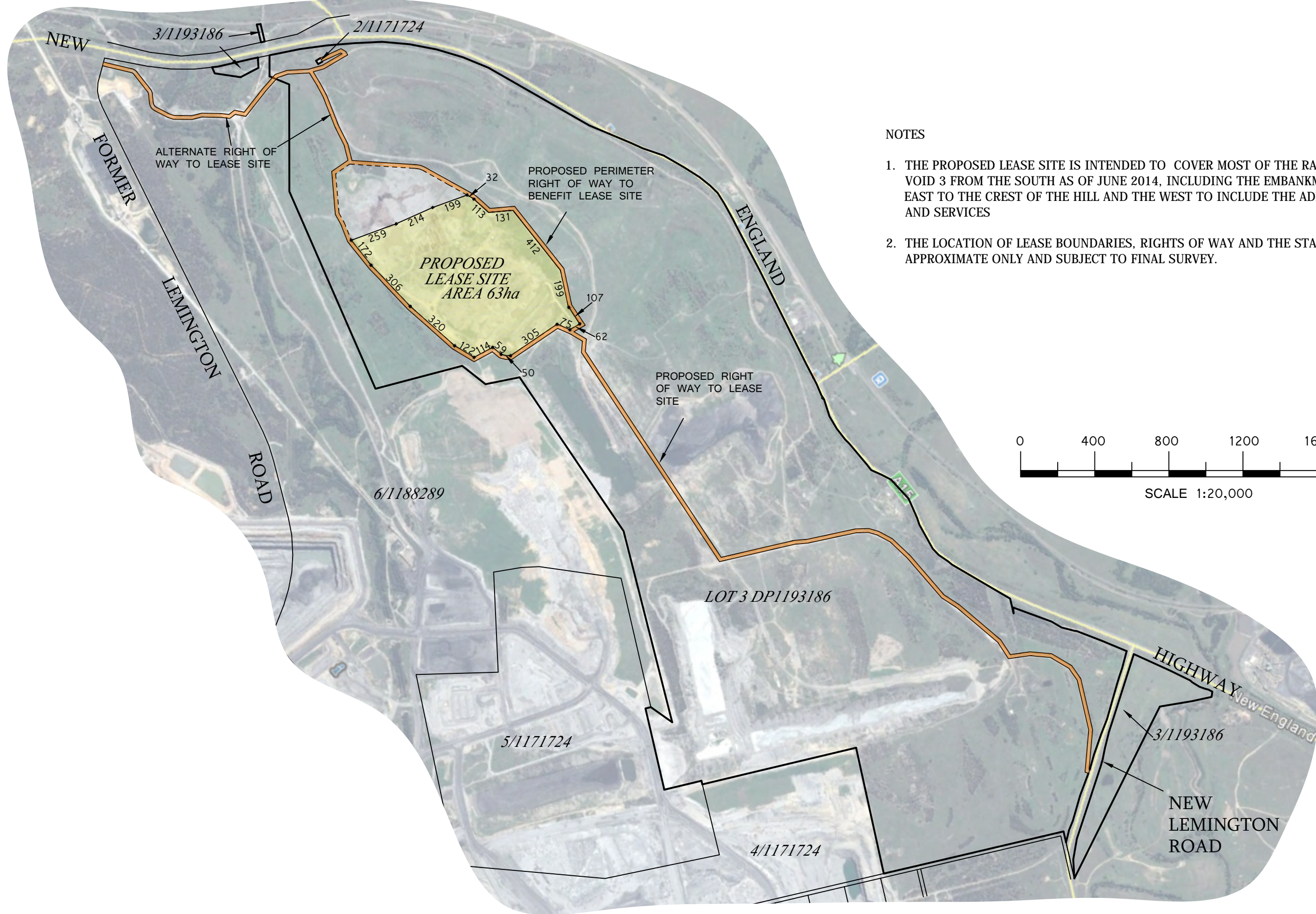


Appendix C

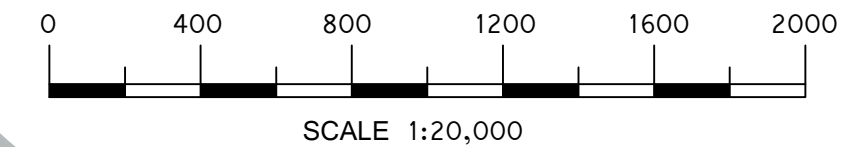
Land Survey and Design Information

Land Survey



NOTES

1. THE PROPOSED LEASE SITE IS INTENDED TO COVER MOST OF THE RAVENSWORTH VOID 3 FROM THE SOUTH AS OF JUNE 2014, INCLUDING THE EMBANKMENTS ON THE EAST TO THE CREST OF THE HILL AND THE WEST TO INCLUDE THE ADMIN BUILDINGS AND SERVICES
2. THE LOCATION OF LEASE BOUNDARIES, RIGHTS OF WAY AND THE STATED AREA ARE APPROXIMATE ONLY AND SUBJECT TO FINAL SURVEY.



**TONY MEXON
& ASSOCIATES**
REGISTERED SURVEYORS

CLIENT/OWNER	BETTERGROW PTY LTD		
--------------	--------------------	--	--

DETAILS		
SURVEYORS REF.	SCALE	SHEET SIZE
14-32	1:20000	A3
DATE OF SURVEY: N/A		

REVISION NOTES	
9/10/2018 LEASE BDY CHANGED	7
6/2/2017 SHEET ADDED	6
12/1/2017 LEASE BDY CHANGED	5
18/7/2016 LEASE BDY CHANGED	4
2/5/2016 LEASE BDY CHANGED	3
14/4/2016 LEASE BDY CHANGED	2
14/8/2014 SHADE LEASE AREAS	1

TITLE	CONCEPT PLAN SHOWING PROPOSED LEASE OF PART OF LOT 3 DP1193186 BEING AGL MACQUARIE PTY LTD'S RAVENSWORTH VOID 3. SHEET 1
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ALTERNATIVE RIGHT OF WAY TO LEASE SITE

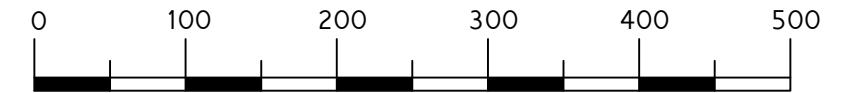
PROPOSED PERIMETER RIGHT OF WAY TO BENEFIT LEASE SITE

EAST WEST ACCESS ROAD

PROPOSED LEASE SITE
AREA 63ha

NOTES

1. THE LOCATION OF LEASE BOUNDARIES, RIGHTS OF WAY AND THE STATED AREA ARE APPROXIMATE ONLY AND SUBJECT TO FINAL SURVEY.



SCALE 1:5000

PROPOSED PERIMETER RIGHT OF WAY TO BENEFIT LEASE SITE

PROPOSED RIGHT OF WAY TO LEASE SITE



CLIENT/OWNER
BETTERGROW PTY LTD

DETAILS		
SURVEYORS REF.	SCALE	SHEET SIZE
14-32	1:5000	A3
DATE OF SURVEY: N/A		

REVISION NOTES	
9/10/2018 LEASE BDY CHANGED	7
6/2/2017 SHEET ADDED	6
12/1/2017 LEASE BDY CHANGED	5
18/7/2016 LEASE BDY CHANGED	4
2/5/2016 LEASE BDY CHANGED	3
14/4/2016 LEASE BDY CHANGED	2
14/8/2014 SHADE LEASE AREAS	1

TITLE
CONCEPT PLAN SHOWING PROPOSED LEASE OF PART OF LOT 3 DP1193186 BEING AGL MACQUARIE PTY LTD'S RAVENSWORTH VOID 3. SHEET 2

96 Castlereagh St, Singleton
Postal PO Box 917
Singleton
NSW 2330

Phone 02 6571 2344
Fax 02 6571 2355
Mobile 0438 660 082
Email tony@tonymexon.com.au



**TONY MEXON
& ASSOCIATES**
REGISTERED SURVEYORS

ABN 11 885 739 260

8th September 2017

Ref: 14-32 Bettergrow 8-9-2017

John Vyse

Bettergrow

48 Industry Road

Vineyard NSW 2765

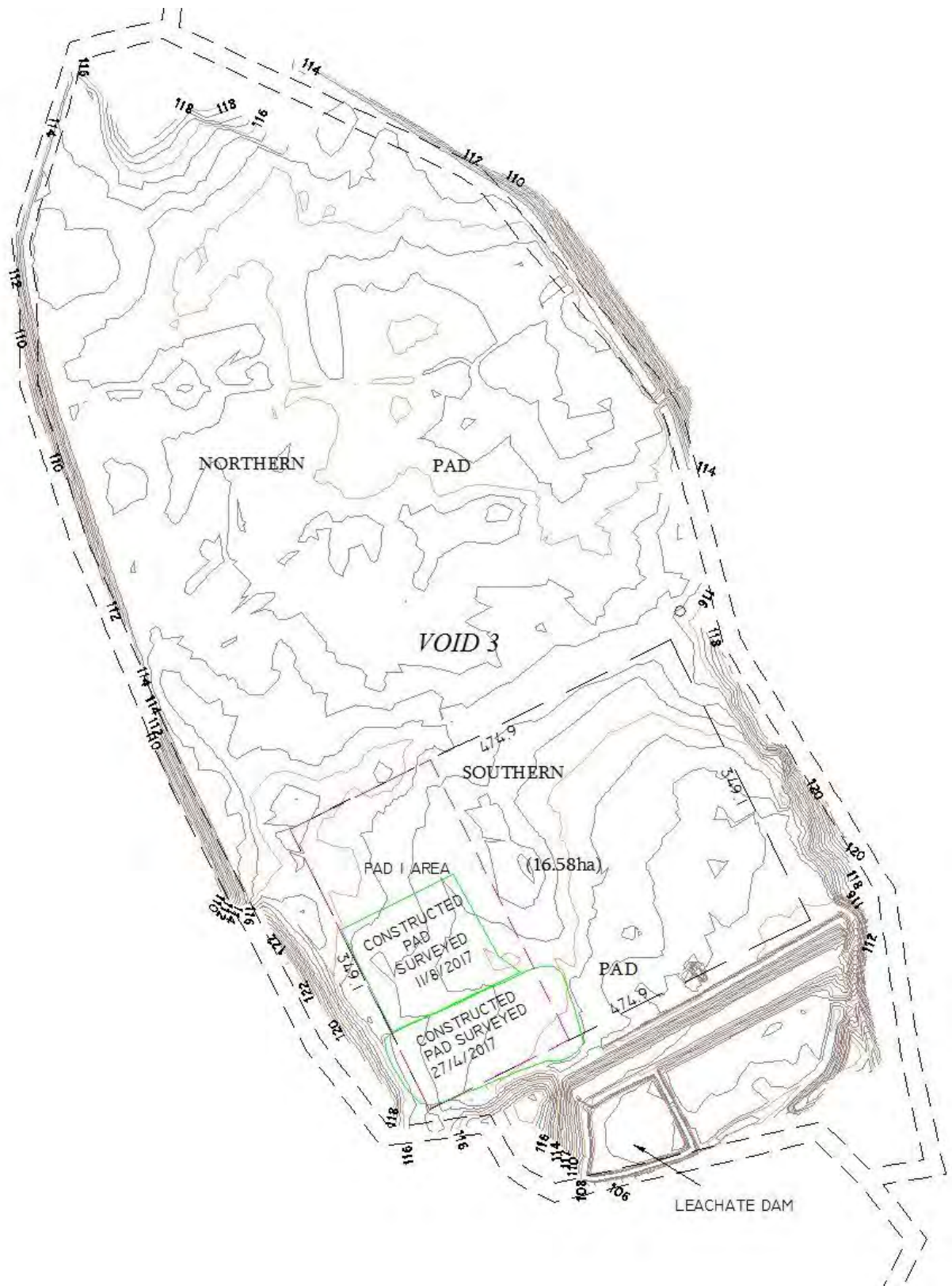
John,

On the 11th August 2017 we surveyed Pad 1 on your Ravensworth Void 3 site as constructed. Since the previous survey, the amount of fill placed over the existing capping is 7750m³ over a pad area of 20500m². This gives an average cover of 378mm over the existing ash capping material.

Regards,

Tony Mexon

B.Surv, Registered Surveyor, MIS



Pad and Dam Design



**Ravensworth Composting Pad Leachate
Detention Basin**

Construction Report

AGL Macquarie

16 May 2017

Revision: 1

Reference: 224159

*Bringing ideas
to life*

Document control record

Document prepared by:

Aurecon Australasia Pty Ltd

ABN 54 005 139 873

Level 5, 116 Military Road
Neutral Bay NSW 2089

PO Box 538

Neutral Bay NSW 2089
Australia

T +61 2 9465 5599

F +61 2 9465 5598

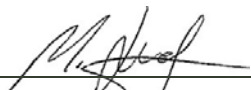

E sydney@aurecongroup.com

W aurecongroup.com

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Current revision		1					

Approval			
Author signature		Approver signature	
			
Name		Name	
Matt Ludeke		Loni Karabesinis	
Title		Title	
Dams Engineer		Technical Director, Energy Services	



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3	Inspections	3
4	Verification Testing	3
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1 Introduction

Aurecon have been engaged by AGL Macquarie to conduct periodic inspections during the construction of the leachate detention basin adjacent to the Ravensworth Void 3 (RWV3) Composting Pad.

The following report summarises the inspections and materials testing undertaken during construction to ensure the specification and design principals have been met. It is understood that this report is required to fulfil approval conditions set by the NSW Environmental Protection Authority (EPA) for the new composting facility.

As part of the approval conditions set for the project, the EPA have referenced the document: 'environmental guidelines: composting and related organics processing facilities'. The key engineering risk identified for this project was to limit the leachate migration from the composting facility, by providing an effective sealing barrier, with a permeability of $10 \text{ e}^{-9} \text{ m/s}$ or less.

2 Design Details

The purpose of the new leachate detention basin is to capture storm runoff from the proposed RWV3 composting facility. The leachate detention basin will be enclosed on the southern and eastern sides by two new embankments up to 1.5 m in height. The northern and western perimeters will have earthfill buttresses added to the existing batters, to separate and seal the pond storage area from the loose overburden.

Runoff will arrive at the north western side of the dam, via a shotcrete lined channel, that connects the composting pad area to the leachate detention basin. This channel has sufficient capacity to discharge the peak flow during a 1 in 100 Annual Exceedance Probability (AEP) storm.

The dam has sufficient storage volume available to detain up to the 1 in 100 AEP, 24 hour storm event, without overtopping. As a protective measure, a small overflow spillway is provided at RL 107.1 m on the eastern wall, to assist in discharging storms above the design level, before overtopping of the embankments.

The leachate detention basin is enclosed and lined by mine overburden material. This overburden material was derived from extremely weathered to fresh, interbedded mudstone, siltstone and medium to fine grained lithic sandstone. This material has been bulk blasted and removed by dragline, producing a mixed spoil with a large range in particle sizes, which are largely coarse grained and up to several metres diameter. The spoil also contains some coal from thin uneconomic coal seams, which were included in the overburden material. As a result, the physical properties of the in-situ spoil are highly variable.

As this project relies on this spoil to form the enclosing embankments, and will be left in place for the floor sealing layer, an understanding of the material permeability is required. Due to the small scale and low risk of this project, spoil properties have been determined from laboratory testing for several other projects in the Ravensworth area, and no detailed sampling and laboratory testing program has been undertaken for the design of this facility (prior to construction). The historical test results are summarised in Table 1.



Table 1 Previous permeability test results

Sample	MDD (t/m ³)	OMC (%)	Permeability (m/s)
606617	1.90	13.0	3 x10 ⁻¹⁰ (sample remoulded to 95 % MDD)
606618	1.88	13.0	6 x10 ⁻¹⁰ (sample remoulded to 98 % MDD)
606619	1.89	13.5	2 x10 ⁻⁹ (sample remoulded to 98 % MDD)

MMD – Maximum Dry Density

OMC – Optimum Moisture Content

Therefore, based on historical testing, it can be demonstrated that by achieving compacting the spoil material to a minimum 95 % MDD, than a satisfactorily low permeability can be achieved.

2.1 Materials specification

The following material specification was developed for the project to ensure

Zone 3A – Select earthfill

This material is processed from existing local overburden deposits.

The material should have a particle size distribution generally in accordance with Table 1.

Table 2 Zone 3A particle size distribution specification

Sieve size (mm)	Percent passing (not less than)
200	80
75	50
2.36	20
0.075	10

The maximum particle size (prior to compaction) of Zone 3A shall be 300 mm.

Material shall be compacted to 98 % maximum dry density at ± 1 % optimum moisture content.

Material shall be dumped and spread in continuous horizontal layers and compacted to a thickness not exceeding 400 mm.

Material shall be watered as required for dust control and moisture content correction.

No fill shall be placed on an area on which free water has ponded. If any area has been softened by wet weather or traffic, the surface of the previous compacted layer shall be scarified to a depth of at least 50 mm.

Zone 4 – Riprap protection

Material to match batter protection in the existing spillway.

This shall be hard, dense and durable rockfill, free of defects that may lead to deterioration in exposed wet conditions.

The maximum particle size shall nominally be 500 mm, with a minimum particle size of 100 mm.

Material shall be dumped and spread in a manner to ensure segregation of large and small rocks does not occur and that rip rap sits stable on the batter without any tendency to slide.

No compaction is required.

3 Inspections

A total of three inspections were completed during the construction of the leachate detention basin.

Each of the inspections confirmed that the construction was proceeding in accordance with the design and specification.

A copy of each of the inspection reports are included in Appendix B.

4 Verification Testing

Material testing was completed during construction to verify the sealing layer underlying the detention pond and composting pad.

Permeability testing was undertaken on samples collected from the overburden material used to construct the composting pad and line the floor of the leachate detention basin. These samples were used to demonstrate the permeability that could be achieved, given that a certain minimum level of compaction is achieved (i.e. compaction to within 95 % of the maximum dry density).

The second set of testing, was to check the density achieved in-situ at the construction site.

The results collected from both these testing sets will verify the in-situ permeability achieved.

4.1 Permeability

Permeability has been tested by undertaking constant head tests using a flexible wall permeameter, appropriately selected for analysing conditions likely to be encountered when the leachate detention basin is full of water after a storm event.

Table 3 Permeability testing

Lab ID	MDD (t/m ³)	OMC (%)	Permeability (m/s)	Preparation
S20884	1.733	15.7	1.8 e ⁻¹⁰	Sample compacted to 95 % MDD
S20885	1.685	17.4	1.8 e ⁻¹⁰	Sample compacted to 95 % MDD
S20886	1.755	13.5	1.6 e ⁻⁹	Sample compacted to 95 % MDD
S20887	1.762	12.8	2.0 e ⁻⁹	Sample compacted to 95 % MDD
S20888	1.676	17.3	2.1 e ⁻¹⁰	Sample compacted to 95 % MDD
S20889	1.689	16.0	1.5 e ⁻¹⁰	Sample compacted to 95 % MDD
S20890	1.818	16.7	2.8 e ⁻⁹	Sample compacted to 95 % MDD
S20891	1.799	16.6	7.4 e ⁻¹⁰	Sample compacted to 95 % MDD

Within the document: 'environmental guidelines: composting and related organics processing facilities', a target permeability of less 10 e⁻⁷ m/s is recommended for any hardstand compost processing area and permeability of less than 10 e⁻⁹ m/s is recommended for any leachate detention pond.

All samples were found to pass both permeability specifications, provided a minimum compaction of 95 % MDD is achieved.

4.2 Compaction tests

It has been established as part of the design, that should 95 % maximum dry density be achieved from the earthworks, this would form a sufficiently low permeability floor for the leachate detention basin.

Hilf density testing (by use of a field nuclear density gauge) has been completed in-situ on prepared surfaces to verify the level of compaction achieved, in comparison to maximum dry density.

Table 4 Summary of hilf density ratio testing

Test ID	Relative Compaction (% MDD)	Moisture Variation (% OMC)
16-2461	103.5	- 5.0
16-2462	99.5	- 4.5
16-2463	100.0	- 5.0
16-2464	102.5	- 4.0
17-1	99.0	- 4.5
17-2	95.5	- 4.5
17-3	101.0	- 4.5
17-4	100.5	- 4.5
17-63	100.5	- 4.5
17-64	100.5	- 4.5
17-65	104.0	- 4.0
17-66	103.0	- 4.5
17-888	100.5	- 3.5
17-889	105.0	- 3.0
17-890	105.0	- 3.0
17-891	105.5	- 4.0
Target	> 95	± 5

While all samples were found to be drier than OMC, this has not affected the soils ability to approach the MDD under compaction effort, as material breakdown has occurred during compaction. This affect should assist in reducing the permeability of the sealing layer.

5 Conclusion

After analysing the results of the site inspections and material testing, it can be concluded that the Leachate detention basin has been constructed to a satisfactory standard and meets the intent of the design and engineering specification.

All tests undertaken to date have met the engineering specification and are well within the acceptable limits presented within the 'environmental guidelines: composting and related organics processing facilities'. As a result, the dam also meets the approval conditions set by the NSW EPA.

Signed,



Senior Dams Engineer

Aurecon Australasia Pty Ltd

Appendix A

Limitations Statement





Appendix A

Limitations Statement

Exclusive Benefit and Reliance

This report has been prepared by Aurecon Pty Ltd, at the request of and exclusively for the benefit and reliance of its Client.

This report is not a warranty or guarantee. It is a report scoped in accordance with the Client's instructions, having due regard to the assumptions that Aurecon Pty Ltd can be reasonably expected to make in accordance with sound engineering practice and exercising the obligations and the level of skill, care and attention required of it under this contract.

Third Parties

It is not possible to make a proper assessment of the report without a clear understanding of the terms of engagement under which the report has to be prepared, including the scope of the instructions and directions given to and the assumptions made by the engineer who has prepared the report.

The report is scoped in accordance with the instructions given by or on behalf of the Client. The report may not address issues which would need to be addressed with a third party if that party's particular circumstances, requirements and experience with such reports were known and may make assumptions about matters of which a third party is not aware.

Aurecon therefore does not assume responsibility for the use of the report by any third party and the use of the report by any third party is at the risk of that party.

Limits of Investigation and Information

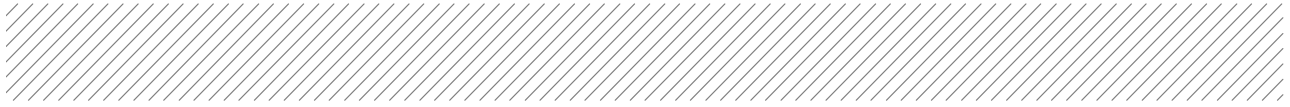
The report is also based on information provided to Aurecon by other parties. The report is provided strictly on the basis that the information that has been provided can be relied on and is accurate, complete and adequate.

Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that the client may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the report that it has verified the information to its satisfaction.

Appendix B

Inspection Reports





Appendix B

Inspection Reports

Site inspection report 9 December 2016

Site inspection report 6 January 2017

Site inspection report May 2017

Memorandum

To	John Vyse	From	Matt Ludeke
Copy	Matthew Parkinson	Reference	224159
Date	14 December 2016	Pages (including this page)	5
Subject	Ravensworth Void 3 Sedimentation Dam		

Aurecon have been engaged by AGL Macquarie to conduct periodic inspections during the construction of the Sedimentation Dam adjacent to the Ravensworth Void 3 Composting Pad.

The following report summarises a construction inspection carried out on 8 November 2016. The aim of the current inspection was to check the sealing layer compaction and new embankment foundation areas.

1 Dam Design

The purpose of the new sedimentation dam is to capture storm runoff from the proposed Void 3 composting facility. The sedimentation dam will be enclosed on the southern and eastern sides by two new embankments up to 1.5 m in height. The northern and western perimeters will have earthfill buttresses added to the existing batters, to separate and seal the pond storage area from the loose overburden.

Runoff will arrive at the north western side of the dam, via a shotcrete lined channel, that connects the composting pad area to the sedimentation dam. This channel has sufficient capacity to discharge the peak flow during a 1 in 100 year storm.

The dam has sufficient storage volume available to detain up to the 1 in 100 year, 24 hour storm event, without overtopping. A small overflow spillway will be provided at RL 107.1 m on the eastern wall, to assist in discharging storms above the design level, before overtopping the embankments.

2 Previous Recommendations

None – first inspection.

3 Observations

Photographs collected during the inspection have been provided to the rear of this memo.

- Earthworks have commenced on site, and the full floor of the new sedimentation pond had been cleared and levelled using a dozer.
- A vibrating sheepsfoot roller was being utilised to compact the full pond floor area.
- The areas towards the western edge were well compacted, and should set the target for the remainder of the floor.
- It was observed that a few large boulders had been uncovered in the floor area. It was discussed that these should not be removed, as this activity will significantly disturb a large area and may only uncover additional voids and boulders in the spoil material. It was recommended to leave them in place and compact over the top.
- Topsoil and vegetation had been removed from the areas to receive fill (the new enclosing embankments). All areas appeared satisfactory and ready to receive the first layer of fill.

- Excavations for the spillway connecting the composting pad and the sedimentation dam had commenced. Material uncovered appears suitable and should perform satisfactorily under the finishing shotcrete.

4 Design changes

None.

5 Recommendations

The site inspection revealed that preparation works for sedimentation dam were being completed in accordance with the design and specification. The following recommendations were discussed on site:

- Undertake a minimum 6 compaction tests around the sedimentation dam embankments. These should be completed over two trips to site, to ensure sampling at separate fill levels.
- Continue compaction operations around the remainder of the sedimentation dam floor area, to replicate the seal achieved along the western side.
- Leave all boulders in place within the floor and compact over the top.



Photo 1 Looking north from the southern fringe over the prepared floor area



Photo 2 Looking east from the western fringe over the prepared floor area



Photo 3 Looking south along the western perimeter prepared floor



Photo 4 Looking west along the southern embankment



Photo 5 Channel connecting the composting pad and the sedimentation dam

Memorandum

To	John Vyse	From	Matt Ludeke
Copy	Matthew Parkinson	Reference	224159
Date	16 January 2017	Pages (including this page)	6
Subject	Ravensworth Void 3 Sedimentation Dam		

Aurecon have been engaged by AGL Macquarie to conduct periodic inspections during the construction of the Sedimentation Dam adjacent to the Ravensworth Void 3 Composting Pad.

The following report summarises a construction inspection carried out on 6 January 2017. The aim of the current inspection was to check the construction of the new embankments and progress on the channel construction.

1 Dam Design

The purpose of the new sedimentation dam is to capture storm runoff from the proposed Void 3 composting facility. The sedimentation dam will be enclosed on the southern and eastern sides by two new embankments up to 1.5 m in height. The northern and western perimeters will have earthfill buttresses added to the existing batters, to separate and seal the pond storage area from the loose overburden.

Runoff will arrive at the north western side of the dam, via a shotcrete lined channel, that connects the composting pad area to the sedimentation dam. This channel has sufficient capacity to discharge the peak flow during a 1 in 100 year storm.

The dam has sufficient storage volume available to detain up to the 1 in 100 year, 24 hour storm event, without overtopping. A small overflow spillway will be provided at RL 107.1 m on the eastern wall, to assist in discharging storms above the design level, before overtopping of the embankments.

2 Previous Recommendations

- Undertake a minimum 6 compaction tests around the sedimentation dam embankments. These should be completed over two trips to site, to ensure sampling at separate fill levels.
- Continue compaction operations around the remainder of the sedimentation dam floor area, to replicate the seal achieved along the western side.
- Leave all boulders in place within the floor and compact over the top.

3 Observations

Photographs collected during the inspection have been provided to the rear of this memo.

- Earthworks for the sedimentation dam have almost been completed on site. The new embankments along the eastern and southern fringes have been constructed to design level and appear to be well compacted (Photographs 1 and 2).
- The upstream face of each new embankment is well constructed and appropriately battered (Photograph 3).
- The overflow spillway have been provided on the eastern embankment, as per the design.

- It was reported that after some slightly wet weather in the past two weeks, some rainfall had ponded within the sedimentation, towards the eastern end. This indicates that the compaction effort has likely achieved a good result, with respect to sealing of the floor.
- The eastern fringe is well compacted and in good condition (Photograph 4). A small pile of boulders was been stockpiled (won during earthworks activities), to be used as riprap protection in the overflow spillway.
- It is understood that the compaction tests have all been undertaken and initial reports indicate a good level of compaction has been achieved. Test certificates are expected from the contractor within the week.
- Excavations for the spillway channel connecting the composting pad and the sedimentation dam have almost completed (Photograph 5). This channel is to be shotcreted.
- A channel has been excavated at the top side of the spillway channel, exposing bottom ash (Photograph 6). It is intended to backfill this with compacted spoil material. This design change was implemented by site staff, to increase the protection against scouring erosion in this area, as it was found that only limited capping was placed over the ash in this area (approximately 100 mm thick).

4 Design changes

Spillway channel approach:

The approach towards the spillway channel has been over excavated and backfilled with compacted spoil to increase the resistance to scouring erosion in this area.

5 Recommendations

The site inspection revealed that earthworks for sedimentation dam were being completed in accordance with the design and specification. The following recommendations were discussed on site:

- Place rockfill around the upstream (inside) section and crest of the sedimentation basin overflow spillway (located on the eastern embankment).
- Forward compaction test results once they become available.



Photo 1 Looking north along the crest of the eastern sedimentation basin embankment



Photo 2 Looking west along the crest of the southern sedimentation basin embankment



Photo 3 Looking east along the upstream face of the southern sedimentation basin embankment



Photo 4 Looking south along the western fringe of the sedimentation basin



Photo 5 Channel connecting the composting pad and the sedimentation basin



Photo 6 Approach of the overflow spillway channel

Memorandum

To	John Vyse	From	Matt Ludeke
Copy	Matthew Parkinson	Reference	224159
Date	9 May 2017	Pages (including this page)	7
Subject	Ravensworth Void 3 Sedimentation Dam		

Aurecon have been engaged by AGL Macquarie to conduct periodic inspections during the construction of the Sedimentation Dam adjacent to the Ravensworth Void 3 Composting Pad.

The following report summarises a construction inspection carried out on 5 May 2017. The aim of the current inspection was to check the construction of the spillway.

1 Dam Design

The purpose of the new sedimentation dam is to capture storm runoff from the proposed Void 3 composting facility. The sedimentation dam will be enclosed on the southern and eastern sides by two new embankments up to 1.5 m in height. The northern and western perimeters will have earthfill buttresses added to the existing batters, to separate and seal the pond storage area from the loose overburden.

Runoff will arrive at the north western side of the dam, via a shotcrete lined channel, that connects the composting pad area to the sedimentation dam. This channel has sufficient capacity to discharge the peak flow during a 1 in 100 year storm.

The dam has sufficient storage volume available to detain up to the 1 in 100 year, 24 hour storm event, without overtopping. A small overflow spillway will be provided at RL 107.1 m on the eastern wall, to assist in discharging storms above the design level, before overtopping of the embankments.

2 Previous Recommendations

- Place rockfill around the upstream (inside) section and crest of the sedimentation basin overflow spillway (located on the eastern embankment).
- Forward compaction test results once they become available.

3 Observations

Photographs collected during the inspection have been provided to the rear of this memo.

- Earthworks for the detention basin have been completed on site. The new embankments along the eastern and southern fringes have been constructed to design level, show no signs of instability and appear to be well compacted (Photograph 1).
- The rock lined overflow section has been provided on the eastern embankment, as per the design (Photograph 2).
- The spillway that connects the composting pad to the detention basin has been completed by shotcrete lining the channel (Photographs 3 and 4). A few rocks have been placed in the shotcrete as baffles for the flow during heavy storms.
- Two surface drains have been completed along the perimeter of the composting pad (Photographs 5 and 6). The eastern drain is unlined, while the southern drain (leading to the spillway) has been lined by shotcrete.

- Both drains are fairly shallow, so a quick hydrological check has been completed on these drains - see section 5.
- A large section of the composting pad has been completed (Photograph 7).

4 Design changes

None applicable for this inspection.

5 Composting pad

At the request of AGL Macquarie, we have also completed a quick hydrological check on the surface drains around the perimeter of the composting pad. As the pad is currently smaller than the original design, this has limited the catchment area reporting to each drain.

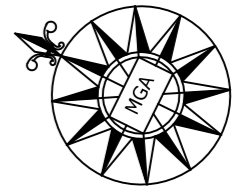
The drains were measured to be roughly between 100 to 250 mm deep, and 900 mm wide at the base.

With reference to the latest survey plan (enclosed to the rear of this memo), the revised catchment areas reporting to each perimeter drain have been estimated. The drains appear to have sufficient capacity to discharge the peak flow resulting from the 1 in 100 AEP storm event.

6 Conclusions

The site inspection revealed that earthworks for the detention basin were being completed in accordance with the design and specification.

There are no recommendations outstanding from this final inspection.



ROAD

ACCESS

SMOOTH

PAD

AREA

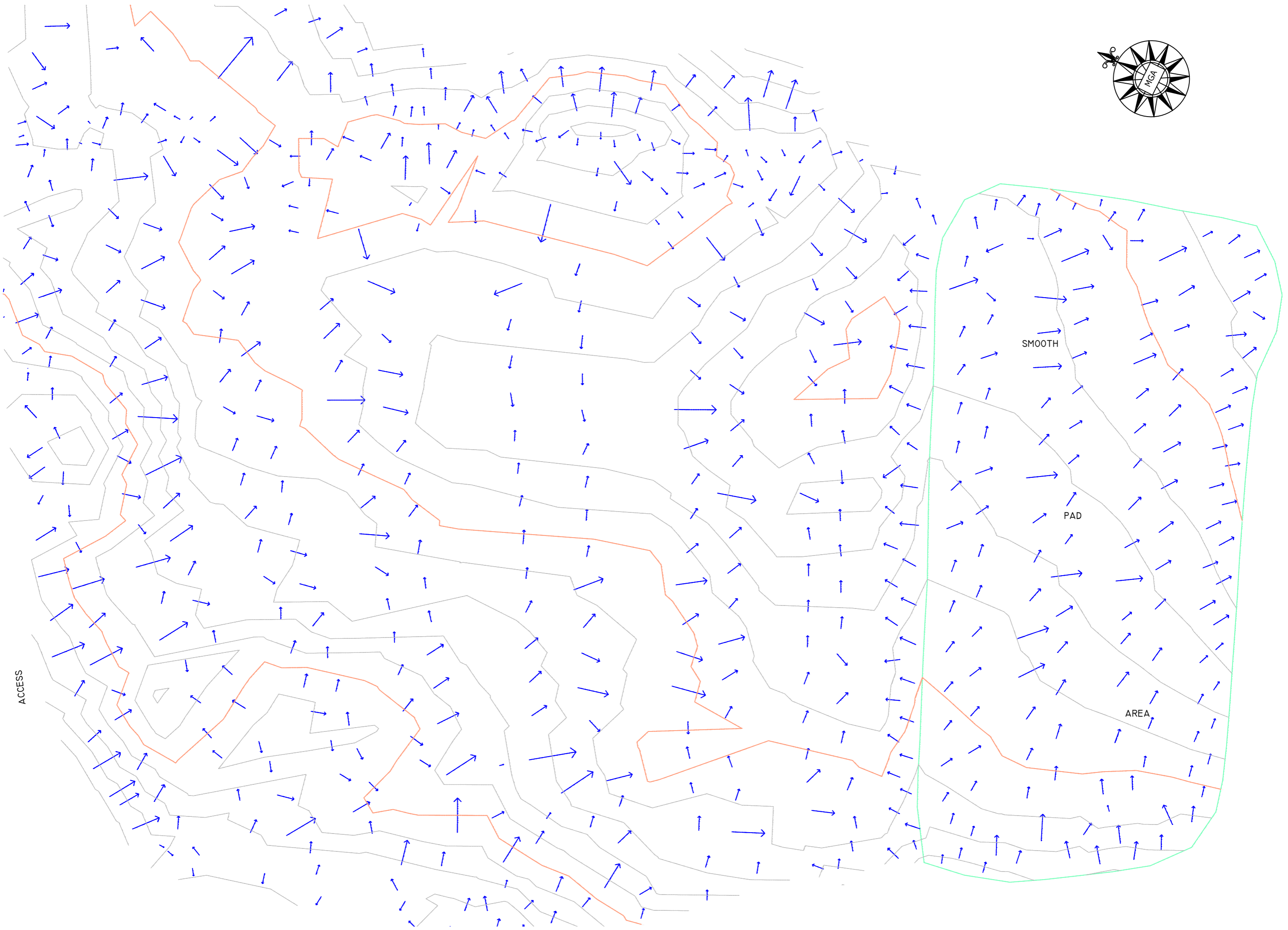




Photo 1 Looking west along the southern upstream face of the detention basin embankment



Photo 2 Rock lined overflow section on the eastern wall of the detention basin



Photo 3 Looking down the shotcreted spillway channel



Photo 4 Looking up the shotcreted spillway channel



Photo 5 Looking along the composting pad eastern perimeter surface drain



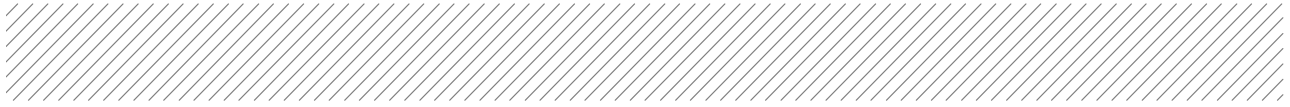
Photo 6 Looking along the composting pad southern perimeter surface drain, leading to the spillway



Photo 7 Looking across the composting pad surface

Appendix C
Test Certificates





Appendix C

Test Certificates

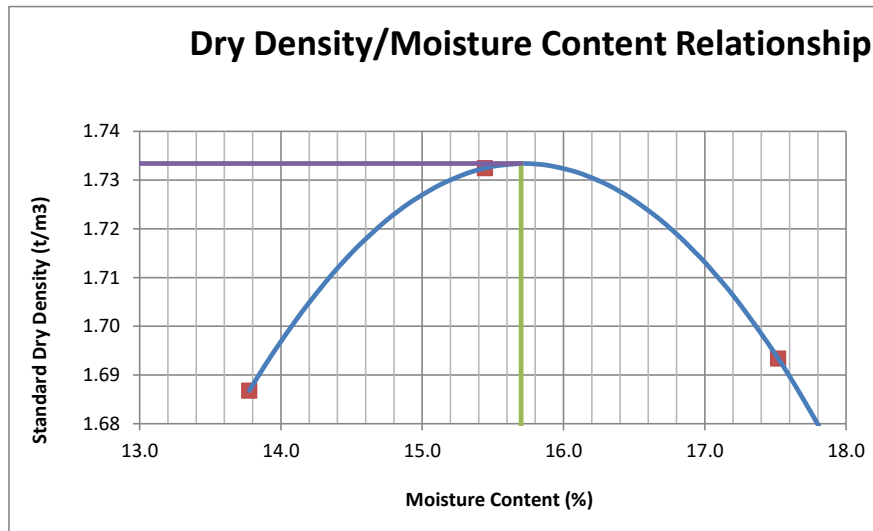
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 1
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20884-MDD
Job No:	S17017	Lab No:	S20884



Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.733
Optimum Moisture Content (%)	15.7
Percentage Oversize on 19mm sieve (%)	33
Percentage Oversize on 37.5mm sieve (%)	22

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<p>NATA Accredited Laboratory Number: 14874</p>	<p>Chris Lloyd</p>	<p>Date:</p>	

	<p>Macquarie Geotechnical Unit 8/10 Bradford Street Alexandria NSW 2015</p>
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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 1
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20884-TP
Job No:	S17017	Lab No:	S20884

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.73	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	15.7	Back Pressure (kPa)	500
Placement Moisture Content (%)	15.7	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.64	Sample Height (mm)	50.0
Density Ratio (%)	95.0	Sample Diameter (mm)	50.0

PERMEABILITY $k_{(20)} =$ **1.8E-10 (m/sec)**

Comments

Permeant Used: Sydney tap water



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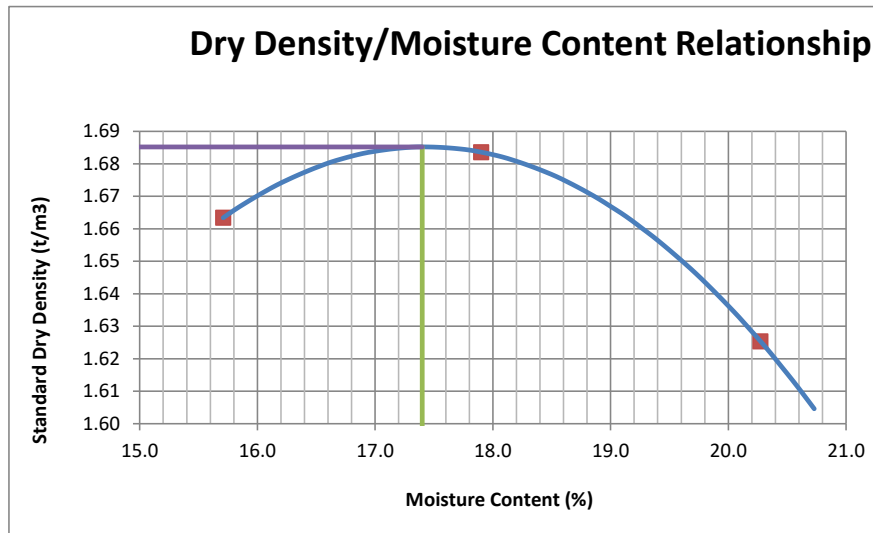
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 2
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20885-MDD
Job No:	S17017	Lab No:	S20885

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.685
Optimum Moisture Content (%)	17.4
Percentage Oversize on 19mm sieve (%)	33
Percentage Oversize on 37.5mm sieve (%)	16



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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 2
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20885-TP
Job No:	S17017	Lab No:	S20885

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.69	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	17.4	Back Pressure (kPa)	500
Placement Moisture Content (%)	17.4	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.61	Sample Height (mm)	50.0
Density Ratio (%)	95.0	Sample Diameter (mm)	50.0

PERMEABILITY $k_{(20)} =$ **1.8E-10 (m/sec)**

Comments

Permeant Used: Sydney tap water



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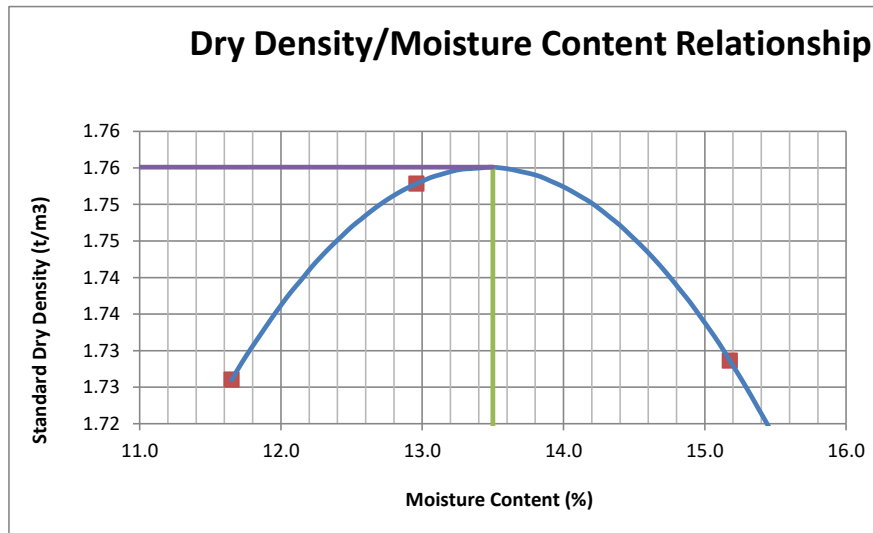
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 3
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20886-MDD
Job No:	S17017	Lab No:	S20886

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.755
Optimum Moisture Content (%)	13.5
Percentage Oversize on 19mm sieve (%)	32
Percentage Oversize on 37.5mm sieve (%)	18



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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 3
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20886-TP
Job No:	S17017	Lab No:	S20886

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.76	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	13.5	Back Pressure (kPa)	500
Placement Moisture Content (%)	13.5	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.67	Sample Height (mm)	53.0
Density Ratio (%)	95.0	Sample Diameter (mm)	50.2

PERMEABILITY $k_{(20)} =$ **1.6E-09 (m/sec)**

Comments

Permeant Used: Sydney tap water



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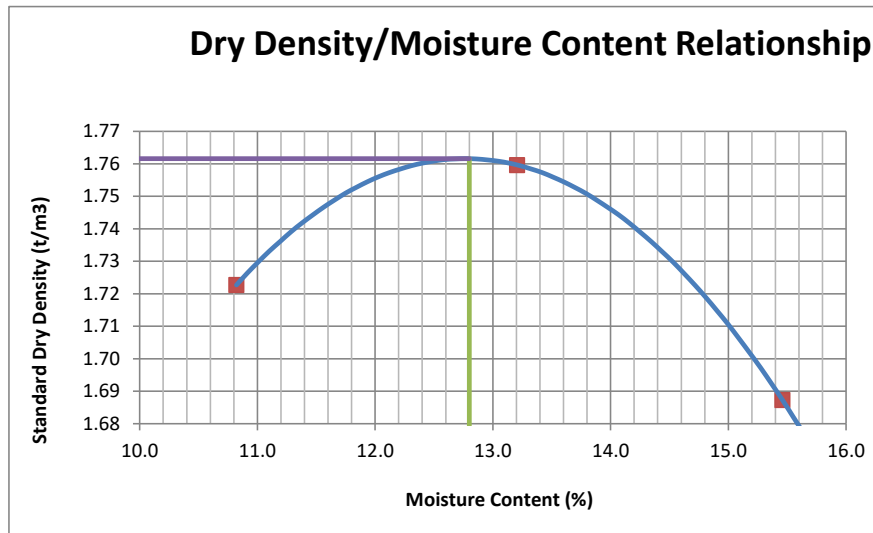
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 4
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20887-MDD
Job No:	S17017	Lab No:	S20887

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.762
Optimum Moisture Content (%)	12.8
Percentage Oversize on 19mm sieve (%)	17
Percentage Oversize on 37.5mm sieve (%)	10

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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 4
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20887-TP
Job No:	S17017	Lab No:	S20887

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.76	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	12.8	Back Pressure (kPa)	500
Placement Moisture Content (%)	12.8	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.67	Sample Height (mm)	52.7
Density Ratio (%)	95.0	Sample Diameter (mm)	50.3

PERMEABILITY $k_{(20)} =$ **2.0E-09 (m/sec)**

Comments

Permeant Used: Sydney tap water



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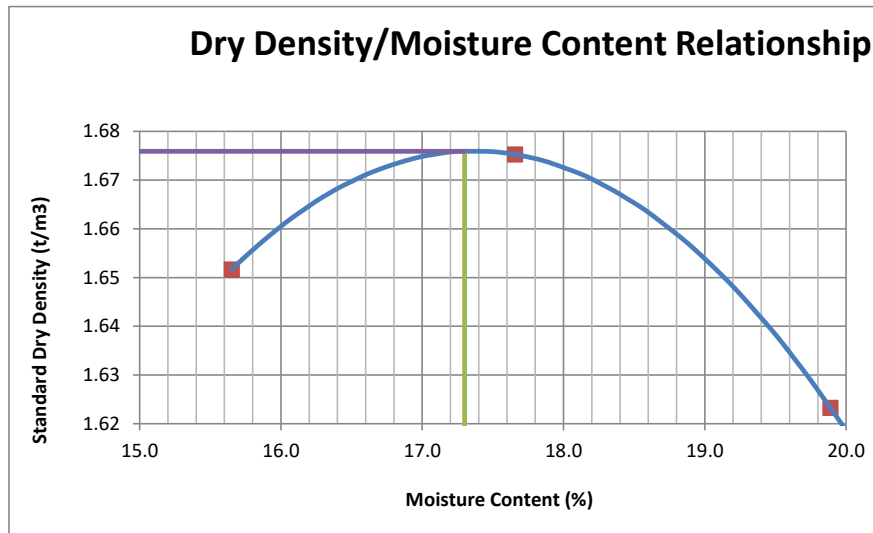
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 5
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20888-MDD
Job No:	S17017	Lab No:	S20888

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.676
Optimum Moisture Content (%)	17.3
Percentage Oversize on 19mm sieve (%)	33
Percentage Oversize on 37.5mm sieve (%)	16



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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 5
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20888-TP
Job No:	S17017	Lab No:	S20888

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
------------------	-------------------	----------------------	---------

Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.68	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	17.3	Back Pressure (kPa)	500
Placement Moisture Content (%)	17.3	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.60	Sample Height (mm)	50.4
Density Ratio (%)	95.0	Sample Diameter (mm)	51.2

PERMEABILITY $k_{(20)} =$ **2.1E-10 (m/sec)**

Comments

Permeant Used: Sydney tap water



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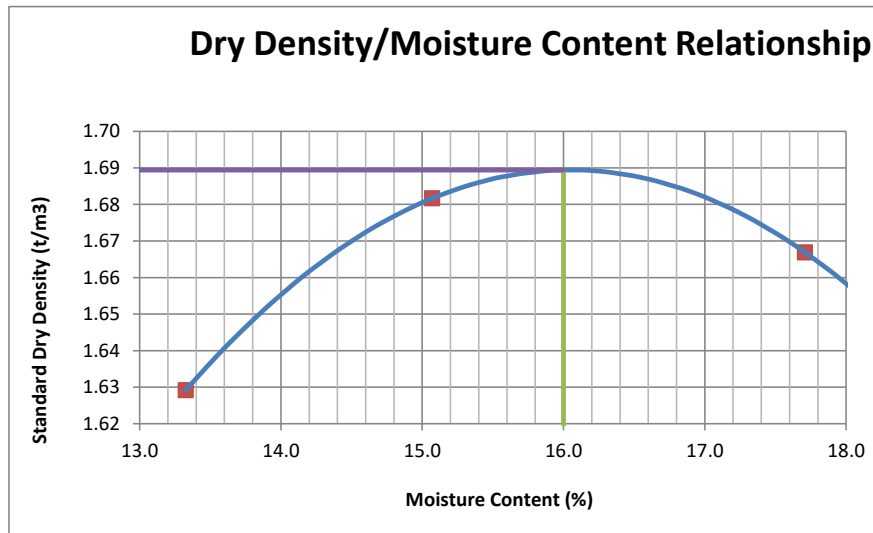
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 6
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey gravelly SAND
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20889-MDD
Job No:	S17017	Lab No:	S20889



Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.689
Optimum Moisture Content (%)	16.0
Percentage Oversize on 19mm sieve (%)	19
Percentage Oversize on 37.5mm sieve (%)	8

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<p>NATA Accredited Laboratory Number: 14874</p>	<p>Chris Lloyd</p>	<p>Date:</p>	

	<p style="font-size: small;">Macquarie Geotechnical Unit 8/10 Bradford Street Alexandria NSW 2015</p>
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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 6
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey gravelly SAND
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20889-TP
Job No:	S17017	Lab No:	S20889

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
---------------------	---

Maximum Dry Density (t/m ³)	1.69	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	16.0	Back Pressure (kPa)	500
Placement Moisture Content (%)	16.0	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.61	Sample Height (mm)	52.2
Density Ratio (%)	95.0	Sample Diameter (mm)	50.2

PERMEABILITY $k_{(20)} =$ **1.5E-10 (m/sec)**

Comments

Permeant Used: Sydney tap water



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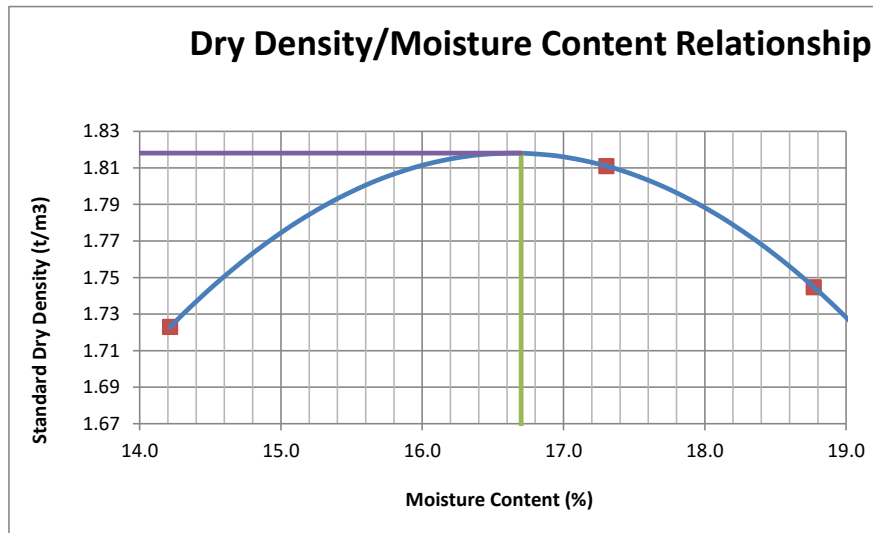
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Corner of Borrow Pit - Location 7
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20890-MDD
Job No:	S17017	Lab No:	S20890

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.818
Optimum Moisture Content (%)	16.7
Percentage Oversize on 19mm sieve (%)	30
Percentage Oversize on 37.5mm sieve (%)	13

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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Corner of Borrow Pit - Location 7
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20890-TP
Job No:	S17017	Lab No:	S20890

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.82	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	16.7	Back Pressure (kPa)	500
Placement Moisture Content (%)	16.7	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.73	Sample Height (mm)	53.0
Density Ratio (%)	95.0	Sample Diameter (mm)	50.1

PERMEABILITY $k_{(20)} =$ **2.8E-09 (m/sec)**

Comments

Permeant Used: Sydney tap water



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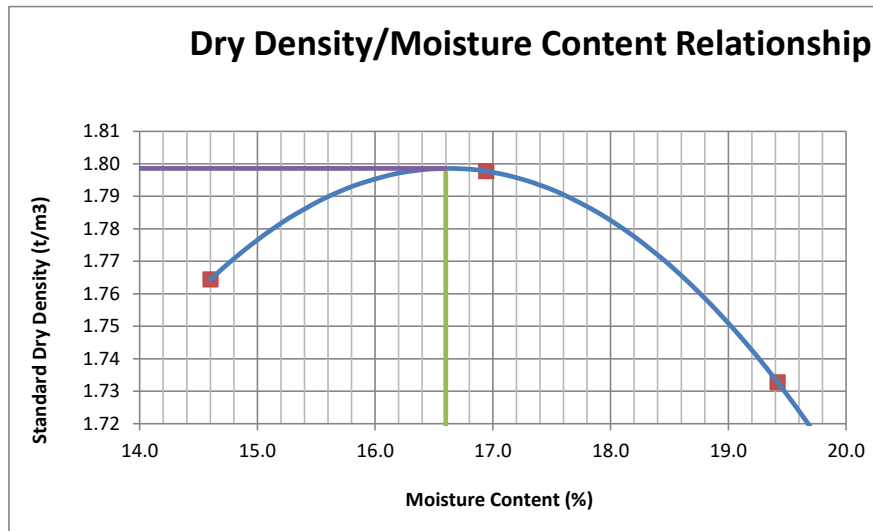
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Corner of Borrow Pit - Location 8
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20891-MDD
Job No:	S17017	Lab No:	S20891

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
------------------	-------------------	----------------------	------------

Preparation:	Prepared in accordance with the test method
---------------------	---



Maximum Dry Density (t/m³)	1.799
Optimum Moisture Content (%)	16.6
Percentage Oversize on 19mm sieve (%)	24
Percentage Oversize on 37.5mm sieve (%)	6

	The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.	Authorised Signatory: <hr style="width: 100%;"/> Chris Lloyd	14/02/2017 <hr style="width: 100%;"/> Date:
NATA Accredited Laboratory Number: 14874			

		Macquarie Geotechnical Unit 8/10 Bradford Street Alexandria NSW 2015
--	--	---

DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Corner of Borrow Pit - Location 8
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20891-TP
Job No:	S17017	Lab No:	S20891

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
------------------	-------------------	----------------------	---------

Preparation:	Prepared in accordance with the test method
---------------------	---

Maximum Dry Density (t/m ³)	1.80	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	16.6	Back Pressure (kPa)	500
Placement Moisture Content (%)	16.6	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.71	Sample Height (mm)	51.3
Density Ratio (%)	95.0	Sample Diameter (mm)	49.9

PERMEABILITY $k_{(20)} =$ **7.4E-10 (m/sec)**

Comments

Permeant Used: Sydney tap water



The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

14/02/2017

Ian Goldschmidt

Date:



Macquarie Geotechnical
Unit 8/10
Bradford Street
Alexandria NSW 2015

Nuclear Hilf Density Ratio Report

Client : JE & J Robinson	Report Number: 12665 - 001
Client Address: PO Box 786 Muswellbrook NSW 2333	Report Date: 10/01/2017
Job Number : 12665	Folder Number:
Project : Compaction Control	Test Methods: AS 1289.2.1.1, 5.4.1, 5.7.1, 5.8.1
Location : Ravensworth Ash Dam ,	Page 1 of 1

Lab No :	16-2461	16-2462	16-2463	16-2464
ID No :	1	2	3	4
Lot No :	-	-	-	-
Date Sampled :	22/12/2016	22/12/2016	22/12/2016	22/12/2016
Material Source :	Site Won	Site Won	Site Won	Site Won
For Use As :	General Fill	General Fill	General Fill	General Fill
Sample Location :	Retention Basin Layer 1	Retention Basin Layer 1	Retention Basin Layer 1	Retention Basin Layer 1
Test Depth/Layer (mm)	300 / 300	300 / 300	300 / 300	300 / 300
Max Size (mm) :	19	19	19	19
Percent Oversize (%) :	12.1	13.4	14.2	18.4
Field Wet Density (t/m ³) :	1.981	1.927	1.967	1.996
Field Moisture Cont (%) :	9.5	9.8	10.7	10.6
PCWD (t/m ³) :	1.918*	1.940*	1.972*	1.950*
Adjusted Moisture Variation (%) :	4.5*	4.5*	4.5*	3.5*
Optimum Moisture Content (%) :	14.5	14.5	15.5	14.5
Compactive Effort :	Standard	Standard	Standard	Standard
Relative Compaction (%) :	103.5	99.5	100.0	102.5
Minimum Specification :	95%	95%	95%	95%
Moisture Ratio (%) :	65.5	67.5	69.0	73.0
Moisture Specification :	N/A	N/A	N/A	N/A
Moisture Variation (%) :	5% (dryer)	4.5% (dryer)	5% (dryer)	4% (dryer)

Remarks:

* - Denotes adjusted for oversize

Lab Number:	Soil Description
16-2461	Gravelly CLAY
16-2462	Gravelly CLAY
16-2463	Gravelly CLAY
16-2464	Gravelly CLAY



Accredited for compliance with ISO/IEC 17025.

APPROVED SIGNATORY



Matt Flood
Senior Technician

FORM NUMBER

RP96-19

Nuclear Hilf Density Ratio Report

Client : JE & J Robinson	Report Number: 12665 - 002
Client Address: PO Box 786 Muswellbrook NSW 2333	Report Date: 10/01/2017
Job Number : 12665	Folder Number:
Project : Compaction Control	Test Methods: AS 1289.2.1.1, 5.4.1, 5.7.1, 5.8.1
Location : Ravensworth Ash Dam ,	Page 1 of 1

Lab No :	17-1	17-2	17-3	17-4
ID No :	5	6	7	8
Lot No :	-	-	-	-
Date Sampled :	5/1/2017	5/1/2017	5/1/2017	5/1/2017
Material Source :	Site Won	Site Won	Site Won	Site Won
For Use As :	General Fill	General Fill	General Fill	General Fill
Sample Location :	Retention Basin Finish Layer	Retention Basin Finish Layer	Retention Basin Finish Layer	Retention Basin Finish Layer
Test Depth/Layer (mm)	300 / 300	300 / 300	300 / 300	300 / 300
Max Size (mm) :	19	19	19	19
Percent Oversize (%) :	10.8	12.6	8.8	9.1
Field Wet Density (t/m ³) :	1.894	1.857	1.954	1.961
Field Moisture Cont (%) :	8.3	8.6	10.4	9.3
PCWD (t/m ³) :	1.915*	1.945*	1.939*	1.953*
Adjusted Moisture Variation (%) :	5.0*	4.0*	4.5*	4.5*
Optimum Moisture Content (%) :	13.0	13.0	15.0	14.0
Compactive Effort :	Standard	Standard	Standard	Standard
Relative Compaction (%) :	99.0	95.5	101.0	100.5
Minimum Specification :	95%	95%	95%	95%
Moisture Ratio (%) :	64.0	66.0	69.5	66.5
Moisture Specification :	N/A	N/A	N/A	N/A
Moisture Variation (%) :	4.5% (dryer)	4.5% (dryer)	4.5% (dryer)	4.5% (dryer)

Remarks:

* - Denotes adjusted for oversize

Lab Number:	Soil Description
17-1	Gravelly CLAY
17-2	Gravelly CLAY
17-3	Gravelly CLAY
17-4	Gravelly CLAY



Accredited for compliance with ISO/IEC 17025.

APPROVED SIGNATORY



Matt Flood
Senior Technician

FORM NUMBER

RP96-19

Nuclear Hilf Density Ratio Report

Client :	JE & J Robinson	Report Number:	12665 - 003
Client Address:	PO Box 786 Muswellbrook NSW 2333	Report Date:	18/01/2017
Job Number :	12665	Folder Number:	
Project :	Compaction Control	Test Methods:	AS 1289.2.1.1, 5.4.1, 5.7.1, 5.8.1
Location :	Ravensworth Ash Dam ,	Page 1 of 2	

Lab No :	17-63	17-64	17-65	17-66
ID No :	9	10	11	12
Lot No :	-	-	-	-
Date Sampled :	13/1/2017	13/1/2017	13/1/2017	13/1/2017
Material Source :	Site Won	Site Won	Site Won	Site Won
For Use As :	General Fill	General Fill	General Fill	General Fill
Sample Location :	Hardstand Final Layer	Hardstand Final Layer	Hardstand Final Layer	Hardstand Final Layer
Test Depth/Layer (mm)	250 / NA	250 / NA	250 / NA	250 / NA
Max Size (mm) :	37.5	37.5	37.5	37.5
Percent Oversize (%) :	12.6	19.8	10.5	11.7
Field Wet Density (t/m ³) :	2.011	2.036	2.111	2.062
Field Moisture Cont (%) :	7.9	7.5	7.8	6.3
PCWD (t/m ³) :	2.000*	2.028*	2.027*	2.005*
Adjusted Moisture Variation (%) :	4.0*	3.5*	4.0*	4.0*
Optimum Moisture Content (%) :	12.5	12.0	12.0	11.0
Compactive Effort :	Standard	Standard	Standard	Standard
Relative Compaction (%) :	100.5	100.5	104.0	103.0
Minimum Specification :	95%	95%	95%	95%
Moisture Ratio (%) :	63.0	62.5	65.0	57.5
Moisture Specification :	N/A	N/A	N/A	N/A
Moisture Variation (%) :	4.5% (dryer)	4.5% (dryer)	4% (dryer)	4.5% (dryer)

Remarks:

* - Denotes adjusted for oversize

Lab Number:	Soil Description
17-63	Clayey Silty GRAVEL
17-64	Clayey Silty GRAVEL
17-65	Clayey Silty GRAVEL
17-66	Clayey Silty GRAVEL



Accredited for compliance with ISO/IEC 17025.

APPROVED SIGNATORY



Matt Flood
Senior Technician

FORM NUMBER

RP96-19

Nuclear Hilf Density Ratio Report

Client : JE & J Robinson	Report Number: 12665 - 003
Client Address: PO Box 786 Muswellbrook NSW 2333	Report Date: 18/01/2017
Job Number : 12665	Folder Number:
Project : Compaction Control	Test Methods: AS 1289.2.1.1, 5.4.1, 5.7.1, 5.8.1
Location : Ravensworth Ash Dam ,	Page 2 of 2

Lab No :	17-67	17-68	
ID No :	13	14	
Lot No :	-	-	
Date Sampled :	13/1/2017	13/1/2017	
Material Source :	Site Won	Site Won	
For Use As :	General Fill	General Fill	
Sample Location :	Hardstand Final Layer	Hardstand Final Layer	
Test Depth/Layer (mm)	250 / NA	250 / NA	
Max Size (mm) :	37.5	37.5	
Percent Oversize (%) :	9.1	5.8	
Field Wet Density (t/m ³) :	2.101	2.021	
Field Moisture Cont (%) :	8.5	7.8	
PCWD (t/m ³) :	1.991*	1.970*	
Adjusted Moisture Variation (%) :	4.0*	4.5*	
Optimum Moisture Content (%) :	12.5	12.5	
Compactive Effort :	Standard	Standard	
Relative Compaction (%) :	105.5	102.5	
Minimum Specification :	95%	95%	
Moisture Ratio (%) :	68.0	62.5	
Moisture Specification :	N/A	N/A	
Moisture Variation (%) :	4% (dryer)	4.5% (dryer)	

Remarks:

* - Denotes adjusted for oversize

Lab Number:	Soil Description
17-67	Clayey Silty GRAVEL
17-68	Clayey Silty GRAVEL



Accredited for compliance with ISO/IEC 17025.

APPROVED SIGNATORY



Matt Flood
Senior Technician

FORM NUMBER

RP96-19

Nuclear Hilf Density Ratio Report



Client : JE & J Robinson Client Address: PO Box 786 Muswellbrook NSW 2333 Job Number : 12665 Project : Compaction Control Location : Ravensworth Ash Dam ,	Report Number: 12665 - 005 Report Date: 2/05/2017 Folder Number: Test Methods: AS 1289.2.1.1, 5.4.1, 5.7.1, 5.8.1
Page 1 of 2	

Lab No :	17-888	17-889	17-890	17-891
ID No :	21	22	23	24
Lot No :	-	-	-	-
Date Sampled :	28/4/2017	28/4/2017	28/4/2017	28/4/2017
Material Source :	Site Won	Site Won	Site Won	Site Won
For Use As :	General Fill	General Fill	General Fill	General Fill
Sample Location :	East Wall Detension Dam Final Layer	East Wall Detension Dam Final Layer	South Wall Detension Dam Final Layer	South Wall Detension Dam Final Layer
Test Depth/Layer (mm)	300 / NA	300 / NA	300 / NA	300 / NA
Max Size (mm) :	19	19	19	19
Percent Oversize (%) :	14.2	13.7	10.2	14.5
Field Wet Density (t/m ³) :	2.029	2.100	2.066	2.088
Field Moisture Cont (%) :	9.7	10.6	12.2	9.9
PCWD (t/m ³) :	2.020*	1.997*	1.966*	1.980*
Adjusted Moisture Variation (%) :	3.0*	3.0*	2.5*	4.0*
Optimum Moisture Content (%) :	13.0	13.5	15.0	14.0
Compactive Effort :	Standard	Standard	Standard	Standard
Relative Compaction (%) :	100.5	105.0	105.0	105.5
Minimum Specification :	95%	95%	95%	95%
Moisture Ratio (%) :	74.5	78.5	81.5	70.5
Moisture Specification :	N/A	N/A	N/A	N/A
Moisture Variation (%) :	3.5% (dryer)	3% (dryer)	3% (dryer)	4% (dryer)

Remarks:

* - Denotes adjusted for oversize

Lab Number:	Soil Description
17-888	Silty GRAVEL
17-889	Silty GRAVEL
17-890	Silty GRAVEL
17-891	Silty GRAVEL

 Accredited for compliance with ISO/IEC 17025.	APPROVED SIGNATORY  Timothy Baker Senior Soil Technician	FORM NUMBER RP96-19
--	---	-------------------------------

Nuclear Hilf Density Ratio Report

Client :	JE & J Robinson	Report Number:	12665 - 005
Client Address:	PO Box 786 Muswellbrook NSW 2333	Report Date:	2/05/2017
Job Number :	12665	Folder Number:	
Project :	Compaction Control	Test Methods:	AS 1289.2.1.1, 5.4.1, 5.7.1, 5.8.1
Location :	Ravensworth Ash Dam ,	Page 2 of 2	

Lab No :	17-892	17-893	17-894	17-895
ID No :	25	26	27	28
Lot No :	-	-	-	-
Date Sampled :	28/4/2017	28/4/2017	28/4/2017	28/4/2017
Material Source :	Site Won	Site Won	Site Won	Site Won
For Use As :	General Fill	General Fill	General Fill	General Fill
Sample Location :	West Wall Detension Dam Final Layer	West Wall Detension Dam Final Layer	North Wall Detension Dam Final Layer	North Wall Detension Dam Final Layer
Test Depth/Layer (mm)	300 / NA	300 / NA	300 / NA	300 / NA
Max Size (mm) :	19	19	19	19
Percent Oversize (%) :	11.6	14.0	13.7	13.4
Field Wet Density (t/m ³) :	2.056	2.028	2.000	2.030
Field Moisture Cont (%) :	9.9	9.4	9.8	10.2
PCWD (t/m ³) :	1.968*	1.987*	1.988*	1.981*
Adjusted Moisture Variation (%) :	4.0*	2.5*	2.5*	2.5*
Optimum Moisture Content (%) :	14.0	12.0	12.5	13.0
Compactive Effort :	Standard	Standard	Standard	Standard
Relative Compaction (%) :	104.5	102.0	100.5	102.5
Minimum Specification :	95%	95%	95%	95%
Moisture Ratio (%) :	70.5	78.5	78.5	78.5
Moisture Specification :	N/A	N/A	N/A	N/A
Moisture Variation (%) :	4% (dryer)	2.5% (dryer)	2.5% (dryer)	3% (dryer)

Remarks:

* - Denotes adjusted for oversize

Lab Number:	Soil Description
17-892	Silty GRAVEL
17-893	Silty GRAVEL
17-894	Silty GRAVEL
17-895	Silty GRAVEL



Accredited for compliance with ISO/IEC 17025.

APPROVED SIGNATORY



Timothy Baker
Senior Soil Technician

FORM NUMBER

RP96-19

Appendix D
Drawings



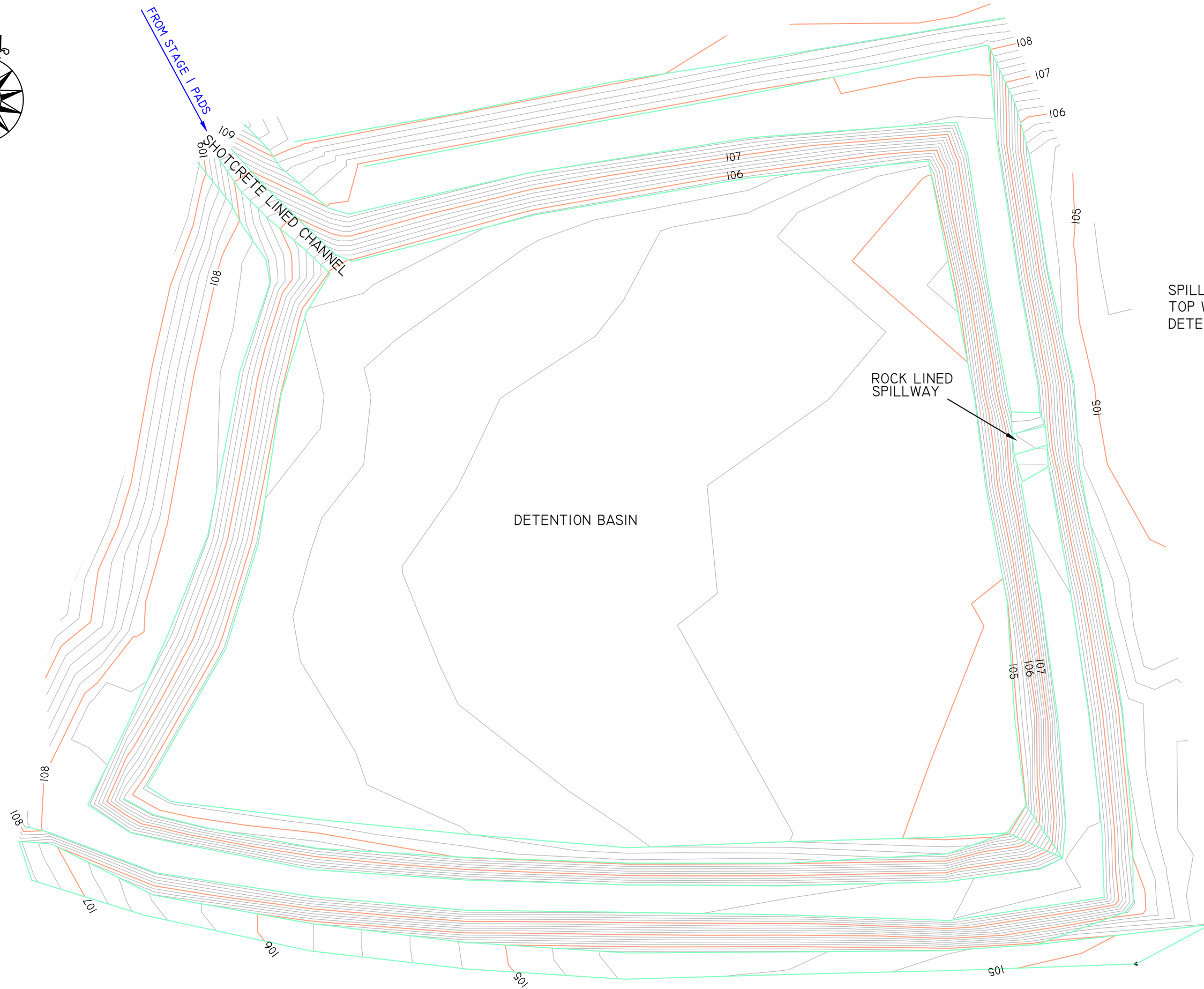


Appendix D

Drawings

List of Drawings

<u>Name</u>	<u>Number</u>
Void 3, Stage 1 Leachate detention basin, as built plan	



SPILLWAY RL - 107.4
 TOP WALL RL - 107.8
 DETENTION BASIN VOLUME - 16200M³

TONY MEXON & ASSOCIATES
 REGISTERED SURVEYORS

CLIENT/OWNER
BETTERGROW

DETAILS		
SURVEYORS REF.	SCALE	SHEET SIZE
14-32	1:500	A3
DATE OF SURVEY: 27 APRIL 2017		

REVISION NOTES	
27/4/2017 ORIGINAL	0

TITLE
VOID 3 STAGE 1 COMPOSTING PADS DETENTION BASIN AS BUILT PLAN



Aurecon Australasia Pty Ltd

ABN 54 005 139 873

Level 5, 116 Military Road
Neutral Bay NSW 2089

PO Box 538
Neutral Bay NSW 2089
Australia

T +61 2 9465 5599

F +61 2 9465 5598

E sydney@aurecongroup.com

W aurecongroup.com

Aurecon offices are located in:

Angola, Australia, Botswana, China,
Ghana, Hong Kong, Indonesia, Kenya,
Lesotho, Macau, Mozambique,
Namibia, New Zealand, Nigeria,
Philippines, Qatar, Singapore, South Africa,
Swaziland, Tanzania, Thailand, Uganda,
United Arab Emirates, Vietnam.

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Level 5, 116 Military Road
Neutral Bay NSW 2089
PO Box 538
Neutral Bay NSW 2089
Australia

T +61 2 9465 5599
F +61 2 9465 5598
E sydney@arecongroup.com
W arecongroup.com

The Aurecon logo consists of a small green square above the word "aurecon" in a bold, lowercase, sans-serif font.

14 July 2016

To whom it may concern
Singleton Shire Council


Ravensthorpe Void 3 composting pad and detention basin

The enclosed drawings for the Ravensthorpe Void 3 composting pad and detention basin have been reviewed and found to meet all engineering requirements for a low hazard dam. It has sufficient capacity available to detain up to the 1 in 100 year, 24 hour storm without any uncontrolled discharge off site. The stability of the basin is also assessed as satisfactory and has no perceived impact upon the existing ash dam structure.

An earthworks specification has been written by Aurecon to compliment the drawings. These specifications are based upon our experience building other dams within the Ravensthorpe complex. In addition, we have been commissioned by AGL Macquarie to undertake a number of inspections during the construction of this pad and basin, with the intention of certifying the structure upon completion. A final construction report shall be submitted to AGL Macquarie.

Should you wish to discuss the engineering of this dam in any more detail, please don't hesitate to contact me on Matthew.Ludeke@arecongroup.com or 02 9465 5362.

Yours faithfully


Matthew Ludeke
Senior dams engineer

Enc: Earthworks specification for Void 3 detention basin
Bettergrow Ravensthorpe Composting Facility – General Arrangement
Bettergrow Ravensthorpe Composting Facility – Existing Arrangement
Bettergrow Ravensthorpe Composting Facility – Stage 1 Works
Bettergrow Ravensthorpe Composting Facility – Stage 2 Works
Bettergrow Ravensthorpe Composting Facility – Cross Section AA
Bettergrow Ravensthorpe Composting Facility – Cross Section CC

Copies: John Vyse john@bettergrow.com.au
Matthew Parkinson Matthew.Parkinson@agl.com.au

Earthworks Specification for Ravensworth Void 3 Detention Basin

Zone 3A – Select earthfill

This material is processed from existing local overburden deposits.

The material should have a particle size distribution generally in accordance with Table 1.

Table 1 Zone 3A particle size distribution

Sieve size (mm)	Percent passing (not less than)
200	80
75	50
2.36	20
0.075	10

The maximum particle size (prior to compaction) of Zone 3A shall be 300 mm.

Material shall be compacted to 98 % maximum dry density at ± 1 % optimum moisture content.

Material shall be dumped and spread in continuous horizontal layers and compacted to a thickness not exceeding 400 mm.

Material shall be watered as required for dust control and moisture content correction.

No fill shall be placed on an area on which free water has ponded. If any area has been softened by wet weather or traffic, the surface of the previous compacted layer shall be scarified to a depth of at least 50 mm.

Zone 4 – Riprap protection

Material to match batter protection in the existing spillway.

This shall be hard, dense and durable rockfill, free of defects that may lead to deterioration in exposed wet conditions.

The maximum particle size shall nominally be 500 mm, with a minimum particle size of 100 mm.

Material shall be dumped and spread in a manner to ensure segregation of large and small rocks does not occur and that rip rap sits stable on the batter without any tendency to slide.

No compaction is required.

RCA ref 12825a-103/0

14 September 2017

BetterGrow
PO Box 945
WINDSOR 2756

Attention: John Vyse

Geotechnical Engineering

Engineering Geology

Environmental Engineering

Hydrogeology

Construction Materials Testing

Environmental Monitoring

Sound & Vibration

Occupational Hygiene

RAVENSWORTH LEACHATE BARRIER CERTIFICATION

1 INTRODUCTION

This report provides a certification of the leachate barrier that BetterGrow have constructed at a site at 74 Lemington Road, Ravensworth, NSW. The leachate barrier has been placed over the southern portion of the second section of the Stage 1 Pad areas over Void 3 at the Ravensworth site. The leachate barrier lies beneath the operating area that BetterGrow are using for preparation of a topsoil medium at the site by blending treated Sydney Water biosolids and green waste (see Survey plan attached to letter provided by Tony Mexon and Associates). The operating area being used for the receipt, blending and preparation is a large relatively level area overlying a relic tailings dam at the site. The works are subject to EPA Notice of Variation of Licence NO. 7654 with the variation relating to preparation of leachate barrier and lining of the operating area.

2 LEACHATE BARRIER APPROVAL CONDITIONS

EPA Notice of Variation of Licence NO. 7654 states that:

Clause O7.1 - Prior to receiving waste, the licensee must ensure that the waste receipt, handling, processing and storage surfaces in the southern portion of Stage 1 are constructed with a leachate barrier in accordance with minimum standards in the EPA's "Environmental Guidelines for Composting and Related Organics Processing Facilities" 2004.

Clauses O7.2 - The licensee must provide a Certified Quality Assurance report to the EPA for approval within four weeks of completion, that the leachate barrier on the working surfaces of the southern portion of Stage 1 at the premises has been installed and constructed in accordance with the EPA's "Environmental Guidelines for Composting and Related Organics Processing Facilities" 2004. The CQA report must be prepared by a suitably qualified expert or engineer.

The EPA's "Environmental Guidelines for Composting and Related Organics Processing Facilities" 2004 states that the liner is to comprise "a clay or modified soil liner consisting of at least 600 mm of recompacted clay with an in-situ permeability (k) of less than 10^{-7} m/s. Such liners should be placed in successive layers up to 300 mm uncompacted thickness."

3 SUMMARY OF WORKS AT THE SITE

Works at the site have been undertaken by:

Earthworks – JE & J Robinson Pty Ltd

Survey – Tony Mexon & Associates

Geotechnical Testing – RCA Australia

Works have comprised preparation of an operations area by placing and compacting a subbase of 300-400mm of site won overburden with 100-150mm gravel compacted over that as a wearing course. The 300-400mm of site won overburden was placed over an existing capping over the relic tailings dam that was investigated by JE & J Robinson Pty Ltd by test pitting and found to comprise a 400mm layer of overburden. The existing capping layer was subjected to rolling and compaction prior to the placement of the additional overburden layer as indicated in the attached letter from JE & J Robinson dated 8 September 2017.

RCA Australia has provided Level 2 compaction testing for BetterGrow during the compaction of the Stage 1 Pad area. As identified on the attached Site Layout Plan of the Void 3 Composting Pads the works are divided into a Southern Pad area and a Northern Pad area.

The attached letter from Tony Mexon & Associates (dated 8 September 2017) indicates that the average thickness of the layer of overburden that was compacted over the second section of the Stage 1 Pad areas was 378mm.

4 TEST RESULTS

4.1 DENSITY TESTING

The compaction testing results for the overburden subbase layer being placed within the Southern Pad area identified on the attached Site Layout plan. The test results are attached and cover tests over the period 7 July 2017 to 17 July 2017. Overburden was placed in two layers (Layer 1 and Final Layer). Density test results indicate density ratios in the range 99-100% for Layer 1 and 102.5-105.5% for the Final Layer.

4.2 OVERBURDEN TESTING

Overburden from the Ravensworth stockpile was tested by RCA (see attached results). The tested material has a PI of 15% with 37% gravel, 23% sand and 40% silt and clay.

4.3 PERMEABILITY TESTING

RCA Australia had sample of the overburden material tested for permeability (k) by Macquarie Geotech. Permeability was tested by method AS1289 6.7.3 on samples compacted to standard density ratio of 95%. The eight test results indicate permeability in the range 2.8×10^{-9} to 1.5×10^{-10} m/s.

5 CERTIFICATION

Based on the data provided RCA Australia consider that the overburden leachate barrier placed over the southern portion of the second section of the Stage 1 works satisfies conditions O7.1 and O7.2 of EPA Notice of Variation of Licence NO. 7654.

Yours faithfully

RCA AUSTRALIA



Mark Allman
Principal Geotechnical Engineer

ATTACHMENTS

Site Layout Plan

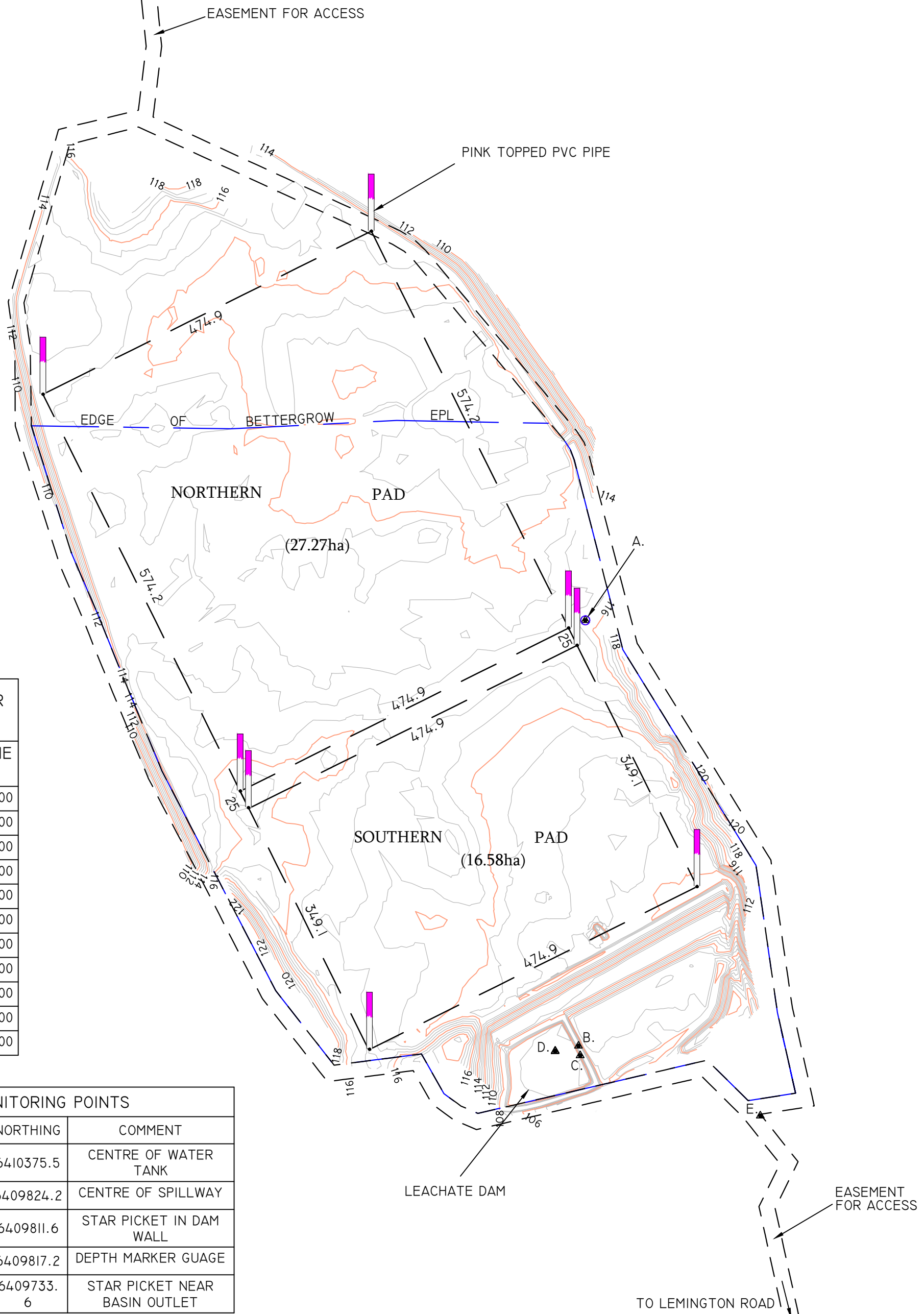
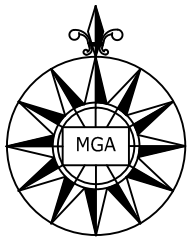
Density Reports 29-40

Overburden Quality of Material Report

Compaction and Permeability Test Results

Tony Mexon & Associates Letter (8/9/2017)

JE & J Robinson Letter (8/9/2017)



DEPTH MARKER VOLUMES	
DEPTH (M)	VOLUME (M ³)
0.4	1000
0.6	2100
0.8	3400
1.0	4900
1.2	6500
1.4	8000
1.6	9600
1.8	11200
2.0	12900
2.2	14500
2.3	15700

MONITORING POINTS			
POINT	EASTING	NORTHING	COMMENT
A.	315785.8	6410375.5	CENTRE OF WATER TANK
B.	315777.0	6409824.2	CENTRE OF SPILLWAY
C.	315779.3	6409811.6	STAR PICKET IN DAM WALL
D.	315746.8	6409817.2	DEPTH MARKER GUAGE
E.	316012.5	6409733.6	STAR PICKET NEAR BASIN OUTLET

SURVEYOR		CLIENT/OWNER		REVISION NOTES		TITLE	
TONY MEXON & ASSOCIATES Registered Surveyors P.O. Box 917 Singleton, NSW 2330		BETTERGROW		13/6/2017 ORIGINAL		VOID 3 COMPOSTING PADS SITE LAYOUT	
SURVEYORS REF. 13-26		SCALE 1:4000		SHEET SIZE A3		0	

Hilf Density Ratio Report

Client :	JE & J Robinson	Report Number:	12665 - 006
Address :	PO Box 786, Muswellbrook, NSW, 2333	Report Date :	10/07/2017
Project Name :	Compaction Control	Order Number :	
Project Number :	12665	Test Method :	AS1289.5.7.1
Location:	Ravensworth Ash Dam	Page 1 of 1	

Sample Number :	17-1554	17-1555	17-1556	17-1557
Test Number :	29	30	31	32
Sampling Method :	AS 1289.1.2.1-6.4b	AS 1289.1.2.1-6.4b	AS 1289.1.2.1-6.4b	AS 1289.1.2.1-6.4b
Date Sampled :	7/07/2017	7/07/2017	7/07/2017	7/07/2017
Date Tested :	7/07/2017	7/07/2017	7/07/2017	7/07/2017
Material Type :	General Fill	General Fill	General Fill	General Fill
Material Source :	Site Won	Site Won	Site Won	Site Won
Lot Number :				
Sample Location :	Hardstand Layer 1	Hardstand Layer 1	Hardstand Layer 1	Hardstand Layer 1
Test Depth (mm) :	300	300	300	300
Layer Depth (mm) :	300	300	300	300
Maximum Size (mm) :	19	37.5	37.5	37.5
Oversize Wet (%) :	19	10	3	14
Oversize Dry (%) :				
Oversize Density (t/m ³) :	2.332	2.428	2.595	2.238
Field Moisture Content (%) :	16.3	13.0	15.2	11.1
Hilf MDR Number :	17-1554	17-1555	17-1556	17-1557
Hilf MDR Method :	AS 1289.5.7.1	AS 1289.5.7.1	AS 1289.5.7.1	AS 1289.5.7.1
Compactive Effort :	Standard	Standard	Standard	Standard
Field Density Method :	AS 1289.5.8.1	AS 1289.5.8.1	AS 1289.5.8.1	AS 1289.5.8.1
Moisture Method :	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1
Moisture Ratio (%) :	102.5	106.0	106.5	108.5
Field Wet Density (t/m ³) :	2.06	2.12	2.12	2.12
Optimum Moisture Content (%) :	15.9	12.2	14.3	10.2
Moisture Variation :	-0.3	-0.8	-0.9	-0.9
Peak Converted Wet Density (t/m ³) :	2.08	2.13	2.12	2.13
Hilf Density Ratio (%) :	99.0	99.5	100.0	99.5
Minimum Specification :	95%	95%	95%	95%
Moisture Specification :	N/A	N/A	N/A	N/A
Site Selection :				
Soil Description :	Gravelly CLAY	Sandy Gravelly CLAY	Gravelly CLAY	Sandy Gravelly CLAY
Remarks :	-			



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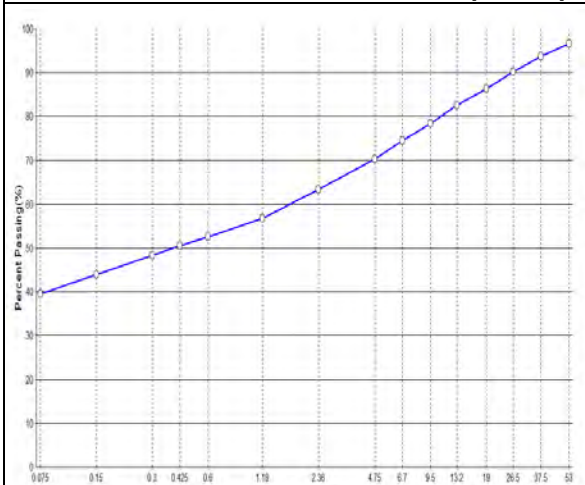
APPROVED SIGNATORY





Timothy Baker - Senior Soil Technician
NATA Accreditation Number
9811 Singleton Lab Site Rec No. 14515

Quality of Materials Report

Client: Better Grow Client Address: PO Box 945 Windsor NSW 2756 Job Number: 12825a Project: Ravensworth Location: Ravensworth ,	Report Number: 12825a - 002 Report Date: 30/06/2017 Order Number: -
Lab No: 17-1442 Date Sampled: 27/06/2017 Date Tested: 28/06/2017 Sampled By: RCA Geotech Sample Method: AS SUPPLIED Material Source: - For Use As: - Remarks: -	Page 1 of 1 Sample Location CWR Ravensworth Stockpile Spec Description: - Lot Number: - Spec Number: -

	A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
Test Method: AS 1289.3.6.1 (washed) 	75.00 mm		100	
	53.00 mm		97	
	37.50 mm		94	
	26.50 mm		90	
	19.00 mm		86	
	13.2 mm		83	
	9.50 mm		78	
	6.7 mm		74	
	4.75 mm		70	
	2.36 mm		63	
	1.18 mm		57	
	0.600 mm		53	
	0.425 mm		50	
	0.300 mm		48	
	0.150 mm		44	
	0.075 mm		40	

Atterberg Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	AS1289.3.1.2		35	
Plastic Limit (%)	AS1289.3.2.1		20	
Plasticity Index	AS1289.3.3.1		15	
Linear Shrinkage (%)			-	
P.I. x % Passing 0.425 mm			-	

 Accredited for compliance with ISO/IEC 17025.	Approved Signatory  Timothy Baker Senior Soil Technician NATA Accred No:9811	Form Number RP132-1
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Hilf Density Ratio Report

Client :	JE & J Robinson	Report Number:	12665 - 007
Address :	PO Box 786, Muswellbrook, NSW, 2333	Report Date :	18/07/2017
Project Name :	Compaction Control	Order Number :	
Project Number :	12665	Test Method :	AS1289.5.7.1
Location:	Ravensworth Ash Dam	Page 1 of 2	

Sample Number :	17-1731	17-1732	17-1733	17-1734
Test Number :	33	34	35	36
Sampling Method :	AS 1289.1.2.1-6.4b	AS 1289.1.2.1-6.4b	AS 1289.1.2.1-6.4b	AS 1289.1.2.1-6.4b
Date Sampled :	17/07/2017	17/07/2017	17/07/2017	17/07/2017
Date Tested :	17/07/2017	17/07/2017	17/07/2017	17/07/2017
Material Type :	General Fill	General Fill	General Fill	General Fill
Material Source :	Site Won	Site Won	Site Won	Site Won
Lot Number :				
Sample Location :	Hardstand Final Layer	Hardstand Final Layer	Hardstand Final Layer	Hardstand Final Layer
Test Depth (mm) :	300	300	300	300
Layer Depth (mm) :	300	300	300	300
Maximum Size (mm) :	19	19	19	19
Oversize Wet (%) :	1	6	7	5
Oversize Dry (%) :				
Oversize Density (t/m ³) :	2.240	2.261	2.263	2.261
Field Moisture Content (%) :	9.6	10.3	10.0	9.4
Hilf MDR Number :	17-1731	17-1732	17-1733	17-1734
Hilf MDR Method :	AS 1289.5.7.1	AS 1289.5.7.1	AS 1289.5.7.1	AS 1289.5.7.1
Compactive Effort :	Standard	Standard	Standard	Standard
Field Density Method :	AS 1289.5.8.1	AS 1289.5.8.1	AS 1289.5.8.1	AS 1289.5.8.1
Moisture Method :	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1
Moisture Ratio (%) :	69.5	70.5	69.5	71.0
Field Wet Density (t/m ³) :	2.03	2.03	2.00	2.03
Optimum Moisture Content (%) :	13.8	14.6	14.4	13.3
Moisture Variation :	4.4	4.4	4.5	4.0
Peak Converted Wet Density (t/m ³) :	1.93	1.95	1.94	1.94
Hilf Density Ratio (%) :	105.0	104.0	103.0	105.0
Minimum Specification :	95%	95%	95%	95%
Moisture Specification :	N/A	N/A	N/A	N/A
Site Selection :				
Soil Description :	Clayey GRAVEL	Clayey GRAVEL	Clayey GRAVEL	Clayey GRAVEL
Remarks :	-			



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APPROVED SIGNATORY



Timothy Baker - Senior Soil Technician
NATA Accreditation Number
9811 Singleton Lab Site Rec No. 14515

Document Code RF89-8

Hilf Density Ratio Report

Client :	JE & J Robinson	Report Number:	12665 - 007
Address :	PO Box 786, Muswellbrook, NSW, 2333	Report Date :	18/07/2017
Project Name :	Compaction Control	Order Number :	
Project Number :	12665	Test Method :	AS1289.5.7.1
Location:	Ravensworth Ash Dam		Page 2 of 2

Sample Number :	17-1735	17-1736	17-1737	17-1738
Test Number :	37	38	39	40
Sampling Method :	AS 1289.1.2.1-6.4b	AS 1289.1.2.1-6.4b	AS 1289.1.2.1-6.4b	AS 1289.1.2.1-6.4b
Date Sampled :	17/07/2017	17/07/2017	17/07/2017	17/07/2017
Date Tested :	17/07/2017	17/07/2017	17/07/2017	17/07/2017
Material Type :	General Fill	General Fill	General Fill	General Fill
Material Source :	Site Won	Site Won	Site Won	Site Won
Lot Number :				
Sample Location :	Hardstand Final Layer	Hardstand Final Layer	Hardstand Final Layer	Hardstand Final Layer
Test Depth (mm) :	300	300	300	300
Layer Depth (mm) :	300	300	300	300
Maximum Size (mm) :	19	19	19	19
Oversize Wet (%) :	6	7	6	6
Oversize Dry (%) :				
Oversize Density (t/m ³) :	2.261	2.241	2.264	2.261
Field Moisture Content (%) :	9.5	9.5	9.8	10.4
Hilf MDR Number :	17-1735	17-1736	17-1737	17-1738
Hilf MDR Method :	AS 1289.5.7.1	AS 1289.5.7.1	AS 1289.5.7.1	AS 1289.5.7.1
Compactive Effort :	Standard	Standard	Standard	Standard
Field Density Method :	AS 1289.5.8.1	AS 1289.5.8.1	AS 1289.5.8.1	AS 1289.5.8.1
Moisture Method :	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1
Moisture Ratio (%) :	69.5	69.0	69.0	70.0
Field Wet Density (t/m ³) :	2.06	2.02	2.08	2.02
Optimum Moisture Content (%) :	13.7	13.8	14.2	14.9
Moisture Variation :	4.3	4.4	4.5	4.4
Peak Converted Wet Density (t/m ³) :	1.96	1.97	1.98	1.98
Hilf Density Ratio (%) :	105.0	102.5	105.5	102.0
Minimum Specification :	95%	95%	95%	95%
Moisture Specification :	N/A	N/A	N/A	N/A
Site Selection :				
Soil Description :	Clayey GRAVEL	Clayey GRAVEL	Clayey GRAVEL	Clayey GRAVEL
Remarks :	-			



Accredited for compliance with ISO/IEC 17025.

APPROVED SIGNATORY



Timothy Baker - Senior Soil Technician
NATA Accreditation Number
9811 Singleton Lab Site Rec No. 14515

Document Code RF89-8

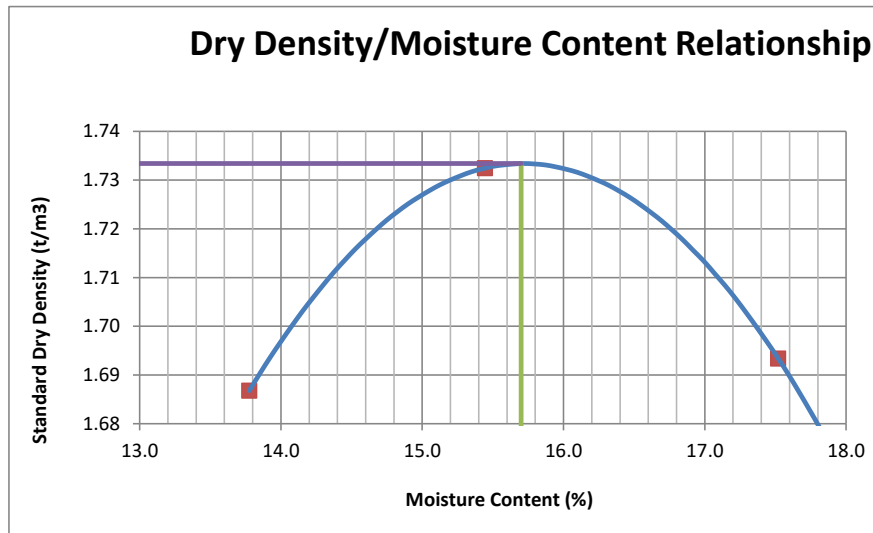
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 1
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20884-MDD
Job No:	S17017	Lab No:	S20884



Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.733
Optimum Moisture Content (%)	15.7
Percentage Oversize on 19mm sieve (%)	33
Percentage Oversize on 37.5mm sieve (%)	22

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<p>NATA Accredited Laboratory Number: 14874</p>	<p>Chris Lloyd</p>	<p>Date:</p>	

	<p>Macquarie Geotechnical Unit 8/10 Bradford Street Alexandria NSW 2015</p>
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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 1
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20884-TP
Job No:	S17017	Lab No:	S20884

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.73	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	15.7	Back Pressure (kPa)	500
Placement Moisture Content (%)	15.7	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.64	Sample Height (mm)	50.0
Density Ratio (%)	95.0	Sample Diameter (mm)	50.0

PERMEABILITY $k_{(20)} =$ **1.8E-10 (m/sec)**

Comments

Permeant Used: Sydney tap water



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Authorised Signatory:

14/02/2017

Ian Goldschmidt

Date:



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Unit 8/10
Bradford Street
Alexandria NSW 2015

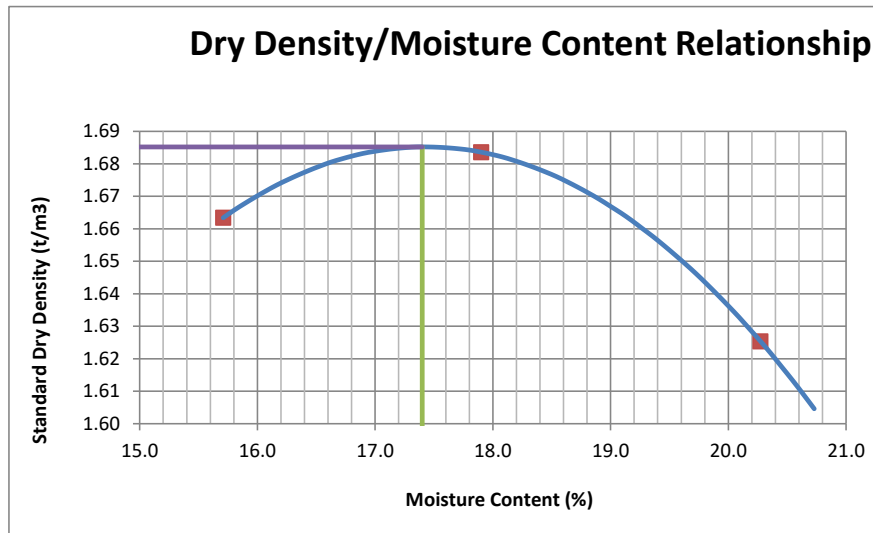
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 2
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20885-MDD
Job No:	S17017	Lab No:	S20885

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.685
Optimum Moisture Content (%)	17.4
Percentage Oversize on 19mm sieve (%)	33
Percentage Oversize on 37.5mm sieve (%)	16



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Authorised Signatory:

Chris Lloyd

14/02/2017

Date:



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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 2
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20885-TP
Job No:	S17017	Lab No:	S20885

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.69	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	17.4	Back Pressure (kPa)	500
Placement Moisture Content (%)	17.4	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.61	Sample Height (mm)	50.0
Density Ratio (%)	95.0	Sample Diameter (mm)	50.0

PERMEABILITY $k_{(20)} =$ **1.8E-10 (m/sec)**

Comments

Permeant Used: Sydney tap water



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Authorised Signatory:

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Ian Goldschmidt

Date:



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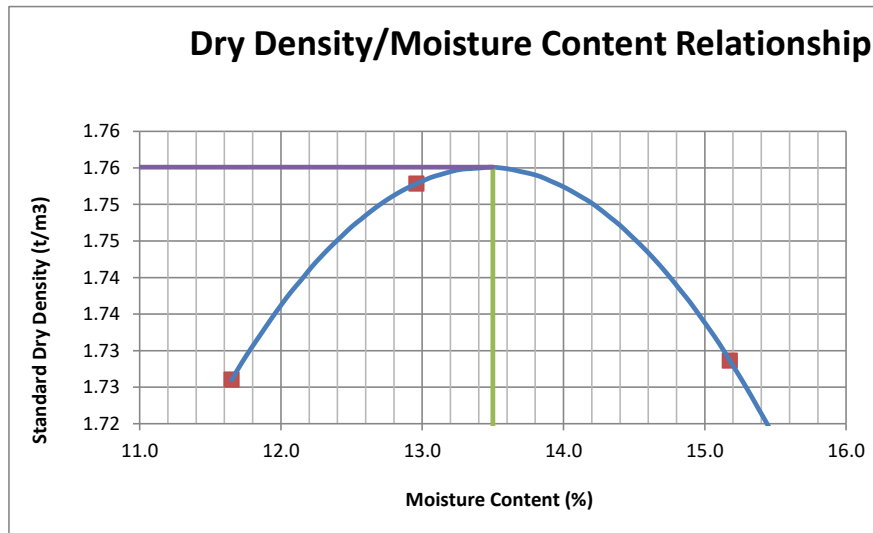
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 3
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20886-MDD
Job No:	S17017	Lab No:	S20886

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.755
Optimum Moisture Content (%)	13.5
Percentage Oversize on 19mm sieve (%)	32
Percentage Oversize on 37.5mm sieve (%)	18

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NATA Accredited Laboratory Number: 14874			

		Macquarie Geotechnical Unit 8/10 Bradford Street Alexandria NSW 2015
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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 3
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20886-TP
Job No:	S17017	Lab No:	S20886

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.76	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	13.5	Back Pressure (kPa)	500
Placement Moisture Content (%)	13.5	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.67	Sample Height (mm)	53.0
Density Ratio (%)	95.0	Sample Diameter (mm)	50.2

PERMEABILITY $k_{(20)} =$ **1.6E-09 (m/sec)**

Comments

Permeant Used: Sydney tap water



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Authorised Signatory:

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Date:



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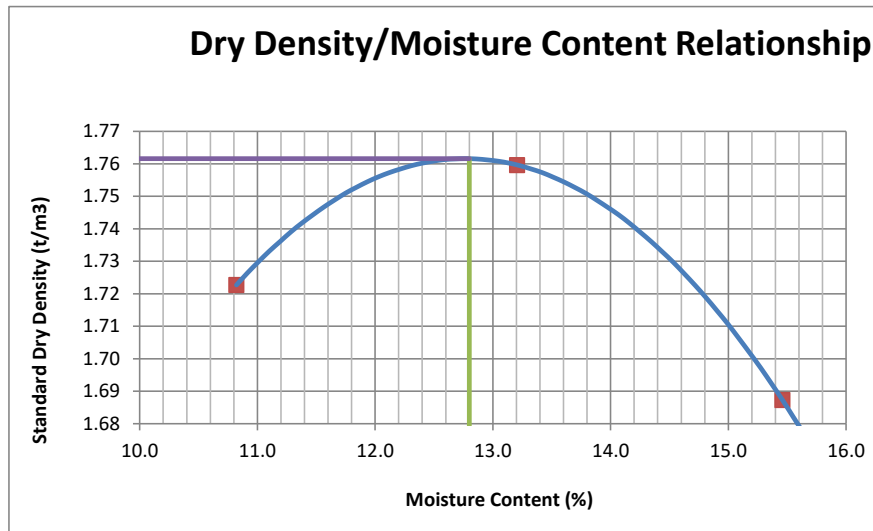
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 4
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20887-MDD
Job No:	S17017	Lab No:	S20887

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.762
Optimum Moisture Content (%)	12.8
Percentage Oversize on 19mm sieve (%)	17
Percentage Oversize on 37.5mm sieve (%)	10

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NATA Accredited Laboratory Number: 14874			

	Macquarie Geotechnical Unit 8/10 Bradford Street Alexandria NSW 2015
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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 4
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20887-TP
Job No:	S17017	Lab No:	S20887

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.76	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	12.8	Back Pressure (kPa)	500
Placement Moisture Content (%)	12.8	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.67	Sample Height (mm)	52.7
Density Ratio (%)	95.0	Sample Diameter (mm)	50.3

PERMEABILITY $k_{(20)} =$ **2.0E-09 (m/sec)**

Comments

Permeant Used: Sydney tap water



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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

14/02/2017

Ian Goldschmidt

Date:



Macquarie Geotechnical
Unit 8/10
Bradford Street
Alexandria NSW 2015

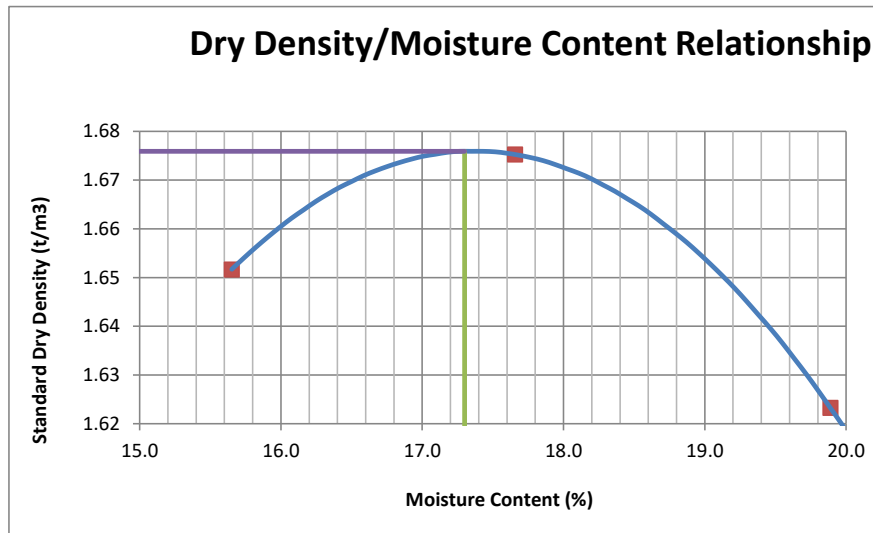
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 5
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20888-MDD
Job No:	S17017	Lab No:	S20888



Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.676
Optimum Moisture Content (%)	17.3
Percentage Oversize on 19mm sieve (%)	33
Percentage Oversize on 37.5mm sieve (%)	16

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NATA Accredited Laboratory Number: 14874			

	Macquarie Geotechnical Unit 8/10 Bradford Street Alexandria NSW 2015
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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 5
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20888-TP
Job No:	S17017	Lab No:	S20888

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.68	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	17.3	Back Pressure (kPa)	500
Placement Moisture Content (%)	17.3	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.60	Sample Height (mm)	50.4
Density Ratio (%)	95.0	Sample Diameter (mm)	51.2

PERMEABILITY $k_{(20)} =$ **2.1E-10 (m/sec)**

Comments

Permeant Used: Sydney tap water



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Authorised Signatory:

14/02/2017

Ian Goldschmidt

Date:



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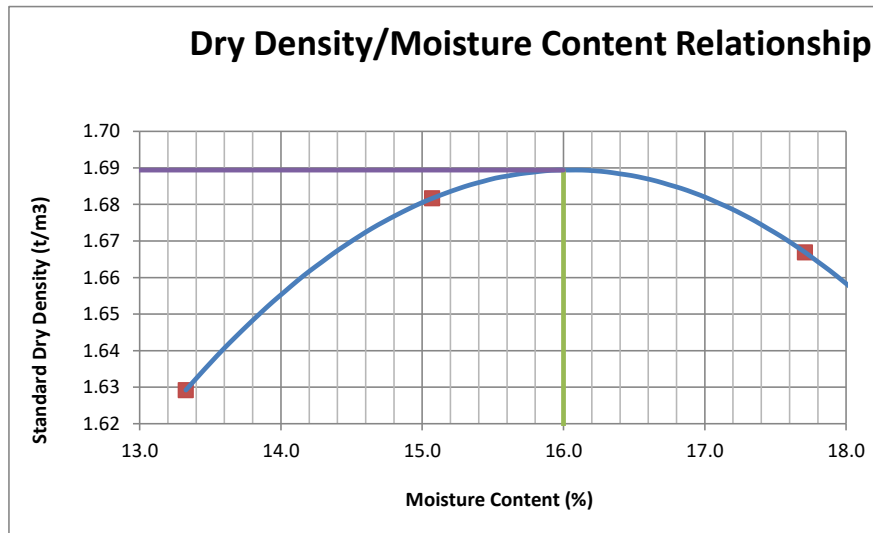
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Borrow Pit - Location 6
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey gravelly SAND
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20889-MDD
Job No:	S17017	Lab No:	S20889

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.689
Optimum Moisture Content (%)	16.0
Percentage Oversize on 19mm sieve (%)	19
Percentage Oversize on 37.5mm sieve (%)	8



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Chris Lloyd

14/02/2017

Date:



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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Borrow Pit - Location 6
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey gravelly SAND
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20889-TP
Job No:	S17017	Lab No:	S20889

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.69	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	16.0	Back Pressure (kPa)	500
Placement Moisture Content (%)	16.0	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.61	Sample Height (mm)	52.2
Density Ratio (%)	95.0	Sample Diameter (mm)	50.2

PERMEABILITY $k_{(20)} =$ **1.5E-10 (m/sec)**

Comments

Permeant Used: Sydney tap water



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Authorised Signatory:

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Ian Goldschmidt

Date:



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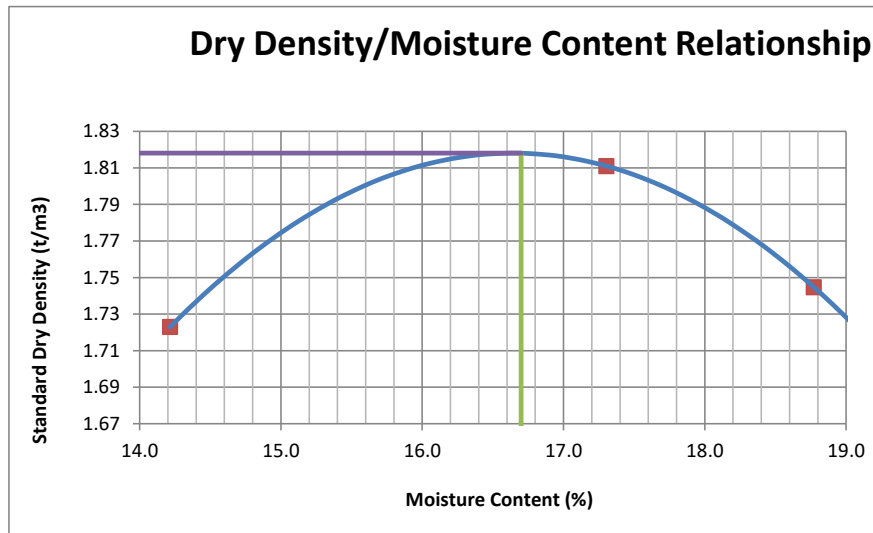
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Corner of Borrow Pit - Location 7
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20890-MDD
Job No:	S17017	Lab No:	S20890

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.818
Optimum Moisture Content (%)	16.7
Percentage Oversize on 19mm sieve (%)	30
Percentage Oversize on 37.5mm sieve (%)	13



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Authorised Signatory:

Chris Lloyd

14/02/2017

Date:



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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Corner of Borrow Pit - Location 7
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20890-TP
Job No:	S17017	Lab No:	S20890

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.82	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	16.7	Back Pressure (kPa)	500
Placement Moisture Content (%)	16.7	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.73	Sample Height (mm)	53.0
Density Ratio (%)	95.0	Sample Diameter (mm)	50.1

PERMEABILITY $k_{(20)} =$ **2.8E-09 (m/sec)**

Comments

Permeant Used: Sydney tap water



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Ian Goldschmidt

Date:



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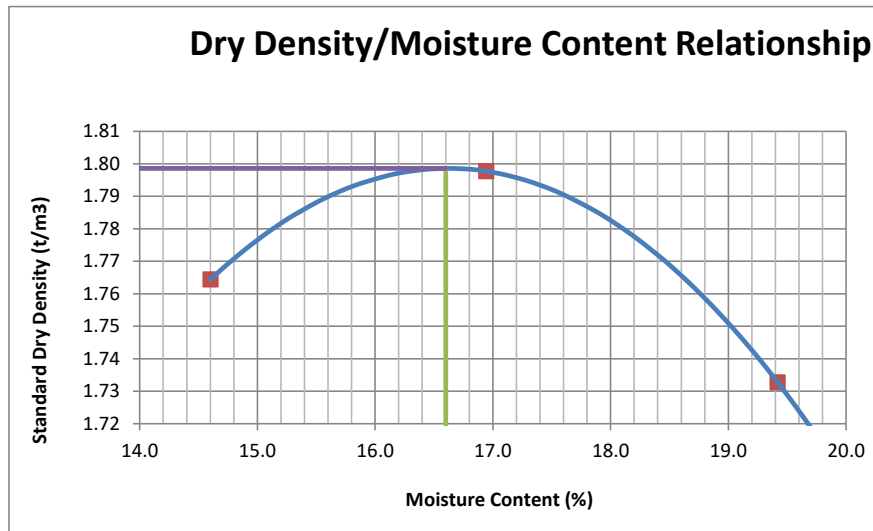
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client:	RCA Australia	Source:	Corner of Borrow Pit - Location 8
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20891-MDD
Job No:	S17017	Lab No:	S20891

Test Procedure:	<input checked="" type="checkbox"/>	AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
	<input checked="" type="checkbox"/>	AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	Date Sampled:	16/01/2017
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m³)	1.799
Optimum Moisture Content (%)	16.6
Percentage Oversize on 19mm sieve (%)	24
Percentage Oversize on 37.5mm sieve (%)	6

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NATA Accredited Laboratory Number: 14874			

		Macquarie Geotechnical Unit 8/10 Bradford Street Alexandria NSW 2015
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DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER

Client:	RCA Australia	Source:	Corner of Borrow Pit - Location 8
Address:	PO Box 175/ 92 Hill Street, Carrington NSW 2294	Sample Description:	clayey sandy GRAVEL
Project:	Compaction Control Ravensworth Ash Dam (12665)	Report No:	S20891-TP
Job No:	S17017	Lab No:	S20891

Test Procedure:	<input checked="" type="checkbox"/>	AS1289 6.7.3	DETERMINATION OF PERMEABILITY OF A SOIL - CONSTANT HEAD METHOD USING A FLEXIBLE WALL PERMEAMETER
	<input checked="" type="checkbox"/>	AS1289 5.1.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
	<input type="checkbox"/>	AS1289 5.2.1	Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Client	Date Sampled:	16.1.17
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Preparation:	Prepared in accordance with the test method
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Maximum Dry Density (t/m ³)	1.80	Confining Pressure (kPa)	600
Optimum Moisture Content (%)	16.6	Back Pressure (kPa)	500
Placement Moisture Content (%)	16.6	Mean Effective Stress (kPa)	100
Moisture Ratio (%)	100.0	Material tested passing (mm)	4.75
Placement Dry Density (t/m ³)	1.71	Sample Height (mm)	51.3
Density Ratio (%)	95.0	Sample Diameter (mm)	49.9

PERMEABILITY $k_{(20)} =$ **7.4E-10 (m/sec)**

Comments

Permeant Used: Sydney tap water



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Authorised Signatory:

14/02/2017

Ian Goldschmidt

Date:



Macquarie Geotechnical
Unit 8/10
Bradford Street
Alexandria NSW 2015

96 Castlereagh St, Singleton
Postal PO Box 917
Singleton
NSW 2330

Phone 02 6571 2344
Fax 02 6571 2355
Mobile 0438 660 082
Email tony@tonymexon.com.au



**TONY MEXON
& ASSOCIATES**
REGISTERED SURVEYORS

ABN 11 885 739 260

8th September 2017

Ref: 14-32 Bettergrow 8-9-2017

John Vyse

Bettergrow

48 Industry Road

Vineyard NSW 2765

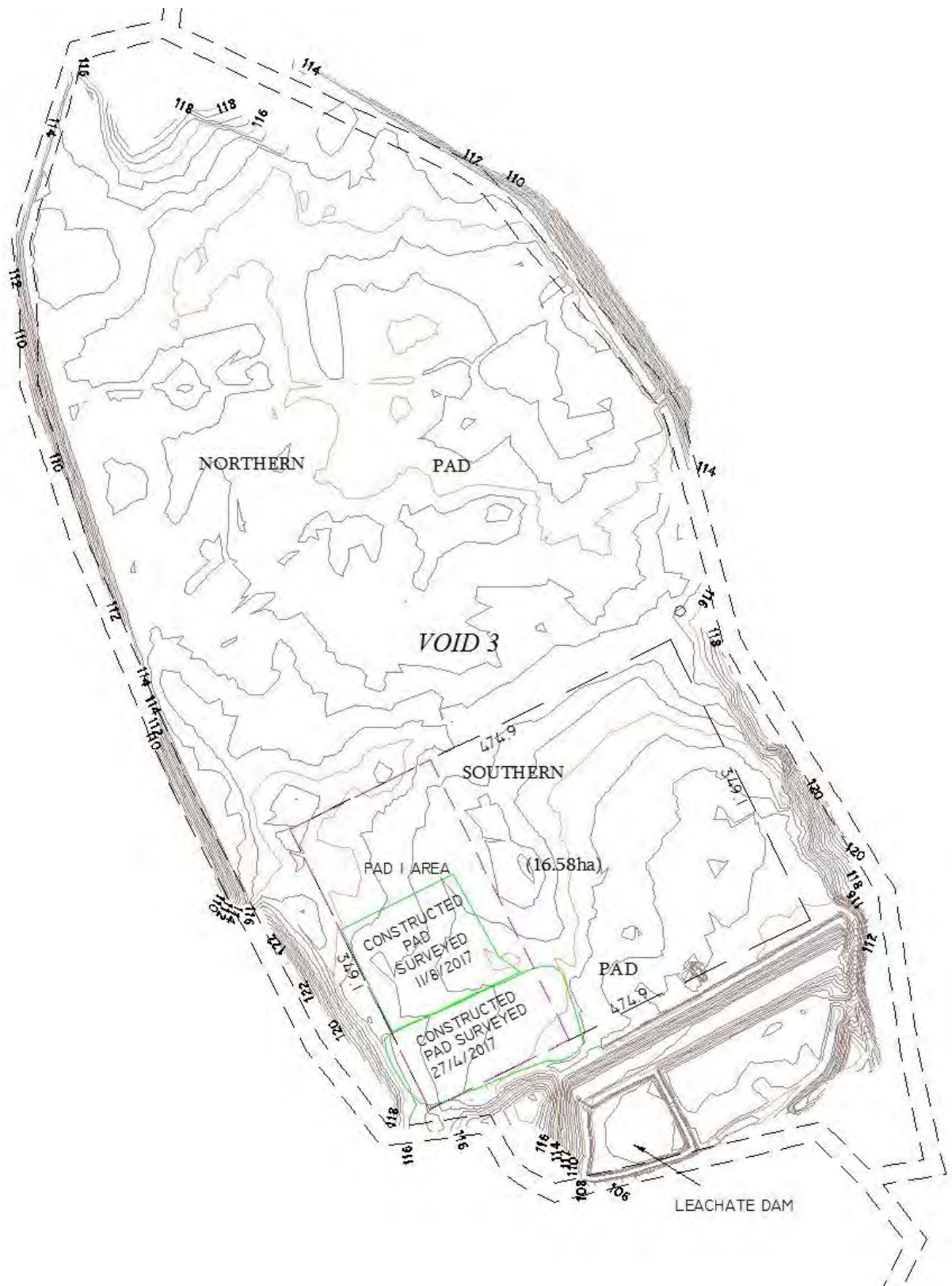
John,

On the 11th August 2017 we surveyed Pad 1 on your Ravensworth Void 3 site as constructed. Since the previous survey, the amount of fill placed over the existing capping is 7750m³ over a pad area of 20500m². This gives an average cover of 378mm over the existing ash capping material.

Regards,

Tony Mexon

B.Surv, Registered Surveyor, MIS





JE & J ROBINSON PTY LTD

PLANT HIRE—EARTHMOVING CONTRACTORS

LIME & GYPSUM SALES

ABN: 87 002 661 341

Phone: 02 6541 2198

Fax: 02 6541 2378

E-mail: Warren@robbos.net

8th September 2017

Mr John Vyse,
Organics Business Manager,
Bettergrow
PO Box 945
WINDSOR NSW 2756

Dear Mr Vyse,

RE: Capping layers at Void 3 area – RAVENSWORTH

I wish to confirm that our Company has undertaken a wide variety of earthworks projects in the Void 3 area at Ravensworth for many years on behalf of Macquarie Generation and now AGL.

We conducted digging of preliminary test pits in the capping layer already on site. It was determined that the existing layer of capping was 400mm thick and we confirm that it was subjected to rolling and compaction prior to the installation of the current fill layer.

The capping material that has now been laid down for Bettergrow has been subjected to and passed compaction and permeability testing and I confirm that the top layer exceeds 300mm depth in all areas.

Please refer to our Site Manager, Darren Kedwell should you require further information.

Yours faithfully,

JE & J ROBINSON PTY LTD

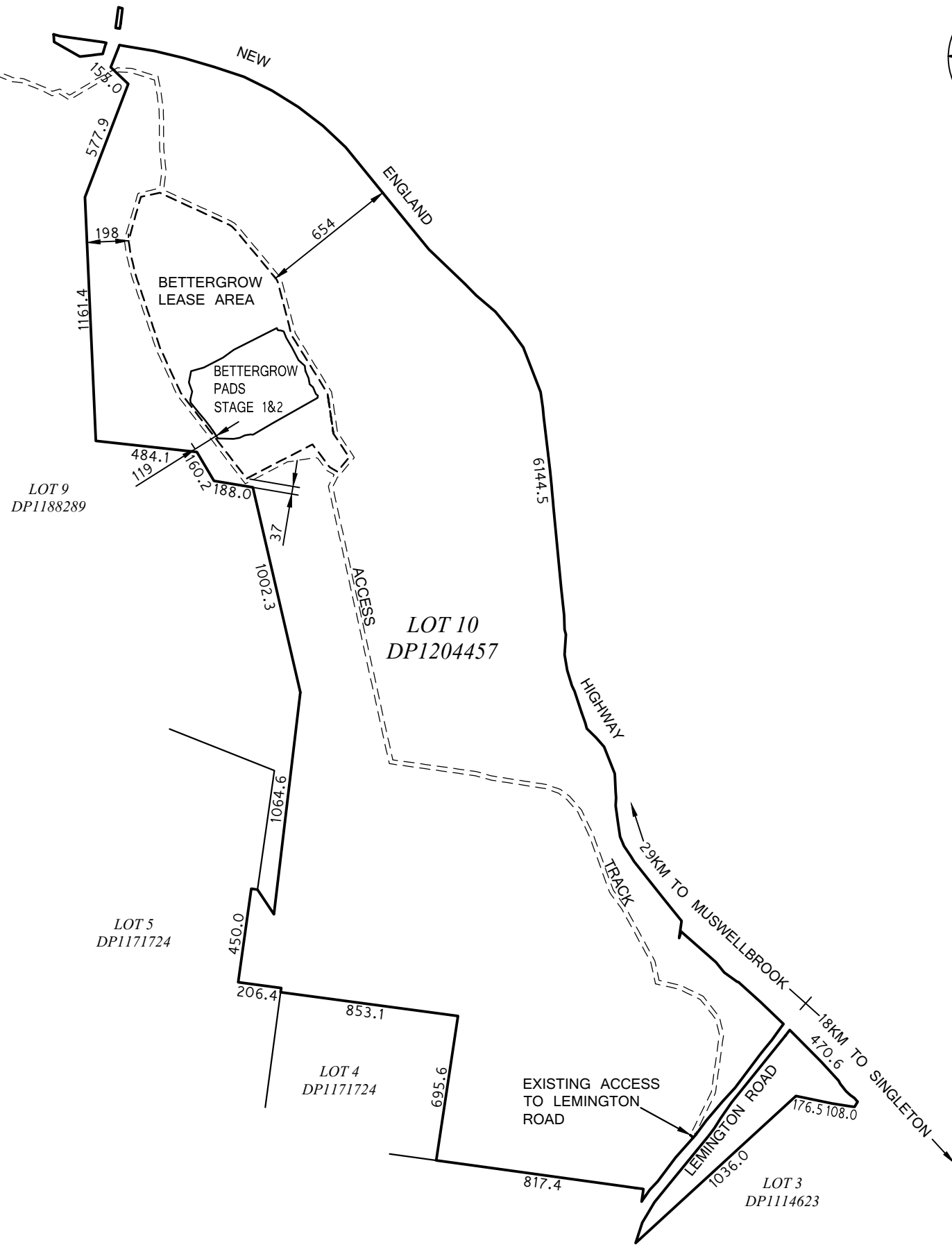
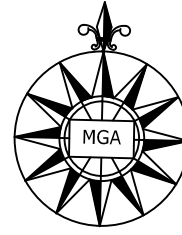
WARREN TREVOR
OFFICE MANAGER

POSTAL ADDRESS:

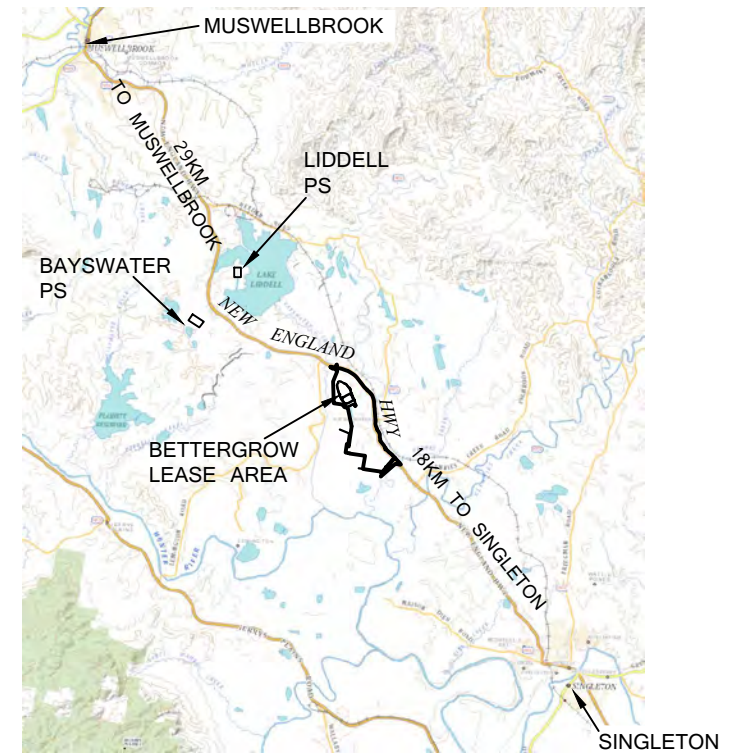
PO Box 786
MUSWELLBROOK NSW 2333

SITE ADDRESS:

30 Wallarah Road
MUSWELLBROOK INDUSTRIAL ESTATE



LOCATION MAP
SCALE 1:400000

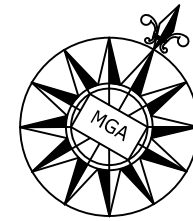
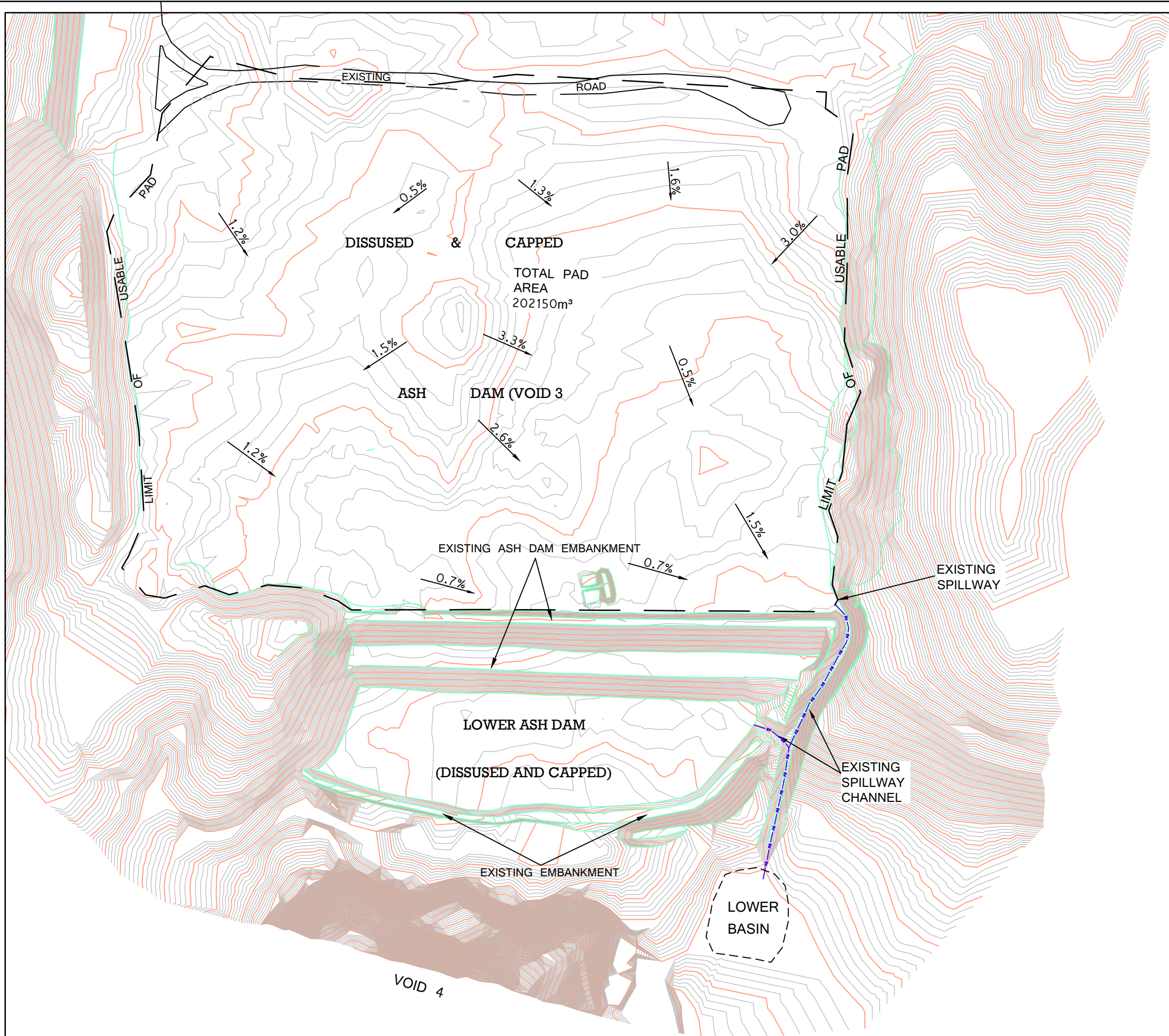


CLIENT/OWNER	BETTERGROW		
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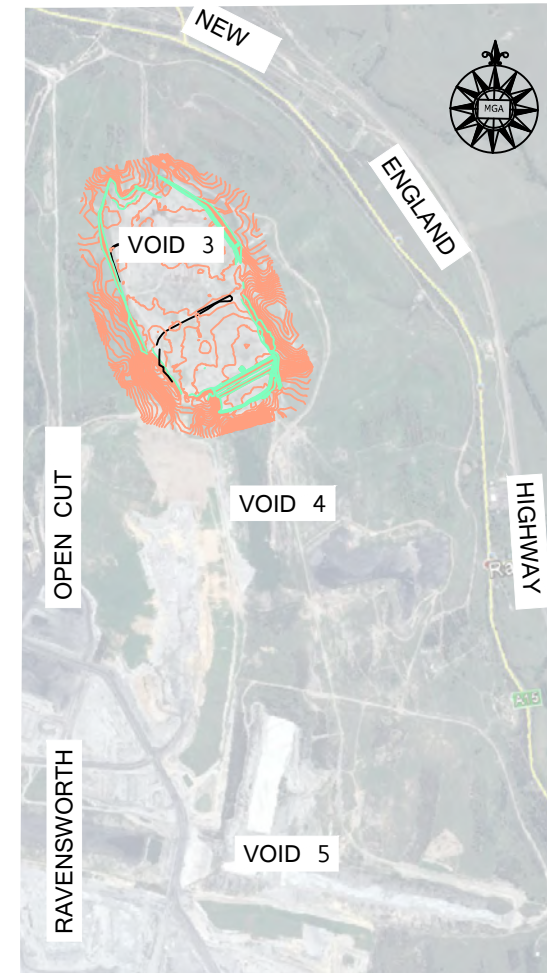
DETAILS		
SURVEYORS REF.	SCALE	SHEET SIZE
14-32	1:25000	A3
DATE OF SURVEY: 23 FEBRUARY 2016		

REVISION NOTES	
18/7/2016 ORIGINAL	0


TITLE
BETTERGROW RAVENSWORTH COMPOSTING FACILITY SHEET 1 OF 6 GENERAL ARRANGEMENT

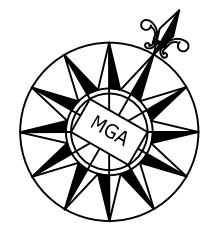
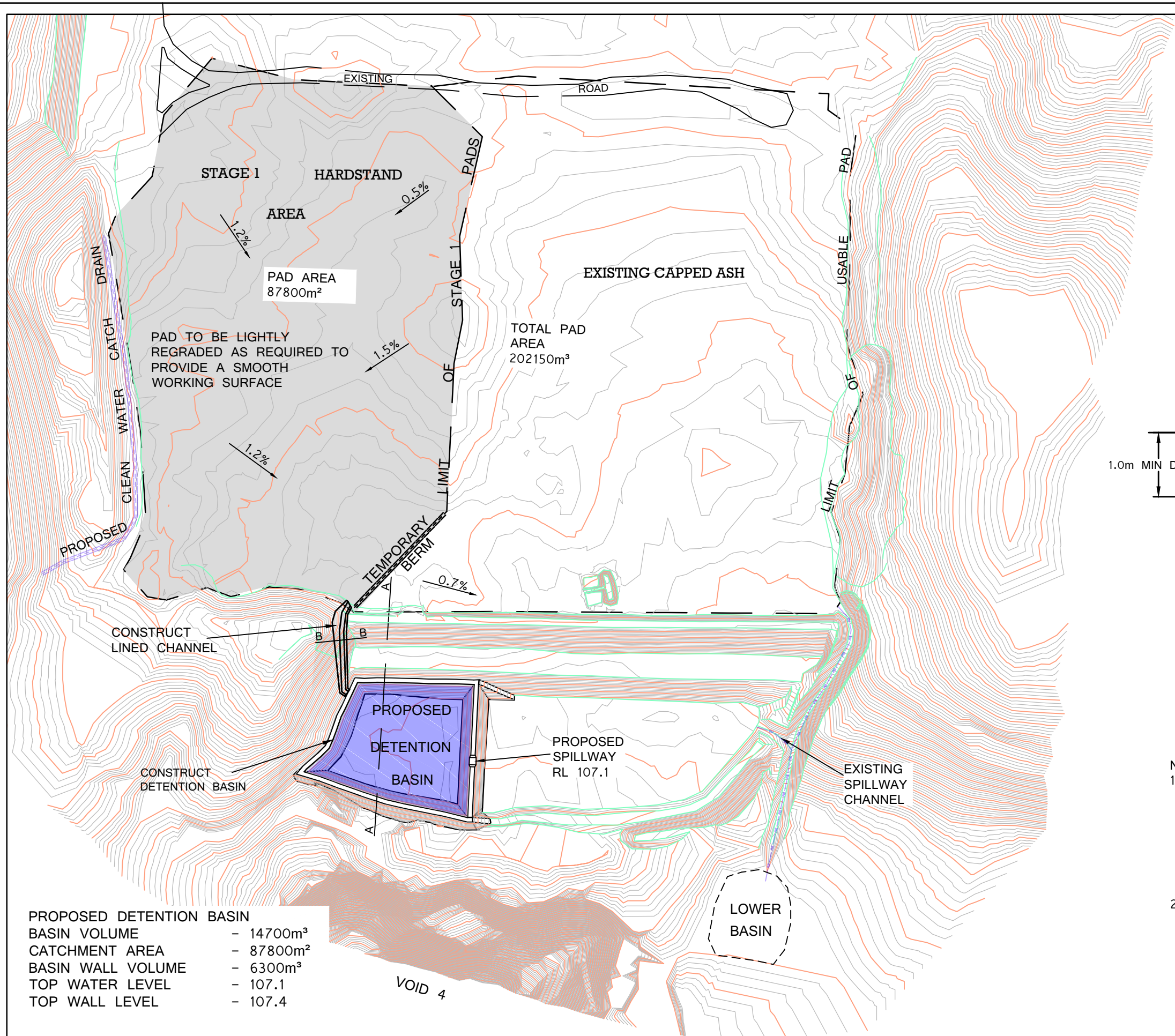


LOCATION MAP
SCALE 1:40000

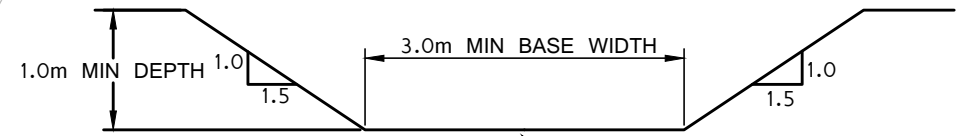


NOTES
 CONTOURS WITHIN THE PAD & PROPOSED DETENTION BASIN ARE DERIVED FROM ACCURATE SURVEY DATA. CONTOURS OVER EXTERNAL AREA INCLUDING THE LOWER BASIN, ARE DERIVED FROM LIDAR DATA AND ARE NOT ACCURATE.

 TONY MEXON & ASSOCIATES REGISTERED SURVEYORS	CLIENT/OWNER	DETAILS			REVISION NOTES		TITLE
	BETTERGROW	SURVEYORS REF.	SCALE	SHEET SIZE	18/7/2016	ORIGINAL	0
		14-32	1:3000	A3			
		DATE OF SURVEY: 23 FEBRUARY 2016					
							BETTERGROW RAVENSWORTH COMPOSTING FACILITY SHEET 2 OF 6 EXISTING ARRANGEMENT



TYPICAL CHANNEL SECTION "B-B"




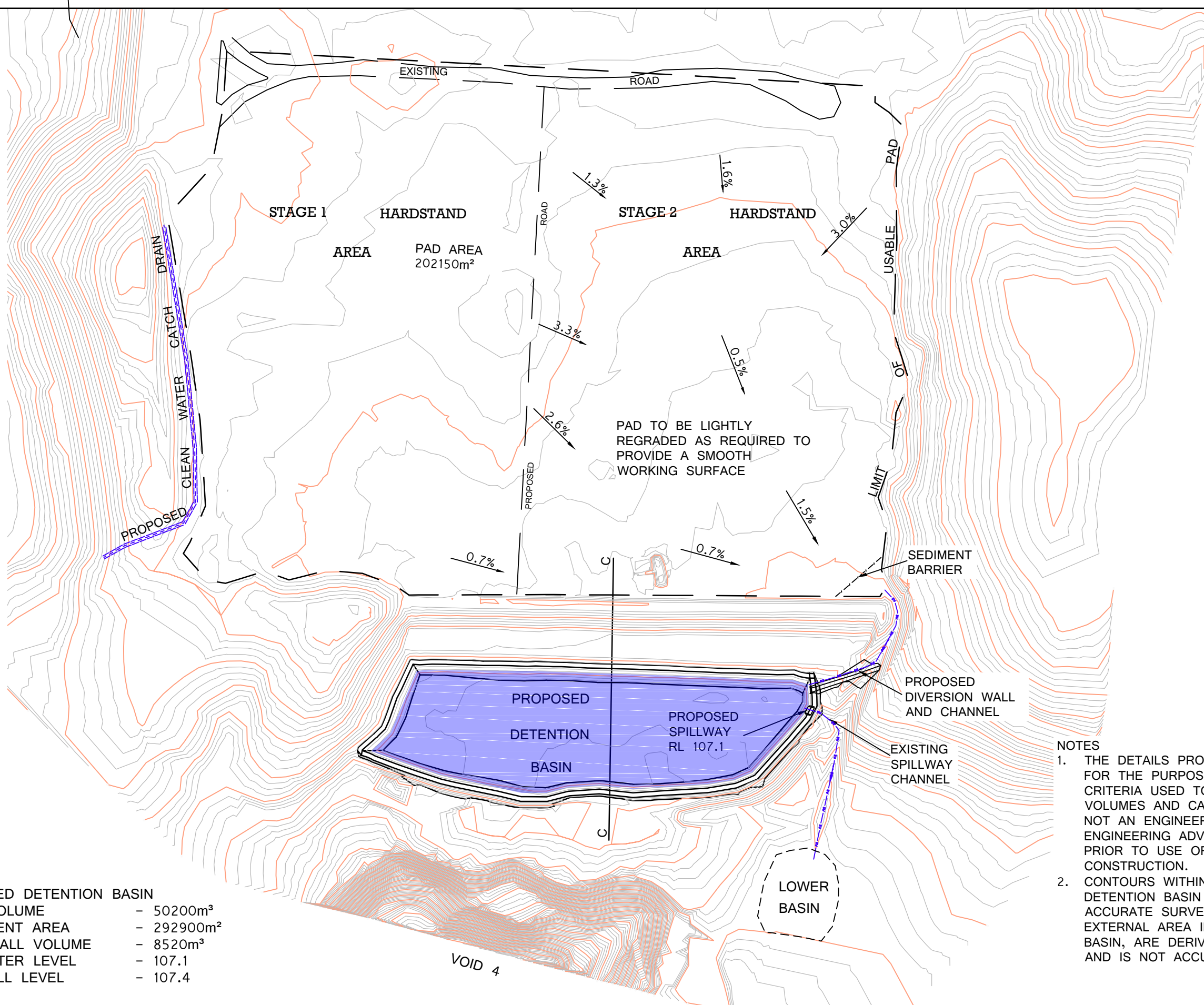
CHANNEL TO BE LINED BY SHOTCRETE, DETAILS TO BE CONFIRMED BY CONTRACTOR

NOTES

1. THE DETAILS PROVIDED IN THIS PLAN ARE FOR THE PURPOSE OF DEMONSTRATING CRITERIA USED TO ASCERTAIN VARIOUS VOLUMES AND CAPACITIES. THIS PLAN IS NOT AN ENGINEERING DRAWING. ENGINEERING ADVICE SHOULD BE SOUGHT PRIOR TO USE OF THIS DRAWING FOR CONSTRUCTION.
2. CONTOURS WITHIN THE PAD & PROPOSED DETENTION BASIN ARE DERIVED FROM ACCURATE SURVEY DATA. CONTOURS OVER EXTERNAL AREA INCLUDING THE LOWER BASIN, ARE DERIVED FROM LIDAR DATA AND IS NOT ACCURATE.

PROPOSED DETENTION BASIN	
BASIN VOLUME	- 14700m ³
CATCHMENT AREA	- 87800m ²
BASIN WALL VOLUME	- 6300m ³
TOP WATER LEVEL	- 107.1
TOP WALL LEVEL	- 107.4

 TONY MEXON & ASSOCIATES REGISTERED SURVEYORS	CLIENT/OWNER	DETAILS			REVISION NOTES		TITLE
	BETTERGROW	SURVEYORS REF.	SCALE	SHEET SIZE	18/7/2016 ORIGINAL	0	BETTERGROW RAVENSWORTH COMPOSTING FACILITY SHEET 3 OF 6 STAGE 1 WORKS
		14-32	1:3000	A3			
		DATE OF SURVEY: 23 FEBRUARY 2016					



PROPOSED DETENTION BASIN
 BASIN VOLUME - 50200m³
 CATCHMENT AREA - 292900m²
 BASIN WALL VOLUME - 8520m³
 TOP WATER LEVEL - 107.1
 TOP WALL LEVEL - 107.4

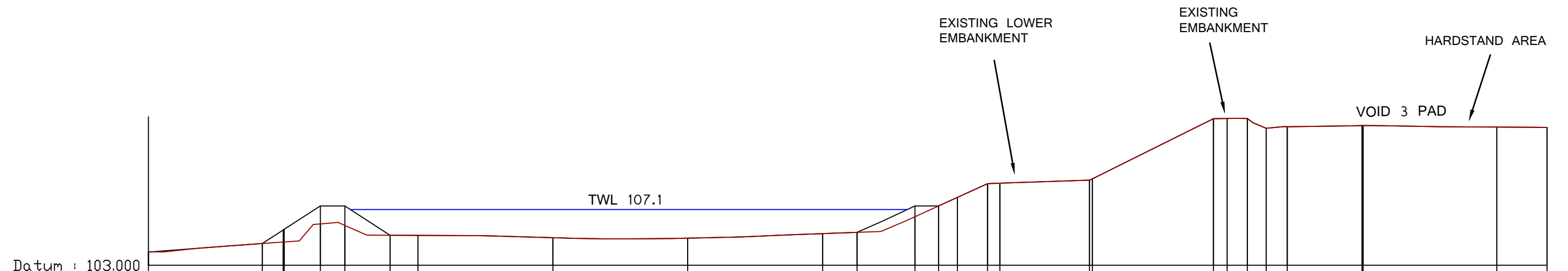
NOTES

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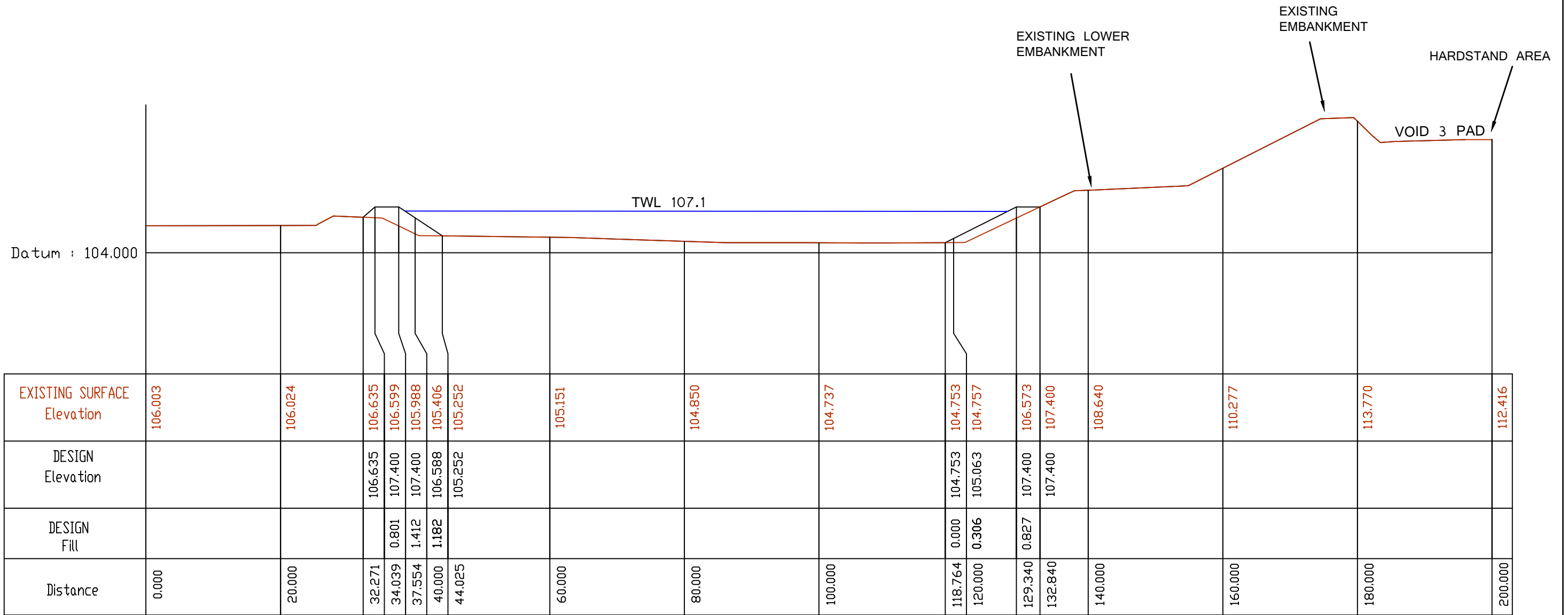
CLIENT/OWNER	DETAILS			REVISION NOTES	TITLE
BETTERGROW	SURVEYORS REF.	SCALE	SHEET SIZE	18/7/2016 ORIGINAL	0
	14-32	1:3000	A3		
	DATE OF SURVEY: 23 FEBRUARY 2016				

**BETTERGROW RAVENSWORTH
 COMPOSTING FACILITY
 SHEET 4 OF 6
 STAGE 2 WORKS**

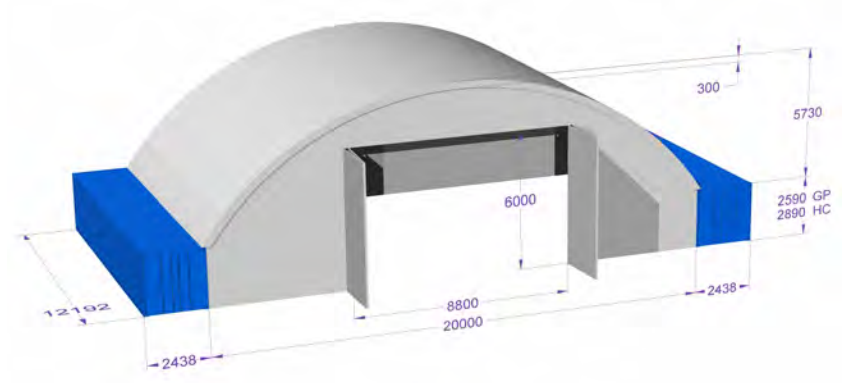
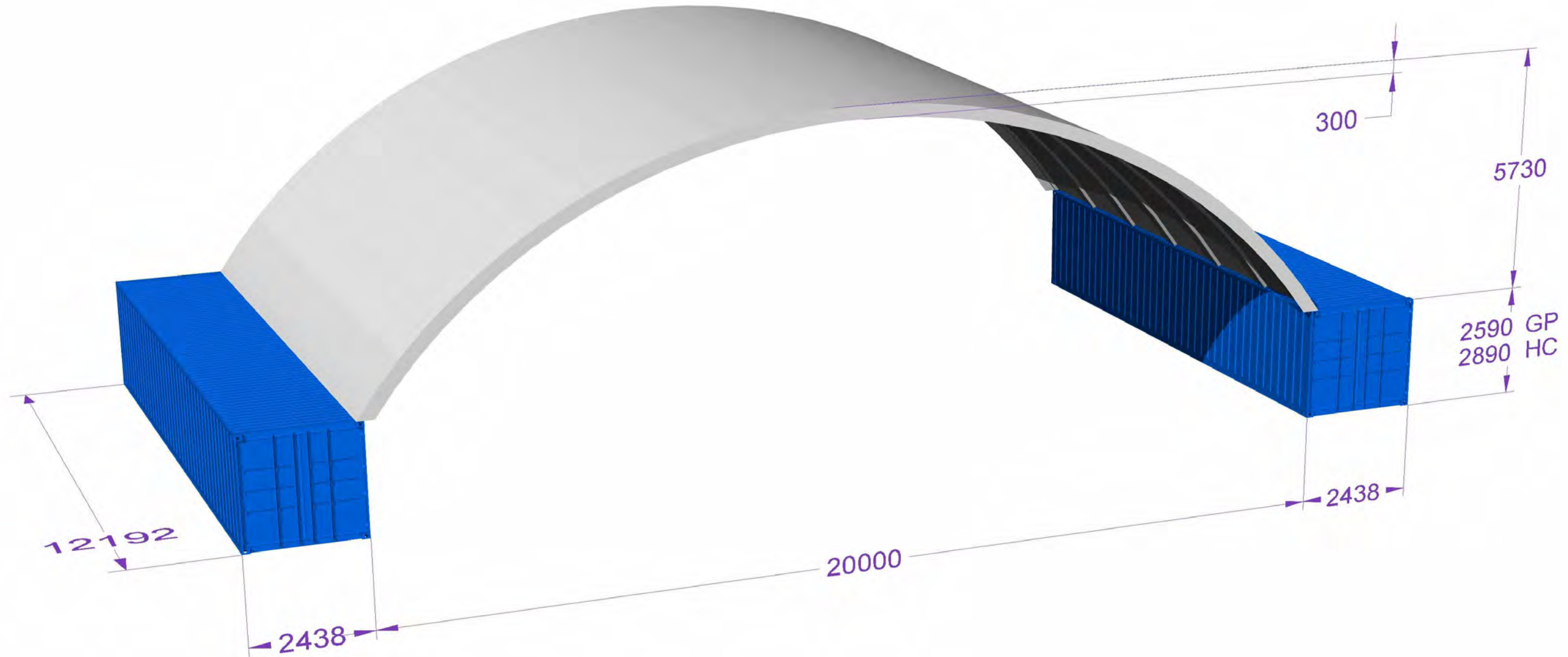


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EXISTING SURFACE Elevation	104.000	104.615	104.728	104.733	106.069	105.951	105.234	105.221	105.045	105.012	105.348	105.441	106.600	107.400	108.037	109.055	109.086	109.302	109.409	113.868	113.883	113.882	113.151	113.268	113.354	113.356	113.242	113.221
DESIGN Elevation	104.000	104.615	105.618	105.668	107.400	107.400	105.234	105.221	105.045	105.012	105.348	105.441	107.400	107.400	108.037	109.055	109.086	109.302	109.409	113.868	113.883	113.882	113.151	113.268	113.354	113.356	113.242	113.221
DESIGN FILL			0.891	0.935	1.331	1.449							0.800															
Distance	0.000	16.893	20.000	20.153	25.519	29.132	35.845	40.000	60.000	80.000	100.000	105.107	113.704	117.209	120.000	124.464	126.302	139.565	140.000	157.964	160.000	162.992	165.784	168.922	180.000	180.154	200.000	207.451

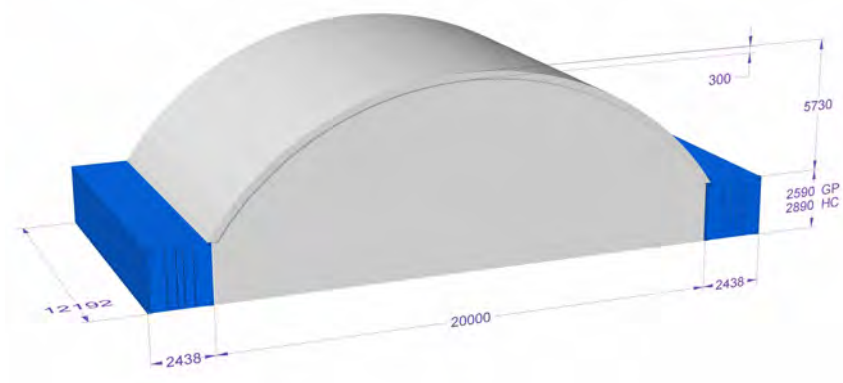
	CLIENT/OWNER	DETAILS			REVISION NOTES		TITLE
	BETTERGROW	SURVEYORS REF.	SCALE	SHEET SIZE	18/7/2016 ORIGINAL	0	BETTERGROW RAVENSWORTH COMPOSTING FACILITY SHEET 5 OF 6 CROSS SECTION "A-A"
		14-32	H 1:600 V 1:300	A3			
		DATE OF SURVEY: 23 FEBRUARY 2016					



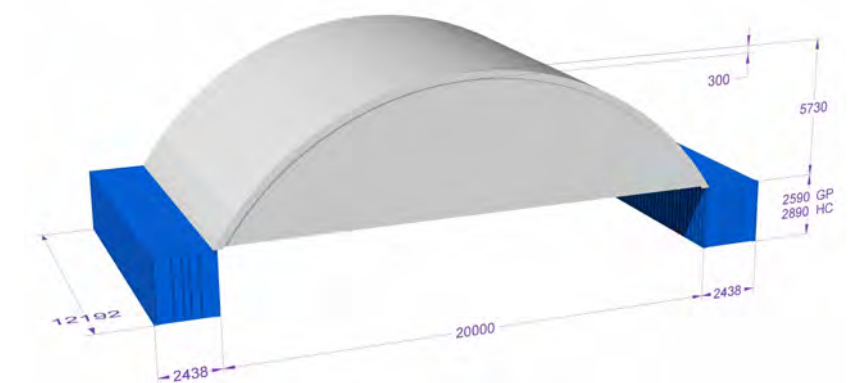
Building Design



DOOR OPTION



FULL END WALL OPTION



PARTIAL END WALL OPTION

PERSPECTIVE- DIMENSIONS IN mm, ALL DIMENSIONS ARE APPROXIMATE

-PRESENTATION DRAWINGS ONLY-
NOT TO BE USED FOR CONSTRUCTION PURPOSES



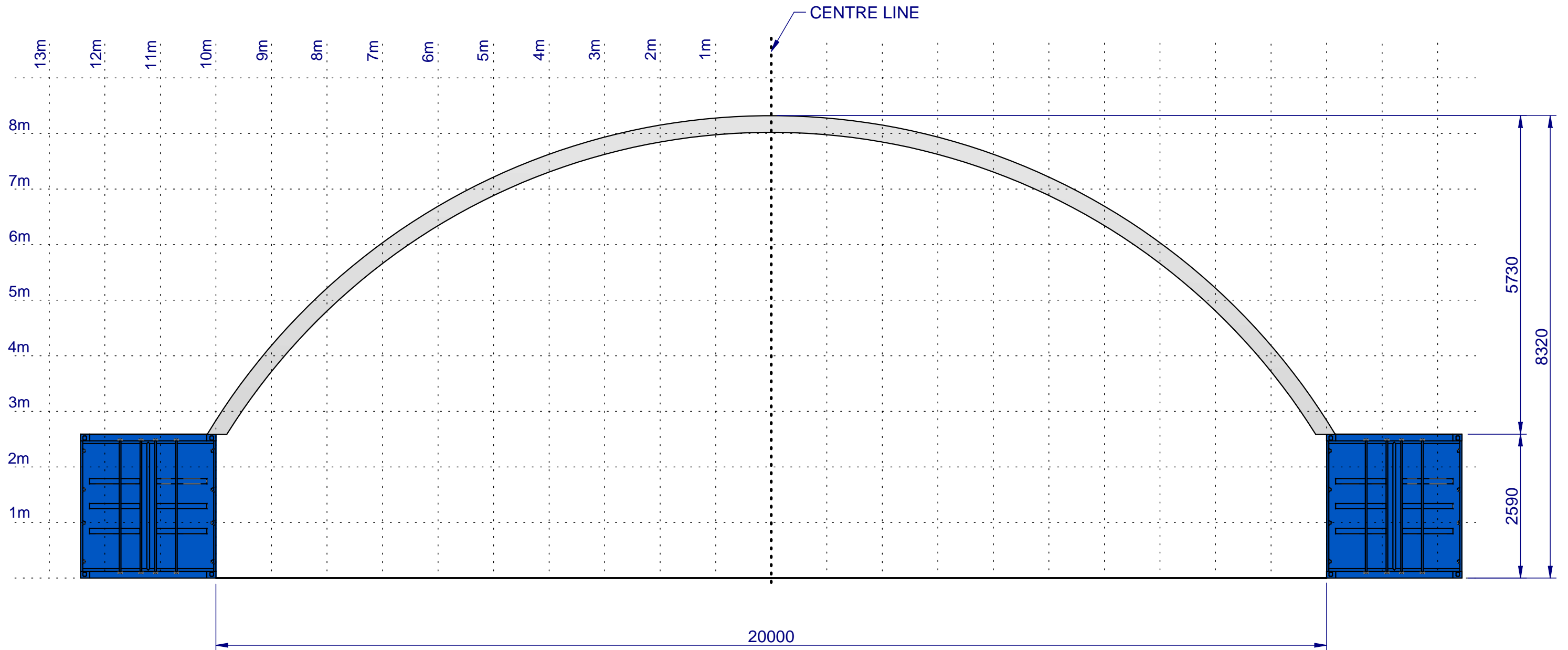
Ph.1800 08 2244 Ph.+612 6898 2244
Email:sales@allshelter.com.au

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**SHELTER
CASA2012IM**



*USEABLE WIDTH INDICATED
MAY VARY ± 200mm DEPENDING
ON ENGINEERING REQUIREMENT



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CASA20_IM
GRIDLINES

