Lots 1006 and 1007 Baldivis Road, Baldivis

Engineering Services Report

Project No: 15-292

pritchard francis
civil and structural engineering consultants

Table of Contents

Revision	Description	Author	Date
0	Initial Issue	Ryan Brook	15 January 2016
1	Updated Water Reticulation and Pipelines	Ryan Brook	29 February 2016
2	Earthworks Appendix Updated	Ryan Brook	11 March 2016
3	Updated Planning Layout	Mark Riddell	27 August 2018
4	Updated Planning Layout	Mark Riddell	15 November 2018

1 Introduction

At the request of the KEC Nominees, this Engineering Servicing Report has been prepared in support of structure planning on Lots 503, 1006, 1007 and 1272 Baldivis Road and Lot 1 Serpentine Road, Baldivis.

Information provided in the report presents a servicing strategy based on preliminary lot layout provided by CLE Town Planners. This plan can be found in Appendix One.

Pritchard Francis is currently involved with the detailed engineering design of the Brightwood Estate development on the western side of Baldivis Road also for ABN Baldivis Joint Venture. As such, Pritchard Francis is well versed in servicing requirements for the area and has been liaising with service authorities in this regard.

2 Site Description

2.1 Locality

The 27ha site is located within the City of Rockingham and is bound by Kwinana Freeway to the east, Sixty Eight Road to the south, Baldivis Road and a tramway reserve to the west and Serpentine Road to the north. The subject site is located approximately 15km south-east of Rockingham.

2.2 Topography

The site currently consists of paddocks and multiple homesteads in the western half, with sparse vegetation throughout. The site elevation decreases from approximately RL 5.8m AHD at Baldivis Road in the west to a low point of RL 2.9m AHD at the south east corner. There is a Water Corporation open drain present in the eastern portion of the site running north-south that is approximately 0.7m below surrounding ground levels with a low point at the south east corner of the site at RL 2.2m AHD.

2.3 Soils and Groundwater

Galt Geotechnics conducted an investigation on the site in November 2015. The soil in the western portion of the site was found to consist of fine to coarse grained sand overlying clayey sand. The soil to the eastern portion of the site consisted of organic clay overlying high plasticity clay.

The Department of Environment and Conservation's Acid Sulfate Soil (ASS) risk mapping indicates that the site contains soils that have moderate to low risk of containing ASS at depths of >3m. Field testing conducted by Galt Geotechnics, confirmed that there are actual acid sulphate soils in the eastern portion of the site (organic clay material), however the sandy western portion of the site did not return any positive results.

The Perth Groundwater Atlas historical maximum contours (1997) do not extend to the site, however May 2004 contours indicate a groundwater level of between RL 2m and RL 3m AHD through the site. Galt Geotechnics encountered groundwater in the west of the site at approximately RL 2m to RL 3m AHD. Groundwater was not observed at the east of the site and it is expected that this was due to the low permeability of the clayey soils.

3 Earthworks Strategy and Retaining Walls

Pritchard Francis has liaised with surrounding landholders, City of Rockingham, Water Corporation and pipeline managers with regards to site levels. The levels across the site will primarily be dictated by sewer servicing requirements as discussed in Section 5, drainage requirements and ground improvement methods in the eastern portion of the site. Surface levels will require filling up to 2.5m at the eastern extremity of the site.

The key elements of the earthworks strategy for the site are:

- Match into ground levels proposed for the development north of Serpentine Road including any changes to Serpentine Road as a result of development.
- Match into levels at Baldivis Road and the tramway reserve including future upgrades to Baldivis Road and improvement works in the tramway reserve.
- Match into and adjust levels through the major pipeline corridors to achieve integrated and functional open spaces.
- Create finished levels within the site that accommodate gravity-reliant infrastructure to facilitate appropriate servicing (sewer and drainage).
- Interface with and reconstruct Sixty Eight Road, ensuring connection to Lots to the south is not adversely affected
- Provide appropriate clay works and clay grading to improve existing site conditions to allow urbanisation.

A conceptual bulk earthworks plan has been provided in Appendix Two.

The organic clay material at the east of the site is not suitable without improvement. Ground improvement methods in this area need to be investigated to allow residential development, or the material is to be removed and replaced with sand. Works may also be required to grade the underlying clay material at the site, if it is close enough to the finished surface levels. Whilst ground improvement works will be required in part, we believe the site is suitable for residential development.

4 Stormwater Drainage

The Peel Sub Drain B runs at the east of the site in a north to south direction. This drain is currently maintained by the Water Corporation, however discussions with Water Corporation and City of Rockingham have confirmed that responsibility for drainage of the area shall transfer to the City of Rockingham following urbanisation. As part of drainage works on site the drain will be piped and realigned to suit road layout and open space drainage areas.

Geotechnical investigation in the western portion of the site indicated that disposal of stormwater via infiltration would likely be suitable, with a minimum recorded permeability of 4m/day. As the sand cover over clay decreases infiltration as the sole disposal methods will no longer be suitable. In the east of the site, attenuation then outflow via the existing drainage path will be required due to the low permeability of materials present.

Stormwater will be collected via pits in roadways and piped to attenuation or infiltration basins. Depending on the final depth of sand cover over impervious layers, lot connection pits for drainage may be required.

Subsoil drainage in conjunction with clay grading may be required on site where the depth of sand cover over impermeable material is shallow.

5 Sewer Reticulation

There is no existing sewer reticulation servicing the site. Attached in Appendix Three is the relevant sheet of the catchment plan for the site. Sewers will grade from east to west due to the wastewater pumping station (Type 90) which is located on the opposite side of Baldivis Road. As such the availability of sewer reticulation will not limit development.

Due to a significant portion of the site being low lying, significant fill will be required across the site to achieve suitable levels for sewer servicing. This is noted on the sewer catchment plan and also discussed in Section 3.

6 Water Reticulation

As part of a recent Water Corporation review of the water servicing to the area the site has been placed in the Tamworth Hill scheme. Connection to the existing reticulation network will be via 150mm mains extensions from developments to the west and north. Refer Appendix Four for correspondence with Brett Coombes of the Water Corporation providing revised planning.

7 ATCO Gas

There is an existing high pressure gas main in Baldivis Road which has sufficient capacity to service the site.

Refer Appendix Five which shows the location of ATCO Gas services.

8 Electrical Reticulation

There is currently high voltage overhead power line running north-south through the western portion of the site which will need to be realigned. A low voltage overhead power line is also present on the eastern edge of the tramline. In the south west corner of the site there is an underground high voltage cable present which continues west down Sixty Eight Road.

9 Communications

There is a current NBN Master Developer Agreement for the development of Lots 21 Sixty Eight Road, Lots 569 and 1263, Baldivis Road, Baldivis. As such the NBN network will be reticulated through these sites. It is expected that this network will be extended as required to service the development of the subject site.

10 Major Pipelines

Pritchard Francis has liaised with the operators of the major gas and water pipelines that traverse the site as they pose a significant constraint to the site and a crossing over the pipelines will be required by roads and services.

Pritchard Francis met with Water Corporation on site in December 2016 to discuss asset protection requirements. Liaison with APA Group has been ongoing and a Pipeline Management Plan will be prepared as planning for the site progresses.

11 Conclusion

Pritchard Francis have been commissioned by KEC Nominees to review engineering servicing requirements for Lots 503, 1006, 1007 and 1272 Baldivis Road and Lot 1 Serpentine Road, Baldivis.

The subject site falls within current Water Corporation sewer and water catchments. It also has access to existing ATCO Gas reticulation, NBN and electrical services adjacent to the site.

Stormwater infiltration with Public Open Space is proposed to treat all stormwater run-off from the road reserves. This strategy will be developed with further with integration into the LWMS. The existing Water Corporation drain will be urbanised into the local road system to continue conveyance through the site.

Based on all items within the Engineering Services Report, Pritchard Francis Pty Ltd believes that the proposed development is capable of being serviced with all essential services and with careful consideration in design will result in a high quality development.

Appendices

Appendix One:	CLE Concept Plan
Appendix Two:	Conceptual Levels Plan
Appendix Three:	Sewer Catchment Plan
Appendix Four:	Water Concept Plan
Appendix Five:	Existing ATCO Gas Services
Appendix Six:	Galt Geotechnics Investigation

Appendix One: CLE Concept Plan

HERITAGE PARK
(BY OTHERS)

FUTURE
ROUNDABOUT
(BY OTHERS)

SERPENTINE ROAD

ROAD INTERFACE TO
TRAMWAY RESERVE

COTTAGE LOTS
FRONTING ONTO POS

MATURE TREES
RETAINED IN RESERVE
AS ENTRY STATEMENT

CONSOLIDATED
ROUNDABOUT TO
"BRIGHTWOOD" ESTATE
& BALDIVIS ROAD

FUTURE
ROUNDABOUT
(BY OTHERS)

ACOUSTIC WALL TO
KWINANA FREEWAY

"PICNIC" NODE
(OUTSIDE PIPELINE
EASEMENT)

POS TO SERVE
DRAINAGE FUNCTION

SOLIS BVD

BALDIVIS ROAD

TRAMWAY RESERVE

BALDIVIS ROAD

SIXTY EIGHT ROAD

KWINANA FREEWAY

1272
1
503
313
1006
1524
1007
5
201

14.02.2018 nearmap.com

CLE Town Planning + Design
www.cleplan.com.au

DEVELOPMENT CONCEPT PLAN DRAFT

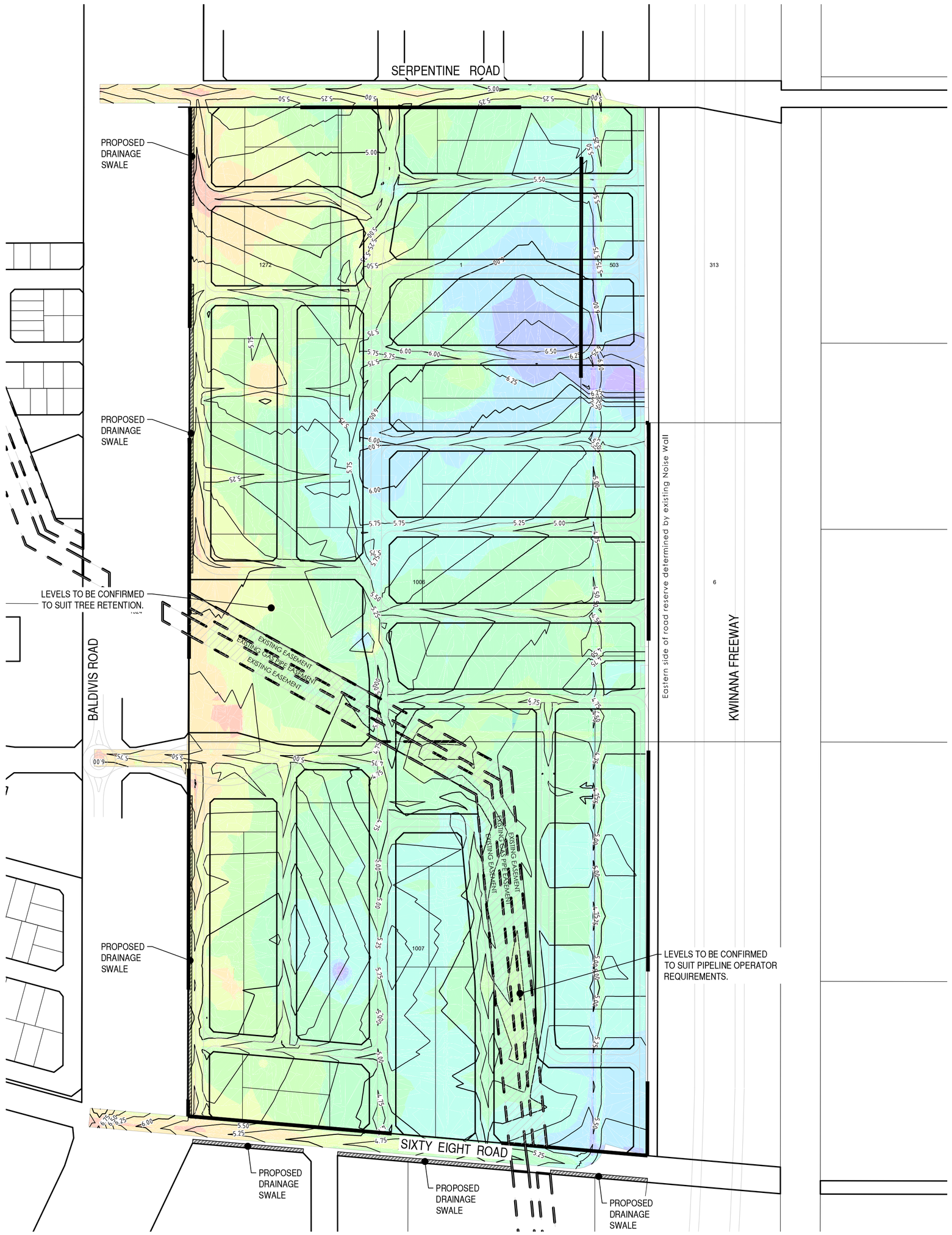
Lots 1006, 1007 & 1272 Baldivis Road & Lots 1 & 503 Serpentine Road, Baldivis

plan no: **3407-37-01**
date: 11 November 2018
scale: 1:2,500 @ A3, 1:1,250 @A1

N

Appendix Two: Conceptual Levels Plan

NORTH



Surface Analysis: Elevation Ranges

Number	Color	Minimum Elevation (m)	Maximum Elevation (m)	2D Area (m^2)
1		-1.000	-0.500	0.0
2		-0.500	0.000	992.9
3		0.000	0.500	5908.3
4		0.500	1.000	12470.6
5		1.000	1.500	21710.4
6		1.500	2.000	29802.8
7		2.000	2.500	43458.1
8		2.500	3.000	53647.8
9		3.000	3.500	56906.9
10		3.500	4.000	15142.3
11		4.000	4.500	179.8

SCALE 1:2000 0m 40m 80m

DIAL BEFORE YOU DIG www.1100.com.au
The Essential First Step.

REV	DATE	DESCRIPTION	BY	CHKR
D	13/08/18	LOT LAYOUT UPDATED	RT	MRi
C	16/03/18	POS AREAS INCLUDED	RT	RB
B	20/02/18	LEVELS AMENDED	RT	RB
A	17/10/17	INITIAL ISSUE	RT	RB

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DRAWING STATUS: NOT FOR CONSTRUCTION
DATE: OCTOBER 2017 | GRID: PCG94 | DATUM: AHD
DESIGNED: RT | DRAWN: RT | CHECKED: RB | APPROVED: .... / ....
W.A.P.C. | SCALE U.N.O.: 1:2000 @

CLIENT & JOB: ABN BALDIVIS JOINT VENTURE
LOTS 503, 1006, 1007 AND 1272, BALDIVIS ROAD
TITLE: PROPOSED EARTHWORKS
SHEET SIZE: A1 | DRG No.: 15292-C9-SK-03 | REVISION: D

Appendix Three: Sewer Catchment Plan

NOTES

1. LOCAL AUTHORITY : CITY OF ROCKINGHAM
2. ESTIMATED GROUND WATER LEVEL: 2.0m AHD
3. THIS RETICULATION AREA IS CLASSIFIED 'DRY' IN ACCORDANCE WITH THE WATER CORPORATION DESIGN STANDARDS (DS) 50 UNLESS NOTED OTHERWISE.
4. EXISTING SURFACE LEVELS DETERMINED FROM DOLA AND DESIGN LEVELS.
5. ALL PIPE SIZES IN MILLIMETRES (DIA 150 U.N.O.). ALL DISTANCES AND LEVELS IN METRES.
6. CADASTRAL BOUNDARIES DERIVED FROM MAPS PRECAL, EXISTING BOUNDARIES AND PLANNERS INFORMATION WHICH MAY BE SUBJECT TO FURTHER CHANGES.

LEGEND

- CATCHMENT AREA BOUNDARY
- SUB-CATCHMENT AREA BOUNDARY
- PROPOSED CONTROL GRAVITY SEWER MAIN PATH.
- S1350 — S1350 PROPOSED GRAVITY SEWER AND ACCESS CHAMBERS
- EXISTING GRAVITY SEWER AND ACCESS CHAMBERS
- FUTURE GRAVITY SEWER AND ACCESS CHAMBERS
- PM — PM PROPOSED DN250 PRESSURE MAIN
- S FUTURE DN1350 SEWER DISTRIBUTION MAIN
- 13.0 DESIGN AND EXISTING SURFACE CONTOURS
- 20.00 PROPOSED PRELIMINARY EARTHWORKS RL
- DO — DO EXISTING WATER CORPORATION OPEN DRAIN
- OF — OF EXISTING OPTIC FIBRE
- W — W — W EXISTING WATER
- G — G — G EXISTING GAS
- 1.78 FLOW IN LITRES PER SECOND

DENOTES RETICULATION AREA CLASSIFICATION "WET" IN ACCORDANCE WITH THE WATER CORPORATION STANDARDS (DS) 50

WET AREA REQUIRING MINIMUM FILL

EMERGENCY OVERFLOW HYDRAULIC GRADE LINE

GL X.XX — DENOTED GROUND LEVEL (GL)
HGL X.XX — DENOTES CALCULATED HYDRAULIC LEVEL (HGL)
CLR X.XX — DENOTES CLEARANCE BETWEEN GL & HGL

DESIGN DATA NOTATION

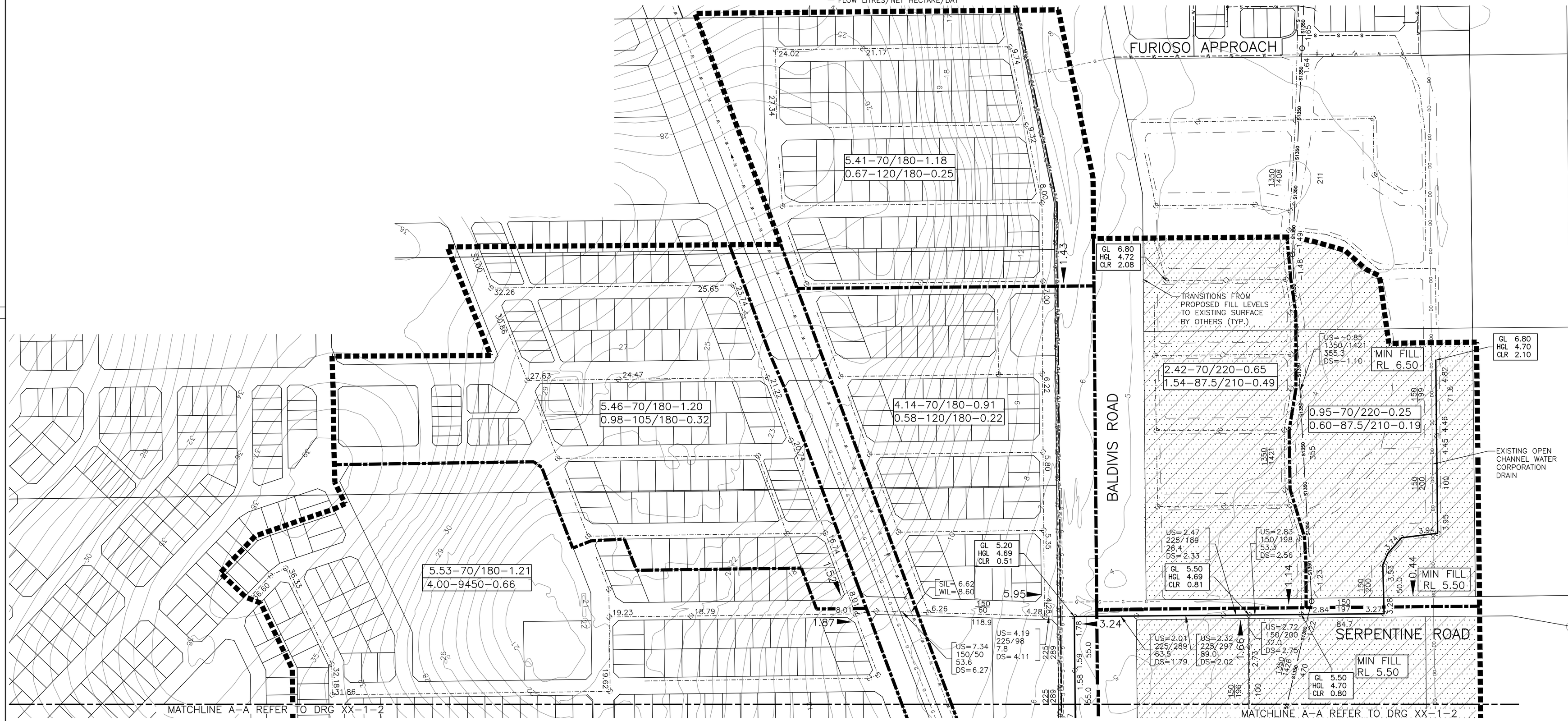
RESIDENTIAL

NET AREA (Ha) — 1.12 – 52.5 / 180 – 0.17 — FLOW LITRES/PERSON/DAY
PERSONS PER NET HECTARE — PEAK FLOW (L/s)

NON RESIDENTIAL

NET AREA (Ha) — 0.850 – 14976 – 0.220 — PEAK FLOW (L/s)
FLOW LITRES/NET HECTARE/DAY

PARAMETER	INITIAL	ULTIMATE	PARAMETER	INITIAL	ULTIMATE
GROSS CATCHMENT AREA:	200.43 Ha				
NET CATCHMENT AREA:	123.01 Ha				
GRAVITY INFLOW TO PUMPING STATION:	21.6L/s	28.0L/s	STORAGE VOLUME OF WET WELL BETWEEN CUT OUT–AT LEVEL (R.L. X.XX) AND ULTIMATE DUTY CUT–IN LEVEL (R.L. X.XX)	XXXX	XXXX
PUMP INFLOW TO PUMPING STATION:	0.0L/s	91.0L/s			
PUMPING FLOW RATE(S):	32.0L/s	90.0L/s	BASED ON 5 STARTS/HOUR (3 MIN STORAGE AT PUMP RATE) THIS IS SUITABLE FOR A MAXIMUM PUMPING FLOW RATE OF:	XXXX	XXXX
STORAGE TIME IN SEWERAGE SYSTEM AT ULTIMATE GRAVITY SEWER DESIGN FLOW CONDITION BETWEEN HIGH LEVEL ALARM LEVEL (R.L. X.XX) AND INVERT LEVEL (R.L.X.XX) OF EMERGENCY OVERFLOW PIPE (OVERFLOW TO ENVIRONMENT).	XXX	XXX	TOTAL STORAGE VOLUME – SYSTEM STORAGE VOLUME – STORAGE TANK VOLUME	TBA m^3 XXXX m^3	TBA m^3 XXXX m^3



CATCHMENT PLAN

SCALE (1)

(1) 20 10 0 20 40 60 80 100 120 140 m
(SCALE 1:2000 – A1 SHEET)

FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

PRITCHARD FRANCIS - REVISION RECORD

No	DATE	DRAFTING CHECK	DESIGN REVIEW	REV'D P.MGR	APP'D P.DIR	AMENDMENT
A2	22/04/15	SK	PA	RB	MR	AMENDED AS PER WATER CORPORATION COMMENTS
A1	08/08/14	SAK	DH	DH	MR	ISSUED FOR APPROVAL

ISSUE	DATE	GRID	REVISION	DRN	REC	APPD

DESIGN SURVEY NONE
ASCON SURVEY NONE
VERTICAL DATUM AHD
COORDINATE SYS MGA94–50
DES REF
DES CALC S.KENNEDY
DES CHD A.LIN
DRN C.BAILEY
Q.C. CHD R.REVY

NORTH POINT

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ACN: 008 891 094

RECOMMENDED
CONSULTANT PROJECT MANAGER
APPROVED
CONSULTANT PROJECT DIRECTOR

WATER CORPORATION

METROPOLITAN WASTEWATER WAPC XXXXXX
BALDIVIS SOUTH INTERIM WWPS NO. 902–XX–UNNAMED RD & PM
CATCHMENT PLAN
SHEET 1 OF 3

FILE JT1 2013 10206
PROJECT C–S01229
PLAN XX–1–1
CAD
ISSUE A

ORIGINAL SHEET SIZE A1
MF

566
810

PARAMETER	INITIAL	ULTIMATE	PARAMETER	INITIAL	ULTIMATE
GROSS CATCHMENT AREA:	200.43 Ha		STORAGE VOLUME OF WET WELL BETWEEN CUT OUT–AT LEVEL (R.L. X.XX) AND ULTIMATE DUTY CUT–IN LEVEL (R.L. X.XX)	XXXX	XXXX
NET CATCHMENT AREA:	123.01 Ha				
GRAVITY INFLOW TO PUMPING STATION:	21.6L/s	28.0L/s			
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STORAGE TIME IN SEWERAGE SYSTEM AT ULTIMATE GRAVITY SEWER DESIGN FLOW CONDITION BETWEEN HIGH LEVEL ALARM LEVEL (R.L. X.XX) AND INVERT LEVEL (R.L.X.XX) OF EMERGENCY OVERFLOW PIPE (OVERFLOW TO ENVIRONMENT).	XXX	XXX	TOTAL STORAGE VOLUME – SYSTEM STORAGE VOLUME – STORAGE TANK VOLUME	TBA m^3 XXXX m^3	TBA m^3 XXXX m^3

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- 13.0 DESIGN AND EXISTING SURFACE CONTOURS
- 20.00 PROPOSED PRELIMINARY EARTHWORKS RL
- DO — DO EXISTING WATER CORPORATION OPEN DRAIN
- OF — OF EXISTING OPTIC FIBRE
- W — W — W EXISTING WATER
- G — G — G EXISTING GAS
- 1.78 FLOW IN LITRES PER SECOND
- DENOTES RETICULATION AREA CLASSIFICATION "WET" IN ACCORDANCE WITH THE WATER CORPORATION STANDARDS (DS) 50
- DENOTES AREA REQUIRING MINIMUM FILL
- EMERGENCY OVERFLOW HYDRAULIC GRADE LINE
- GL X.XX — DENOTED GROUND LEVEL (GL)
- HGL X.XX — DENOTES CALCULATED HYDRAULIC LEVEL (HGL)
- CLR X.XX — DENOTES CLEARANCE BETWEEN GL & HGL

NOTES

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NET AREA (Ha) — 1.12–52.5/180–0.17 — FLOW LITRES/PERSON/DAY; PERSONS PER NET HECTARE; PEAK FLOW (L/s)

NON RESIDENTIAL

NET AREA (Ha) — 0.850 – 14976 – 0.220 — PEAK FLOW (L/s); FLOW LITRES/NET HECTARE/DAY

INSET A
SCALE (2)

MATCHLINE A–A REFER TO DRG XX–1–1

MATCHLINE B–B REFER TO DRG XX–1–3

BALDIVIS ROAD

SIXTY EIGHT ROAD

WWPS

PROPOSED TYPE 90 WWPS

ULTIMATE DN450 TO DN1350

ULTIMATE DN1350 TO NORTH

REFER INSET A

EXISTING OPEN CHANNEL WATER CORPORATION DRAIN

TRANSITIONS FROM PROPOSED FILL LEVELS TO EXISTING SURFACE

MIN FILL RL 16.00

MIN FILL RL 6.50

MIN FILL RL 5.20

7.00–70/180–1.53

5.28–70/180–1.16

4.48–70/180–0.98
0.17–120/180–0.06

3.86–70/180–0.84

3.77–70/180–0.83

0.59–70/180–0.13
5.99–9450–0.98

3.20–70/180–0.70

6.23–70/220–1.66

0.58–70/220–0.15
0.37–180/195–0.22

2.84–52.5/210–0.59
5.44–70/220–1.45

3.33–70/180–0.73
0.39–70/220–0.10

5.34–70/220–1.43

CATCHMENT PLAN
SCALE (1)

(1) 20 10 0 20 40 60 80 100 120 140 m (SCALE 1:2000 – A1 SHEET)

(2) 10 5 0 10 20 30 40 50 60 70 m (SCALE 1:1000 – A1 SHEET)

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NORTH POINT

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ACN: 009 891 094

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METROPOLITAN WASTEWATER WAPC XXXXXX
BALDIVIS SOUTH INTERIM WWPS NO. 902–XX–UNNAMED RD & PM
CATCHMENT PLAN
SHEET 2 OF 3

FILE JT1 2013 10206 | PLAN XX–1–2 | CAD | ISSUE A | ORIGINAL SHEET SIZE A1

PROJECT C–S01229 | MF

566
810

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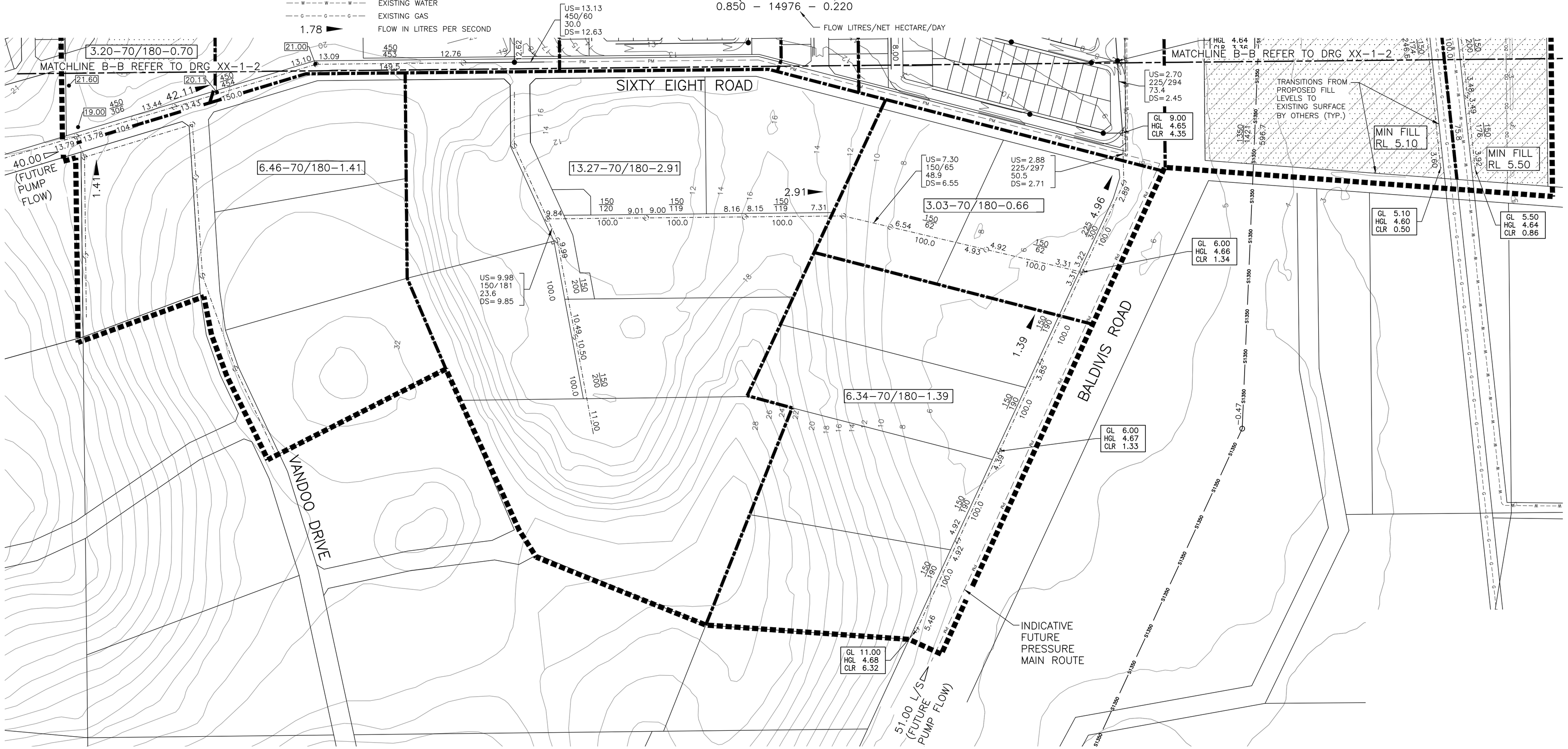
PUMP INFLOW TO PUMPING STATION:	0.0L/s	91.0L/s			
PUMPING FLOW RATE(S):	32.0L/s	90.0L/s	BASED ON 5 STARTS/HOUR (3 MIN STORAGE AT PUMP RATE) THIS IS SUITABLE FOR A MAXIMUM PUMPING FLOW RATE OF:	XXXX	XXXX
STORAGE TIME IN SEWERAGE SYSTEM AT ULTIMATE GRAVITY SEWER DESIGN FLOW CONDITION BETWEEN HIGH LEVEL ALARM LEVEL (R.L. X.XX) AND INVERT LEVEL (R.L.X.XX) OF EMERGENCY OVERFLOW PIPE (OVERFLOW TO ENVIRONMENT).	XXX	XXX	TOTAL STORAGE VOLUME – SYSTEM STORAGE VOLUME – STORAGE TANK VOLUME	TBA m^3 XXXX m^3	TBA m^3 XXXX m^3



FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

CATCHMENT PLAN
SCALE (1)

(1) 20 10 0 20 40 60 80 100 120 140 m
(SCALE 1:2000 – A1 SHEET)

PRITCHARD FRANCIS - REVISION RECORD

No	DATE	DRAFTING CHECK	DESIGN REVIEW	REV'D P.MGR	APP'D P.DIR	AMENDMENT
A2	22/04/15	SK	PA	RB	MR	AMENDED AS PER WATER CORPORATION COMMENTS
A1	08/08/14	SAK	DH	DH	MR	ISSUED FOR APPROVAL

ISSUE	DATE	GRID	REVISION	DRN	REC	APPD

DESIGN SURVEY NONE | VERTICAL DATUM AHD | COORDINATE SYS MGA94–50 | ASCON SURVEY NONE | DES REF
DES CALC S.KENNEDY | DES CHD A.LIN | DRN C.BAILEY | Q.C. CHD R.REVY

NORTH POINT

pritchard francis
civil and structural engineering consultants

Level 1, 430 Roberts Road
PO Box 2150
Subiaco WA 6904
Telephone: (08) 9382 5111
Facsimile: (08) 9382 5199
admin@pfeng.com.au
ACN: 008 891 094

RECOMMENDED
CONSULTANT PROJECT MANAGER
APPROVED
CONSULTANT PROJECT DIRECTOR

WATER CORPORATION

METROPOLITAN WASTEWATER WAPC XXXXXX
BALDIVIS SOUTH INTERIM WWPS NO. 902–XX–UNNAMED RD & PM
CATCHMENT PLAN
SHEET 3 OF 3

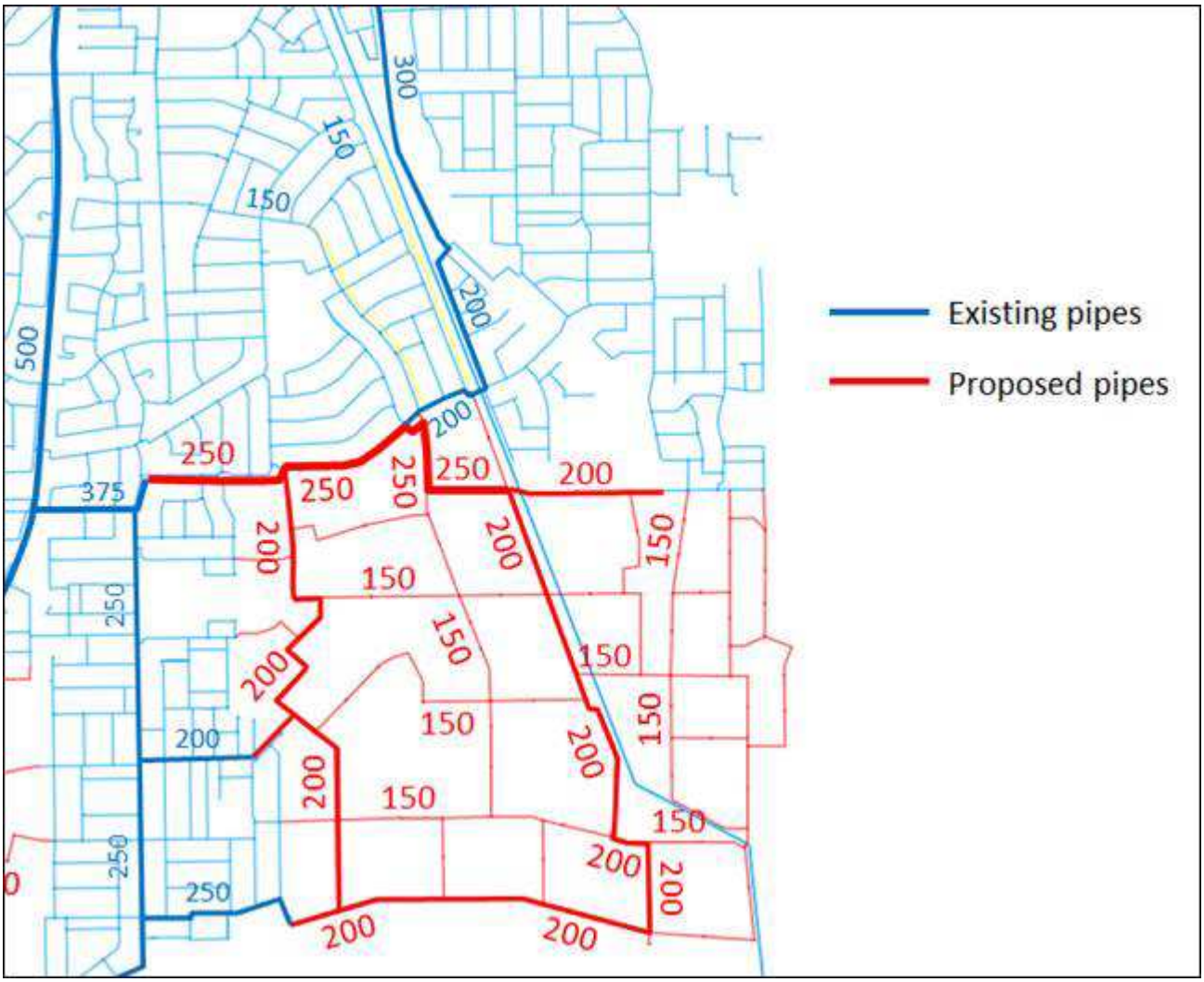
FILE JT1 2013 10206 | PLAN XX–1–3 | CAD | ISSUE A | ORIGINAL SHEET SIZE A1
PROJECT C–S01229 | MF

566
810

Appendix Four: Water Concept Plan

Ryan Brook

From: Brett Coombes <Brett.Coombes@watercorporation.com.au>
Sent: Monday, 22 February 2016 2:49 PM
To: Ryan Brook
Subject: RE: Water Planning for Lot 1006 Baldivis Road



Brett Coombes
Senior Urban Planner
Assets Planning Group
Water Corporation
T: *(08) 9420 3165*

From: Ryan Brook [mailto:ryan.b@pfeng.com.au]
Sent: Friday, 19 February 2016 3:11 PM
To: Brett Coombes
Subject: Water Planning for Lot 1006 Baldivis Road

Hi Brett,
Have discussed with you previously that Lot 1006 Baldivis Road and surrounds (North of Sixty Eight Road, East of Baldivis Road) which is not within the Tamworth water supply scheme. Do you know if there has been any more progress on the reassessment of supply to this area by Water Corporation?

Our planner for the area has had some preliminary discussions with the Department of Planning prior to lodging an MRS amendment for the area and provided the following comments;

Regarding reticulated water, we were told that as part of the recent MRS Amendment over Heritage Park (immediately north of our site), Water Corp suggested that getting reticulated water further south (i.e to our land) may be problematic and that the system was currently at capacity. The Department admitted that this was potentially aged advice, but can we ask that you review this and confirm your report? This may not be the issue as I understand we are brining water in via Brightwood and not form the south. And hopefully the service planning in the area has also progressed since this advice was given and this is now all a non-issue - but it would be nice to confirm prior to lodgement.

Any further advice you could provide on this area would be appreciated.

Thanks,

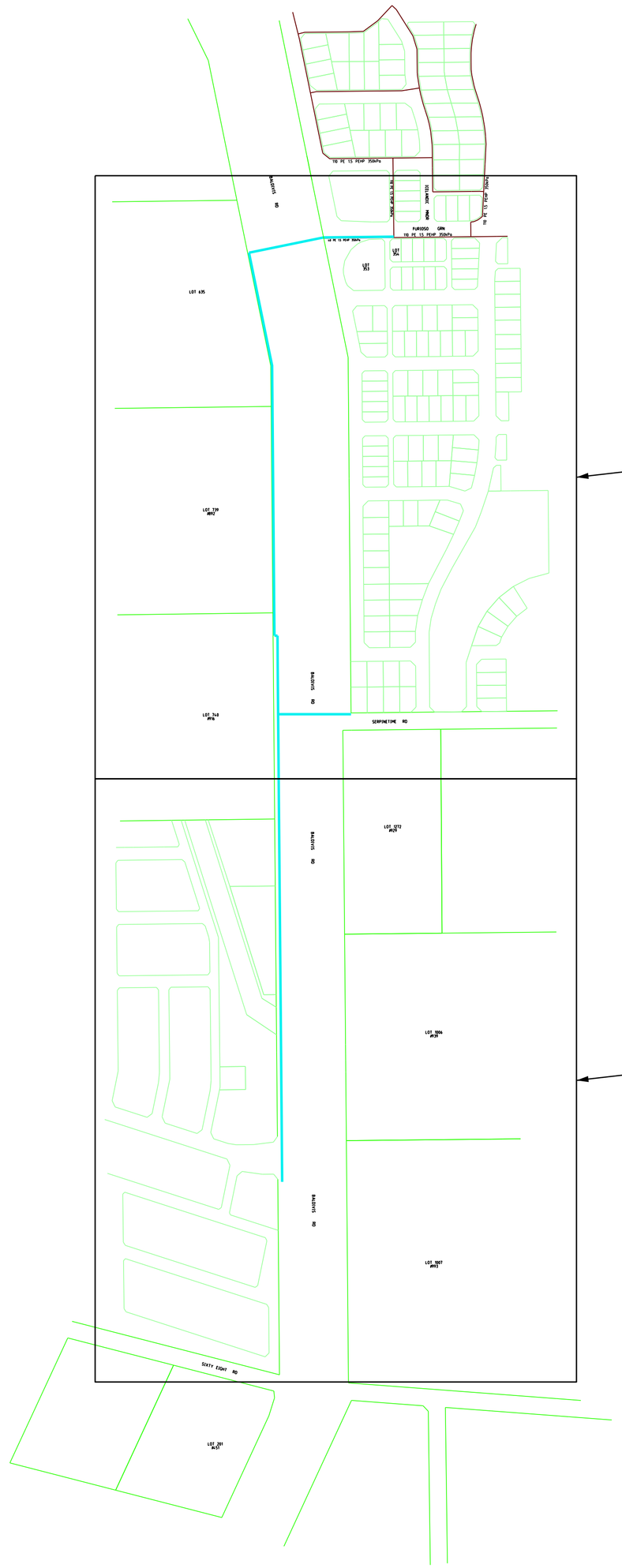
Ryan Brook
Engineer - Civil
BE (Hons) BCom

pritchard francis

T (08) 9382 5111 | **E** ryan.b@pfeng.com.au | **W** www.pfeng.com.au
Level 1, 430 Roberts Road, Subiaco WA 6008 | PO Box 2150 Subiaco WA 6904

Appendix Five: Existing ATCO Gas Services

NOTES: 1. ALL DIMENSIONS IN METRES U.O.N.
2. PIPELINE DEPTH OF COVER = 0.75m MIN. U.O.N.
3. CONSTRUCTED IN ACCORDANCE WITH AS4645.3:2008
4. LATERAL CLEARENCE 0.5m TO OTHER UNDERGROUND ASSETS.



ITEM	SIZE	DESCRIPTION	QTY
7	160	EQUAL TEE SDR11 PE100	1
6	160	END CAP SDR11 PE100	2
5	160	ELBOW 45° SDR11 PE100	2
4	160	ELBOW 90° SDR11 PE100	3
3	160x110	REDUCER ELECTROFUSION SDR11 PE100	1
2	110	EQUAL TEE SDR11 PE100	1
1	160	PIPE 160mm OD SDR17 PE100	1360m

REVISION

REV	DATE	DESCRIPTION	DRAWN	CHK'D	R.O.	MNGR.	DRAWING No.	DRAWING REFERENCES
C	14-10-14	ROAD CROSSING ADDED AT SERPENTINE RD AND DOC ADDED TO SECTION ON 5.1m	L.C.D.	C.B.		J.R.		
B	11-9-14	ISSUED FOR TENDER	L.C.D.					
A	11-9-14	DESIGN	L.C.D.	C.B.		J.R.		

PROJECT EXTENSION
BALDIVIS RD
BALDIVIS

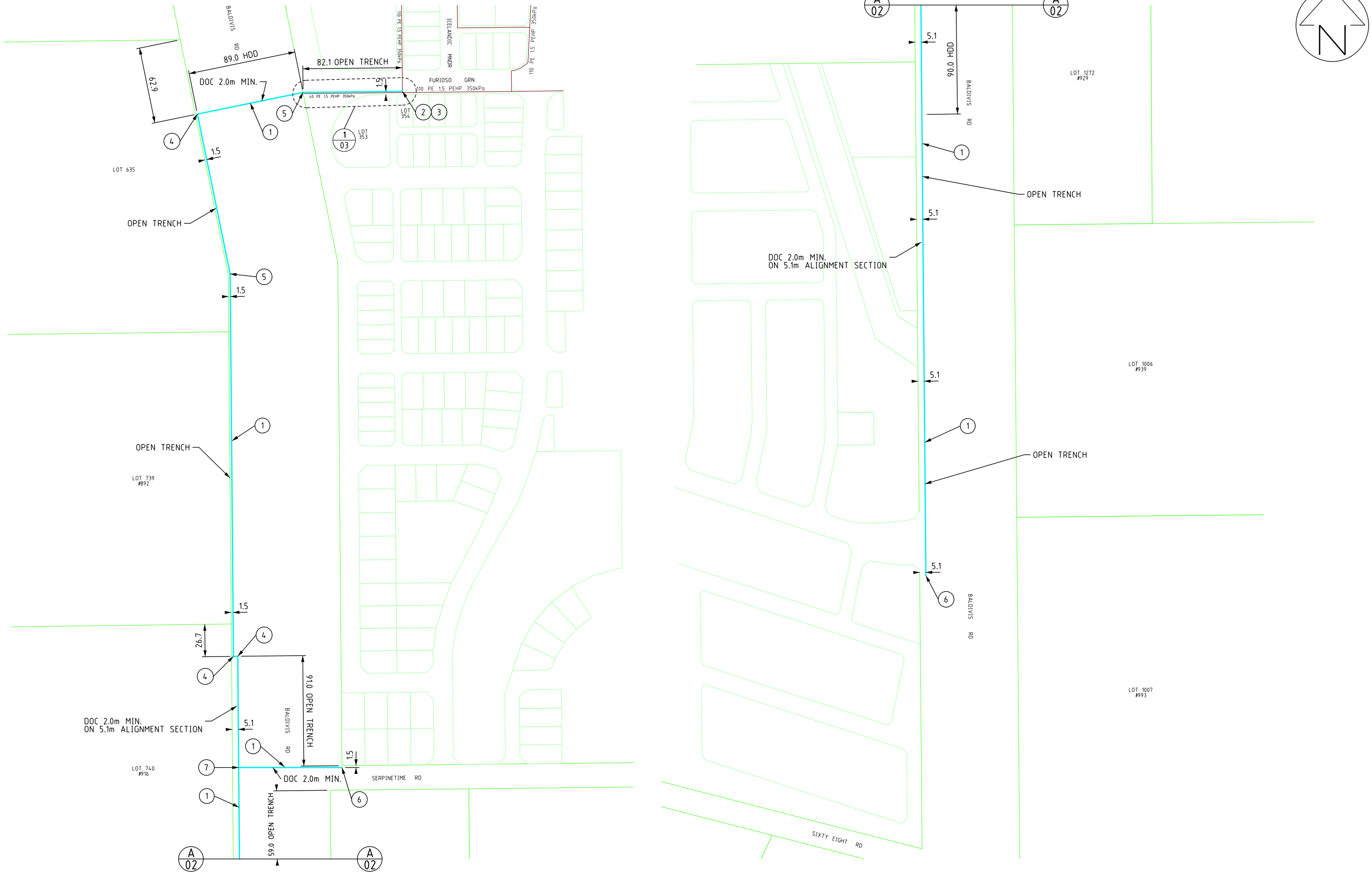
MAOP = 350kPa
1521-2014-GCA1-SM-067

ATCO Gas AUSTRALIA

Dial Before You Dig

J. Richardson
AUTHORISING MANAGER

DRG. No. P4-900-1422-01
REV C
DATE 10 OCTOBER 2014
SCALE 1:4000
CONT'D ON SH 02
A1
CAD FILE NAME /DISTHP/P4-900-1422.DGN



REV	DATE	DESCRIPTION	DRAWN	CHK'D	R.O.	MNGR.	DRAWING No.	DRAWING REFERENCES
C	14-10-14	ROAD CROSSING ADDED AT SERPENTINE RD AND DOC ADDED TO SECTION ON 5.1m	L.C.D.	C.B.		J.R.		
B	11-9-14	ISSUED FOR TENDER	L.C.D.					
A	11-9-14	DESIGN	L.C.D.	C.B.		J.R.		

PROJECT EXTENSION
BALDIVIS RD
BALDIVIS

MAOP = 350kPa

1521-2014-GCA1-SM-067

ATCO Gas AUSTRALIA

DIAL BEFORE YOU DIG 1100

J. Richardson
AUTHORISING MANAGER

DRG. No. P4-900-1422-02

REV C

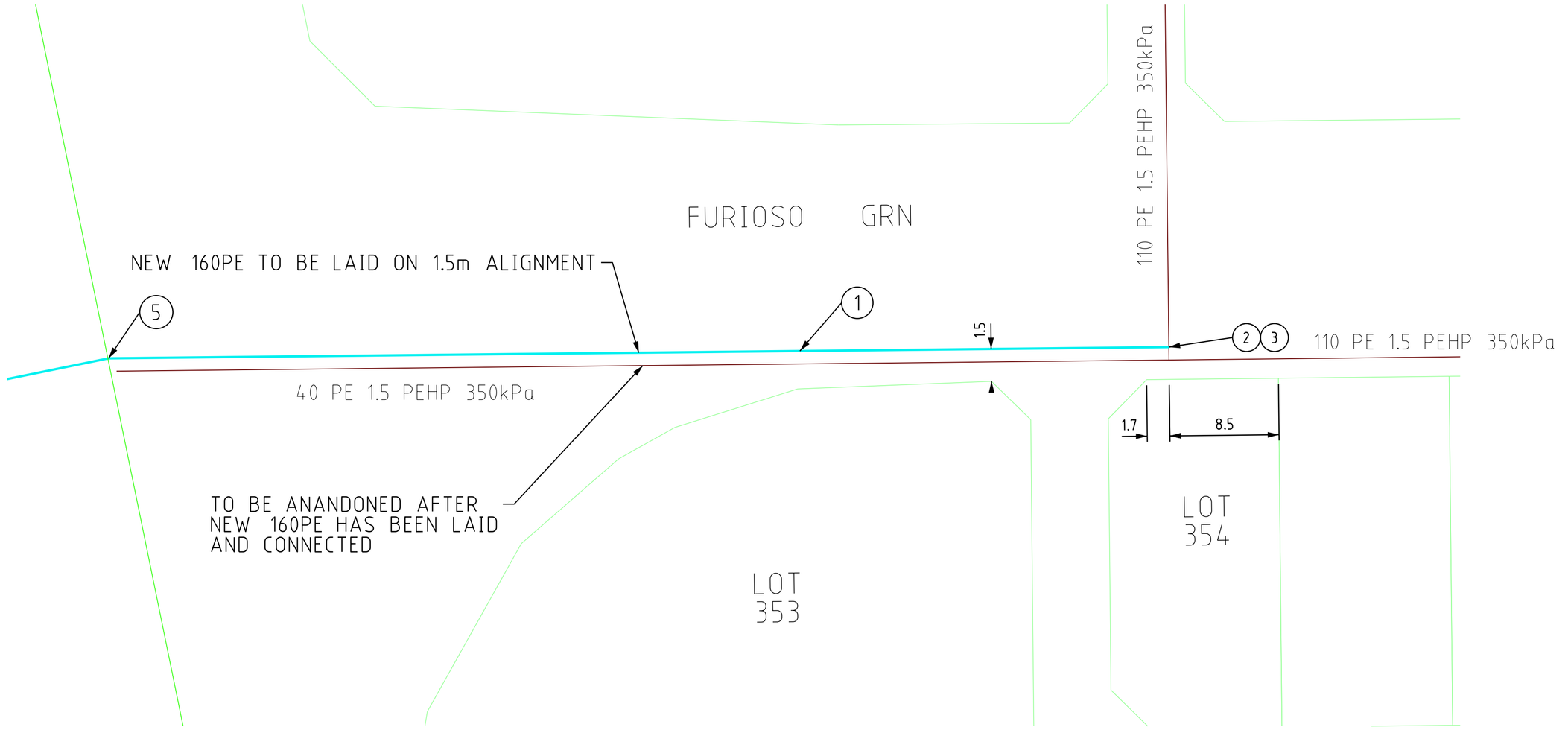
DATE 10 OCTOBER 2014

SCALE 1:1500

CONT'D ON SH 03

A1

CAD FILE NAME /DISTHP/P4-900-1422.DGN



DETAIL 1/02
SCALE 1 : 250

REV	DATE	DESCRIPTION	DRAWN	CHK'D	R.O.	MNGR.	DRAWING No.	DRAWING REFERENCES
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B	11-9-14	ISSUED FOR TENDER	L.C.D.					
A	11-9-14	DESIGN	L.C.D.	C.B.		J.R.		

PROJECT EXTENSION
BALDIVIS RD
BALDIVIS

MAOP = 350kPa

1521-2014-GCA1-SM-067

ATCO Gas AUSTRALIA

DIAL BEFORE YOU DIG

J. Richardson
AUTHORISING MANAGER

DRG. No. P4-900-1422-03

REV C

DATE -

SCALE SEE DETAIL

CAD FILE NAME /DISTHP/P4-900-1422.DGN

CONT'D ON SH -

A1

Appendix Six: Galt Geotechnics Investigation

Report on

GEOTECHNICAL& ENVIRONMENTAL STUDY PROPOSED RESIDENTIAL SUBDIVISION 939 & 993 BALDIVIS ROAD, BALDIVIS

Submitted to:

ABN Group
Ground Floor, 131 Hasler Road
OSBORNE PARK WA 6017

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J1501236 001 R Rev0

26 November 2015

TABLE OF CONTENTS

TABLES (WITHIN TEXT)

TABLES (ATTACHED)

FIGURES

APPENDICES

1. INTRODUCTION

This report presents the outcomes of Galt Geotechnics Pty Ltd and Galt Environmental Pty Ltd (Galt's) geotechnical and environmental study for the proposed residential subdivision at 939 & 993 Baldivis Road, Baldivis ("the site"). The location of the site relative to the surrounding area is shown on Figure 1, Site and Location Plan.

The work was authorised by Steve Claudio via a signed client authorisation form dated 21 October 2015.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

Based on the supplied information, the site is approximately 18.8 ha in plan area and rectangular in shape. It is bounded by Sixty-Eight road to the south, Baldivis Road to the west, Kwinana Freeway to the east and by existing residential properties to the north.

The areas of the various lots are as follows:

- 939 Baldivis Road: 8.388 ha; and
- 993 Baldivis Road: 10.362 ha.

The site has been cleared but is largely undeveloped, with a residential dwelling and associated sheds present in both lots along the western boundary. Scattered trees are present through the site, predominantly along fence lines within the properties. A buried high pressure gas and water main traverse the site, entering the site along the western boundary of 939 Baldivis Road, and exiting the site along the southern boundary of 993 Baldivis Road. A small drain running north-south is also present close to the eastern boundary of the site.

Based on a site plan provided by Pritchard Francis, we understand the site surface levels fall from around RL 5 m AHD along the western boundary to around RL 3 m AHD along the eastern boundary.

Based on the provided drawings showing the minimum fill requirements for reticulated sewers, we understand that between 0.5 m and 2.5 m of fill will be imported to raise the existing surface levels (finished surface levels between RL 5.1 m and RL 5.5 m AHD). The fill thickness typically ranges between 0.5 m in the west of the site, increasing to around 2.5 m thick along the eastern boundary.

It is understood that the proposed development will comprise the subdivision of the site into residential lots and the construction of new access roads. It is expected that the new residential structures will be single or double storey brick masonry and founded on shallow footings, with ground-bearing slabs. Target site classification is likely to be 'Class A' in accordance with AS2870-2011.

We understand that the existing pipeline easement present in the south of the site will be left relatively undeveloped, with minimal to no earthworks proposed within this area, the only exception being a road crossover the easement near the centre of the site. We understand that only minor filling will occur at the proposed road crossing (0.5 m or less), with the crossing to be constructed close to the existing surface level.

3. PROJECT OBJECTIVES

The objectives of the study were to:

Geotechnical

- assess subsurface soil and groundwater conditions across the site, with a particular emphasis on:
  - the presence and depth of clayey soil across the site;
  - the presence, thickness and organic content of any topsoil;
  - the consistency of the backfill to the gas and power trenches in the area of the proposed road crossing; and
  - the presence of any sediment/organic material/soft soil within the drain along the eastern boundary.
- provide a site classification(s) in accordance with AS 2870-2011 "Residential Slabs and Footings";
- provide recommendations and geotechnical design parameters for earth retaining structures;
- recommend appropriate site preparation procedures including compaction criteria and recommendations for elevation of the site above groundwater level;
- assess the permeability of the soils at the site for potential on-site disposal of stormwater by infiltration;
- provide a subgrade California bearing ratio (CBR) value for pavement thickness design by others; and
- recommend any further studies which may be required to facilitate detailed design and earthworks.

Environmental

- identify the nature and extent of acid sulfate soil (ASS) material (if any) across the site;
- recommend appropriate strategies for the management ASS (if any) during any proposed excavation works; and
- recommend any further studies which may be required to facilitate detailed design and earthworks.

4. FIELDWORK

Fieldwork was carried out on 23 and 28 October 2015 and comprised:

- a site walkover including taking photographs;
- drilling of machine-augered boreholes at 23 locations:
  - 20 locations extending to 2.5 m, spread over the site; and
  - three locations along the existing drain, extending to depths of 1.5 m;
- testing with a dynamic cone penetrometer (DCP) or a Perth sand penetrometer (PSP) adjacent to the boreholes, and at three locations near the proposed road crossing over the pipeline easement, extending to depths of between 0.9 m and 1.8 m;
- infiltration testing using the 'inverse auger hole technique' at four locations, at a depth of about 0.5 m below the existing ground level; and
- hand excavated test pits at four locations, extending to depths of about 0.5 m.

General

Test locations were selected and positioned by a geotechnical engineer from Galt using a handheld GPS, accurate to within +/- 5 m in the horizontal plane. Our engineer conducted the walkover survey, observed the drilling, logged the materials encountered and performed the infiltration and penetrometer testing.

The approximate test locations are shown on Figure 1, Site and Location Plan and details are summarised in Table A1: Summary of Tests. Photographs of the site are presented in Appendix A, Site Photographs.

Machine Augered Boreholes

Boreholes were drilled using a utility mounted Eziprobe equipped with a 100 mm auger. Borehole reports along with the method of soil description used on the reports are presented in Appendix B, Borehole Reports.

Penetrometer Testing

Penetrometer testing was carried out adjacent to each machine auger borehole and three additional locations where the proposed road crossing across the pipeline easement is located.

Dynamic cone penetrometer (DCP) tests were carried out in accordance with AS1289.6.3.2. Perth sand penetrometer (PSP) tests were conducted in accordance with AS 1289.6.3.3 although to a greater depth than the 0.45 m covered in the standard.

The results of the penetrometer testing are presented in Appendix C, Penetrometer Test Results.

Infiltration Tests

Infiltration testing was carried out in hand-augered boreholes using the method described by Cocks[1]. The results of the infiltration testing are presented in Appendix D, Infiltration Test Results and summarised in Table 1.

Table 1: Summary of Infiltration Test Results

Test Location	Description	Pipe Embedment (m)	Minimum Unsaturated Permeability[1], k (m/day)		
			Test 1	Test 2	Test 3
IT01	SAND	0.55	14.3	11.7	13.4
IT02	SAND	0.56	17.8	14.4	8.7
IT03	SAND	0.5	9.2	9.9	8.5
IT04	SAND	0.52	4.9	3.4	3.3

Note: The minimum unsaturated permeabilities shown are typically recorded towards the end of the test, with pressure head varying between about 0.52 m and 0.08 m.

Environmental Sampling

Soil samples for the ASS study were collected from the boreholes in accordance with the following guideline and Australian Standard.

- AS 4482.1 (2005) *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil Part I Non Volatile and Semi Volatile Compounds*; and
- Department of Environment and Conservation (DEC) (2013) *Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes*.

Samples were collected at 0.25 metre intervals from boreholes using dedicated nitrile gloves and placed in laboratory supplied plastic zip-lock bags. The samples were then placed in an ice-chilled cooler until field testing and submission to the laboratory for analysis.

[1] Cocks, G (2007), "Disposal of Stormwater Runoff by Soakage in Perth Western Australia", Journal and News of the Australian Geomechanics Society, Volume 42 No. 3, pp 101-114

5. LABORATORY TESTING

5.1 Geotechnical

Laboratory testing was undertaken by Civil and Mining Geotest in their NATA accredited laboratory. The testing comprised determination of:

- particle size distribution on five samples;
- Atterberg limits on five samples; and
- organic content on four samples.

Laboratory test results along with the test methods followed are presented in Appendix E, Geotechnical Laboratory Test Results. The results are summarised in Table 2: Summary of Laboratory Test Results.

Table 2: Summary of Laboratory Test Results

Test Location	Sample Depth (m)	% Organics	% Gravel	% Sand	% Fines	LL (%)	PI (%)	LS (%)
HTP01	0.0 – 0.3	10.5	1	19	80	58	24	9.5
HTP02	0.0 – 0.3	10.7	6	16	78	72	37	13.5
HTP03	0.0 – 0.3	10.1	1	53	46	42	16	8.0
HTP04	0.0 – 0.3	10.0	1	26	63	49	17	8.0
BH16	1.0 – 2.0	-	0	7	93	120	82	27.5

Note: LL – Liquid Limit PI – Plasticity Index LS – Linear Shrinkage

5.2 Environmental

Soil samples were tested for pH before (pH_F) and after (pH_{FOX}) rapid oxidation with hydrogen peroxide (H_2O_2). The field tests were undertaken to provide an indication of soil types likely to have the potential to generate acidity as a result of oxidation during earthworks. Test results are included in Table A2 at the end of the text.

Selected samples were chosen for laboratory analysis for the chromium reducible sulfur (CRS) method, which provides acid base accounting and quantification of potential acid generation. The selection of samples for laboratory analysis was based on soil type and the results of field testing. Analysis of soil samples was undertaken by Eurofins in their NATA accredited laboratory. Laboratory certificates of analysis are presented in Appendix F, Environmental Laboratory Certificates of Analysis.

6. SITE CONDITIONS

6.1 Geology

The Rockingham sheet of the 1:50,000 scale Environmental Geology series map indicates that central and eastern portions of the site are underlain by:

- *Clayey SILT – Dark greyish brown, mottled in part, soft when wet, plastic in part, blocky, variable clay content, of alluvial origin.*

The western portion of the site is underlain by:

- *Bassendean SAND – very light grey at surface, yellow at depth, fine to medium grained, sub-rounded quartz, moderately well sorted, of eolian origin, present as relatively thin layer over clayey / silty soils*.

The findings of our investigation are generally in accordance with geological mapping in the west of the site, with the sand extending further to the east than shown on the geological mapping.

The eastern portion of the site is underlain by Organic SILT / Organic CLAY in the top 0.5 m. The Organic SILT / Organic CLAY did not seem to be as prevalent around the location of the drain in the east of the site, with this area directly underlain by CLAY. It is assumed that the surficial 0.5 m to 1.0 m around the drain was stripped to facilitate its construction.

6.2 Subsurface Conditions

The subsurface conditions at the site are variable, but can be summarised as follows:

Western portion of the site:

- SAND (SP) – fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics, dry, medium dense, present from the ground surface to depths of between 0.5 m and greater than 2.5 m; overlying
- SANDY CLAY/CLAYEY SAND(CI/SC) – medium plasticity fines, fine to coarse grained sand, sub-angular to sub-rounded, dark grey, moist becoming wet, present to the maximum investigated depth of 2.5 m.

Eastern portion of the site:

- Organic CLAY (OH) – medium plasticity fines, dark brown, with some fine to coarse grained sand, with some organics (~10%), trace rootlets, dry becoming moist, stiff upper crust on the material which becomes very soft to firm below, present from the ground surface to depths of up to 0.6 m; overlying
- CLAY (CH), high plasticity fines, dark grey, trace fine grained sand, moist becoming wet, stiff, present to the maximum investigated depth of 2.5 m.

The Organic CLAY present in the eastern portion of the site typically has a stiff upper crust (top 0.1 m to 0.2 m), which becomes very soft to firm below. Large shrinkage cracks were also observed at the surface where the organic clay is present.

6.3 Groundwater

The Perth Groundwater Atlas (1997) does not extend to the site, but nearby data suggests that the maximum historic groundwater level at the site would be around RL 3 m to RL 4 m AHD. The Perth Groundwater Atlas (2004) which reflects the late summer groundwater levels, shows the groundwater level to be around RL 2 m AHD.

We expect a perched groundwater level is likely to be present over the clayey soils in the east of the site during wetter times of the year.

In the west of the site, groundwater was encountered at depths of between 1.4 m and 2.5 m. This equates to a groundwater level of around RL 2 m to RL 3 m AHD. Groundwater was not observed in the eastern half of the site, except for the standing water present in the existing drain. We expect that this is due to the low permeability of the clayey soils, and the relatively short time for which the boreholes were left open (i.e. groundwater may be expected to seep into boreholes and excavations very slowly).

7. GEOTECHNICAL ASSESSMENT

7.1 Site Classification

We have assessed the site in accordance with AS 2870 – 2011 "Residential Slabs and Footings". Based on the proposed raising of the existing surface levels within the site, we consider that a site classification of "Class A" will be applicable provided at least 1.8 m of natural sand or sand fill is present over the underlying clayey soils and all organic/soft soils are removed/remediated.

Isolated areas of the site, in particular close the centre of the site, may have between 1.2 m and 1.8 m of sand fill overlying clayey soils. We consider that a site classification of "Class S" is appropriate for these isolated areas. Improvement of this area to "Class A" is possible with importation and placement of inert sand fill to produce a total thickness of about 1.8 m of inert fill overlying the clayey material below building footprints.

The above classification is applicable provided that the site preparation, presented in Section 7.2, is undertaken prior to construction.

Note: In its current state the majority of the site is classified as "Class P" due to the presence of Organic CLAY. It is necessary to treat or remove this material in order to achieve the specified site classifications.

7.2 Site Preparation

The site preparation measures outlined below are aimed at improvement of the site in preparation for construction of the structures including on-ground slabs, shallow footings, retaining walls and pavements.

The following site preparation measures must be undertaken:

Western Portion of the Site

- Demolish the existing structures onsite and remove offsite. This includes buried soak wells, fences and outbuildings.
- Stockpile the sandy topsoil for potential re-use in non-structural applications or for possible blending with clean sand. We recommend a 100 mm topsoil strip or as otherwise necessary to remove all significant organic material from the soil.
- Excavate to the required level (if at all).
- Compact the exposed stripped surface to a depth of 0.9 m (Section 7.4). **Note:** Where there is more than 1 m of bulk fill to be placed over the in-situ sand, the depth of compaction can be reduced to 0.45 m.
- Where fill is required to build up levels, use approved fill (Section 7.5), placed and compacted in layers no greater than 0.3 m loose thickness.

Eastern Portion of the Site

- Demolish the existing structures onsite and remove offsite. This includes buried soak wells, fences and outbuildings (where present).
- Strip and dispose of off-site the clayey topsoil and the remaining organic clayey layer (unless you are going to treat it in-situ, refer Section 7.7) from the eastern portion of the site. We recommend a strip as necessary to remove all significant organic material from the soil (likely to be around 0.4 m to 0.6 m). The stripped area must be inspected by a geotechnical engineer to ensure the area has been adequately stripped prior to filling.
- Once the organic clay material is removed, compact the exposed surface to a depth of 0.3 m (Section 7.4) assuming more than 1 m of bulk fill to be placed over the clayey soils. It will probably be necessary to tine the surface and allow it to dry back to around OMC (in dry weather) to be able to undertake compaction.

- Grade the exposed clayey surface to promote the runoff of water and prevent water from ponding over the clayey soils. We recommend a grade of at least 1%.
- Where fill is required to build up levels, use approved fill, placed and compacted in layers no greater than 0.3 m loose thickness.

Compaction and trafficking of the clayey areas of the site must NOT be attempted when the site is wet (i.e. following rainfall or if the site has been over-wet during moisture conditioning). It will be necessary to let the site dry out or trim wet soil off to expose underlying drier material. Attempting to traffic or compact the wet clayey soils is likely to result in soil disturbance and significant softening of the clayey soils.

7.3 Construction Issues and Drainage

Due to the low permeability of the clayey soils in the east of the site, storm-water runoff is expected to pond on the ground surface during the wetter parts of the year. This may cause difficulties during construction including:

- heaving and rutting of saturated clayey soils when trafficked; and
- softening of clayey soils when water is allowed to pond.

We therefore recommend that earthworks are carried out in the summer months, even though earthworks conducted in summer have their own issues such as dust control and rapid drying out of soils.

7.4 Compaction

7.4.1 Sand

Approved granular fill and the *in situ* sands must be compacted using suitable compaction equipment to achieve a dry density ratio of at least 95% MMDD (maximum modified dry density) as determined in accordance with AS 1289 5.2.1 at a moisture content within 2% of optimum moisture content (OMC).

A Perth sand penetrometer (PSP) may be used for compaction control on in-situ sand and imported sand fill. We consider that the following blow counts correspond to a DDR of 95% MMDD:

- 0-150 mm: SET
- 150-450 mm: 8
- 450-750 mm: 10
- 750-1050 mm: 12 (or 750-900 mm: 6)

If difficulties are experienced recording the required blow count, a site-specific PSP correlation should be carried out to determine the PSP blow count correlating to a DDR of 95% MMDD. The correlation must:

- be done on site;
- use the nuclear density gauge (NDG) to determine density at a minimum of 5 points with varying density to a depth of 300 mm below surface;
- use a calibrated PSP to determine the PSP blow count from 150 mm to 450 mm at each of the NDG test points; and
- be plotted on a chart of PSP blow count vs DDR.

If gravel is used as fill, compaction testing must be done using a nuclear density gauge (NDG) in accordance with AS1289.5.8.1.

Over-excavation and replacement of loose materials must be done where the minimum dry density ratio cannot be achieved.

Fill must be placed in horizontal layers of not greater than 300 mm loose thickness. Each layer must be compacted by suitable compaction equipment, and carefully controlled to ensure even compaction over the full area and depth of each layer.

Care will need to be taken when compacting in the vicinity of existing structures, such as adjacent properties. This is particularly important if vibratory compaction is being carried out. Tynan (1973)[2] provides assistance with the selection of compaction equipment for use adjacent to structures. Of particular concern are the existing masonry buildings on adjacent lots.

Large compaction equipment (self-propelled vibrating rollers, etc.) must not be used within 2 m behind retaining walls. Hand compaction plant (e.g. plate compactors) must be used.

7.4.2 Clay

The *in situ* clayey soils and clay fill must be compacted using suitable compaction equipment to a minimum dry density ratio of 95% SMDD (standard maximum dry density) as determined in accordance with AS1289.5.1.1.

The in-situ clay and clay fill will require careful moisture conditioning so that the moisture content of the material is between optimum moisture content (OMC) and 2% wet of OMC at the time of placement and compaction. We note that compaction to 95% SMDD can be difficult to achieve for the clayey in situ material when not appropriately moisture conditioned.

For clayey soils, compaction testing must be done using a nuclear density gauge (NDG) in accordance with AS1289.5.8.1.

The clayey soils on the site will drain poorly when inundated during the wetter times of the year and result in saturated conditions that may inhibit compaction of the soil. To reduce the risk associated with this, we recommend that earthworks are not carried out within 1-2 weeks following heavy rainfall. If difficulties are encountered during compaction due to water, further advice should be sought from a geotechnical engineer.

7.5 Approved Fill

Imported granular fill must comply with the material requirements as stated in AS 3798-2007, “Guidelines on Earthworks for Commercial and Residential Developments”.

The sand present at the site is suitable for re-use as inert structural fill. Sand fill containing demolition rubble will not be suitable for re-use as structural fill. Any organic-rich sand or sand containing significant proportions of fines (material less than 0.075 mm in size) must not be used.

The organic-rich clay on the eastern half of the site will not be re-usable as structural fill. The clay below the organic-rich clay could potentially be re-used as structural fill, however it is highly reactive and therefore not expected to be suitable for raising site levels.

Any organic-rich sand (including the nominal 100 mm topsoil strip) or sand containing significant proportions of fines (material less than 0.075 mm in size) must not be used as fill without further treatment.

[2] Tynan (1973) Ground Vibration and Damage Effects on Buildings, Australia Road Research Board, Special Report No. 11.

Where doubt exists, a geotechnical engineer must be engaged to inspect and approve the use of potential fill materials. We must comment on specific topsoil blending regimes once a design permeability has been established for the site.

7.6 Reuse of Topsoil

We expect that sandy topsoil can be suitably blended with clean sand to produce a permeable structural fill, once organics are removed (by screening). This usually requires:

- Drying-out of topsoil (typically by undertaking topsoil strip during late summer, or by stockpiling for several months).
- Screening using a vibrating screen plant (50 mm screen deck or smaller is typically appropriate).
- Blending either mechanically (using scrapers, graders, etc) or through the screen, usually at a rate of 1 to 2 parts clean sand to 1 part screened topsoil.

Where the blended topsoil fill is to be reused in areas where stormwater disposal is proposed, permeability testing of material must be carried out to ensure it meets the specified requirements prior to use. This typically involves the construction of a compacted trial pad approximately 1 m thick of the blended topsoil at different ratios (generally 1:1 and 1:2 parts screened topsoil to clean sand). We can assist with this if required.

7.7 Treatment of Organic Clay

Due to the high organic content and low strength, the in-situ organic clay present in the east of the site requires either excavation and disposal off-site or treatment to stabilise the material. Where material is left in-situ without treatment settlements in the order of 100 mm to 150 mm could be expected.

If the material is to be removed offsite, as the organic clay is classified as actual acid sulfate soil (refer Section 8) the material will require treatment as part of the removal process. This is likely to involve dosing of the excavated material with lime.

If the material is instead to be stabilised in-situ, cement could be added to the clayey material to stabilise the full thickness of the layer. This could be achieved by tining the surface (say to 500 mm deep), applying cement and mixing it into the clay (by further tining or rotary hoe) and then compacting the clay. The clay/cement mix should not be allowed set prior to compaction.

We consider that a treatment rate of between about 3% and 8% cement (i.e. 18 mm to 48 mm for a 600 mm thick layer) may be required. The addition of cement to the organic clay will help dry out the clay, as well as chemically stabilises it to be less reactive. Depending on the blending methodology, lime treatment is unlikely to be required for ASS neutralisation if the material is treated in-situ.

Where the in-situ material will be treated and left in place, blending trials will need to be undertaken to assess adequate cement dosage rates for the clay. We can assist with this if necessary. Lime stabilisation (with quicklime, not aglime) may also be an option, but will require further assessment.

7.8 Earth Retaining Structures

Retaining structures may be designed in accordance with AS 4678 (2002) "Earth Retaining Structures". We recommend that all retaining walls at the site be backfilled with free-draining fill, e.g. sand (imported free draining sand fill with less than 5% fines). We further recommend that retaining walls are founded in sand. If walls are to be founded on clay (or if the sand cover is such that it is less than 1.8 m over clayey soils, hence a site classification of other than 'Class A' will apply), the footing detail should be considered appropriately. Founding on any clay fill is not recommended.

For the design of retaining structures, the following parameters are considered appropriate for compacted sand backfill.

Table 3: Retaining Wall Geotechnical Design Parameters

Soil Type	Bulk Density (t/m^3)	Angle of Internal Friction (deg.)	Wall Friction = 0°		Wall Friction = 0.5Φ	
			Coefficient of Active Earth Pressure, K_a	Coefficient of Passive Earth Pressure, K_p	Coefficient of Active Earth Pressure, K_a	Coefficient of Passive Earth Pressure, K_p
Compacted sand or gravel fill	18	34	0.28	3.5	0.25	5.7

Notes: Earth pressure coefficients are provided in this table for conditions of zero friction between the wall and the soil and with wall friction of 0.5Φ'. The retaining wall designer should make an independent assessment of the parameters appropriate to the construction method to be used, including alternative values of wall friction. A horizontal ground surface behind the wall has been assumed.

Unless a suitable drainage layer is placed behind the wall such that a build-up of pore pressure is prevented, the retaining wall must be designed to accommodate water pressure behind the wall (10 kPa per metre height). In this instance, calculation of lateral earth pressures must include the addition of pore pressure (not required for retaining walls entirely within clean sand and sand fill). A separator geotextile (Bidim A14, or similar, or heavier) must also be used between the interface of any granular backfill and in-situ clayey soil.

Where any walls have clayey soil behind them, they must be backfilled with a 300 mm minimum wide layer of free-draining granular fill. A slotted drain (wrapped in a geotextile) should be used at the base of the granular backfill to collect seepage and direct it to a collection point (either discharging by gravity away from the retaining wall, or collecting at a sump fitted with an automatic pump system to ensure that it remains dry).

Compaction plant can augment the lateral earth pressure acting on retaining walls. Hand operated compaction equipment is recommended within 2 m of any retaining walls to minimise compaction pressures.

It is important to note that some ground movement will occur behind any soil retaining system, including gravity retaining walls.

Detailed design of retaining structures should be undertaken using methods appropriate to the proposed retention system.

7.9 Stormwater Disposal

Permeability testing was carried out at four locations in the western portion of the site. The average unsaturated permeability values indicate an average permeability of about 10 m/day (noting that a lower value of around 4 m/day was observed at one location where a thin layer of sand was present over clayey soils). The permeability testing was undertaken at about 0.5 m below existing surface level.

Provided at least 1.2 m of sand or sand fill is present over the maximum groundwater level or clayey soils (whichever level is higher), we consider that the in-situ sand (present in the western portion of the site) and sand fill are suitable for the disposal of stormwater by infiltration by means of soakwells assuming that the site preparation requirements have been carried out (Section 7.2).

The clayey soils in the eastern portion of the site are not suitable for the disposal of stormwater by infiltration.

Notwithstanding the results of the permeability testing, we recommend a design value of permeability (k) not greater than 5 m/day for the in-situ sand and sand fill to allow for the variability in materials and reduced permeability as a consequence of:

- densification of sand during site preparation works;
- natural variation in sands; and
- clogging of the sand around soakwells and soakage basins over time with fines.

Soak wells should be placed outside a line of 1V:2H extending below the edge of the nearest footing, subject to local council regulations. Discharge from soak wells has been known to promote densification of loose sandy soils, leading to settlements of footings and slabs. Soak wells should be carefully wrapped with geotextile to prevent migration of sand and fines into the soak well.

7.10 Pavement Design

Where design of flexible pavements is undertaken, a subgrade California bearing ratio (CBR) of 10% may be assumed for pavement thickness design where the pavement subgrade comprises at least 0.5 m thick layer of sand or sand fill. This CBR assumes that the site preparation requirements outlined in Section 7.2 have been carried out in pavement subgrade areas.

Where the organic clay is stabilised and left in-situ (understood to only be applicable at the proposed road crossing over the pipeline easement), a suitable design CBR will need to be assessed based on the adopted cement/lime ratio. We can assist with this if necessary. We do not recommend construction of pavements over the organic clay if it is not treated.

8. ACID SULFATE SOILS ASSESSMENT

8.1 Assessment Criteria

Results of the soil analysis have been compared with criteria provided in the DER (2015) *Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes*. In most cases, field test results where pH_F values of <3 to 4 are recorded indicate the presence of actual acid sulfate soils (AASS).

Generally, the presence of unoxidised acids or potential (PASS) is indicated if:

- a strong reaction with hydrogen peroxide is observed;
- the pH_{FOX} is at least 1 pH unit below pH_F; or
- the pH_{FOX} is <3 to 4 and one or both of the above conditions apply.

The net acidity criterion of 0.03 %S has been adopted for this investigation as volumes greater than 1000 tonnes of material are to be disturbed. The net acidity value has been calculated using the following formula:

$$\text{Net acidity} = \text{Retained acidity}^{3} + \text{Potential acidity}^{4}$$

8.2 Field Testing Results

Soil testing results are presented in Table A2, ASS Test Results (located at the end of the text) and are summarised below.

- Field pH_F test results for all soil samples ranged from 4.5 (BH07/0.00) to 7.2 (BH11/0.00-1.50, BH12/0.0-2.50).
- Field pH_{FOX} test results were lower, ranging from 1.5 (BH14/0.25) to 5.2 (BH09/2.50).
- Differences between pH_F and pH_{FOX} levels in individual soil samples ranged from 0.0 (BH03/1.75) to 4.0 (BH11/0.50-0.75).
- During oxidation, 132 of the 209 samples field tested displayed a low reaction, 38 displayed a moderate reaction, 27 displayed a high reaction, three displayed an extreme reaction and 9 displayed a volcanic reaction.

8.3 Laboratory Analysis

The acid sulfate soil analytical results using the CRS method are presented also in Table A2 and are summarised below.

- Titratable actual acidity (TAA) values ranged from <0.02 %S (a number of locations) to 0.13 %S (BH16/0.00).
- CRS values ranged from <0.005 %S (a number of locations) to 0.059 %S (BH25/0.00).
- Net acidity values ranged from <0.02 %S (a number of locations to 0.13 %S (BH16/0.00) with a number of values exceeding to the action criterion of 0.03 %S.

8.4 Summary

Soils located in the western portion of the site that comprise sand, sandy clay and clayey sand had a net acidity that conformed to the adopted criterion, as such these soils are classified as non acid sulfate soils (NASS).

[3] Total actual acidity (TAA) value adopted
[4] Chromium reducible sulfur (CRS) value adopted

Soils located in the eastern portion of the site comprise predominantly organic clay and clay. The net acidity for these soils exceeded the adopted criterion in all samples, as such these soils are classified as actual acid sulfate soils (AASS). Sampling locations where ASS material has been identified are shown on Figure 2.

Based on these results and the presence of ASS, we recommend that an acid sulfate soil management plan (ASSMP) be developed for the site regardless of what earthworking strategy is adopted for the organic clay located on the eastern portion of the site.

9. CLOSURE

We draw your attention to Appendix F of this report, "Understanding your Report". The information provided within is intended to inform you as to what your realistic expectations of this report should be. Guidance is also provided on how to minimize risks associated with groundworks for this project. This information is provided not to reduce the level of responsibility accepted by Galt, but to ensure that all parties who rely on this report are aware of the responsibilities each assumes in so doing.

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Tables

Table A1: Summary Of Tests

Test Name	Test Depth (m)	Depth to Groundwater (m)	Sand Thickness(m)	Organic Clay Thickness (m)	Reason for Termination	Stratigraphy[2]
BH01	2.5	2.2	>2.5	Not Present	Target depth	SAND
BH02	2.5	1.9	>2.5	Not Present		
BH03	2.5	Not Observed[1]	NE[1]	0.5		Organic CLAY overlying Silty CLAY
BH04	Not undertaken due to access constraints					
BH05	2.5	2.3	>2.5	Not Present	Target depth	SAND
BH06	2.5	1.4	>2.5	Not Present		
BH07	2.5	Not Observed	0.5	Not Present		SAND overlying Sandy CLAY/Clayey SAND
BH08	2.5	Not Observed	NE	0.4		Organic CLAY overlying CLAY
BH09	2.5	Not Observed	NE	0.4		
BH10	1.5	0.0	NE			CLAY
BH11	2.5	Not Observed	NE	0.4		Organic CLAY overlying CLAY
BH12	2.5	Not Observed	NE	0.5		
BH13	1.5	0.0	NE	0.6		CLAY
BH14	2.5	Not Observed	NE	0.3		Organic CLAY overlying CLAY
BH15	Not undertaken due to access constraints					
BH16	2.5	Not Observed	NE	0.5	Target depth	Organic CLAY overlying Silty CLAY
BH17	1.5	0.0	NE			Silty CLAY
BH18	2.5	1.7	>2.5	Not Present		FILL: SAND overlying SAND
BH19	2.5	2.4	1.0	Not Present		SAND overlying Clayey SAND/Sandy CLAY
BH20	2.5	Not Observed	>2.5	Not Present		SAND
BH21	2.5	1.8	>2.5	Not Present		
BH22	2.5	2.5	1.5	Not Present		SAND overlying Clayey SAND
BH23	2.5	2.0	>2.5	Not Present		SAND
BH24	2.5	1.5	>2.5	Not Present		
BH25	2.5	Not Observed	1.4	Not Present		SAND overlying Sandy CLAY

Notes: [1.] Not observed within borehole, noting boreholes were likely not left open long enough water to permeate through

Table A2: Acid Sulfate Soil Test Results

Field Observations							Lab pH	CRS				ASS Classification
Sample ID		Soil Description	pH_f	pH_{fox}	$pH_f - pH_{fox}$	Reaction Rate	pH_{KCl}	TAA	S_{CR}	ANC_E	Net Acidity	
Location	Depth/ mBGL		pH units	pH units	pH units	LMHXV	pH units	%S	%S	%S	%S	
Assessment Criteria			4	4	1	NV	NV	0.03	0.03	NV	0.03	NV
BH01	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics	6.6	4.0	2.6	M	5.8	<0.02	<0.005	. . .	<0.02	NASS
	0.25		6.2	3.9	2.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		6.0	4.1	1.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.9	4.2	1.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.7	4.2	1.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		5.6	4.3	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		5.5	4.4	1.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		5.5	4.2	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		5.7	4.5	1.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		5.8	4.6	1.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		5.7	4.7	1.0	L	. . .	. . .	. . .	. . .	. . .	. . .
BH02	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics	5.3	3.7	1.6	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		5.3	3.9	1.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		5.3	4.0	1.3	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.2	3.8	1.4	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.7	4.4	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		5.8	4.5	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		5.9	4.5	1.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		6.2	4.5	1.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		6.0	4.5	1.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		6.2	4.4	1.8	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		6.6	4.5	2.1	M	5.9	<0.02	<0.005	. . .	<0.02	NASS
BH03	0.00	CLAY: medium plasticity, 70-80% fines, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	4.9	2.6	2.3	V	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		4.9	3.6	1.3	V	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		4.9	2.1	2.8	V	4.7	0.09	<0.005	. . .	0.09	AASS
	0.75		4.9	2.2	2.7	H	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		4.9	2.4	2.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		4.9	2.6	2.3	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		4.9	4.4	0.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75	Silty CLAY: medium plasticity, 80% fines, pale grey-brown, with some fine to medium grained sand	4.8	4.8	0.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		4.8	4.6	0.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		4.7	4.6	0.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		4.7	4.4	0.3	L	. . .	. . .	. . .	. . .	. . .	. . .
BH05	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics	6.1	4.9	1.2	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		6.1	4.7	1.4	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		5.9	5.0	0.9	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		6.0	5.1	0.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		6.0	5.0	1.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		6.1	5.0	1.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		5.9	4.9	1.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		5.8	4.9	0.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		5.9	4.1	1.8	L	5.6	<0.02	<0.005	. . .	<0.02	NASS
	2.25		5.7	4.9	0.8	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		5.7	4.7	1.0	L	. . .	. . .	. . .	. . .	. . .	. . .
BH06	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics	5.3	4.2	1.1	4.2	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		5.4	3.6	1.8	3.6	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		5.3	3.4	1.9	3.4	5.5	<0.02	<0.005	. . .	<0.02	NASS
	0.75		5.4	3.8	1.6	3.8	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.9	4.1	1.8	4.1	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		6.0	4.3	1.7	4.3	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		6.0	4.4	1.6	4.4	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		6.2	4.6	1.6	4.6	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		6.1	4.7	1.4	4.7	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		6.1	4.7	1.4	4.7	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		6.1	4.7	1.4	4.7	. . .	. . .	. . .	. . .	. . .	. . .

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Field Observations							Lab pH	CRS				ASS Classification
Sample ID		Soil Description	pH_f	pH_{fox}	$pH_f - pH_{fox}$	Reaction Rate	pH_{KCl}	TAA	S_{CR}	ANC_E	Net Acidity	
Location	Depth/ mBGL		pH units	pH units	pH units	LMHXV	pH units	%S	%S	%S	%S	
Assessment Criteria			4	4	1	NV	NV	0.03	0.03	NV	0.03	NV
BH07	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, brown-grey, trace rootlets, trace organics, trace low plasticity fines	**4.5**	3.6	0.9	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		4.9	4.1	0.8	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	Sandy CLAY/Clayey SAND: medium plasticity, dark grey mottled pale brown, 40-60% fines, fine to coarse grained sand	4.9	3.9	1.0	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.0	3.8	1.2	H	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		4.9	4.0	0.9	H	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		5.6	4.1	1.5	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		5.1	3.7	1.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		5.1	3.5	1.6	L	4.9	0.05	<0.005	. . .	0.05	AASS
	2.00		4.9	3.5	1.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		4.8	3.7	1.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		5.0	3.7	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
BH08	0.00	Organic CLAY: medium plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	5.5	2.5	3.0	V	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		5.0	2.6	2.4	X	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	Silty CLAY: high plasticity, grey mottled brown, trace fine to coarse grained sand, trace organics	5.2	2.8	2.4	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.3	2.6	2.7	H	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.5	2.3	3.2	H	4.7	0.05	<0.005	. . .	0.05	AASS
	1.25		5.3	2.4	2.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		5.1	2.4	2.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		5.0	4.3	0.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		4.9	3.0	1.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		4.9	3.2	1.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		4.8	4.6	0.2	L	. . .	. . .	. . .	. . .	. . .	. . .
BH09	0.00	Organic CLAY: medium plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	5.7	3.7	2.0	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		5.4	3.7	1.7	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	Clayey/Silty SAND: fine to medium grained, sub-angular to sub-rounded, dark grey mottled brown, low to medium plasticity fines	5.0	2.7	2.3	H	4.9	0.06	<0.005	. . .	0.06	AASS
	0.75		5.6	3.3	2.3	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.7	3.5	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		5.9	4.4	1.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50	Increasing fines content, becoming Silty CLAY, with some sand	5.4	4.4	1.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		5.7	4.8	0.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		5.3	5.0	0.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		5.6	4.9	0.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		5.9	5.2	0.7	L	. . .	. . .	. . .	. . .	. . .	. . .
BH11	0.00	Organic CLAY: medium plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	**7.2**	3.4	3.8	V	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		**7.2**	3.3	3.9	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	Silty CLAY: high plasticity, dark grey, trace fine grained sand	**7.2**	3.2	4.0	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		**7.2**	3.2	4.0	H	5	0.04	<0.005	. . .	0.04	AASS
	1.00		**7.2**	3.3	3.9	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		**7.2**	3.4	3.8	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		**7.2**	3.4	3.8	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		7.1	3.4	3.7	M	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		7.1	3.7	3.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		7.1	3.8	3.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		7.1	3.9	3.2	L	. . .	. . .	. . .	. . .	. . .	. . .
BH12	0.00	Organic CLAY: medium plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	**7.2**	4.7	2.5	X	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		**7.2**	4.6	2.6	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	Sandy CLAY: high plasticity, dark grey, fine to coarse grained sand	**7.2**	4.5	2.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		**7.2**	4.3	2.9	H	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		**7.2**	4.3	2.9	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		**7.2**	4.4	2.8	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		**7.2**	4.5	2.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		**7.2**	4.2	3.0	L	4.8	0.06	<0.005	. . .	0.06	AASS
	2.00		**7.2**	4.2	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		**7.2**	4.3	2.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		**7.2**	4.2	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .

Field Observations							Lab pH	CRS				ASS Classification
Sample ID		Soil Description	pH_f	pH_{fox}	pH_f - pH_{fox}	Reaction Rate	pH_{KCl}	TAA	S_{CR}	ANC_E	Net Acidity	
Location	Depth/ mBGL		pH units	pH units	pH units	LMHXV	pH units	%S	%S	%S	%S	
Assessment Criteria			4	4	1	NV	NV	0.03	0.03	NV	0.03	NV
BH14	0.00	Organic CLAY: medium plasticity, fines, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	5.6	1.8	3.8	X	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		5.3	1.5	3.8	V	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	Silty CLAY: high plasticity, grey mottled brown, trace fine to coarse grained sand	5.7	1.9	3.8	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.8	2.0	3.8	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.2	2.2	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		5.0	2.1	2.9	L	4.8	0.04	<0.005	. . .	0.04	AASS
	1.50		5.0	2.0	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		5.1	2.1	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		5.2	2.2	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		5.2	1.9	3.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		5.5	2.1	3.4	L	. . .	. . .	. . .	. . .	. . .	. . .
BH16	0.00	Organic CLAY: medium plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	6.1	2.9	3.2	V	4.6	0.13	<0.005	. . .	0.13	AASS
	0.25		6.1	3.8	2.3	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	Silty CLAY: high plasticity, grey mottled brown, trace fine to medium grained sand	5.6	3.9	1.7	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.6	4.0	1.6	H	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		6.1	4.2	1.9	H	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		6.1	4.9	1.2	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		6.5	4.6	1.9	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		6.5	4.7	1.8	M	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		7.0	4.8	2.2	H	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		7.0	4.9	2.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		7.1	5.1	2.0	L	. . .	. . .	. . .	. . .	. . .	. . .
BH18	0.00	FILL: SAND, fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics	6.1	3.9	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		6.1	3.9	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.50	SAND: fine to coarse grained, sub-angular to sub-rounded, brown-grey	6.4	3.7	2.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		6.5	3.6	2.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		6.5	3.8	2.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		6.3	3.6	2.7	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		6.2	3.4	2.8	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		6.3	3.2	3.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		6.2	3.1	3.1	L	5.8	<0.02	<0.005	. . .	<0.02	NASS
	2.25		6.4	3.3	3.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		6.4	3.5	2.9	L	. . .	. . .	. . .	. . .	. . .	. . .
BH19	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace rootlets, trace low plasticity fines	6.1	2.5	3.6	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		6.0	2.3	3.7	M	5.4	<0.02	<0.005	. . .	<0.02	NASS
	0.50		6.2	3.7	2.5	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		6.2	4.4	1.8	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.00	Clayey SAND/Sandy CLAY: medium plasticity fines, fine to coarse grained sand, dark grey	6.3	3.3	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		6.2	3.7	2.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		6.2	3.4	2.8	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		6.2	3.2	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		6.3	3.4	2.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		6.1	3.3	2.8	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		5.8	3.5	2.3	L	. . .	. . .	. . .	. . .	. . .	. . .
BH20	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace low plasticity fines	5.6	3.0	2.6	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		5.6	2.8	2.8	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		5.6	2.4	3.2	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.6	2.4	3.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.7	2.5	3.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		5.6	2.4	3.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		5.9	2.6	3.3	L	5.7	<0.02	<0.005	. . .	<0.002	NASS
	1.75		5.6	2.5	3.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		5.6	2.6	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		5.8	2.7	3.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		5.7	2.5	3.2	L	. . .	. . .	. . .	. . .	. . .	. . .

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Field Observations							Lab pH	CRS				ASS Classification
Sample ID		Soil Description	pH_f	pH_{fox}	pH_f - pH_{fox}	Reaction Rate	pH_{KCl}	TAA	S_{CR}	ANC_E	Net Acidity	
Location	Depth/ mBGL		pH units	pH units	pH units	LMHXV	pH units	%S	%S	%S	%S	
Assessment Criteria			4	4	1	NV	NV	0.03	0.03	NV	0.03	NV
BH21	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics, trace low plasticity fines	5.3	4.0	1.3	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		5.3	3.8	1.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		5.3	3.8	1.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.5	3.4	2.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.5	3.2	2.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		5.5	3.1	2.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		5.5	3.3	2.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		5.6	3.3	2.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		5.7	3.3	2.4	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		5.8	3.1	2.7	L	5.9	<0.02	<0.005	. . .	<0.02	NASS
	2.50		5.7	3.3	2.4	L	. . .	. . .	. . .	. . .	. . .	. . .
BH22	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace rootlets, trace fines	5.6	4.1	1.5	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		6.0	3.5	2.5	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		5.8	3.3	2.5	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.9	3.3	2.6	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.9	3.3	2.6	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		6.0	3.4	2.6	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, grey, medium plasticity fines	6.3	3.4	2.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		5.7	3.1	2.6	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		6.1	2.8	3.3	L	5.5	<0.02	<0.005	. . .	<0.02	NASS
	2.25		5.7	3.1	2.6	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		6.0	3.0	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
BH23	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace rootlets, trace fines	5.4	4.5	0.9	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		5.3	4.2	1.1	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		5.2	3.9	1.3	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.1	3.8	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.0	3.7	1.3	L	5.3	<0.02	<0.005	. . .	<0.02	NASS
	1.25		5.2	3.9	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		5.2	3.9	1.3	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		5.1	4.0	1.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		5.1	3.9	1.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		5.0	4.0	1.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		5.2	4.1	1.1	L	. . .	. . .	. . .	. . .	. . .	. . .
BH24	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace rootlets, trace organics, trace low plasticity fines	5.9	2.9	3.0	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.25		6.0	3.4	2.6	M	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		6.1	3.6	2.5	L	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		6.1	3.2	2.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		6.2	3.6	2.6	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		6.2	3.3	2.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.50		6.3	3.4	2.9	L	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		6.3	3.2	3.1	L	5.9	<0.02	<0.005	. . .	<0.02	NASS
	2.00		6.6	3.4	3.2	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		6.3	3.3	3.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		6.5	3.4	3.1	L	. . .	. . .	. . .	. . .	. . .	. . .
BH25	0.00	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics, trace fines	5.5	1.7	3.8	V	5.3	<0.02	0.059	. . .	0.059	PASS
	0.25		5.4	1.9	3.5	V	. . .	. . .	. . .	. . .	. . .	. . .
	0.50		5.5	2.4	3.1	H	. . .	. . .	. . .	. . .	. . .	. . .
	0.75		5.4	2.5	2.9	H	. . .	. . .	. . .	. . .	. . .	. . .
	1.00		5.6	3.0	2.6	H	. . .	. . .	. . .	. . .	. . .	. . .
	1.25		5.6	3.9	1.7	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.50	Sandy CLAY: fine to coarse grained, sub-angular to sub-rounded, dark grey, medium plasticity fines	5.6	4.2	1.4	M	. . .	. . .	. . .	. . .	. . .	. . .
	1.75		5.3	4.3	1.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.00		5.4	4.3	1.1	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.25		5.4	4.4	1.0	L	. . .	. . .	. . .	. . .	. . .	. . .
	2.50		5.2	4.3	0.9	L	. . .	. . .	. . .	. . .	. . .	. . .

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Figures

Legend

- Site Boundary
- Buffer Zone
- Borehole
- Dynamic Cone Penetration
- Hand Excavation
- Infiltration Test

N

0 40 80 120 160 200
Meters

SCALE	1:2,500 (A3)
DRAWN	DAC
DATE DRAWN	24/11/2015
CHECKED	–
DATE CHECKED	–
PROJECTION	GDA 1994 MGA Zone 50

Galt Geotechnics Pty Ltd
ACN : 138 490 865
Tel : +61 (0)8 6272-0200
Fax : +61 (0)8 9285 8444
Address : U2, 39 Flynn Street, Wembley, WA, 6014

CLIENT	ABN GROUP
PROJECT	PROPOSED RESIDENTIAL SUBDIVISION
LOCATION	939 & 993 BALDIVIS ROAD BALDIVIS
TITLE	SITE & LOCATION PLAN
Job No	J1501236
Fig No	FIGURE 1
Rev	A

O:\Jobs\2015\J1501236 - ABN Group SI Baldivis\09 GIS\04 MXD\J1501236-001.mxd (DamonClark) 24/11/2015 3:58:33 PM

389,750 390,000 390,250

6,419,250 6,419,000 6,418,750

BH01 NASS
BH02 NASS
BH03 0.09%S @ 0.5m bgl
BH05 NASS
BH06 NASS
BH07 0.05%S @ 1.75m bgl
BH08 0.05%S @ 1m bgl
BH09 0.06%S @ 0.5m bgl
BH11 0.04%S @ 0.75m bgl
BH12 0.06%S @ 1.75m bgl
BH14 0.04%S @ 1.25m bgl
BH16 0.13%S @ 0m bgl
BH18 NASS
BH19 NASS
BH20 NASS
BH21 NASS
BH22 NASS
BH23 NASS
BH24 NASS
BH25 0.059%S @ 0m bgl

Legend

- Site Boundary
- Buffer Zone
- Borehole

ACID SULFATE SOIL

- AASS *Showing % of Acid Sulfate at depth (m) below ground level*
- PASS *Showing % of Acid Sulfate at depth (m) below ground level*
- NASS *No acid sulfate detected*

N

0 40 80 120 160 200
Meters

SCALE	1:2,500 (A3)
DRAWN	DAC
DATE DRAWN	24/11/2015
CHECKED	_
DATE CHECKED	_
PROJECTION	GDA 1994 MGA Zone 50

Galt Geotechnics Pty Ltd
ACN : 138 490 865
Tel : +61 (0)8 6272-0200
Fax : +61 (0)8 9285 8444
Address : U2, 39 Flynn Street, Wembley, WA, 6014

CLIENT	**ABN GROUP**
PROJECT	PROPOSED RESIDENTIAL SUBDIVISION
LOCATION	939 & 993 BALDIVIS ROAD BALDIVIS
TITLE	ACID SULFATE SOIL TESTING
Job No	J1501236
Fig No	FIGURE 2
Rev	**A**

Appendix A: Site Photographs

www.galtgeo.com.au
2/39 Flynn St, WEMBLEY WA 6014

ABN: 64 625 054 729

Photograph 1: Typical surface cover across the site. Western portion of site looking east.

Photograph 2: South of site looking north west.

Photograph 3: Shrinkage cracks in Organic Clay material in east of site

Photograph 4: Drain in east of the site, looking north

Appendix B: Borehole Reports

www.galtgeo.com.au
2/39 Flynn St, WEMBLEY WA 6014
ABN: 64 625 054 729

EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS

METHOD OF DRILLING OR EXCAVATION

AC	Air Core	E	Excavator	PQ3	PQ3 Core Barrel
AD/T	Auger Drilling with TC-Bit	EH	Excavator with Hammer	PT	Push Tube
AD/V	Auger Drilling with V-Bit	HA	Hand Auger	R	Ripper
AT	Air Track	HMLC	HMLC Core Barrel	RR	Rock Roller
B	Bulldozer Blade	HQ3	HQ3 Core Barrel	SON	Sonic Rig
BH	Backhoe Bucket	N	Natural Exposure	SPT	Driven SPT
CT	Cable Tool	NMLC	NMLC Core Barrel	WB	Washbore
DT	Diatube	PP	Push Probe	X	Existing Excavation

SUPPORT

T	Timbering

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

VE	Very Easy	E	Easy	F	Firm
H	Hard	VH	Very Hard		

WATER

►	Water Inflow	▼	Water Level
◄	Water Loss (complete)		
◁	Water Loss (partial)		

SAMPLING AND TESTING

B	Bulk Disturbed Sample	P	Piston Sample
BLK	Block Sample	PBT	Plate Bearing Test
C	Core Sample	U	Undisturbed Push-in Sample
CBR	CBR Mould Sample		U50: 50 mm diameter
D	Small Disturbed Sample	SPT	Standard Penetration Test
ES	Environmental Soil Sample		Example: 3, 4, 5 N=9
EW	Environmental Water Sample		3,4,5: Blows per 150 mm
G	Gas Sample		N=9: Blows per 300 mm after
HP	Hand Penetrometer		150 mm seating interval
LB	Large Bulk Disturbed Sample	VS	Vane Shear; P = Peak
M	Mazier Type Sample		R = Remoulded (kPa)
MC	Moisture Content Sample	W	Water Sample

ROCK CORE RECOVERY

TCR = Total Core Recovery (%) $= \frac{CRL}{TCL} \times 100$

SCR = Solid Core Recovery (%) $= \frac{CCR}{TCL} \times 100$

RQD = Rock Quality Designation (%) $= \frac{ALC>100}{TCL} \times 100$

TCL	Length of Core Run
CRL	Recovered Length of Core
CCR	Total Length of Cylindrical Pieces of Core Recovered
ALC>100	Total Length of Axial Lengths of Core Greater than 100 mm Long

METHOD OF SOIL DESCRIPTION
BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG & UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) SYMBOLS

Graphic	USCS	Soil Name
		FILL (various types)
		COBBLES
		BOULDERS
	GP	GRAVEL (poorly graded)
	GW	GRAVEL (well graded)
	GC	Clayey GRAVEL
	SP	SAND (poorly graded)
	SW	SAND (well graded)
	SC	Clayey SAND

Graphic	USCS	Soil Name
	SM	Silty SAND
	ML	SILT (low liquid limit)
	MH	SILT (high liquid limit)
	CL	CLAY (low plasticity)
	CI	CLAY (medium plasticity)
	CH	CLAY (high plasticity)
	OL	Organic SILT (low liquid limit)
	OH	Organic SILT (high liquid limit)
	Pt	PEAT

RESISTANCE TO EXCAVATION

Symbol	Term	Description
VE	Very easy	All resistances are relative to the selected method of excavation
E	Easy	
F	Firm	
H	Hard	
VH	Very hard	

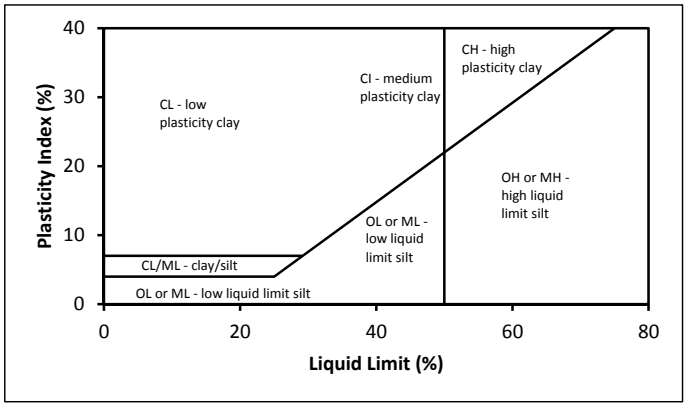
SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil descriptions are based on AS1726-1993, Appendix A. Material properties are assessed in the field by visual/tactile methods in combination with field testing techniques (where used).

PARTICLE SIZE

Soil Name		Particle Size (mm)
BOULDERS		>200
COBBLES		63 to 200
GRAVEL	Coarse	20 to 63
	Medium	6 to 20
	Fine	2 to 6
SAND	Coarse	0.6 to 2.0
	Medium	0.2 to 0.6
	Fine	0.075 to 0.2
FINES	SILT	0.002 to 0.075
	CLAY	<0.002

PLASTICITY PROPERTIES



MOISTURE CONDITION

AS1726-1993

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays and silts may be brittle or friable and powdery.
M	Moist	Soils are darker than in the dry condition and may feel cool. Sands and gravels tend to cohere.
W	Wet	Soils exude free water. Sands and gravels tend to cohere.

CONSISTENCY AND DENSITY

AS1726-1993 and HB160-2006

Symbol	Term	Undrained Shear Strength (kPa)	SPT "N"	DCP blows per 100 mm
VS	Very Soft	0 to 12	0 to 2	<1
S	Soft	12 to 25	2 to 4	<1
F	Firm	25 to 50	4 to 8	1 to 2
St	Stiff	50 to 100	8 to 15	3 to 4
VSt	Very Stiff	100 to 200	15 to 30	5 to 10
H	Hard	>200	>30	>10

Symbol	Term	Density Index (%)	SPT "N"	DCP blows per 100 mm	PSP Blows per 300 mm
VL	Very Loose	<15	0 to 4	<1	0 to 2
L	Loose	15 to 35	4 to 10	1 to 2	2 to 6
MD	Medium Dense	35 to 65	10 to 30	2 to 3	6 to 8
D	Dense	65 to 85	30 to 50	4 to 8	8 to 15
VD	Very Dense	>85	>50	>8	>15

Note: PSP correlations only valid to 450 mm depth

Consistency and density may also be inferred from excavation performance and material behaviour.

BOREHOLE: BH01

Job Number:	J1501236	**Easting:**	389982 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419296 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH01/0.00-*BH01-1*				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics	D	MD	No density testing conducted below 0.9 m
			0.5		ES-BH01/0.25-*BH01-1*					No rootlets, no organics		D	
			1.0		ES-BH01/0.50-*BH01-1*								
					ES-BH01/0.75-*BH01-1*								
					ES-BH01/1.00-*BH01-1*								
					ES-BH01/1.25-*BH01-1*						M		
			1.5		ES-BH01/1.50-*BH01-1*								
					ES-BH01/1.75-*BH01-1*					Becoming brown, trace low plasticity fines			
			2.0		ES-BH01/2.00-*BH01-1*								
		▼			ES-BH01/2.25-*BH01-1*						W		
			2.5		ES-BH01/2.50-*BH01-1*					Hole terminated at 2.50 m Target depth Groundwater encountered at 2.2m			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH02

Job Number:	J1501236	**Easting:**	390059 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419294 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH02/0.00-*BH02-1*				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics	D	MD	No density testing conducted below 1.8 m
			0.5		ES-BH02/0.25-*BH02-1*								
					ES-BH02/0.50-*BH02-1*								
					ES-BH02/0.75-*BH02-1*								
			1.0		ES-BH02/1.00-*BH02-1*					Becoming dark grey, no rootlets, no organics	M		
					ES-BH02/1.25-*BH02-1*								
			1.5		ES-BH02/1.50-*BH02-1*					Trace low plasticity fines, becoming silty			
		▼			ES-BH02/1.75-*BH02-1*								
			2.0		ES-BH02/2.00-*BH02-1*						W		
					ES-BH02/2.25-*BH02-1*								
			2.5		ES-BH02/2.50-*BH02-1*					Hole terminated at 2.50 m Target depth Groundwater encountered at 1.9m			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH03

Job Number:	J1501236	**Easting:**	390153 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419290 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH03/0.00-*BH03-1*				OH	Organic CLAY: medium to high plasticity, dark brown, with some organics, trace rootlets	M	F - St	No density testing conducted below 0.9 m
			0.5		ES-BH03/0.50-*BH03-1*				CH	CLAY: high plasticity, dark grey mottled brown, trace sand and organics			
			1.0		ES-BH03/1.00-*BH03-1*								
			1.5		ES-BH03/1.50-*BH03-1*								
			2.0		ES-BH03/2.00-*BH03-1*								
			2.5		ES-BH03/2.50-*BH03-1*					Hole terminated at 2.50 m Target depth Groundwater not encountered			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH05

Job Number:	J1501236	**Easting:**	390238 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419289 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH			0.0		ES-BH05/0.00-*BH05-1*				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics	D	MD - D	No density testing conducted below 0.9 m
					ES-BH05/0.25-*BH05-1*								
			0.5		ES-BH05/0.50-*BH05-1*					No rootlets, no organics			
					ES-BH05/0.75-*BH05-1*								
			1.0		ES-BH05/1.00-*BH05-1*					Pale grey			
					ES-BH05/1.25-*BH05-1*						M		
			1.5		ES-BH05/1.50-*BH05-1*					Becoming brown with depth			
					ES-BH05/1.75-*BH05-1*								
			2.0		ES-BH05/2.00-*BH05-1*								
		▼			ES-BH05/2.25-*BH05-1*						W		
			2.5		ES-BH05/2.50-*BH05-1*					Hole terminated at 2.50 m Target depth Groundwater encountered at 2.3m			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH06

Job Number:	J1501236	**Easting:**	390058 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419191 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA		▼	0.0		ES-BH06/0.00-*BH06-1*				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics	D	MD - D	No density testing conducted below 0.9 m
			0.5		ES-BH06/0.25-*BH06-1*								
					ES-BH06/0.50-*BH06-1*						M		
					ES-BH06/0.75-*BH06-1*								
			1.0		ES-BH06/1.00-*BH06-1*					Dark grey, no rootlets, no organics			
					ES-BH06/1.25-*BH06-1*								
			1.5		ES-BH06/1.50-*BH06-1*					Grey	W		
					ES-BH06/1.75-*BH06-1*								
			2.0		ES-BH06/2.00-*BH06-1*								
					ES-BH06/2.25-*BH06-1*								
			2.5		ES-BH06/2.50-*BH06-1*					Hole terminated at 2.50 m Target depth Groundwater encountered at 1.4m			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH07

Job Number:	J1501236	**Easting:**	390106 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419236 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH07/0.00-*BH07-1*				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, brown-grey, trace rootlets, trace organics, trace low plasticity fines	D	MD	No density testing conducted below 1.0 m
					ES-BH07/0.25-*BH07-1*							L	
			0.5		ES-BH07/0.50-*BH07-1*					Sandy CLAY/Clayey SAND: medium plasticity, dark grey mottled pale brown, 40-60% fines, fine to coarse grained sand		F - St	
					ES-BH07/0.75-*BH07-1*								
			1.0		ES-BH07/1.00-*BH07-1*								
					ES-BH07/1.25-*BH07-1*								
			1.5		ES-BH07/1.50-*BH07-1*				SC-Cl		M		
					ES-BH07/1.75-*BH07-1*								
			2.0		ES-BH07/2.00-*BH07-1*								
					ES-BH07/2.25-*BH07-1*								
			2.5		ES-BH07/2.50-*BH07-1*					Hole terminated at 2.50 m Target depth			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH08

Job Number:	J1501236	**Easting:**	390192 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419228 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH08/0.00- *BH08-1*				OH	Organic CLAY: medium to high plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	D	VS - S	No density testing conducted below 0.9 m
			0.5		ES-BH08/0.25- *BH08-1*					CLAY: high plasticity, grey mottled brown, trace fine to coarse grained sand, trace organics		F - St	
			1.0		ES-BH08/0.50- *BH08-1*								
					ES-BH08/0.75- *BH08-1*								
					ES-BH08/1.00- *BH08-1*								
					ES-BH08/1.25- *BH08-1*								
			1.5		ES-BH08/1.50- *BH08-1* B(BH08-01)				CH		M		
					ES-BH08/1.75- *BH08-1*					Becoming pale grey-brown			
			2.0		ES-BH08/2.00- *BH08-1*								
					ES-BH08/2.25- *BH08-1*								
			2.5		ES-BH08/2.50- *BH08-1*								
					ES-BH08/2.75- *BH08-1*								
			3.0							Hole terminated at 2.80 m Target depth Groundwater not encountered			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH09

Job Number:	J1501236	**Easting:**	390154 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419166 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH09/0.00-*BH09-1*				OH	Organic CLAY: medium plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	M	St	No density testing conducted below 1.8 m
					ES-BH09/0.25-*BH09-1*								
			0.5		ES-BH09/0.50-*BH09-1*				SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, dark grey mottled brown, 20-30% low to medium plasticity fines		F	
					ES-BH09/0.75-*BH09-1*								
			1.0		ES-BH09/1.00-*BH09-1*								
					ES-BH09/1.25-*BH09-1*								
			1.5		ES-BH09/1.50-*BH09-1*				CI	Increasing fines content, becoming Silty CLAY, with some sand		St	
					ES-BH09/1.75-*BH09-1*								
			2.0		ES-BH09/2.00-*BH09-1*								
					ES-BH09/2.25-*BH09-1*								
			2.5		ES-BH09/2.50-*BH09-1*					Hole terminated at 2.50 m Target depth Groundwater not encountered			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH10

Job Number:	J1501236	**Easting:**	390239 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419165 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0						CH	CLAY: high plasticity, dark grey, trace fine to coarse grained sand, trace rootlets	W		Density not assessed
			0.5							No rootlets			
			1.0										
			1.5							Hole terminated at 1.50 m Target depth			
			2.0										
			2.5										
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH11

Job Number:	J1501236	**Easting:**	390173 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419109 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH11/0.00-*BH11-1*				OH	Organic CLAY: medium to high plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	D		No density testing conducted below 0.9 m
			0.5		ES-BH11/0.25-*BH11-1* ES-BH11/0.50-*BH11-1* ES-BH11/0.75-*BH11-1*				CH	CLAY: high plasticity, dark grey, trace fine grained sand	M	F - St	
			1.0		ES-BH11/1.00-*BH11-1* ES-BH11/1.25-*BH11-1*								
			1.5		ES-BH11/1.50-*BH11-1* ES-BH11/1.75-*BH11-1*								
			2.0		ES-BH11/2.00-*BH11-1* ES-BH11/2.25-*BH11-1*								
			2.5		ES-BH11/2.50-*BH11-1*					Hole terminated at 2.50 m Target depth Groundwater not encountered			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH12

Job Number:	J1501236	**Easting:**	390262 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419097 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH12/0.00-*BH12-1*				OH	Organic CLAY: medium to high plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets		F - St	No density testing conducted below 0.9 m
			0.5		ES-BH12/0.50-*BH12-1*				CH	CLAY: high plasticity, dark grey, fine to coarse grained sand	M		
					ES-BH12/0.75-*BH12-1*								
			1.0		ES-BH12/1.00-*BH12-1*								
					ES-BH12/1.25-*BH12-1*								
			1.5		ES-BH12/1.50-*BH12-1*								
					ES-BH12/1.75-*BH12-1*						M		
			2.0		ES-BH12/2.00-*BH12-1*								
					ES-BH12/2.25-*BH12-1*								
			2.5		ES-BH12/2.50-*BH12-1*					Hole terminated at 2.50 m Target depth Groundwater not encountered			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH13

Job Number:	J1501236	**Easting:**	390240 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419032 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0						CH	CLAY: high plasticity, grey mottled brown, with some (10%) fine to coarse grained sand, with some organics and rootlets	W		Density not assessed
			0.5							No rootlets			
			1.0		B(BH13-01)								
			1.5							Hole terminated at 1.50 m Target depth Groundwater not encountered			
			2.0										
			2.5										
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH14

Job Number:	J1501236	**Easting:**	390266 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6418968 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH14/0.00-*BH14-1*				OH	Organic CLAY: medium plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets			No density testing conducted below 0.9 m
					ES-BH14/0.25-*BH14-1*				CH	CLAY: high plasticity, grey mottled brown, trace fine to coarse grained sand		F - St	
			0.5		ES-BH14/0.50-*BH14-1* B(BH14-01)								
					ES-BH14/0.75-*BH14-1*								
			1.0		ES-BH14/1.00-*BH14-1*						M		
					ES-BH14/1.25-*BH14-1*								
			1.5		ES-BH14/1.50-*BH14-1*								
					ES-BH14/1.75-*BH14-1*								
			2.0		ES-BH14/2.00-*BH14-1*								
					ES-BH14/2.25-*BH14-1*						W		
			2.5		ES-BH14/2.50-*BH14-1*					Hole terminated at 2.50 m Target depth Groundwater not encountered			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH16

Job Number:	J1501236	**Easting:**	390269 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6418845 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH16/0.00- *BH16-1*				OH	Organic CLAY: medium to high plasticity, dark brown, with some fine to coarse grained sand, with some organics, trace rootlets	D	F	No density testing conducted below 0.9 m
			0.5		ES-BH16/0.50- *BH16-1*					CLAY: high plasticity, grey mottled brown, trace fine to medium grained sand			
					ES-BH16/0.75- *BH16-1*								
			1.0		ES-BH16/1.00- *BH16-1*								
					ES-BH16/1.25- *BH16-1*								
			1.5		ES-BH16/1.50- *BH16-1*				CH		M		
					ES-BH16/1.75- *BH16-1*								
			2.0		ES-BH16/2.00- *BH16-1* B(BH16-01)					Becoming pale brown			
					ES-BH16/2.25- *BH16-1*								
			2.5		ES-BH16/2.50- *BH16-1*					Hole terminated at 2.50 m Target depth Groundwater not encountered			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH17

Job Number:	J1501236	**Easting:**	390241 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6418782 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0						CI	CLAY: medium to high plasticity fines, dark grey, trace organics	W		Density not assessed
			0.5										
			1.0										
			1.5							Hole terminated at 1.50 m Target depth Groundwater not encountered			
			2.0										
			2.5										
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH18

Job Number:	J1501236	**Easting:**	390023 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419051 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH18/0.00-*BH18-1*				SP	FILL: SAND, fine to coarse grained, sub-angular to sub-rounded, gray, trace rootlets, trace organics	D	MD	No density testing conducted below 0.9 m
					ES-BH18/0.25-*BH18-1*					SAND: fine to coarse grained, sub-angular to sub-rounded, brown-grey			
			0.5		ES-BH18/0.50-*BH18-1*							VD	
					ES-BH18/0.75-*BH18-1*						M		
			1.0		ES-BH18/1.00-*BH18-1*								
					ES-BH18/1.25-*BH18-1*				SP				
			1.5		ES-BH18/1.50-*BH18-1*					Becoming pale grey			
		▼			ES-BH18/1.75-*BH18-1*						W		
			2.0		ES-BH18/2.00-*BH18-1*								
					ES-BH18/2.25-*BH18-1*								
			2.5		ES-BH18/2.50-*BH18-1*					Hole terminated at 2.50 m Target depth Groundwater encountered at 1.7m			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH19

Job Number:	J1501236	**Easting:**	390089 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6419012 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH19/0.00-BH19-1				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace rootlets, trace low plasticity fines	D	VD	No density testing conducted below 0.9 m
					ES-BH19/0.25-BH19-1								
			0.5		ES-BH19/0.50-BH19-1							D	
					ES-BH19/0.75-BH19-1								
			1.0		ES-BH19/1.00-BH19-1					Clayey SAND/Sandy CLAY: medium plasticity fines, fine to coarse grained sand, dark grey	M		
					ES-BH19/1.25-BH19-1								
			1.5		ES-BH19/1.50-BH19-1				SC-CI				
					ES-BH19/1.75-BH19-1					Increasing fines content			
			2.0		ES-BH19/2.00-BH19-1								
					ES-BH19/2.25-BH19-1						W		
			2.5		ES-BH19/2.50-BH19-1					Hole terminated at 2.50 m Target depth Groundwater encountered at 2.4m			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH20

Job Number:	J1501236	**Easting:**	389962 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6418989 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH20/0.00-*BH20-1*				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace low plasticity fines	D	MD	No density testing conducted below 1.8 m
			0.5		ES-BH20/0.25-*BH20-1*								
					ES-BH20/0.50-*BH20-1*					Pale grey, no rootlets, no fines			
					ES-BH20/0.75-*BH20-1*								
			1.0		ES-BH20/1.00-*BH20-1*								
					ES-BH20/1.25-*BH20-1*						M		
			1.5		ES-BH20/1.50-*BH20-1*					Becoming brown			
					ES-BH20/1.75-*BH20-1*								
			2.0		ES-BH20/2.00-*BH20-1*								
					ES-BH20/2.25-*BH20-1*								
			2.5		ES-BH20/2.50-*BH20-1*					Hole terminated at 2.50 m Target depth Groundwater not encountered			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH21

Job Number:	J1501236	**Easting:**	390014 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6418924 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA		▼	0.0		ES-BH21/0.00-*BH21-1*				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics, trace low plasticity fines	D	MD	No density testing conducted below 0.9 m
			0.5		ES-BH21/0.25-*BH21-1*								
					ES-BH21/0.50-*BH21-1*								
					ES-BH21/0.75-*BH21-1*					No fines, no rootlets, no organics, becoming pale grey			
			1.0		ES-BH21/1.00-*BH21-1*								
					ES-BH21/1.25-*BH21-1*								
			1.5		ES-BH21/1.50-*BH21-1*						M		
					ES-BH21/1.75-*BH21-1*								
			2.0		ES-BH21/2.00-*BH21-1*								
					ES-BH21/2.25-*BH21-1*								
			2.5		ES-BH21/2.50-*BH21-1*					Hole terminated at 2.50 m Target depth Groundwater encountered at 1.8m			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH22

Job Number:	J1501236	**Easting:**	390089 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6418916 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH22/0.00-*BH22-1*				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace rootlets, trace fines	M	MD	No density testing conducted below 0.9 m
			0.5		ES-BH22/0.25-*BH22-1*								
					ES-BH22/0.50-*BH22-1*								
					ES-BH22/0.75-*BH22-1*								
			1.0		ES-BH22/1.00-*BH22-1*					No rootlets			
					ES-BH22/1.25-*BH22-1*								
			1.5		ES-BH22/1.50-*BH22-1*				SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, grey, medium plasticity fines	W		
					ES-BH22/1.75-*BH22-1*					Increasing fines content with depth			
			2.0		ES-BH22/2.00-*BH22-1*								
					ES-BH22/2.25-*BH22-1*								
		▼	2.5		ES-BH22/2.50-*BH22-1*					Hole terminated at 2.50 m Target depth Groundwater encountered at 2.5m			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH23

Job Number:	J1501236	**Easting:**	390041 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6418851 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH23/0.00-*BH23-1*				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace rootlets, trace fines	M	MD	No density testing conducted below 0.9 m
			0.5		ES-BH23/0.25-*BH23-1*								
					ES-BH23/0.50-*BH23-1*								
					ES-BH23/0.75-*BH23-1*								
			1.0		ES-BH23/1.00-*BH23-1*								
					ES-BH23/1.25-*BH23-1*								
			1.5		ES-BH23/1.50-*BH23-1*					Pale grey			
					ES-BH23/1.75-*BH23-1*								
		▼	2.0		ES-BH23/2.00-*BH23-1*						W		
					ES-BH23/2.25-*BH23-1*								
			2.5		ES-BH23/2.50-*BH23-1*					Hole terminated at 2.50 m Target depth Groundwater encountered at 2m			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH24

Job Number:	J1501236	**Easting:**	389973 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6418805 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA		▼	0.0		ES-BH24/0.00-*BH24-1* B(BH24-01)				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace rootlets, trace organics, trace low plasticity fines	M	MD	No density testing conducted below 0.9 m
			0.5		ES-BH24/0.25-*BH24-1*								
					ES-BH24/0.50-*BH24-1*					Grey, no rootlets, no organics, no fines			
			1.0		ES-BH24/0.75-*BH24-1*								
					ES-BH24/1.00-*BH24-1*								
					ES-BH24/1.25-*BH24-1*								
			1.5		ES-BH24/1.50-*BH24-1*					Pale grey	W		1.50: Hole collapse at 1.2 m after extraction. Groundwater inferred at 1.5 m.
					ES-BH24/1.75-*BH24-1*								
			2.0		ES-BH24/2.00-*BH24-1*								
					ES-BH24/2.25-*BH24-1*								
			2.5		ES-BH24/2.50-*BH24-1*					Hole terminated at 2.50 m Target depth Groundwater encountered at 1.5m			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

BOREHOLE: BH25

Job Number:	J1501236	**Easting:**	390093 m	**Contractor:**	Galt	**Date:**	23/10/2015
Client:	ABN Group	**Northing:**	6418801 m	**Drill Rig:**	Eziprobe	**Logged:**	SC
Project:	Proposed Residential Subdivision	**Datum:**	MGA94 Zone 50	**Inclination:**	-90°	**Checked Date:**	24/11/2015
Location:	939 & 993 Baldivis Road, Baldivis			**Hole Dia:**	100 mm	**Checked By:**	PCW

Drilling					Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	ACID SULPHATE SAMPLE	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
MA			0.0		ES-BH25/0.00-*BH25-1*				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets, trace organics, trace fines	D	MD	No density testing conducted below 0.9 m
					ES-BH25/0.25-*BH25-1*								
			0.5		ES-BH25/0.50-*BH25-1*					Mottled dark grey			
					ES-BH25/0.75-*BH25-1*						M		
			1.0		ES-BH25/1.00-*BH25-1*								
					ES-BH25/1.25-*BH25-1*								
			1.5		ES-BH25/1.50-*BH25-1*				CI	Sandy CLAY: fine to coarse grained, sub-angular to sub-rounded, dark grey, medium plasticity fines	W		
					ES-BH25/1.75-*BH25-1*								
			2.0		ES-BH25/2.00-*BH25-1*								
					ES-BH25/2.25-*BH25-1*								
			2.5		ES-BH25/2.50-*BH25-1*					Hole terminated at 2.50 m Target depth Groundwater not encountered			
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Appendix C: Penetrometer Test Results

www.galtgeo.com.au
2/39 Flynn St, WEMBLEY WA 6014
ABN: 64 625 054 729

DYNAMIC CONE PENETROMETER FIELD TEST DATA
(AS12896.3.2)

Client: ABN Group
Project: Proposed Residential Development
Location: 939 & 993 Baldivis Road, Baldivis

Job No: J1501236
Date: 23/10/2015
Engineer: SC

Test No:	DCP01	DCP02	DCP03						
Location:	RC01	RC02	RC03						
Depth (mm)	**No of Penetrometer Blows per 100 mm Depth Interval**								
0-100	-	-	-						
100-200	2	2	3						
200-300	4	1	3						
300-400	1	1	2						
400-500	0	0	3						
500-600	2	1	3						
600-700	3	2	4						
700-800	3	2	3						
800-900	3	3	4						
900-1000									
1000-1100									
1100-1200									
1200-1300									
1300-1400									
1400-1500									
1500-1600									
1600-1700									
1700-1800									
1800-1900									

Test No:									
Location:									
Depth (mm)	**No of Penetrometer Blows per 100 mm Depth Interval**								
0-100									
100-200									
200-300									
300-400									
400-500									
500-600									
600-700									
700-800									
800-900									
900-1000									
1000-1100									
1100-1200									
1200-1300									
1300-1400									
1400-1500									
1500-1600									
1600-1700									
1700-1800									

Dynamic Cone Penetrometer tests done in accordance with AS 1289.6.3.2
HB: Hammer bounce (refusal)
0 = Penetration due to hammer weight only
R: Refusal

DYNAMIC CONE PENETROMETER FIELD TEST DATA
(AS12896.3.2)

Client: ABN Group
Project: Proposed Residential Development
Location: 939 & 993 Baldivis Road, Baldivis
Job No: J1501236
Date: 23/10/2015
Engineer: SC

Test No:	DCP4	DCP05	DCP06	DCP07	DCP08	DCP09	DCP10	DCP11	DCP12
Location:	BH01	BH02	BH03	BH04	BH05	BH06	BH07	BH08	BH09
Depth (mm)	**No of Penetrometer Blows per 100 mm Depth Interval**								
0-100	-	-	-	Borehole not drilled due to access constraints	-	-	-	-	-
100-200	2	3	6		2	2	3	3	4
200-300	2	3	2		2	3	2	1	2
300-400	3	1	1		2	3	2	0	1
400-500	3	2	1		3	3	1	0	1
500-600	5	2	3		2	4	1	3	1
600-700	7	3	2		3	4	1	2	2
700-800	8	2	2		3	4	2	3	2
800-900	7	2	4		4	3	3	5	2
900-1000		2			4		3		5
1000-1100		2							2
1100-1200		3							2
1200-1300		3							3
1300-1400		3							4
1400-1500		4							4
1500-1600		3							5
1600-1700		4							4
1700-1800		3							4
1800-1900									5

Test No:	DCP13	DCP14	DCP15	DCP16	DCP17	DCP18	DCP19	DCP20	
Location:	BH10	BH11	BH12	BH13	BH14	BH15	BH16	BH17	
Depth (mm)	**No of Penetrometer Blows per 100 mm Depth Interval**								
0-100	Density not assessed	-	-	Density not assessed	-	Borehole not drilled due to access constraints	-	Density not assessed	
100-200		2	3		1		2		
200-300		2	2		2		1		
300-400		1	2		2		1		
400-500		1	3		1		1		
500-600		3	2		1		2		
600-700		3	3		2		2		
700-800		3	3		3		2		
800-900		4			4		3		
900-1000									
1000-1100									
1100-1200									
1200-1300									
1300-1400									
1400-1500									
1500-1600									
1600-1700									
1700-1800									

Dynamic Cone Penetrometer tests done in accordance with AS 1289.6.3.2
HB: Hammer bounce (refusal)
0 = Penetration due to hammer weight only
R: Refusal

PERTH SAND PENETROMETER FIELD TEST DATA (Standard Depth 900mm)
(AS12896.3.3)

Client: ABN Group
Project: Proposed Residential Development
Location: 939 & 993 Baldivis Road, Baldivis

Job No: J1501236
Date: 23/10/2015
Engineer: SC

Test No:	PSP01	PSP02	PSP03	PSP04	PSP05	PSP06	PSP07	PSP08
Location:	BH18	BH019	BH20	BH21	BH22	BH23	BH24	BH25
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**							
0-150	-	-	-	-	-	-	-	-
150-300	4	12	2	2	3	3	3	8
300-450	5	12	4	4	6	4	4	7
450-600	12	6	4	5	6	5	5	5
600-750	12	5	5	5	6	5	5	6
750-900	13	6	4	5	6	5	6	5
900-1050		7	3	6			5	6
1050-1200			3					
1200-1350			4					
1350-1500			5					
1500-1650			5					
1650-1800			5					
1800-1950								
1950-2100								

Test No:								
Location:								
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**							
0-150								
150-300								
300-450								
450-600								
600-750								
750-900								
900-1050								
1050-1200								
1200-1350								
1350-1500								
1500-1650								
1650-1800								
1800-1950								
1950-2100								

Test No:								
Location:								
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**							
0-150								
150-300								
300-450								
450-600								
600-750								
750-900								
900-1050								
1050-1200								
1200-1350								
1350-1500								
1500-1650								
1650-1800								

Perth Sand Penetrometer tests done in accordance with AS 1289.6.3.3 (except blow counts are reported per 150 mm, rather than 300 mm)
HB: Hammer bounce (refusal)
0 = Penetration due to hammer weight only
R: Refusal

Appendix D: Infiltration Test Results

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2/39 Flynn St, WEMBLEY WA 6014
ABN: 64 625 054 729

Permeability Calculation - Inverse Auger Hole Method

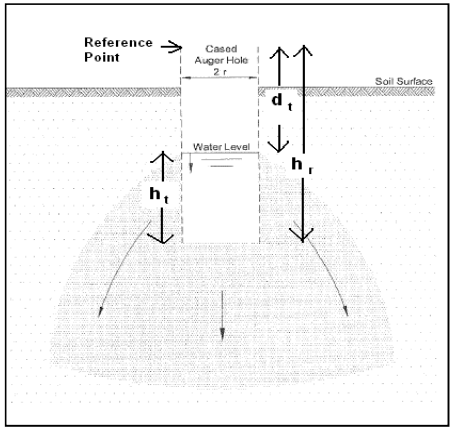
Galt Geotechnics

Job No:	J1501236
Client:	ABN Group
Site:	939 & 993 Baldivis Rd
Location:	Baldivis
Calc by:	SC
BH Name:	IT01
Test Depth:	0.55 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

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	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	0.7	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

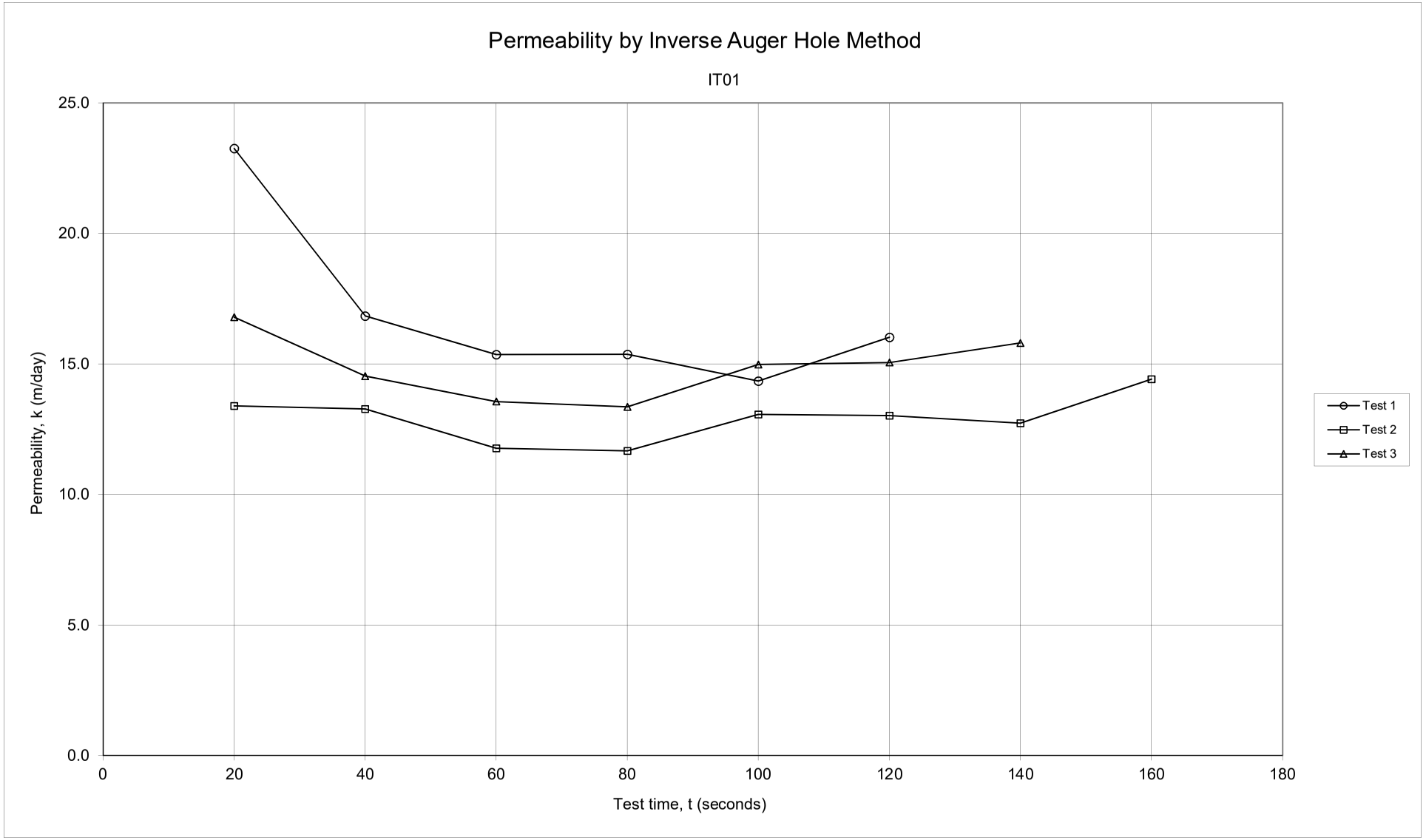
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.185	0.515		
20	0.345	0.355	2.7E-04	23.3
40	0.4	0.3	1.9E-04	16.8
60	0.455	0.245	1.8E-04	15.4
80	0.51	0.19	1.8E-04	15.4
100	0.54	0.16	1.7E-04	14.3
120	0.595	0.105	1.9E-04	16.0
		AVERAGE	2.0E-04	16.9

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.18	0.52		
20	0.28	0.42	1.6E-04	13.4
40	0.36	0.34	1.5E-04	13.3
60	0.405	0.295	1.4E-04	11.8
80	0.455	0.245	1.4E-04	11.7
100	0.52	0.18	1.5E-04	13.1
120	0.555	0.145	1.5E-04	13.0
140	0.58	0.12	1.5E-04	12.7
160	0.625	0.075	1.7E-04	14.4
		AVERAGE	1.5E-04	12.9

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.19	0.51		
20	0.31	0.39	1.9E-04	16.8
40	0.38	0.32	1.7E-04	14.5
60	0.435	0.265	1.6E-04	13.6
80	0.485	0.215	1.5E-04	13.4
100	0.55	0.15	1.7E-04	15.0
120	0.585	0.115	1.7E-04	15.1
140	0.62	0.08	1.8E-04	15.8
		AVERAGE	1.7E-04	14.9


Permeability by Inverse Auger Hole Method
IT01
Permeability, k (m/day)
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160
180
Test time, t (seconds)
Test 1
Test 2
Test 3

Permeability Calculation - Inverse Auger Hole Method

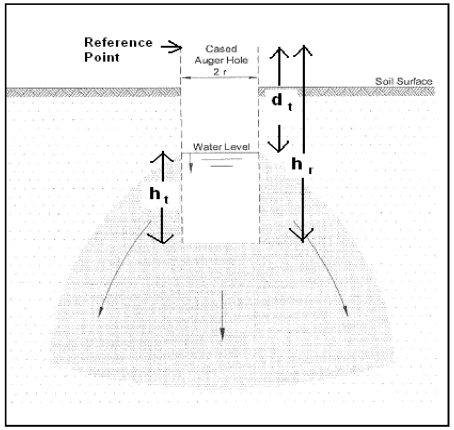
Galt Geotechnics

Job No:	J1501236
Client:	ABN Group
Site:	939 & 993 Baldivis Rd
Location:	Baldivis
Calc by:	SC
BH Name:	IT02
Test Depth:	0.56 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

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	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	0.7	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

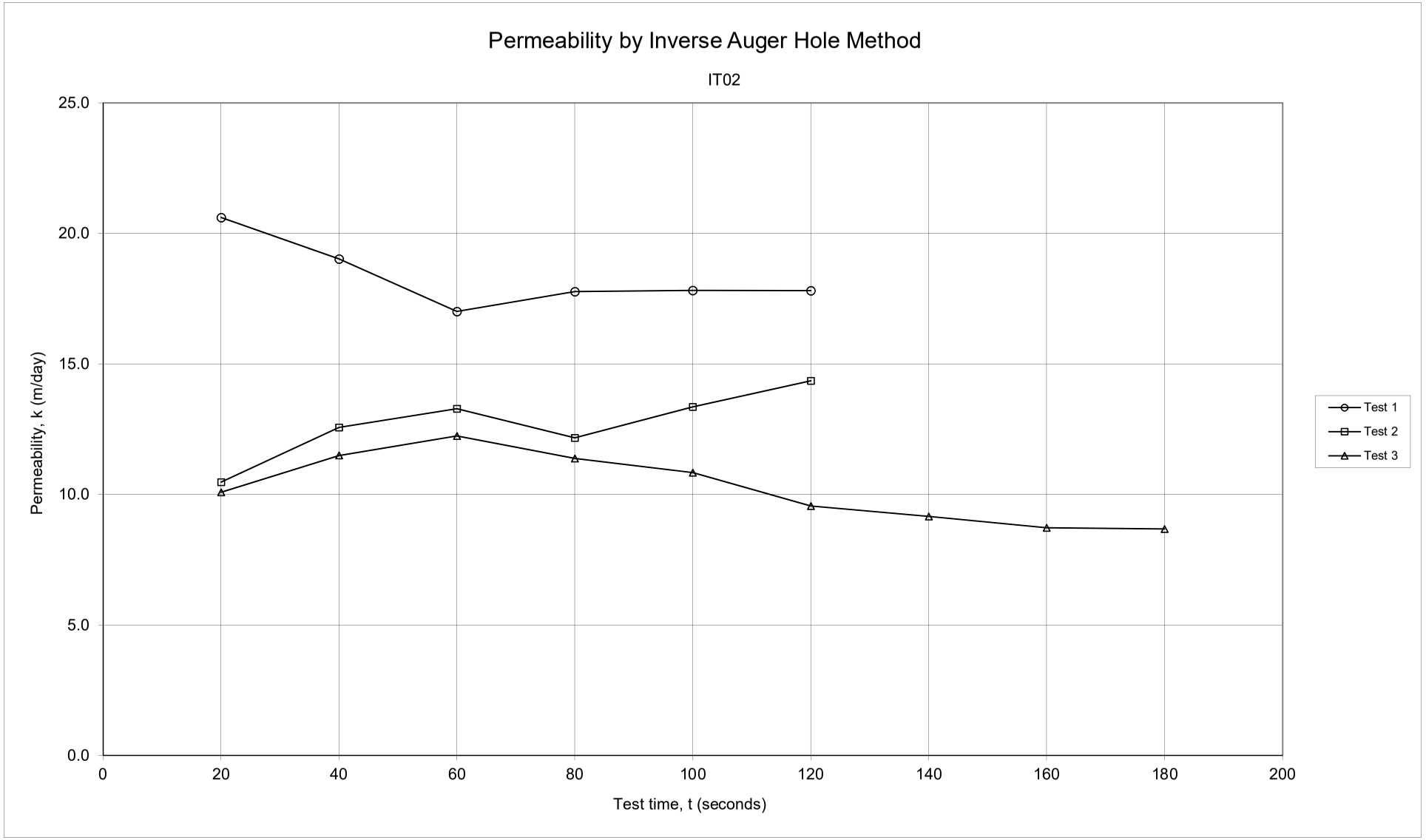
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.22	0.48		
20	0.355	0.345	2.4E-04	20.6
40	0.44	0.26	2.2E-04	19.0
60	0.49	0.21	2.0E-04	17.0
80	0.55	0.15	2.1E-04	17.8
100	0.59	0.11	2.1E-04	17.8
120	0.62	0.08	2.1E-04	17.8
		AVERAGE	2.1E-04	18.3

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.28	0.42		
20	0.345	0.355	1.2E-04	10.5
40	0.42	0.28	1.5E-04	12.6
60	0.48	0.22	1.5E-04	13.3
80	0.51	0.19	1.4E-04	12.2
100	0.56	0.14	1.5E-04	13.4
120	0.6	0.1	1.7E-04	14.4
		AVERAGE	1.5E-04	12.7

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.23	0.47		
20	0.3	0.4	1.2E-04	10.1
40	0.375	0.325	1.3E-04	11.5
60	0.44	0.26	1.4E-04	12.2
80	0.475	0.225	1.3E-04	11.4
100	0.505	0.195	1.3E-04	10.8
120	0.515	0.185	1.1E-04	9.6
140	0.535	0.165	1.1E-04	9.2
160	0.55	0.15	1.0E-04	8.7
180	0.57	0.13	1.0E-04	8.7
		AVERAGE	1.2E-04	10.2


Permeability by Inverse Auger Hole Method
IT02
Permeability, k (m/day)
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Test 1
Test 2
Test 3

Permeability Calculation - Inverse Auger Hole Method

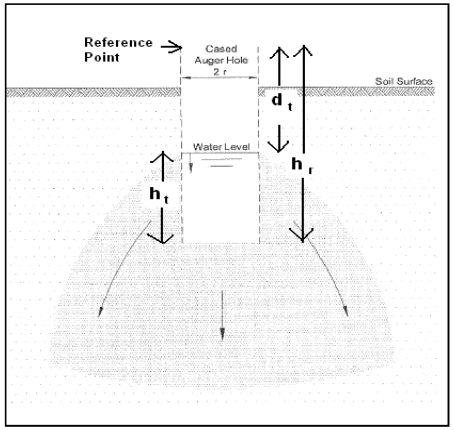
Galt Geotechnics

Job No:	J1501236
Client:	ABN Group
Site:	939 & 993 Baldivis Rd
Location:	Baldivis
Calc by:	SC
BH Name:	IT03
Test Depth:	0.5 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

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	Comment field
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Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	0.7	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

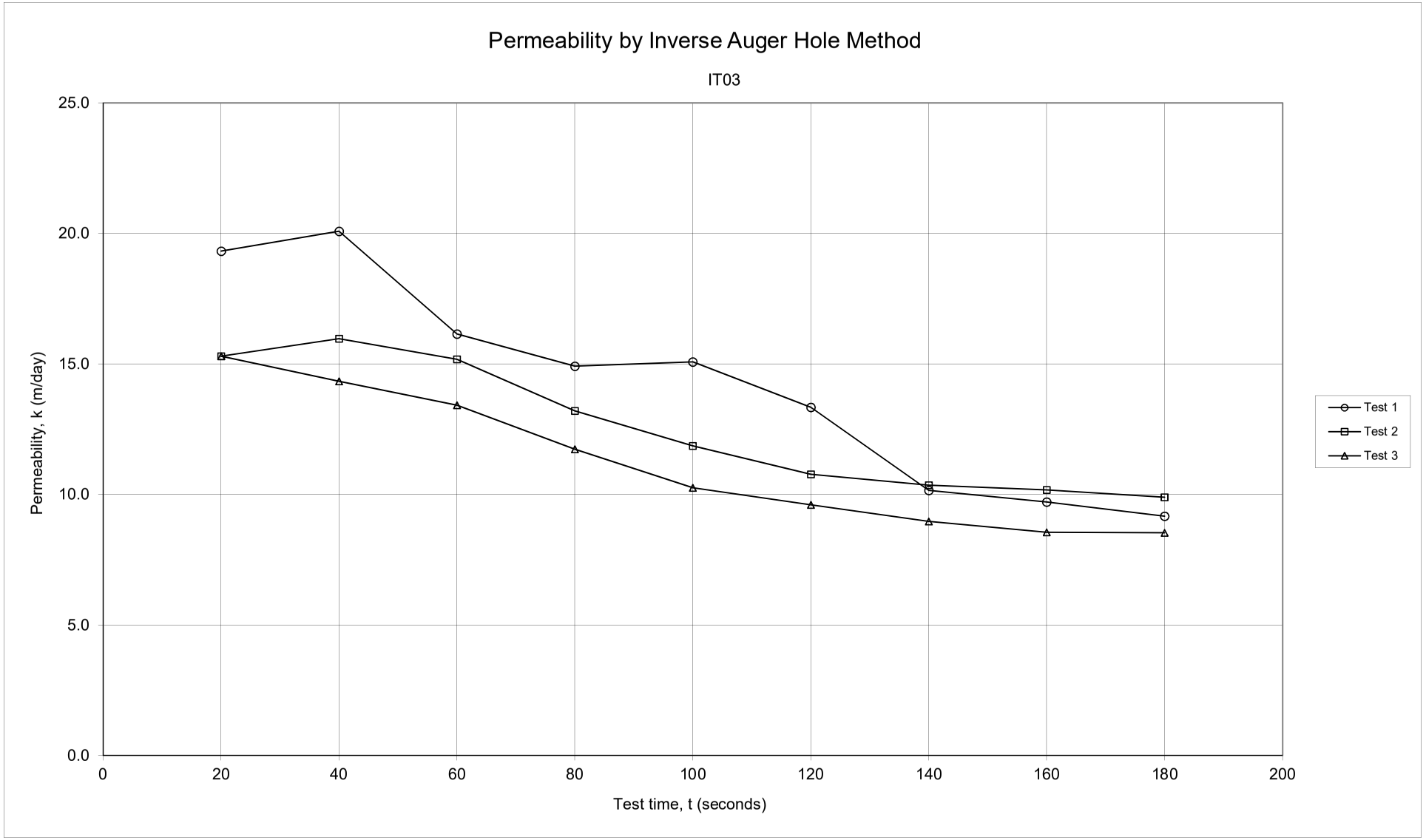
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.25	0.45		
20	0.37	0.33	2.2E-04	19.3
40	0.465	0.235	2.3E-04	20.1
60	0.495	0.205	1.9E-04	16.1
80	0.53	0.17	1.7E-04	14.9
100	0.57	0.13	1.7E-04	15.1
120	0.58	0.12	1.5E-04	13.3
140	0.56	0.14	1.2E-04	10.2
160	0.575	0.125	1.1E-04	9.7
180	0.585	0.115	1.1E-04	9.2
		AVERAGE	1.6E-04	14.2

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.24	0.46		
20	0.34	0.36	1.8E-04	15.3
40	0.425	0.275	1.8E-04	16.0
60	0.48	0.22	1.8E-04	15.2
80	0.505	0.195	1.5E-04	13.2
100	0.525	0.175	1.4E-04	11.9
120	0.54	0.16	1.2E-04	10.8
140	0.56	0.14	1.2E-04	10.4
160	0.58	0.12	1.2E-04	10.2
180	0.595	0.105	1.1E-04	9.9
		AVERAGE	1.4E-04	12.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.24	0.46		
20	0.34	0.36	1.8E-04	15.3
40	0.41	0.29	1.7E-04	14.3
60	0.46	0.24	1.6E-04	13.4
80	0.485	0.215	1.4E-04	11.7
100	0.5	0.2	1.2E-04	10.3
120	0.52	0.18	1.1E-04	9.6
140	0.535	0.165	1.0E-04	9.0
160	0.55	0.15	9.9E-05	8.6
180	0.57	0.13	9.9E-05	8.5
		AVERAGE	1.3E-04	11.2


Permeability by Inverse Auger Hole Method
IT03
Permeability, k (m/day)
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Test 1
Test 2
Test 3

Permeability Calculation - Inverse Auger Hole Method

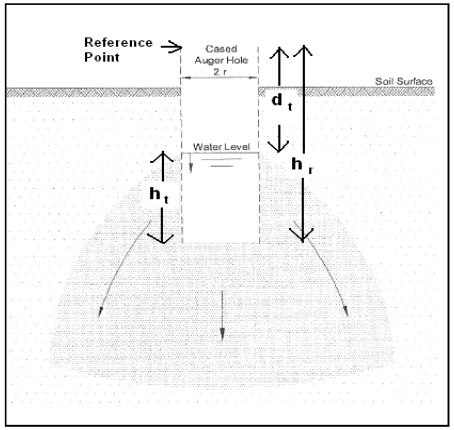
Galt Geotechnics

Job No:	J1501236
Client:	ABN Group
Site:	939 & 993 Baldivis Rd
Location:	Baldivis
Calc by:	SC
BH Name:	IT04
Test Depth:	0.52 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
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Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	0.7	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

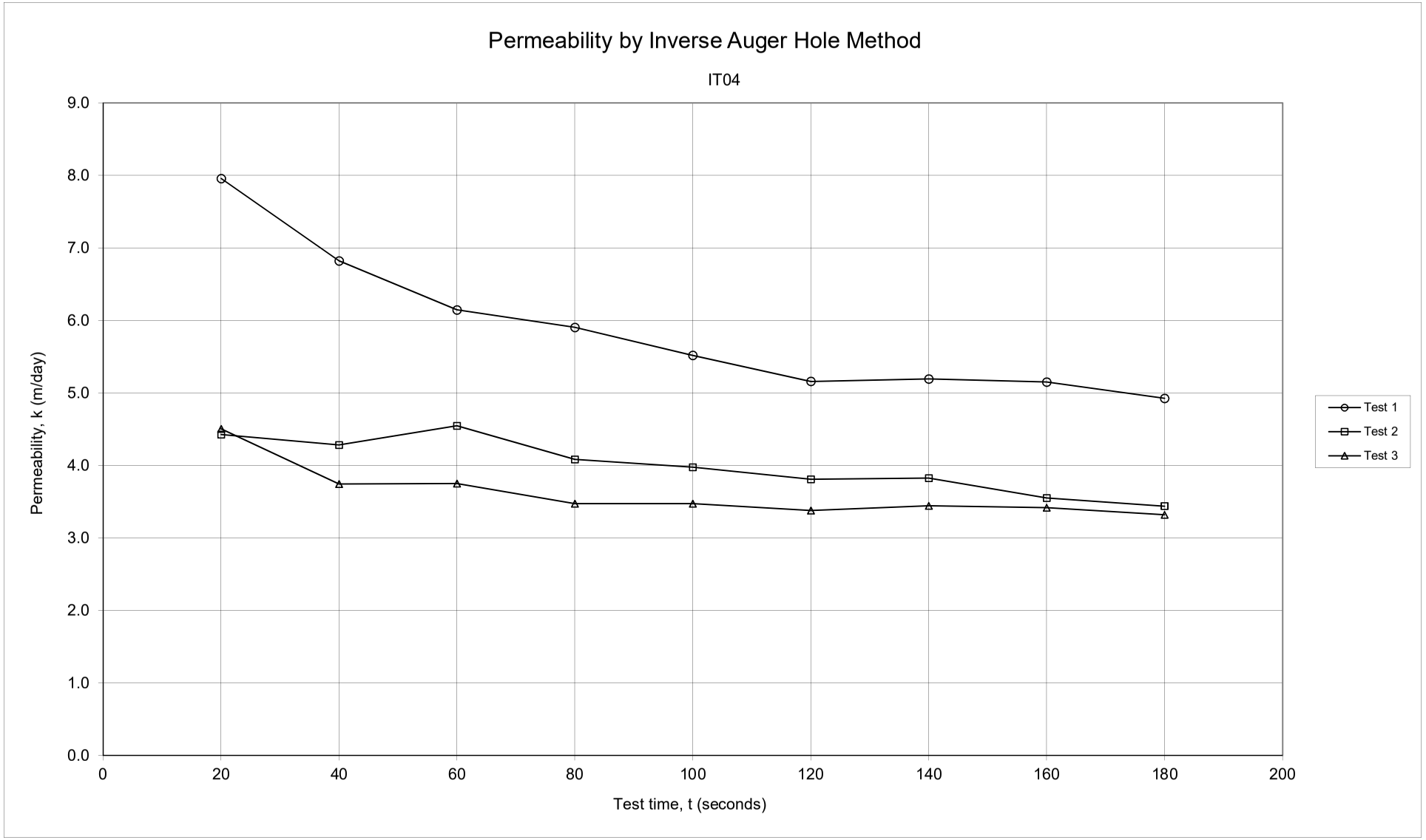
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.11	0.59		
20	0.18	0.52	9.2E-05	8.0
40	0.225	0.475	7.9E-05	6.8
60	0.26	0.44	7.1E-05	6.1
80	0.295	0.405	6.8E-05	5.9
100	0.32	0.38	6.4E-05	5.5
120	0.34	0.36	6.0E-05	5.2
140	0.37	0.33	6.0E-05	5.2
160	0.395	0.305	6.0E-05	5.2
180	0.41	0.29	5.7E-05	4.9
		AVERAGE	6.8E-05	5.9

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.11	0.59		
20	0.15	0.55	5.1E-05	4.4
40	0.185	0.515	5.0E-05	4.3
60	0.225	0.475	5.3E-05	4.5
80	0.245	0.455	4.7E-05	4.1
100	0.27	0.43	4.6E-05	4.0
120	0.29	0.41	4.4E-05	3.8
140	0.315	0.385	4.4E-05	3.8
160	0.325	0.375	4.1E-05	3.6
180	0.34	0.36	4.0E-05	3.4
		AVERAGE	4.6E-05	4.0

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.12	0.58		
20	0.16	0.54	5.2E-05	4.5
40	0.185	0.515	4.3E-05	3.7
60	0.215	0.485	4.3E-05	3.8
80	0.235	0.465	4.0E-05	3.5
100	0.26	0.44	4.0E-05	3.5
120	0.28	0.42	3.9E-05	3.4
140	0.305	0.395	4.0E-05	3.4
160	0.325	0.375	4.0E-05	3.4
180	0.34	0.36	3.8E-05	3.3
		AVERAGE	4.2E-05	3.6


Permeability by Inverse Auger Hole Method
IT04
Permeability, k (m/day)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Test 1
Test 2
Test 3

Appendix E: Geotechnical Laboratory Test Results

www.galtgeo.com.au
2/39 Flynn St, WEMBLEY WA 6014
ABN: 64 625 054 729

Mining & Civil Geotest Pty Ltd

Ph (08) 9414 8022 Fax (08) 9414 8011

Email matt@mcgeotest.com.au

Unit 1/1 Pusey Road, JANDAKOT WA 6164

Organic content of Soils
ASTM: D 2974-07a
Test Method C

Job No: 60083

Report No: 60083-P15/7784

Date of issue: 5 November 2015

Client:	Galt Geotechnics (J1501236)	Date tested:	30 October 2015
Project:	ABN Group	Tested by:	P Culverston
Location:	Proposed Residential Subdivision, Baldivis	Checked:	K M Jones

Sample Number	Sample Identification & Depth (m)	Ash content %	Organic content %
P15/7784	HTP 01, 0	89.5	10.5
P15/7785	HTP 02, 0	89.3	10.7
P15/7786	HTP 03, 0	89.9	10.1
P15/7787	HTP 04, 0	90.0	10.0
Tested as received	Furnace temperature 440^{oc}		

Client address: 2/39 Flynn St, Wembley WA

Organic content April 2009

Approved Signature Kevin M Jones

Particle Size Distribution & Plasticity Index tests

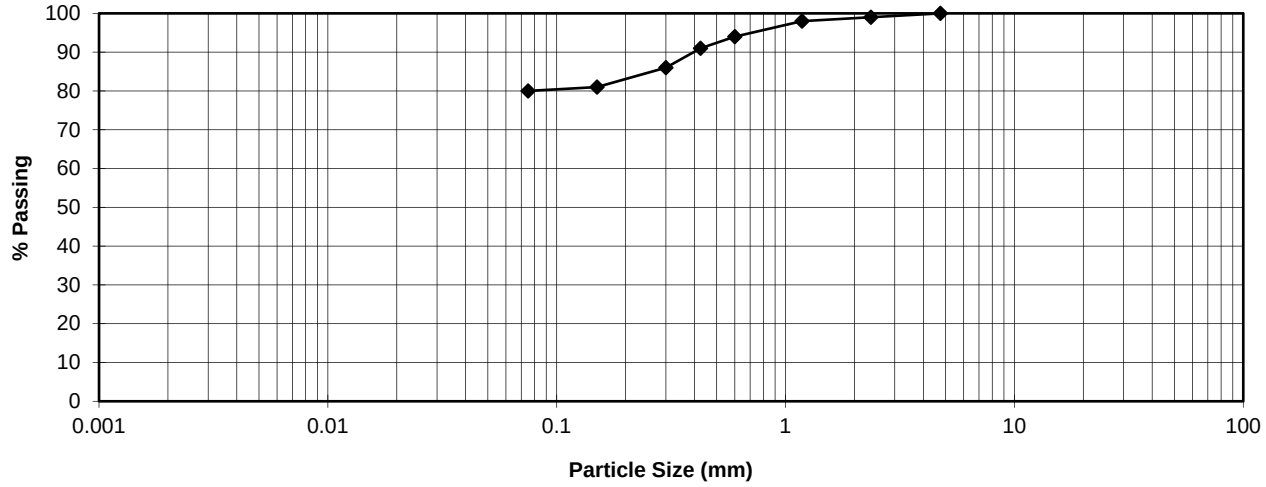
Mining & Civil
Geotest Pty Ltd

unit1/1 Pusey Road, Jandakot, WA 6164
Ph (08) 9414 8022 Fax (08) 9414 8011
Email: kevin@mcgeotest.com.au

Job No: 60083
Report No: 60083-P15/7784
Sample No: P15/7784
Issue Date: 5 November 2015

Client: Galt Geotechnics (J1501236)
Project: ABN Group
Location: Proposed Residential Subdivision, Baldivis

Sample Location: HTP 01
Sample Depth: 0



SIEVE ANALYSIS AS 1289.3.6.1

Sieve Size (mm)	% Passing
125.0	
75.0	
37.5	
19.0	
9.5	
4.75	100
2.36	99
1.18	98
0.600	94
0.425	91
0.300	86
0.150	81
0.075	80

Plasticity index tests
AS 1289

Liquid limit 3.1.1	58	%
Plastic limit 3.2.1	34	%
Plasticity index 3.3.1	24	%
Linear shrinkage 3.4.1	9.5	%

Cracked ☐

Curled ☑

Sampling Procedure: Tested as received

Approved signature

Kevin M Jones

Particle Size Distribution & Plasticity Index tests

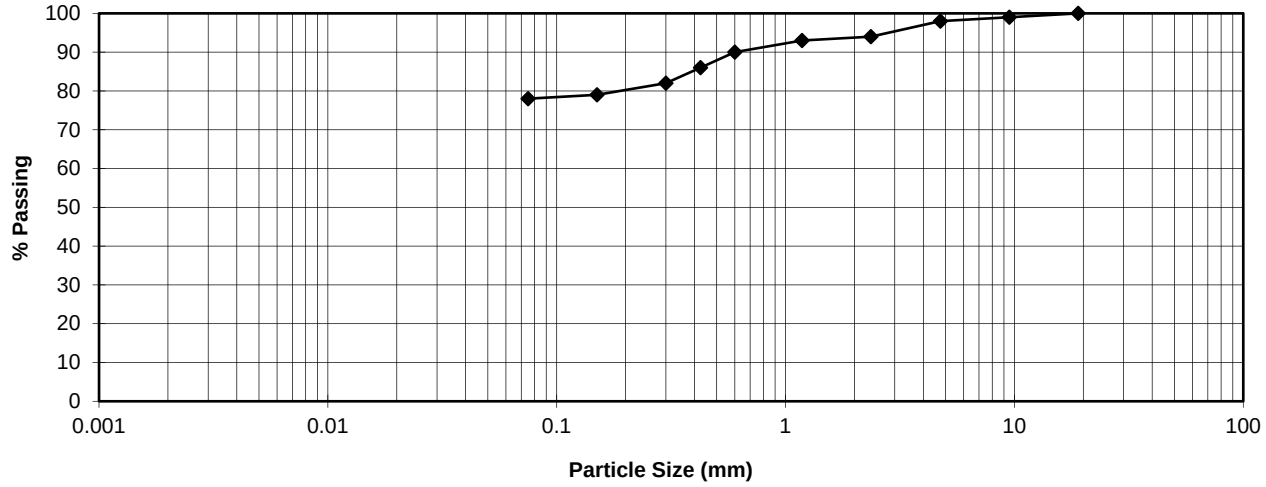
Mining & Civil
Geotest Pty Ltd

unit1/1 Pusey Road, Jandakot, WA 6164
Ph (08) 9414 8022 Fax (08) 9414 8011
Email: kevin@mcgeotest.com.au

Job No: 60083
Report No: 60083-P15/7785
Sample No: P15/7785
Issue Date: 5 November 2015

Client: Galt Geotechnics (J1501236)
Project: ABN Group
Location: Proposed Residential Subdivision, Baldivis

Sample Location: HTP 02
Sample Depth: 0



SIEVE ANALYSIS AS 1289.3.6.1

Sieve Size (mm)	% Passing
125.0	
75.0	
37.5	
19.0	100
9.5	99
4.75	98
2.36	94
1.18	93
0.600	90
0.425	86
0.300	82
0.150	79
0.075	78

Plasticity index tests
AS 1289

Liquid limit 3.1.1	72	%
Plastic limit 3.2.1	35	%
Plasticity index 3.3.1	37	%
Linear shrinkage 3.4.1	13.5	%

Cracked ☐

Curled ☑

Sampling Procedure: Tested as received

Approved signature

Kevin M Jones

Particle Size Distribution & Plasticity Index tests

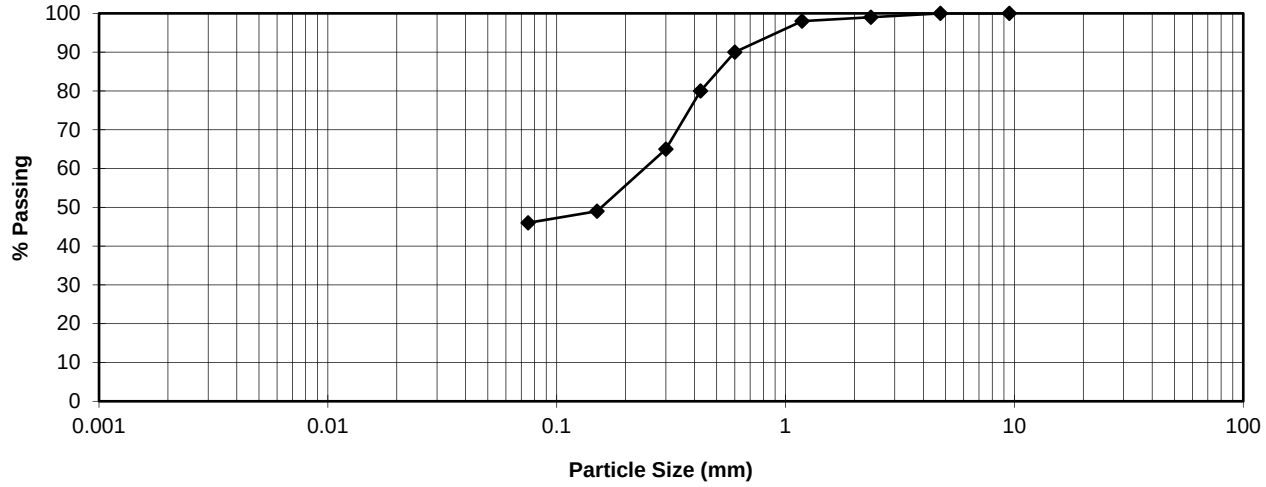
Mining & Civil
Geotest Pty Ltd

unit1/1 Pusey Road, Jandakot, WA 6164
Ph (08) 9414 8022 Fax (08) 9414 8011
Email: kevin@mcgeotest.com.au

Job No: 60083
Report No: 60083-P15/7786
Sample No: P15/7786
Issue Date: 5 November 2015

Client: Galt Geotechnics (J1501236)
Project: ABN Group
Location: Proposed Residential Subdivision, Baldivis

Sample Location: HTP 03
Sample Depth: 0



SIEVE ANALYSIS AS 1289.3.6.1

Sieve Size (mm)	% Passing
125.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	99
1.18	98
0.600	90
0.425	80
0.300	65
0.150	49
0.075	46

Plasticity index tests
AS 1289

Liquid limit 3.1.1	42	%
Plastic limit 3.2.1	26	%
Plasticity index 3.3.1	16	%
Linear shrinkage 3.4.1	8.0	%

Cracked ☐

Curled ☑

Sampling Procedure: Tested as received

Approved signature

Kevin M Jones

Particle Size Distribution & Plasticity Index tests

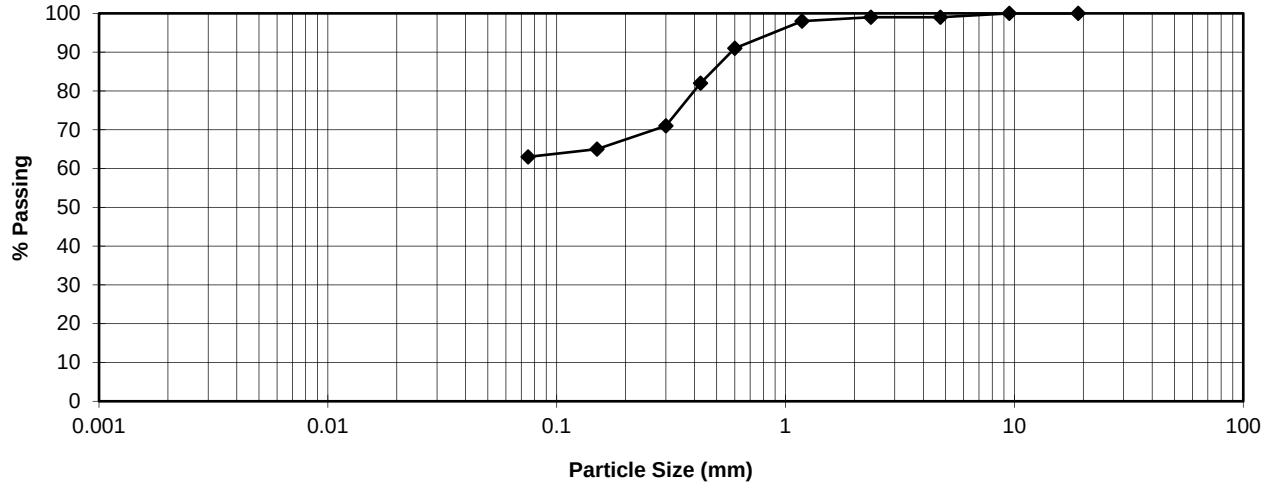
Mining & Civil
Geotest Pty Ltd

unit1/1 Pusey Road, Jandakot, WA 6164
Ph (08) 9414 8022 Fax (08) 9414 8011
Email: kevin@mcgeotest.com.au

Job No: 60083
Report No: 60083-P15/7787
Sample No: P15/7787
Issue Date: 5 November 2015

Client: Galt Geotechnics (J1501236)
Project: ABN Group
Location: Proposed Residential Subdivision, Baldivis

Sample Location: HTP 04
Sample Depth: 0



SIEVE ANALYSIS AS 1289.3.6.1

Sieve Size (mm)	% Passing
125.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	99
2.36	99
1.18	98
0.600	91
0.425	82
0.300	71
0.150	65
0.075	63

Plasticity index tests
AS 1289

Liquid limit 3.1.1	49	%
Plastic limit 3.2.1	32	%
Plasticity index 3.3.1	17	%
Linear shrinkage 3.4.1	8.0	%

Cracked ☐

Curled ☑

Sampling Procedure: Tested as received

Approved signature

Kevin M Jones

Particle Size Distribution & Plasticity Index tests

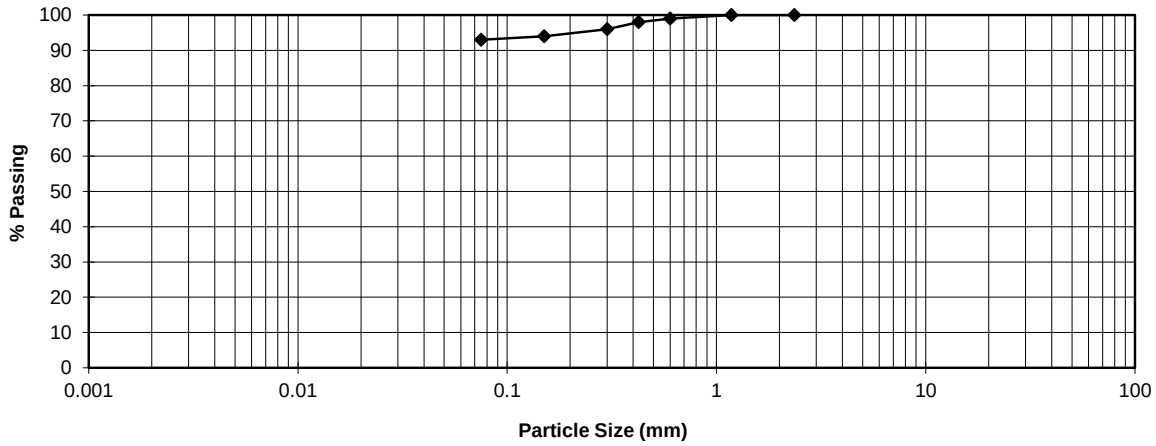
Mining & Civil
Geotest Pty Ltd

unit1/1 Pusey Road, Jandakot, WA 6164
Ph (08) 9414 8022 Fax (08) 9414 8011
Email: kevin@mcgeotest.com.au

Job No:	**60083**
Report No:	**60083-P15/8059**
Sample No:	**P15/8059**
Issue Date:	**20-Nov-15**

Client: Galt Geotechnics (J1501236)
Project: ABN Group - Proposed Residential Subdivision
Location: Baldivis Re-test

Sample Location: BH16
Sample: 2



SIEVE ANALYSIS AS 1289.3.6.1

Sieve Size (mm)	% Passing
125.0	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	99
0.425	98
0.300	96
0.150	94
0.075	93

Plasticity index tests
AS 1289

Liquid limit 3.1.1	120	%
Plastic limit 3.2.1	38	%
Plasticity index 3.3.1	82	%
Linear shrinkage 3.4.1	27.5	%
Cracked	☑	
Curled	☑	

Sampling Procedure: Tested as received

Approved signature

Kevin M Jones

Appendix F: Environmental Laboratory Certificates of Analysis and Chain of Custody Documentation

www.galtgeo.com.au
2/39 Flynn St, WEMBLEY WA 6014
ABN: 64 625 054 729

eurofins | mgt

☐ Sydney
Unit F3 - 6 Building F, 16 Mars Road, Lane Cove
Phone: +612 9900 8400
Email: enviro.syd@mgtlabmark.com.au

☐ Brisbane
Unit 1-21 Smallwood Place, Murrarie
Phone: +617 3902 4600
Email: enviro.bris@mgtlabmark.com.au

☐ Melbourne
2 Kingston Town Close, Oakleigh, VIC 3166
Phone: +613 8564 5000 Fax: +613 8564 5090
Email: enquiries.melb@mgtlabmark.com.au

CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Company Name : Galt Environmental Pty Ltd	Contact Name : Ashe Gulbert//Brad Palmer	Purchase Order :	COC Number : 1501236-01
Office Address : 2/39 Flynn Street, Wembley		PROJECT Number : J1501236	Eurofins | mgt quote ID :
	Email for COC/SRN/Results : lab.results@galtenv.com.au ; michael.carmichael@galtenv.com.au	PROJECT Name : ABN Group Baldivis	Data output format: PDF; ESDAT

Special Directions & Comments :

PLEASE ENSURE THAT ALL CORRESPONDENCE IS SENT TO LAB.RESULTS@GALTENV.COM.AU

Eurofins | mgt DI water batch number:

Some common holding times (with correct preservation). For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

	Sample ID	Date	Matrix	CRS	Containers: 1LP	250P	125P	1LA	40mL vial	125mL A	Jar		Sample comments:
1	BH01/0.0	23/10/2015	Soil	x									
2	BH02/2.5	23/10/2015	Soil	x									
3	BH03/0.5	23/10/2015	Soil	x									
4	BH05/2.0	23/10/2015	Soil	x									
5	BH06/0.5	23/10/2015	Soil	x									
6	BH07/1.75	23/10/2015	Soil	x									
7	BH08/1.0	23/10/2015	Soil	x									
8	BH09/0.5	23/10/2015	Soil	x									
9	BH11/0.75	23/10/2015	Soil	x									
10	BH12/1.75	23/10/2015	Soil	x									
11	BH14/1.25	23/10/2015	Soil	x									
12	BH16/0.0	23/10/2015	Soil	x									
13	BH18/2.0	23/10/2015	Soil	x									
14	BH19/0.25	23/10/2015	Soil	x									
15	BH20/1.5	23/10/2015	Soil	x									
16	BH21/2.25	23/10/2015	Soil	x									
17	BH22/2.0	23/10/2015	Soil	x									
18	BH23/1.0	23/10/2015	Soil	x									
19	BH24/1.75	23/10/2015	Soil	x									
20	BH25/0.0	23/10/2015	Soil	x									
21													
22													
23													
24													
25													
26													
27													

Relinquished By:	Laboratory Staff Received By:	Turn around time	Method Of Shipment	Temperature on arrival:
Ashe G		1 DAY ☐ 2 DAY ☐ 3 DAY ☐	☐ Courier	
Date & Time : 2-11-15	Date & Time :	5 DAY ☐ 10 DAY ☐ Other:	☐ Hand Delivered	Report number:
Signature:	Signature:		☐ Postal	
			Courier Consignment # :	

Parkerval
#477984

Certificate of Analysis

Galt Environment P/L
2/39 Flynn St
Wembley
WA 6014

NATA Accredited
Accreditation Number 1261
Site Number 1254

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

Attention: **-ALL :-SRA/Results**

Report **477984-S**
Project name ABN GROUP BALDIVIS
Project ID J1501236
Received Date Nov 03, 2015

Client Sample ID			**BH01/0.0**	**BH02/2.5**	**BH03/0.5**	**BH05/2.0**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**B15-No01346**	**B15-No01347**	**B15-No01348**	**B15-No01349**
Date Sampled			**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**
Test/Reference	LOR	Unit				
Chromium Suite						
pH-KCL	0.1	pH Units	5.8	5.9	4.7	5.6
Acid trail - Titratable Actual Acidity	2	mol H+/t	6.0	4.0	57	6.0
sulfidic - TAA equiv. S% pyrite	0.02	% pyrite S	< 0.02	< 0.02	0.09	< 0.02
Chromium Reducible Sulfur[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	< 3	< 3	< 3
Sulfur - KCl Extractable	0.02	% S	n/a	n/a	n/a	n/a
HCl Extractable Sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	n/a	n/a	n/a	n/a
Acid Neutralising Capacity (ANCbt)	0.01	%CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - acidity (ANCbt)	2	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[S03]	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Sulfur Units)	0.02	% S	< 0.02	< 0.02	0.09	< 0.02
Net Acidity (Acidity Units)	10	mol H+/t	< 10	< 10	57	< 10
Liming Rate[S01]	1	kg CaCO3/t	< 1	< 1	4.0	< 1
Extraneous Material						
<2mm Fraction	0.005	g	n/a	n/a	n/a	n/a
>2mm Fraction	0.005	g	n/a	n/a	n/a	n/a
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
% Moisture	0.1	%	3.1	16	18	3.1

Client Sample ID			BH06/0.5	BH07/1.75	BH08/1.0	BH09/0.5
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**B15-No01350**	**B15-No01351**	**B15-No01352**	**B15-No01353**
Date Sampled			**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**
Test/Reference	LOR	Unit				
Chromium Suite						
pH-KCL	0.1	pH Units	5.5	4.9	4.7	4.9
Acid trail - Titratable Actual Acidity	2	mol H+/t	7.0	32	33	37
sulfidic - TAA equiv. S% pyrite	0.02	% pyrite S	< 0.02	0.05	0.05	0.06
Chromium Reducible Sulfur[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	< 3	< 3	< 3
Sulfur - KCl Extractable	0.02	% S	n/a	n/a	n/a	n/a
HCl Extractable Sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	n/a	n/a	n/a	n/a
Acid Neutralising Capacity (ANCbt)	0.01	%CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - acidity (ANCbt)	2	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[S03]	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Sulfur Units)	0.02	% S	< 0.02	0.05	0.05	0.06
Net Acidity (Acidity Units)	10	mol H+/t	< 10	32	33	37
Liming Rate[S01]	1	kg CaCO3/t	1.0	2.0	3.0	3.0
Extraneous Material						
<2mm Fraction	0.005	g	n/a	n/a	n/a	n/a
>2mm Fraction	0.005	g	n/a	n/a	n/a	n/a
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
% Moisture	0.1	%	6.8	19	24	18

Client Sample ID			BH11/0.75	BH12/1.75	BH14/1.25	BH16/0.0
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**B15-No01354**	**B15-No01355**	**B15-No01356**	**B15-No01357**
Date Sampled			**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**
Test/Reference	LOR	Unit				
Chromium Suite						
pH-KCL	0.1	pH Units	5.0	4.8	4.8	4.6
Acid trail - Titratable Actual Acidity	2	mol H+/t	22	36	26	79
sulfidic - TAA equiv. S% pyrite	0.02	% pyrite S	0.04	0.06	0.04	0.13
Chromium Reducible Sulfur[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	< 3	< 3	< 3
Sulfur - KCl Extractable	0.02	% S	n/a	n/a	n/a	n/a
HCl Extractable Sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	n/a	n/a	n/a	n/a
Acid Neutralising Capacity (ANCbt)	0.01	%CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - acidity (ANCbt)	2	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[S03]	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Sulfur Units)	0.02	% S	0.04	0.06	0.04	0.13

Client Sample ID			BH11/0.75	BH12/1.75	BH14/1.25	BH16/0.0
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**B15-No01354**	**B15-No01355**	**B15-No01356**	**B15-No01357**
Date Sampled			**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**
Test/Reference	LOR	Unit				
Chromium Suite						
Net Acidity (Acidity Units)	10	mol H+/t	22	36	26	79
Liming Rate[S01]	1	kg CaCO3/t	2.0	3.0	2.0	6.0
Extraneous Material						
<2mm Fraction	0.005	g	n/a	n/a	n/a	n/a
>2mm Fraction	0.005	g	n/a	n/a	n/a	n/a
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
% Moisture	0.1	%	29	22	24	14

Client Sample ID			BH18/2.0	BH19/0.25	BH20/1.5	BH01/2.25
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**B15-No01358**	**B15-No01359**	**B15-No01360**	**B15-No01361**
Date Sampled			**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**
Test/Reference	LOR	Unit				
Chromium Suite						
pH-KCL	0.1	pH Units	5.8	5.4	5.7	5.9
Acid trail - Titratable Actual Acidity	2	mol H+/t	4.0	9.0	3.0	2.0
sulfidic - TAA equiv. S% pyrite	0.02	% pyrite S	< 0.02	< 0.02	< 0.02	< 0.02
Chromium Reducible Sulfur[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	< 3	< 3	< 3
Sulfur - KCl Extractable	0.02	% S	n/a	n/a	n/a	n/a
HCl Extractable Sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	n/a	n/a	n/a	n/a
Acid Neutralising Capacity (ANCbt)	0.01	%CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - acidity (ANCbt)	2	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[S03]	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Sulfur Units)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Net Acidity (Acidity Units)	10	mol H+/t	< 10	< 10	< 10	< 10
Liming Rate[S01]	1	kg CaCO3/t	< 1	1.0	< 1	< 1
Extraneous Material						
<2mm Fraction	0.005	g	n/a	n/a	n/a	n/a
>2mm Fraction	0.005	g	n/a	n/a	n/a	n/a
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
% Moisture	0.1	%	4.6	2.9	1.7	2.8

Client Sample ID			BH22/2.0	BH23/1.0	BH24/1.75	BH25/0.0
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**B15-No01362**	**B15-No01363**	**B15-No01364**	**B15-No01365**
Date Sampled			**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**	**Oct 23, 2015**
Test/Reference	LOR	Unit				
Chromium Suite						
pH-KCL	0.1	pH Units	5.5	5.3	5.9	5.3
Acid trail - Titratable Actual Acidity	2	mol H+/t	8.0	5.0	2.0	9.0
sulfidic - TAA equiv. S% pyrite	0.02	% pyrite S	< 0.02	< 0.02	< 0.02	< 0.02
Chromium Reducible Sulfur[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	0.059
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	< 3	< 3	37
Sulfur - KCl Extractable	0.02	% S	n/a	n/a	n/a	n/a
HCl Extractable Sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	n/a	n/a	n/a	n/a
Acid Neutralising Capacity (ANCbt)	0.01	%CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - acidity (ANCbt)	2	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[S03]	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Sulfur Units)	0.02	% S	< 0.02	< 0.02	< 0.02	0.07
Net Acidity (Acidity Units)	10	mol H+/t	< 10	< 10	< 10	46
Liming Rate[S01]	1	kg CaCO3/t	1.0	< 1	< 1	3.0
Extraneous Material						
<2mm Fraction	0.005	g	n/a	n/a	n/a	n/a
>2mm Fraction	0.005	g	n/a	n/a	n/a	n/a
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
% Moisture	0.1	%	13	2.1	2.5	9.6

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chromium Suite			
Chromium Suite	Brisbane	Nov 03, 2015	6 Week
- Method: LTM-GEN-7070			
Extraneous Material	Brisbane	Nov 03, 2015	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Brisbane	Nov 03, 2015	14 Day
- Method: LTM-GEN-7080 Moisture			

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Company Name:	Galt Environment P/L	**Order No.:**	
Address:	2/39 Flynn St	**Report #:**	477984
	Wembley	**Phone:**	08 6272 0200
	WA 6014	**Fax:**	08 9285 8444
Project Name:	ABN GROUP BALDIVIS		
Project ID:	J1501236		

Received: Nov 3, 2015 9:00 AM
Due: Nov 10, 2015
Priority: 5 Day
Contact Name: -ALL :-SRA/Results

Eurofins | mgt Client Manager: Natalie Krasselt

Eurofins | mgt 1/21 Smallwood Place, Murarrie, QLD, Australia, 4172
ABN : 50 005 085 521 Telephone: +61 7 3902 4600 Facsimile: +61 7 3902 4646

web : www.eurofins.com.au e.mail : EnviroSales@eurofins.com.au ABN – 50 005 085 521

Sample Detail					Chromium Suite	Moisture Set
aboratory where analysis is conducted						
elbourne Laboratory - NATA Site # 1254 & 14271						
ydney Laboratory - NATA Site # 18217						
risbane Laboratory - NATA Site # 20794					X	X
xternal Laboratory						
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
H01/0.0	Oct 23, 2015		Soil	B15-No01346	X	X
H02/2.5	Oct 23, 2015		Soil	B15-No01347	X	X
H03/0.5	Oct 23, 2015		Soil	B15-No01348	X	X
H05/2.0	Oct 23, 2015		Soil	B15-No01349	X	X
H06/0.5	Oct 23, 2015		Soil	B15-No01350	X	X
H07/1.75	Oct 23, 2015		Soil	B15-No01351	X	X
H08/1.0	Oct 23, 2015		Soil	B15-No01352	X	X
H09/0.5	Oct 23, 2015		Soil	B15-No01353	X	X
H11/0.75	Oct 23, 2015		Soil	B15-No01354	X	X

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Company Name:	Galt Environment P/L	**Order No.:**	
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ABN : 50 005 085 521 Telephone: +61 7 3902 4600 Facsimile: +61 7 3902 4646

Sample Detail					Chromium Suite	Moisture Set
Laboratory where analysis is conducted						
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794					X	X
External Laboratory						
H12/1.75	Oct 23, 2015		Soil	B15-No01355	X	X
H14/1.25	Oct 23, 2015		Soil	B15-No01356	X	X
H16/0.0	Oct 23, 2015		Soil	B15-No01357	X	X
H18/2.0	Oct 23, 2015		Soil	B15-No01358	X	X
H19/0.25	Oct 23, 2015		Soil	B15-No01359	X	X
H20/1.5	Oct 23, 2015		Soil	B15-No01360	X	X
H01/2.25	Oct 23, 2015		Soil	B15-No01361	X	X
H22/2.0	Oct 23, 2015		Soil	B15-No01362	X	X
H23/1.0	Oct 23, 2015		Soil	B15-No01363	X	X
H24/1.75	Oct 23, 2015		Soil	B15-No01364	X	X

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Eurofins | mgt Client Manager: Natalie Krasselt

Sample Detail					Chromium Suite	Moisture Set
aboratory where analysis is conducted						
elbourne Laboratory - NATA Site # 1254 & 14271						
ydney Laboratory - NATA Site # 18217						
risbane Laboratory - NATA Site # 20794					X	X
xternal Laboratory						
H25/0.0	Oct 23, 2015		Soil	B15-No01365	X	X

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per Kilogram

mg/l: milligrams per litre

ug/l: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery									
Chromium Suite									
Chromium Reducible Sulfur			%	100			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Chromium Suite				Result 1	Result 2	RPD			
pH-KCL	B15-No01346	CP	pH Units	5.8	5.8	1.0	30%	Pass	
Acid trail - Titratable Actual Acidity	B15-No01346	CP	mol H+/t	6.0	6.0	5.0	30%	Pass	
sulfidic - TAA equiv. S% pyrite	B15-No01346	CP	% pyrite S	< 0.02	< 0.02	<1	30%	Pass	
Chromium Reducible Sulfur	B15-No01346	CP	% S	< 0.005	< 0.005	<1	30%	Pass	
Chromium Reducible Sulfur -acidity units	B15-No01346	CP	mol H+/t	< 3	< 3	<1	30%	Pass	
Sulfur - KCl Extractable	B15-No01346	CP	% S	n/a	n/a	n/a	30%	Pass	
HCl Extractable Sulfur	B15-No01346	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur	B15-No01346	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - acidity units	B15-No01346	CP	mol H+/t	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - equivalent S% pyrite	B15-No01346	CP	% S	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity (ANCbt)	B15-No01346	CP	%CaCO3	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)	B15-No01346	CP	% S	n/a	n/a	n/a	30%	Pass	
ANC Fineness Factor	B15-No01346	CP	factor	1.5	1.5	<1	30%	Pass	
Net Acidity (Sulfur Units)	B15-No01346	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Net Acidity (Acidity Units)	B15-No01346	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
Liming Rate	B15-No01346	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B15-No01346	CP	%	3.1	3.2	5.0	30%	Pass	
Duplicate									
Chromium Suite				Result 1	Result 2	RPD			
pH-KCL	B15-No01356	CP	pH Units	4.8	4.8	<1	30%	Pass	
Acid trail - Titratable Actual Acidity	B15-No01356	CP	mol H+/t	26	25	3.0	30%	Pass	
sulfidic - TAA equiv. S% pyrite	B15-No01356	CP	% pyrite S	0.04	0.04	3.0	30%	Pass	
Chromium Reducible Sulfur	B15-No01356	CP	% S	< 0.005	< 0.005	<1	30%	Pass	
Chromium Reducible Sulfur -acidity units	B15-No01356	CP	mol H+/t	< 3	< 3	<1	30%	Pass	
Sulfur - KCl Extractable	B15-No01356	CP	% S	n/a	n/a	n/a	30%	Pass	
HCl Extractable Sulfur	B15-No01356	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur	B15-No01356	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - acidity units	B15-No01356	CP	mol H+/t	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - equivalent S% pyrite	B15-No01356	CP	% S	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity (ANCbt)	B15-No01356	CP	%CaCO3	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)	B15-No01356	CP	% S	n/a	n/a	n/a	30%	Pass	
ANC Fineness Factor	B15-No01356	CP	factor	1.5	1.5	<1	30%	Pass	
Net Acidity (Sulfur Units)	B15-No01356	CP	% S	0.04	0.04	n/a	30%	Pass	
Net Acidity (Acidity Units)	B15-No01356	CP	mol H+/t	26	25	n/a	30%	Pass	
Liming Rate	B15-No01356	CP	kg CaCO3/t	2.0	2.0	3.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B15-No01356	CP	%	24	26	6.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

Authorised By

Natalie Krasselt	Analytical Services Manager
Bryan Wilson	Senior Analyst-Metal (QLD)
Richard Corner	Senior Analyst-Inorganic (QLD)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

Appendix G: Understanding Your Report

www.galtgeo.com.au
2/39 Flynn St, WEMBLEY WA 6014
ABN: 64 625 054 729

UNDERSTANDING YOUR REPORT

GALT FORM PMP11 Rev2

1. EXPECTATIONS OF THE REPORT

This document has been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

2. THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- the project objectives as we understood them and as described in this report;
- the specific site mentioned in this report; and
- the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- the report was not written for you;
- the report was not written for the site specific to your development;
- the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

3. SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

4. THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

5. CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

6. SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

7. ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

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