing materials are found to be less than 0.1g/kg: and (c) these non-respirable asbestos fibre bundles and/or the asbestos containing materials are only visible under stereo-microscope viewing conditions.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	This analysis is not covered by the scope of accreditation.	QFH	QC result is above the upper tolerance
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
^	Performed by outside laboratory.	-	The sample was not analysed for this analyte
		NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here:
http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

ChemName	Units	EQL	SE137450-1 TP03_1.0-1.1 18/03/2015	SE137450-1 QA1 18/03/2015	RPD	SE140881-1 TPA1_1.0 18/06/2015	SE140881-1 D01_180615 18/06/2015	RPD	SE137450-1 TP08_1.1-1.2 19/03/2015	Interlab D QA4 19/03/2015	RPD	SE140881-1 TPA1_1.0 18/06/2015	Interlab D T01_180615 18/06/2015	RPD
SDG / Field ID / Sampled Date/Time														
TRH C37-C40	mg/kg	100	<100.0	<100.0	0									
Benzene	mg/kg	0.1 (Primary): 0.2 (Interlab)	<0.1	<0.1	0				<0.1	<0.2	0			
Benzene	mg/kg	0.1 (Primary): 0.2 (Interlab)	<0.1	<0.1	0				<0.1	<0.2	0			
Ethylbenzene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0				<0.1	<0.5	0			
Toluene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0				<0.1	<0.5	0			
Total BTEX	mg/kg	0.6 (Primary): 0.2 (Interlab)	<0.6	<0.6	0				<0.6	<0.2	0			
Xylene (m & p)	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
Xylene (o)	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0				<0.1	<0.5	0			
Xylene Total	mg/kg	0.3 (Primary): 0.5 (Interlab)	<0.3	<0.3	0				<0.3	<0.5	0			
C6-C10 less BTEX (F1)	mg/kg	25 (Primary): 10 (Interlab)	<25.0	<25.0	0				<25.0	<10.0	0			
Hexachlorobenzene	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
% Moisture	mg/kg	10000				79000.0	99000.0	22				79000.0		
Lead	mg/kg	1 (Primary): 5 (Interlab)	8.0	10.0	22	10.0	8.0	22	9.0	12.0	29	10.0	12.0	18
Arsenic	mg/kg	1 (Primary): 5 (Interlab)	1.0	2.0	67	2.0	2.0	0	2.0	<5.0	0	2.0	<5.0	0
Beryllium	mg/kg	0.5 (Primary): 1 (Interlab)	0.6	0.7	15				0.5	<1.0	0			
Boron	mg/kg	5 (Primary): 50 (Interlab)	<5.0	<5.0	0				<5.0	<50.0	0			
Cadmium	mg/kg	0.3 (Primary): 1 (Interlab)	<0.3	<0.3	0	<0.3	<0.3	0	<0.3	<1.0	0	<0.3	<1.0	0
Chromium (III+VI)	mg/kg	0.5 (Primary): 2 (Interlab)	9.9	13.0	27	5.9	5.6	5	**6.4**	**14.0**	**75**	5.9	7.0	17
Cobalt	mg/kg	0.5 (Primary): 2 (Interlab)	4.0	4.9	20				4.2	5.0	17			
Copper	mg/kg	0.5 (Primary): 5 (Interlab)	3.9	5.5	34	3.8	3.5	8	3.5	<5.0	0	3.8	<5.0	0
Manganese	mg/kg	1 (Primary): 5 (Interlab)	250.0	280.0	11				**230.0**	**403.0**	**55**			
Mercury	mg/kg	0.01 (Primary): 0.1 (Interlab)	0.01	0.01	0	<0.01	<0.01	0	<0.01	<0.1	0	<0.01	<0.1	0
Nickel	mg/kg	0.5 (Primary): 2 (Interlab)	2.9	3.3	13	4.0	3.1	25	2.6	3.0	14	4.0	5.0	22
Selenium	mg/kg	3 (Primary): 5 (Interlab)	<3.0	<3.0	0				<3.0	<5.0	0			
Zinc	mg/kg	2 (Primary): 5 (Interlab)	13.0	11.0	17	16.0	14.0	13	12.0	10.0	18	16.0	24.0	40
2,4-DDT	mg/kg	0.1	<0.1	<0.1	0									
4,4-DDE	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
a-BHC	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
Aldrin	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
b-BHC	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
Chlordane (cis)	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
gamma-Chlordane	mg/kg	0.1	<0.1	<0.1	0									
d-BHC	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
DDD	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
DDT	mg/kg	0.1 (Primary): 0.2 (Interlab)	<0.1	<0.1	0				<0.1	<0.2	0			
Dieldrin	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
Endosulfan I	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
Endosulfan II	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
Endosulfan sulphate	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
Endrin	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
Endrin aldehyde	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
Endrin ketone	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
g-BHC (Lindane)	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
Heptachlor	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
Heptachlor epoxide	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
Methoxychlor	mg/kg	0.1 (Primary): 0.2 (Interlab)	<0.1	<0.1	0				<0.1	<0.2	0			
o,p-DDD	mg/kg	0.1	<0.1	<0.1	0									
o,p'-DDE	mg/kg	0.1	<0.1	<0.1	0									
trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	0									
Azinophos methyl	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
Bromophos-ethyl	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
Chlorpyrifos	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
Diazinon	mg/kg	0.5 (Primary): 0.05 (Interlab)	<0.5	<0.5	0				<0.5	<0.05	0			
Dichlorvos	mg/kg	0.5 (Primary): 0.05 (Interlab)	<0.5	<0.5	0				<0.5	<0.05	0			
Dimethoate	mg/kg	0.5 (Primary): 0.05 (Interlab)	<0.5	<0.5	0				<0.5	<0.05	0			
Ethion	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
Fenitrothion	mg/kg	0.2	<0.2	<0.2	0									
Malathion	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
Methidathion	mg/kg	0.5	<0.5	<0.5	0									
Naphthalene	mg/kg	0.1 (Primary): 1 (Interlab)							<0.1	<1.0	0			
Naphthalene	mg/kg	0.1 (Primary): 1 (Interlab)	<0.1	<0.1	0				<0.1	<1.0	0			
Isodrin	mg/kg	0.1	<0.1	<0.1	0									
Mirex	mg/kg	0.1	<0.1	<0.1	0									
Parathion	mg/kg	0.2	<0.2	<0.2	0				<0.2	<0.2	0			
C10-C16	mg/kg	25 (Primary): 50 (Interlab)	<25.0	<25.0	0				<25.0	<50.0	0			
C16-C34	mg/kg	90 (Primary): 100 (Interlab)	<90.0	<90.0	0				<90.0	<100.0	0			
C34-C40	mg/kg	120 (Primary): 100 (Interlab)	<120.0	<120.0	0				<120.0	<100.0	0			
F2-NAPHTHALENE	mg/kg	25 (Primary): 50 (Interlab)	<25.0	<25.0	0				<25.0	<50.0	0			
C6 - C9	mg/kg	20 (Primary): 10 (Interlab)	<20.0	<20.0	0				<20.0	<10.0	0			
C10 - C14	mg/kg	20 (Primary): 50 (Interlab)	<20.0	<20.0	0				<20.0	<50.0	0			
C15 - C28	mg/kg	45 (Primary): 100 (Interlab)	<45.0	<45.0	0				<45.0	<100.0	0			
C29-C36	mg/kg	45 (Primary): 100 (Interlab)	<45.0	<45.0	0				<45.0	<100.0	0			
+C10 - C36 (Sum of total)	mg/kg	110 (Primary): 50 (Interlab)	<110.0	<110.0	0				<110.0	<50.0	0			
C10 - C40 (Sum of total)	mg/kg	210 (Primary): 50 (Interlab)	<210.0	<210.0	0				<210.0	<50.0	0			
C6-C10	mg/kg	25 (Primary): 10 (Interlab)	<25.0	<25.0	0				<25.0	<10.0	0			

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 80 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

3002402

Table 2
Asbestos ID Laboratory Results

SMEC

Sampling Round 1

Sample Name	Sample Depth	Method	Lab	Report Number	Date Sampled	Asbestos
TP01	0.1-0.2	Detect/Non-detect	SGS	SE137450 R0	18/03/2015	No Asbestos Detected
TP02	0.5-0.6	Detect/Non-detect	SGS	SE137450 R0	18/03/2015	No Asbestos Detected
TP03	1.0-1.1	Detect/Non-detect	SGS	SE137450 R0	18/03/2015	No Asbestos Detected
TP04	0.1-0.2	Detect/Non-detect	SGS	SE137450 R0	18/03/2015	No Asbestos Detected
TP05	2.0-2.2	Detect/Non-detect	SGS	SE137450 R0	18/03/2015	No Asbestos Detected
TP06	3.0-3.1	Detect/Non-detect	SGS	SE137450 R0	18/03/2015	No Asbestos Detected
TP07	0.5	Detect/Non-detect	SGS	SE137450A R0	18/03/2015	No Asbestos Detected
TP07	1.0-1.2	Detect/Non-detect	SGS	SE137450 R0	18/03/2015	Asbestos Detected
TP07	1.8-2.0	Detect/Non-detect	SGS	SE137450A R0	18/03/2015	No Asbestos Detected
TP08	1.1-1.2	Detect/Non-detect	SGS	SE137450 R0	18/03/2015	No Asbestos Detected

Frag01 (425 g) TP07-1.0-1.2	1.0-1.2	Detect/Non-detect	SGS	SE137450 R0	18/03/2015	Asbestos Detected

Sampling Round 2

Sample Name	Sample Depth	Method	Lab	Report Number	Date Sampled	Asbestos
TPA1	0.5	Detect/Non-detect	SGS	SE140881 R0	18/06/2015	No Asbestos Detected
TPA1	1	Detect/Non-detect	SGS	SE140881 R0	18/06/2015	No Asbestos Detected
TPA2	0.2	Detect/Non-detect	SGS	SE140881 R0	18/06/2015	No Asbestos Detected
TPA2	1	Detect/Non-detect	SGS	SE140881 R0	18/06/2015	No Asbestos Detected
TPA3	0.5	Detect/Non-detect	SGS	SE140881 R0	18/06/2015	No Asbestos Detected
TPA3	1	Detect/Non-detect	SGS	SE140881 R0	18/06/2015	No Asbestos Detected

				Metals								Asbestos
				Lead	**Arsenic**	**Cadmium**	**Chromium (III+VI)**	**Copper**	**Mercury**	**Nickel**	**Zinc**	**Estimated Fibres**
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				1	1	0.3	0.5	0.5	0.01	0.5	2	100
NEPM 2013 Table 1A(1) HILs Rec C Soil				600	300	90		17000	80	1200	30000	
NEPM 2013 Table 1A(1) HILs Res A Soil				300	100	20		6000	40	400	7400	
NEPM 2013 Table 1B(1,2,3,4,5) EILs Comm/Ind				440	80			180		190	460	
NEPM 2013 Table 1B(1,2,3,4,5) EILs Areas of Ecological Significance				**110**	**20**			**75**		**40**	**100**	
ACT 2000 Inert Waste (CT1)				10	10	2			0.4	4		
ACT 2000 General Solid Waste (CT2)				100	100	20			4	40		
ACT 2000 Industrial Waste (CT3)				400	400	80			16	160		
Field_ID	**Sample_Depth_Range**	**Sampled_Date-Time**	**Lab_Report_Number**									
D01_180615		18/06/2015	SE140881-1	8	2	<0.3	5.6	3.5	<0.01	3.1	14	-
TP3A_0.5	0.5	18/06/2015	SE140881-1	12	2	<0.3	5.6	4.2	<0.01	3.2	13	0
TP3A_1.0	1	18/06/2015	SE140881-1	9	2	<0.3	5.6	3.1	<0.01	3.2	14	0
TPA1_0.5	0.5	18/06/2015	SE140881-1	10	2	<0.3	5.9	3.5	<0.01	2.7	16	0
TPA1_1.0	1	18/06/2015	SE140881-1	10	2	<0.3	5.9	3.8	<0.01	4	16	0
TPA2_0.2	0.2	18/06/2015	SE140881-1	17	2	<0.3	15	4.7	0.02	3.3	12	0
TPA2_1.0	1	18/06/2015	SE140881-1	8	2	<0.3	3.2	2.1	<0.01	2.6	17	0

	Hydrocarbon												
	C10-C16	C16-C34	C34-C40	F2-NAPHTHALENE	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	C10 - C40 (Sum of total)	C6 - C9	C6-C10 less BTEX (F1)	C6-C10	TRH C37-C40
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	25	90	120	25	20	45	45	110	210	20	25	25	100
NEPM 2013 Table 1A(1) HILs Rec C Soil													
NEPM 2013 Table 1A(1) HILs Res A Soil													
NEPM 2013 Table 1B(1,2,3,4,5) EILs Comm/Ind													
NEPM 2013 Table 1B(1,2,3,4,5) EILs Areas of Ecological Significance													
NEPM 2013 Table 1A(3) Rec C Soil HSL for Vapour Intrusion, Sand													
0-1m				NL							NL		
1-2m				NL							NL		
2-4m				NL							NL		
>4m				NL							NL		
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand													
0-1m				110							45		
1-2m				240							70		
2-4m				440							110		
>4m				NL							200		
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil													
0-2m		300	2800	120							180		
NEPM 2013 Table 1B(6) ESLs for Areas of Ecological Significance, Coarse Soil													
0-2m		-	-	25							125		
NEPM 2013 Table 1B(7) Management Limits in Comm and Ind, Coarse Soil	1000	3500	10,000									700	
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil	1000	2500	10000									700	
ACT 2000 Inert Waste (CT1)								5000		650			
ACT 2000 GeneraL Solid Waste (CT2)								10,000		650			
ACT 2000 Industrial Waste (CT3)								40,000		2600			

	Metals																			
	Arsenic	Beryllium	Boron	Cadmium	Chromium (III+VI)	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Zinc	Mercury	2,4-DDT	4,4-DDE	a-BHC	Aldrin	b-BHC	Chlordane (cis)	gamma-Chlordane
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	1	0.5	5	0.3	0.5	0.5	0.5	1	1	0.5	3	2	0.01	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NEPM 2013 Table 1A(1) HILs Rec C Soil	300	90	20000	90		300	17000	600	19000	1200	700	30000	80							
NEPM 2013 Table 1A(1) HILs Res A Soil	100	60	4500	20		100	6000	300	3800	400	200	7400	40							
NEPM 2013 Table 1B(1,2,3,4,5) EILs Comm/Ind	80						180	440		190		460								
NEPM 2013 Table 1B(1,2,3,4,5) EILs Areas of Ecological Significance	**20**						**75**	**110**		**40**		**100**								
NEPM 2013 Table 1A(3) Rec C Soil HSL for Vapour Intrusion, Sand																				
0-1m																				
1-2m																				
2-4m																				
>4m																				
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																				
0-1m																				
1-2m																				
2-4m																				
>4m																				
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil																				
0-2m																				
NEPM 2013 Table 1B(6) ESLs for Areas of Ecological Significance, Coarse Soil																				
0-2m																				
NEPM 2013 Table 1B(7) Management Limits in Comm and Ind, Coarse Soil																				
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																				
ACT 2000 Inert Waste (CT1)	10	2		2				10		4	2		0.4							
ACT 2000 GeneraL Solid Waste (CT2)	100	20		20				100		40	20		4							
ACT 2000 Industrial Waste (CT3)	400	80		80				400		160	80		16							

Field_ID	LocCode	Sample Depth	Sampled Date	C10-C16	C16-C34	C34-C40	F2-NAPHTHALENE	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	C10 - C40 (Sum of total)	C6 - C9	C6-C10 less BTEX (F1)	C6-C10	TRH C37-C40
QA1	TP03_1.0-1.1		19/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100
TP01_0.1-0.2	TP01	0.1-0.2	18/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100
TP02_0.5-0.6	TP02	0.5-0.6	18/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100
TP03_1.0-1.1	TP03	1-1.1	18/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100
TP04_0.1-0.2	TP04	0.1-0.2	18/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100
TP05_2.0-2.2	TP05	2-2.2	18/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100
TP06_3.0-3.1	TP06	3-3.1	18/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100
TP07_1.0-1.2	TP07	1-1.2	19/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100
TP08_1.1-1.2	TP08	1.1-1.2	19/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100
TP09_0.4-0.5	TP09	0.4-0.5	19/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100
TP10_0.1-0.2	TP10	0.1-0.2	19/03/2015	<25	<90	<120	<25	<20	<45	<45	<110	<210	<20	<25	<25	<100

Field_ID	Arsenic	Beryllium	Boron	Cadmium	Chromium (III+VI)	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Zinc	Mercury	2,4-DDT	4,4-DDE	a-BHC	Aldrin	b-BHC	Chlordane (cis)	gamma-Chlordane
QA1	2	0.7	<5	<0.3	13	4.9	5.5	10	280	3.3	<3	11	0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP01_0.1-0.2	2	<0.5	<5	<0.3	8.3	3.8	4.2	12	290	2.5	<3	12	0.01	-	-	-	-	-	-	-
TP02_0.5-0.6	2	<0.5	<5	<0.3	3.8	2.4	2.6	8	130	1.7	<3	10	<0.01	-	-	-	-	-	-	-
TP03_1.0-1.1	1	0.6	<5	<0.3	9.9	4	3.9	8	250	2.9	<3	13	0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP04_0.1-0.2	2	0.7	<5	<0.3	13	6	4.9	11	410	3.1	<3	14	0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP05_2.0-2.2	2	1.1	<5	<0.3	11	4.2	8.7	9	57	7.7	<3	10	0.05	-	-	-	-	-	-	-
TP06_3.0-3.1	1	0.9	<5	<0.3	6.4	4.5	6.7	9	110	6.2	<3	8	0.04	-	-	-	-	-	-	-
TP07_1.0-1.2	2	0.7	<5	<0.3	13	3.3	4.1	10	200	2.6	<3	13	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP08_1.1-1.2	2	0.5	<5	<0.3	6.4	4.2	3.5	9	230	2.6	<3	12	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP09_0.4-0.5	2	0.6	<5	<0.3	5.5	3.8	3.3	10	280	2.6	<3	12	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP10_0.1-0.2	2	<0.5	<5	<0.3	13	4.2	3.6	12	400	2.3	<3	8	0.01	-	-	-	-	-	-	-

				OCP/OPP																																		
				d-BHC	DDD	DDT	Aldrin + Dieldrin	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Hexachlorobenzene	Isodrin	Methoxychlor	Mirex	o,p-DDD	o,p'-DDE	Azinophos methyl	Bromophos-ethyl	Chlorpyrifos	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Methidathion	Parathion	trans-Nonachlor	Benzo[b+j]fluoranthene	1-Methylnaphthalene
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.1	0.1	0.1			0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.5	0.5	0.5	0.2	0.2	0.2	0.5	0.2	0.1	0.1	0.1
NEPM 2013 Table 1A(1) HILs Rec C Soil							10	400					20				10		10		400	20					250											
NEPM 2013 Table 1A(1) HILs Res A Soil							6	240					10				6		10		300	10					160											
NEPM 2013 Table 1B(1,2,3,4,5) EILs Comm/Ind						640																																
NEPM 2013 Table 1B(1,2,3,4,5) EILs Areas of Ecological Significance						**3**																																
NEPM 2013 Table 1A(3) Rec C Soil HSL for Vapour Intrusion, Sand																																						
0-1m																																						
1-2m																																						
2-4m																																						
>4m																																						
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																																						
0-1m																																						
1-2m																																						
2-4m																																						
>4m																																						
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil																																						
0-2m																																						
NEPM 2013 Table 1B(6) ESLs for Areas of Ecological Significance, Coarse Soil																																						
0-2m																																						
NEPM 2013 Table 1B(7) Management Limits in Comm and Ind, Coarse Soil																																						
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																																						
ACT 2000 Inert Waste (CT1)																											0.4											
ACT 2000 GeneraL Solid Waste (CT2)																											4											
ACT 2000 Industrial Waste (CT3)																											16											
Field_ID	**LocCode**	**Sample Depth**	**Sampled Date**																																			
QA1	TP03_1.0-1.1		19/03/2015	<0.1	<0.1	<0.1	<0.3	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.2	<0.1	-	-
TP01_0.1-0.2	TP01	0.1-0.2	18/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP02_0.5-0.6	TP02	0.5-0.6	18/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP03_1.0-1.1	TP03	1-1.1	18/03/2015	<0.1	<0.1	<0.1	<0.3	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.2	<0.1	<0.1	<0.1
TP04_0.1-0.2	TP04	0.1-0.2	18/03/2015	<0.1	<0.1	<0.1	<0.3	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.2	<0.1	<0.1	<0.1
TP05_2.0-2.2	TP05	2-2.2	18/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP06_3.0-3.1	TP06	3-3.1	18/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP07_1.0-1.2	TP07	1-1.2	19/03/2015	<0.1	<0.1	<0.1	<0.3	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.2	<0.1	<0.1	<0.1
TP08_1.1-1.2	TP08	1.1-1.2	19/03/2015	<0.1	<0.1	<0.1	<0.3	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.2	<0.1	<0.1	<0.1
TP09_0.4-0.5	TP09	0.4-0.5	19/03/2015	<0.1	<0.1	<0.1	<0.3	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.2	<0.1	<0.1	<0.1
TP10_0.1-0.2	TP10	0.1-0.2	19/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

				PAH and PCB																	BTEX								ESDAT Combined Compounds		
				2-methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene	Benzene	Ethylbenzene	Naphthalene	Toluene	Total BTEX	Xylene (m & p)	Xylene (o)	Xylene Total	PAH (total, NSW Waste 2008)	Pesticides (total, NSW Waste 2008)	Scheduled chemicals (NSW Waste 2008)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.6	0.2	0.1	0.3			
NEPM 2013 Table 1A(1) HILs Rec C Soil																		300													
NEPM 2013 Table 1A(1) HILs Res A Soil																		300													
NEPM 2013 Table 1B(1,2,3,4,5) EILs Comm/Ind																	370														
NEPM 2013 Table 1B(1,2,3,4,5) EILs Areas of Ecological Significance																	**10**														
NEPM 2013 Table 1A(3) Rec C Soil HSL for Vapour Intrusion, Sand																															
0-1m																	NL				NL	NL	NL	NL				NL			
1-2m																	NL				NL	NL	NL	NL				NL			
2-4m																	NL				NL	NL	NL	NL				NL			
>4m																	NL				NL	NL	NL	NL				NL			
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																															
0-1m																	3				0.5	55	3	160				40			
1-2m																	NL				0.5	NL	NL	220				60			
2-4m																	NL				0.5	NL	NL	310				95			
>4m																	NL				0.5	NL	NL	540				170			
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil																															
0-2m									0.7												50	70		85				105			
NEPM 2013 Table 1B(6) ESLs for Areas of Ecological Significance, Coarse Soil																															
0-2m									1.4												8	1.5		10				10			
NEPM 2013 Table 1B(7) Management Limits in Comm and Ind, Coarse Soil																															
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																															
ACT 2000 Inert Waste (CT1)									0.08									200			1	60		28.8				100			
ACT 2000 GeneraL Solid Waste (CT2)									0.8									200			10	600		288				1000			
ACT 2000 Industrial Waste (CT3)									3.2									800			40	2400		1152				4000			
Field_ID	**LocCode**	**Sample Depth**	**Sampled Date**																												
QA1	TP03_1.0-1.1		19/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	<2.1	<1.6
TP01_0.1-0.2	TP01	0.1-0.2	18/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	-	-
TP02_0.5-0.6	TP02	0.5-0.6	18/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	-	-
TP03_1.0-1.1	TP03	1-1.1	18/03/2015	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<1.5	<2.1	<1.6
TP04_0.1-0.2	TP04	0.1-0.2	18/03/2015	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<1.5	<2.1	<1.6
TP05_2.0-2.2	TP05	2-2.2	18/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	-	-
TP06_3.0-3.1	TP06	3-3.1	18/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	-	-
TP07_1.0-1.2	TP07	1-1.2	19/03/2015	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<1.5	<2.1	<1.6
TP08_1.1-1.2	TP08	1.1-1.2	19/03/2015	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<1.5	<2.1	<1.6
TP09_0.4-0.5	TP09	0.4-0.5	19/03/2015	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<1.5	<2.1	<1.6
TP10_0.1-0.2	TP10	0.1-0.2	19/03/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	-	-

APPENDIX I VERIFICATION MATRIX

Isabella Weir Upgrade

Construction Verification Matrix

LEGEND:
Prime Responsibility PR
Input Required I
Review R
Approval A

Task	CMTEDD Dam Owner	Principal's Authorised Person	Contractor	Design Consultant	Dam Regulator	Jemena/ZNX	Telstra	EPA	
Construction Risk Assessment	A	R	PR	I	A				
Project Quality Management Plan		R	PR	R					
Project Safety Management Plan		R	PR	R					
Dam Safety Emergency Plan	A	R	PR		A	A			
Construction Environmental Management Plan		R	PR	R					
Construction Planning, Sequence and Methodology		R	PR	R					
Temporary Works design		R	PR	R					
Environmental Approvals		R	PR	I					
Stakeholder Consultation	PR	I	I	I					
Services relocation									
Gas Main		R	PR	R		A			
Telstra		R	PR	R			A		
Contractor Initiated changes	A	A	PR	A					
Design changes arising out of encountered conditions	A	A	PR	A					
Principal initiated changes	I	A	PR	R					
Geological Mapping of Excavations		R	PR	A					
Records of foundation treatments including:									
Photographic records		R	PR	I/R					
Grouting		A	PR	I/R					
Dental Concrete		A	PR	I/R					
Cut -off walls		A	PR	R					
Anchor Installation		A	PR	I/R					
Subsoil drain installation		A	PR	I/R					
Material Selection									
Zone 1 Fill		R	PR	A					
Zone 2 Fill		R	PR	A					
Zone 3 Filter		R	PR	A					
Zone 4 rip rap		R	PR	A					
Zone 5A Fine filter		R	PR	A					
Zone 5B Coarse Filter		R	PR	A					
Concrete Mix Design		R	PR	A					
Earthworks records including:									
Materials tracking		R	PR	R					
Date time and location of filling		R	PR	R					
Material testing records (including contamination testing)		R	PR	R				A	
Compaction testing records		R	PR	A					
As placed survey		R	PR	A					
WaE Survey		R	PR	A					
Defect rectification		A	PR	A					
Sediment Removal									
Materials tracking		R	PR						
Date time and location of stockpiling		R	PR						
Contamination testing		R	PR					A	
Treatment plan		R	PR					A	
Treatment records		R	PR					A	
Pond bed survey		R	PR						
Concrete Structures									
Formwork Design		R	PR						
Reinforcement Schedules		R	PR						
Date time and location of reinforcement placement		R	PR						
Date time and location of concrete pours		R	PR						
Materials and installation of joints, sealants, waterstops		A	PR	A					
Reinforcement testing records		R	PR	R					
Concrete testing records		R	PR	R					
WaE survey		R	PR	R					
Defect rectification		A	PR	A					
Steel Structures									
Shop Drawings		R	PR						
Steel testing records		R	PR						
Corrosion protection records		R	PR						
Date time and location of steel element erection		R	PR						
WaE survey		R	PR						
Defect rectification		A	PR	A					
Mechanical Works									
Pipe selection		R	PR	A					
Valve selection		R	PR	A					
Date time and location of component installation		R	PR	R					
Testing and commissioning records	A	A	PR	A					
First Filling Inspection	A			PR	A				
Construction Report	A	I/R	PR	I/R	A				

APPENDIX J GAS MAIN CORRESPONDENCE

Barlow, Sam

From: Crocker, Leigh <Leigh.Crocker@act.gov.au>
Sent: Thursday, 11 June 2015 11:38 AM
To: Li, Xunyong; Stojanov, Milan; Oxborrow, Stuart; Taylor, Nick; [redacted]
Subject: FW: Isabella Weir
Attachments: ISABELLA WEIR RELOCATION.pdf

Hi Gents,

See below. Also looks like we have a drawing for the DA (attached to Jim's email). I assume its $60k in $300k or so, and given the time and risk advantages I think it confirms that directional drilling will be preferred.

I told Jim we would discuss this so we can respond quickly when he sends the final numbers, but looks on track.

Regards

Leigh

Leigh Crocker | Contract Engineer
Phone 6207 9146 | **Mobile** 0414 510 553
Infrastructure Planning and Design **| Civil Infrastructure and Capital Works**
Chief Minister, Treasury and Economic Development Directorate (CMTEDD) **| ACT Government**
Level 3 Annex, Macarthur House, 12 Wattle Street Lyneham ACT 2602 | PO Box 818 Dickson ACT 2602 |
www.economicdevelopment.act.gov.au

From: Schedule 2.2 (a)(ii) [redacted] [mailto:Schedule 2.2 (a)(ii) [redacted]
Sent: Thursday, 11 June 2015 11:11 AM
To: Crocker, Leigh
Subject: FW: Isabella Weir

Leigh,

Apologies, that's a $60**k** difference, I meant to write

From: Schedule 2.2 (a)(ii) [redacted]
Sent: Thursday, 11 June 2015 11:05 AM
To: Crocker, Leigh (Leigh.Crocker@act.gov.au)
Subject: FW: Isabella Weir

Leigh

Preliminary estimates from TR Civils
indicate a $60 difference between drilling and excavation.

I have asked them to document more thoroughly the scope and processes,
along with their recommendations as the why drilling is the preferred option.

ZNX is exploring the availability of steel and having the rock jacket coating applied.

Give us another week or so, for us to prepare the total costs for each option.

Regards

Schedule 2.2 (a)(ii) [redacted]

1370

Construction Project Planner

Ph: [redacted]
E: [redacted]

5-7 Johns Place
HUME ACT 2620

From: [redacted]
Sent: Wednesday, 10 June 2015 3:15 PM
To: Crocker, Leigh
Subject: RE: Isabella Weir

Leigh

Acknowledged.
Please note that “sign –off’ for the DA will probably be by Jemena.
Also the Letter of Offer might also be by Jemena.

I’ll contact you as soon as I have some feed-back from TR Civils
in regards to their preliminary costs and advice.
[redacted] has been investigating pipe procurement and I’ll try to
advise you further on that, when practical.

Thanks
We’ll keep talking..

[redacted]
Construction Project Planner

Ph: [redacted]
E: [redacted]

5-7 Johns Place
HUME ACT 2620

From: Crocker, Leigh [mailto:Leigh.Crocker@act.gov.au]
Sent: Wednesday, 10 June 2015 2:13 PM
To: [redacted]
Cc: Oxborrow, Stuart; Taylor, Nick
Subject: Isabella Weir

[redacted]

Isabella Weir – steel gas main relocation (meeting held between ZNX and ACT Government on Wednesday 3rd June 2015)

1371

Thank you for organising the meeting yesterday regarding the potential to relocate the steel gas main that currently goes through the Isabella Weir embankment.

As discussed, The ACT Government is upgrading Isabella Weir to double its flood capacity. As part of this project our designer, SMEC, have written to us recently regarding the dam safety issues associated with having a gas main through the embankment. In short SMEC's advice is that the main has to be removed from the embankment. Note that this is a new development and supersedes the previous discussion the ACT Government have had with ZNX regarding protection of the gas main in its current location.

At the meeting we discussed the potential to move the gas main, and how we might proceed with this project. The ACT Government voiced our preference for relocating the main upstream of the weir, probably using directional drilling. However the ACT Government would need to justify directional drilling on the basis of cost and risk when compared to the possibility of trenching the route when the pond is drained for our construction.

Following discussion about the various options and processes we agreed the following;

1. The ACT Government would provide all the currently available geotechnical information to enable ZNX to assess the costs and risks associated with directional drilling and trenching;
2. The issue of the potential relocation of the telecommunications conduit that was laid with the gas main was also discussed. SMEC and ZNX to resolve this issue with Telstra, and the directional drilling estimate will include an estimate for the relocation of the telecommunications conduit if agreed by Telstra;
3. The ACT Government will confirm the location of the adjacent 300mm watermain;
4. ZNX would also look at the issue of pipe supply to ensure adequate length of the appropriately coated steel pipe is available for the relocation, and develop a cost and timing estimate for the works;
5. Based on this preliminary advice the ACT Government will then formally confirm our intention to do the work, and in doing so confirm whether the trenching or the directional drilling option should be adopted;
6. The ACT Government will commission SMEC to develop a draft DA for the works, and liaise with ZNX for its development. This will include an appropriate supporting letter and "sign off" from ZNX on the appropriateness of the DA. This work will commence now and be done in parallel with points 2 and 3 above;
7. Based on the resolution of all the issues listed above, ZNX will develop a "letter of offer" for the works. This document will become the contract between ACT Government and ZNX for the project, and will include;
    - Cost, including any upfront payments that may be required (e.g. for purchase of pipe);
    - Timing;
    - ZNX as the manager of the work;
8. The project can start when the DA is approved and the ACT Government has formally accepted the letter of offer.

Finally, whilst no commitments were made, ZNX noted that, excluding unforseen holdups, and given appropriately coated pipes can be sourced, it is likely the project can be completed by Christmas. The final timing and cost will be confirmed in the letter of offer.

Please let us know if there are any misunderstandings or errors in this record of the meeting, and we would be happy to discuss and amend them as appropriate.

Regards

Leigh

Leigh Crocker | Contract Engineer
Phone 6207 9146 | **Mobile** [redacted]
Infrastructure Planning and Design **| Civil Infrastructure and Capital Works**
Chief Minister, Treasury and Economic Development Directorate (CMTEDD) **| ACT Government**
Level 3 Annex, Macarthur House, 12 Wattle Street Lyneham ACT 2602 | PO Box 818 Dickson ACT 2602 |
www.economicdevelopment.act.gov.au

1372

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

****
This is a confidential message intended for the named recipient(s) only. The contents herein are privileged to the sender and the use thereof is restricted to the intended purpose. If you have received this e-mail in error, please do not use, disclose, distribute, copy, print or relay on this email. If receipt is in error, please advise the sender by reply email. Thank you.
****

This e-mail has been scanned for viruses by Symantec.Cloud.

1373

Local People. Global Experience.

Suite 2, Level 1
243 Northbourne Avenue
Lyneham, Canberra ACT 2602, Australia
T +61 2 6234 1900 **F** +61 2 6234 1966 **E** canberra@smec.com
www.smec.com

29 April 2015 File: 2015/5255/ 3002402/001

Procurement & Capital Works
PO Box 818
Dickson
ACT 2602

Attn: Mr Miloje Beljic

Dear Mr Beljic,

RE: Isabella Weir Upgrade Design and Construction Monitoring
Impact of the existing 200mm gas main on design and construction of the Isabella Weir Upgrade

We are writing in regard to the 200mm diameter gas main which is located within the embankments forming Isabella Weir, and also extends across the creek channel immediately downstream of the weir. The impact of the main on the design and construction of the upgrade works for the weir has been discussed a number of times during the course of the project. Below is presented a summary of our understanding of the key aspects relating to the issue:

- Jemena/ZNX has indicated that they do not wish to relocate the mains. However, it is noted that the original (Jacobs-SKM) design concept for upgrading the weir provided for widening the existing labyrinth to the right (west) only. As such, it is judged that the gas main on this abutment would have needed to be relocated, possibly both in the embankment and downstream where the widened creek channel would be constructed.
- The primary purpose of the weir embankments is to retain the water in Isabella Pond. That the gas main was installed within the embankment following its (the embankment's) construction is surprising considering conduits through water retaining embankments should be avoided if possible. If a request were received today to install the gas main through the embankments, SMEC's recommendation would be that approval not be given. As stated numerous times, the gas main should not be located in the embankments.
- The presence of the gas main (and telecom cables) within the embankment results in 'defects' within the structure, and an associated increase in the risk of failure due to piping. Jacobs-SKM judged this risk to be low. Additional information obtained since the Jacobs-SKM assessment was undertaken indicates that the installed depth of the main is lower than previously considered, and the standard of installation is judged to be poor (it is not clear how Jacobs-SKM assessed this aspect). It is envisaged that settlement of fill beneath the mains could have occurred generally along the length of the mains, and overall the likelihood of piping is greater than assessed by Jacobs-SKM, albeit still not large. Irrespective of the assessed low likelihood of piping, Jacobs-SKM recommended that the sections of the gas main through the embankments be treated by construction of filter collars. It is agreed that the 'gas main' needs to be treated. It should be noted that when assessing the acceptability of risk, the ALARP (as low as reasonably practical) principle needs to be applied. In this case the cost of addressing the issue is judged to be relatively small and not disproportionate to the benefit, and as

such should be done.

- It should be noted that the downstream portions of the mains are located below full supply level, so the mains present an inherent defect in this portion of the embankments. It is our understanding that Jacobs-SKM had not reached a position on whether filters were required in the embankments generally to guard against piping, but an untreated gas main would increase the risk and hence the need for appropriate protection.
- Provision of filter collars would require exposing the downstream portions of the mains, placing the collars, with appropriate cut-offs to guard against settlement leading to 'windows' in the system, and extending the filter/drainage system downstream so any seepage which develops can be safely discharged. In addition, it may be appropriate to provide a 'core' along part of the length of the mains upstream of the filter collars.
- An alternative approach to providing piping protection for the gas mains in the embankments would be to extend the concrete abutment walls well past the location of the mains and associated trench. The gas mains would extend through the walls in a 'watertight' penetration, with the walls founded on rock, providing a non-erodible cut-off.
- The wall option requires exposing a section of the main where the wall is to be located. A number of design issues would need to be addressed including:
    - support of the main, it being supported partly on concrete and partly on soil, with potential for differential settlement and bending of the main;
    - the condition of the main; it may need to be replaced prior to construction of the abutment walls
    - potential for corrosion of the main
    - foundation conditions
- Construction of protection works (whether a filter collar or concrete wall) require work to be undertaken on a live main, including temporary exposure and support.
- In the long term, maintenance of the main will remain an issue. Excavation within the embankment will remain problematic, particularly if access to the main in an emergency is required. Any work must be undertaken in the presence of, and to the requirements of, the owner of the weir. It should be noted that excavation would likely impact on the integrity of the filter collar, and hence this approach would not be recommended.

Cost estimates have been prepared for both relocating the gas main away from the weir (Option 1) and leaving it in its current position and treating it (Option 2). In terms of treatment, the cost estimate is based on extending the abutment wall option; the option of providing a filter collar is considered not suitable in view of the potential for future maintenance works impacting on the integrity of the filter protection system. It should be noted that the estimates are of a preliminary nature, and should be used for comparative purposes only.

- **Option 1 – Relocation of Main.**

  Relocation of the main could potentially be achieved by:

    - realigning it across the Drakeford Drive Bridge, or
    - installing it beneath the pond upstream of the weir using directional drilling.

  Either approach would require relocation of about 100m of main. A recent project in which SMEC was involved required relocation of a very short section of 100mm gas main, which cost in the region of \$2200/m. Allowing (say) 30% increase for the larger diameter and with no allowance for economies of scale, the cost of relocation would be of the order of \$290,000 - say \$300,000. As a check, a contractor was contacted to provide an informal indicative cost for installing 100m of 200mm gas main beneath the pondage using directional drilling. The indicative price provided was \$100,000, suggesting a cost of the order of \$300,000 is probably conservative.

- **Option 2 – Treatment of Existing Main**

  Treating the existing main by extending the abutment walls would require:

    - excavation and supporting the gas mains through both embankments

- provision of concrete as part of the wall to support the mains, together with transition sections to reduce the potential for differential settlement between the concrete and existing main sections
- protection of the section of main across the widened creek channel downstream of the weir

In addition, work would need to be undertaken in the presence of ZNX personnel due to working in the vicinity of a live main.

Indicative costs for these items of work are:

- excavation and temporary support of mains, comprising the 2 sections through the embankment plus the section across the creek channel - allow $50,000 lump sum
- concrete support of the main to rock through left and right embankments, say over 3m length; allow for 3m length or 10m3 (for both sections of main) at $2,000/m3 = $20,000.
- allow similar amount for transition sections = $20,000
- install downstream protection works – say 50 lineal metres at $2,000/m = $100,000 (assume main does not need to be relocated (lowered) or replaced due to poor condition)
- attendance on site by ZNX personnel when working within 3m of gas main; say 2 persons over 3x2 weeks @ $5,000 per person per week = $120,000

Total: $310,000

There are a number of additional costs which cannot be quantified at this stage, including:

- additional cost to the contractor of working around the mains, resulting in inefficient excavation methods, additional WHS requirements, increased levels of supervision, liaison with Jemena/ZNX, and the like
- increased risk of delays to the works
- risk of damage to the main during exposure, for instance due to flooding of the works resulting in damage to temporary supports
- risk of damage to the main from differential settlement or corrosion above that which would typically occur
- increased duration of the works resulting in additional 'overhead costs'
- future costs associated with management of the main, including liaison between the owners of the main and the dam.

While the estimated cost for either approach is similar, it is judged that relocation would be cheaper noting the 'hidden' costs associated with retaining the main in its current location. Furthermore, relocating the main, in addition to simplifying construction, eliminates the risk to the structure and avoids potential long term operation and maintenance issues. As well, it is understood Jemena/ZNX does not want the gas main concrete encased, notwithstanding that the existing section of main where it crosses the creek channel downstream of the weir is encased in concrete. Overall, it is assessed that the main should be relocated.

Yours sincerely,

Schedule 2.2 (a)(ii) [redacted]

Schedule 2.2 (a)(ii) [redacted]

Project Manager
SMEC – Australia & New Zealand Division

APPENDIX K EXTERNAL REVIEWER'S COMMENTS AND RESPONSES

1377

ISABELLA WEIR UPGRADE DESIGN
Project No: 3002402

INDEPENDENT VERIFICATION - ISABELLA WEIR UPGRADE DESIGN

Design Stage: FSP
Structure: Weir and Embankment
Date Documents Issued:

Organisation: Independent Reviewer

Reviewer: [redacted]

Checked By:
Review Date:

SMEC Response

Response By: Schedule 2.2 (a)(ii)
Response Date: 8-Jun-16
Response Reviewed By: Schedule 2.2 (a)(ii)

Item	Document	Reference	Comments / Conditions	SMEC Response	Close Out Response
	Drawings:				
1		21	Stage 4 include wording 'on each side'	Agreed will be captured in the DR set.	
2		107	You rightly say in the design report that the top of the blinding concrete must be treated as a construction joint. Great. Make sure the construction guys know and make sure they do the right thing!	To be captured in specification.	
3		109	This flap valve should be checked regularly. They have a habit of not working when you want them to work.	To be captured in the O&M manual	
4		120 Sn 5	You might be better to use stainless steel dowels. Gal lasts 20-25 yrs, less if water is present.	Drawing to be amended to accommodate S/S dowels.	
5		154 Sn 4	You would be better to use U-bars than cross the top bars as you have shown.	Agreed detail to be amended.	
6		188	A quick check. The rockfill is not nec compatible with the coarse filter if the latter's grading is on the fine side of its grading.	To be addressed in next stage of the design process.	
	Report:				
7		Sn 11.2.8.1	We are dealing with a hydraulic structure. We should be able to get a lower peak temp than 50 deg. I would aim for 40 deg C peak or at least 45 deg max.	To be incorporated into the specification	

ISABELLA WEIR UPGRADE DESIGN
Project No: 3002402

Item	Document	Reference	Comments / Conditions	SMEC Response	Close Out Response
8		Sn 16.3	Accepting that we will drain the pond, you are probably right as the Contractor will be given the creek in its original condition - well almost I would strongly suggest that you warn everyone in this report that the Contractor would be wise to set up close contact with BOM so that he gets advance warning of possible loaclised flooding in Tugeranong Creek. During the construction of Tuggeranong Dam, we had two early floods and one late in the piece, the last one nearly breaching our coffer dam. You and the owner should be very mindful that there are existing embankments, which could be seriously damaged in a big flood. The owner will not be able to escape responsibility if either were overtopped at any stage. Once your right hand return wall is done, the overtopping risk will be left with the left hand embankment.	Provision to be incorporated into the tender document	
9		192			
10		193			
11		194			
12		195			
13		196			
14		197			
15		198			