Specialist Studies

- Contamination Assessment & Remediation Plan
- Bushfire Protection Assessment
- Flora, Fauna & Riparian Assessment
- Aboriginal Heritage Assessment
- Traffic Study
- Landscape Plan
- Stormwater Management Assessment
- Salinity Assessment
- Vegetation Management

Annexure "B"
Contamination Assessment and Remedial Action Plan

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia
PO Box 1543, Macquarie Centre. North Ryde, NSW 2113

ABN: 62 084 294 762
Tel: (02) 9679 8733
Fax: (02) 9679 8744
Email: geoenviro@exemail.com.au

Report

Additional Contamination Investigation and Remediation Action Plan (RAP) Proposed Residential Development Nos 187 and 195-203, Lots 36, 37 and 38 DP 28024 Turner Road, Currans Hills, NSW

Prepared for:-

Turner Developments
Harrington Park Plaza
Level 1, 23 Fairwater Drive
HARRINGTON PARK NSW 2567

Ref: Jc04031A-r8
August 2015

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia
PO Box 1543, Macquarie Centre. North Ryde, NSW 2113
ABN: 62 084 294 762
Tel: (02) 9679 8733
Fax: (02) 9679 8744
Email: geoenviro@exemail.com.au

14th August 2015

Our Ref: JC04031A-r8

Turner Developments
Harrington Park Plaza
Level 1, 23 Fairwater Drive
HARRINGTON PARK NSW 2567

Attention: Ms Brenda Favelle

Dear Madam

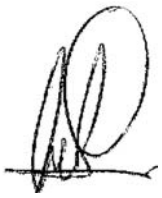
Re: **Additional Contamination Investigation and Remediation Action Plan**
Proposed Residential Development
Nos 187 and 195-203 Lots 36, 37 and 38 DP 28024 Turner Road, Currans Hill

This report presents the results of our Additional Contamination Assessment and RAP for the above site. The site was the subject of a number of contamination studies carried out by GeoEnviro Consultancy Pty Ltd between 2004 and 2009 and extracts of the reports are attached in Appendix A to C of this report.

The purpose of this report is to further assess the site conditions and based on the findings, to provide a remediation action plan (RAP) to clean up the site to ensure suitability of the site for the proposed residential development.

Should you have any queries, please contact the undersigned.

Yours faithfully,
GeoEnviro Consultancy Pty Ltd



Solern Liew CPEng (NPER)
Director

C:\\04JOB\031\A\JC04031A-r8.DOC

TABLE OF CONTENTS

Section Page

1.0 INTRODUCTION ***1***

2.0 SITE INFORMATION ***2***

2.1 Site Location **2**

2.2 Site Topography **3**

2.3 Geological Setting and Hydrogeology **3**

2.4 Site Description and History **3**

3. PREVIOUS STUDIES ***5***

4.0 ADDITIONAL INVESTIGATION ***7***

5.0 CONTAMINATION ASSESSMENT ***8***

6.0 REMEDIATION ACTION PLAN ***10***

6.1 Remediation Goals **11**

6.2 Remediation Criteria **11**

6.3 Remediation Strategy and Process **11**

6.4 Backfilling and Compaction **13**

6.5 Monitoring and Control **13**

6.6 Validation **14**

6.7 Unexpected Asbestos Finds **14**

7.0 LIMITATIONS ***15***

REFERENCES

LIST OF DRAWINGS

Drawing No 1B Site Locality and Previous Site Feature Plan
Drawing No 2B: Test Pit Location Plan
Drawing No 3B: Remediation Area Plan

LIST OF TABLES

Table A Summary of Test Pit Profile

LIST OF APPENDICES

Appendix A Extracts of the Preliminary Contamination Report (Reference 1)
Appendix B Extracts of the Buried Rubbish Fill Report (Reference 2)
Appendix C Extracts of the Salinity/Contamination & RAP Report (Reference 3)
Appendix D Unexpected Asbestos Finds Protocol
Appendix E Important Information about your Environmental Site Assessment Report.

1.0 INTRODUCTION

This report presents the results of an additional contamination assessment and Remediation Action Plan (RAP) for the site referred to as Nos 187 and 195-203 Lots 36, 37 and 38 DP 28024 Turner Road Currans Hill (Subject Site), as shown on Drawing No 1 (hereafter referred to as the Subject Site). The investigation was commissioned by Ms Brenda Favelle of Turner Developments following our fee proposal referenced JC04031A-L6 dated 22nd June 2015.

We understand that the proposed development will include subdivision of the site into residential lots.

The site was the subject of a number of contamination studies (References 1 to 3) carried out by GeoEnviro Consultancy Pty Ltd between 2004 and 2009 and extracts of the report are attached in Appendix A to C. Our reports concluded that the Subject Site has a number of contamination issues which need to be addressed to ensure suitability of the site for the proposed residential subdivision development. The issues are as follows (Refer to Drawing No 1B);

- Buried Rubbish Cell (Site Feature No 9) –Rubbish rubbish including telegraph poles, fence posts, timber pieces, tree stumps, bricks, concrete, plastics and metals, cloth, plastics and bonded asbestos up to 5m deep.

- Buried Rubbish Area (Site Feature No 10) – Rubbish fill including bricks, concrete, timber, plastics, steel mesh, metal pieces, crushed rock and bonded asbestos pieces up to 2.4m deep.

- Buried Rubbish Area (Site Feature No 23) –Rubbish fill including bricks, concrete, timber, plastics, metal wires and cloths up to 2.0m deep.

- Previous House (Site Feature 18) – Lead contamination.

The reports also indicated the following;

- The possibility of contamination in the vicinity of the workshop building (Site Feature No 13) and in the shed (Site Feature No 12).

- The fill (Site Feature Nos 21 and 22) along the drainage depression was found to have some minor inclusions of building material including concrete and asphalt lumps.

We understand that since our previous studies, there were changes to the ownership of all properties and the Subject Site was cleared of all structures (Site Features 6, 11, 12, 13 and 18) and surface fill stockpiles (Site Features 8 and 14). We also understand from the current property owners that the buried rubbish fill (Site Features 9, 10, 21 and 22) were excavated and removed.

The objective of this additional investigation was to assess the site conditions and to provide a strategy to remediate the site to ensure suitability of the site for the proposed residential subdivision development.

2.0 SITE INFORMATION

2.1 Site Location

The site is located on the northern side of Turner Road at Currans Hill and consists of three properties, Nos 187 and 195 to 203 Lots 36, 37 and 38 DP 28024 . The overall property has an irregular shape with an approximate 225m frontage to Turner Road and extends about 530m to the north.

The site is within the jurisdiction of Camden City Council, Parish of Narellan and County of Cumberland.

Immediate adjoining properties to the west consist of semi-rural residential land. The properties to the north and west consist of residential subdivision development sites.

2.2 Site Topography

The site is situated on gentle undulating terrain with ground surface sloping down in a general direction to the southeast. Ground surface within the site generally slopes at angles of about 3 to 5 degrees. The ground surface steepens to the north at angles of about 8 to 12 degrees.

2.3 Geological Setting and Hydrogeology

Based on the 1:100,000 geological map of Port Hacking-Wollongong (Reference 4), the site is underlain by Bringelly Shale (Rwa) of the Wianamatta Group comprising of shale, carbonaceous claystone, laminite and occasional coal.

The 1:100,000 soil landscape map (Reference 5) indicates the overburden soil to consist of residual soil of the Blacktown soil landscape. The residual soil is typically highly plastic, low permeability and moderately reactive.

From our knowledge of the area, permanent groundwater table is not expected to be present at shallow depths.

2.4 Site Description and History

The site currently consists of vacant land will all previous buildings and sheds demolished and cleared. The dams (Site Features 7, 15, 16 and 19) remained undisturbed and there were a number of trees on property along the drainage depression.

From our previous investigation of 2004 and 2009, the following site features were recorded (refer to Drawing No 1B).

Feature No	Description
1	Single storey brick residential dwelling with metal roof with an above ground pool immediately to the rear of the dwelling and septic tanks at the side. The building platform preparation appeared to have been prepared by excavation into the natural slope on the western side, judging from the approximate 1.5m high embankment.
2	A small fill stockpile with some bricks and concrete
3	A small earthfill stockpile about 1m high consisting predominantly of silty clay and sandstone mixture.

Feature No	Description
4	Filled Area. Based on the test pit investigation, the fill was found to consist mainly of clayey silt topsoil/fill and silty clay fill.
5	Dam with an earth embankment of about 3 to 4m high. The dam was predominantly dry at the time of the investigation.
6	Fibro house with a septic tank
7	Dam which was predominantly dry at the time of the site investigation.
8	A spread of rubbish over this area. Rubbish includes timber, wires, metal pieces, tiles, steel beams and domestic rubbish. This area is underlain by topsoil and topsoil fill consisting predominantly of silty clay and clayey silt.
9	Buried rubbish consisting mainly of timber with a layer of clay capping on top. Depth for buried rubbish was found to be in excess of 3m
10	Topsoil and fill mixture with building material and rubbish including concrete fragments, bricks, steel mesh, metal pieces, plastics. A trace of bonded asbestos pieces was encountered in one test pit. A dam existed in this area based on the aerial photograph.
11	Timber and brick house.
12	Garage/shed with concrete slab in one area.
13	Workshop shed on concrete slab. Some oil staining on the floor.
14	Filled area consisting mainly of earthfill
15	Dam which was constructed by predominantly excavating into the ground.
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area consisting mainly of silty clay with a trace of asphaltic concrete pieces.
21	Filled area which forms the banks of a drainage depression. The test pit investigation indicates the fill to consist mainly of ripped sandstone and silty clay mixture with some small pieces of concrete and asphaltic concrete.
22	Filled area consisting mainly of ripped sandstone with some small pieces of concrete and asphaltic concrete.

3. PREVIOUS STUDIES

The site was the subject of a number of contamination studies carried out between 2004 and 2009 by GeoEnviro Consultancy Pty Ltd (References 1 to 3). Refer to Appendix A to C for extracts of our previous report.

Our previous investigation (Reference 1) which was carried out between 24th February and 2nd March 2004 consisted of excavation of 210 test pits (TP 1 to TP 210) as shown on Drawing No 2 in Appendix A. Additional test pit investigation was carried out shortly in late April 2004 to delineate more accurately the rubbish fill encountered in Site Feature 9, 10 and 23 (Reference 2). In February 2009, an additional contamination assessment involving excavation of 17 test pits (TP 1A to 17A) was carried out by GeoEnviro in order to further assess the contamination status of property Nos 195-203 (Reference 3).

Environmental samples were collected and were analysed for the contaminants of concern consisting of;

- Heavy metals - Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Mercury (Hg), Lead (Pb), Nickel (Ni) and Zinc (Zn).
- Organochlorine Pesticides (OCP).
- Organophosphorus Pesticides (OPP)
- Total Recoverable Hydrocarbons (TRH)
- Benzene, Toluene, Ethyl Benzenes and Xylenes (BTEX)
- Polycyclic Aromatic Hydrocarbons (PAH)

Based on the laboratory test results and the test pit investigation, the following comments and assessments were made;

- Buried Rubbish Cell (Site Feature No 9) – TP 131 to 135 encountered a layer of topsoil and clay fill about 0.4m to 0.8m thick overlying buried rubbish comprising predominantly of timber material such as telegraph poles, fence posts, timber pieces and tree stumps. Other rubbish such as bricks, concrete, plastics and metals, cloth and plastics were also encountered in TP 131 to 133. A piece of bonded asbestos piece was encountered in TP 131. The depth of buried rubbish in TP 131 to 133 could not be determined due to collapsing test pits and the maximum reach of the backhoe bucket at 3m depth. The fill in TP 134 and 135 were found be about 0.8m and 0.4m thick respectively.

- Buried Rubbish Area (Site Feature No 10) – TP 140 to 145 encountered a mixture of topsoil, silty clay and rubbish fill such as bricks, concrete, timber, plastics, steel mesh, metal pieces and crushed rock to depths varying from 0.7m to 2.0m below existing ground surface. Two small pieces of bonded asbestos pieces were encountered in TP 143.

- Buried Rubbish Area (Site Feature No 23) – TP 165 to 168 encountered a mixture of topsoil, clayey silt, silty clay fill and rubbish fill such as bricks, concrete, timber, plastics, metal wires and cloths with thickness ranging from 0.6m to 1.0m.

- Previous House (Site Feature 18) – TP 87 encountered unacceptable concentration of Lead

The reports also indicated the following;

- The possibility of contamination in the vicinity of the workshop building (Site Feature No 13) and in the shed (Site Feature No 12).

- The fill (Site Feature Nos 21 and 22) along the drainage depression was found to have some minor inclusions of building material including concrete and asphalt lumps and these inclusions should be removed.

To ensure suitability of the site for the proposed development, our reports recommended for the site to be remediated.

4.0 ADDITIONAL INVESTIGATION

The fieldwork for the investigation was carried out on the 27th July 2015 and consisted of excavation of 29 test pits (TP 1B to TP 29B) using a rubber tyred tractor mounted backhoe in the areas of environmental concern. Refer to Drawing No 2B for test pit locations which were located by off-set measurements relative to site boundaries and features and Table A for summary of test pit profiles. The following is a summary of our test pit findings;

Test Pit	Site Feature	Description
TP 1B	Fibro house (Site Feature No 6)	Topsoil/fill consisting of Gravelly Silty Clay about 0.3m overlying 150mm thick of Clayey Silt overlying natural Silty Clay
TP 2B to 4B	Previous spread of fill (Site Feature No 8)	A spread of topsoil/fill consisting of Clayey Silt and Gravelly Clayey Silt of 250mm to 500mm. Some bonded asbestos evident on the surface in TP 4B.
TP 5B to 7B	Previous buried rubbish cell (Site Feature No 9)	Fill up to 1.6m thick encountered with some plastic sheet and terracotta tiles.
TP 8B to 10B	Buried rubbish fill (Site Feature No 10)	Rubbish fill consisting of bricks, plastic , timber and bonded asbestos encountered up to about 2.4m thick.
TP 11B to 14B	Open Grassed area	Generally encountered topsoil and minor topsoil/fill up to 0.5m overlying natural clay.
TP 15B and TP 16B	Buried rubbish fill (Site Feature 23)	Minor topsoil/fill consisting of Clayey Silt with some brick and timber inclusion.
TP 17B to TP 20B	Small fill mounds (Site Features 21 and 22)	Minor topsoil/fill consisting mainly of Clayey Silt up to 0.4m thick with some timber and mulch.
TP 21B and TP 22B	Spread fill (Site Feature 17)	Minor topsoil/fill consisting mainly of Clayey Silt up to 250mm thick

Test Pit	Site Feature	Description
TP 23B	Spread fill (Site Feature 20)	Minor topsoil/fill consisting mainly of Clayey Silt up to 700mm thick.
TP 24B to 26B	Previous house and sheds (Site Features 11 to 13)	Minor topsoil/fill consisting of Clayey Silt with traces of tiles, glass, plastics and fragments of building debris.
TP 27B and 28B	Previous house and surrounds (Site Feature 18)	Minor topsoil/fill consisting of Clayey Silt with traces of bricks and glass.
TP 29B	Spread fill (Site Feature 14)	Encountered natural ground consisting of Clayey Silt topsoil overlying natural clay

5.0 CONTAMINATION ASSESSMENT

Based on the results of our current investigation and previous investigations, seven areas of environmental contamination (AEC I to VII) were identified and these areas need to be remediated in order to ensure suitability of the site for the proposed residential subdivision development. The areas are as follows (Refer to Drawing No 3B);

AEC	Site Feature	Contamination	Approximate Area
I	Site Feature No 9	Fill expected to be up to 5m deep consisting of Silty Clay with some rubbish inclusion (ie plastic sheet and terracotta). Previous investigation (Reference 2) encountered rubbish fill (eg timber sleepers, wooden planks, steel pieces, cloths PVC pipes, etc) up to 5m and this fill is believed to have been removed in more recent times.	28m x 10m and 5m deep

AEC	Site Feature	Contamination	Approximate Area
II	Site Feature No 10	Rubbish fill consisting of bricks, plastic , timber and bonded asbestos encountered up to about 2.4m thick. Previous investigation (Reference 2) encountered rubbish fill (eg concrete slab, steel, bricks, metal sheets asbestos, pipes, wires, plastics, tyres and general household rubbish) up to 2m deep and this fill is believed to have been removed in more recent times.	20m x 50m and 2.4m deep
III	Site Feature No 23	Minor topsoil/fill consisting of Clayey Silt with some brick and timber inclusion. Previous investigation (Reference 2) encountered rubbish fill (eg demolition rubble such as bricks, concrete, metal pieces and wires) up to 2m deep and this fill is believed to have been removed in more recent times	28m by 30m and 2m deep
IV	Site Feature No 6	Topsoil/fill consisting of Gravelly Silty Clay about 0.3m overlying 150mm thick of Clayey Silt overlying natural Silty Clay	10m x 18m and 0.15m deep
V	Site Feature 8	Some bonded asbestos evident on the surface in TP 4B.	20m x 60m and surface
VI	Site Feature No 13	Minor topsoil/fill consisting of Clayey Silt with traces of tiles, glass, plastics and fragments of building debris.	10m wide, 25m and surface.
VII	Site Feature No 18	Minor topsoil/fill consisting of Clayey Silt with traces of bricks and glass. Previous investigation encountered Lead contamination adjacent to the house.	5m by 5m and 150mm thick

6.0 REMEDIATION ACTION PLAN

In order to ensure suitability of the site for the proposed residential subdivision development, site remediation will be required to clean up the site.

The clean up criteria (Acceptance Criteria) relevant to the site is in the following Table 1;

Table 1: Clean Up Criteria

Analyte	HILs A Criteria (mg/kg)	EIL (mg/kg)	DEC Service Station Guideline Criteria (mg/kg)	Clean-Up Criteria "Acceptance Criteria" (mg/kg)
Cu	1000	100	-	100
Pb	300	600	300	300
Zn	7000	200	-	600
Cd	20	3	-	3
Cr	100	400[b]-/1[c]	-	100
Ni	600	60		60
As	100	20	-	20
Hg	15	1	-	1
DDT	200		-	200
Deldrin	10		-	10
PCB	10		-	10
Benzo(a)pyrene	1		1	1
PAH	20		20	20
Benzene	-		1	1
Toluene	-		1.4	1.4
Ethyl-Benzene	-		3.1	3.1
Xylene	-		14	14
TRH C_6-C_9	-		65	65
TRH C_{05}-C_{36}	5600		1000	1000

a) For C16-C35 (Aliphatics)
b) Chromium III
c) Chromium V1
d) - No criterion available

The following sections describe the components essential for the remediation of the site. Appropriate modification of these components may be required depending upon actual site conditions encountered during the remediation process and other factors involving the logistics of the work to be carried out.

6.1 Remediation Goals

The remediation goal is to clean up all areas of environmental concerns as described in above Section 5 to ensure the site is suitable for the proposed residential subdivision development.

6.2 Remediation Criteria

The Acceptance Criteria as outlined in Table 1 is adopted as the remediation criteria to clean up the site.

6.3 Remediation Strategy and Process

The remediation strategy is as follows;

AEC I, II and III -Buried rubbish fill containing bonded asbestos

- Excavation of all buried fill and removal of all asbestos impacted fill/soil where possible and this may require manual isolation of asbestos fragments. The asbestos and building rubbish should be isolated and stockpiled separately if possible for disposal.
- Validation sampling and laboratory testing should be carried out on the excavated surface to ensure the underlying soil and walls of the excavation are clean of contaminants of concern within the Acceptance Criteria.
- In the event where the validation samples are found to have contamination, further excavation and removal of the affected soil should be carried out and additional validation sampling should be carried out to confirm complete removal of the contaminated soil.
- All rubbish and asbestos fill should be disposed off site to an OEH approved landfill. The asbestos impacted fill may be classified as "Special waste - Asbestos Waste" based on the OEH's guidelines (Reference 12). All rubbish fill which are not impacted by asbestos may be classified as "General Solid Waste (Non putrescible).

AEC IV, V and VI – Surface rubbish fill, some containing bonded asbestos

- Stripping of surface rubbish fill and removal of all asbestos impacted fill/soil where possible and this may require manual isolation of asbestos fragments. The asbestos and building rubbish should be isolated and stockpiled separately if possible for disposal.

- Validation sampling and laboratory testing should be carried out on the stripped surface to ensure the underlying soil and walls of the excavation are clean of contaminants of concern within the Acceptance Criteria.
- In the event where the validation samples are found to have contamination, further excavation and removal of the affected soil should be carried out and additional validation sampling should be carried out to confirm complete removal of the contaminated soil.
- All rubbish and asbestos fill should be disposed off site to an OEH approved landfill. The asbestos impacted fill may be classified as "Special waste - Asbestos Waste" based on the OEH's guidelines (Reference 12). All rubbish fill which are not impacted by asbestos may be classified as "General Solid Waste (Non putrescible)

AEC VII– House area with Lead Contamination

Lead impacted soil around the existing house and surround may be remediated by removal off site. This will involve;

- Excavation of the upper topsoil/fill impacted by Lead in AEC VII and stockpiled separately.
- Validation sampling and laboratory testing should be carried out on the excavated surface to ensure the underlying soil is clean of contaminants of concern within the Acceptance Criteria.
- In the event where the validation samples are found to have contamination, further excavation and removal of the affected soil should be carried out and additional validation sampling should be carried out to confirm complete removal of the contaminated soil.
- The Lead contaminated stockpile to be disposed off site should be characterised in accordance with OEH's guidelines (Reference 12). The stockpile may be preliminarily classified as "General Solid Waste (non putrescible). Note that fill containing asbestos would need to be classified as "Special waste - Asbestos Waste".

6.4 Backfilling and Compaction

All excavation areas requiring backfilling may be backfilled with clean fill which must be validated. Adequate compaction levels should be achieved in the fill by rolling using a compactor and moisture control.

6.5 Monitoring and Control

All remediation works should be supervised by a qualified and experienced environmental consultant. Supervision and control include but not limited to the following;

Excavation

The extent of excavation may be determined prior to or during clean-up works by sampling and laboratory analysis.

Stockpiling

Stockpiling of contaminated soil if necessary should be carried out at locations away from construction activities, drainage easement or watercourse. The stockpile should be adequately covered with a waterproof membrane during wet periods to prevent contaminants from leaching through the soil and migrating to surrounding areas. Silt fence should be placed around the stockpile.

Rubbish Fill

Though the test pit investigation did not encounter significant rubbish fill, they may still exist in areas between test locations. Should buried rubbish including asbestos material be encountered during residential development, all buried rubbish should be excavated and disposed off site to a landfill in accordance with regulatory requirements.

Landfill Disposal

All fill material to be disposed off site should be characterised in accordance to OEH's guidelines (Reference 12).

6.6 Validation

Excavation Area

After excavation is completed, validation of the excavation walls and bases and/or surrounding areas should be carried out in order to ensure the excavation area is cleaned of contaminated soil and suitable for backfilling if required. As a general guide, validation samples should be collected at regular intervals of one every 10m apart.

Imported Fill Material

Imported fill material should be validated by sampling and laboratory analysis. One validation sample per 500m^3 of earth fill or a minimum of 3 samples should generally be adequate depending on the homogeneity of the fill material. More samples per unit volume of earthfill may be required if the fill material is found to be variable

6.7 Unexpected Asbestos Finds

Though asbestos was not encountered within the buried fill within Area F, they may still exist as asbestos was a common building material used in the past.

In the event where bonded asbestos fragments are encountered on the site other those areas identified, an unexpected asbestos finds protocol as detailed in Appendix F should be initiated.

7.0 LIMITATIONS

The findings contained in this report are the results of discreet/specific sampling methodologies used in accordance with normal practices and standards. There is no investigation which is thorough enough to preclude the presence of material which presently, or in future, may be considered hazardous to the site. The site may be subject of dumping of rubbish fill in the past and the scope of this report do not cover for future dumping and burial of such material on the subject site.

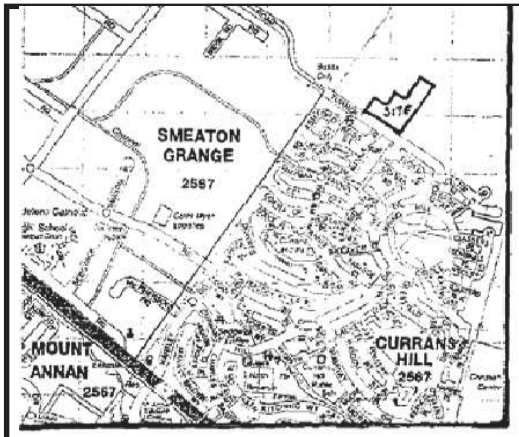
As regulatory evaluation criteria are constantly updated, concentrations of contaminants presently considered low, may in the future fall short of regulatory standards that require further investigation/redemption.

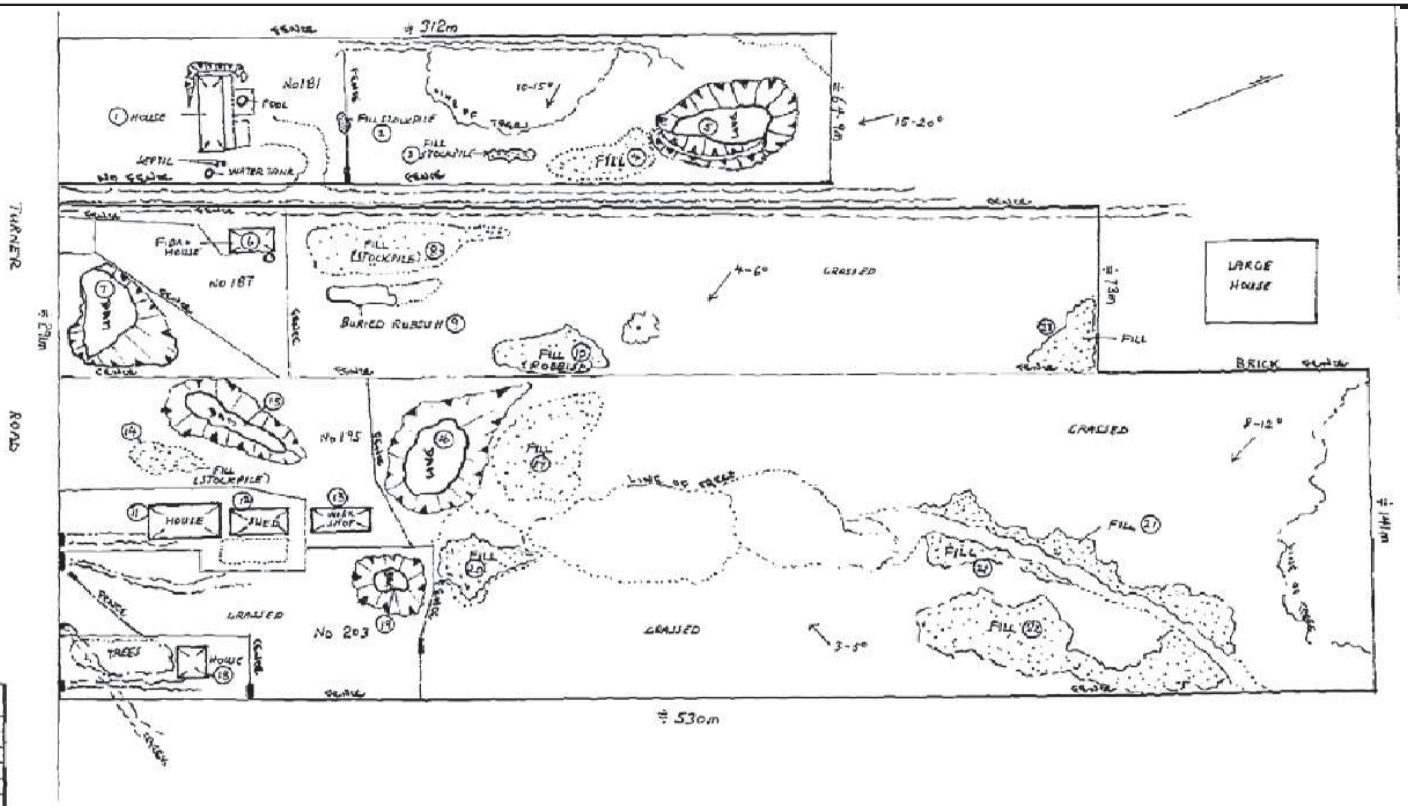
The statements presented in these documents are intended to advise you of what should be your realistic expectations of this report, and to present you with recommendations on how to minimise the risks associated with the groundworks for this project. The document is not intended to reduce the level of responsibility accepted by GeoEnviro Consultancy Pty Ltd, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

Attached in Appendix E are documents entitled "Important Information about Your Environmental Site Assessment" in conjunction with which this report must be read, as it details important limitations regarding the investigation undertaken and this report.

REFERENCES

1. *Preliminary Contamination, Geotechnical and Salinity Assessment , No 181, 187, 195-203 Turner Road Currans Hill – GeoEnviro Consultancy Pty Ltd Ref JC04031A dated March 2004*
2. *Buried Rubbish Fill Nos 181, 187, 195-203 Turner Road Currans Hill – GeoEnviro Consultancy Pty Ltd Ref JC04031A-r2 dated 29th April 2004*
3. *Additional Salinity/Contamination Assessment and RAP, No 195-203 Lots 37 and 38 DP 28024 Turner Road Currans Hill – GeoEnviro Consultancy Pty Ltd Ref JC04031A-r5 dated March 2009*
4. *1:100,000 Geological Map of Penrith – Geological Series Sheet 9029-9129 (Edition 1) 1985*
5. *1:100,000 Soil Landscape Map of Penrith – Soil Conservation Service of NSW ; Sheet 9029-9129*
6. *Australian & New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Conservation Council and National Health and Medical Research Council, 1992.*
7. *Assessment of Orchard and Market Garden Contamination - Contaminated Sites Discussion Paper, NSW EPA 1995.*
8. *Health Based Soil Investigation Levels, National Environmental Health Forum Monographs Soil series No. 1 – 1996*
9. *Assessment of Site Contamination- Measure 1999 – National Environment Protection*
10. *Guidelines for Assessment Service Station Sites – NSW EPA 1994*
11. *Guidelines for the NSW Auditor Scheme(2nd Edition), NSW EPA 2004*
12. *NSW EPA 2014 guidelines "Part 1 – Classifying Waste*





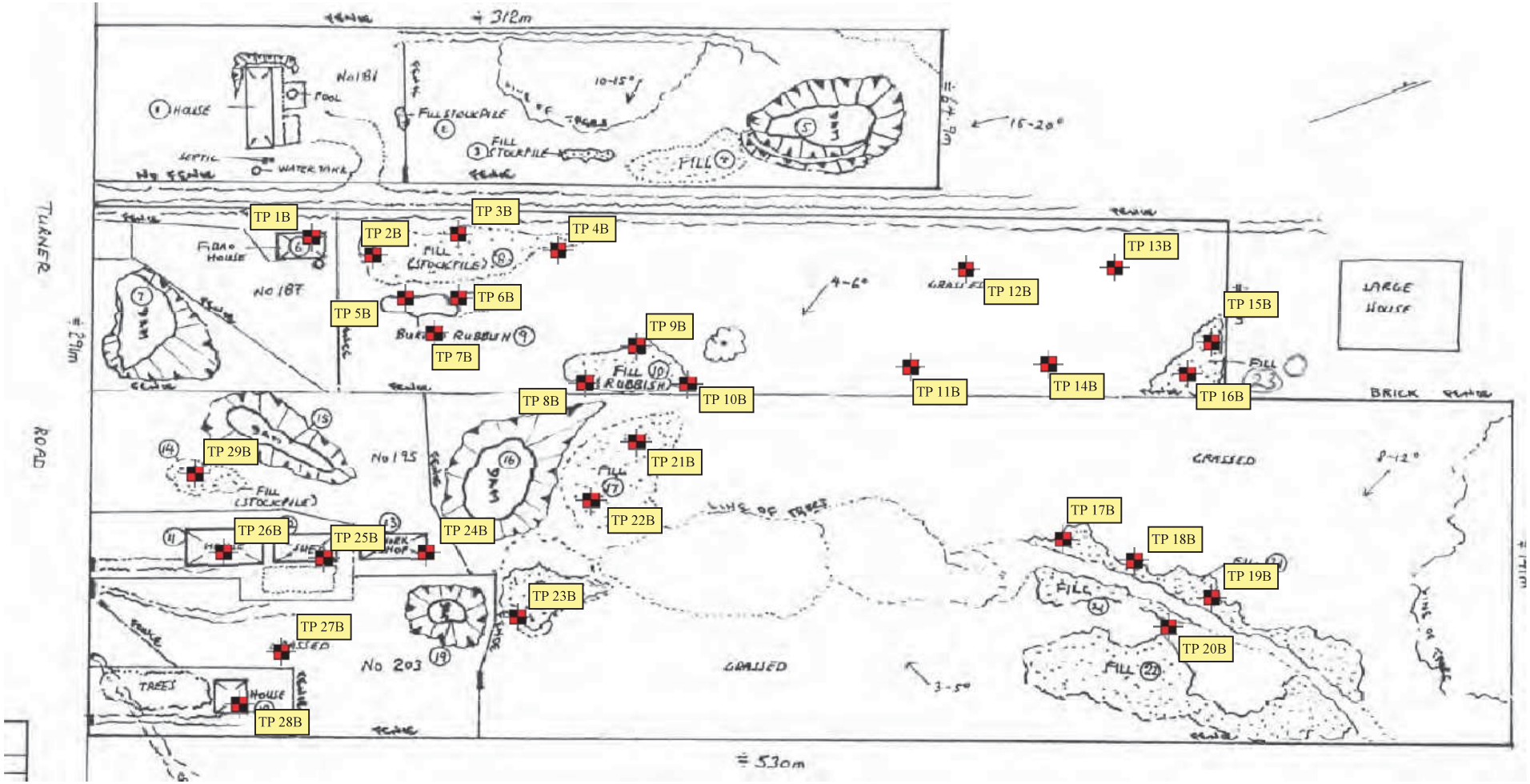
Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, tiles and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

LEGEND

6° → SLOPE DOWN AT 6°

GeoEnviro Consultancy
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Drawn By: AT	Date: 12/08/15	Dartanyon Pty Ltd	
Checked By: SL	Date: 12/08/15	No 187 and 195-203 Turner Road Currans Hill	
Revision By:	Date:	Site Locality and Previous Site Feature Plan	
Scale: Proportional	A3	Project No: JC04031A-r8	Drawing No: 1B

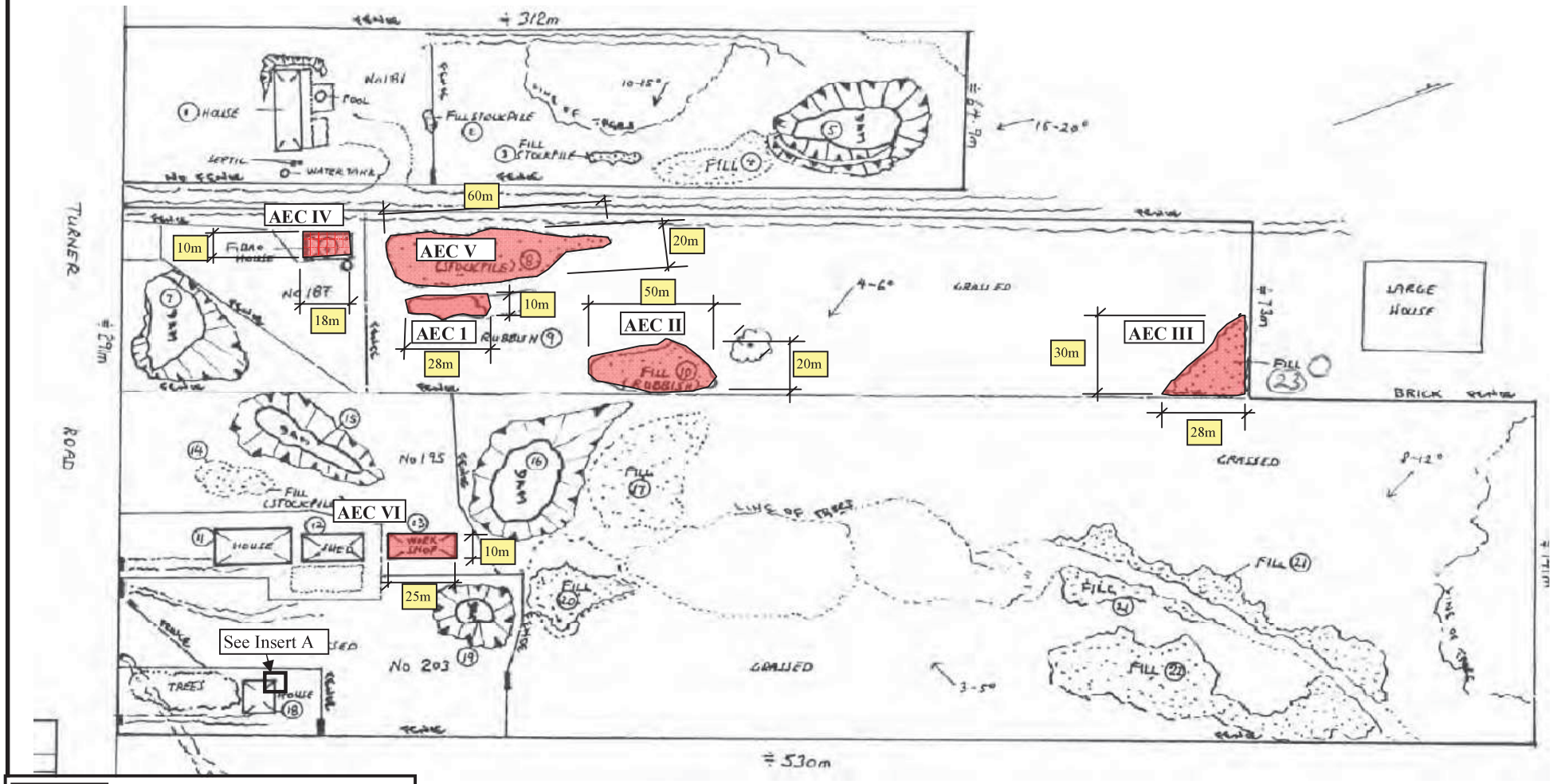


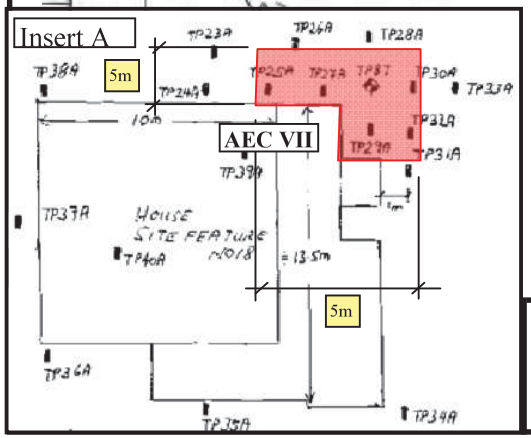
Legend

Test Pit

GeoEnviro Consultancy
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Drawn By: AT	Date: 12/08/15	Dartanyon Pty Ltd
Checked By: SL	Date: 12/08/15	No 187 and 195-203 Turner Road Currans Hill
Revision By:	Date:	Test Pit Location Plan
Scale: Proportional	A3	Project No: JC04031A-r8 / Drawing No: 2B





Legend

Area of Environmental Concern

GeoEnviro Consultancy
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Drawn By: AT	Date: 12/08/15	Dartanyon Pty Ltd
Checked By: SL	Date: 12/08/15	No 187 and 195-203 Turner Road Currans Hill
Revision By:	Date:	Remediation Area Plan
Scale: Proportional	A3	Project No: JC04031A-r8 / Drawing No: 3B

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

Client: Dartanyon Pty Ltd — Job Number: JC04031A-r8

Project: Proposed Residential Subdivision — Logged By: SG/AT

Location: No 187 & 195-203 Turner Road Currans Hill — Date: 27/07/2015

Test Pit Number	Test Pit Location	Depth (m) From	Depth (m) To	Material Description
1B	Refer to	0	0.30	Topsoil/Fill: Gravelly Silty Clay: medium plasticity, brown with fine to medium grained gravel, dry
	Drawing	0.30	0.55	Clayey Silt: low liquid limit, brown, dry to moist
	No 1A	0.55	0.70	(CH) Silty Clay: high plasticity, red brown, MC<=PL
2B		0	0.20	Topsoil/Fill: Gravelly Clayey Silt: low liquid limit, dark brown, dry
		0.20	0.50	Topsoil: Clayey Silt: low liquid limit, dark brown, dry to moist
		0.50	0.70	(CH) Silty Clay: high plasticity, red brown, MC=PL
3B		0	0.25	Topsoil: Clayey Silt: low liquid limit, brown, dry to moist (thin film (0-0.01m) fill on surface)
		0.25	0.40	(CI-CH) Silty Clay: medium to high plasticity, brown, dry to moist
4B		-	-	Asbestos fragments on surface
		0	0.30	Topsoil/Fill: Clayey Silt: low liquid limit, brown with 1 brick fragment, dry to moist
		0.30	0.50	(CH) Silty Clay: high plasticity, red brown, MC=PL
5B		0	0.40	Topsoil/Fill: Clayey Silt/Silty Clay: low plasticity, dark brown with plastic sheet and terracotta, dry to moist
		0.40	1.60	Fill: Silty Clay: medium plasticity, brown red, MC=PL
		1.60	2.10	(CI-CH) Silty Clay: medium plasticity, red brown
6B		0	0.40	Topsoil/Fill: Clayey Silt: low liquid limit, dark brown with wire, dry
		0.40	0.70	(CH) Silty Clay: high plasticity, brown, MC=PL
7B		0	0.40	Topsoil: Clayey Silt: low liquid limit, dark brown, dry
		0.40	0.70	(CH) Silty Clay: high plasticity, brown, MC=PL
8B		-	-	Asbestos fragments on surface
		0	1.90	Fill: Silty Clay: medium plasticity, brown with brick fragment, cobble 300mm, plastic lid and wire, moist to wet
		1.90	2.20	(CI) Silty Clay: medium plasticity, brown, MC<=PL
9B		-	-	Asbestos fragments on surface
		0	2.20	Fill: Silty Clay: medium plasticity, brown with asbestos fragements and timber, moist to wet
		2.20	2.60	(CI) Silty Clay: medium plasticity, brown, dry to moist
10B		0	2.40	Fill: Silty Clay: medium plasticity, brown with plastic, timber, cable, brick fragments and tile fragments, moist to wet
		2.40	2.60	(CI) Silty Clay: medium plasticity, brown, moist
11B		0	0.35	Topsoil: Clayey Silt: low liquid limit, brown, moist to wet
		0.35	0.50	(CI) Silty Clay: medium plasticity, brown, moist

Notes:
MC = Moisture Content.
PL = Plastic Limit.
PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

Client: Dartanyon Pty Ltd — Job Number: JC04031A-r8

Project: Proposed Residential Subdivision — Logged By: SG/AT

Location: No 187 & 195-203 Turner Road Currans Hill — Date: 27/07/2015

Test Pit Number	Test Pit Location	Depth (m) From	Depth (m) To	Material Description
12B	Refer to Drawing No 1A	0	0.30	Topsoil: Clayey Silt: low liquid limit, brown, moist to wet
		0.30	0.50	(Cl) Silty Clay: medium plasticity, brown, MC=PL
13B		0	0.50	Topsoil/Fill: Clayey Silt: low liquid limit, brown with 1 tile fragment, moist to wet
		0.50	0.80	(Cl) Silty Clay: medium plasticity, brown, MC=PL
14B		0	0.45	Topsoil: Clayey Silt: low liquid limit, brown, moist to wet
		0.45	0.60	(Cl) Silty Clay: medium plasticity, brown, MC=PL
15B		0	0.80	Topsoil/Fill: Clayey Silt: low liquid limit, brown with bricks and timber, moist
		0.80	1.00	(Cl) Silty Clay: medium plasticity, brown, MC=PL
16B		0	0.50	Topsoil/Fill: Clayey Silt: low liquid limit, brown with sanstone cobble, moist to wet
		0.50	0.70	(Cl) Silty Clay: medium plasticity, brown, MC=PL
17B		0	0.40	Topsoil/Fill: Clayey Silt: low liquid limit, brown with some timber and mulch, moist
		0.40	0.60	(Cl) Silty Clay: medium plasticity, brown, MC=PL
18B		0	0.25	Topsoil/Fill: Clayey Silt: low liquid limit, brown with some timber and mulch, moist
		0.25	0.40	(Cl) Silty Clay: medium plasticity, brown, MC=PL
19B		0	0.40	Topsoil/Fill: Clayey Silt: low liquid limit, brown with some timber and mulch, moist
		0.40	0.50	(Cl) Silty Clay: medium plasticity, brown, MC=PL
20B		0	0.30	Topsoil: Clayey Silt: low liquid limit, brown, moist
		0.30	0.50	(Cl) Silty Clay: medium plasticity, brown, MC=PL
21B		0	0.25	Topsoil: Clayey Silt: low liquid limit, brown, moist
		0.25	0.50	(Cl) Silty Clay: medium plasticity, brown, MC=PL
22B		0	0.20	Topsoil: Clayey Silt: low liquid limit, brown, moist
		0.20	0.70	(Cl) Silty Clay: medium plasticity, brown, moist with seepage at 0.6m
23B		0	0.70	Topsoil: Clayey Silt: low liquid limit, brown, moist
		0.70	0.80	(Cl) Silty Clay: medium plasticity, brown, MC=PL
24B		0	0.40	Topsoil/Fill: Clayey Silt: low liquid limit, brown with timber, moist to wet
		0.40	0.80	(Cl) Silty Clay: medium plasticity, brown, MC=PL
25B		0	0.35	Topsoil/Fill: Clayey Silt: low liquid limit, brown with tile fragments, timber, glass, cobbles and plastic, m
		0.35	0.60	(CH) Silty Clay: high plasticity, red, moist, MC=PL
				Notes:
				MC = Moisture Content.
				PL = Plastic Limit.
				PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

Client: Dartanyon Pty Ltd — Job Number: JC04031A-r8

Project: Proposed Residential Subdivision — Logged By: SG/AT

Location: No 187 & 195-203 Turner Road Currans Hill — Date: 27/07/2015

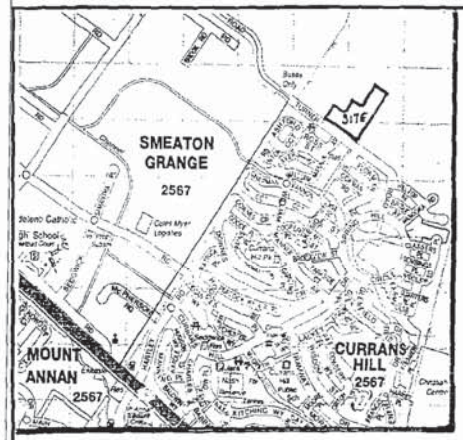
Test Pit Number	Test Pit Location	Depth (m) From	Depth (m) To	Material Description
26B	Refer to	0	0.50	Topsoil/Fill: Clayey Silt: low liquid limit, brown with brick fragments, plastic, timber and glass, moist
	Drawing	0.50	0.70	(Cl) Silty Clay: medium plasticity, brown, MC=PL
	No 1A			
27B		0	0.30	Topsoil/Fill: Clayey Silt: low liquid limit, brown with timber, terracotta tile fragments, dry
		0.30	0.60	(Cl) Silty Clay: medium plasticity, brown, MC=PL
28B		0	0.35	Topsoil/Fill: Clayey Silt: low liquid limit, brown with brick fragments, sanstone gravel/cobble and glass, dry to moist
		0.35	0.50	(Cl) Silty Clay: medium plasticity, brown, MC=PL
29B		0	0.20	Topsoil: Clayey Silt: low liquid limit, brown, moist
		0.20	0.60	(Cl) Silty Clay: medium plasticity, brown, MC=PL

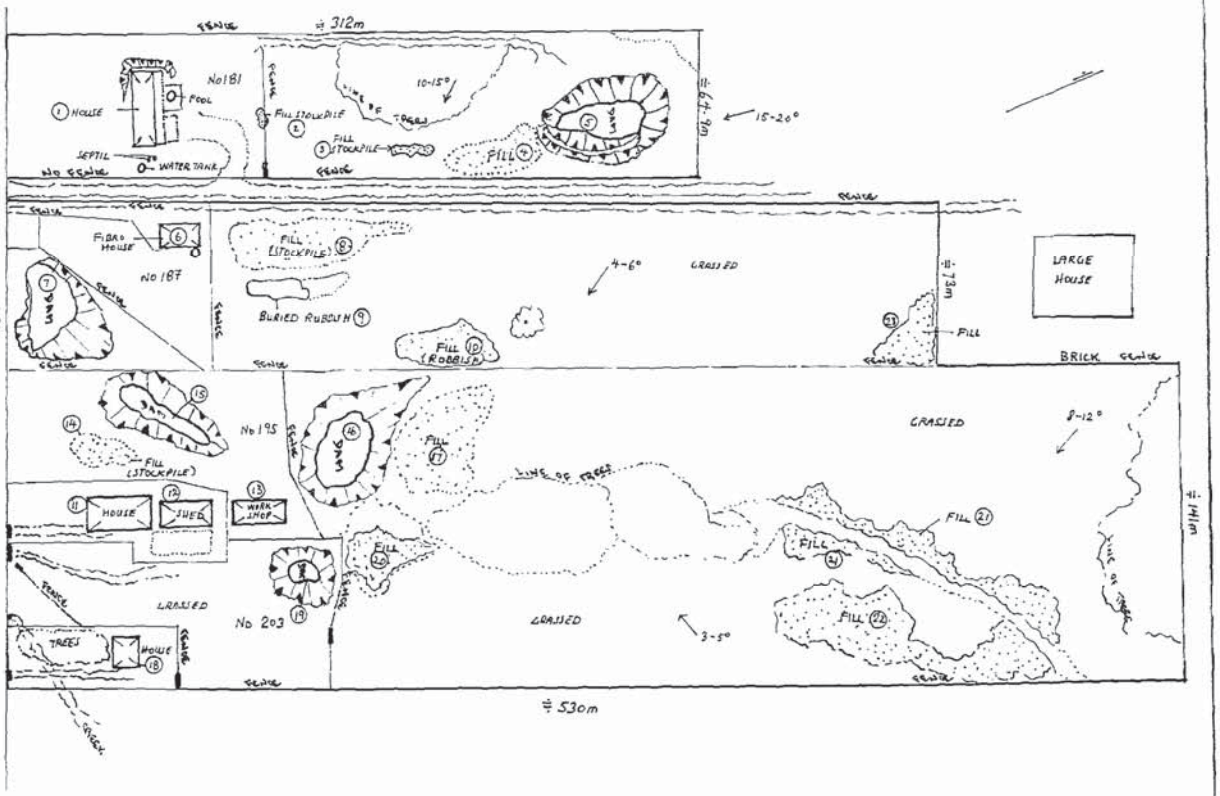
Notes:
MC = Moisture Content.
PL = Plastic Limit.
PP = Pocket Penetrometer.

APPENDIX A

Extracts of the Preliminary Contamination Report (Reference 1)

Preliminary Contamination, Geotechnical and Salinity Assessment , No 181, 187, 195-203 Turner Road Currans Hill – GeoEnviro Consultancy Pty Ltd Ref JC04031A dated March 2004





Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, tiles and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

LEGEND

6° → SLOPE DOWN AT 6°

Note: All site features indicated on the drawings are only indicative and not to scale

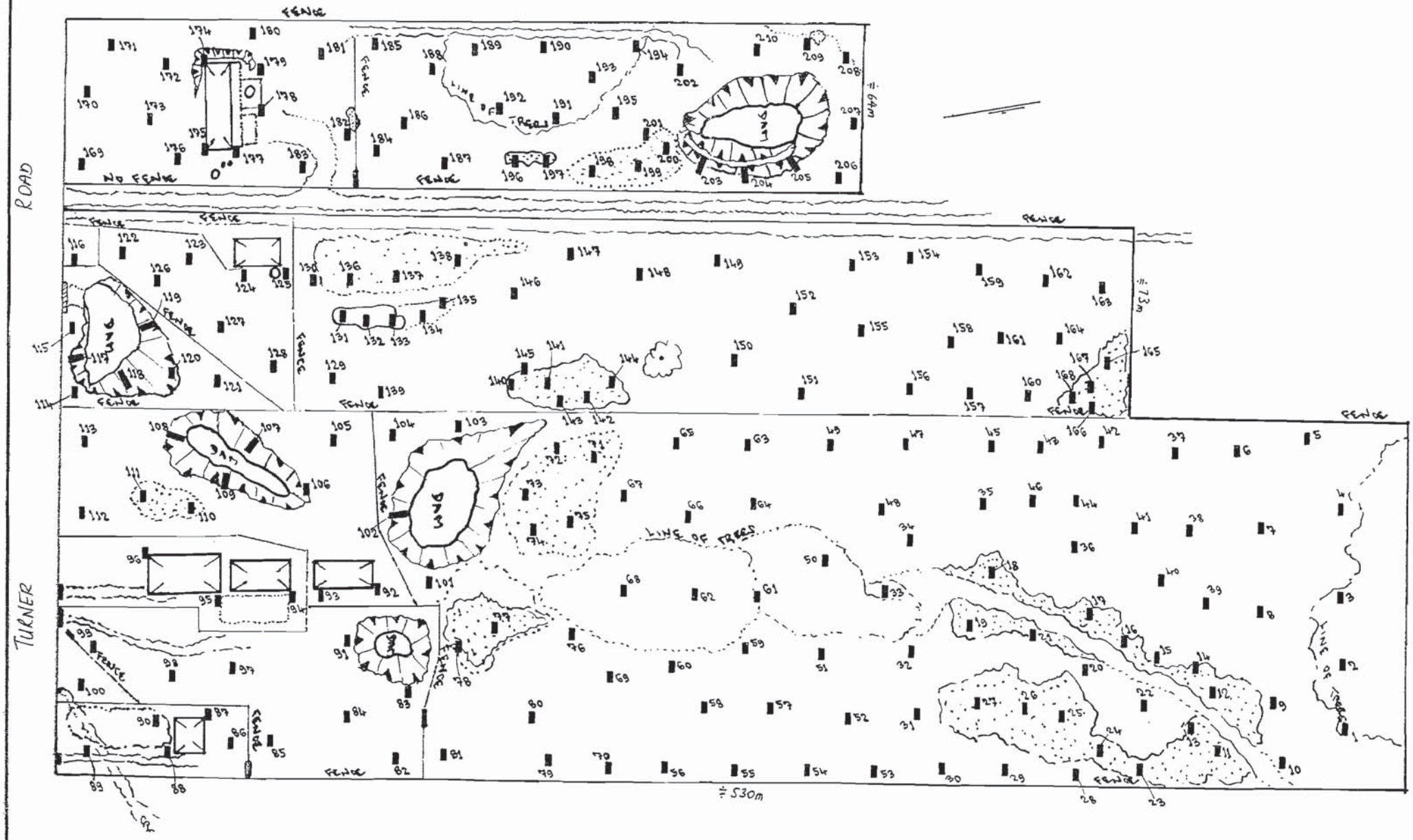
GeoEnviro Consultancy

Drawn By:	SL	Date: 22/3/04	
Checked By:	SL	Date: 22/3/04	
Revision By:		Date:	
Scale:	1:2000 (approx)		A3

Australand Holdings Ltd
No 181, 187, 195-203 Turner Road, Currans Hill
Site Locality and Features Plan

Project No: JC04031A

Drawing No: 1

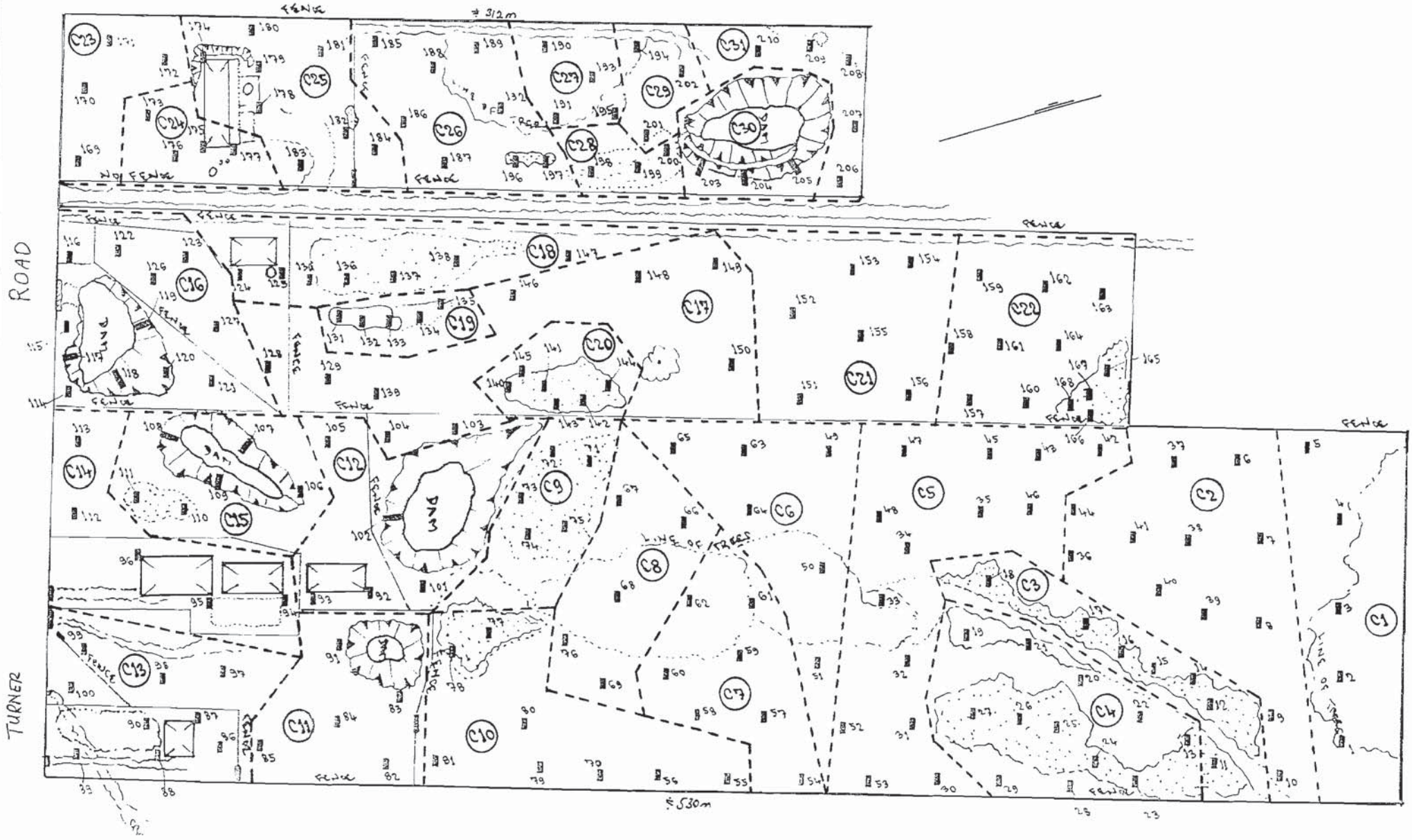


Legend

Test Pit

Note: All site features indicated on the drawings are only indicative and not to scale

GeoEnviro Consultancy	Drawn By: SL	Date : 22/3/04	Australand Holdings Ltd
	Checked By: SL	Date : 22/3/04	No 181, 187, 195-203 Turner Road, Currans Hill
	Revision By:	Date:	Test Pit Location Plan
	Scale: Proportional	A3	Project No: JC04031A / Drawing No: 2



Legend

Test Pit

C2 Composite Sample C2

Note: All site features indicated on the drawings are only indicative and not to scale

GeoEnviro Consultancy

Drawn By: SL	Date : 22/3/04	Australand Holdings Ltd	
Checked By: SL	Date : 22/3/04	No 181, 187, 195-203 Turner Road, Currans Hill	
Revision By:	Date:	Composite Sample Plan	
Scale: Proportional	A3	Project No: JC04031A	Drawing No: 3

Test Pit Number	Depth (m)	Profile Type	Description
1	0.0-0.4	Topsoil	Silt, low liquid limit, light grey, dry
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, with some gravel, MC<=PL, hard, PP>600kPa
2	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, MC<PL, PP>600kPa
3	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, very hard, MC<PL, PP>600kPa
	1.2-1.4	Natural	(CI) Gravelly Silty Clay: medium plasticity, red brown and grey, MC<PL, PP>600kPa
4	0.0-0.4	Topsoil	Clayey Silt, some gravel, brown, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, red and grey, MC<PL, PP>600kPa
5	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.1	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<PL, hard, PP>600kPa
	1.1-1.3	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey, MC<PL, PP>600kPa
	1.3-1.6	Bedrock	Shale/Siltstone: extremely to distinctly weathered, extremely to very low strength, grey and brown
	1.6		Backhoe refusal
6	0.0-0.7	Topsoil/Fill	Clayey silt with silt, dark brown and brown, dry, hard
	0.7-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and brown, MC<PL, PP>600kPa
7	0.0-0.5	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.5-0.9	Natural	(CH) Silty Clay: high plasticity, grey and brown, MC<=PL, PP>600kPa
8	0.0-0.6	Topsoil	Clayey Silt, dark grey and dark brown, dry to moist
	0.6-1.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<PL, PP>600kPa
	1.5-2.8	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, red/grey and brown, some sand, MC<=PL, PP>600kPa
	2.8-3.3	Bedrock	Shale/Siltstone: extremely weathered, extremely low strength, grey and brown
9	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<PL, PP>600kPa
10	0.0-0.5	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.5-0.7	Natural	(CH) Silty Clay: high plasticity, yellow brown, dry, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 1 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
11	0.0-0.3	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete, with some shale gravel, grey and brown
	0.3-0.6	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, very hard, dry
12	0.0-1.0	Fill	Mixture of sandstone gravel/cobbles with silty clay and some roadbase, small pieces of asphaltic concrete, small pieces of concrete, brown and grey, moist
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry
13	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.4-0.8	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow, dry, PP>600kPa
14	0.0-0.4	Fill	Mixture of sandstone gravel/cobbles, silty clay, some roadbase, small pieces of asphaltic concrete, small pieces of concrete, brown/grey, moist
	0.4-0.6	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.6-0.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<PL, hard, PP>600kPa
15	0.0-0.3	Topsoil	Clayey Silt and Silt, low liquid limit, grey, dry
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow brown, dry, PP>600kPa
16	0.0-0.6	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete, some shale gravel, grey and brown
	0.6-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, PP>600kPa
17	0.0-1.0	Fill	Mixture of silty clay, sandstone gravel, shale, roadbase, asphalt pieces, some small pieces of concrete, brown and grey, moist
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry
18	0.0-0.7	Fill	Mixture of silty clay and sandstone gravel, some shale and roadbase, asphalt pieces, some small pieces of concrete, brown and grey, moist
	0.7-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
19	0.0-0.2	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete and with shale gravel, grey and brown, dry to moist
	0.2-0.4	Topsoil	Clayey Silt, brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, MC<PL, hard, PP>600kPa
20	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow/brown, hard, MC<PL
21	0.0-0.1	Fill	Mixed silty clay and clayey silt and sandstone gravel, some roadbase, dark grey, moist
	0.1-0.4	Topsoil	Clayey Silt, low liquid limit, some gravel, grey and brown, dry
	0.4-0.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 2 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road, Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
22	0.0-0.3	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete and with shale gravel, brown and dark grey, dry
	0.3-0.6	Topsoil	Clayey Silt, some gravel, brown, dry
	0.6-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, MC<PL, hard, PP>600kPa
23	0.0-0.2	Fill	Mixture of silty clay and some silt with sandstone gravel/cobbles and roadbase, some small pieces of concrete, some pieces of asphaltic concrete, some sand, dark grey and brown, dry
	0.2-0.4	Topsoil	Clayey Silt, brown, dry
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
24	0.0-0.4	Fill	Mixture of silty clay, silt, some sandstone gravel/cobbles and roadbase, some small pieces of concrete, some pieces of asphaltic concrete, some sand, brown and grey, dry
	0.4-0.7	Topsoil	Clayey Silt, brown, dry
	0.7-1.0	Natural	(CH) Silty Clay: high plasticity, yellow/brown, MC<=PL, hard
25	0.0-0.6	Fill	Mixed silty clay and clayey silt and concrete pieces, sandstone, some asphalt, brown, dry to moist
	0.6-0.9	Topsoil	Clayey Silt and Silt, some gravel, grey, dry
	0.9-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, PP>600kPa
26	0.0-0.4	Fill	Mixed silty clay/clayey silt and some concrete pieces, sandstone gravel, with some asphalt, brown and grey, dry to moist
	0.4-0.7	Topsoil	Clayey Silt and Silt, some gravel, grey, dry
	0.7-0.9	Natural	(CH) Silty Clay: high plasticity, yellow, dry, hard
27	0.0-0.8	Fill	Mixed silty clay and topsoil, silt and some concrete pieces, sandstone gravel, with some asphalt, dark brown and grey, dry to moist
	0.8-1.0	Topsoil	Silt and Clayey Silt, with some gravel, grey, dry
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, yellow/brown, dry, hard
28	0.0-0.2	Topsoil	Clayey Silt, with some gravel, brown and grey, dry
	0.2-0.4	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, MC<PL, PP>600kPa
29	0.0-0.3	Topsoil	Clayey Silt and Silt, low liquid limit, brown/grey, dry
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, PP>600kPa
30	0.0-0.4	Topsoil	Silt with some Clayey Silt, grey, dry
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, MC<PL, hard
31	0.0-0.4	Topsoil	Clayey Silt, brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 3 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 17/4/04

Test Pit Number	Depth (m)	Profile Type	Description
32	0.0-0.4	Topsoil	Clayey Silt, brown and grey, dry
	0.4-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<PL, PP>600kPa
33	0.0-0.6	Topsoil	Silt, some Clayey Silt, dark grey and light grey, dry
	0.6-1.2	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<PL, dry, PP>600kPa
	1.2-1.4	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey and red, MC<=PL, hard, PP>600kPa
34	0.0-0.5	Topsoil	Clayey Silt and Silt, low liquid limit, grey, dry
	0.5-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard
35	0.0-0.4	Topsoil	Clayey Silt, brown and grey, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow, MC<PL, hard
36	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, grey brown, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard
37	0.0-0.6	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.6-1.8	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<=PL, PP>600kPa
	1.8-2.6	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey and brown, MC<=PL, hard, PP>600kPa
38	0.0-0.5	Topsoil	Clayey Silt, dark brown and brown, dry
	0.5-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, PP>600kPa
39	0.0-0.4	Topsoil/Fill	Clayey silt, some gravel, dark brown and brown/grey, dry
	0.4-0.8	Topsoil	Silt with some Clayey Silt, grey, dry
	0.8-1.6	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and dark brown, very hard, very dry, MC<PL, PP>600kPa
40	0.0-0.4	Topsoil/Fill	Clayey silt, dark brown, dry
	0.4-0.7	Topsoil	Silt, some Clayey Silt, light grey, dry
	0.7-1.6	Natural	(CI-CH) Silty Clay/Gravelly Silty-Sandy Clay: medium to high plasticity, dark red and dark brown, very hard, very dry, MC<PL, PP>600kPa
41	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.3-1.0	Natural	(CI) Silty Clay: medium plasticity, dark brown and red, some gravel, MC<=PL, PP>600kPa
42	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-1.6	Natural	(CH) Silty Clay: high plasticity, yellow, dry/moist, MC<=PL, PP>600kPa
	1.6-2.2	Natural	(CI-CH) Gravelly Silty Clay: medium to high plasticity, red/brown and dark red, some sand, MC<PL, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 4 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
43	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<=PL, PP>600kPa
44	0.0-0.4	Topsoil	Clayey Silt, some gravel, dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow, MC<=PL, PP>600kPa
45	0.0-0.3	Topsoil	Clayey silt, brown and dark brown, dry
	0.3-0.5	Topsoil	Silt, light grey, very dry
	0.5-1.3	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, hard
46	0.0-0.3	Topsoil	Clayey silt, dark brown, moist
	0.3-0.4	Topsoil	Silt, light grey, very dry
	0.4-0.9	Natural	(CH) Silty Clay: high plasticity, yellow/brown, moist, MC<=PL, PP>600kPa
47	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, brown and yellow, moist, hard
48	0.0-0.4	Topsoil	Clayey Silt and Silt, brown, dry to moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry and hard, some gravel, MC<=PL, PP>600kPa
49	0.0-0.3	Topsoil	Clayey Silt and Silt with some gravel, brown and grey, moist
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and yellow , MC<PL, hard
50	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.3-1.1	Natural	(CH) Silty Clay: high plasticity, red/orange and yellow, some gravel, moist, hard
51	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.0-1.5	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and brown, dry, MC<PL, PP>600kPa
	1.5-1.7	Bedrock	Shale/Siltstone: extremely weathered, extremely low strength, grey and brown
52	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry to moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, hard
53	0.0-0.3	Topsoil	Clayey Silt, some gravel, brown, dry to moist
	0.3-0.8	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, very dry and very hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 5 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
54	0.0-0.3	Topsoil	Clayey Silt, some gravel, brown, moist
	0.3-0.5	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, PP>600kPa
55	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.2-1.8	Natural	(CI) Silty Clay: medium plasticity, grey, some shale gravel, MC<=PL, PP>600kPa
	1.8-2.4	Bedrock	Shale: extremely weathered/Interbedded with gravelly shaley clay, grey and brown, dry to moist
56	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, hard
57	0.0-0.3	Topsoil	Clayey Silt, some gravel, brown, moist
	0.3-0.9	Natural	(CH) Silty Clay: high plasticity, yellow, hard, MC<=PL, PP>600kPa
58	0.0-0.3	Topsoil	Clayey Silt, with some gravel, brown, dry/moist
	0.3-0.5	Natural	(CH) Silty Clay: high plasticity, yellow/brown, MC<PL, hard
59	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown and brown, dry to moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and red/brown, MC<=PL, hard
60	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-1.3	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.3-1.9	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	1.9-2.2	Natural	(CL) Gravelly Shaley Clay: low plasticity, grey, with layers/bands of extremely weathered shale
	2.2-2.4	Bedrock	Shale: extremely weathered, extremely low strength, grey and brown
61	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, dark brown, dry to moist
	0.2-0.5	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, PP:480-560kPa
62	0.0-0.3	Topsoil	Clayey Silt, brown, moist
	0.3-0.9	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
63	0.0-0.2	Topsoil	Clayey Silt, brown, some gravel, moist
	0.2-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard
64	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and red, MC<PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 6 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
65	0.0-0.3	Topsoil	Clayey Silt, brown, dry to moist
	0.3-1.4	Natural	(CH) Silty Clay: high plasticity, red/grey and brown, MC<PL, very hard
66	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry/moist
	0.3-1.6	Natural	(CH) Silty Clay: high plasticity, red/brown and grey, with some gravel, MC<=PL, hard, PP>600kPa
	1.6-2.4	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, dark red and dark brown/grey, very dry and very hard, MC<PL, PP>600kPa
67	0.0-0.3	Topsoil	Clayey Silt with Silt, grey and brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, dry to moist, hard
68	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, with some gravel, dry/moist
	0.4-0.8	Natural	Silt/(CL) Silty Clay: low plasticity, grey and brown, dry, MC<PL, hard, PP>600kPa, with some fine to coarse gravel
	0.8-1.2	Natural	(CH) Silty Clay: high plasticity, red/brown and grey, with some gravel, MC<PL, hard, PP>600kPa
69	0.0-0.2	Topsoil	Clayey Silt, brown, moist
	0.2-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown/red, MC<=PL, PP>600kPa
70	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.2-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
71	0.0-0.7	Fill/Topsoil	Clayey silt and silty clay with gravel, brown/red and grey, dry
	0.7-1.2	Natural	(CI-CH) Silty Clay/Gravelly Silty-Sandy Clay: medium to high plasticity, dark brown and red, very hard, MC<PL, PP>600kPa
72	0.0-0.6	Fill/Topsoil	Clayey silt/silty clay with some gravel, brown and grey, dry
	0.6-1.5	Natural	(CI-CH) Gravelly Silty Clay: medium to high plasticity, some sand, MC<PL, PP>600kPa
73	0.0-0.8	Fill/Topsoil	Silty clay with gravel and some sand, some clayey silt, grey and red/brown, dry
	0.8-1.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, MC<PL, PP>600kPa
74	0.0-0.7	Fill/Topsoil	Clayey silt with silty clay and some gravel, brown/red and grey, dry
	0.7-1.2	Natural	(CI-CH) Silty Sandy Clay: medium to high plasticity, brown and red, dry, hard
75	0.0-0.5	Topsoil/Fill	Clayey silt mixed with some gravel, brown and grey, dry
	0.5-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry
76	0.0-0.6	Topsoil/Fill	Clayey silt and silty clay with some gravel, brown and grey, dry
	0.6-1.0	Natural	(CI-CH) Silty Sandy Clay: medium to high plasticity, red and grey, MC<=PL, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 7 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: CL Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
77	0.0-0.6	Fill	Silty clay mixed with sandstone gravel, some asphaltic concrete pieces, some clayey silt, dark brown and grey, moist to wet profile
	0.6-1.0	Topsoil	Silt, with some clayey silt, light grey and brown, dry
	1.0-1.4	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, MC<PL, hard
78	0.0-0.7	Fill	Mixture of silty clay medium plasticity with some gravel and with some silt, yellow brown and grey, moist to wet
	0.7-0.9	Topsoil	Silt and some clayey silt, light grey, dry
	0.9-1.1	Natural	(CI) Silty Sandy Clay: medium plasticity, red and dark grey, MC<=PL, PP>600kPa
79	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.4-1.1	Natural	(CH) Silty Clay: high plasticity, yellow and red/brown, MC<=PL, hard, PP>600kPa
	1.1-1.9	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, dark red and brown, MC<PL, PP>600kPa
80	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.3-0.5	Natural	(CH) Silty Clay: high plasticity, red and grey, MC<PL, PP>600kPa
81	0.0-0.6	Fill/Topsoil	Clayey silt with silty clay, some gravel, brown/grey and yellow, moist
	0.6-1.0	Natural	(CI-CH) Silty Sandy Clay: medium to high plasticity, brown, MC<PL, hard
82	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
83	0.0-0.3	Topsoil/Fill	Silty clay and clayey silt with gravel, brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard
84	0.0-0.5	Topsoil/Fill	Clayey silt with silt and with some gravel, brown, moist
	0.5-1.4	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, grey yellow and brown, MC<PL, PP>600kPa, very hard and very dry
85	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, moist
	0.4-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow/brown and grey, MC<PL, PP>600kPa
86	0.0-0.4	Topsoil/Fill	Clayey silt, some gravel, brown and grey, moist
	0.4-0.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey and brown, dry, hard
87	0.0-0.3	Topsoil/Fill	Clayey silt with some gravel, brown, dry to moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 8 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
88	0.0-0.4	Topsoil/Fill	Clayey silt, some gravel, brown, dry to moist
	0.4-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, dry, hard
89	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, dark brown and grey, moist
	0.4-0.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard, PP>600kPa
90	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark grey and brown, dry
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, red and grey, MC<PL, PP>600kPa
91	0.0-0.6	Fill/Topsoil	Clayey silt with gravel, brown and grey, moist
	0.6-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, MC<PL, hard
92	0.0-0.2	Fill	Silty clay with sandstone and clayey silt, grey, moist
	0.2-0.6	Natural	(CH) Silty Clay: high plasticity, yellow/brown, dry, MC<PL, PP>600kPa
93	0.0-0.4	Fill	Silty clay with gravel, some clayey silt, dark grey, moist
	0.4-0.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<PL, hard
94	0.0-0.3	Fill/Topsoil	Clayey silt with gravel, brown and grey, dry
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<PL, hard
95	0.0-0.3	Fill/Topsoil	Clayey silt with some gravel, brown and grey, dry
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, dry, hard
96	0.0-0.3	Fill/Topsoil	Clayey silt with gravel, brown and grey, dry
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, very hard, dry
97	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.3-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and dark red, MC<PL, hard, PP>600kPa
98	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, brown and grey, dry
	0.4-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, dry, MC<PL, hard, PP>600kPa
	0.9-1.8	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, grey yellow and brown, MC<PL, PP>600kPa, dry
99	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, with some gravel, MC<=PL, PP:380-460kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 9 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 22/03/2004
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
100	0.0-0.5	Topsoil/Fill	Clayey silt mixed with silt and some gravel, light grey and brown, dry
	0.5-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and grey, MC<=PL, PP>600kPa
101	0.0-0.7	Topsoil/Fill	Silt with gravel and some clayey silt, grey, dry to moist
	0.7-1.0	Natural	(CI) Silty Clay: medium plasticity, yellow and red/brown, MC<=PL, hard
102	Dam Embankment	Fill	Clayey silt and silty clay high plasticity and some gravel, brown, moist
103	0.0-0.3	Topsoil/Fill	Clayey silt with some gravel, brown, dry to moist
	0.3-0.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown, dry, hard
104	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.4	Natural	(CH) Silty Clay: high plasticity, red and brown, with some gravel, dry to moist, hard, MC<=PL, PP>600kPa
105	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
	1.0-1.9	Natural	(CI) Gravelly Silty Clay: medium plasticity, brown, very hard, MC<PL, PP>600kPa
106	0.0-0.8	Fill	Silty clay and some silt mixed with some gravel, grey and brown, dry
	0.8-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, dry, hard
107	Dam Embankment	Fill	Mixture of clayey silt, silty clay of high plasticity and some gravel, yellow/brown and dark brown/grey, moist
108	Dam Embankment	Fill	Mixed clayey silt, silty clay of high/medium to high plasticity, some gravel, yellow and brown and dark brown/grey, moist
109	Dam Embankment	Fill	Mixture of silty clay and clayey silt, silty clay of high plasticity with some gravel, yellow/brown and dark grey and dark brown, moist
110	0.0-0.7	Fill	Silty clay of medium plasticity mixed with gravel, some silt, some clayey silt, some sandstone cobbles, brown, dry to moist
	0.7-1.0	Topsoil	Silt, low liquid limit, light grey, dry
	1.0-1.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, MC<=PL, hard
111	0.0-0.8	Fill	Mixed silty clay with silt and sandstone gravel/cobbles, brown, moist
	0.8-1.0	Topsoil	Silt, with some clayey silt, grey, dry
	1.0-1.3	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and yellow, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 10 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
112	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
113	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry to moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, MC<=PL, hard, PP>600kPa
114	0.0-0.4	Topsoil/Fill	Clayey silt, dark brown, dry to moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard
115	0.0-1.5	Fill	Mixture of silty clay high and medium to high plasticity with gravel and some topsoil, brown/yellow and grey, moist
	1.5-2.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and grey, MC<=PL, PP>600kPa
116	0.0-1.0	Fill	Silty clay mixed with some ironstone and shale gravel, some topsoil, brown, moist
	1.0-1.1	Natural	(CH) Silty Clay: high plasticity, yellow/brown, moist, hard
117	Dam Embankment	Fill	Mixture of silty clay high plasticity with some clayey silt/topsoil and some gravel, brown and dark brown/grey, moist
118	Dam Embankment	Fill	Mixed clayey silt, silty clay of high plasticity, some gravel, yellow and brown and grey, moist
119	Dam Embankment	Fill	Mixture of silty clay and clayey silt, silty clay of high plasticity, some gravel, yellow/brown and dark grey, moist
120	0.0-1.0	Topsoil/Fill	Clayey silt with some gravel and some silty clay, dark brown/grey, some silt, moist
	1.0-1.3	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, brown, MC>=PL, very stiff
121	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, grey and brown, dry to moist
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and brown, MC<PL, PP>600kPa
122	0.0-0.5	Topsoil	Clayey Silt and Silt, low liquid limit, some fine gravel, dark brown and grey, moist
	0.5-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, MC<=PL, very hard, PP>600kPa
	1.0-1.9	Natural	(CI) Silty Sandy Clay/Gravelly Silty Clay: medium plasticity, red/orange and brown, MC<PL, very hard, PP>600kPa
123	0.0-0.4	Topsoil	Clayey Silt and Silt with some gravel, brown and grey, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and grey, moist, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 11 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ea Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
124	0.0-0.3	Topsoil/Fill	Clayey silt, dark brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown/grey, moist, hard
125	0.0-0.4	Topsoil/Fill	Clayey silt mixed with some gravel, dark brown and grey, moist
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, PP>600kPa
126	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.5	Topsoil	Silt, light grey, dry
	0.5-1 2	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and grey, moist, hard
127	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, some gravel, dark brown, dry to moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown/yellow, moist, hard
128	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and red, MC<=PL, PP>600kPa
129	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, some gravel, dark brown, moist
	0.3-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and grey, moist, hard
130	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, brown, dry
	0.4-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, orange and red, MC<PL, PP>600kPa
131	0.0-0.4	Fill	Topsoil mixed with silty clay high plasticity and gravel, brown/red and grey, moist
	0.4-3.0	Fill	Timber and topsoil mixture with corrugated iron, broken timber poles, cloth, plastic pieces, tiles, bricks, some silty clay, one small piece of bonded asbestos, dry
132	0.0-0.6	Fill	Silty clay/topsoil mixed with some silty clay high plasticity and gravel, red and brown grey, moist
	0.6-2.8	Fill	Topsoil and some silty clay mixed with broken timber pieces, poles, tree stumps, fence posts, some pieces of brick and concrete, some plastic and rusty metal pieces, very dry
	2.8		Test pit terminated due to collapsing and test pit started caving in
133	0.0-0.8	Fill	Silty clay and clayey silt /topsoil mixture with some silty clay medium/high plasticity and gravel, red/brown and grey, moist
	0.8-2.6	Fill	Topsoil and silty clay with broken timber poles, tree stumps, fence posts, some pieces of brick and concrete, some plastic and rusty metal pieces, dry to very dry
	2.6		Test pit terminated due to collapsing and test pit started caving in
134	0.0-0.8	Fill	Mixed silty clay with topsoil and brick/concrete fragments, brown and grey, moist
	0.8-1.0	Topsoil	Silt and Clayey Silt, grey and brown, dry
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, red/brown and grey, MC<=PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 12 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
135	0.0-0.4	Fill/Topsoil	Clayey silt with concrete fragments, dark grey and brown, moist
	0.4-0.8	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and grey, MC<PL, hard
136	0.0-0.6	Fill	Silty clay with gravel and topsoil, yellow and brown, dry to moist
	0.6-0.9	Topsoil	Clayey Silt and Silt, light grey and brown, dry
	0.9-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP:>600kPa
137	0.0-0.5	Fill/Topsoil	Clayey silt with gravel, brown, moist
	0.5-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, hard
138	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, yellow/red, MC<PL, PP>600kPa
139	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, PP>600kPa
			board, timber pieces, rusty metal car parts, brown, dry
140	0.0-0.7	Fill	Mixed topsoil and silty clay with some gravel, some concrete fragments, brown, moist
	0.7-1.0	Topsoil	Silt and Clayey Silt, grey and brown, dry
	1.0-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
141	0.0-1.0	Fill	Silty clay mixed with topsoil, some small brick and concrete fragments, some sandstone gravel, brown and grey, moist
	1.0-2.4	Natural	(CI) Silty Sandy Clay/Gravelly Silty Clay: medium plasticity, brown and grey, MC<=PL, very hard, PP>600kPavery stiff
142	0.0-1.5	Fill	Topsoil and some silty clay mixed with large concrete boulders up to 0.8-1.0m, bricks and cloth, plastic, steel mesh, rusty metal pieces, grey/dark grey and brown, moist
	1.5-2.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, MC<=PL, PP>600kPa
143	0.0-2.0	Fill	Mixture of dark brown topsoil and some silty clay with bricks, timber, large concrete boulders, steel (mesh and wire), plastic pieces, glass, two small asbestos pieces, some sandstone and crushed rock gravel, dark brown and grey, moist
	2.0-2.4	Natural	(CI) Silty Sandy Clay/Gravelly Silty Clay: medium plasticity, dark grey and brown, moist, hard
144	0.0-0.6	Fill	Silty clay and topsoil mixed with brick and concrete fragments, some crushed rock, brown and grey, moist
	0.6-0.9	Topsoil/Fill	Clayey silt and silt, grey and brown, moist
	0.9-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red, dry, hard, PP>600kPa
145	0.0-0.7	Fill	Mixed topsoil and silty clay with sandstone, concrete and brick rubble, some steel, plastic, crushed rock, brown/grey, moist
	0.7-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and dark red, MC<PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 13 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
146	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.4-1.8	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark red/brown and orange, some sand, some gravel, MC<=PL, hard, PP>600kPa
	1.8-2.2	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey with yellow mottling, MC<=PL, moist, hard, PP>600kPa
147	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.4-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and brown, MC<=PL, PP>600kPa
148	0.0-0.6	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.6-0.9	Natural	(CH) Silty Clay: high plasticity, yellow/brown and red, MC<=PL, PP>600kPa
149	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, with some gravel, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, hard, PP>600kPa
150	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown and brown, some gravel, moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, brown and dark red, MC<=PL, PP>600kPa
151	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, some gravel, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, PP>600kPa
152	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, yellow/brown, hard, with some gravel, moist
153	0.0-0.6	Topsoil/Fill	Clayey silt mixed with some gravel, dark brown and brown/grey, moist
	0.6-1.4	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, PP>600kPa
	1.4-1.8	Bedrock	Shale/Gravelly Shaley Clay: extremely weathered, extremely low strength, grey and brown
154	0.0-0.5	Topsoil/Fill	Clayey silt with gravel, brown, moist
	0.5-0.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard
155	0.0-0.3	Topsoil/Fill	Clayey silt, with low liquid limit, dark brown, moist
	0.3-0.6	Topsoil	Silt, with some gravel, light grey, dry
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow/brown, moist, hard
156	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, with some gravel, dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, moist

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 14 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
157	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, dry to moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and grey, MC<=PL, PP>600kPa
158	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow/brown and grey, hard, some gravel, moist
159	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<=PL, PP>600kPa
160	0.0-0.3	Topsoil	Clayey Silt, with some gravel, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, grey yellow/brown, moist, MC<=PL, PP>600kPa
	0.8-1.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, PP>600kPa, with some gravel
161	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, PP>600kPa
162	0.0-0.6	Topsoil/Fill	Silty clay and clayey silt mixed with some shale gravel, brown/dark brown and grey, moist
	0.6-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown/grey, moist, hard
163	0.0-0.3	Topsoil/Fill	Clayey silt with gravel and some sandy silt, brown, moist
	0.3-1.2	Natural	(CH) Silty Clay: high plasticity, yellow brown and grey, with some gravel, MC<=PL, hard, PP>600kPa
	1.2-1.7	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey and brown, MC<=PL, hard, PP>600kPa
	1.7-2.2	Bedrock	Siltstone: extremely weathered, extremely to very low strength, grey and brown
164	0.0-0.5	Topsoil	Clayey Silt, low liquid limit, some gravel, dark brown and black, moist
	0.5-1.0	Natural	(CH) Silty Clay: high plasticity, yellow/brown, moist, PP>600kPa
165	0.0-0.6	Fill	Mixed topsoil with silty clay and with bricks, pieces of concrete, timber, plastic, metal wires, some gravel, brown and grey, moist
	0.6-1.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown/grey, with some gravel, MC<=PL, hard, PP>600kPa
	1.9-2.3	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey and brown, some sand, MC<=PL, hard
166	0.0-0.6	Topsoil/Fill	Clayey silt with some gravel, some sand, brown and grey, moist
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, hard
167	0.0-1.0	Fill	Topsoil mixed with silty clay and bricks/concrete pieces, timber, plastic, metal wires, some gravel, brown/dark brown and grey, moist
	1.0-1.3	Natural	(CH) Silty Clay: high plasticity, yellow and grey, some gravel, MC<=PL, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 15 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
168	0.0-0.7	Fill	Mixture of topsoil with some silty clay, bricks, concrete pieces, plastic, cloth, timber and some metal wires, some gravel, brown and grey, moist
	0.7-1.0	Natural	(CH) Silty Clay: high plasticity, brown and yellow, MC<PL, PP>600kPa
169	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, dark brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and red, MC<=PL, hard
170	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.2-0.8	Natural	(CH) Silty Clay: high plasticity, red/yellow and brown, MC<=PL, PP>600kPa
171	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.2-0.9	Natural	(CH) Silty Clay: high plasticity, red and brown, some fine to coarse ironstone gravel, MC<=PL, moist, PP>600kPa
	0.9-1.2	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey and brown, MC<PL, hard and dry clays, PP>600kPa
	1.2-1.5	Bedrock	Siltstone/Shale: extremely weathered, extremely low strength, grey
172	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, PP>600kPa
173	0.0-0.4	Topsoil/Fill	Clayey silt, with some gravel, brown and dark brown, moist
	0.4-0.6	Topsoil	Silt/Clayey Silt, light grey, very dry
	0.6-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, hard
174	0.0-0.2	Fill/Topsoil	Clayey silt with silty clay and some gravel, brown and grey, moist
	0.2-0.4	Natural	(CH) Silty Clay: high plasticity, brown, hard, MC<=PL
175	0.0-0.4	Topsoil/Fill	Clayey silt with gravel, brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, MC<=PL, hard
176	0.0-0.7	Topsoil/Fill	Clayey silt with silt and some gravel, light grey/dark brown, moist
	0.7-0.9	Natural	(CH) Silty Clay: high plasticity, brown and red, MC<=PL, PP>600kPa
177	0.0-0.3	Fill/Topsoil	Silty clay with clayey silt, brown and grey, moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, brown and grey, hard, MC<=PL
178	0.0-0.2	Topsoil/Fill	Clayey silt with gravel, brown, moist
	0.2-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown, dry, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 16 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road, Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
179	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, dry, hard, PP>600kPa
180	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, some gravel, brown, dry to moist
	0.2-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<PL, PP>600kPa
	0.6-1.0	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey and brown, MC<PL, dry, PP>600kPa
	1.0-1.6	Bedrock	Siltstone: extremely weathered, extremely low strength, grey and brown, with some shale bands/layers
181	0.0-0.4	Topsoil	Clayey Silt, some gravel, dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, MC<=PL, PP>600kPa
182	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, brown, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown with grey mottling, MC<=PL, hard, PP>600kPa
183	0.0-0.5	Fill	Silty clay with some ash, shale and sandstone gravel, grey and dark brown
	0.5-0.8	Natural	(CH) Silty Clay: high plasticity, red and grey, moist, MC<=PL, PP>600kPa
184	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, some gravel, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, red and grey, dry, PP>600kPa
185	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry to moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<=PL, PP>600kPa
	0.8-1.6	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, red and grey, hard, MC<PL, dry, PP>600kPa
	1.6-2.0	Bedrock	Siltstone/Shale: extremely weathered, extremely low strength, brown and grey
186	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, grey and brown/dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and red/brown, dry/moist, hard, PP>600kPa
187	0.0-0.3	Topsoil	Clayey Silt, some gravel, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, MC<=PL, PP>600kPa
188	0.0-0.4	Topsoil	Clayey Silt, with some gravel, brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 17 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road, Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 21/4/04

Test Pit Number	Depth (m)	Profile Type	Description
189	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry to moist
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red/yellow and brown, some gravel, MC<=PL, PP>600kPa
	1.0-1.6	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey, hard, MC<PL, PP>600kPa
	1.6-1.8	Bedrock	Siltstone: extremely weathered, extremely low strength, brown and grey
190	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-1.1	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, PP>600kPa
	1.1-1.4	Natural	(CI) Silty Clay: medium plasticity, grey and brown, with gravel, moist, hard
	1.4-1.8	Bedrock	Siltstone/Shale: extremely weathered, extremely low strength, grey/brown
191	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, MC<=PL, PP>600kPa
	1.0-1.6	Natural	(CI) Silty Clay: medium plasticity, grey and brown, with some gravel, moist, PP>600kPa
	1.6-2.0	Bedrock	Siltstone: extremely weathered, extremely low to very strength, grey
192	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, some gravel, brown and dark brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, hard, PP>600kPa
193	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, PP>600kPa
194	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown/dark brown, moist
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red brown, with some gravel, MC<=PL, PP>600kPa
	1.0-1.6	Natural	(C-CH) Silty Clay: medium to high plasticity, brown/red and grey, with gravel, MC<=PL, hard clays, PP>600kPa
	1.6-2.4	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey with red mottling, MC<=PL, hard
195	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, brown, moist, PP>600kPa
196	0.0-0.6	Fill	Mixed silty clay with sandstone and some shale gravel, brown and grey, moist
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, red/grey, moist, PP>600kPa, hard
197	0.0-0.5	Fill	Mixed silty clay with sandstone/shale gravel, brown, moist
	0.5-0.8	Natural	(CH) Silty Clay: high plasticity, brown and red, MC<=PL, PP>600kPa
198	0.0-0.8	Topsoil/Fill	Clayey silt with silty clay and some gravel, dark brown, moist
	0.8-1.1	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 18 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
199	0.0-0.9	Topsoil/Fill	Clayey silt mixed with some silty clay and some gravel, dark brown, moist
	0.9-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, PP>600kPa
200	0.0-0.6	Topsoil/Fill	Clayey silt with some gravel, dark brown, moist
	0.6-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown, with some gravel, MC<=PL, PP>600kPa, hard
201	0.0-0.5	Topsoil/Fill	Clayey silt, brown and dark brown, moist
	0.5-0.7	Natural	(CH) Silty Clay: high plasticity, red/grey and brown, moist, hard
202	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown/dark brown, some gravel, moist
	0.2-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown with grey mottling, with some gravel, MC<=PL, PP>600kPa
	1.2-2.2	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey and brown, MC<=PL, hard
203	Dam Embankment	Fill	Mixed silty clay of high plasticity with some gravel and topsoil, brown/red and grey, moist
204	Dam Embankment	Fill	Mixed clayey silt, silty clay of high plasticity, some gravel, red/grey and yellow/brown, moist
205	Dam Embankment	Fill	Mixture of silty clay high plasticity and clayey silt, with some gravel, brown and red/grey, moist
206	0.0-0.5	Topsoil	Clayey Silt, low liquid limit, dark brown, some gravel, moist
	0.5-1.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, with some gravel, MC<=PL, PP>600kPa
	1.5-2.4	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey, MC<=PL, hard, PP>600kPa
207	0.0-0.4	Topsoil/Fill	Silt/Clayey silt with some gravel, brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and grey, some gravel, MC<=PL, PP>600kPa, hard
208	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, some gravel, moist
	0.4-1.1	Natural	(CH) Silty Clay: high plasticity, red/grey and brown, MC<=PL, PP>600kPa
	1.1-2.0	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey and brown, dry and very hard,
	2.0-2.5	Bedrock	Siltstone/Shale: extremely weathered, extremely low strength, brown and grey, with frequent gravelly shaley clay bands

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 19 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
209	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, dark brown and brown, moist
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown/grey, with some gravel, MC<=PL, hard, PP>600kPa
210	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, some gravel, dry
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 20 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Sample	Depths	Sample Date	Sample Type	Sample Composition	Analysis													
						Heavy Metals								OCP	OPP	TRH	BTEX	PAH
					pH	Cu	Pb	Zn	Cd	Cr	Ni	As	Hg					
C1	0.0-0.2	24-27/2/04	Soil	TP1 (0-0.2m) TP3 (0-0.2m) TP5 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C2	0.0-0.2	24-27/2/04	Soil	TP8 (0-0.2m) TP40 (0-0.2m) TP44 (0-0.2m)		o	o	o	o	o	o	o	o					
C3	0.0-0.2	24-27/2/04	Soil	TP11 (0-0.2m) TP14 (0-0.2m) TP17 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C4	0.0-0.2	24-27/2/04	Soil	TP22 (0-0.2m) TP23 (0-0.2m) TP25 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C5	0.0-0.2	24-27/2/04	Soil	TP43 (0-0.2m) TP48 (0-0.2m) TP53 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C6	0.0-0.2	24-27/2/04	Soil	TP50 (0-0.2m) TP51 (0-0.2m) TP63 (0-0.2m)		o	o	o	o	o	o	o	o					
C7	0.0-0.2	24-27/2/04	Soil	TP57 (0-0.2m) TP59 (0-0.2m) TP60 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C8	0.0-0.2	24-27/2/04	Soil	TP66 (0-0.2m) TP67 (0-0.2m) TP68 (0-0.2m)		o	o	o	o	o	o	o	o					
C9	0.0-0.5	24-27/2/04	Soil	TP71 (0-0.5m) TP73 (0-0.5m) TP74 (0-0.5m)		o	o	o	o	o	o	o	o	o	o			
C10	0.0-0.2	24-27/2/04	Soil	TP55 (0-0.2m) TP70 (0-0.2m) TP81 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C11	0.0-0.2	24-27/2/04	Soil	TP83 (0-0.2m) TP84 (0-0.2m) TP85 (0-0.2m)		o	o	o	o	o	o	o	o					
C12	0.0-0.2	24-27/2/04	Soil	TP92 (0-0.2m) TP101 (0-0.2m) TP105 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C13	0.0-0.2	24-27/2/04	Soil	TP87 (0-0.2m) TP88 (0-0.2m) TP98 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C14	0.0-0.2	24-27/2/04	Soil	TP94 (0-0.2m) TP96 (0-0.2m) TP113 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C15	0.0-0.2	24-27/2/04	Soil	TP106 (0-0.2m) TP110 (0-0.2m) TP111 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C16	0.0-0.2	24-27/2/04	Soil	TP120 (0-0.2m) TP122 (0-0.2m) TP127 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C17	0.0-0.2	24-27/2/04	Soil	TP104 (0-0.2m) TP146 (0-0.2m) TP149 (0-0.2m)		o	o	o	o	o	o	o	o					
C18	0.0-0.2	24-27/2/04	Soil	TP125 (0-0.2m) TP136 (0-0.2m) TP137 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C19	0.0-1.0	24-27/2/04	Soil	TP131 (0-1.0m) TP132 (0-1.0m) TP133 (0-1.0m)		o	o	o	o	o	o	o	o	o	o			
C20	0.0-0.5	24-27/2/04	Soil	TP140 (0-0.5m) TP141 (0-0.5m) TP142 (0-0.5m)		o	o	o	o	o	o	o	o	o	o			
C21	0.0-0.2	24-27/2/04	Soil	TP151 (0-0.2m) TP153 (0-0.2m) TP156 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C22	0.0-0.2	24-27/2/04	Soil	TP159 (0-0.2m) TP160 (0-0.2m) TP163 (0-0.2m)		o	o	o	o	o	o	o	o					
C23	0.0-0.2	2/03/04	Soil	TP169 (0-0.2m) TP170 (0-0.2m) TP172 (0-0.2m)		o	o	o	o	o	o	o	o					
C24	0.0-0.2	2/03/04	Soil	TP173 (0-0.2m) TP175 (0-0.2m) TP177 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C25	0.0-0.2	2/03/04	Soil	TP179 (0-0.2m) TP181 (0-0.2m) TP184 (0-0.2m)		o	o	o	o	o	o	o	o					
C26	0.0-0.2	2/03/04	Soil	TP185 (0-0.2m) TP187 (0-0.2m) TP189 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C27	0.0-0.2	2/03/04	Soil	TP190 (0-0.2m) TP191 (0-0.2m) TP195 (0-0.2m)		o	o	o	o	o	o	o	o					
C28	0.0-0.2	2/03/04	Soil	TP198 (0-0.2m) TP199 (0-0.2m) TP200 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			
C29	0.0-0.2	2/03/04	Soil	TP194 (0-0.2m) TP201 (0-0.2m) TP202 (0-0.2m)		o	o	o	o	o	o	o	o					
C30	0.0-0.2	2/03/04	Soil	TP203 (0-1.0m) TP204 (0-1.0m) TP205 (0-1.0m)		o	o	o	o	o	o	o	o					
C31	0.0-0.2	2/03/04	Soil	TP206 (0-0.2m) TP208 (0-0.2m) TP209 (0-0.2m)		o	o	o	o	o	o	o	o	o	o			

Note: o denotes tested

GeoEnviro Consultancy

TABLE 2 (Page 1 of 3)

Analytical Program and Compositing Schedule

Australand Holdings Ltd

Preliminary Contamination, Geotechnical and Salinity Investigation

No. 181, 187, 195-203 Turner Road, Currans Hill

Prepared By:SL Date: 21/03/04
checked by [illegible] Date: 1/4/04

Sample	Depths	Sample Date	Sample Type	Sample Composition	Analysis													
						Heavy Metals								OCP	OPP	TRH	BTEX	PAH
					pH	Cu	Pb	Zn	Cd	Cr	Ni	As	Hg					
TP6	0.0-0.2	24-27/2/04	Soil		o	o	o	o	o	o	o	o	o	o	o			
TP35	0.0-0.2	24-27/2/04	Soil		o	o	o	o	o	o	o	o	o	o	o			
TP77	0.0-0.2	24-27/2/04	Soil		o	o	o	o	o	o	o	o	o	o	o			
TP93	0.0-0.2	24-27/2/04	Soil		o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP95	0.0-0.2	24-27/2/04	Soil		o	o	o	o	o	o	o	o	o	o	o			
TP115	0.0-0.2	24-27/2/04	Soil		o	o	o	o	o	o	o	o	o	o	o			
TP124	0.0-0.2	24-27/2/04	Soil		o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP165	0.0-0.2	24-27/2/04	Soil		o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP5	0.0-0.2	24-27/2/04	Soil		o													
TP12	0.0-0.2	24-27/2/04	Soil		o													
TP25	0.0-0.2	24-27/2/04	Soil		o													
TP50	0.0-0.2	24-27/2/04	Soil		o													
TP55	0.0-0.2	24-27/2/04	Soil		o													
TP81	0.0-0.2	24-27/2/04	Soil		o													
TP98	0.0-0.2	24-27/2/04	Soil	From Composite C13	o	o	o	o	o									
TP106	0.0-0.2	24-27/2/04	Soil		o													
TP111	0.0-0.2	24-27/2/04	Soil		o													
TP125	0.0-0.2	24-27/2/04	Soil		o													
TP133	0.0-0.2	24-27/2/04	Soil		o													
TP140	0.0-0.2	24-27/2/04	Soil		o													
TP151	0.0-0.2	24-27/2/04	Soil		o													
TP159	0.0-0.2	24-27/2/04	Soil		o													
TP163	0.0-0.2	24-27/2/04	Soil		o													
TP87	0.0-0.2	24-27/2/04	Soil	From Composite C13		o	o	o	o									
TP88	0.0-0.2	24-27/2/04	Soil	From Composite C13		o	o	o	o									

Note: o denotes tested

GeoEnviro Consultancy

TABLE 2 (Page 2 of 3)

Analytical Program and Compositing Schedule

Australand Holdings Ltd

Preliminary Contamination, Geotechnical and Salinity Investigation

No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By:SL Date: 21/03/04
checked by_____ Date: 2/4/04

Sample	Depths	Sample Date	Sample Type	Sample Composition	Analysis													
						Heavy Metals								OCP	OPP	TRH	BTEX	PAH
					pH	Cu	Pb	Zn	Cd	Cr	Ni	As	Hg					
TP174	0.0-0.2	2/03/04	Soil		o													
TP178	0.0-0.2	2/03/04	Soil		o	o	o	o	o	o	o	o	o	o	o			
TP183	0.0-0.2	2/03/04	Soil		o	o	o	o	o	o	o	o	o	o	o			
TP196	0.0-0.2	2/03/04	Soil		o	o	o	o	o	o	o	o	o	o	o			
TP170	0.0-0.2	2/03/04	Soil		o													
TP175	0.0-0.2	2/03/04	Soil		o													
TP179	0.0-0.2	2/03/04	Soil		o													
TP187	0.0-0.2	2/03/04	Soil		o													
TP197	0.0-0.2	2/03/04	Soil		o													
TP199	0.0-0.2	2/03/04	Soil		o													
TP202	0.0-0.2	2/03/04	Soil		o													
TP204	0.0-1.0	2/03/04	Soil		o													
TP209	0.0-0.2	2/03/04	Soil	From Composite C31	o			o										
TP206	0.0-0.2	2/03/04	Soil	From Composite C31				o										
TP208	0.0-0.2	2/03/04	Soil	From Composite C31				o										
Duplicate 1A		24-27/2/04	Soil											o	o	o	o	o
Duplicate 1B		24-27/2/04	Soil			o	o	o	o	o	o	o	o					
Duplicate 2A		24-27/2/04	Soil															
Duplicate 2B		24-27/2/04	Soil			o	o	o	o	o	o	o	o					
Duplicate 3B		24-27/2/04	Soil			o	o	o	o	o	o	o	o					
Duplicate 4A		2/03/04	Soil											o	o			
Duplicate 4B		2/03/04	Soil			o	o	o	o	o	o	o	o					
Duplicate 5B		2/03/04	Soil			o	o	o	o	o	o	o	o					

Note: o denotes tested

GeoEnviro Consultancy

TABLE 2 (Page 3 of 3)
Analytical Program and Compositing Schedule

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road, Currans Hill

Prepared By: SL Date: 21/03/04
checked by: [illegible] Date: 1/4/04

Sample	Depths	pH	Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
C1	0.0-0.2		12	12	32	<0.5	14	9	4	0.05
C2	0.0-0.2		11	12	30	<0.5	13	8.5	4	0.03
C3	0.0-0.2		16	25	32	<0.5	16	15	4.5	0.045
C4	0.0-0.2		14	13	30	<0.5	16	14	4.5	0.055
C5	0.0-0.2		12	17	26	<0.5	13	9	3.5	0.06
C6	0.0-0.2		10	17	17	<0.5	15	8.5	3.5	0.045
C7	0.0-0.2		10	16	16	<0.5	15	8	4	0.07
C8	0.0-0.2		12	15	18	<0.5	12	8	4.5	0.04
C9	0.0-0.5		16	16	26	<0.5	16	8.5	4.5	0.055
C10	0.0-0.2		12	20	22	<0.5	16	7	3.5	0.05
C11	0.0-0.2		16	14	22	<0.5	12	8	3.5	0.04
C12	0.0-0.2		13	24	54	<0.5	12	7	4.5	0.05
C13	0.0-0.2		***73***	***180***	***1000***	***2.5***	17	12	5.5	0.09
C14	0.0-0.2		15	20	42	<0.5	13	9.5	5	0.055
C15	0.0-0.2		17	21	51	<0.5	13	10	4	0.06
C16	0.0-0.2		11	13	15	<0.5	14	8	4	0.045
C17	0.0-0.2		12	32	19	<0.5	15	7.5	4	0.06
C18	0.0-0.2		11	16	20	<0.5	12	5	4	0.03
C19	0.0-1.0		16	16	25	<0.5	16	8	4.5	0.05
C20	0.0-0.5		17	14	28	<0.5	15	5	4.5	0.03
C21	0.0-0.2		16	13	25	<0.5	13	9	5.5	0.045
C22	0.0-0.2		17	12	37	<0.5	16	12	5	0.04
C23	0.0-0.2		17	18	50	<0.5	12	15	4	0.055
C24	0.0-0.2		17	17	44	<0.5	15	7.5	3	0.045
C25	0.0-0.2		11	17	26	<0.5	15	7	3	0.04
C26	0.0-0.2		13	16	33	<0.5	13	7	3.5	0.04
C27	0.0-0.2		15	18	35	<0.5	16	10	3.5	0.05
C28	0.0-0.2		12	21	34	<0.5	16	10	4	0.05
C29	0.0-0.2		17	16	45	<0.5	14	10	4.5	0.05
C30	0.0-0.2		14	13	29	<0.5	16	9	4	0.035
C31	0.0-0.2		18	15	***76***	<0.5	16	12	4	0.045
Modified ANZECC/NHMRC Criteria			**20**	**100**	**67**	**1**	**17**	**20**	**7**	**0.33**
Modified Proposed NSW EPA Phytotoxicity Criteria			**33.3**	**200**	**67**	**1**	**133/0.33***	**20**	**6**	**0.33**
Modified HILs 'A' Criteria			**333**	**100**	**2333**	**7**	**33**	**200**	**33**	**5**

Notes

1) All results are expressed as mg/kg and pH (units)

2) Figures in bold italics exceed the ANZECC/NHMRC criteria or modified criteria

3) Figures in bold italics that have been underlined exceed the Phytotoxicity Criteria or the modified Criteria

4) Figures in bold italics that have been underlined and shaded exceed the HILs 'A' Criteria or the modified Criteria

5) * Chromium (III)/ Chromium (VI)

GeoEnviro Consultancy

TABLE 3

Summary of Analytical Results - pH & Heavy Metals (Composite Samples)

Australand Holdings Ltd

Preliminary Contamination, Geotechnical and Salinity Investigation

No. 181, 187, 195-203 Turner Road , Currans Hill

No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL Date: 21/03/04
Checked By: ___ Date: 1/4/04

Sample	Depths	pH	Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP6	0.0-0.2	6.9	17	10	35	<0.5	16	14	5	0.05
TP35	0.0-0.2	7.1	17	14	29	<0.5	16	13	4.5	0.04
TP77	0.0-0.2	7.2	11	12	18	<0.5	15	7	4.5	0.04
TP93	0.0-0.2	7.1	9	20	32	<0.5	9	6	3.5	0.04
TP95	0.0-0.2	6.4	12	11	20	<0.5	12	6	3	0.05
TP115	0.0-0.2	6.7	18	15	33	<0.5	12	9	4	0.055
TP124	0.0-0.2	6.7	7	13	12	<0.5	14	5	4	0.03
TP165	0.0-0.2	7.5	15	11	31	<0.5	16	11	4.5	0.05
TP5	0.0-0.2	7								
TP12	0.0-0.2	6.7								
TP25	0.0-0.2	7.1								
TP50	0.0-0.2	6.6								
TP55	0.0-0.2	6.1								
TP81	0.0-0.2	6.8								
TP98	0.0-0.2	6.2	17	24	30	<0.5				
TP106	0.0-0.2	6.4								
TP111	0.0-0.2	7.1								
TP125	0.0-0.2	6.6								
TP133	0.0-0.2	6.9								
TP140	0.0-0.2	5.1								
TP151	0.0-0.2	6.4								
TP159	0.0-0.2	7.2								
TP163	0.0-0.2	7.1								
TP87	0.0-0.2		***150***	***320***	***2450***	6				
TP88	0.0-0.2		57	220	***650***	1				
TP174	0.0-0.2	6.9								
TP178	0.0-0.2	6.9	19	14	57	<0.5	13	12	5	0.08
TP183	0.0-0.2	6.7	9.5	15	26	<0.5	8	5.5	4	0.02
TP196	0.0-0.2	7.4	12	12	29	<0.5	12	7	4	0.025
TP170	0.0-0.2	6.3								
TP175	0.0-0.2	5.9								
TP179	0.0-0.2	6.2								
TP187	0.0-0.2	6.4								
ANZECC/NHMRC Criteria			**60**	**300**	**200**	**3**	**50**	**60**	**20**	**1**
Proposed NSW EPA Phytotoxicity Criteria			**100**	**600**	**200**	**3**	**400/1***	**60**	**20**	**1**
HILs 'A' Criteria			**1000**	**300**	**7000**	**20**	**100**	**600**	**100**	**15**

Notes

1) All results are expressed as mg/kg and pH (units).

2) Figures in bold italics exceed the ANZECC/NHMRC criteria or modified criteria

3) Figures in bold italics that have been underlined exceed the Phytotoxicity Criteria or the modified Criteria

4) Figures in bold italics that have been underlined and shaded exceed the HILs 'A' Criteria or the modified Criteria

5) * Chromium (III)/ Chromium (VI)

GeoEnviro Consultancy

TABLE 4 (Page 1 of 2)

Summary of Analytical Results - pH & Heavy Metals (Individual Samples)

Australand Holdings Ltd

Preliminary Contamination, Geotechnical and Salinity Investigation

No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL Date: 21/03/04
Checked By: CL Date: 1/4/04

Sample	Depths	pH	Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP197	0.0-0.2	7.3								
TP199	0.0-0.2	6.6								
TP202	0.0-0.2	6.2								
TP204	0.0-1.0	6.5								
TP209	0.0-0.2	6.8			59					
TP206	0.0-0.2				54					
TP208	0.0-0.2				110					
Duplicate 1B	0.0-0.2		14	12	22	<0.5	13	6.5	3.5	0.045
Duplicate 2B	0.0-0.2		6	12	13	<0.5	15	4	4.5	0.035
Duplicate 3B	0.0-0.2		16	10	33	<0.5	17	12	4.5	0.05
Duplicate 4B			20	15	54	<0.5	12	11	4.5	0.075
Duplicate 5B			10	14	24	<0.5	1	6.5	4	0.025
ANZECC/NHMRC Criteria			**60**	**300**	**200**	**3**	**50**	**60**	**20**	**1**
Proposed NSW EPA Phytotoxicity Criteria			**100**	**600**	**200**	**3**	**400/1***	**60**	**20**	**1**
HILs 'A' Criteria			**1000**	**300**	**7000**	**20**	**100**	**600**	**100**	**15**

Notes

1) All results are expressed as mg/kg and pH (units).

2) Figures in bold italics exceed the ANZECC/NHMRC criteria or modified criteria

3) Figures in bold italics that have been underlined exceed the Phytotoxicity Criteria or the modified Criteria

4) Figures in bold italics that have been underlined and shaded exceed the HILs 'A' Criteria or the modified Criteria

5) * Chromium (III)/ Chromium (VI)

GeoEnviro Consultancy

TABLE 4 (Page 2 of 2)

Summary of Analytical Results - pH & Heavy Metals (Individual Samples)

Australand Holdings Ltd

Preliminary Contamination, Geotechnical and Salinity Investigation

No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL Date: 21/03/04
Checked By: [illegible] Date: 1/4/04

Sample	Depths	HCB	alpha-BHC	beta-BHC	gamma-BHC(Lindane)	delta-BHC	Heptachlor	Aldrin	Dieldrin	Endrin	Heptachlor Epoxide	alpha-Endosulfan	trans-Chlordane	cis-Chlordane	trans-Nonachlor	p,p'-DDE	o,p'-DDE	o,p'-DDD	p,p'-DDD	p,p'-DDT	o,p'-DDT	beta-Endosulfan	Endrin Aldehyde	Endosulfan Sulphate	Endrin Ketone	Methoxychlor	Total OCP
C1	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C3	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C4	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C5	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C7	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C9	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C10	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C12	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C13	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C14	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C15	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C16	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C18	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C19	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C20	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C21	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C24	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C26	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C28	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
C31	0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
Modified HILs 'A' Criteria							3.33	3.33												66.67							

Notes

1) All results are expressed as mg/kg and pH (units)

2) Figures in bold italics exceed the HILs 'A' criteria or Modified Criteria

GeoEnviro Consultancy

TABLE 5

Summary of Analytical Results - OCP (Composite Samples)

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared by: SL Date: 21/03/04
Checked : ____ Date: 1/4/04

Sample	Depths	HCB	alpha-BHC	beta-BHC	gamma-BHC(Lindane	delta-BHC	Heptachlor	Aldrin	Dieldrin	Endrin	Heptachlor Epoxide	alpha-Endosulfan	trans-Chlordane	cis-Chlordane	trans-Nonachlor	p,p'-DDE	o,p'-DDE	o,p'-DDD	p,p'-DDD	p,p'-DDT	o,p'-DDT	beta-Endosulfan	Endrin Aldehyde	Endosulfan Sulphate	Endrin Ketone	Methoxychlor	Total OCP
TP6	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
TP35	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
TP77	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
TP93	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
TP95	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
TP115	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
TP124	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
TP165	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
TP178	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
TP183	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
TP196	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
Duplicate 1A	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
Duplicate 2A	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
Duplicate 4A	0.0-0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
HILs 'A' Criteria							10	10								200											

Notes 1) All results are expressed as mg/kg and pH (units).

2) Figures in bold italics exceed the HILs 'A' criteria or Modified Criteria

GeoEnviro Consultancy

TABLE 6

Summary of Analytical Results - OCP (Individual Samples)

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared by: SL Date: 21/03/04
Checked : Date: 1/4/04

Sample	Depths	Chlorpyrifos	Fenitrothion	Bromofos Ethyl	Ethion
C1	0-0.2	<0.10	<0.10	<0.10	<0.10
C3	0-0.2	<0.10	<0.10	<0.10	<0.10
C4	0-0.2	<0.10	<0.10	<0.10	<0.10
C5	0-0.2	<0.10	<0.10	<0.10	<0.10
C7	0-0.2	<0.10	<0.10	<0.10	<0.10
C9	0-0.2	<0.10	<0.10	<0.10	<0.10
C10	0-0.2	<0.10	<0.10	<0.10	<0.10
C12	0-0.2	<0.10	<0.10	<0.10	<0.10
C13	0-0.2	<0.10	<0.10	<0.10	<0.10
C14	0-0.2	<0.10	<0.10	<0.10	<0.10
C15	0-0.2	<0.10	<0.10	<0.10	<0.10
C16	0-0.2	<0.10	<0.10	<0.10	<0.10
C18	0-0.2	<0.10	<0.10	<0.10	<0.10
C19	0-0.2	<0.10	<0.10	<0.10	<0.10
C20	0-0.2	<0.10	<0.10	<0.10	<0.10
C21	0-0.2	<0.10	<0.10	<0.10	<0.10
C24	0-0.2	<0.10	<0.10	<0.10	<0.10
C26	0-0.2	<0.10	<0.10	<0.10	<0.10
C28	0-0.2	<0.10	<0.10	<0.10	<0.10
C31	0-0.2	<0.10	<0.10	<0.10	<0.10

Notes 1) All results are expressed as mg/kg



GeoEnviro Consultancy

TABLE 7

Summary of Analytical Results - OPP (Composite Samples)

Australand Holdings Ltd

Preliminary Contamination, Geotechnical and Salinity Investigation

No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL Date: 21/03/04
Checked by: CA Date: 1/4/04

Sample	Depths	Chlorpyrifos	Fenitrothion	Bromofos Ethyl	Ethion
TP6	0.0-0.2	<0.5	<0.5	<0.5	<0.5
TP35	0.0-0.2	<0.5	<0.5	<0.5	<0.5
TP77	0.0-0.2	<0.5	<0.5	<0.5	<0.5
TP93	0.0-0.2	<0.5	<0.5	<0.5	<0.5
TP95	0.0-0.2	<0.5	<0.5	<0.5	<0.5
TP115	0.0-0.2	<0.5	<0.5	<0.5	<0.5
TP124	0.0-0.2	<0.5	<0.5	<0.5	<0.5
TP165	0.0-0.2	<0.5	<0.5	<0.5	<0.5
TP178	0.0-0.2	<0.5	<0.5	<0.5	<0.5
TP183	0.0-0.2	<0.5	<0.5	<0.5	<0.5
TP196	0.0-0.2	<0.5	<0.5	<0.5	<0.5
Duplicate 1A	0.0-0.2	<0.5	<0.5	<0.5	<0.5
Duplicate 2A	0.0-0.2	<0.5	<0.5	<0.5	<0.5
Duplicate 4A	0.0-0.2	<0.5	<0.5	<0.5	<0.5

Notes 1) All results are expressed as mg/kg



GeoEnviro Consultancy

TABLE 8
Summary of Analytical Results - OPP (Individual Samples)

Australand Holdings Ltd

Preliminary Contamination, Geotechnical and Salinity Investigation

No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL Date: 21/03/04
Checked by: LL Date: 1/4/04

Sample	Depth	C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	C_{10}-C_{36}	Benzene	Toluene	Ethyl-Benzenes	Total Xylenes
TP93	0.0-0.2	<20	<20	<50	<50	ND	<0.5	<0.5	<0.5	<1.5
TP124	0.0-0.2	<20	<20	<50	<50	ND	<0.5	<0.5	<0.5	<1.5
TP165	0.0-0.2	<20	<20	<50	<50	ND	<0.5	<0.5	<0.5	<1.5
Duplicate 1A	0.0-0.2	<20	<20	<50	<50	ND	<0.5	<0.5	<0.5	<1.5
Duplicate 2A	0.0-0.2	<20	<20	<50	<50	ND	<0.5	<0.5	<0.5	<1.5
NSW EPA (1994)		**65**	**1000**			**1000**	1	1.4	3.1	14

Notes

1) All results are expressed as mg/kg unless otherwise specified

2) Figures in bold italics exceed the NSW EPA criteria or modified criteria

3) ND Not detected

GeoEnviro Consultancy

TABLE 9

Summary of Analytical Results - TRH and BTEX

Australand Holdings Ltd

Preliminary Contamination, Geotechnical and Salinity Investigation

No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared by SL Date : 21/03/04
Checked by: Dated: 1/4/04

Sample	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,k)fluoranthene	Benzo(a)pyrene	Indeno(123-cd)pyrene	Dibenzo(ah)abthracene	Benzo(ghi)perylene	Total PAHs
TP93	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.2	<0.05	<0.10	<0.10	<0.10	ND
TP124	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.2	<0.05	<0.10	<0.10	<0.10	ND
TP165	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.2	<0.05	<0.10	<0.10	<0.10	ND
Duplicate 1A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.2	<0.05	<0.10	<0.10	<0.10	ND
Duplicate 2A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.2	<0.05	<0.10	<0.10	<0.10	ND
HILs 'A' level												1				20

Notes 1) All results are expressed as mg/kg and pH (units).

2) Figures in bold italics exceed the HIL's 'A' level

GeoEnviro Consultancy

TABLE 10
Summary of Analytical Results - PAH

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared by : SL Date : S{date}
Checked: Date: 1/4/04

Sample	Depths	Metals							
		Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP95	0.0-0.2	12	11	20	<0.5	12	6	3	0.05
Duplicate 1B		14	12	22	<0.5	13	6.5	3.5	0.045
Relative Percentage Difference (RPD)		15.4	8.7	9.5	NA	8.0	8.0	15.4	10.5

Sample	Depths	Metals							
		Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP124	0.0-0.2	7	13	12	<0.5	14	5	4	0.03
Duplicate 2B		6	12	13	<0.5	15	4	4.5	0.035
Relative Percentage Difference (RPD)		15.4	8.0	8.0	NA	6.9	22.2	11.8	15.4

Sample	Depths	Metals							
		Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP165	0.0-0.2	15	11	31	<0.5	16	11	4.5	0.05
Duplicate 3B		16	10	33	<0.5	17	12	4 5	0.05
Relative Percentage Difference (RPD)		6.5	9.5	6.3	NA	6.1	8.7	0.0	0.0

Sample	Depths	Metals							
		Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP 178	0.0-0.2	19	14	57	<0.5	13	12	5	0.08
Duplicate 4B		20	15	54	<0.5	12	11	4.5	0.075
Relative Percentage Difference (RPD)		5.1	6.9	5.4	NA	8.0	8.7	10.5	6.5

Sample	Depths	Metals							
		Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP 196	0.0-0.2	12	12	29	<0.5	12	7	4	0.025
Duplicate 5B		10	14	24	<0.5	11	6.5	4	0.025
Relative Percentage Difference (RPD)		18.2	15.4	18.9	NA	8.7	7.4	0.0	0.0

Sample	Depths	OCP	OPP	TRH	BTEX	PAH
TP 95	0.0-0.2	ND	ND	ND	ND	ND
Duplicate 1A		ND	ND	ND	ND	ND
Relative Percentage Difference (RPD)		NA	NA	NA	NA	NA

Sample	Depths	OCP	OPP	TRH	BTEX	PAH
TP 124	0.0-0.2	ND	ND	ND	ND	ND
Duplicate 2A		ND	ND	ND	ND	ND
Relative Pereentage Difference (RPD)		NA	NA	NA	NA	NA

Sample	Depths	OCP	OPP
TP 178	0.0-0.2	ND	ND
Duplicate 4A		ND	ND
Relative Percentage Difference (RPD)		NA	NA

GeoEnviro Consultancy

Notes

1) All results are expressed as mg/kg .

2) ND - Not Detected

3) NA - Not Applicable

TABLE 11

Summary of Analytical Results - Quality Assurance

Australand Holdings Ltd

Preliminary Contamination, Geotechnical and Salinity Investigation

No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared by : SL Date: 4/04/04
Checked: ..... Date: 4/4/04

APPENDIX B

Extracts of the Buried Rubbish Fill Report (Reference 2)

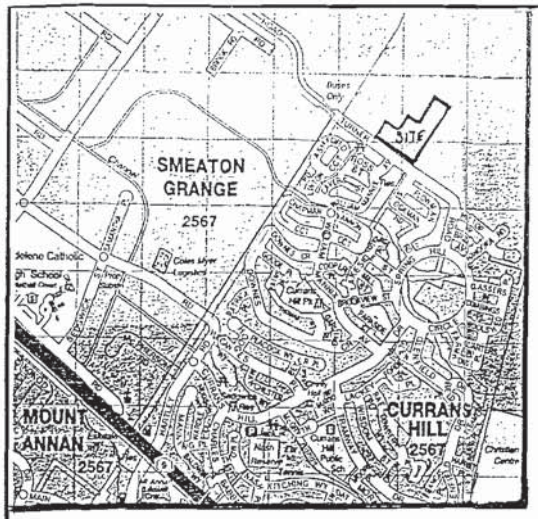
Buried Rubbish Fill Nos 181, 187, 195-203 Turner Road Currans Hill – GeoEnviro Consultancy Pty Ltd Ref JC04031A-r2 dated 29th April 2004

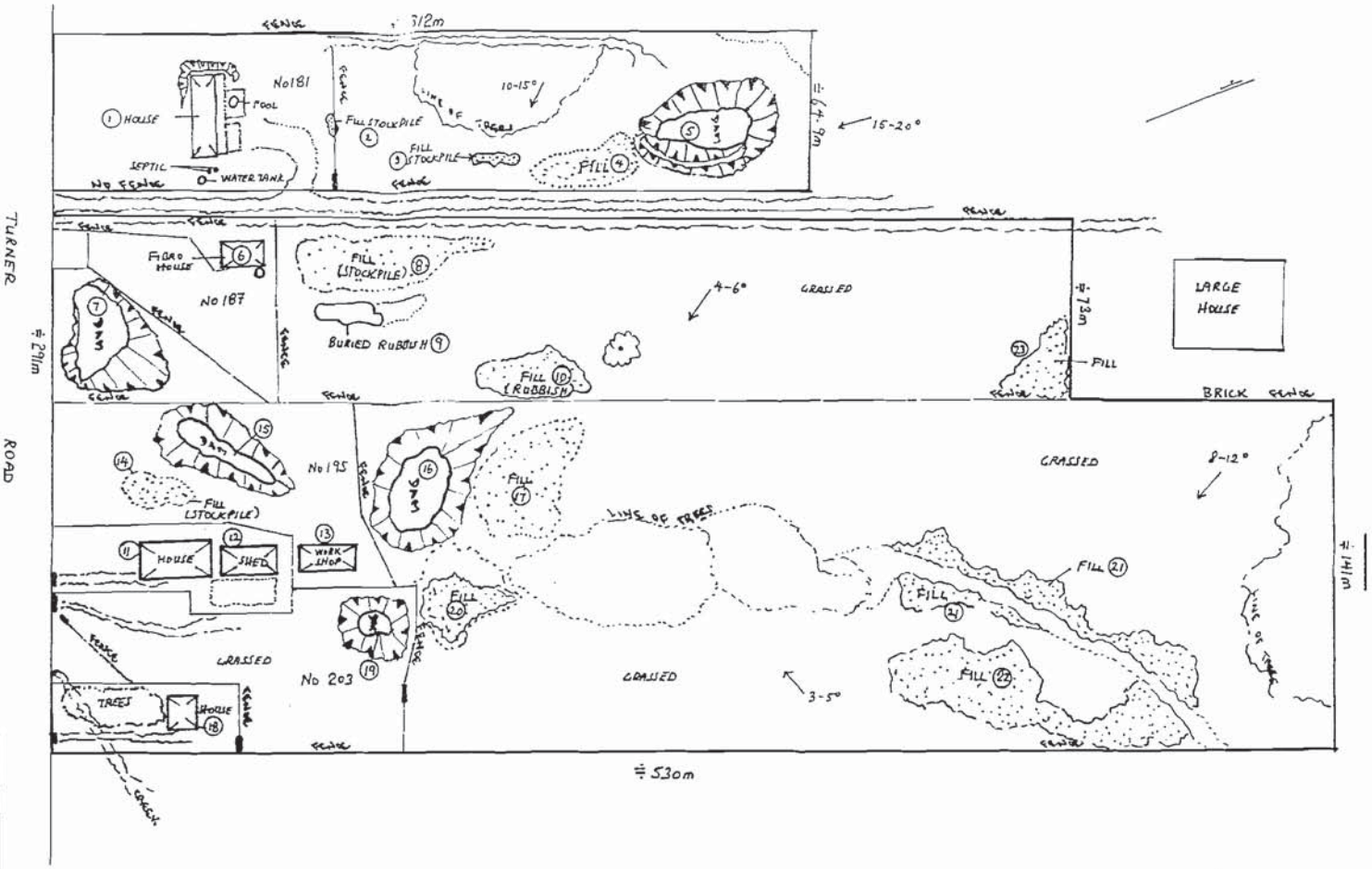
GeoEnviro Consultancy Pty Ltd

Table A : Summary of Test Pit Profile

CLIENT:	Australand Holdings Ltd	Job Number:	JC04031A-r2
PROJECT:	Proposed Residential Development	Logged By:	SL
LOCATION:	No 187, Turner Road, Currans Hill	Checked By:	SL
		Date:	29-Apr-2004

Test Pit Number	Test Location	Depth (m) From	Depth (m) To	Material Description
1A	Refer to Drawing No 2	0.0	1.40	Fill: Silty Clay , medium to high plasticity, with some clayey silt topsoil, gravel, grey brown and red brown
		1.40	5.00	Fill: Clayey Silt Topsoil, with a lot of timber sleepers and wooden planks, some steel pieces, steel post and a stormwater pipe (100mm diameter)
		5.00	5.30	(CI) Silty Clay: medium plasticity, grey mottled brown, moist to wet
2A		0.0	5.00	Fill: Silty Clay and Clayey Silt Topsoil, with a lot of timber pieces, wooden planks and sleepers, some metal pieces, a PVC pipe, corrugated metal, a steel sink, and some cloths.
		5.00	5.20	(CI) Silty Clay: medium plasticity, grey brown, moist to wet
3A (40m long trench)		0.0	2.0	Fill: Silty Clay and Clayey Silt topsoil mixed with a significant quantity of building material (eg concrete slab, steel pieces, bricks, corrugated metal sheets, bonded asbestos pieces, steel pipes, tiles, etc) and household rubbish (eg wires, plastic pieces and sheets, tyres and general rubbish)
		2.00	2.20	(CI-CH) Silty Clay: medium to high plasticity, grey mottled red brown.
4A		0.0	1.60	Fill: Silty Clay and Clayey Silt Topsoil with a significant amount of demolition rubble including bricks, concrete, metal pieces, wires, etc
		1.60	1.70	(CH) Silty Clay: high plasticity, grey mottled red brown





Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, tiles and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

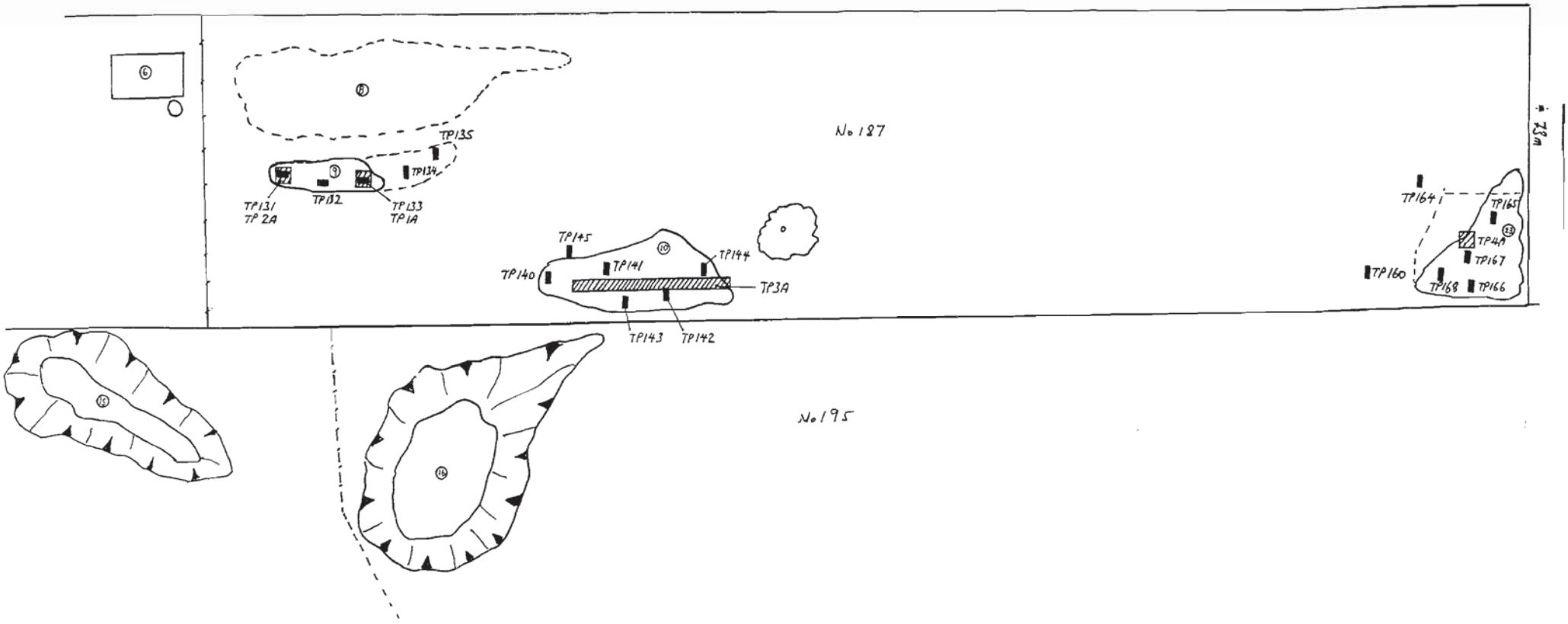
LEGEND

6° → SLOPE DOWN AT 6°

Note: All site features indicated on the drawings are only indicative and not to scale

GeoEnviro Consultancy

Drawn By:	SL	Date : 22/3/04	Australand Holdings Ltd
Checked By:	SL	Date : 22/3/04	No 181, 187, 195-203 Turner Road, Currans Hill
Revision By:		Date:	Site Locality and Features Plan
Scale:	1:2000 (approx) A3	Project No: JC04031A - r 2	Drawing No: 1



Legend

TEST PIT (REF JC04031A MAR 04)

Test Pit

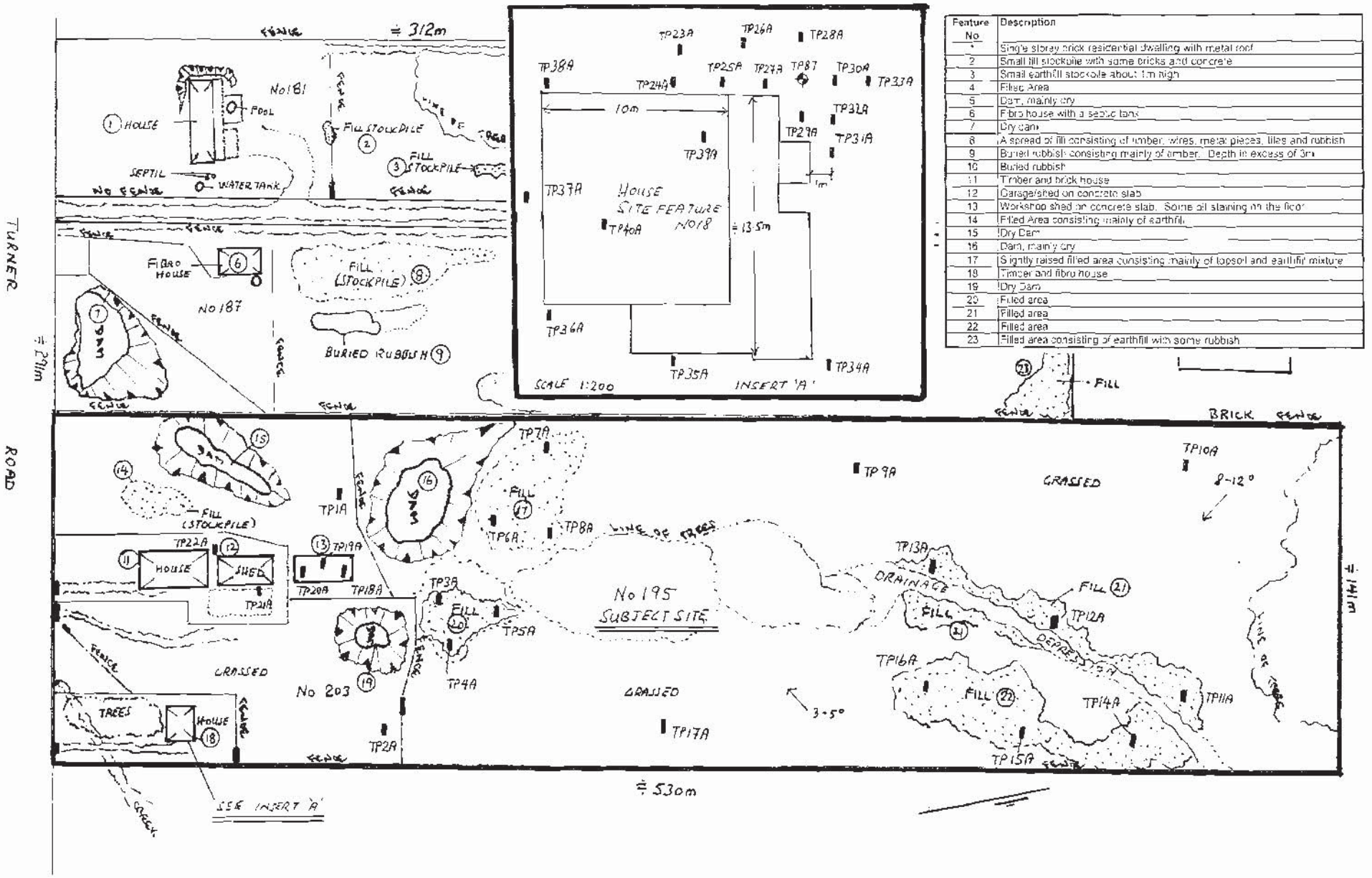
GeoEnviro Consultancy

Drawn By: SL	Date : 29/4/04	Australand Holdings Ltd	
Checked By: SL	Date : 29/4/04	181, 187, 195-203 Turner Road, Currans Hill	
Revision By:	Date:	Test Pit Location Plan	
Scale: Proportional	A3	Project No: JC04031A-r2	Drawing No: 2

APPENDIX C

Extracts of the Additional Salinity/Contamination and RAP Report (Reference 3)

Additional Salinity/Contamination Assessment and RAP, No 195-203 Lots 37 and 38 DP 28024 Turner Road Currans Hill – GeoEnviro Consultancy Pty Ltd Ref JC04031A-r5 dated March 2009



Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, tiles and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

Legend

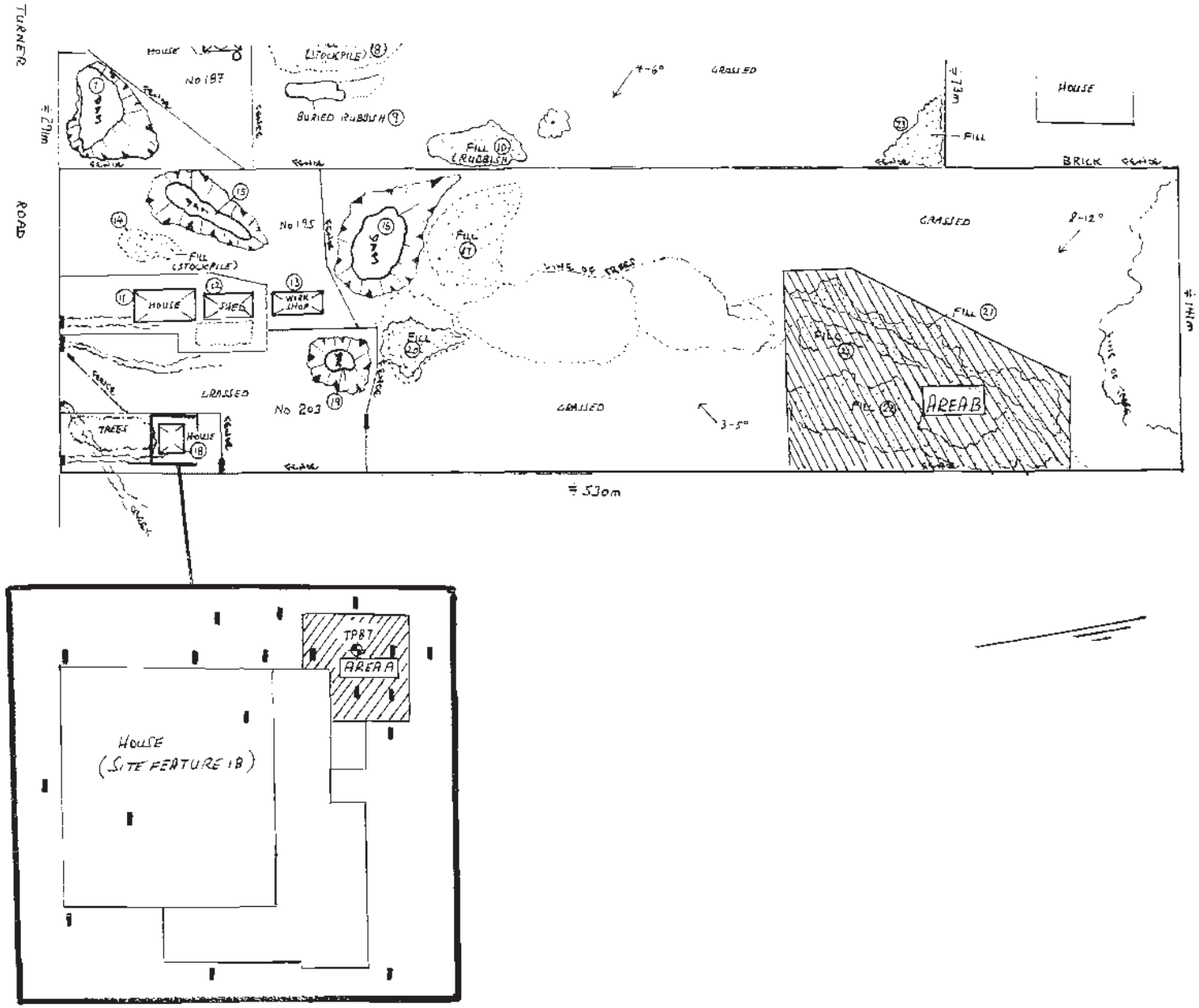
- Test Pit
- (11) SITE FEATURE No 11
- PREVIOUS TEST PIT 2004

GeoEnviro Consultancy

Drawn By:	SL	Date: 16/3/09	
Checked By:	SL	Date: 16/3/09	
Revision By:		Date:	
Scale:	Proportional	A3	

Mr Jim and Ms Vanessa Driver
Nos 195-203 Turner Road Currans Hill
Sampling Location Plan

Project No: JC04031A-r5 | Drawing No: 1A



Legend

Remediation Area B

GeoEnviro Consultancy

Drawn By: SL	Date: 16/3/09	Mr Jim and Ms Vanessa Driver	
Checked By: SL	Date: 16/3/09	Nos 195-203 Turner Road Currans Hill	
Revision By:	Date:	Remediation Area Plan	
Scale: Proportional	A3	Project No: JC04031A-rs	Drawing No: 2A

Test Pit Number	Depth (m)	Profile Type	Description
100	0.0-0.5	Topsoil/Fill	Clayey silt mixed with silt and some gravel, light grey and brown, dry
	0.5-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and grey, MC<=PL, PP>600kPa
101	0.0-0.7	Topsoil/Fill	Silt with gravel and some clayey silt, grey, dry to moist
	0.7-1.0	Natural	(CI) Silty Clay: medium plasticity, yellow and red/brown, MC<=PL, hard
102	Dam Embankment	Fill	Clayey silt and silty clay high plasticity and some gravel, brown, moist
103	0.0-0.3	Topsoil/Fill	Clayey silt with some gravel, brown, dry to moist
	0.3-0.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown, dry, hard
104	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.4	Natural	(CH) Silty Clay: high plasticity, red and brown, with some gravel, dry to moist, hard, MC<=PL, PP>600kPa
105	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
	1.0-1.9	Natural	(CI) Gravelly Silty Clay: medium plasticity, brown, very hard, MC<PL, PP>600kPa
106	0.0-0.8	Fill	Silty clay and some silt mixed with some gravel, grey and brown, dry
	0.8-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, dry, hard
107	Dam Embankment	Fill	Mixture of clayey silt, silty clay of high plasticity and some gravel, yellow/brown and dark brown/grey, moist
108	Dam Embankment	Fill	Mixed clayey silt, silty clay of high/medium to high plasticity, some gravel, yellow and brown and dark brown/grey, moist
109	Dam Embankment	Fill	Mixture of silty clay and clayey silt, silty clay of high plasticity with some gravel, yellow/brown and dark grey and dark brown, moist
110	0.0-0.7	Fill	Silty clay of medium plasticity mixed with gravel, some silt, some clayey silt, some sandstone cobbles, brown, dry to moist
	0.7-1.0	Topsoil	Silt, low liquid limit, light grey, dry
	1.0-1.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, MC<=PL, hard
111	0.0-0.8	Fill	Mixed silty clay with silt and sandstone gravel/cobbles, brown, moist
	0.8-1.0	Topsoil	Silt, with some clayey silt, grey, dry
	1.0-1.3	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and yellow, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

TABLE 1 (Page 10 of 11)
SUMMARY OF SOIL PROFILE

Test Pit Number	Depth (m)	Profile Type	Description
112	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
113	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry to moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, MC<=PL, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 11 of 11)
SUMMARY OF SOIL PROFILE

Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Test Pit Number	Depth (m)	Profile Type	Description
1A	0.0-0.1	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.1-0.6	Fill	Silty Clay: medium to high plasticity, brown loose
	0.6-0.7	Natural	Clayey Silt, low liquid limit, brown dry
	0.7-1.7	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
	1.7-2.7	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey brown, moist to wet with a trace of fine gravel
	2.7-3.3	Natural	(CI) Silty Clay: medium plasticity, brown and grey some minor groundwater seepage at about 3.0m
2A	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.3-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
	1.2-2.1	Natural	As above but pale brown, MC<PL, hard, PP>600kPa
	2.1-3.1	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey brown, with some ironstone gravel, MC<PL
	3.1-3.5	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
3A	0.0-0.2	Fill	Clayey Silt, low liquid limit, brown and grey, dry, a trace of fine gravel
	0.2-0.8	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, dark red and brown, MC<PL, PP>600kPa
4A	0.0-0.3	Fill	Mixture of silty clay medium plasticity with some gravel and with some silt, yellow brown and grey, moist to wet
	0.3-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, some sand, dark red and brown, MC<PL, PP>600kPa
5A	0.0-0.4	Fill/Topsoil	Mixture of silty clay medium plasticity with some gravel and with some silt, yellow brown and grey, moist to wet
	0.4-1.1	Natural	(CI-CH) Silty Clay: medium to high plasticity, some sand, brown, very stiff
6A	0.0-0.2	Fill/Topsoil	Clayey Silt with gravel and some sand, some clayey silt, grey and red/brown, dry
	0.2-0.5	Fill	Silty Clay: medium plasticity, red brown and dark brown , MC<PL
	0.5-1.1	Natural	(CI) Sillty Clay: medium plasticity, orange brown , MC<PL, PP>600kPa
7A	0.0-0.2	Fill/Topsoil	Clayey Silt/Silty Clay: low liquid limit, low plasticity with gravel dry
	0.2-0.5	Fill	Silty Clay: medium plasticity, red brown , a trace of gravel
	0.5-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, MC<PL, PP>600kPa
8A	0.0-0.2	Fill/Topsoil	Silty clay with gravel and some sand, some clayey silt, grey and red/brown, dry
	0.2-0.8	Fill	Silty Clay/Clayey Silt : low to medium plasticity, red brown , a trace of gravel and sand
	0.8-1.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, MC<PL, PP>600kPa

Note:
PP = Pocket Penetrometer
MC = Moisture Content
PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1A (Page 1 of 4)
SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009
Checked By:_____Date:_____

Test Pit Number	Depth (m)	Profile Type	Description
9A	0.0-0.35	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.35-1.3	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.3-2.0	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	2.0-3.0	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey, with layers/bands of extremely weathered shale
	3.0-3.5	Natural	As above but medium to high plasticity, brown grey MC=PL
10A	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.2-2.0	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and brown, dry, MC<PL, PP>600kPa
	2.0-2.4	Natural	(CI) Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	2.4-3.0	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey, with layers/bands of extremely weathered shale
	3.0-3.7	Bedrock	Shale/Siltstone: extremely weathered, extremely low strength, grey and brown
11A	0.0-0.2	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.2-0.35	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.35-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, very hard, dry
12A	0.0-0.6	Fill	Mixture of silty clay and sandstone gravel, some shale and roadbase
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
13A	0.0-0.7	Fill	Silty Clay/Clayey Silt: low to medium plasicity, brown with a trace of concrete fragments
	0.7-1.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
14A	0.0-0.6	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
15A	0.0-0.4	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.4-0.5	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.5-1.3	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and brown, dry, MC<PL, PP>600kPa
	1.3-2.4	Natural	(CI) Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	2.4-3.1	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey, with layers/bands of extremely weathered shale

Note:

PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1A (Page 2 of 4)

SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009

Checked By:_____Date:_____

Test Pit Number	Depth (m)	Profile Type	Description
16A	0.0-0.2	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.2-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
17A	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.0-1.7	Natural	(CI) Silty Clay: medium plasticity, grey, some shale gravel, MC<=PL, PP>600kPa
	1.7-1.8	Bedrock	Shale: extremely weathered/Interbedded with gravelly shaley clay, grey and brown, dry to moist
18A	0.0-0.15	Slab	Concrete : 150mm thick
	0.15-0.3	Subbase	Sand: fine to medium grained, brown
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown MC<PL, some gravel
	0.6-0.7	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey
19A	0.0-0.07	Slab	Concrete : 150mm thick
	0.07-0.5	Fill	Silty Clay: medium plasticity, brown, MC<PL some gravel
	0.5-0.9	Fill	Gravelly Silty Clay: medium plasticity, some ironstone gravel,
20A	0.0-0.11	Slab	Concrete : 150mm thick
	0.11-0.25	Fill	Gravelly Silty Clay: medium plasticity, some ironstone gravel,
21A	0.0-0.1	Fill	Silty Sandy Gravel
	0.1-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, hard, PP>600kPa
22A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
23A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
24A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity,grey mottled brown, MC<=PL, hard
25A	0.0-0.1	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.1-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa

Note:

PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1A (Page 3 of 4)

SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009

Checked By:_____Date:_____

Test Pit Number	Depth (m)	Profile Type	Description
26A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
27A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, red brown, MC<=PL, hard
28A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
29A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey brown, hard, PP>600kPa
30A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, red brown and grey, MC<=PL, hard, PP>600kPa
31A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red brown
32A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
33A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.45	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red brown
34A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red brown
35A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.45	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
36A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.45	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey brown, hard, PP>600kPa
37A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
38A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey brown, hard, PP>600kPa
39A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
40A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa

Note:

PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1A (Page 4 of 4)

SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009

Checked By:_____Date:_____

Sample	Depths	Sample Date	Sample Type	Analysis														
					Heavy Metals								OCP	OPP	PCB	TRH	BTEX	PAH
				pH	Cu	Pb	Zn	Cd	Cr	Ni	As	Hg						
TP1A	0.0-0.1	9/02/2009	Soil	o														
TP1A	1.1-1.2	9/02/2009	Soil	o														
TP1A	2.4-3.0	9/02/2009	Soil	o														
TP2A	0.0-0.1	9/02/2009	Soil	o														
TP2A	0.4-0.5	9/02/2009	Soil	o														
TP2A	2.3-2.4	9/02/2009	Soil	o														
TP3A	0.0-0.1	9/02/2009	Soil															
TP3A	0.4-0.5	9/02/2009	Soil															
TP4A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP4A	0.4-0.5	9/02/2009	Soil															
TP5A	0.0-0.1	9/02/2009	Soil															
TP5A	0.4-0.5	9/02/2009	Soil															
TP6A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP6A	0.4-0.5	9/02/2009	Soil															
TP8A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP8A	0.4-0.5	9/02/2009	Soil															
TP8A	1.0-1.1	9/02/2009	Soil															
TP9A	0.0-0.1	9/02/2009	Soil	o														
TP9A	1.5-1.6	9/02/2009	Soil	o														
TP9A	3.2-3.3	9/02/2009	Soil	o														
TP10A	0.0-0.1	9/02/2009	Soil	o														
TP10A	0.4-0.5	9/02/2009	Soil	o														
TP10A	2.2-2.3	9/02/2009	Soil	o														
TP11A	0.0-0.1	9/02/2009	Soil															
TP11A	0.4-0.5	9/02/2009	Soil															
TP12A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o

Note: O denotes tested

GeoEnviro Consultancy

TABLE 2A (Page 1 of 3)

Analytical Program

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Sample	Depths	Sample Date	Sample Type	Analysis														
					Heavy Metals								OCP	OPP	PCB	TRH	BTEX	PAH
				pH	Cu	Pb	Zn	Cd	Cr	Ni	As	Hg						
TP12A	0.8-0.9	9/02/2009	Soil															
TP13A	0.0-0.1	9/02/2009	Soil															
TP13A	0.8-0.9	9/02/2009	Soil															
TP14A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP14A	0.7-0.8	9/02/2009	Soil															
TP15A	0.0-0.1	9/02/2009	Soil	o														
TP15A	0.5-0.6	9/02/2009	Soil	o														
TP15A	2.4-2.5	9/02/2009	Soil	o														
TP16A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP16A	0.5-0.6	9/02/2009	Soil															
TP17A	0.0-0.1	9/02/2009	Soil															
TP17A	0.4-0.5	9/02/2009	Soil															
TP17A	1.2-1.3	9/02/2009	Soil															
TP18A	0.3-0.4	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP19A	0.1-0.2	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP19A	0.6-0.7	9/02/2009	Soil															
TP20A	0.1-0.2	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP21A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP21A	0.3-0.4	9/02/2009	Soil															
TP22A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP22A	0.4-0.5	9/02/2009	Soil															
TP23A	0.0-0.1	9/02/2009	Soil			o	o											
TP23A	0.3-0.4	9/02/2009	Soil			o	o											
TP24A	0.0-0.1	9/02/2009	Soil			o	o											
TP24A	0.3-0.4	9/02/2009	Soil															

Note: O denotes tested

GeoEnviro Consultancy

TABLE 2A (Page 2 of 3)

Analytical Program

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Sample	Depths	Sample Date	Sample Type	Analysis														
					Heavy Metals								OCP	OPP	PCB	TRH	BTEX	PAH
				pH	Cu	Pb	Zn	Cd	Cr	Ni	As	Hg						
TP25A	0.0-0.1	9/02/2009	Soil			o	o											
TP25A	0.3-0.4	9/02/2009	Soil															
TP26A	0.0-0.1	9/02/2009	Soil			o	o											
TP26A	0.3-0.4	9/02/2009	Soil			o	o											
TP27A	0.0-0.1	9/02/2009	Soil			o	o											
TP27A	0.3-0.4	9/02/2009	Soil															
TP28A	0.0-0.1	9/02/2009	Soil			o	o											
TP28A	0.3-0.4	9/02/2009	Soil			o	o											
TP29A	0.0-0.1	9/02/2009	Soil			o	o											
TP29A	0.3-0.4	9/02/2009	Soil															
TP30A	0.0-0.1	9/02/2009	Soil			o	o											
TP30A	0.3-0.4	9/02/2009	Soil			o	o											
TP31A	0.0-0.1	9/02/2009	Soil			o	o											
TP31A	0.3-0.4	9/02/2009	Soil															
TP32A	0.0-0.1	9/02/2009	Soil			o	o											
TP32A	0.3-0.4	9/02/2009	Soil															
TP33A	0.0-0.1	9/02/2009	Soil			o	o											
TP33A	0.3-0.4	9/02/2009	Soil															
TP34A	0.0-0.1	9/02/2009	Soil			o	o											
TP35A	0.0-0.1	9/02/2009	Soil			o	o											
TP36A	0.0-0.1	9/02/2009	Soil			o	o											
TP36A	0.3-0.4	9/02/2009	Soil			o	o											
TP37A	0.0-0.1	9/02/2009	Soil			o	o											
TP37A	0.3-0.4	9/02/2009	Soil															
TP38A	0.0-0.1	9/02/2009	Soil															
TP38A	0.3-0.4	9/02/2009	Soil															
TP39A	0.0-0.1	9/02/2009	Soil															
TP40A	0.0-0.1	9/02/2009	Soil															
Duplicate A		9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
Duplicate B		9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o

Note: O denotes tested

GeoEnviro Consultancy

TABLE 2A (Page 3 of 3)

Analytical Program

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Sample	Depths	pH	Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP1A	0.0-0.1	6								
TP1A	1.1-1.2	6.2								
TP1A	2.4-3.0	8.4								
TP2A	0.0-0.1	6.3								
TP2A	0.4-0.5	7.8								
TP2A	2.3-2.4	8.1								
TP3A	0.0-0.1									
TP3A	0.4-0.5									
TP4A	0.0-0.1	5.9	25	31	92	<0.5	14	14	6	<0.1
TP4A	0.4-0.5									
TP5A	0.0-0.1									
TP5A	0.4-0.5									
TP6A	0.0-0.1	6.2	25	20	39	<0.5	19	14	7	<0.1
TP6A	0.4-0.5									
TP8A	0.0-0.1	6.1	17	27	34	<0.5	17	13	8	<0.1
TP8A	0.4-0.5									
TP8A	1.0-1.1									
TP9A	0.0-0.1	6.5								
TP9A	1.5-1.6	8.2								
TP9A	3.2-3.3	8.6								
TP10A	0.0-0.1	6.4								
TP10A	0.4-0.5	9.2								
TP10A	2.2-2.3	8.4								
TP11A	0.0-0.1									
TP11A	0.4-0.5									
TP12A	0.0-0.1	6.7	28	22	50	<0.5	19	15	8	<0.1
EIL's (Interim Urban)			**100**	**600**	**200**	**3**	**400/1***	**60**	**20**	**1**
HILs 'A' Criteria			**1000**	**300**	**7000**	**20**	**100**	**600**	**100**	**15**

Notes

1) All results are expressed as mg/kg and pH (units).

2) Figures in bold italics exceed the EIL or the modified Criteria

3) Figures in bold italics that have been underlined exceed the HILs 'A' Criteria or the modified Criteria

4) * Chromium (III)/ Chromium (VI)

GeoEnviro Consultancy

TABLE 3A (Page 1 of 3)

Summary of Analytical Results - pH & Heavy Metals

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL Date: 23/03/2009

Checked By:_____Date:_____

Sample	Depths	pH	Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP12A	0.8-0.9									
TP13A	0.0-0.1									
TP13A	0.8-0.9									
TP14A	0.0-0.1	7.5	22	35	52	<0.5	22	20	14	<0.1
TP14A	0.7-0.8									
TP15A	0.0-0.1	7.8								
TP15A	0.5-0.6	6.2								
TP15A	2.4-2.5	7.8								
TP16A	0.0-0.1	6.9	18	35	43	0.5	23	13	10	<0.1
TP16A	0.5-0.6									
TP17A	0.0-0.1									
TP17A	0.4-0.5									
TP17A	1.2-1.3									
TP18A	0.3-0.4	8	28	24	55	<0.5	20	23	7	<0.1
TP19A	0.1-0.2	6.3	25	24	59	<0.5	12	18	5	<0.1
TP19A	0.6-0.7									
TP20A	0.1-0.2	6.6	23	38	67	<0.5	15	17	6	<0.1
TP21A	0.0-0.1	7.7	24	14	97	<0.5	31	37	<4	<0.1
TP21A	0.3-0.4									
TP22A	0.0-0.1	5.7	23	34	92	<0.5	16	15	7	<0.1
TP22A	0.4-0.5									
TP23A	0.0-0.1			22	78					
TP23A	0.3-0.4			17	40					
TP24A	0.0-0.1			49	130					
TP24A	0.3-0.4									
EIL's (Interim Urban)			**100**	**600**	**200**	**3**	**400/1***	**60**	**20**	**1**
HILs 'A' Criteria			**1000**	**300**	**7000**	**20**	**100**	**600**	**100**	**15**

Notes

1) All results are expressed as mg/kg and pH (units).

2) Figures in bold italics exceed the EIL or the modified Criteria

3) Figures in bold italics that have been underlined exceed the HILs 'A' Criteria or the modified Criteria

4) * Chromium (III)/ Chromium (VI)

GeoEnviro Consultancy

TABLE 3A (Page 2 of 3)

Summary of Analytical Results - pH & Heavy Metals

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL Date: 23/03/2009
Checked By:_____Date:_____

Sample	Depths	pH	Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP25A	0.0-0.1			130	170					
TP25A	0.3-0.4									
TP26A	0.0-0.1			24	53					
TP26A	0.3-0.4			24	47					
TP27A	0.0-0.1			26	67					
TP27A	0.3-0.4									
TP28A	0.0-0.1			25	82					
TP28A	0.3-0.4			16	44					
TP29A	0.0-0.1			35	80					
TP29A	0.3-0.4									
TP30A	0.0-0.1			24	64					
TP30A	0.3-0.4			18	39					
TP31A	0.0-0.1			29	57					
TP31A	0.3-0.4									
TP32A	0.0-0.1			190	***240***					
TP32A	0.3-0.4									
TP33A	0.0-0.1			32	63					
TP33A	0.3-0.4									
TP34A	0.0-0.1			36	67					
TP35A	0.0-0.1			39	130					
TP36A	0.0-0.1			46	96					
TP36A	0.3-0.4			28	47					
TP37A	0.0-0.1			32	59					
TP37A	0.3-0.4									
TP38A	0.0-0.1									
TP38A	0.3-0.4									
TP39A	0.0-0.1									
TP40A	0.0-0.1	5.5	21	27	57	<0.5	15	15	6	<0.1
Duplicate A		6	27	30	58	<0.5	16	16	8	<0.1
Duplicate B		5.5	22	28	58	<0.5	17	17	7	<0.1
EIL's (Interim Urban)			**100**	**600**	**200**	**3**	**400/1***	**60**	**20**	**1**
HILs 'A' Criteria			**1000**	**300**	**7000**	**20**	**100**	**600**	**100**	**15**

Notes

1) All results are expressed as mg/kg and pH (units).

2) Figures in bold italics exceed the EIL or the modified Criteria

3) Figures in bold italics that have been underlined exceed the HILs 'A' Criteria or the modified Criteria

4) * Chromium (III)/ Chromium (VI)

GeoEnviro Consultancy

TABLE 3A (Page 3 of 3)

Summary of Analytical Results - pH & Heavy Metals

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL Date: 23/03/2009

Checked By:_____Date:_____

Sample	Depths	alpha-BHC	HCB	beta-BHC	gamma-BHC	Heptachlor	delta-BHC	Aldrin	Dieldrin	Endrin	Heptachlor Epoxide	gamma-Chlordane	alpha-Chlordane	Endosulfan I	pp-DDE	pp-DDD	pp-DDT	Endosulfan II	Endrin Aldehyde	Endosulfan Sulphate	Total OCP
TP4A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP6A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP8A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP12A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP14A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP16A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP18A	0.3-0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP19A	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP20A	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP21A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP22A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP40A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
Duplicate A		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
Duplicate B		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
HILs 'A' Criteria							10	10							200						

Notes

1) All results are expressed as mg/kg and pH (units).

2) Figures in bold italics exceed the HILs 'A' criteria

GeoEnviro Consultancy

TABLE 4A

Summary of Analytical Results - OCP

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Sample	Depths (m)	Dimethoate	Diazinon	Chrlopyriphos-methyl	Ronnel	Fenitronthion	Malathion	Chlorphyriphos	Bromophos-ehyl	Ethion
TP4A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP6A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP8A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP12A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP14A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP16A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP18A	0.3-0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP19A	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP20A	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP21A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP22A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP40A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Duplicate A		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Duplicate B		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Notes

1) All results are expressed as mg/kg

GeoEnviro Consultancy

TABLE 5A

Summary of Analytical Results - OPP

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Sample	Depths	Arochlor 1016	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	Total PCB
TP4A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP6A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP8A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP12A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP14A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP16A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP18A	0.3-0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP19A	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP20A	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP21A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP22A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
TP40A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
Duplicate A		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
Duplicate B		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ND
HIL's 'A' Level								10

Notes

1) All results are expressed as mg/kg

2) Figures in bold italics that have been underlined exceed the HILs 'D' level

GeoEnviro Consultancy

TABLE 6A
Summary of Analytical Results - PCB

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL Date: 23/03/2009

Checked by:_____ Date:_____

Sample	Depth	C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	C_{10}-C_{36}	Benzene	Toluene	Ethyl-Benzenes	m+p-Xylene	0-Xylene
TP4A	0.0-0.1	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP6A	0.0-0.1	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP8A	0.0-0.1	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP12A	0.0-0.1	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP14A	0.0-0.1	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP16A	0.0-0.1	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP18A	0.3-0.4	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP19A	0.1-0.2	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP20A	0.1-0.2	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP21A	0.0-0.1	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP22A	0.0-0.1	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
TP40A	0.0-0.1	<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
Duplicate A		<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
Duplicate B		<25	<50	<100	<100	ND	<0.5	<0.5	<1.0	<2.0	<1.0
NSW DEC (1994)		**65**				**1000**	1	1.4	3.1	14	

Notes

1) All results are expressed as mg/kg unless otherwise specified

2) Figures in bold italics exceed the NSW DEC criteria

3) ND Not detected

GeoEnviro Consultancy

TABLE 7A
Summary of Analytical Results - TRH and BTEX

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Sample	Depths	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,k)fluoranthene	Benzo(a)pyrene	Indeno(123-cd)pyrene	Dibenzo(ah)abthracene	Benzo(ghi)perylene	Total PAHs
TP4A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP6A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP8A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP12A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP14A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP16A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP18A	0.3-0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP19A	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP20A	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP21A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP22A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
TP40A	0.0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
Duplicate A		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
Duplicate B		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	ND
HILs 'A' Level													1				20

Notes

1) All results are expressed as mg/kg

2) Figures in bold italics ex

GeoEnviro Consultancy

TABLE 8A
Summary of Analytical Results - PAH

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL Date: 23/03/2009
Checked by:_____ Date:_____

Sample	Asbestos
TP12A	ND
TP14A	ND
TP16A	ND

Note: ND = Not detected

GeoEnviro Consultancy

TABLE 9A

Summary of Analytical Results - Asbestos

Mr Jim and Vanessa Driver
Proposed Residential Development
Nos 195-203 Turner Street Elderslie

Sample	Depths	Metals							
		Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP19A	0.1-0.2	25	24	59	<0.5	12	18	5	<0.1
Duplicate A	-	27	30	58	<0.5	16	16	8	<0.1
Relative Percentage Difference (RPD)		7.7	22.2	1.7	NA	28.6	11.8	46.2	NA

Sample	Depths	Metals							
		Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP 40A	0.0-0.1	21	27	57	<0.5	15	15	6	<0.1
Duplicate B	-	22	28	58	<0.5	17	17	7	<0.1
Relative Percentage Difference (RPD)		4.7	3.6	1.7	NA	12.5	12.5	15.4	NA

Sample	Depths	OCP	OPP	PCB	TRH	BTEX	PAH
TP19A	0.1-0.2	ND	ND	ND	ND	ND	ND
Duplicate A	-	ND	ND	ND	ND	ND	ND
Relative Percentage Difference (RPD)		NA	NA	NA	NA	NA	NA

Sample	Depths	OCP	OPP	PCB	TRH	BTEX	PAH
TP 40A	0.0-0.1	ND	ND	ND	ND	ND	ND
Duplicate B	-	ND	ND	ND	ND	ND	ND
Relative Percentage Difference (RPD)		NA	NA	NA	NA	NA	NA

Notes

1) All results are expressed as mg/kg .

2) ND - Not Detected

3) NA - Not Applicable

GeoEnviro Consultancy

TABLE 10A
Summary of Analytical Results - Quality Assurance

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

APPENDIX D

Unexpected Asbestos Finds Protocol

Unexpected Asbestos Finds

If asbestos is detected in area not identified as containing asbestos prior to, or during, bulk excavation works the following 'Unexpected Finds Protocol' will apply:

- Upon discovery of suspected asbestos containing material, the Council officer is to be notified and the affected area closed off by the use of barrier tape and warning signs. Warning signs shall be specific to Asbestos Hazards and shall comply with the Australian Standard 1319-1994 – Safety Signs for the Occupational Environment;
- Work shall comply with WorkCover requirements including *Working with Asbestos*, *2008*;
- An OHS consultant or a hygienist is to be notified to inspect the area and confirm the presence of asbestos and determine whether the asbestos is classified as friable or bonded asbestos and determine the extent of remediation works to be undertaken. A report detailing this information will be compiled by the OHS consultant and provided to the Council officer (or his representative);
- The impacted soil will be classified and disposed of, as a minimum, as Special Waste (Asbestos) at an appropriately licensed facility. In dry and windy conditions the stockpile will be kept lightly wetted and may be covered with plastic sheet whilst awaiting disposal;
- All work associated with asbestos in soil will be undertaken by a contractor holding a class AS-1 Licence (friable) or AS2 Licence for bonded asbestos, as appropriate. WorkCover must be notified 7 days in advance of any asbestos works;
- Monitoring for airborne asbestos fibres is to be carried out during the soil excavation in asbestos contaminated materials;
- Documentary evidence (weighbridge dockets) of correct disposal is to be provided to the Council officer (or their representative);
- At the completion of the excavation, a clearance inspection is to be carried out, soil samples taken and analysed for asbestos fibres followed by written certification provided by an OHS Consultant that the area is safe to be accessed and worked (with respect to asbestos impact). If required, the filling material remaining in the inspected area can be covered/ sealed by an appropriate physical barrier layer of non-asbestos containing material prior to sign–off;
- Details are to be recorded in the site record system.

APPENDIX E

Important Information about your Environmental Site Assessment

IMPORTANT INFORMATION REGARDING YOUR ENVIRONMENTAL SITE ASSESSMENT

These notes have been prepared by GeoEnviro Consultancy Pty Ltd, using guidelines prepared by ASFE. The Association of Engineering Firms Practising in the Geosciences. The notes are offered as an aid in the interpretation of your environmental site assessment report.

REASONS FOR AN ENVIRONMENTAL SITE ASSESSMENT

Environmental site assessments are typically, though not exclusively, performed in the following circumstances:

- As a pre- acquisition assessment on behalf of either a purchaser or a vendor, when a property is to be sold
- As a pre-development assessment, when a property or area of land is to be redeveloped, or the land use has change, eg from a factory to a residential subdivision
- As a pre-development assessment of greenfield sites, to establish baseline conditions and assess environmental, geological and hydrological constraints to the development of, eg, a landfill
- As an audit of the environmental effects of previous and present site usage

Each circumstance requires a specific approach to the assessment of soil and groundwater contamination. In all cases the objective is to identify and if possible, quantify the risks which unrecognised contamination poses to the ongoing or proposed activity. Such risk may be both financial (clean-up costs or limitations in site use) and physical (health risks to site users or the public).

ENVIRONMENTAL SITE ASSESSMENT LIMITATIONS

Although information provided by an environmental site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination within a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which did not show signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur, only the most likely contaminants are screened.

AN ENVIRONMANTAL SITE ASSESSMENT REPORT IS BASED ON A UNIQUE SET OF PROJECT SPECIFIC FACTORS

Your environmental assessment report should not be used;

- When the nature of the proposed development is changed, eg, if a residential development is proposed, rather than a commercial development

- When the size or configuration of the proposed development is altered, eg, if a basement is added

- When the location or orientation of the proposed structure is modified
- When there is a change of land ownership, or
- For application to an adjacent site

In order to avoid costly problems, you should ask your consultant to assess any changes in the project since the assessment and the implications, if any, to recommendations made in the assessment.

ENVIRONMENTAL SITE ASSESSMENT FINDINGS ARE PROFESSIONAL ESTIMATES

Site assessment identifies actual sub-surface conditions only at those points where samples are taken, when they are taken. Data obtained from the sampling and subsequent laboratory analyses are interpreted by geologists, engineers or scientist and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on any proposed development and appropriate remediation measures. Actual conditions may differ from those inferred, because no professional, no matter how qualified and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, however, steps can be taken to help minimise the impact. For this reason, site owner should retain the services of their consultants throughout the development stage of the project in order to identify variances, conduct additional tests which may be necessary and to recommend solutions to problems encountered on site.

Soil and groundwater contamination is a field in which legislation and interpretation of legislation by government departments is changing rapidly. Whilst every attempt is made by GeoEnviro Consultancy Pty Ltd to be familiar with current policy, our interpretation of the investigation findings should not be taken to be that of the relevant authority. When approval from a statutory authority is required for a project, that approval should be directly sought.

STABILITY OF SUB-SURFACE CONDITIONS

Sub-surface conditions can change by natural processes and site activities. As an environmental site assessment is based on conditions existing at the time of the investigation, project decisions should not be based on environmental site assessment data which may have been affected by time. The consultant should be requested to advise if additional tests are required.

ENVIRONMENTAL SITE ASSESSMENTS ARE PERFORMED FOR SPECIFIC PURPOSES AND CLIENTS

Environmental site assessments are prepared in response to a specific scope of work required to meet the specific needs or specific individuals. An assessment prepared for a consulting civil engineer may not be adequate to a construction contractor or another civil engineer.

An assessment should not be used by other persons for any purpose, or by the client for a different purposes. No individual, other than the client, should apply an assessment, even for its intended purposes, without first conferring with the consultant. No person should apply an assessment for any purposes other than that originally contemplated, without first conferring with the consultant.

MISINTERPRETATION OF ENVIRONMENTAL SITE ASSESSMENTS

Costly problems can occur when design professionals develop plans based on misinterpretation of an environmental site assessment. In order to minimise problems, the environmental consultant should be retained to work with appropriate design professionals, to explain relevant findings and to review the adequacy of plans and specifications relative to contamination issues.

LOGS SHOULD NOT BE SEPARATED FORM THE REPORT

Borehole and test pit logs are prepared by environmental scientists, engineers or geologist, based upon interpretation of field conditions and laboratory evaluation of field samples. Field logs normally provided in our reports and these should not be redrawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however, contractors can still misinterpret the logs during bid preparation if separated from the test of the assessment. Should this occur, delays and disputes , or unanticipated costs may result.

To reduce the likelihood of boreholes and test pit logs misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of sub-surface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations, such as contractors.

READ RESPONSIBILITY CLAUSES CLOSELY

An environmental site assessment is based extensively on judgement and opinion, therefore, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claim being lodged against consultants. In order to aid in prevention of this problem, model clauses have been developed for use in written transmittals. These are definitive clauses, designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment and you are encouraged to read them closely. Your consultant will be happy to give full and frank answers to any questions you may have.

Annexure "C"
Bushfire Hazard Assessment

Bushfire Protection Assessment

Proposed Rezoning – Turner Road, Currans Hill

Prepared for
Dartanyon Pty Ltd

September 2017







DOCUMENT TRACKING

Item	Detail
Project Name	Bushfire Protection Assessment: Proposed rezoning – Turner Road, Currans Hill
Project Number	1879
Project Manager	Steve House Suite 204, Level 2, 62 Moore Street, Austinmer NSW 2515 Tel: 02 4201 2205
Prepared by	Danielle Meggos
Reviewed by	David Peterson (FPAA BPAD Certified Practitioner No. BPD-L3-18882)
Approved by	Steven House
Status	Final
Version Number	1
Last saved on	1 September 2017
Cover Photo	Subject land taken by Steven House

This report should be cited as 'Eco Logical Australia 1 September 2017. Bushfire Protection Assessment: Proposed rezoning – Turner Road, Currans Hill. Prepared for Dartanyon Pty Ltd.'

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and Dartanyon Pty Ltd. The scope of services was defined in consultation with Dartanyon Pty Ltd by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.

Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

© ECO LOGICAL AUSTRALIA PTY LTD

Contents

1 Executive Summary 1

2 Property and proposal 3

2.1 Description of proposal 3

2.2 Location and description of subject land 3

3 Bushfire threat assessment 7

3.1 Vegetation types 7

3.2 Effective slope 7

4 Asset protection zones 8

4.1 APZ maintenance plan 8

5 Construction standard 10

6 Utilities and access 11

6.1 Water supply 11

6.2 Gas and electrical supplies 11

6.3 Access 11

6.3.1 Public roads 11

6.3.2 Access and egress 11

7 Assessment of environmental issues 13

8 Recommendations and conclusion 14

References 15

© ECO LOGICAL AUSTRALIA PTY LTD

List of figures

Figure 1: Study area 4

Figure 2: Vegetation communities 5

Figure 3: Development plan 6

Figure 4: Asset Protection Zone 9

List of tables

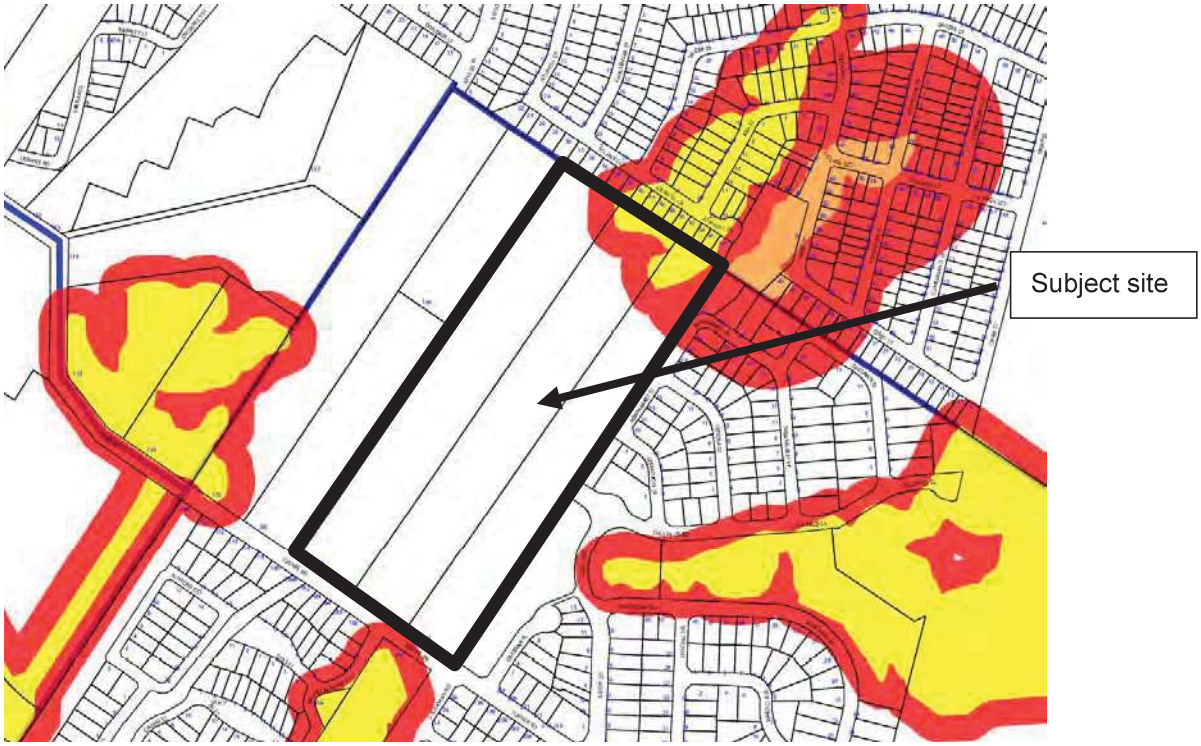
Table 1: Threat assessment, APZ and category of bushfire attack 8

Table 2: Performance criteria for proposed public roads (PBP p. 23) 12

1 Executive Summary

This report assesses the proposed rezoning of Lots 187, 195 and 203 Turner Road, Currans Hills. To assist in the assessment of the rezoning a detailed assessment that meets the requirements of Section 100B of the Rural Fires Act, 1997 has been undertaken.

This assessment is required as part of the site is currently classified as bushfire prone land due to it being within 100 metres of bushfire prone vegetation to the north and south of the site. Importantly, there is only a small area of bushfire prone vegetation within the site, this is proposed to be removed as part of future development applications. A copy of the Camden Councils bushfire prone land map is provided below;



Bushfire Prone Land Map

Vegetation to the north of the site is located within the Gregory Hills development. This vegetation has been completed removed as part of the Gregory Hills development (see following page). Due to the small size of the vegetation remaining on the site it will no longer be classified as bushfire prone land once the bushfire prone land maps are updated.

© ECO LOGICAL AUSTRALIA PTY LTD



Aerial photo (dated 5th May, 2016).

Due to revegetation works being undertaken on the adjoining subdivision to the east of the site, this will impact an emerging bushfire hazard on the south-eastern corner of the site. As this vegetation is less than 50 metres in width this vegetation is considered 'low hazard', requiring a 10 metre wide asset protection zone that can be easily incorporated into subdivision (See figure 4).

With regards to the riparian area within the site a Vegetation Management Plan (VMP) has been prepared for the riparian corridor traversing the centre of the subject land (see Figure 3), the small remnant of Riverflat Eucalypt forest shown in Figure 1 will be removed as part of this development. As shown in the VMP the width of the riparian corridor is no more than 10 m either side of the watercourse, and it is greater than 20 metres from other bush fire prone vegetation. This riparian corridor is not considered bush fire prone and will not impart a bushfire threat to future development on the site.

The site is well serviced by public roads and reticulated water. Future dwellings will need to comply with *AS3959-2009 Construction of building on bushfire prone land.*

In summary, the site is subject to a very low, bordering on negligible bushfire risk and is suitable for the proposed rezoning. Any required bushfire protection measures can be incorporated into development consents, as demonstrated by the included subdivision report.

© ECO LOGICAL AUSTRALIA PTY LTD

2 Property and proposal

Name:	Turner Road, Currans Hill		
Street or property name:	187, 195 and 203 Turner Road		
Suburb, town or locality:	Currans Hill	**Postcode:**	2567
Lot and DP:	Lot 36-38 DP 28024		
Local Government Area:	Camden Council		
Type of area:	Urban		
Type of development:	Residential subdivision		

2.1 Description of proposal

Dartanyon Pty Ltd commissioned Eco Logical Australia Pty Ltd (ELA) to prepare a bushfire protection assessment (BPA) for a proposed subdivision at 187, 195 and 203 Turner Road, Currans Hill (hereafter referred to as the subject land).

The proposed development will result in the creation of 139 residential/super lots with associated roads and infrastructure.

2.2 Location and description of subject land

The subject land is located in south western Sydney where it adjoins the Turner Road Precinct within the South Western Growth Centre as shown in **Figure 1**. It is located within the area known as Manooka Valley and comprises mostly cleared pasture land.

Figure 2 shows the subject land and the location of the proposed subdivision in relation to the nearest bush fire prone vegetation to the south.

Figure 3 shows the proposed lot layout.

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 1: Study area

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 2: Vegetation communities

© ECO LOGICAL AUSTRALIA PTY LTD

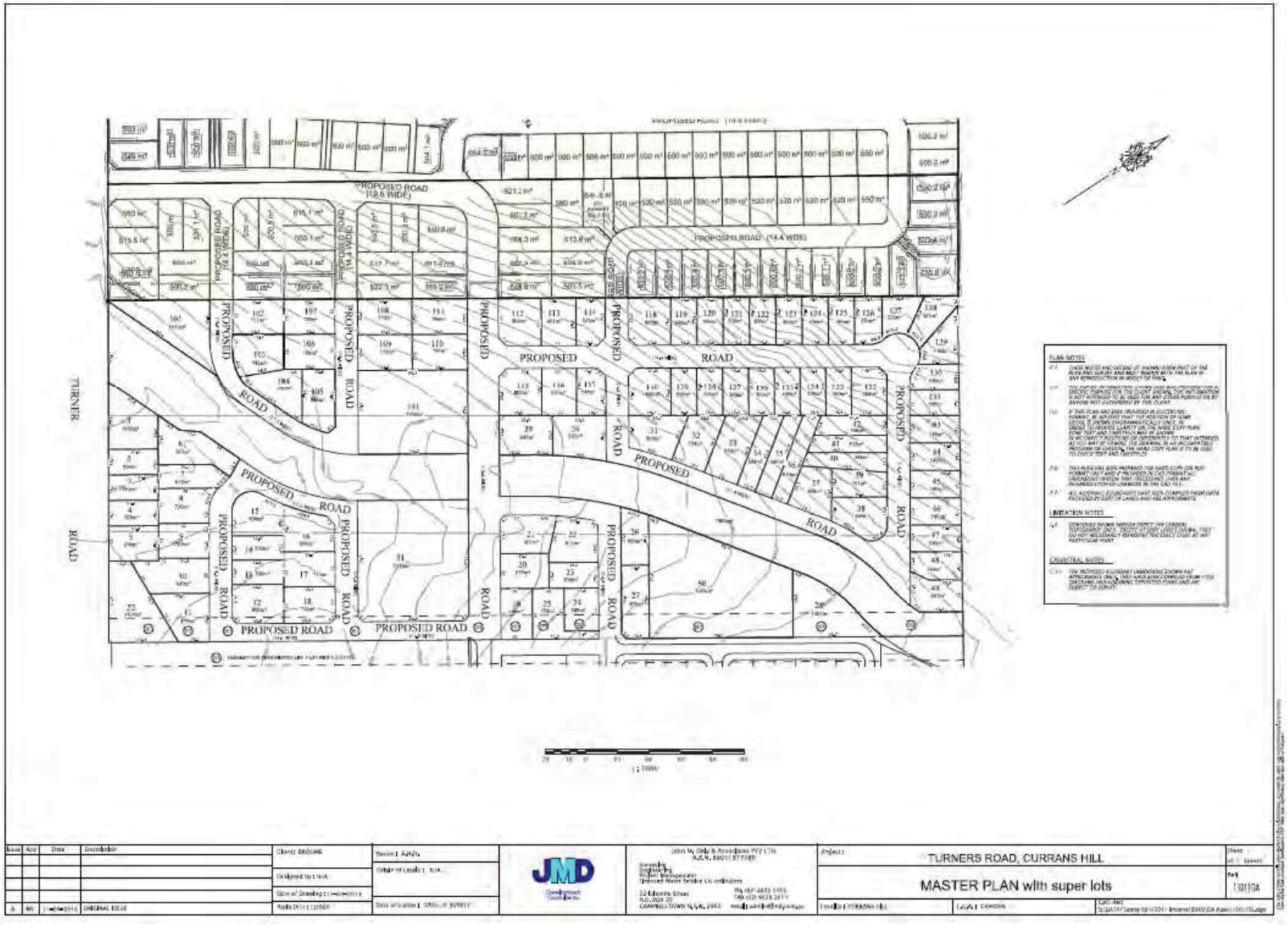


Figure 3: Development plan

© ECO LOGICAL AUSTRALIA PTY LTD

3 Bushfire threat assessment

The subject land is identified as bush fire prone land by Camden Council. This report has been prepared in accordance with Section 100B of the *Rural Fires Act 1997* and *Planning for Bush Fire Protection 2006* (RFS 2006), herein referred to as PBP.

3.1 Vegetation types

In accord with PBP, the predominant vegetation class has been assessed within the development and calculated for a distance of at least 140 m out from the proposed development.

The majority of the area proposed for subdivision has been cleared and now consists of weedy areas, cleared grasslands and scattered paddock trees.

A narrow riparian corridor occurs within the subject land. The existing small patch of Alluvial Woodland within the corridor is less than 1 ha in size. Following rehabilitation the riparian corridor will include a strip of vegetation that is less than 20 m in width consisting of grasses and sedges (Juncus and Carex) with scattered trees. This vegetation is considered to be negligible and is not considered a bushfire hazard, consistent with the *Guide for Bush Fire Prone Land Mapping* (RFS, 2014). A small patch of vegetation occurs to the north east of the subject land which is less than 1 ha in size and is also not considered a bushfire hazard in accordance with the Guide.

An area of remnant vegetation (less than 2 ha in size) occurs to the south of the subject land, on the opposite side of Turner Road within a vegetated riparian corridor. For the purposes of applying PBP this is considered a 'low hazard'.

3.2 Effective slope

In accord with PBP, the slope that would most significantly influence fire behaviour was determined over a distance of 100 m from the boundary of the proposed development where the vegetation was found. This assessment was made with 10 m contours and confirmed during a site inspection. The land slopes gently within the vegetation to the south of Turner Road and falls within the slope class '>0-5° downslope'.

© ECO LOGICAL AUSTRALIA PTY LTD

4 Asset protection zones

Table A2.4 of PBP has been used to indicate the required asset protection zone (APZ) dimensions for the development using the vegetation and slope data identified in **Section 2**. The APZ calculation is tabulated below and shown in **Figure 4.**

Table 1: Threat assessment, APZ and category of bushfire attack

Direction from development	Slope[1]	Vegetation[2]	PBP required APZ[3]	Available APZ	Comments
South	>0-5° downslope	Low hazard	10 m	20 m	Provided by Turner Road
South-east	>0-5° downslope	Low hazard	10 m	10 m	Located within proposed lots
All other directions	Existing and future residential development				

[1] Slope most significantly influencing the fire behaviour of the site having regard to vegetation found. Slope classes are according to PBP.

[2] Predominant vegetation is identified, according to PBP and *"Where a mix of vegetation types exist the type providing the greater hazard is said to be predominate".*

[3] Assessment according to Table A2.4 of PBP

4.1 APZ maintenance plan

The following fuel management specifications are required for any landscaping undertaken within the subject land:

- No tree or tree canopy is to occur within 2 m of the dwelling roofline.
- The presence of a few shrubs or trees is acceptable provided that they:
  - are well spread out and do not form a continuous canopy
  - are not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period
  - are located far enough away from the building so that they will not ignite the building by direct flame contact or radiant heat emission.
- Any landscaping or plantings should preferably be local endemic mesic species or other low flammability species.

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 4: Asset Protection Zone

5 Construction standard

The building construction standard is based on the determination of the Bushfire Attack Level (BAL) in accordance with Method 1 of *Australian Standard AS 3959-2009 'Construction of buildings in bushfire-prone areas'* (Standards Australia 2009). The BAL is based on known vegetation type, effective slope, and managed separation distance between the development and the bushfire hazard.

Construction standards for future dwellings within the development will be determined at when individual development application are lodged, and are likely to be BAL-Low to BAL-29 in accordance with AS3959.

© ECO LOGICAL AUSTRALIA PTY LTD

6 Utilities and access

6.1 Water supply

The furthest point from any dwelling to a hydrant will be less than 90 m in accordance with *Australian Standard AS 2419.1 'Fire hydrant installations – System design installation and commissioning'* (Standards Australia 2005).

The reticulated water supply is to also comply with the following acceptable solutions within Section 4.1.3 of PBP:

- Reticulated water supply uses a ring main system for areas with perimeter roads.
- Hydrants are not located within any road carriageway.
- All above ground water and gas service pipes external to the building are metal, including and up to any taps.
- The PBP provisions of parking on public roads are met.

6.2 Gas and electrical supplies

The electricity supply to the proposed development is to be located underground. This complies with PBP.

Any gas services are to be installed and maintained in accordance with *Australian Standard AS/NZS 1596 'The storage and handling of LP Gas'* (Standards Australia 2008).

6.3 Access

6.3.1 Public roads

The proposed public roads within the development are able to comply with the PBP design requirements as outlined in **Table 2**.

6.3.2 Access and egress

Dwellings within the proposed development will be accessed via standard residential driveways. No battle-axe allotments are proposed as part of the development. A fire involving any of the proposed dwellings would be attended to by fire appliances from the hardstand surface of the proposed roads.

© ECO LOGICAL AUSTRALIA PTY LTD

Table 2: Performance criteria for proposed public roads (PBP p. 23)

Intent may be achieved where:	Acceptable solutions	Complies
• firefighters are provided with safe all weather access to structures (thus allowing more efficient use of firefighting resources)	• public roads are two-wheel drive, all weather roads	Can comply
• public road widths and design that allows safe access for firefighters while residents are evacuating an area	• urban perimeter roads are two-way, that is, at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb), allowing traffic to pass in opposite directions. Non perimeter roads comply with Table 4.1 – Road widths for Category 1 Tanker (Medium Rigid Vehicle) requiring a minimum trafficable surface of 6.5 metres • the perimeter road is linked to the internal road system at an interval of no greater than 500 metres in urban areas • traffic management devices are constructed to facilitate access by emergency services vehicles • public roads have a cross fall not exceeding 3 degrees • public roads are through roads. Dead end roads are not recommended, but if unavoidable, dead ends are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end and direct traffic away from the hazard • curves of roads (other than perimeter roads) are a minimum inner radius of six metres • maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient • there is a minimum vertical clearance to a height of four metres above the road at all times • the capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles (approximately 15 tonnes for areas with reticulated water, 28 tonnes or 9 tonnes per axle for all other areas). Bridges clearly indicated load rating	Can comply Can comply Can comply Can comply Can comply Can comply Can comply Can comply Can comply
• the capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles	• public roads greater than 6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water for fire suppression	Can comply
• roads that are clearly sign posted (with easy distinguishable names) and buildings / properties that are clearly numbered	• public roads between 6.5 metres and 8 metres wide are No Parking on one side with the services (hydrants) located on this side to ensure accessibility to reticulated water for fire suppression • public roads up to 6.5 metres wide provide parking within parking bays and located services outside of the parking bays to ensure accessibility to reticulated water for fire suppression	Can comply Can comply
• there is clear access to reticulated water supply	• one way only public access roads are no less than 3.5 metres wide and provide parking within parking bays and located services outside of the parking bays to ensure accessibility to reticulated water for fire suppression • parking bays are a minimum of 2.6 metres wide from kerb to kerb edge to road pavement . No services or hydrants are located within the parking bays	Can comply Can comply
• parking does not obstruct the minimum paved width	• public roads directly interfacing the bush fire hazard vegetation provide roll top kerbing to the hazard side of the road	Can comply

7 Assessment of environmental issues

A Flora and Fauna Assessment has been prepared for the proposed development (Eco Logical Australia 2015). This report concluded that the proposed development is unlikely to significantly impact upon listed species or communities that occur within the subject land. Recommendations are provided within the report to minimise the impact of the proposal on the environment.

Camden Council is the determining authority for this development; they will assess more thoroughly any potential environmental and heritage issues.

© ECO LOGICAL AUSTRALIA PTY LTD

8 Recommendations and conclusion

The proposal consists of residential subdivision adjoining a narrow riparian corridor which is in the process of being rehabilitated and revegetated. The development aim and objectives of PBP and the standards for subdivision as specified in Section 4.1.3 of PBP as outlined below:

- Asset protection zones are provided as outlined in **Section 3** of this report
- Water supply is to be installed in accordance with the requirements outlined in **Section 5**
- Electrical services are to be underground (**Section 5**).
- Any gas services are to be installed and maintained in accordance with AS/NZS 1596:2008 (**Section 5**).
- Public roads are to comply with the requirements outlined in **Section 5** of this report.

In the author's professional opinion, the bushfire protection measures demonstrated in this report comply with *Planning for Bush Fire Protection 2006* and allow for the issue of a Bush Fire Safety Authority.

If you have any questions or concerns in respect to this report, please contact Danielle Meggos on (02) 8539 8605.



Danielle Meggos

Senior Bushfire Planner

Reviewed and approved by



David Peterson

Principal Bushfire Consultant

FPAA BPAD Certified Practitioner No. BPD-L3-18882

© ECO LOGICAL AUSTRALIA PTY LTD

References

Eco Logical Australia June 2015. *Currans Hill, Turner Road Ecological Report.* Prepared for Dartanyon Pty Ltd.

NSW Rural Fire Service (RFS). 2006. *Planning for Bush Fire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners* including the 2010 Appendix 3 Addendum. Australian Government Publishing Service, Canberra.

NSW Rural Fire Service (RFS). 2014. *Guide for Bush Fire Prone Land Mapping.*

Standards Australia. 2005. *Fire hydrant installations - System design, installation and commissioning*, AS 2419.1, Fourth edition 2005, SAI Global, Sydney

Standards Australia. 2008. *The storage and handling of LP Gas*, AS/NZS 1596:2008, Fourth edition 2005, SAI Global, Sydney.

Standards Australia. 2009. *Construction of buildings in bushfire-prone areas*, AS 3959-2009. SAI Global, Sydney.

© ECO LOGICAL AUSTRALIA PTY LTD

HEAD OFFICE
Suite 4, Level 1
2-4 Merton Street
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

SYDNEY
Level 6
299 Sussex Street
Sydney NSW 2000
T 02 8536 8650
F 02 9264 0717

ST GEORGES BASIN
8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA
Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

NEWCASTLE
Suites 28 & 29, Level 7
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA
5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE
92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

MUDGEE
Unit 1, Level 1
79 Market Street
Mudgee NSW 2850
T 02 4302 1230
F 02 6372 9230

PERTH
Suite 1 & 2
49 Ord Street
West Perth WA 6005
T 08 9227 1070
F 08 9322 1358

WOLLONGONG
Suite 204, Level 2
62 Moore Street
Austinmer NSW 2515
T 02 4201 2200
F 02 4268 4361

GOSFORD
Suite 5, Baker One
1-5 Baker Street
Gosford NSW 2250
T 02 4302 1220
F 02 4322 2897

© ECO LOGICAL AUSTRALIA PTY LTD

DARWIN
16/56 Marina Boulevard
Cullen Bay NT 0820
T 08 8989 5601

BRISBANE
PO Box 1422
Fortitude Valley QLD 4006
T 07 3503 7193

1300 646 131
www.ecoaus.com.au

Annexure "D"
Flora and Fauna Assessment

Rezoning Report 185, 195 & 203 Turner Road, Currans Hill

Flora, fauna and riparian assessment

Prepared for
Turner Road Developments and Ken Broome

18th August 2017



DOCUMENT TRACKING

ITEM	DETAIL
Project Name	Currans Hill, Turner Road – Consultancy Services
Project Number	1879
File location	N: 15COR-1879
Project Manager	Steven House Phone: 02 4201 2201 Office address: Suite 204, Level 2, 62 Moore Street, Austinmer NSW 2515
Prepared by	Catherine Wade, Robyn Johnson
Approved by	Steven House
Status	FINAL
Version Number	1
Last saved on	18th August, 2017
Cover photo	Turner Rd, Currans Hill (taken by Steven House)

This report should be cited as 'Eco Logical Australia August 2017. *'Currans Hill, Turner Road, Flora and Fauna Assessment'*. Prepared for Turner Road Developments and Ken Broome.

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and Turner Road Developments Pty Ltd and Ken Broome. The scope of services was defined in consultation with Turner Road Developments Pty Ltd and Ken Broome, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.

Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

Contents

Executive summary **6**

1 Introduction **7**
1.1 Background 7
1.2 Description of project 7
1.3 Site description 7
1.4 Report objectives 9

2 Legislative requirements **10**
2.1 Commonwealth legislation 10
2.1.1 Environment Protection & Biodiversity Conservation Act 1999 10
2.2 State legislation and policies 10
2.2.1 Environmental Planning and Assessment Act 1979 10
2.2.2 Threatened Species Conservation Act 1995 10
2.2.3 Water Management Act 2000 11
2.2.4 Noxious Weeds Act 1993 11

3 Methods **12**
3.1 Literature review and data audit 12
3.2 Mapping 12
3.3 Field survey 13

4 Results **14**
4.1 Literature review and data audit 14
4.2 Vegetation and fauna habitat 14
4.3 Threatened ecological communities 14
4.4 Threatened flora 14
4.5 Threatened fauna 14

5 Impact Assessment **17**
5.1 Introduction 17
5.2 Vegetation and fauna habitat 17
5.3 Threatened ecological communities 17
5.4 Threatened flora 17
5.5 Threatened fauna 17

6 Riparian Assessment **18**

7 Conclusions and recommendations 20
7.1 Assessments of significance 20
7.2 Mitigation measures 20
7.2.1 Dam dewatering plan 21

References 22

Appendix A: NOW Correspondence 23

Appendix B: Threatened species & communities likelihood of occurrence 24

Appendix C: Seven part tests (EP&A Act) 40

Appendix D: Significant impact criteria (EPBC Act) 55

List of Figures

Figure 1: Subject site location 8

Figure 2: Threatened species records 15

Figure 3: Validated vegetation communities 16

Figure 4. Riparian zones and revegetation 19

List of Tables

Table 1: Field survey species list 38

Abbreviations

ABBREVIATION	DESCRIPTION
CA	Controlled Action
CEEC	Critically Endangered Ecological Community
CLS	Cumberland Land Snail
CPW	Cumberland Plain Woodland
DA	Development Application
DCP	Development Control Plan
ELA	Eco Logical Australia
EPBC Act	*Environment Protection Biodiversity Conservation Act 1999*
EP&A Act	*Environmental Planning and Assessment Act 1979*
FM	Fisheries Management
GIS	Geographic Information System
LEP	Local Environment Plan
LGA	Local Government Area
NCA	Non-controlled action
NCA-SM	Non-controlled action – specified manner

ABBREVIATION	DESCRIPTION
NES	National environmental significance
NPWS	National Parks & Wildlife Service
NSW	New South Wales
OEH	Office of Environment and Heritage
SEWPAC	Sustainability, Environment, Water, Population and Communities
SIS	Species Impact Statement
TEC	Threatened Ecological Community
TSC Act	*Threatened Species Conservation Act 1995*
VMP	Vegetation Management Plan
WM Act	*Water Management Act 2000*

Executive summary

This report is a flora, fauna and riparian assessment of the proposed rezoning of 187, 195 and 203 Turner Road, Currans Hill, New South Wales (NSW). This assessment has been undertaken in a manner that assesses that statutory requirements in relation to approval to clear the site and the requirements of the *Water Management Act, 2000*. This is to demonstrate that the rezoning will facilitate development that is permissible under state and commonwealth legislation.

This assessment addresses the requirements of the NSW *Threatened Species Conservation Act 1995* (TSC Act), *Water Management Act, 2000* (WM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It combines information from database searches with a field survey to identify species, populations and communities known or likely to occur on the subject site, and assesses the significance of the proposed impacts.

The threatened community Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) occurs within the subject site, in the form of approximately 25 scattered paddock trees surrounded by approximately 10.5 hectares (ha) of exotic pasture. This community is a critically endangered ecological community (CEEC) under the TSC Act. Although CPW is also listed as critically endangered under the EPBC Act, the scattered trees present on the subject site do not meet the criteria to be considered part of the community under this Act. A small remnant (0.2 ha) of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (RFEF) occurs along the main drainage line on the subject site. This community is an endangered ecological community (EEC) under the TSC Act.

No threatened flora or fauna was observed during the field survey. However, the following species have the potential or are known to occur within the subject site:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) (TSC Act)
- *Mormopterus norfolkensis* (East Coast Freetail Bat) (TSC Act)
- *Myotis macropus* (Southern Myotis) (TSC Act)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat) (TSC Act)
- *Pteropus poliocephalus* (Grey-headed Flying-Fox) (TSC Act and EPBC Act).

The proposal would result in the removal of approximately 25 scattered paddock trees of the CPW community and approximately 0.2 ha of the RFEF community. The proposal would also remove one hollow bearing tree and dewater three existing dams.

The impacts of the proposal of the above listed two ecological communities and five bat species were assessed using the 'Assessment of Significance' (7-part test) under Section 5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and using 'Significant Impact Criteria' under the EPBC Act. The impacts of the proposal of the threatened communities and species are not considered significant and therefore a Species Impact Statement is not required under the TSC Act and referral to Commonwealth Department of Environment (DotE) is not required under the EPBC Act.

1 Introduction

1.1 Background

This report is a flora and fauna assessment of the proposed rezoning of 187, 195 and 203 Turner Road, Currans Hill, New South Wales (NSW). Eco Logical Australia (ELA) was commissioned by Turner Road Developments Pty Ltd and Ken Broome to prepare this assessment to assist with obtaining development consent for subdividing the land.

This assessment addresses the requirements of the NSW *Threatened Species Conservation Act, 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act,* 1999. It combines information from database searches with field investigations to identify species and ecosystems known or likely to occur on the subject site.

1.2 Description of project

This report assesses the ecological impact of the proposed rezoning for 187, 195 and 203 Turner Road, Currans Hill, as shown in **Figure 1**.

1.3 Site description

Turner Road, Currans Hill is located within the Western Sydney region of NSW. It lies within the Cumberland Plain and comprises exotic pasture across undulating hills, with some small pockets of remnant native vegetation. The dominant soil type is clay based, originating from Wianamatta Shale and Cumberland Plain Woodland (CPW) is the associated vegetation type. Small pockets of alluvial soil in drainage areas support River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (RFEF). The subject site consists mostly of cleared grassland and weeds with areas of native vegetation along the creek (**Figure 1**). The subject site is composed of approximately 25 scattered paddock trees belonging to the CPW community, 0.2 hectares (ha) of RFEF and approximately 10.5 ha of pasture grasses.



Figure 1: Subject site location

1.4 Report objectives

The aim of this report is to:

- Identify native vegetation communities, flora, fauna and ecological values at the subject site
- Assess the impact of the proposed development on the vegetation communities, flora, fauna and ecological values recorded at the subject site using the 7 part tests in accordance with Section 5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).
- Provide recommendations to alleviate the impact of the proposal on threatened vegetation communities, flora and fauna.

2 Legislative requirements

2.1 Commonwealth legislation

2.1.1 Environment Protection & Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes a process for assessing the environmental impact of activities and developments where matters of 'national environmental significance' (NES) may be affected, such as threatened species, ecological communities and migratory species.

The CPW vegetation on the subject site does not meet the criteria for listing under this act. Impacts of the proposal on *Pteropus poliocephalus* (Grey-headed Flying-Fox) have been assessed using 'Significant Impact Criteria' under the EPBC Act.

2.2 State legislation and policies

2.2.1 *Environmental Planning and Assessment Act 1979*

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state of NSW, providing a framework for environmental planning instruments and development and activity assessment of proposals. Various additional legislative instruments, such as the NSW *Threatened Species Conservation Act 1995* (TSC Act), are also integrated with EP&A Act.

Section 5A of the EP&A Act specifically requires consideration of whether there is likely to be a significant effect on threatened species, populations or ecological communities or their habitats. This assessment of significance is known as the '7-part test' and is undertaken in relation to species, communities, habitat and threatening processes listed under either the TSC Act or the *Fisheries Management Act 1994* (FM Act).

Assessments of significance (7-part tests) have been undertaken for this proposal in relation to two ecological communities and five bat species.

2.2.2 Threatened Species Conservation Act 1995

The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities listed under the TSC Act. The TSC Act is integrated with the EP&A Act and requires consideration of whether a development or an activity is likely to significantly affect threatened species, populations and ecological communities or their habitat.

An assessment of significance or 7-part test is required for any species, population or community that has been recorded on the subject site or could potentially occur on the subject site due to the presence of specific habitat requirements. If the assessment determines that a significant impact to a particular species, population or community is likely to result, a Species Impact Statement (SIS) may be required.

Seven part-tests were prepared for a number of threatened communities and species known or likely to occur on the subject site.

2.2.3 Water Management Act 2000

A controlled activity approval under the *Water Management Act 2000* (WM Act) is required for certain types of developments and activities that are carried out in or within 40 m of a river, lake or estuary. The WM Act provides a number of mechanisms for protection of water sources via the water management planning process. If a 'controlled activity' is proposed on 'waterfront land', an approval is required under Section 91 (2) of the WM Act. 'Controlled activities' include; the construction of buildings or carrying out of works; the removal of material or vegetation from land by excavation or any other means; the deposition of material on land by landfill or otherwise. 'Waterfront land' is defined as 'the bed of any river or lake, and any land lying between the river or lake and a line drawn parallel to and 40 metres inland from either the highest bank or shore'.

Approvals for controlled activities are administered by the NSW Office of Water (NOW) (a part of the NSW Department of Primary Industries) and a set of guidelines have been developed to assist applicants who are considering carrying out a controlled activity on waterfront land. The guidelines provide information on the design and construction of a controlled activity, and other mechanisms for the protection of waterfront land and include:

- In-stream works
- Laying pipes and cables in watercourses
- Outlet structures
- Riparian corridors
- Vegetation management plans
- Watercourse crossings.

This proposal has been prepared in consultation with NOW (see **Appendix A**) and a Controlled Activity Approval will be required.

2.2.4 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (NW Act) defines the roles of government, councils, private landholders and public authorities in the management of noxious weeds. The NW Act sets up categorisation and control actions for the various noxious weeds, according to their potential to cause harm to our local environment.

Under this Act, noxious weeds have been identified for Local Government Areas (LGAs) and assigned Control Categories (e.g. 1, 2, 3, 4 and 5). Part 3 of the NW Act stipulates that occupiers of land (this includes owners of land) have an enforceable responsibility for controlling noxious weeds on the land they occupy.

African Boxthorn and African Olive were present on subject site and will be removed as part of this development.

3 Methods

3.1 Literature review and data audit

The following information and databases were reviewed prior to field survey:

- Existing vegetation, soil and landscape mapping, as well as other available GIS data
- Atlas of NSW Wildlife
- EPBC Act Protected Matters Search Tool
- OEH Online Threatened Species Profiles.

Descriptions of vegetation communities present within the subject site were also reviewed along with aerial photography of the subject site prior to field survey. A search of the online EPBC Protected Matters Search Tool and Atlas of NSW Wildlife was performed for a radius of 5 km centred on the subject site on 2 June 2015.

Results from both searches were combined to produce a list of threatened species, populations and communities that may possibly occur within the subject site. Likelihood of occurrences for threatened species, populations and communities on the subject site were then made based on the habitat characteristics of the subject site, determined from knowledge of the species' ecology and is shown in **Appendix B**. Five terms for the likelihood of occurrence of species are used in this report, as defined below:

- "known" = the species was or has been observed on the subject site
- "likely" = a medium to high probability that a species uses the subject site
- "potential" = suitable habitat for a species occurs on the subject site, but there is insufficient information to categorise the species as likely, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the subject site
- "no" = habitat on the subject site and in the vicinity is unsuitable for the species.

All species that were assessed as having the potential to occur in the subject site prior to field survey were considered during field survey. Where these targeted species were not found, and where habitat on the subject site was not considered to be suitable for supporting a species, or was extremely small relative to the habitat available elsewhere in the locality and within the species' known range, their likelihood of occurrence was considered to be "unlikely to occur" and thus an Assessment of Significance for the species was not conducted.

3.2 Mapping

ELA mapped extant native vegetation, at a scale of 1:4,000 from high resolution digital aerial photographs with ArcGIS.

Vegetation community information, canopy density and understorey condition categories were assigned using a combination of existing mapping from the Natural Assets Policy (Camden Council, 2003) and aerial photograph interpretation.

3.3 Field survey

Field survey was carried out on 28 May 2015 by Steven House of ELA to assess and refine the accuracy of the aerial photo interpretation. Approximately two hours were spent walking over the study area to validate the mapped vegetation communities, assess vegetation condition, to identify species, to opportunistically record fauna species and record habitats. A list of native and exotic flora is included in **Appendix B**.

During the field survey, fauna habitat such as waterways (e.g. drainage and creek lines), hollow-bearing trees, logs, rocks, and condition of vegetation were noted.

Incidental sightings of fauna have been included in **Appendix B**.

4 Results

4.1 Literature review and data audit

The search for threatened species using the Protected Matters Search Tool and Atlas of NSW Wildlife (within a 5 km buffer around the subject site) and the review of literature resulted in a list of two endangered ecological communities, 41 threatened and migratory fauna species and 11 threatened flora species, which are shown in **Appendix B.** It should be noted that the result of the Protected Matters Search Tool, which has been included in **Appendix B**, is only a list of species based on habitat modelling, therefore, not all species listed in **Appendix B** are shown in **Figure 2**.

4.2 Vegetation and fauna habitat

Fauna is supported on the subject site by vegetation communities, including exotic pasture and remnant paddock trees. Habitat features are very limited, and include riparian areas and one hollow bearing tree. The bird species observed were common species found in urbanised environments in particular Noisy Minor (*Manorina melanocephala*), Magpie-lark (*Grallina cyanoleuca*), and Australian Raven (*Corvus coronoides*).

Woodlands on the subject site are not of sufficient size and complexity to support resident populations of sedentary bird species, whilst they do provide other resources to transient or wide ranging threatened species. The vegetation on the subject site provides no linkages to other areas of habitat. Along the eastern boundary of the subject site the adjacent development has established a riparian corridor which provides a linkage between Narellan Creek and the Scenic Hills area.

4.3 Threatened ecological communities

The threatened community Cumberland Plain Woodland (CPW) occurs within the subject site. This community was in the form of approximately 25 scattered paddock trees within predominantly exotic pasture. This community is a critically endangered ecological community (CEEC) under the TSC Act and is also listed as critically endangered under the EPBC Act.

A small remnant of River-Flat Eucalypt Forest (RFEF) on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions occurs along the main drainage line on the site.

Vegetation communities are mapped in **Figure 2**. Due to the small size and poor quality of the vegetation, the vegetation does not meet the definition of CPW under the EPBC Act.

4.4 Threatened flora

No threatened flora species were recorded in the subject site during the field survey.

4.5 Threatened fauna

No threatened fauna species were recorded in the subject site during the field survey.



Figure 2: Threatened species records



Figure 3: Validated vegetation communities

5 Impact Assessment

5.1 Introduction

The proposed residential development would occur inside the subject site boundary shown in **Figure 1**. The potential impact of the proposed development on threatened species and communities was assessed by undertaking assessments of significance for selected species and communities listed under the TSC Act and these are shown in **Appendix C**.

5.2 Vegetation and fauna habitat

Potential impacts resulting from the proposal include:

- Removal / modification of existing vegetation
- Loss / modification of fauna habitat
- Soil erosion.

The vegetation communities are CPW and RFEF, these communities occur as paddock trees and small riparian remnant respectively.

5.3 Threatened ecological communities

CPW and RFEF would be affected by the proposal and the areas that would be cleared are shown in **Figure 3**. Assessments of Significance were undertaken for these two communities and are provided in **Appendix C**. The results of these assessments indicated that it is unlikely that these endangered ecological communities would be significantly impacted by the proposal.

5.4 Threatened flora

No threatened flora species were recorded during the field survey or are considered to have the potential to occur on the subject site. Therefore, no Assessments of Significance were undertaken.

5.5 Threatened fauna

Five threatened fauna species have the potential to occur on the subject site, even though they were not recorded during the field survey. These species included:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Mormopterus norfolkensis* (East Coast Freetail Bat)
- *Myotis macropus* (Southern Myotis)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Pteropus poliocephalus (*Grey-headed Flying-Fox).

Based on the habitat requirements of the above species it is possible that they may occur on the subject site and have the potential to be affected by the proposal. Assessments of Significance under the TSC Act and consideration of the Significant Impact Criteria under the EPBC Act for the Grey-headed Flying Fox was undertaken and these assessments are provided in **Appendix C** and

Appendix D. The conclusions of these tests were that no significant impact from the proposal is likely, as long as the mitigation measures outlined in the following section are implemented.

6 Riparian Assessment

An assessment of the riparian zones on the site identified three drainage lines that were highly disturbed and were considered to be of relatively low value. The main drainage line running through the centre of the site to the Gregory Hills development to the north includes a series of farm dams, is highly modified downstream of the site and has been approved for compete removal upstream of the site, within the Gregory Hills development.

This stream will be realigned and treated as a first order stream, with a buffer 10m either side of a reconstructed channel (See figure 4). An online basin will be constructed at the southern boundary of the site. The stream on the southeastern corner of the site will be treated in a manner consistent with the adjacent Manuka Valley development.

The above approach has been developed in consultation with the NSW Office of Water (see Appendix A) and a detailed vegetation management plan has been prepared to guide the restoration of the riparian areas.

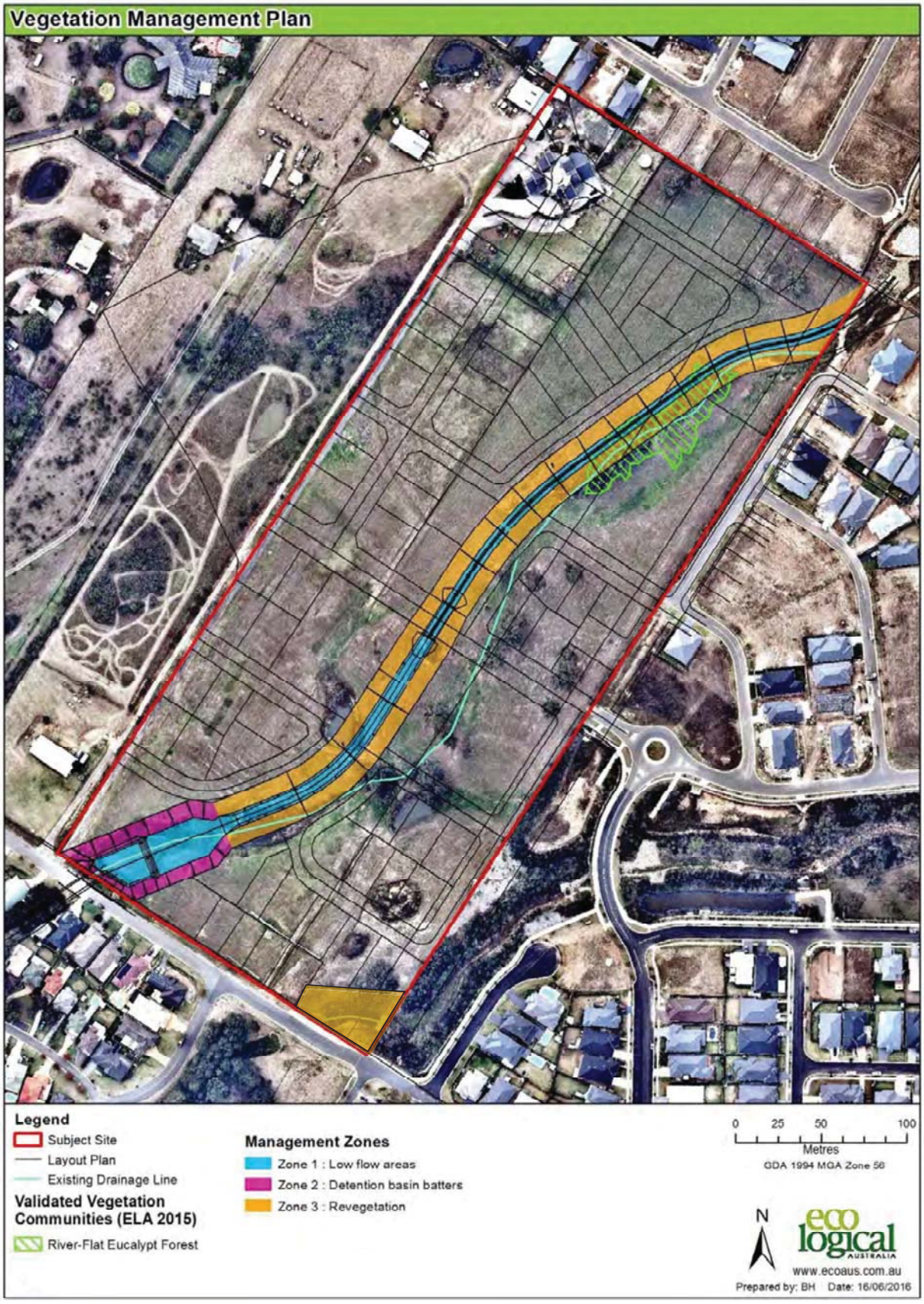


Figure 4. Riparian zones and revegetation

7 Conclusions and recommendations

7.1 Assessments of significance

The proposal would result in the removal of approximately 25 scattered paddock trees of the CPW community and approximately 0.2 ha of the RFEF community. The proposal would also remove one hollow bearing tree and dewater three existing dams. Reconstruction of the creek is proposed to improve water quality and revegetation of the riparian corridor is proposed under a Vegetation Management Plan for the subject site.

The results of the assessments of significance indicate that the proposal is not likely to have a significant impact on the following communities and species:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) (TSC Act)
- River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (RFEF) (TSC Act)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) (TSC Act)
- *Mormopterus norfolkensis* (East Coast Freetail Bat) (TSC Act)
- *Myotis macropus* (Southern Myotis) (TSC Act)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat) (TSC Act)
- *Pteropus poliocephalus* (Grey-headed Flying-Fox) (TSC Act and EPBC Act).

Mitigation measures and offsets are discussed in **Section 7.2** below.

7.2 Mitigation measures

A number of mitigation measures will be implemented which will minimise the potential impact on threatened species and communities listed under the TSC Act. General mitigation measures that should be implemented include:

- A qualified ecologist must be present throughout vegetation clearing activities to relocate fauna, or take fauna into care where appropriate (i.e. juvenile or nocturnal fauna). Tree hollows shall be inspected to identify presence or potential presence of fauna inhabitants. Measures must be taken to ensure that fauna inhabiting tree hollows, active nests or other habitat (i.e. logs, leaf litter) are treated humanely and relocated before development activities commence, in line with the *National Parks and Wildlife Act 1974*.
- One hollow bearing tree is present on the subject site. Short-term habitat shall be provided in the form of nest box installation during vegetation clearance and bushland restoration works. Each individual tree hollow must be replaced at a minimum 1:1 ratio with nest boxes that will provide suitable short-term habitat requirements for displaced fauna.
- Control weeds to ensure the enhancement and protection for remaining CPW and RFEF throughout the subject site, including control of any noxious or environmental weeds, the management of the introduction of weed propagules to the subject site through washing down of construction and vegetation clearing equipment prior to their use.
- Follow the hygiene protocol for the control of disease in frogs (DECC, 2008).

- Install specific erosion and sediment controls to avoid sediment and other pollution entering waterways.
- Regularly monitor the subject site before and after heavy rainfall and follow-up work to repair / install erosion and sedimentation controls.
- Use herbicides in accordance with appropriate guidelines with regard to environmental and personal safety.
- Include native winter-flowering trees within the rehabilitated riparian zone.
- Dewater dams in accordance with the method proposed below.

7.2.1 Dam dewatering plan

Three man-made dams lie within the subject site. It is recommended that a 'Dam Dewatering Plan' be established prior to construction to ensure mitigation measures are in place to reduce or avoid any adverse environmental impacts as a consequence of the development.

While the final outline of the Dam Dewatering Plan will be dependent on further field work results, it is likely it would cover aspects such as:

- Assessment of water quality and discharge options
- Management of aquatic pests and weeds (e.g. Gambusia, Carp, Salvinia, Alligator Weed)
- Relocation of native aquatic species (e.g. Eastern Long-necked Turtles, Gudgeons)
- Relocation or protection of key habitat elements (such as waterbird nests or unique flora)
- Options for enhancing or protecting any remaining habitat during works.

References

Australian Government, 2012. *Protected Matters Search Tool*. http://www.environment.gov.au/epbc/pmst/index.html

Benson, D. and Howell, J. 1994. *The natural vegetation of the Sydney 1:100,000 map sheet*. *Cunninghamia* 3(4). http://www.canri.nsw.gov.au/nrdd/records/ANZNS0263000011.html

Camden Council, 2012. *Camden Local Environmental Plan (LEP) 2010*. http://www.camden.nsw.gov.au/page/camden_local_environment_plan_2010.html

Camden Council, 2003. *Natural Assets*. http://www.camden.nsw.gov.au/page/natural_assets_policy.html

Clark, S. & Richardson, B. (2002). *Spatial analysis of genetic variation as a rapid assessment tool in the conservation management of narrow-range endemics*. Invertebrate Systematics, Volume 16, CSIRO Publishing.

Department of Environment, Climate Change and Water (DECCW) 2011. *Cumberland Plain Recovery Plan*. Department of Environment, Climate Change and Water.

Department of Primary Industries, 2012. *Noxious weed declarations for Camden Council.* http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed/noxious-app-application?sq_content_src=%252BdXJsPWh0dHAlM0ElMkYlMkZ3d3dpLmFncmljLm5zdy5nb3YuYXUlMkZ0b29scyUyRnZpZXdjb3VuY2lsLmh0bWwmYWxsPTE%253D&council_id=18

National Parks and Wildlife Service 2004. *Endangered Ecological Community Information: Cumberland Plain Woodland*. Produced by the NSW National Parks and Wildlife Service (NPWS; now the NSW Department of Environment and Climate Change).

Office of Environment and Heritage, 2012. *Native Vegetation Maps of the Cumberland Plain Western Sydney Interpretation Guidelines Final Edition, (NSW NPWS, 2002).* http://www.environment.nsw.gov.au/resources/nature/cumbPlainMappingInterpguidelines.pdf

Office of Environment and Heritage, 2012a. *NSW threatened species.* http://www.environment.nsw.gov.au/threatenedspecies/

Office of Environment and Heritage, 2012b. *NSW Wildlife Atlas.* http://www.environment.nsw.gov.au/wildlifeatlas/about.htm

Office of Environment and Heritage, 2012c. *Cumberland Plain Recovery Plan*. http://www.environment.nsw.gov.au/threatenedspecies/CumberlandPlainRecoveryPlan.htm

Appendix A: NOW Correspondence

From: Jeremy Morice <Jeremy.Morice@water.nsw.gov.au>
Date: 7 August 2014 2:00:26 PM AEST
To: Ian Dixon <IanD@ecoaus.com.au>
Subject: Re: FW: Merit based assessment - 195-203 Turner Road, Currans Hill (Manooka Valley West)

Hi Ian,

I have reviewed your riparian report prepared for the subject site. Based on the information provided the following NSW Office of Water comments apply to any future development of the site:

- The eastern mapped watercourse as referred to in your riparian report below can be removed.

  "To the east of the Driver Property, a residential development has removed a 1st order creek that once flowed into the Driver Property (water in that catchment will flow through road drainage to the larger creek further south). I am advised that this creek has been approved for removal within the Driver Property."

- The second order mapped watercourse from reaches A-I as specified in the report provided is considered to be waterfront land as defined by the *Water Management Act 2000*. It is acknowledged that this watercourse is highly degraded with some reaches of disconnected channel within the site. It is also modified or removed within adjacent properties.

  The following requirements for this watercourse apply:

  - Given the condition of this watercourse it is considered suitable for treatment as a 1st order stream as specified by the Guidelines for riparian corridors on waterfront land
  - The online wet detention basins as proposed in the concept plan are allowable subject to the assessment of detailed design by the NSW Office of Water. Basins require riparian planting including some trees and shrubs along the fringes of the basins. Designs will also require Council approval in regard to water quality and drainage requirements.

- The second order stream located in the south eastern corner of the site requires the establishment of a riparian corridor consistent with its treatment within the adjoining Manooka Valley development to the east of the site.

Any revisions to the current concept subdivision plan for the site should be provided to the NSW Office of Water for further comment prior to submission of a Development Application for the site.

Please give me a call if you wish to discuss any of the above.

Regards,

Jeremy Morice | Water Regulation Officer NSW Department of Primary Industries | NSW Office of Water Level 0 | 84 Crown Street | Wollongong NSW 2500 PO Box 53 | Wollongong NSW 2520

T: 02 4224 9736 | F: 02 4224 9740 | E: jeremy.morice@water.nsw.gov.au
W: www.dpi.nsw.gov.au | www.water.nsw.gov.au

Appendix B: Threatened species & communities likelihood of occurrence

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
Ecological Communities					
Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW)		CEEC	CEEC	Woodland community occurring on shale derived soils throughout low rainfall areas of western Sydney.	Known
River-Flat Eucalypt Forest (RFEF) on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	-	Occurs exclusively along or close to minor watercourses draining soils derived from Wianamatta Shale. Common on soils of recent alluvial deposits and is found on the floodplains of the Hawkesbury-Nepean River.	Known
Fauna					
Macquarie australasica	Macquarie Perch	E	E	Habitat for the Macquarie Perch is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie Perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods.	Unlikely
Prototroctes maraena	Australian Grayling	-	V	Historically, this species occurred in coastal streams from the Grose River southwards through NSW, VIC and TAS. On mainland Australia, this species has been recorded from rivers flowing east and south of the main dividing	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
				ranges. This species spends only part of its lifecycle in freshwater, mainly inhabiting clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops but has also been found in muddy-bottomed, heavily silted habitat. Grayling migrate between freshwater streams and the ocean and as such it is generally accepted to be a diadromous (migratory between fresh and salt waters) species.	
Heleioporus australiacus	Giant Burrowing Frog	V	V	Forages in woodlands, wet heath, dry and wet sclerophyll forest (Ehmann 1997). Associated with semi-permanent to ephemeral sand or rock based streams (Ehmann 1997), where the soil is soft and sandy so that burrows can be constructed (Environment Australia 2000).	No
Litoria aurea	Green and Golden Bell Frog	E	V	This species has been observed utilising a variety of natural and man-made waterbodies (Pyke & White 1996) such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water (DECC 2007). Fast flowing streams are not utilised for breeding purposes by this species (Mahony 1999). Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading (DECC 2007). Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–Typha sp. and spikerushes–Eleocharis sp.) adjacent to open grassland areas for foraging are preferable (Ehmann 1997; Robinson 1993). Ponds that are typically inhabited tend to be free from predatory fish such as Mosquito Fish (*Gambusia holbrooki*) (DECC 2007).	Unlikely
Litoria raniformis	Southern Bell Frog	E	V	Relatively still or slow-flowing sites such as billabongs, ponds, lakes or farm dams, especially where bulrushes (Typha sp., Eleocharis sp. and Phragmites sp.) are present (DECC 2007; Ehmann 1997). This species is common in	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
				lignum shrublands, black box and River Red Gum woodlands, irrigation channels and at the periphery of rivers in the southern parts of NSW (DECC 2007). This species occurs in vegetation types such as open grassland, open forest and ephemeral and permanent non-saline marshes and swamps (DECC 2007). Open grassland and ephemeral permanent non-saline marshes and swamps have also been associated with this species (Ehmann 1997).	
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Typical sites consist of exposed sandstone outcrops and benching where the vegetation is predominantly woodland, open woodland and / or heath on Triassic sandstone of the Sydney Basin (DECC 2007). They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (Webb & Shine 1998b). Some of the canopy tree species found to regularly co-occur at known sites include *Corymbia eximia*, *C. gummifera*, *Eucalyptus sieberi*, *E. punctata* and *E. piperita* (DECC 2007).	No
Ardea ibis	Cattle Egret	-	M	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005).	Unlikely
Anthochaera Phrygia (aka Xanthomyza phrygia)	Regent Honeyeater	E	E & M	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*) (Garnett 1993). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised (NPWS 1997). The Regent Honeyeater primarily	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
				feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000).	
Botaurus poiciloptilus	Australasian Bittern	E	E	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats (Marchant & Higgins 1993). Reedbeds, swamps, streams, estuaries (Simpson & Day 1999).	Unlikely
Calidris canutus	Red Knot	-	M	Red Knots are widespread around the Australian coast, less in the south and with few inland records. Small numbers visit Tasmania and off-shore islands. It is widespread but scattered in New Zealand. They breed in North America, Russia, Greenland and Spitsbergen. Red Knots are a non-breeding visitor to most continents (BIB, 2006)	Unlikely
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands (Morcombe 2004). In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages (Shields & Chrome 1992). They sometimes inhabit woodland, farms and suburbs in autumn/winter (Simpson & Day 2004).	Unlikely
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils (Environment Australia 2000; NPWS 1997; DECC 2007). Intact drier forest types with less rugged landscapes are preferred (DECC 2007). Nests in large trees with large hollows (Environment Australia 2000).	Unlikely
Chthonicola sagittata	Speckled Warbler	V	-	Occupies a wide range of eucalypt dominated communities with a grassy understory, often on rocky ridges or in gullies (DECC 2007). Typical habitat includes scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy (DECC 2007). Large, relatively	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
				undisturbed remnants are required for the species to persist in an area (DECC 2007). Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding (DECC 2007).	
Daphoenositta chrysoptera	Varied Sittella	V	-	Distribution includes most of mainland Australia except deserts and open grasslands. Prefers eucalypt forests and woodlands with rough-barked species, or mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods from bark, dead branches, or small branches and twigs.	Unlikely
Dasyornis brachypterus	Eastern Bristlebird	E	E	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously.	No
Erythrotriorchis radiatus	Red Goshawk	*CE*	V	Associated with forests and woodlands with a mosaic of vegetation types, an abundance of birds and permanent water. In NSW, this species is thought to favour mixed subtropical rainforest, Melaleuca Swamp Forest, and open eucalypt forest along rivers, often in rugged terrain (Marchant & Higgins 1993; DECC 2005). Across northern Australian south through eastern Queensland to far north-east NSW. The species is very rare in NSW. Most records are from the Clarence River Catchment, with a few about the lower Richmond and	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
				Tweed Rivers. (DECC 2005, Threatened Species Website Profiles. NSW Dept. of Environment and Climate Change (www.threatenedspecies.nsw.gov.au))	
Gallinago hardwickii	Latham's Snipe	-	Mi	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover (Marchant and Higgins 1999). Occupies a variety of vegetation around wetlands (Marchant and Higgins 1999) including wetland grasses and open wooded swamps (Simpson and Day 1999).	Unlikely
Glossopsitta pusilla	Little Lorikeet	*V*	-	In NSW Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands White Box *Eucalyptus albens* and Yellow Box *E. melliodora* are particularly important food sources for pollen and nectar respectively.	Unlikely
Hieraaetus morphnoides	Little Eagle	V	-	Utilises open eucalypt, sheoak and acacia forest, woodland or open woodland. Uses tall trees for nesting, with a large stick nest being built. Lays eggs in spring, and young fledge in early summer. Preys on birds, reptiles and mammals, and occasionally feeds on large insects or carrion.	Unlikely
Lathamus discolor	Swift Parrot	E	E	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts (Blakers et al. 1984; Schodde and Tidemann 1986; Forshaw and Cooper 1981). Hence, in this region, autumn and winter flowering eucalypts are important for this	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
				species. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (DECC 2007).	
Melanodryas cucullata cucullata	Hooded Robin (southeastern subspecies)	V	-	Associated with a wide range of Eucalypt woodlands, Acacia shrubland and open forests (Blakers et al. 1984). In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover (NSW Scientific Committee 2001). Hooded Robin home ranges are relatively large, averaging 18ha for birds from the New England Tableland (NSW Scientific Committee 2001).	Unlikely
Merops ornatus	Rainbow Bee-eater	-	Ma,Mi	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May (Pizzey and Doyle 1988). Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs (ibid). Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting (ibid).	Unlikely
Neophema pulchella	Turquoise Parrot	V	-	Steep rocky ridges and gullies, rolling hills, valleys and river flats and the plains of the Great Dividing Range compromise the topography inhabited by this species (Marchant & Higgins 1993). Spends much of the time on the ground foraging on seed and grasses (DECC 2007). It is associated with coastal scrubland, open forest and timbered grassland, especially low shrub ecotones between dry hardwood forests and grasslands with high proportion of native grasses and forbs (Environment Australia 2000).	Unlikely
Oxyura australis	Blue-billed Duck	V	-	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation (DECC 2007). The species is	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
				completely aquatic, swimming low in the water along the edge of dense cover (DECC 2007). It will fly if disturbed, but prefers to dive if approached (DECC 2007). Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and over-wintering lakes with some long-distance dispersal to breed during spring and early summer (DECC 2007). Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes (DECC 2007).	
Petroica boodang	Scarlet Robin	V	-	The Scarlet Robin is found in south-eastern and south-western Australia, as well as on Norfolk Island. In Australia, it is found south of latitude 25°S, from south-eastern Queensland along the coast of New South Wales (and inland to western slopes of Great Dividing Range) to Victoria and Tasmania, and west to Eyre Peninsula, South Australia; it is also found in south-west Western Australia. The Scarlet Robin lives in open forests and woodlands in Australia, while it prefers rainforest habitats on Norfolk Island. During winter, it will visit more open habitats such as grasslands and will be seen in farmland and urban parks and gardens at this time (BIB, 2006).	Unlikely
Petroica phoenicea	Flame Robin	V	-	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes, often on ridges and slopes, in NSW. Prefers clearings or areas with open understoreys, and grassy groundlayer for breeding habitat. Will often occur in recently burnt areas. Shrub density does not appear to be an important habitat factor. Many birds move to the inland slopes and plains in winter, or to drier more open habitats in the lowlands.	Unlikely
Rostratula australis (a.k.a. R. benghalensis)	Painted Snipe (Australian subspecies)	E	V & M	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DECC 2007). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (ibid.). Breeding is often in response to local conditions; generally occurs from September to December (DECC 2007). Roosts during the day in dense	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
				vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (DECC 2007). Feeds on worms, molluscs, insects and some plant-matter (ibid.).	
Stictonetta naevosa	Freckled Duck	V	-	Associated with a variety of plankton-rich wetlands, such as heavily vegetated, large open lakes and their shores, creeks, farm dams, sewerage ponds and floodwaters (DECC 2007).	Unlikely
Ninox strenua	Powerful Owl	V	-	Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000).	Unlikely
Dasyurus maculatus maculatus	Spotted-tailed Quoll (SE Mainland Population)	V	E	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests (Mansergh 1984; DECC 2007j), more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in (DECC 2007). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (Environment Australia 2000).	Unlikely
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (Strahan 1995).	No
Phascolarctos cinereus	Koala	V	V	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70% (Reed et al. 1990), with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: *Eucalyptus tereticornis*, *E. punctata*, *E. cypellocarpa*, *E. viminalis.*	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE Mainland Population)	V	V	Associated with dry coastal heath and dry and wet sclerophyll forests (Strahan 1998) with dense cover for shelter and adjacent more open areas for foraging (Menkhorst & Knight 2004).	No
Pseudomys novaehollandiae	New Holland Mouse	-	V	A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (DSEWPC 2010)	No
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (Churchill 1998; DECC 2007). This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; DECC 2007).	Unlikely
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Prefers moist habitats with trees taller than 20m (DECC 2007). Roosts in tree hollows but has also been found roosting in buildings or under loose bark (DECC 2007).	Potential
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (AMBS 1995, Dwyer 1995, Dwyer 1981). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995).	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
Mormopterus norfolkensis	East Coast Freetail Bat	V	-	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range (Churchill 1998). Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges (Environment Australia 2000; Allison & Hoye 1998). Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (Environment Australia 2000; Allison & Hoye 1998).	Potential
Myotis macropus (formerly *M. adversus*)	Southern Myotis, Large-footed Myotis	V	-	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Will occupy most habitat types such as mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River Red Gum woodland, as long as they are close to water (Churchill 1998). While roosting (in groups of 10-15) is most commonly associated with caves, this species has been observed to roost in tree hollows, amongst vegetation, in clumps of Pandanus, under bridges, in mines, tunnels and stormwater drains (Churchill 1998). However the species apparently has specific roost requirements, and only a small percentage of available caves, mines, tunnels and culverts are used (Richards 1998).. Forages over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December (DECC 2005)	Potential
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998).	Potential
Scoteanax rueppellii	Greater Broad-nosed	V	-	Associated with moist gullies in mature coastal forest, or rainforest, east of the	Potential

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
	Bat			Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests (Hoye & Richards 1998). Within denser vegetation types use is made of natural and man made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1998).	
Flora					
Cynanchum elegans	White-flowered Wax Plant	E1	E	Cynanchum elegans is a climber or twiner with a variable form, and flowers between August and May, peaking in November (DEC 2005). It occurs in dry rainforest gullies, scrub and scree slopes, and prefers the ecotone between dry subtropical rainforest and sclerophyll woodland/forest (NPWS 1997). The species has also been found in littoral rainforest; Leptospermum laevigatum – Banksia integrifolia subsp. integrifolia coastal scrub; Eucalyptus tereticornis open forest/ woodland; Corymbia maculata open forest/woodland; and Melaleuca armillaris scrub to open scrub (DEC 2005).	Unlikely
Eucalyptus benthamii	Camden White Gum	V	V	*Eucalyptus benthamii* occurs in wet open forest on well drained sandy alluvial soils along stream channels, small terraces and alluvial flats on valley floors (DEC 2005).	Unlikely
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	*Grevillea parviflora* subsp. *parviflora* is sporadically distributed throughout the Sydney Basin mainly around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie and Cessnock and Kurri Kurri. It grows in sandy or light clay soils over thin shales, often with lateritic ironstone gravels. It often occurs in open, slightly disturbed sites such as tracks (DEC 2005).	Unlikely
Lepidium hyssopifolium	Aromatic Peppercress	E	E	Lepidium hyssopifolium occurs near Bathurst, near Bungendore, near Crookwell and near Armidale, occurring in a variety of habitats including	Unlikely

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
				woodland with a grassy understorey and grassland (DEC 2005).	
Persoonia bargoensis	Bargo Geebung	E	V	Associated with woodland to dry sclerophyll forest, on sandstone and clayey laterite on heavier, well-drained, loamy, gravelly soils of the Hawkesbury Sandstone and Wianamatta Shale in the catchments of the Cataract, Cordeaux and Bargo Rivers (NSW Scientific Committee 2000).	Unlikely
Pimelea spicata	Spiked Rice-flower	E1	E	In western Sydney, Pimelea spicata occurs on an undulating topography of well-structured clay soils, derived from Wianamatta shale (DEC 2004). It is associated with Cumberland Plains Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines (Ibid.). Has been located in disturbed areas that would have previously supported CPW (Ibid.).	Unlikely
Pomaderris brunnea	Rufous Pomaderris	V	V	Pomaderris brunnea occurs in a limited area around the Colo, Nepean and Hawkesbury Rivers as well as near Walcha on the Northern Tablelands. It grows in moist woodland or forest on clay or alluvial soils of floodplains and creek lines (DEC 2005).	Unlikely
Pterostylis gibbosa	Illawarra Greenhood	E	E	Known from a small number of populations in the upper Hunter Valley (Milbrodale), the Illawarra region (Albion Park and Yallah) and near Nowra (DEC 2005). Plants grow in a variety of woodland and open forest communities with shallow rocky soils.	No
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Terrestrial orchid predominantly found in Hawkesbury Sandstone Gully Forest growing in small pockets of soil that have formed in depressions in sandstone rock shelves (NPWS 1997). Known from Georges River National Park, Ingleburn, Holsworthy, Peter Meadows Creek, St Marys Tower (NSW Scientific Committee 1999).	No
Streblus pendulinus	Siah's Backbone	-	E	On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800	No

SCIENTIFIC NAME	COMMON NAME	TSC STATUS	EPBC STATUS	HABITAT	LIKELIHOOD OF OCCURRENCE
				m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest (ATRP 2010). On Norfolk Island, the species is found in a variety of forest types, though it is rare (DNP 2010).	
Thelymitra sp. *Kangaloon*	Kangaloon Sun-orchid	CE	CE	*Thelymitra sp*. Kangaloon is only known to occur on the southern tablelands of NSW in the Moss Vale / Kangaloon / Fitzroy Falls area at 550-700 m above sea level. It is thought to be a short-lived perennial, flowering in late October and early November. It is found in swamps in sedgelands over grey silty grey loam soils (DEWHA 2010). It is known to occur at three swamps that are above the Kangaloon Aquifer, and that are a part of the ecological community "Temperate Highland Peat Swamps on Sandstone" which is listed under the EPBC Act.	No

Disclaimer: Data extracted from the Atlas of NSW Wildlife and EPBC Protected Matters Report are only indicative and cannot be considered a comprehensive inventory.

Note: Rows represent species and populations listed under either the TSC Act or EPBC Act.

M = Migratory species, CE = Critically Endangered species under EPBC Act, E = Endangered species under EPBC Act, E1 = Endangered species under TSC Act, V = Vulnerable species under EPBC Act and TSC Act

TSC Status = Listing under the *NSW Threatened Species Conservation Act 1995*

EPBC Status = Listed under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*

Table 1: Field survey species list

COMMON NAME	SCIENTIFIC NAME	NATIVE / EXOTIC
FLORA		
Prickly-leaved Paper-bark	*Melaleuca styphelioides*	N
African Box Thorn	*Lycium ferocissium*	E – Class 4 Noxious Weed
Weeping grass	*Microlaena stipoides*	N
African Olive	*Olea europaea subsp africana L.*	E – Class 4 Noxious Weed
Couch grass	*Elymus repens*	E
Sticky heads Dallis grass	*Paspalum dilatatum*	E
Fleabane	*Conyza bonariensis*	E
Red Gum	*Eucalyptus tereticornis*	N
Rhodes grass	*Chloris gayana*	E
Kikuyu	*Pennisetum clandestinum*	E
Swamp oak	*Casuarina glauca*	N
Climbing saltbush	*Einardia nutans*	N
Paddy's Lucerne	*Sida rhombifolia*	E
Moth vine	*Araujia sericifera*	E
Fire weed	*Chamerion angustifolium*	E
Cotoneaster	*Pomaderris cotoneaster*	E
Kangaroo grass	*Themeda australis*	N
Greybox	*Eucalyptus molucanna*	N
Blackthorn	*Busaria spinosa*	N
Cyperus	*Cyperus sp.*	N
Cotton Bush	*Gomphocarpus fruticosus*	E
Kidney weed	*Dichondra repens*	N
Poison rock fern	*Cheilanthes sieberi*	N
Bullrush	*Typha orientalis*	N

Common rush	*Juncus usitatis*	N
Jointed Twig-rush	*Baumea articulata*	N
Marsh Club-rush	*Bolboschenus fluviatilis*	N
Wallaby Grass	*Austrodanthonia tenoir*	N
FAUNA		
Australian Wood Duck	*Chenonetta jubata*	N
Australian Raven	*Corvus coronoides*	N
Common Eastern Froglet	*Crinia Signifera*	N
White-faced Heron	*Egretta novaehollandiae*	N
Magpie-lark	*Grallina cyanoleuca*	N
Magpie	*Gymnorhina tibicen*	N
Welcome Swallow	*Hirundo neoxena*	N
Noisy Miner	*Manorina melanocephala*	E
Eastern Rosella	*Platycercus eximius*	N
Willie Wagtail	*Rhipidura leucophrys*	N
Ibis	*Threskiornis molucca*	N

Appendix C: Seven part tests (EP&A Act)

Seven part tests are applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the FM Act. The assessment sets out 7 factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Species Impact Statement (SIS). All factors must be considered and an overall conclusion made based on all factors in combination. An SIS is required if, through application of the 7-part test, an action is considered likely to have a significant impact on a threatened species, population or ecological community.

The threatened species and communities that are the subject of 7-part tests for this report include:

Endangered Ecological Communities

- Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW)
- River-Flat Eucalypt Forest (RFEF) on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

Fauna

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Mormopterus norfolkensis* (East Coast Freetail Bat)
- *Myotis macropus* (Southern Myotis)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Pteropus poliocephalus (*Grey-headed Flying-Fox).

Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW)

Cumberland Plain Woodland (CPW) is listed as a Critically Endangered Ecological Community under the TSC Act. In the NPWS vegetation mapping of the Cumberland Plain, two forms of Cumberland Plain Woodland have been identified: Shale Hills Woodland and Shale Plains Woodland. Shale Hills Woodland occurs mainly on the elevated and sloping southern half of the Cumberland Plain and is the most widely distributed form of CPW (NPWS 2004). The dominant canopy trees in CPW include *Eucalyptus moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum) and *E. crebra* (Narrow-leaved Ironbark), although *Corymbia maculata* (Spotted Gum) and *E. eugenioides* (Thin-leaved Stringybark) may also occur. The community has a shrub layer dominated by *Bursaria spinosa* (Blackthorn), with other shrubs, such as *Acacia implexa*, *Indigofera australis* and *Dodonaea viscosa* subsp. *cuneata*, also present. The diverse understorey layer is similar for both forms of Cumberland Plain Woodland. It is common to find grasses, such as *Themeda australis* (Kangaroo Grass), *Microlaena stipoides* var. *stipoides* (Weeping Meadow Grass) in the community, as well as herbs, such as *Dichondra repens* (Kidney Weed), *Brunoniella australis* (Blue Trumpet) and *Desmodium varians* (NPWS 2004).

Before European settlement, CPW was extensive across western Sydney, covering 125,000 ha. In 2002, there was only 9% of the original extent, with a further 14% remaining as scattered trees across the landscape (NPWS 2002). CPW is an important part of the western Sydney landscape and occurs on the well-structured clay soils, derived from Wianamatta shale (NPWS 2004). It is well adapted to drought and fire and the understorey plants often rely on underground tubers or profuse annual seed production to survive adverse conditions (DECC 2009).

Bushland remnants of CPW occur in an area bounded by Scheyville (north), Penrith (west), Parramatta (east) and Thirlmere (south). CPW also occurs in the Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly Local Government Areas (LGAs).

CPW is habitat for many flora and fauna species. Some threatened species supported by CPW include: *Pimelea spicata* (Spiked Rice Flower) and *Meridolum corneovirens* (Cumberland Plain Land Snail). Tree hollows are commonly found in the old growth canopy species, and are of high conservation value.

Clearing for agriculture and urban development is the greatest threat to CPW. Given it exists now only in fragments, CPW is vulnerable to disturbances, such as weed invasion, increased soil nutrients, rubbish dumping and frequent fire. Weeds, such as *Eragrostis curvula* (African Lovegrass), *Olea europaea* subsp. *cuspidata* (African Olive), *Asparagus asparagoides* (Bridal Veil Creeper) and *Chloris gayana* (Rhodes Grass), are major threats to the community (NPWS 2004).

CPW exists in the proposed developed footprint. The CPW that will be cleared is of very poor quality and comprises of scattered trees within an exotic pasture.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable to endangered ecological communities.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable to endangered ecological communities.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Approximately 25 scattered paddock trees of poor quality CPW will be removed as part of this proposal. The removal of a small area of poor quality vegetation is unlikely to have an adverse effect on the extent of the local occurrence of this ecological community.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The vegetation that is proposed to be removed has low native species and structural diversity. Within 5km of the proposed clearing exists 971.7 ha of CPW, thus the removal of a small area of poor quality vegetation is unlikely to have an adverse effect on the community. The proposal is unlikely to modify the composition of the ecological community such that its local occurrence will be placed at risk of extinction.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal will remove approximately 25 scattered paddock trees belonging to the CPW community.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The vegetation proposed to be removed is poorly connected with other vegetation in the area. It is isolated and surrounded by exotic pasture.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality,

The scattered trees of the CPW community proposed to be removed are of low quality and are considered to be of negligible importance to the long term survival of this community in the locality.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat has been declared for CPW.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The *Cumberland Plain Recovery Plan* (DECCW 2011) has four main objectives that are addressed below:

1. Building a protected area focused on Priority Conservation Lands
   The vegetation proposed to be cleared is of low quality and is not included in the Priority Conservation Lands map

2. Best practice management focused on Priority Conservation Lands and Public Reserves
   No relevant to the subject site

3. Increase understanding and enhance community awareness
   Not relevant to the subject site

4. To increase knowledge of the threats to CPW and improve capacity to manage these in a strategic and effective manner
   Not relevant to the subject site

The proposal is considered to be consistent with the relevant objectives and actions of the recovery plan.

No relevant threat abatement plans have been prepared for CPW.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Clearing of native vegetation is listed as a key threatening process. The area of CPW to be cleared (25 scattered paddock trees) is small, isolated and of low quality having low native diversity and cover. The loss of this low quality vegetation will not increase the impact of this key threatening process.

Conclusion

The proposal would result in the removal of approximately 25 scattered paddock trees of poor quality CPW at the subject site. The proposed vegetation removal is unlikely to be considered significant for the following reasons:

- the scattered trees of the CPW community are of low quality with low native species diversity and low native cover
- the areas of CPW to be removed are isolated and do not play an important role in habitat connectivity in the locality
- The area of CPW to be removed is small.

River-Flat Eucalypt Forest (RFEF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

River-Flat Eucalypt-Forest (RFEF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions is an endangered ecological community listed under the TSC Act. This community is an open forest which occurs on silts, clay-loams and sandy loams, on alluvial flats, drainage lines and river terraces associated with coastal floodplains. RFEF occurs south from Port Stephens in the NSW North Coast, Sydney Basin and South East Corner Bioregion.

This community has suffered large amounts of clearing for grazing, market gardens and other cropping enterprises, with less than 30% of its total original extent estimated as remaining (NSW Scientific Committee 2004) and less than one-quarter of the original extent on the Cumberland Plain (Tozer 2003). Ongoing clearing and fragmentation is recognised as a threat to this community along with urban and industrial development, flood mitigation and drainage works, changes in water quality, weed invasion, and frequent burning which reduces the diversity of woody plant species.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

RFEF is not a threatened species.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

RFEF is not an endangered population.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

A small area of poor quality RFEF will be removed as part of the development. The loss of this small area is unlikely to place the local occurrence at risk of extinction.

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The 0.2 ha of RFEF that is proposed to be removed has low native species and structural diversity. Within 5km of the proposed clearing exists 188.8 ha of RFEF, thus the removal of a small area of poor quality vegetation is unlikely to have an adverse effect on the community. The proposal is unlikely to modify the composition of the ecological community such that its local occurrence will be placed at risk of extinction.

d) in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal will remove approximately 0.2 ha of RFEF with low numbers of native species and structural diversity.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The 0.2 ha of RFEF is already fragmented from other patches of native vegetation, being surrounded by pasture and cleared lands. The riparian area around it has been subject to past disturbance and earthworks. The proposal would not result in further fragmentation or isolation from other areas of habitat.

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality.

The 0.2 ha area of RFEF being removed is small in size, has low structural diversity and is isolated from other patches of native vegetation. Whilst the RFEF may provide a foraging resource for fauna (e.g. bats), its loss is unlikely to impact upon the long term survival of threatened species or populations. Also, within 5km of the proposed clearing exists 188.8 ha of RFEF, thus the removal of a small area of poor quality vegetation is unlikely to have an adverse effect on the long term survival of the RFEF community.

The RFEF to be removed is located within a riparian corridor that will require revegetation as part of a Vegetation Management Plan (VMP) under the WM Act. The establishment and maintenance of this riparian corridor with locally native species of the Cumberland Plain, along with improvements to water quality is likely to be beneficial to native flora and fauna in the area.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat has been declared for RFEF.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No recovery plan has been prepared for RFEF, however, DECCW has prepared a Draft Cumberland Plain Recovery Plan that covers a number of threatened species, populations and ecological communities that occur on the Cumberland plain, including RFEF. The plan identifies actions to be taken covering the following four areas: building a protected area network comprising of public and private lands; delivering best practice management to remnant bushland on the Cumberland Plain; raise community awareness and understanding; and increase knowledge of the threats to the survival of the threatened biodiversity of the Cumberland Plain to enable better management of threats. The proposal is not inconsistent with actions outlined in the draft plan.

No relevant threat abatement plan has been prepared for RFEF.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined under the TSC Act as "*a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities*". The action proposed constitutes one key threatening process listed under the TSC Act:

clearing of native vegetation. Whilst the proposal would increase the impact of these key threatening processes, the scale of the impact is not considered significant.

Conclusion

Given the 0.2 ha of RFEF to be cleared is small, isolated, has low structural diversity and has been subject to past disturbance the proposal is unlikely to have a significant impact on the RFEF community. Revegetation of the riparian corridor with locally native species will improve floristic diversity and habitat for fauna overtime. Consequently, a Species Impact Statement is not required for the proposed works with respect to this community.

Microchiropteran bats - tree hollows

Due to similar habitat requirements and associated impacts, a combined 7-Part Test has been undertaken for the following microchiropteran bats which dwell in tree-hollows:

- **Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)**
- **Eastern Freetail Bat (*Mormopterus norfolkensis*)**
- **Greater Broad Nosed Bat (*Scoteanax rueppellii*)**
- **Southern Myotis (*Myotis macropus*).**

***Falsistrellus tasmaniensis* (Eastern False Pipistrelle)**

The Eastern False Pipistrelle is listed as vulnerable under Schedule 2 of the TSC Act. The species is wide-ranging, occurring along the southeast coast of Australia with records from South East Queensland, New South Wales, Victoria and Tasmania.

The species occurs in sclerophyll forests from the Great Dividing Range to the coast, and generally prefers wet habitats where trees are more than 20 m high. Roosting occurs in hollow trunks of eucalypt trees, usually in single sex colonies, but the species has been recorded roosting in caves under loose bark and occasionally in old wooden buildings (Churchill 1998). Their flight pattern is high and fast and they forage within or just below the tree canopy. They feed on a variety of prey including moths, rove beetles, weevils, plant bugs, flies and ants.

This species is threatened by a number of processes including loss of trees for foraging and hollow-bearing trees for roosting, disturbance to winter roosting and breeding sites, and application of pesticides in or adjacent to foraging areas (DECC 2005).

Potential foraging and roosting habitat for the species occurs within the RFEF vegetation in the riparian corridor, scattered trees of the Cumberland Plain Woodland and hollow bearing tree on the subject site.

***Mormopterus norfolkensis* (East Coast Freetail Bat)**

East Coast Freetail-bat is listed as a vulnerable species under the TSC Act. It is found along the east coast from south Queensland to southern NSW. The species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range (OEH 2012).

The East Coast Freetail-bat roosts mainly in tree hollows but would also roost under bark or in man-made structures. The species is solitary and probably insectivorous (OEH 2012).

Threats to the species include the loss of hollow-bearing trees, loss of foraging habitat and the application of pesticides in or adjacent to foraging areas (OEH 2012).

East Coast Freetail-bat has not been previously recorded within the subject site, but there is potential for the species to use the subject site on occasion. Potential foraging and roosting habitat for the species occurs within the RFEF vegetation in the riparian corridor, scattered trees of the Cumberland Plain Woodland and hollow bearing tree on the subject site.

***Myotis macropus* (Southern Myotis)**

The Southern Myotis is listed as vulnerable under the TSC Act and is encountered in various habitats, but always near open water. The species feeds on water insects and other small animals by 'raking' them from the water surface with its enlarged feet (Churchill 1998). Roost sites in the vicinity of waterways are preferred, and include caves, anthropogenic features (such as bridges), tree hollows and clumps of vegetation (Churchill 1998).

Potential foraging habitat for the Large-footed Myotis exists within farm dams on the subject site. Potential foraging and roosting habitat for the species occurs within the RFEF vegetation in the riparian corridor, scattered trees of the Cumberland Plain Woodland and hollow bearing tree on the subject site.

***Scoteanax rueppellii* (Greater Broad-nosed Bat)**

The Greater Broad-nosed bat, is listed as vulnerable under the TSC Act and occurs along the east coast of Australia from southeast Queensland to southern NSW, mainly in dry eucalypt forest and woodland to the east of the Great Dividing Range (Allison and Hoye 1995).

The species feeds on flying insects over the tops of trees or along the edges of forests. They roost in hollows or under the loose bark of trees in open forests, and may roost together in small colonies.

The Greater Broad-nosed Bat has not been previously recorded within the subject site. Potential foraging and roosting habitat for the species occurs within the RFEF vegetation in the riparian corridor, scattered trees of the Cumberland Plain Woodland and hollow bearing tree on the subject site.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Factors likely to have an adverse effect on the life cycle of all of the above listed species would include impacts which resulted in the loss of significant areas of forest and woodland foraging habitat, the loss of hollow bearing trees, disturbance to roosts, and use of pesticides in or adjacent to foraging areas.

The proposal would result in the removal of approximately 25 scattered paddock trees of the CPW community and approximately 0.2 ha of the RFEF community. The proposal would also remove one hollow bearing tree and dewater three existing dams.

The removal of scattered trees of the CPW and RFEF is unlikely to have a significant impact on the life cycle of these microbat species, such that a viable local population of these species would be places at risk of extinction. The amount of habitat to be removed is minimal and the scattered trees and small patch of RFEF do not provide connectivity to other vegetation, given past fragmentation of the landscape.

The hollow bearing tree on the subject site has the potential to provide roosting habitat for these species. However given its' isolation, the use of the hollow for roosting for these species is unlikely to be important such that its' removal would place these species at the risk of extinction.

Dams would be dewatered in accordance with a 'Dam Dewatering Plan' and the creek would be reconstructed and revegetated under the WM Act, in accordance with a VMP. These species could continue to use these areas to forage and shelter.

It is unlikely that the proposal would result in the use of pesticides that would impact on these species and their habitat and therefore the life cycle of these species.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not Applicable

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not Applicable

d) in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal will result in the removal of 0.2 ha of remnant RFEF vegetation and 25 scattered paddock trees providing potential foraging habitat for the species. The hollow bearing tree may be potential roosting habitat for these species. The vegetation proposed to be removed is poorly connected with other vegetation in the area. It is isolated and surrounded by exotic pasture. The proposed removal of potential foraging and roosting habitat is considered to be minimal, especially when considered in the context of areas of potential foraging and roosting habitat present on surrounding lands and accessible to these highly mobile species.

Dewatering the dams is not considered to significantly modify habitat for these species, as these highly mobile species will have access to other waterbodies in the locality, including the proposed reconstructed creek within the riparian corridor of the subject site.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The proposal would not isolate any currently connected areas of potential habitat, as the 0.2 ha of remnant RFEF vegetation and 25 scattered paddock trees are already fragmented by past vegetation clearing and use of the subject site for pasture. The species are highly mobile and it is not considered unlikely that the vegetation / habitat to be removed would isolate any currently interconnected areas of potential foraging habitat.

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality,

The habitat that would be removed has been subject to past and ongoing disturbance. The potential foraging and roosting habitat within the subject site for these species is unlikely to be important to the species given the availability of potential foraging and roosting habitat available in the locality. The proposal to remove approximately 0.2 ha of remnant RFEF vegetation and 25 scattered paddock trees, that are already isolated is unlikely to impact upon the long term survival of these species.

e) Whether the action proposed is likely to have an adverse effect on critical habitat.

No critical habitat has been declared for Eastern False Pipistrelle, East Coast Free Tail Bats, Greater Broad Nosed Bats and Southern Myotis.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan or threat abatement plan of relevance to the microbats has been prepared.

g) The action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Two key threatening processes listed under the TSC Act have relevance with respect to these microbat species: clearing of native vegetation and removal of hollow-bearing trees. Whilst the proposal would increase the impact of this key threatening process, the scale of the impact is not considered significant.

Conclusions

The proposal is unlikely to constitute a significant impact on these species, given that:

- The proposal would disturb a small area of potential habitat within the subject site
- These species are highly mobile and forage widely
- The hollow bearing tree to be removed is unlikely to be important roosting habitat for the species, given its isolation
- The poor quality of the vegetation proposed for removal does not support much structural diversity and therefore is only marginal foraging habitat for these species
- The proposal would not fragment any current populations.

On the basis of the above considerations, it is unlikely that the proposal will result in a significant impact on these microbat bat species. Consequently, a SIS is not required for the proposal with respect to these species.

***Pteropus poliocephalus* (Grey-headed Flying-Fox)**

The Grey-headed Flying Fox (GHFF) is listed as vulnerable under Schedule 2 of the TSC Act. The species is endemic to the east coast of Australia with a distribution from Bundaberg in the north to Melbourne in the south, from the western slopes of the Great Dividing Range to the coast (Eby 2000).

GHFF are a highly mobile species whose migration patterns are determined by the availability of flowering food resources (Eby 1991). The species is a canopy-feeding frugivore, blossom-eater, and nectarivore, and occurs in rainforest, woodlands, paperbark swamps and Banksia woodlands (NSW Scientific Committee 2001). This species feeds in particular on the nectar and pollen of native trees, especially *Eucalyptus* spp., *Melaleuca* spp. and *Banksias* spp., and fruits of rainforest trees and vines. During times when native food resources are limited, GHFF forage on fruit crops and cultivated gardens. GHFF congregate in large colonies of up to 200,000 individuals in the summer season (Churchill 1998). Camp sites are generally located next to rivers or creeks, and occur in a range of vegetation communities including rainforest, wet sclerophyll forest, Melaleuca woodland, Casuarina forest or mangroves (Eby 2000). These sites have a dense canopy, providing them with the moist, humid microclimate they require. Camp sites are critical for mating, birthing, rearing of young and as diurnal refuge from predators. Urban gardens, cultivated fruit crops and roadside verges may also provide temporary roosting habitat for this species.

This species is threatened by a number of processes including loss of foraging habitat, disturbance of roosting sites, unregulated shooting, and electrocution on powerlines (OEH 2012).

GHFF were not recorded within the subject site during the field surveys, but are known from previous records from within a 5 km radius of the study area. The nearest known GHFF camp sites are located approximately 6 km to the west in Campbelltown (off Blaxland Road) and a nationally important GHFF camp site located approximately 12 km to the west at Brownlow Hill in Camden. There is potential for the species to occur within the subject site due to the presence of suitable foraging habitat, although the subject site does not contain current or historic campsites.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Factors likely to have an adverse effect on the life cycle of Grey-headed Flying Fox would include a substantial loss and / or fragmentation of foraging habitat, increases in the mortality rate (e.g. via unregulated shooting or electrocution on power lines).

The proposal would result in the removal of approximately 25 scattered paddock trees of the CPW community and approximately 0.2 ha of the RFEF community. The proposal would also remove one hollow bearing tree and dewater three existing dams. The vegetation represents potential foraging habitat for the GHFF.

The GHFF has a very large home range with the subject site likely to form only a portion of the foraging area for this species. Further, no camp sites are to be impacted. The proposal would result in an increase in human use of the subject site, but this would be unlikely to result in the increase in unregulated shooting. It is not known whether additional powerlines would be installed as a result of the proposed action, resulting in an increased risk of electrocution on powerlines, which could have an adverse effect on the life cycle of the species. However, the study area is already located in a built up area. If additional powerlines were installed, these would provide a minimal increase the number of powerlines already in the area.

As such, it is unlikely the proposed action will have an adverse effect on the life cycle of the GHFF such that a viable local population of the species is likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not Applicable

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not Applicable

(d) in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal would result in the removal of approximately 25 scattered paddock trees of the CPW community and approximately 0.2 ha of the RFEF community. The proposal would also remove one hollow bearing tree and dewater three existing dams. The vegetation represents potential foraging habitat for the GHFF.

The proposed loss of potential foraging habitat is minimal when considered in the context of the species' use of the subject site, which due to past fragmentation, is likely to be limited to occasional use of marginal foraging habitat. The species is unlikely to be dependent on foraging resources within the study area. The proposed loss of potential habitat is considered minimal due to the small amount of potential habitat to be removed and the areas of potential foraging habitat present in surrounding lands that are accessible to this highly mobile species. No camp sites would be impacted by the proposal. Therefore, the proposed loss of potential habitat is minimal and is not likely to represent a significant loss to the GHFF.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The proposal would result in the removal of approximately 25 scattered paddock trees of the CPW community and approximately 0.2 ha of the RFEF community. The proposal would also remove one hollow bearing tree and dewater three existing dams. The vegetation represents potential foraging habitat for the GHFF. The removal of vegetation in the subject site would not exacerbate the fragmentation and isolation of other areas of habitat for GHFF. This species is a highly mobile species and it is not considered likely that the vegetation / habitat to be removed would isolate any currently interconnected areas of potential foraging habitat.

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The proposal would result in the removal of approximately 25 scattered paddock trees of the CPW community and approximately 0.2 ha of the RFEF community, which represents marginal foraging habitat for the species. The habitat that would be removed is not likely to be crucial habitat for the species and is small in scale: scattered trees and 0.2 ha of remnant vegetation. Further, extensive areas of potential habitat are present throughout the locality. No camp sites used for roosting will be impacted by the proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat.

No critical habitat has been declared by the Director-General of the OEH for GHFF.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A Draft National Recovery Plan for the GHFF was created in 2009 (DECCW 2009). These include:

- Action 1: Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
- Action 2: Enhance winter and spring foraging habitat for Grey-headed Flying-foxes
- Action 3: Identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes
- Action 4: Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
- Action 5: Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps
- Action 6: Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions
- Action 7: Monitor population trends for the Grey-headed Flying-fox
- Action 8: Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- Action 9: Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- Action 10: Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan

The proposal is consistent with the relevant objectives of the actions for GHFF.

(g) The action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal constitutes the key threatening process of clearing of native vegetation under the TSC Act.

However, the scale of these impacts within the study area is not considered to be significant in relation to any local population of GHFF. This proposal is unlikely to adversely affect the long term survival of this species in the locality.

Conclusion

The proposed development is unlikely to impose a significant impact on GHFF given that the proposal:

- Would only remove a very small area of potential foraging habitat
- Would not impact on any camps sites and hence the life cycle of the species
- Would not isolate an area of known habitat from currently interconnecting areas of potential habitat for this species.

On the basis of the above considerations, it is unlikely that the proposal would result in a significant impact on the GHFF and a SIS is not required.

Appendix D: Significant impact criteria (EPBC Act)

This section provides an assessment of the potential significance of impacts from the proposed activity on Matters of National Environmental Significance (MNES). The EPBC Act Administrative Guidelines on Significance set out 'Significant Impact Criteria' that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance.

MNES considered relevant to this assessment include:

- *Pteropus poliocephalus* (Grey-headed Flying-fox)

Grey-headed Flying-fox

a) lead to a long-term decrease in the size of an important population of a species

Two Grey-headed Flying-fox (GHFF) camp sites occur within approximately 12 km of the subject site. Seasonal fluctuations in the number of individuals in the camp are common. Individuals will move between camp sites in response to foraging resources. It is likely that colonies occur at single camps and that many colonies make up an important population of this species. Individuals are also likely to move between colonies.

The proposal would result in the removal of approximately 25 scattered paddock trees of the CPW community and approximately 0.2 ha of the RFEF community. The proposal would also remove one hollow bearing tree and dewater three existing dams. The vegetation represents potential foraging habitat for the GHFF and the proposal will not impact on any part of a known camp.

The vegetation within the study area provides limited foraging habitat for this species, with a small amount of winter foraging habitat for this species present in the form of scatted *Eucalyptus tereticornis* trees. Given that this species is highly mobile and that foraging habitat exists in the surrounding landscape the proposal is unlikely to affect the GHFF such that it would lead to a long-term decrease in the size of an important population of this species.

b) reduce the area of occupancy of an important population;

GHFFs are considered to form a single large and broadly distributed population. The area of occupancy for this population is dynamic with individuals moving between camps across its range. Presently, its range includes most of the east / south-eastern sea-board from central Queensland to South Australia. Individuals of this population are highly mobile and are known to travel up to 50 – 150 km a night. Because of this the numbers present at individual camps may change during seasonal fluctuations.

The GHFF is known from 43 records from a 5 km radius around the subject site. Under the proposal the 0.2 ha of potential low quality foraging habitat and approximately 25 scattered trees will be removed. However, these impacts are unlikely to reduce the area of occupancy for this population

given the availability of foraging and roosting habitat present in adjacent areas and the highly mobile nature of this species.

c) fragment an existing important population into two or more populations;

Given that species is highly mobile and that the proposal will not occur within current or potential roosting habitat, the proposed actions are unlikely to fragment this population.

d) adversely affect habitat critical to the survival of a species;

Two types of habitat are critical to the survival of this species: critical foraging and roosting habitats. The subject site could represent low quality irregular productive foraging habitat. However, due to the mobility of this species and the extent of more optimal foraging across this species range, the removal of this habitat is unlikely to have a significant impact upon this species. No critical roost habitat occurs at or nearby to the subject site. Therefore, it is unlikely that habitat critical to the survival of this species would be adversely affected.

e) disrupt the breeding cycle of an important population;

The proposal will not affect any GHFF breeding habitat. The closest camp is located approximately 6 km west of the subject site in Campbelltown. Although the study area contains winter flowering species that could provide nutrients to lactating females, there are extensive resources located closer to the camp and throughout the wider locality. Therefore, it is unlikely that the proposal will impact upon the breeding cycle of this species.

f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

As no critical roosting habitat would be removed or disturbed and extensive foraging habitat exists outside of the subject site, the proposal would be unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;

Mitigation measures have been provided to ensure that the proposal will not result in an invasive species, such as weeds or a destructive pathogen known or considered harmful to GHFF becoming established. As part of the proposal, control of invasive species has been recommended.

h) introduce disease that may cause the species to decline; or

Mitigation measures have been provided to ensure that the proposal will not result in the introduction of disease that is considered harmful to GHFF.

i) interfere substantially with the recovery of the species

A Draft National Recovery Plan for the GHFF was developed in 2009. The proposed removal of this vegetation is unlikely to interfere with the recovery of the GHFF as the impacts to potential habitat are minor compared to available surrounding habitat.

Conclusion

The proposal would result in the removal of approximately 25 scattered paddock trees of the CPW community and approximately 0.2 ha of the RFEF community. The proposal would also remove one hollow bearing tree and dewater three existing dams. This habitat removal is unlikely to impact upon any habitat that is considered critical to the lifecycle of this species.

Based on the information provided above, the proposal is unlikely to result in a significant impact for the GHFF. Therefore, a referral to the Commonwealth regarding this species is not recommended.

ecological AUSTRALIA

HEAD OFFICE
Suite 4, Level 1
2-4 Merton Street
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

SYDNEY
Level 6
299 Sussex Street
Sydney NSW 2000
T 02 8536 8650
F 02 9264 0717

ST GEORGES BASIN
8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA
Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

NEWCASTLE
Suites 28 & 29, Level 7
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA
5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE
92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

MUDGEE
Unit 1, Level 1
79 Market Street
Mudgee NSW 2850
T 02 4302 1230
F 02 6372 9230

PERTH
Suite 1 & 2
49 Ord Street
West Perth WA 6005
T 08 9227 1070
F 08 9322 1358

WOLLONGONG
Suite 204, Level 2
62 Moore Street
Austinmer NSW 2515
T 02 4201 2200
F 02 4268 4361

GOSFORD
Suite 5, Baker One
1-5 Baker Street
Gosford NSW 2250
T 02 4302 1220
F 02 4322 2897

DARWIN
16/56 Marina Boulevard
Cullen Bay NT 0820
T 08 8989 5601

BRISBANE
PO Box 1422
Fortitude Valley QLD 4006
T 07 3503 7192

Annexure "E"
Due Diligence Assessment

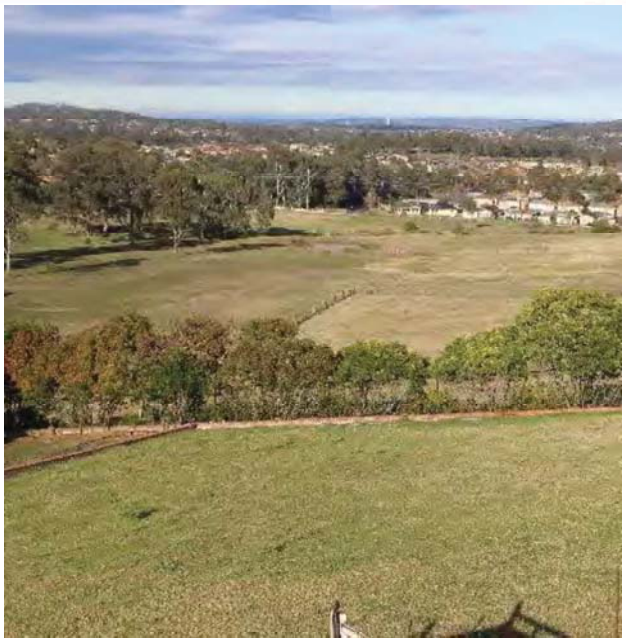
185, 195 & 203 Turner Road, Currans Hills NSW

Aboriginal Heritage Rezoning Assessment

Prepared for
Turner Road Developments and Ken Broome

September 2017









DOCUMENT TRACKING

Item	Detail
Project Name	187, 195 & 203 Turners Rd Currans Hill – Aboriginal Heritage Due Diligence Assessment
Project Number	1879
Project Manager	Lyndon Patterson Eco Logical Australia PO Box 12 Sutherland NSW 1499
Prepared by	Andrew Roberts
Reviewed by	Lyndon Patterson
Approved by	Steven House
Status	Draft
Version Number	V1
Last saved on	1 September 2017
Cover photos	187, 195 & 203 Turners Rd (A. Roberts)

This report should be cited as 'Eco Logical Australia 2017. 187, 195 & 203 *Turners Rd Currans Hill*. Prepared for Turner Road Developments and Ken Broome.

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Turner Road Developments and Ken Broome.

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd, Turner Road Developments and Ken Broome. The scope of services was defined in consultation with Turner Road Developments and Ken Broome, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.

Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

Template 08/05/2014

Contents

1 Introduction 1
1.1 Project background 1
1.2 Study area 1
1.3 Proposed development 1
1.4 Purpose and aims of this report 1
1.5 Legislative framework 2
1.5.1 *National Parks and Wildlife Act 1974* (NSW) 2
1.5.2 Heritage Act 1997 (NSW) 4

2 Environmental and archaeological context 7
2.1 Introduction 7
2.2 Landscape context 7
2.3 Land use history and disturbances 8
2.4 AHIMS search results 8
2.5 Australian heritage database search results 9
2.6 State heritage inventory search results 9
2.7 Previous archaeological assessments 9
2.8 Aboriginal site types 12
2.9 Predictive model and archaeological implications for area 14

3 Site Inspection 2
3.1 Aims of site inspection 2
3.2 Methods of site inspection 2
3.3 Site inspection findings 2
3.3.1 Areas of disturbance identified 2
3.3.2 Area of archaeological sensitivity identified around registered site 52-2-2122 3

4 Due Diligence Assessment Summary 10

5 Recommendations 12

References 14

Appendix A : Development Master Plan 15

Appendix B : AHIMS search results 16

© ECO LOGICAL AUSTRALIA PTY LTD

List of figures

Figure 1: Study area: 185, 195 and 203 Turners Road, Currans Hill (ELA 2015) 5

Figure 2: Generic due diligence process (OEH 2010) 6

Figure 3: 1961 aerial image of the Turner Rd property showing vegetation communities and urban development on neighbouring properties (ELA 2015)..... 15

Figure 4: AHIMS sites within 2km of the Turner Rd property (ELA 2015 with data from AHIMS) 16

Figure 5: AHIMS sites within proximity of the Turner Rd property (ELA 2015 with data from AHIMS). Note AHIMS site 52-2-2122 falls within the subject site. 0

Figure 6: AHIMS site 52-2-2122 falls within the study area. Photo from AHIMS site card (McDonald CHM 2001). Note proximity to fence and transmission line. Regrowth Eucalypts now absent from area (ELA 2015). 1

Figure 7: View to north-east of ponded 2nd order stream showing reformed and graded banks. Note small area of outcropping sandstone in foreground (ELA 2015). 4

Figure 8: View from the top (north-western end) of the study area looking south-east towards 2nd Order stream. Note the large areas of improved pasture, residential development and Eucalyptus species on banks of stream. View from residence in north-western corner showing retaining walls and reformed slope. (ELA 2015)..... 5

Figure 9: View from the top (north-western end) of the study area looking east showing moderate slope (ELA 2015) 5

Figure 10: View of one of three constructed dams on the property (ELA 2015)..... 6

Figure 11: View of building site at southern end of property and disturbed soils (ELA 2015) 6

Figure 12: Peripheral impacts from the neighbouring property indicates building debris emanate from the western slope (ELA 2015). 7

Figure 13: The access road to the property skirts along its western perimeter. 7

Figure 14: Bioturbation was noted to be present in the vicinity of the creek banks. 8

Figure 15: Archaeologically sensitive area..... 9

List of tables

Table 1: Due diligence process..... 3

Table 2 : Aboriginal Site types in the vicinity of the Study area 8

Table 3: Aboriginal site types for the study area..... 12

Abbreviations

Abbreviation	Description
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
CHL	Commonwealth Heritage List
CoP	Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales
DA	Development Application
DEC	(former) Department of Environment and Conservation, NSW Government
DECCW	(former) Department of Environment, Climate Change and Water, NSW Government
DoE	Department of the Environment, Australian Government
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
LES	Local Environment Study
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
OEH	Office of Environment and Heritage, NSW Government
PAD	Potential Archaeological Deposit
RNE	Register of the National Estate
SHI	State Heritage Inventory
SHR	State Heritage Register

© ECO LOGICAL AUSTRALIA PTY LTD

1 Introduction

1.1 Project background

Eco Logical Australia (ELA) was engaged by Turner Road Developments and Ken Broome to prepare an Aboriginal heritage rezoning assessment for 185, 195 and 203 Turners Road, Curran's Hill, NSW. The purpose of this assessment is to determine if there are any Aboriginal heritage constraints on the property and any subsequent management required.

1.2 Study area

The study area is residential allotment at 185, 195 and 203 Turners Rd Curran's Hill, in the Camden Local Government Area (LGA) (**Figure 1**). The land is known legally as Lots 1 and 2 DP 28024. The property is approximately 550 m long by 220 m wide (121,000 m^2 or 12.1 hectares (ha) in area). Curran's Hill is located on the southern Cumberland Plain, 44 km south of Sydney.

1.3 Proposed development

Subject to rezoning, tt is proposed to develop the majority of the subject site for residential subdivision (refer to **Appendix A** for details of the proposal). The development of the subject site will involve the construction of new roads, houses and associated infrastructure such as water and electricity. This will change the nature of the land from its current semi-rural setting and involve excavation and levelling of land.

1.4 Purpose and aims of this report

This report follows the due diligence Code of Practice as set out in the Office of Environment and Heritage's (OEH) *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (hereafter referred to as 'CoP') (DECCW 2010). The COP determines whether Aboriginal objects will be harmed by future or proposed development work, as required under Part 6 of the NSW *National Parks and Wildlife Act 1974* (NSW). The CoP applies where future development would impact the ground surface.

The CoP sets out the reasonable and practicable steps which individuals and organisations need to take in order to:

1. Identify whether or not Aboriginal objects are, or area likely to be, present in an area;
2. Determine whether or not their activities are likely to harm Aboriginal objects (if present); and
3. Determine whether an Aboriginal Heritage Impact Permit (AHIP) is required.

No Aboriginal community consultation has been undertaken as part of this due diligence process as it is not required under the CoP for the current level of assessment. As such no cultural assessment has been prepared nor considered. The local Aboriginal land council or traditional owner groups may be contacted regarding cultural values in the area.

The aims of the current due diligence assessment are therefore to:

- Undertake a search of the Aboriginal Heritage Information Management System (AHIMS) register maintained by the OEH to establish if there are any previously recorded Aboriginal objects or places on the properties;

© ECO LOGICAL AUSTRALIA PTY LTD

- Undertake a search of the NSW State Heritage Inventory and Australian Heritage Database to determine if there any places of Aboriginal significance at the properties;
- Check for and evaluate landscape features which may indicate past Aboriginal activity and the likely presence of Aboriginal objects;
- Undertake a desktop review of relevant previous archaeological assessments to understand the local archaeological context and assist in predicting the likely occurrence of unrecorded archaeological sites;
- Undertake a one-day site inspection to verify the findings of the desktop review, to check any areas identified in the background review as having the potential to retain archaeological evidence and to note any factors that may influence the presence of archaeological sites; and
- Prepare a stand-alone archaeological due diligence report determining if known objects are present or additional unrecorded objects are likely to occur as well indicate whether further assessment and/or an AHIP is required. The report would include a map of any Aboriginal objects or places identified in the assessment.

1.5 Legislative framework

The conservation and management of Aboriginal cultural heritage takes place in accordance with relevant Commonwealth, State or local government legislation. The study area is affected by a number of statutory controls for the planning and management of natural and cultural heritage. Statutory requirements for the study area are summarised below.

1.5.1 *National Parks and Wildlife Act 1974* (NSW)

Aboriginal cultural heritage is afforded protection under the provisions of the *National Parks and Wildlife Act 1974* (NSW) [NPW Act]. The Act is administered by the OEH which has responsibilities under the legislation for the proper care, preservation and protection of 'Aboriginal objects' and 'Aboriginal places'.

Under the provisions of the NPW Act, all Aboriginal objects are protected irrespective of their level of significance or issues of land tenure. Aboriginal objects are defined by the Act as "any deposit, object or material evidence (that is not a handicraft made for sale) relating to Aboriginal habitation of NSW, before or during the occupation of that area by persons of non-Aboriginal extraction" (and includes Aboriginal remains). Aboriginal objects are limited to physical evidence and may be referred to as 'Aboriginal sites', 'relics' or 'cultural material'. Aboriginal objects can include scarred trees, artefact scatters, middens, rock art and engravings, as well as post-contact sites and activities such as fringe camps and stockyards.

The NPW Act also affords protection to Aboriginal places, which are defined as a place that is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects. Aboriginal places can only be declared by the Minister.

AHIMS database

The Aboriginal Heritage Information Management System (AHIMS) is a statutory register managed by the OEH under section 90Q of the NPW Act. The AHIMS manages information on known Aboriginal sites, including objects as defined under the Act. A search of the AHIMS database was undertaken as part of the due diligence process (refer to **Section 2.4**).

The due diligence process

Part 6 of the NPW Act provides specific protection for Aboriginal objects and places by making it an offence to destroy, deface, damage, or move them from the land. The CoP as adopted by the *National Parks and Wildlife Regulation 2009* (NPW Regulation) made under the NPW Act, provides guidance to individuals and organisations to exercise due diligence when carrying out activities that may harm

Aboriginal objects and to determine whether they should apply for consent in the form of an Aboriginal Heritage Impact Permit (AHIP). This CoP can be used for all activities across all environments. The NPW Act provides that a person who exercises due diligence in determining that their actions will not harm Aboriginal objects has a defence against prosecution for the strict liability offence if they later unknowingly harm an object without an AHIP. However, if an Aboriginal object is encountered in the course of an activity work must cease and an application should be made for an AHIP.

AHIPs may be issued in relation to a specified Aboriginal object, Aboriginal place, land, activity or person or specified types or classes of Aboriginal objects, Aboriginal places, land, activities or persons. Applications for an AHIP must be accompanied by an Aboriginal Cultural Heritage Assessment report, as set out the guidelines of the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH 2011). Applications for an AHIP must provide evidence of consultation with the Aboriginal communities as required under Part 8A of the NPW Regulation 2009 and in accordance with OEH's Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW 2010b). An Aboriginal Cultural Heritage Assessment Report documents the process of investigation, consultation and assessment undertaken.

Table 1 provides a summary of CoP steps and where these steps are addressed in the structure of this report.

Table 1: Due diligence process

Due Diligence Code of Practice Process	Where each step is addressed in this report
Step1: Will the activity disturb the ground surface?	Yes, Section 1.3
Step 2a: Search the AHIMS database and use any other sources of information of which you are already aware	Sections 2.4, 2.5, 2.6 and 2.7.
Step 2b: Consider if activities are proposed in areas where landscape features indicate the presence of Aboriginal objects. If the proposed activity is : • within 200m of waters • located within a sand dune system • located on a ridge top or headland • located within 200m below or above a cliff face • within 20m of or in a cave, rock shelter or cave mouth and is on land that is not disturbed#, go to Step 3.	Sections 2.2, 4.
Step 3. Can you avoid harm to the object or disturbance of the landscape feature?	Section 4
Step 4. Desktop assessment and visual inspection	Section 3 and 4
Step 5: Further investigations and impact assessment	Sections 4 and 5

Disturbed land or land already disturbed by previous activities is described in the CoP definitions as:

Land is disturbed if it has been the subject of human activities that has changed the land's surface, being changes that remain clear and observable. Examples include ploughing, construction of rural infrastructure (such as dams and fences), construction of roads, trails and tracks (including fire trails and tracks walking tracks), clearing vegetation, construction of buildings and the erection of other structures, construction or installation of utilities and other similar services (such as above or below ground electrical infrastructure, water or sewerage pipeline, stormwater drainage and other similar infrastructure) and construction of earthworks.

The CoP process flowchart is presented in **Figure 2**. The results of the due diligence assessment are presented in Section 5.

1.5.2 Heritage Act 1997 (NSW)

The NSW *Heritage Act 1977* is a statutory tool designed to conserve the environmental heritage of NSW and is used to regulate development impacts on the state's heritage places, buildings, works, relics, moveable objects or precincts that are important to the people of NSW. These include items of Aboriginal and non-Aboriginal heritage significance. The state heritage inventory contains over 25,000 heritage items on statutory lists in NSW, including items listed on the State Heritage Register (SHR) under the NSW *Heritage Act 1977* and heritage items local government and state agencies.



Figure 1: Study area: 185, 195 and 203 Turners Road, Currans Hill (ELA 2015)

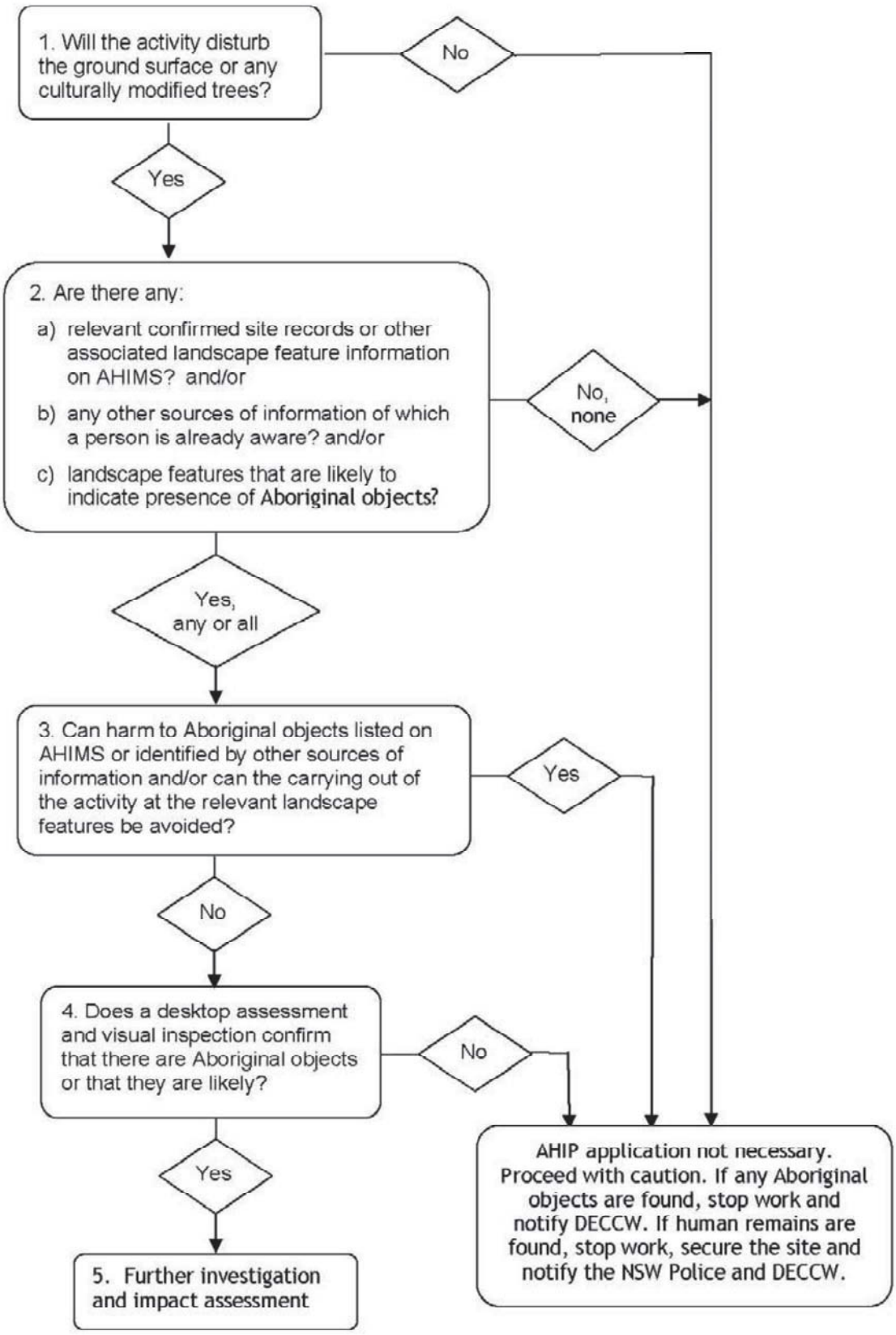


Figure 2: Generic due diligence process (OEH 2010)

2 Environmental and archaeological context

2.1 Introduction

An understanding of the physical landscape is important in identifying the interface between humans and their environment. This is particularly true of Indigenous communities where a close relationship has historically existed between people and their surroundings. Environmental factors and resources can also have considerable influence upon the distribution of people (and thus the archaeological remains of their sites) across the landscape. The following section presents a brief overview of the environmental and archaeological context including results of the searches of the heritage databases.

2.2 Landscape context

Turner Road, Currans Hill is located within the Western Sydney region of New South Wales. It lies within the Cumberland Plain and comprises exotic pasture across undulating hills, with some small pockets of remnant native vegetation. The landscape is characterized by a broad hillcrest in the north-western corner with an upper slope grading into a concave lower slope with a broad drainage depression of a second order stream of South Creek and valley flat. Higher elevations of up to 18% are found in the north-western corner of the property. The central and south-eastern areas of the property have a lower landscape with a gradient of <5%.

Soil landscapes are largely determined by the underlying geology. The dominant soil type is clay based, originating from Wianamatta Shale and includes the Blacktown Soil Landscape. The Cumberland Plain Woodland (CPW) is the associated vegetation type. Small pockets of alluvial soil in drainage areas support River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. The study area consists mostly of cleared grassland and weeds with areas of native vegetation along the creek. The study area is composed of 11.5 hectares of pasture grasses with scattered paddock trees and 0.2 hectares of River-Flat Eucalypt Forest.

The soil landscapes within to the project area has distinct morphological and topographical characteristics, and they provide terrain units to summarise archaeological potential and surface detectability of archaeological sites. In general, Wianamatta Group-derived soils are characterised by low fertility and high soil acidity (Tozer 2003). The project area is within Blacktown Soil Landscape.

- The Blacktown Soil landscape and associated landforms have undulating rises with slopes usually less than 5%. This landscape consists of up to four soil horizons with shallow to moderately deep red to brown sandy clay soils on crests, upper slopes and well drained areas, and deep yellow sand and clay soils on lower slopes and localised areas of poor drainage (Hazelton & Tille 1990).

Application to the Project Area's Archaeological Record

Soil landscapes can affect the degree to which archaeological materials are preserved, remain *in situ*, and are detectable on the ground surface. The predominance of the stable Blacktown Soil Landscape, with generally low slope gradients (taking into account previous landform modelling) indicates Aboriginal sites can be expected in almost all localities of the subject area.

2.3 Land use history and disturbances

A large proportion of the project area has been cleared, agricultural activities have disturbed soils and the construction of tracks, roads and farm dams has occurred. The vegetation that remains consists of scattered patches of Cumberland Plain Woodland, narrow bands of River-flat Eucalypt Forest along the creek line and areas of native grasslands (refer to **Figure 3**). Introduced vegetation exists in broad areas across the project area. Within the catchment area there is an absence of permanent water, some major modifications of the original creek systems due to damming and diverting of drainage flows, and major stripping of a large proportion of the riparian vegetation. Within the project area, South Creek forms a 2nd order stream which ultimately drains to the Nepean River to the south-west of the project area. The property is currently grazing land, proposed for subdivision and residential development. The riparian corridor is associated with 2nd order (South) creek flowing from the Turner Road Precinct upstream to a residential development downstream. Camden Council has rezoned this riparian corridor as E2. With all of the contributing creeks upstream of the Driver Property now gone (road drainage and bio-retention), the hydrology of the 2nd order creek is likely to be highly modified. Further, because the creek downstream of the Driver Property is a constructed grass swale and narrow riparian corridor (approx. 13 m wide including channel).

2.4 AHIMS search results

An advanced search of the AHIMS register was undertaken by ELA on the 16 June 2015 (refer to **Appendix B**). The search revealed there was one registered site within the study area 52-2-2122 a surface artefact scatter. The advanced search shows two Aboriginal Heritage Impact Permits (AHIP) issued against the site (AHIP 2576 and AHIP 2838). Copies of these AHIPs were requested by ELA to the OEH. The OEH sent a copy of AHIP 2838 (on 17 July 2015) which was a consent to destroy four sites including site 52-2-2221 dated 6 December 2007 for five years. It is understood from the OEH that AHIP 2576 is superseded by AHIP 2838. The site visit demonstrated that site 52-2-2221 has not been impacted and development has not occurred in this area. The AHIP 2838 is now expired and is no longer valid for impacts to this site.

The location of site 52-2-2122 is shown in **Figure 4** and **Figure 5**.

The AHIMS search also identified 56 recorded Aboriginal sites and objects within 2 km of the study area. By far the largest number of these site types / features are open sites with artefacts some with large numbers of artefacts, representing 85% of the total sites. There were a total of 6 potential archaeological deposits recorded, representing 10% of the total sites. Modified or scarred trees totalled 3 or 5% of sites. A breakdown of the site types is presented in **Table 2**.

Table 2 : Aboriginal Site types in the vicinity of the Study area

Site Type / Feature	Frequency	Percentage
Artefact	47	85%
Potential archaeological deposits and artefact	6	10%
Modified Tree	3	5%
Total	56	100%

2.5 Australian heritage database search results

A search was undertaken of the Australian heritage database on 30 June 2015. The property at 187,195 and 203 Turner Rd Curran's Hill is not on the World Heritage List, National Heritage List, Commonwealth Heritage List or RNE. As such there are no implications for this study.

2.6 State heritage inventory search results

The State Heritage Inventory (SHI) contains over 25,000 heritage items on statutory lists in NSW, including some of Aboriginal heritage significance. The SHI, including items listed on the State Heritage Register (SHR) under the NSW Heritage Act 1977 and heritage items local government and state agencies. A search of the SHI by ELA on 30 June 2015 did not identify any SHR places or heritage items of Aboriginal heritage significance on or nearby to the study area.

2.7 Previous archaeological assessments

There have been a number of archaeological assessments completed in the surrounding area of Curran's Hill which form relevant background information for the current due diligence. A summary of the key findings of these studies is presented below.

Archaeological investigation of the Turner Road and Oran Park Precincts within the South West Growth Centre, Camden, NSW. Report to APP on behalf of the Growth Centres Commission and Camden City Council. (McDonald CHM 2001)

This report was commissioned by APP on behalf of the Growth Centres Commission (GCC) and Camden Council. It documented the Stage 1 assessment of the Oran Park and Turner Road Precincts. This report summarised the existing information, identified knowledge gaps and detailed further work to be undertaken in both Precincts. Preliminary mapping of previous land use impacts indicated that there has been a significant amount of prior disturbance across the majority of the Oran Park and Turner Road Precincts. Land identified as having primarily agricultural land use was identified as having the highest potential for containing intact archaeological sites. The land with the highest archaeological sensitivity was mapped. The report recommended that the Oran Park and Turner Road Precincts should be surveyed on foot in order to identify the presence of surface archaeological sites and to ground-truth the results of sensitivity mapping. It further recommended that fieldwork should focus on areas identified as having particular potential for retaining intact archaeological sites across the study area such as:

- Land identified as having a primarily agricultural land use and areas of good to high potential to contain archaeological deposit as identified through sensitivity mapping;
- Original water holes at the junction of higher order streams;
- Fluvial erosional benches above third and fourth order channels; and that

This report predicted that in the middle reaches of minor tributaries (second-order creeks) there will be archaeological evidence for sparse but focused activity (e.g. one-off camp locations, single episode knapping events). This report also indicated that the degree of prior disturbance has limited the archaeological potential across the majority of the study areas. Agricultural land is likely to have the highest potential for retaining intact archaeological sites and this is subject to localised areas of low to very high disturbance throughout.

Archaeological survey for Aboriginal sites, proposed extension area to Manooka Valley rural residential area subdivision, Curran Hill, NSW. (McDonald CHM 2001)

The following account is taken from AHIMS site card for 52-2-2122 located in the survey area

Eight stone artefacts were recorded at this small, open artefact scatter on the lower hillslope. The site is located in the central/northern portion of the Driver property adjacent to the eastern boundary fence line of the extension area (refer to **Figure 4** and **Figure 5**). The artefacts were located in two small clusters on an area of sheetwash erosion and along a stock track about eighty metres east of the main (second order creekline) (**Figure 6**). All of the artefacts, apart from a flaked piece of silicified tuff are silcrete faking debitage. The average artefact density was low at 1 artefact/3m^2. The ground surface visibility on the exposures (totalling ca.84m^2) was moderate (50-70%) obscured by shale gravel, leaf litter and rabbit droppings. There was limited ground surface visibility (0-30%) in the surrounding area due to thin grass cover which may be the result of previous clearing and grading. A grader scrape (ca.10-15cm depth) and a large windrow (consisting of soil and vegetation, with numerous rabbit burrows) were observed immediately to the north of the site. The surrounding area has mostly been cleared for grazing and is covered with sparse, scattered older growth Forest Red Gums (E. teriticornis) and Box Eucalypts (E. molluccana), with young regrowth Eucalypts and Acacia in the immediate vicinity of the scatter. Apart from the evidence of previous grading/clearing, other forms of disturbance in the area include the nearby fence line and transmission line, erosion and stock activity. Considering the degree of previous disturbance in the area and the predictive model, the potential for intact, sub-surface archaeological deposit in the vicinity is low-moderate.

McDonald assessed the site was located within a proposed open space of the proposed development area and would not be impacted. McDonald assessed that no further archaeological work was required though the site should be protected from indirect of inadvertent damage during the construction of the proposed road. A representative from the Tharawal Local Aboriginal Land Council was present during the survey undertaken by McDonald CHM and the site was considered important by this representative. The development proposal assessed by McDonald has since changed and the site is now considered to be within the development zone.

The following studies were undertaken within the Cumberland Plain within a few kilometres of the study area and are considered here as they inform on site types in the region in similar landscape areas to Curran's Hill.

Central Hills Rezoning Aboriginal Heritage Assessment (AMBS 2006)

AMBS prepared a report on an archaeological survey of the Central Hills study area. The study area included eight open camp sites (80%) consisting entirely of stone artefacts (comprising of more than one stone artefact), two isolated finds (20%) and one scarred tree. The report indicates the nature of archaeological site types in the study area including their density, distribution and artefact raw material is typical of the Cumberland Plain Aboriginal archaeology demonstrated by previous archaeological studies undertaken throughout this region. Across the study area artefact density for the open camp sites was low. The highest number of artefacts (11) were dispersed across an area of several square meters. Silcrete was the dominant artefact raw material in the assemblage, comprising 86.2% of the artefacts encountered. Silicified tuff, quartzite, chert and quartz each comprised smaller proportions of the raw materials used (each at 3.4%). The isolated finds and open camp sites identified in the study area were located in several landform contexts, including low-moderate slopes, flats and principally 1st order streams. Two of the sites were identified as having been disturbed by made-made features, such as a dam and golf course.

© ECO LOGICAL AUSTRALIA PTY LTD

The scarred tree was identified in an area of remnant bushland, although the presence of some new growth vegetation indicates that clearance activities had taken place. The identification of one PAD demonstrated the presence of a limited area of undisturbed subsurface archaeological deposit within the Central Hills study area. The significant features of the PAD included its strategic location near a creek line and available riparian resources and its location on an elevated landform. Large portions of the study area exhibited little or no archaeological potential due to previous land use and disturbance, and were classified as having low archaeological significance.

El Caballo Blanco & Gledswood, NSW Rezoning: Aboriginal Heritage Assessment (AMBS 2008)

AMBS was commissioned to undertake an Aboriginal heritage assessment as part of the LES for land formerly referred to as 'Central Hills', Camden and to provide input into the planning process for the future development of the area with regard to Aboriginal heritage. The objectives of this Aboriginal heritage study were to:

- summarise Aboriginal heritage works previously undertaken for the study area;
- review and assess the impact of the development's revised footprint on previously identified sites and places of Aboriginal heritage significance;
- provide updated strategies for the ongoing management of any identified Aboriginal heritage, if necessary; and
- identify the process for undertaking a subsequent detailed investigation of Aboriginal heritage significance, should the review of the previous reporting identify the need for more detailed investigations.

Consultation was undertaken with the Aboriginal community in accordance with Department of Environment and Climate Change (DECC) guidelines during a previous Aboriginal heritage assessment (AMBS 2006a). Archaeological assessment of the study area demonstrated the presence of seven archaeological sites (CH7-13), as well as four areas assessed as having a moderate level of archaeological potential (PADs 1-4). The study area was shown to represent a relatively intact cultural landscape and AMBS recommended that the conservation of representative portions of that landscape was a desirable outcome, particularly remnant and intact landscape features, and areas of archaeological sensitivity and potential including low to moderate slopes, and potentially ridge lines. PADs 3 and 4 were assessed as having potential to containing intact subsurface archaeological deposits, requiring a Section 90 consent from DECC including a program of test excavation carried out under a Section 87 permit.

Catherine Fields (part) Precinct. South West Growth centre: Aboriginal Heritage Assessment (Kelleher Nightingale Consulting (KNC 2012)

KNC identified 16 Aboriginal archaeological sites within the Catherine Fields (part) Precinct. Sites consisted of open artefact scatters, isolated artefacts and registered locations of potential archaeological deposit (PAD). These results were consistent with predictions for the study area. Sites ranged from low to moderate scientific significance. Six isolated finds, three Potential archaeological deposits and seven artefact scatters were recorded during the assessment. It was recommended in this assessment that mitigation measures (salvage excavation and collection of objects) were required to mitigate harm to Aboriginal objects and the loss of value resulting from development of the part precinct. Mitigation measures were recommended for those sites of moderate archaeological or high cultural value in the form of an AHIP from the DECC.

© ECO LOGICAL AUSTRALIA PTY LTD

East Leppington Heritage Report (Godden Mackay Logan (GML) 2012)

The archaeological survey identified Aboriginal objects at twelve locations across the northern study area. These expressions of objects have been described as GML1-12. Of particular note was site GML12-EL-AS5 located in an open cultivated field that had been highly impacted from vegetation stripping and ploughing, resulting in low soil integrity. The artefact assemblage comprised a range of technological classes, including cores, flakes, blades, and retouched pieces made on a variety of raw materials. In addition to the flaked stone assemblage, a flaked and ground stone axe was recovered. Archaeological test excavation was undertaken in collaboration with registered Aboriginal stakeholders. A total of 533 test units (TU) were excavated across the study area yielding a total of 531 Aboriginal objects (an average density of four objects per metre square (GML 2012: 7)

2.8 Aboriginal site types

A wide range of Aboriginal site types can be encountered during archaeological investigations and these reflect the range of activities carried out by Aboriginal people in the past. AHIMS sets out twenty site types which are defined by the cultural activities associated with the use of a place. The main site types which may be present in the study area are summarised in **Table 3** below along with a prediction of likelihood of these sites types to be present. This summary is based on previous archaeological research and predictive models, as well as the assessment of landforms and environment within the study area.

Table 3: Aboriginal site types for the study area

Site Type	Description
Open Camp Sites / Stone Artefact Scatters / Isolated Finds	Open camp sites represent past Aboriginal subsistence and stone knapping activities, and include archaeological remains such as stone artefacts and hearths. This site type usually appears as surface scatters of stone artefacts in areas where vegetation is limited and ground surface visibility increases. Such scatters of artefacts are also often exposed by erosion, agricultural events such as ploughing, and the creation of informal, unsealed vehicle access tracks and walking paths. These types of sites are often located on dry, relatively flat land along or adjacent to rivers and creeks. Camp sites containing surface or subsurface deposit from repeated or continued occupation are more likely to occur on elevated ground near the most permanent, reliable water sources. Flat, open areas associated with creeks and their resource-rich surrounds would have offered ideal camping areas to the Aboriginal inhabitants of the local area. Isolated finds may represent a single item discard event, or be the result of limited stone knapping activity. The presence of such isolated artefacts may indicate the presence of a more extensive, in situ buried archaeological deposit, or a larger deposit obscured by low ground visibility. Isolated artefacts are likely to be located on landforms associated with past Aboriginal activities, such as ridgelines that would have provided ease of movement through the area, and level areas with access to water, particularly creeks and rivers. Artefact scatter sites are less common in coastal areas than in inland areas such as the Cumberland Plain where they dominant.
Potential Archaeological	Potential Archaeological Deposits (or PADs) are areas where there is no surface expression of stone artefacts, but due to a landscape feature there is a strong likelihood that the area will contain buried deposits of stone artefacts. Landscape features which

Site Type	Description
Deposit and shelter sites	may feature in PADs include proximity to waterways, particularly terraces and flats near 3rd order streams and above, ridge lines and ridge tops and sand dune systems. PADs may also occur in shelter sites, such as deposits of shell, stone artefacts or remains of hearths. Shelters may also contain art sites in the region.
Scarred or Carved Trees	Tree bark was utilised by Aboriginal people for various purposes, including the construction of shelters (huts), canoes, paddles, shields, baskets and bowls, fishing lines, cloaks, torches and bedding, as well as being beaten into fibre for string bags or ornaments. The removal of bark exposes the heart wood of the tree, resulting in a scar. Trees may also have been scarred in order to gain access to food resources (e.g. cutting toe-holds so as to climb the tree and catch possums or birds), or to mark locations such as tribal territories. These sites most often occur in areas with mature, remnant native vegetation. The locations of scarred trees often reflect historical clearance of vegetation rather than the actual pattern of scarred trees. Carved trees generally marked areas for ceremonial purposes, or the locations of graves. The limited number of old native trees in the study area means this site type is unlikely to be present.
Axe Grinding Grooves	Grinding grooves are the physical evidence of tool making or food processing activities undertaken by Aboriginal people. The manual rubbing of stones against each other creates grooves in the rock, which are usually found on flat areas of soft rock such as sandstone, in areas of creek beds and other water sources. They are often associated with rock pools in creek beds and on platforms to enable the wet-grinding technique. Sandstone outcropping in the study area should be inspected for possible grinding grooves.
Quarries	Aboriginal quarry sites are sources of raw materials, primarily for the manufacture of stone tools, but also for ochre procurement. They are only found where raw materials (stone or ochre) occur within the landscape, and where these have been exploited in the past. Such sites are often associated with stone artefact scatters and stone knapping areas. Raw materials can be sourced to these sites and provide evidence for Aboriginal movement and/or exchange. There is low potential for quarries given the local sandstone geology. Sandstone is generally not suitable for stone knapping.
Bora/Ceremonial	Aboriginal ceremonial sites are locations that have spiritual or ceremonial values to Aboriginal people. Aboriginal ceremonial sites may comprise natural landforms and, in some cases, will also have archaeological material. Bora grounds are a ceremonial site type, usually consisting of a cleared area around one or more raised earth circles, and often comprised two circles of different sizes, connected by a pathway, and accompanied by ground drawings or mouldings of people, animals or deities, and geometrically carved designs on the surrounding trees. Agricultural and pastoral activities are likely to damage or destroy raised earth features. Vegetation growth and exposure to weather would also be impacting factors. It is unlikely that any bora or ceremonial grounds remain within the study area, if indeed they

Site Type	Description
	once existed in this part of the landscape. The steep slope of the land also means this site type would be less likely.
Natural Mythological (Ritual) sites	These types of sites are usually identified by the local Aboriginal community as locations of cultural significance, and they may not necessarily contain material evidence of Aboriginal associations with the place. These sites are generally determined through community consultation. There is no information to suggest that the property contains such sites.
Burial	Aboriginal burial of the dead often took place relatively close to camp site locations. This is due to the fact that most people tended to die in or close to camp (unless killed in warfare or hunting accidents), and it is difficult to move a body long distances. Soft, sandy soils on, or close to, rivers and creeks allowed for easier movement of earth for burial; and burials may also occur within rock shelters or middens. Aboriginal burial sites may be marked by stone cairns, carved trees or a natural landmark. Burial sites may also be identified through historic records, or oral histories. Some burial sites are known on the coastal sand dunes in the Illawarra region to the south. Burial sites are considered highly unlikely in the study area.
Contact / Historical Sites	These types of sites are most likely to occur in locations of Aboriginal and settler interaction, such as on the edge of pastoral properties or towns. Artefacts located at such sites may involve the use of introduced materials such as glass or ceramics by Aboriginal people, or be sites of Aboriginal occupation in the historical period. There is no information to suggest that the property is the location of a contact site.

2.9 Predictive model and archaeological implications for area

Archaeological implications for the study area based on previously recorded sites, archaeological investigations in the region, predictive models, and the site's environmental characteristics are as follows:

- From the AHIMS search results and previous reporting for the Curran's Hill area, open sites containing artefacts are by far the most recorded on the Cumberland Plain and the most common site within 2 km of the study area representing some 86% of all sites recorded.
- Grinding groove sites while less common are generally located on exposed sandstone outcrops in open areas.
- Other site types such as scarred trees and quarries are generally rare in the region, however are known to occur within 2 kilometres of the study area comprising 5% of all sites.
- Human burials would be highly unlikely in the area.

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 3: 1961 aerial image of the Turner Rd property showing vegetation communities and urban development on neighbouring properties (ELA 2015).



Figure 4: AHIMS sites within 2km of the Turner Rd property (ELA 2015 with data from AHIMS)

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 5: AHIMS sites within proximity of the Turner Rd property (ELA 2015 with data from AHIMS). Note AHIMS site 52-2-2122 falls within the subject site.

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 6: AHIMS site 52-2-2122 falls within the study area. Photo from AHIMS site card (McDonald CHM 2001). Note proximity to fence and transmission line. Regrowth Eucalypts now absent from area (ELA 2015).

© ECO LOGICAL AUSTRALIA PTY LTD

3 Site Inspection

3.1 Aims of site inspection

The aims of the site inspection were as follows:

- Identify Aboriginal objects which may be present on the property including the recorded AHIMS site;
- Identify any landscape features which may indicate the presence or likelihood of Aboriginal objects;
- Inspect mature native trees for possible Aboriginal cultural scarring;
- Inspect rock outcrops for possible grinding grooves, engravings and quarries; and
- Consider the level of past soil and landscape disturbance.

3.2 Methods of site inspection

The following standard methods for archaeological assessment were employed during the site visit:

- The property was subject to a pedestrian site walk over to identify any sites and areas of archaeological potential based on landform and any areas of historical land use and disturbance;
- Any identified Aboriginal sites and / or PADS within the project area would be recorded using a GPS and photographed using an IFRAO scale and standardised recording forms
- Any new Aboriginal sites would require the completion of an Aboriginal heritage site recording form (AHIMS Site Card) as required by OEH.

3.3 Site inspection findings

A site inspection was undertaken by ELA Senior Archaeologist Andrew Roberts on 1 July 2015. The weather conditions were fine during the site visit. The key findings of site inspection were:

- No Aboriginal objects were located during the site visit;
- The artefacts from the registered AHIMS sites 52-2-2122 on the property could not be relocated during the site visit.
- Trees were inspected for cultural scarring and none were identified;
- The property was found to contain small areas of sandstone outcropping, particularly in the middle sections of the land on the banks of the ponded 2nd order stream (**Figure 7**). This outcropping was inspected for engravings and grinding grooves and none were identified;

3.3.1 Areas of disturbance identified

- The residential area to the north-west of the property on the hillcrest had substantially disturbed soils that were retained by brick retaining walls (**Figure 8**);
- The property was found to be largely clear of vegetation. There was a stand of small Eucalypt species around the 2nd order creek with a limited understorey. Approximately 20 other mature Eucalypts were located across the middle section of the property (**Figure 8**);
- Overall one of the main features of the property was the moderate slope of the land with a southerly aspect. The slope increased in gradient on its westerly and northern perimeters (**Figure 9**);

© ECO LOGICAL AUSTRALIA PTY LTD

- The level of disturbance was consistent across the northern, western and southern areas of the property. There has been a considerable amount of topsoil grading/raking that has reformed the soils across the property eradicating micro-relief on the slopes. This reforming has also moved soils downslope (**Figure 9**);
- The western bank of the ponded area of the second order creek has been subject to this reforming right up to its banks (**Figure 7**);
- Further evidence of high disturbance was noted on the southern perimeter where three dams and a drainage channel have been constructed (**Figure 10**);
- Further to this there has been building on the southern margins of the property adjacent to the dams. These buildings have been demolished leaving a considerable amount of debris and disturbing soils over a large area (**Figure 11**);
- There have also been peripheral impacts from the neighbouring property where building debris emanates from the western slope. This is widely spread across the western side of the property and includes rubble, broken tiles and concrete (**Figure 12**);
- The access road to the property skirts along this western perimeter. This has significantly disturbed any existing topsoils (**Figure 13**);
- There was generally less soil disturbance on the slopes of the property, however towards the western boundary the land was moderately steep and exposed soils appeared shallow (**Figure 8**);
- Bioturbation from rabbit burrows in the vicinity of the ponded stream was noted (**Figure** 14).

3.3.2 Area of archaeological sensitivity identified around registered site 52-2-2122

To the east of the ponded area there appeared to be greater soil integrity and therefore archaeological sensitivity between it and the reported location of AHIMS site 52-2-2122. This area archaeological sensitivity is mapped in **Figure 15**.



Figure 7: View to north-east of ponded 2nd order stream showing reformed and graded banks. Note small area of outcropping sandstone in foreground (ELA 2015).

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 8: View from the top (north-western end) of the study area looking south-east towards 2nd Order stream. Note the large areas of improved pasture, residential development and Eucalyptus species on banks of stream. View from residence in north-western corner showing retaining walls and reformed slope. (ELA 2015)



Figure 9: View from the top (north-western end) of the study area looking east showing moderate slope (ELA 2015)



Figure 10: View of one of three constructed dams on the property (ELA 2015)



Figure 11: View of building site at southern end of property and disturbed soils (ELA 2015)

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 12: Peripheral impacts from the neighbouring property indicates building debris emanate from the western slope (ELA 2015).



Figure 13: The access road to the property skirts along its western perimeter.



Figure 14: Bioturbation was noted to be present in the vicinity of the creek banks.

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 15: Archaeologically sensitive area

© ECO LOGICAL AUSTRALIA PTY LTD

4 Due Diligence Assessment Summary

Due diligence is defined in the CoP as "taking reasonable and practical steps to determine whether a person's actions will harm an Aboriginal object and, if so, what measures can be taken to avoid that harm". The following discussion relates to the generic due diligence process as applied to the study area.

Step 1 – Will the activity disturb the ground surface or any culturally modified trees? – If there is future development of the property, ground disturbance will occur.

It is understood that the residential development proposal would generate significant ground disturbance. This would include the grading and levelling of the land, construction of multiple houses or buildings, roads, driveways and underground utilities (refer to **Appendix A**). No culturally modified trees were located in the study area.

Step 2 – Are there any relevant confirmed site records of other associated landscape features on AHIMS, other sources of information or landscape features that are likely to indicate presence of Aboriginal objects?

A search of the AHIMS register identified a previously recorded (AHIMS) sites within the study area (52-2-2122). This site is an open site containing a small artefact scatter on the eastern perimeter of the property within a few metres of a fenceline and adjacent electricity transmission line.

A ponded 2nd order stream of South Creek is located on the property approximately 80 metres to the west of site 52-2-2122.

Step 3 – Can harm to Aboriginal objects listed on AHIMS be identified by other sources of information and/or can carrying out of the activity at the relevant landscape features be avoided?

The desktop assessment indicated that site 52-2-2122 was located a short distance from the ponded creek. After reviewing the site card from AHIMS however the site was relocated to approximately eighty metres east of the creek line (refer to **Figure 6**). Soils in the area between the ponded creek and the AHIMS site location appeared to have suffered less impact than those to the west and north of the ponded area and have archaeological sensitivity (**Figure 15**).

Step 4 – Does the desktop assessment and visual inspection confirm that there are Aboriginal objects or that they are likely?

The site visit did not locate any Aboriginal objects and the artefacts from the registered site 52-2-2122 could not be relocated. The following site types were considered - stone artefacts, scarred/carved trees, potential archaeological deposits, grinding grooves, however none were located.

This assessment considers the impacts of a large scale residential development in an area where Aboriginal objects have been previously recorded (site 52-2-2122).

The site visit revealed the level of disturbance was high over much of the study area, particularly on the western banks of the ponded area from the grading of slopes and reforming of the drainage line of the creek. There was evidence of on the ground of bioturbation from rabbits. The upper (north-western) part of the study area contained shallow soils and obvious soil disturbance was encountered throughout. This area is similarly unlikely to have any archaeological integrity. Where building and road construction had

© ECO LOGICAL AUSTRALIA PTY LTD

occurred in the lower (southern) section, any archaeological material that may exist in this area is likely to be disturbed and out of context with low site integrity.

The central eastern part of the study area between the ponded stream and the registered archaeological site 52-2-2122 does however contain soils that are likely to retain some integrity. Due to the presence of this registered archaeological site within the development zone and based on the information reviewed in this due diligence assessment and a field visit, further assessment is recommended in this area (**Figure 15**).

© ECO LOGICAL AUSTRALIA PTY LTD

5 Recommendations

According to the requirements of the NPW Act, the due diligence investigation and assessment of Aboriginal cultural heritage is undertaken to explore the potential harm of a proposed activity on Aboriginal objects and declared Aboriginal places and landscape features that are likely to indicate the presence of Aboriginal objects.

Based on the results of this Aboriginal heritage due diligence assessment the following is recommended:

- A search of the AHIMS register confirmed a registered Aboriginal archaeological site (52-2-2122) is known to exist on the property. The advanced search shows the site as valid, indicating it has not be destroyed. The advanced search shows two permits issued against the site 2576 and 2838. Copies of these permits were requested by ELA to the OEH. The OEH sent a copy of permit 2838, which was a consent to destroy four sites including site 52-2-2221 dated 6 December 2007 for five years. It is understood from the OEH that permit 2576 is superseded by permit 2838. The site visit demonstrated that site 52-2-2221 has not been impacted and development has not occurred in this area. The AHIP is now expired and is no longer valid for future impacts to this site.

  Whilst no surface Aboriginal objects or sites were relocated during the site visit, the extent of the proposed development has the potential to impact on this previously recorded Aboriginal site. The soils in the vicinity of site 52-2-2122 retain low to moderate integrity and should therefore be the subject of further assessment. The site 52-2-2122 and area of archaeological sensitivity is within an area proposed for development (**Appendix A**) but should be considered for conservation by the proponent.

- If conservation of the site 52-2-21211 and area of sensitivity cannot be achieved, further assessment and an application for an *Aboriginal Heritage Impact Permit* (AHIP) under section 90A of the *National Parks and Wildlife Act 1974* will be required.

- Applications for an AHIP must be accompanied by an Aboriginal Cultural Heritage Assessment report, as set out the guidelines of the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011). Applications for an AHIP must provide evidence of consultation with the Aboriginal communities as required under Part 8A of the NPW Regulation 2009 and in accordance with *OEH's Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010b). An Aboriginal Cultural Heritage Assessment Report documents the process of investigation, consultation and assessment undertaken.

- The ponded 2nd order stream located to the west of the registered site has the potential to retain sub surface soils that have not been impacted by channel reforming and grading particularly on the eastern margins. As part of the further assessment, a limited program of archaeological test excavations should be undertaken on the eastern side of the ponded area and between it and the reported AHIMS site (52-2-2122) to confirm the extent of the subsurface archaeological material (**Figure 15**), being the area bounded by lots 19-25, 27 and 47 on the proposed layout (refer to **Appendix A**).

- Due to the steep nature of the property, shallow soils and past soil disturbance, it is assessed that there is a low likelihood for Aboriginal objects to occur in upper slope areas or those areas disturbed by residential development and the construction of dams and drainage channels. Therefore, no further archaeological assessment is recommended in these areas.

- If suspected Aboriginal objects, such as stone artefacts are located during future works, works must cease in the affected area and an archaeologist called in to assess the finds. If the finds are found to be Aboriginal objects, the OEH must be notified under section 89A of the NPW Act. Appropriate assessment and management should be sought and may include approvals under a section 90 AHIP should objects be moved or harmed.

- In the extremely unlikely event that human remains are found, works should immediately cease and the NSW Police should be contacted. If the remains are suspected to be Aboriginal, the OEH may also be contacted at this time to assist in determining appropriate management.

© ECO LOGICAL AUSTRALIA PTY LTD

References

AMBS (2006a) Central Hills Camden, NSW – Rezoning: Aboriginal Heritage Assessment. Consultancy report to APP Corporation on behalf of Camden Council

AMBS, 2006. Central Hills Rezoning: Aboriginal Heritage Assessment. APP Corporation on behalf of Camden Council.

AMBS, 2008. *El Caballo Blanco & Gledswood, NSW Rezoning Aboriginal Heritage Assessment*. Prepared by Australian Museum Business Services for Camden Council

DECCW, 2010. *Archaeological Investigation of Aboriginal Objects in New South Wales*.

DECCW, 2010b. *Aboriginal cultural heritage consultation requirements for proponents*.

Hazelton, P.A and Tille, P.J. 1990 *Soil Landscapes of the Wollongong-Port Hacking 1:100 000 Sheet*. Soil Conservation Service of NSW, Sydney.

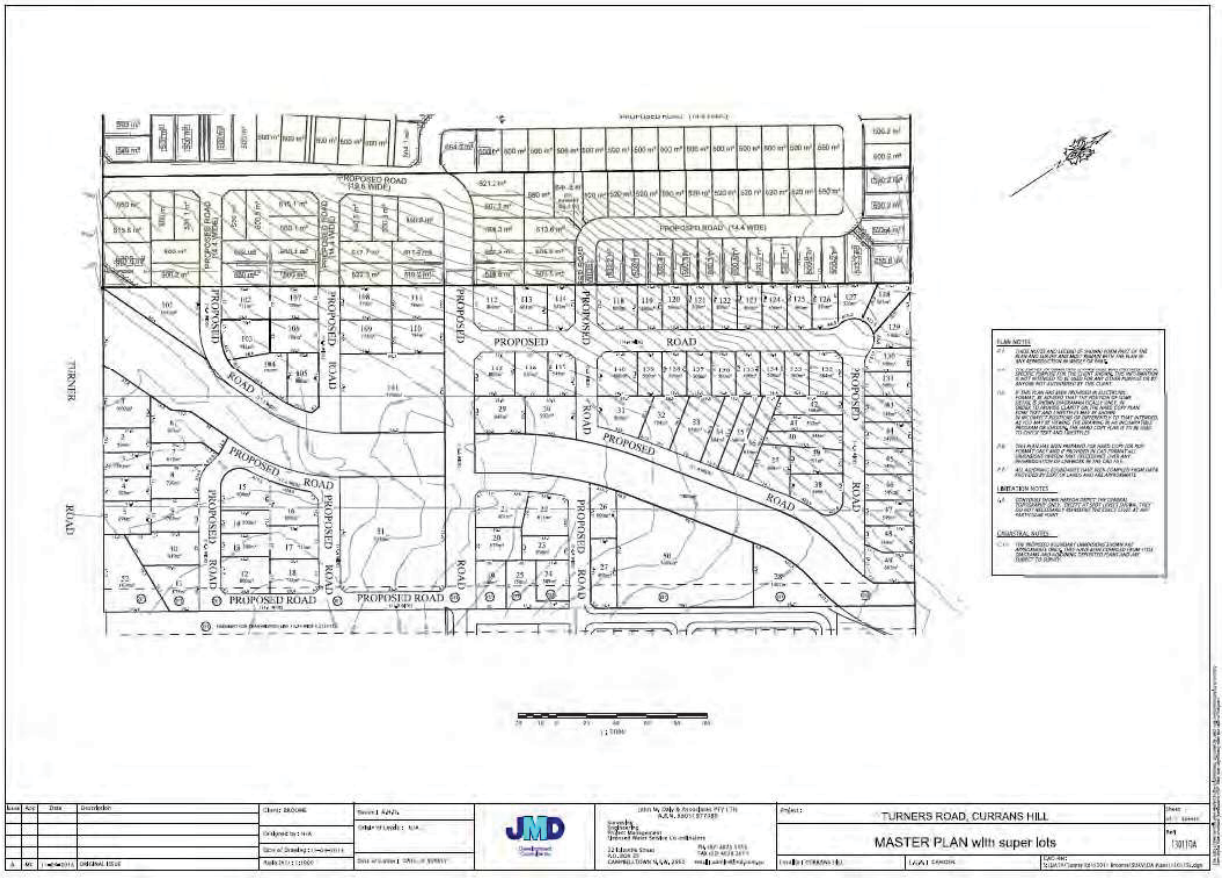
Jo MacDonald CHM 2001, *Archaeological survey for Abriginal Sites, proposed extension area to Manooka Valley rural residential area subdivision*, Curran Hill, NSW.

Jo McDonald CHM 2007, Archaeological investigation of the Turner Road and Oran Park Precincts within the South West Growth Centre, Report to APP on behalf of the Growth Centres Commission and Camden City Council

Kelleher Nightingale Consulting. 2012, Catherine Fields (part) Precinct South West Growth Centre. Aboriginal Heritage Assessment:: Prepared for Valad Development Management and Department of Planning and Infrastructure.

© ECO LOGICAL AUSTRALIA PTY LTD

Appendix A : Proposed layout



Appendix B : AHIMS search results

Included in separate file, not suitable for public exhibition

© ECO LOGICAL AUSTRALIA PTY LTD

ecological AUSTRALIA

HEAD OFFICE
Suite 2, Level 3
668-672 Old Princes Highway
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

SYDNEY
Level 6
299 Sussex Street
Sydney NSW 2000
T 02 8536 8650
F 02 9264 0717

ST GEORGES BASIN
8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA
Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

NEWCASTLE
Suites 28 & 29, Level 7
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA
5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE
92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

MUDGEE
Unit 1, Level 1
79 Market Street
Mudgee NSW 2850
T 02 4302 1230
F 02 6372 9230

PERTH
Suite 1 & 2
49 Ord Street
West Perth WA 6005
T 08 9227 1070
F 08 9322 1358

WOLLONGONG
Suite 204, Level 2
62 Moore Street
Austinmer NSW 2515
T 02 4201 2200
F 02 4268 4361

GOSFORD
Suite 5, Baker One
1-5 Baker Street
Gosford NSW 2250
T 02 4302 1220
F 02 4322 2897

DARWIN
16/56 Marina Boulevard
Cullen Bay NT 0820
T 08 8989 5601
F 08 8941 1220

BRISBANE
Suite 1 Level 3
471 Adelaide Street
Brisbane QLD 4000
T 07 3503 7191
F 07 3854 0310

1300 646 131
www.ecoaus.com.au

Annexure "F"
Traffic Impact Assessment

DRAFT

TRAFFIC IMPACT AND ACCESS ASSESSMENT

FOR

PROPOSED STAGE 2
69 LOT RESIDENTIAL REZONING

AT

NO. 187. 195 & 203

TURNER ROAD CURRANS HILL

Ref. 15097r3

June 2015
Revised November 2019

Prepared By

TRANSPORT & URBAN PLANNING PTY LTD
Traffic Engineering, Transport Planning
Road Safety & Project Management Consultants
5/90 Toronto Parade
P.O. Box 533
SUTHERLAND NSW 2232
Tel: (02) 9545-1411
Fax: (02) 9545-1556
Email: mick@transurbanplan.com.au

CONTENTS

1.0 INTRODUCTION **1**

2.0 THE SITE AND ZONING **2**
2.1 Site Location 2
2.2 Site Description 2
2.3 Existing Development 2
2.4 Adjoining Development 2
2.5 Zoning 2
2.6 Access 3

3.0 DEVELOPMENT PROPOSAL **4**
3.1 Development Subdivision 4
3.2 Road Layout and Guideline Standards 4
3.3 Subdivision Access 6
3.4 Parking 7
3.5 Pedestrian and Cycleway Facilities 7
3.6 Public Transport 8

4.0 EXISTING TRAFFIC CONDITIONS **9**
4.2 Access Roads 9
4.2 Daily Traffic Flows 9
4.2.2 Peak Hour Volumes 10
4.3 Service Levels and Amenity 11
4.4 Road Safety 11

5.0 TRAFFIC ASSESSMENTS **12**
5.1 Traffic Generation 12
5.2 Trip Distribution 12
5.3 Post Development Traffic Conditions 13
5.4 Traffic Impacts and Level of Service 13
5.4.1 Narellan Road and Tramway Drive 15

6.0 SUMMARY AND CONCLUSIONS **16**

FIGURES

Figure 1 Site Location
Figure 2 Site Location

1.0 INTRODUCTION

This report has been prepared as a Traffic Impact Assessment on behalf of Turner Road Developments and Ken and Lynne Broome to accompany a rezoning application in respect of a proposed 69 lot residential subdivision to be located off Turner Road at Currans Hill.

The existing zoning permits 63 lots ie. 6 lots less than this proposal.

This report supports the planning to adjust the zoning which currently allows 63 single lots within stage 2 of the residential subdivision to 69 residential allotments accessed from New Market Street and Ascot Drive to the east at one midblock new intersection locations.

This study has been prepared in accordance with the aims and objectives of State Environmental Planning Policy Infrastructure 2007 (formerly SEPPII) and in accordance with the guidelines and procedures for traffic generating developments as prepared by the Roads and Maritime Services (RMS) of NSW and with reference to with the provisions of Camden Council DCP 2011.

This report considers the following matters:

- The subdivision and road layouts
- Cycleway and pedestrian access
- Public transport provisions
- Traffic Generation
- Vehicular access to New Market Street and Geraldton Drive
- Future traffic impacts

This study is based on the Masterplan of the land prepared by John M Daly and Associates Pty Limited dated October 2019 and identified as Drawing No. 14194E13

The Masterplan includes the lots approved under Camden Council DA525/2017 as well as the proposed lot layout which is being considered as part of the current rezoning application.

2.0 THE SITE AND ZONING

2.1 Site Location

The subject land is located on the north side of Turner Road west of Stockmann Road within the Currans Hill residential precinct.

The location of the land in the local context is shown in **Figure 1** and **2** overleaf.

2.2 Site Description

In 2015 the subject land was described as Lots 36, 37 and 38 in DP28024. Recent subdivisions have resulted in Lots 37 and 38 being subdivided. Therefore, the subject land is now Lot 36 in DP28024 and Lot 105 in DP1210084.

2.3 Existing Development

The subject site consists of three adjoining lots (land parcels) to be ultimately subdivided to residential allotments. In 2015 the existing development on the site consisted of two larger rural residential homes, one of which has been removed since then. The remaining lands are mostly vacant.

2.4 Adjoining Development

The adjoining development consists of a mix of new residential housing to the east and south and older freestanding single level and 2 storey brick and tile residential dwellings on larger road parcels to the north and west within a newer 50km/h residential area.

Within the adjoining residential precinct to the east accessed via Ascot Drive, Newmarket Street, Gereladton Drive, Oaklawn Street, Caufield Street and Penola Street there are some 110 residential lots with 5 dwellings under construction (not occupied).

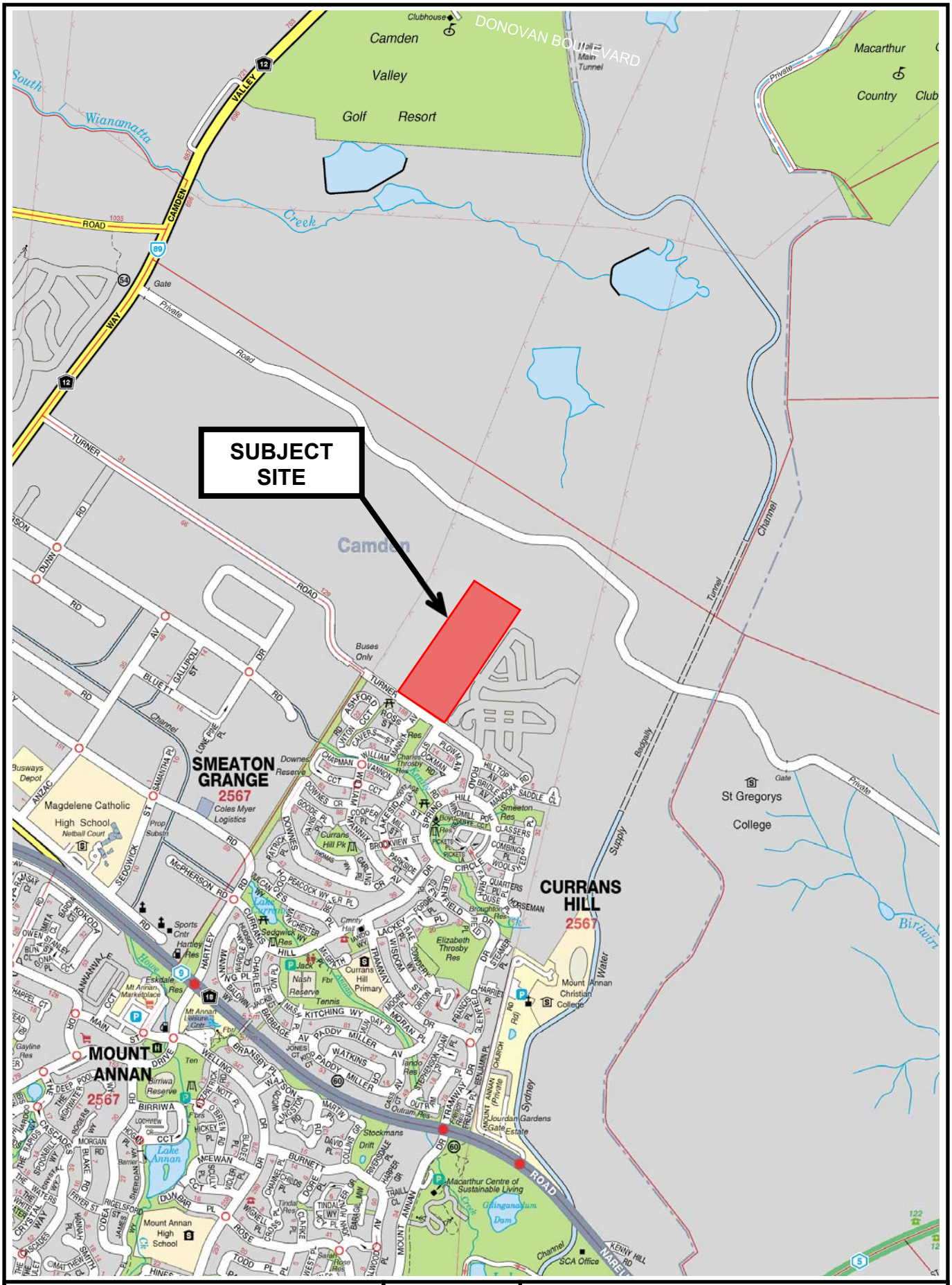
To the north and east of Turner Road via Ascot Drive a further 90 residential dwellings are also under construction.

2.5 Zoning

DA525/2017 allows approximately 40 new residential lots to be created in the subject lands and recently 4 lots were created along Turner Road.

The current zoning of these lands comprise of mixed zoning and includes R1 General Residential, E2 Environmental Conservation and E4 Environmental Living. The residential subdivision of land is permissible within the R1 and E4 zoning; however, residential development is a prohibited use within the E2 zoning.

Development that is permissible with consent in the E2 zone is limited to environmental protection works; flood mitigation works; recreation areas; roads; and water reticulation systems. While the construction and provision of roads within this zone is permissible with consent, the subdivision of land for future residential purposes is prohibited in the E2 zone and cannot be supported by Council.



TRANSPORT AND URBAN PLANNING

TRAFFIC, TRANSPORT & PROJECT MANAGEMENT CONSULTANTS

5/90 Toronto Parade, Sutherland NSW 2232
Phone 02 9545 1411 Fax 02 9545 1556

admin@transurbanplan.com.au

N

NOT TO SCALE

FIGURE 1

PROPOSED SUBDIVISION
187, 195 & 203 TURNERS RD, CURRANS HILL

SITE LOCATION

JOB NO. 15097



TRANSPORT AND URBAN PLANNING

TRAFFIC, TRANSPORT & PROJECT MANAGEMENT CONSULTANTS

5/90 Toronto Parade, Sutherland NSW 2232
Phone 02 9545 1411 Fax 02 9545 1556

admin@transurbanplan.com.au

N

NOT TO SCALE

FIGURE 2

PROPOSED SUBDIVISION
187, 195 & 203 TURNERS RD, CURRANS HILL

SUBJECT SITE

JOB NO. 15097

2.6 Access

Access to the area is generally from Narellan Road via Hartley Road and the roundabout junction at Currans Hill Drive.

Circuitous access is also available from Camden Valley Way via Anderson Road through the Smeaton Grange Industrial Area. No motor car access is available to Camden Valley Way via Turner Road.

3.0 DEVELOPMENT PROPOSAL

3.1 Development Subdivision

The development lies within the Manooka Valley and involves the Stage 2 subdivision of the land to accommodate 69 residential allotments with a minimum lot area of 500m^2 (over two land parcels) as shown in **Appendix 1** for future development, road construction, drainage, landscaping and associated site works, including construction and embellishment of a riparian zone as shown in the subdivision master plan prepared by John M Daly and Associates Pty Ltd attached as **Appendix 2**. As we further understand Stage 1 for 40 lots already has DA approval.

We understand development applications for the multiple land parcels will be lodged with each other over a number of stages.

3.2 Road Layout and Guideline Standards

The subdivision layout has been designed generally in accord with AMCORD Guidelines and Camden Council's DCP 2011 Part C for new residential subdivisions.

Generally the road widths should comply with the provision of the Camden DCP 2011. However road widths of 12.5m are proposed adjacent to the riparian corridor compared to the 14m to 14.4m widths specified in the DCP.

A hierarchical road network is essential to maximise road safety, residential amenity and legibility. Each local access road in the subdivision will serve a distinct set of residential functions and has been designed accordingly. The design will convey to motorists the predominant low volume, low speed function of the road.

Within the subdivision each access road will reflect its role in the road hierarchy by its visual appearance and related physical design standards. All new access roads should differ in alignment and design standard according to the volume they are intended to carry, the desirable traffic speeds and other factors.

The number of turning movements at intersections or junctions that a visitor is required to undertake to reach a particular address within the development will be minimised.

Low speeds are desirable in lightly trafficked streets to protect pedestrians, cyclists and allow them to share the street with vehicles.

Future bus routes serving the area should be within acceptable walking distance (400 metres) of all dwellings.

The aims of the proposed local road system within the subdivision are to achieve:

- Convenient and safe access to all allotments for pedestrians, vehicles and cyclists.
- Safe, logical and hierarchical transport linkages with existing street system.
- Appropriate access for emergency and service vehicles.
- A quality product that minimises maintenance costs.
- A convenient way for public utilities.
- An opportunity for street landscaping.
- Convenient on and off street parking for visitors.

AMCORD recommends the following standards for the various classes of roads in new subdivisions.

TABLE 1

AMCORD RECOMMENDED GUIDELINES

Road Classification	Recommended Pavement Width	Max. Flow veh/day	Max. Road Length	Max. Dwellings Served
Access Place	3.5 – 3.7 metres	300	100 metres	30
Local Access Streets (A)	5.0 – 5.5 metres	1000	250 metres	100
Local Access Streets (B)	5.5 or 7.0 metres	2000	N/A	200
Collector Road	7.0 – 7.5 metres	3000	N/A	N/A

NB. Any roads that are bushfire affected will contain 8m wide pavement.

These roads should in terms of amenity and road safety afford the following environmental capacity/performance standards.

Road Class	Road Type	Desirable Max. Speed (km/hr)	Desirable Max. Peak Hour Volume (veh/hr)
Local	Accessway (with footpath) Street Street Street	25 40 40	100 200 environmental goal 300 maximum
Collector	Street Street	50 50	300 environmental goal 500 maximum

Past analysis of traffic volumes for new residential sub divisions has focussed on allotting appropriate maximum traffic volumes for new areas. *The Australian Model Code for Residential Development,* (1990), cites daily volume maximum of 1,000-2,000 veh/day for different types of local access streets, and 6,000 veh/day for trunk collector streets. This subject is discussed further in Section 7 of these guidelines.

Environmental Capacity for residential streets is best estimated by considering a range of differing perceptions and attitudes to traffic impacts in a particular area. The environmental expectations of residents often varies significantly, even within the same district. It is accepted that the performance standard usually occurs at the top end of a range. While it can be argued that there is no particular threshold beyond which problems may emerge, this standard is subject to the same constraints as all other standards. Engineering standards are often based on concepts of good practice, with a concerted focus on safety factors. While it is generally accepted that a departure from this standard may be accommodated to a degree. Table 1 sets out the recommended Environmental Capacity performance standards now for residential precincts. This table relates to streets with direct access to residential properties.

The proposed intersections are generally located in such a way that:

- New Roads intersect at right angles;
- The landform allows clear sight distance on each of the approach legs of the intersection;
- The vertical grade lines at the intersection do not impose undue driving difficulties;

- The vertical grade lines at the intersection will allow for any direct surface drainage.

Adequate stopping and sight distances will be provided for horizontal and vertical curves at all intersections as follows:

- 40kph minimum stopping sight distance 30 metres
- 50kph minimum stopping sight distance 40 metres
- 60kph minimum stopping sight distance 55 metres

Source: AUSTROAD Guide to Traffic Engineering Practice 1992

3.3 Subdivision Access

Initially all vehicle access to the Stage 1 subdivision will be via Ascot Drive and New Market Street to the east. In the longer term a further link to Turner Road will be provided over the most western land parcel no. 3 (refer subdivision masterplan).



Photo 1
Proposed Access from Geraldton Avenue



Photo 2
Proposed Access from Ascot Drive

In addition, advice (to date), from Council, indicates that:

- There will be no link via Turner Road to Camden Valley Way or the Smeaton Grange area; and

- There will be no link to the Gregory Hills residential area, to the north, from Manooka Valley.

3.4 Parking

Camden Council's Off Street car parking policy DCP 2011 Part B suggests on-site car parking be provided for larger residential dwellings at two (2) spaces per dwelling.

Future on-site car parking will be proposed for the various components of the subdivision in accordance with Council's car parking policy and the relevant codes.

3.5 Pedestrian and Cycleway Facilities

It is proposed that a shared pathway be extended along the riparian corridor and connected to the existing shared pathway in Gregory Hills promoting pedestrian activity throughout the entire Currans Hill and Gregory Hills district, including:

- Pedestrian paths are to be provided for pedestrian movement through the open spaces in Manooka Valley in the riparian corridor and connected into the wider Currans Hill area.

- Bridges, boardwalks and other landscape devices are to be used to limit pedestrian access into areas of high vegetation sensitivity, and to provide views of special interest points and the broader landscape.

- Dedicated cycle routes will be provided in accordance with the DCP.

3.6 Public Transport

In a broader regional context the future subdivision can be serviced by public transport comprising buses and taxis. Regular bus services are provided to Campbelltown, Narellan and Camden, Oran Park and Liverpool.

Bus services are provided by (local) private bus operators who provide regular services for the general public as well as school bus services.

- The layout of bus routes are shown in the Manooka Valley Masterplan.

- Bus route shall be extended into Manooka Valley along the Collector Road, in order to increase the number of dwellings within a reasonable walking distance to public transport.

Taxis are available in Narellan and Camden between the adjoining towns for people who choose not to use buses or who need to get from their residence to the shops or the railway station at Campbelltown.

Future release areas and land subdivisions can affect the delivery of public transport services by providing more people and good traffic circulation routes encouraging private bus operators to extend and increase the frequency of services.

4.0 EXISTING TRAFFIC CONDITIONS

4.2 Access Roads

The main access roads serving the Currans Hill Area are Narellan Road (north and south) and Camden Valley Way (east – west). Both routes are multi lane divided state roads. Access into Currans Hill from Narellan Road is via the Hartley Road traffic signals. Secondary, circuitous access to Camden Valley Way is also available via the Anderson Road traffic signals and through the Smeaton Grange industrial area.

Currans Hill Drive to Turner Road is an undivided two way two lane residential collector road, 13.0 metres wide kerb to kerb, with a marked parking lane either side. Currans Hill Drive and Ascot Drive are speed zoned to 50km/h. Newmarket Street and Geraldton Drive are both two way 2 lane local access roads with roll kerbs, linking to Ascot Drive and servicing the adjoining newer and adjoining residential subdivision.

4.2 Daily Traffic Flows

Recent (2015) RMS AADT daily vehicle counts on Narellan Road and Camden Valley Way indicate average daily passenger vehicle equivalents are as follows:

- Narellan Road east of Hartley Drive - 62,000 veh/day
- Camden Valley Way south of Cobbitty Road - 31,500 veh/day

Average daily traffic volumes on Hartley Road, at Narellan Road based on our original **Appendix 3** traffic counts are projected at 17,000 veh/day.

Average daily traffic volumes on Currans Hill Drive, Turner Road, Ascot Drive and Tramway Drive are shown below.

TABLE 4.1

EXISTING AVERAGE 5 DAY VOLUMES - 2018

Location	EB	85th% km/h	WB	85th% km/h	Two way
Currans Hill Drive east of Tramway Drive	2885	56	2760	56.9	**5645**
Turner Road west of Ascot Drive	285	40.4	268	42.4	**555**
	WB	**85th% km/h**	**SB**	**85th% km/h**	**Two way**
Ascot Drive at Turner road	286	53.8	324	51.4	**610**
Tramway Drive at Currans Hill Drive	1918	52.2	1834	53.5	**3752**

4.2.2 Peak Hour Volumes

Current AM and PM peak hour volumes on Narellan Road, Hartley Road and Ascot Drive are summarised as follows:

TABLE 4.2

PEAK AM AND PM VOLUMES VEH/HOUR

	Narellan Road at Hartley Road					
AM	EB	4389	WB	3012	**2 Way**	**7401**
PM	EB	4246	WB	5079	**2 Way**	**9325**
	Hartley Road at Narellan Road					
AM	NB	910	SB	676	**2 Way**	**1586**
PM	NB	730	SB	1188	**2 Way**	**1918**
	Ascot Drive at Turner Road					
AM	NB	30	SB	5	**2 Way**	**35**
PM	NB	10	SB	10	**2 Way**	**20**

More recent 2018 traffic volume and data analysis for Currans Hill Drive, Turner Road and Ascot Drive and Tramway Drive is shown below.

TABLE 4.3

EXISTING PEAK HOUR VOLUMES AND SERVICE LEVELS - 2018

Location	**Time**	**Vehicles per Hour Direction/LOS**					
		EB	**LoS**	**WB**	**LoS**	**Two Way**	**LoS**
Currans Hill Drive east of Tramway Drive	6-7am	181	A	52	A	233	A
	7-8am	251	B	75	A	326	A
	8-9am	294	B	130	A	424	B
	3-4pm	162	A	307	B	469	B
	4-5pm	197	A	307	B	504	B
	5-6pm	190	A	348	B	538	B
Turner Road West of Ascot Drive	6-7am	11	A	14	A	25	A
	7-8am	14	A	15	A	29	A
	8-9am	30	A	26	A	56	A
	3-4pm	25	A	29	A	54	A
	4-5pm	29	A	24	A	53	A
	5-6pm	31	A	25	A	56	A

	Time	**NB**	**LoS**	**SB**	**LoS**	**Two Way**	**LoS**
Ascot Drive at Turner Road	6-7am	7	A	23	A	30	A
	7-8am	10	A	37	A	47	A
	8-9am	14	A	36	A	50	A
	3-4pm	24	A	17	A	41	A
	4-5pm	28	A	19	A	47	A
	5-6pm	38	A	24	A	62	A
Tramway Drive at Currans Hill Drive	6-7am	84	A	120	A	284	A
	7-8am	127	A	185	A	312	A
	8-9am	235	B	201	B	436	B
	3-4pm	197	A	135	A	332	A
	4-5pm	168	A	147	A	315	A
	5-6pm	185	A	167	A	352	A

NB: Level of service is based on RMS Traffic Generation Guidelines 2002, Table 4.4.

Quite clearly the above table indicates that during peak times 6-9am and 3-6pm Monday to Friday, the existing four access roads recently surveyed operate at a Level of Service B or better.

NB: LOS B indicates a zone of stable traffic flows mid block free flow where drivers are free to choose their desired speed and manoeuvre within the street stream.

Table 4.6 of the RMS Guidelines indicates that the local streets (Ascot Drive and Turner Road) in residential precincts should operate with a maximum peak flow of up to 300veh per hour and collector roads, Currans Hill Drive and Tramway Drive can operate with peak volumes up to 500 veh per hour.

4.3 Service Levels and Amenity

Existing traffic service levels in Turner Road, Ascot Drive and Currans Hill Drive can be described as very good i.e. low traffic volumes and 85th% free flow speed around 55km/h.

In keeping with the RMS and AMCORD Environmental Capacity Performance Standard for local residential streets of less than 200veh.hr as an environmental goal and up to 300veh/hr as a maximum before amenity is compromised. Ascot Drive and Turner Road currently has a relatively high level of traffic amenity.

Hartley Road from Narellan Road to Currans Hill Drive is a major collector route with a poor level of services in peak times due to excessive queueing and vehicle delays.

4.4 Road Safety

The existing level of road safety along Ascot Drive, Turner Road, Newmarket Street and Geraldton Drive is considered to be acceptable due to good sight distances, low traffic volumes, moderate free flow traffic speeds and minimal traffic, pedestrian and cyclist activity to/from adjoining residential properties.

A review of the RMS PC crash records for the 3 year period to mid 2018 did not reveal any adverse accident history for these local roads.

5.0 TRAFFIC ASSESSMENTS

5.1 Traffic Generation

The propose rezoning (the subject of this application) creates an additional 6 dwellings to a total of up to 69 dwellings with one dwelling per lot.

RMS recommended traffic generation per freestanding residential household is between 8 and 9 movements per day. The peak period is normally 0.9 movements per dwelling per hour and the AM peak period represents only 7% of the daily total.

Based on the above recommended RMS rates we would suggest future traffic generation levels for 69 residential allotments realising 75 dwellings including 10 dual occupancies as follows:

- Daily vehicle trips (69 dwelling houses x 9) = +621 trips daily

- Weekday peak hour vehicle trips (69 dwelling houses x 0.9) = +62 trips

In addition a further 172 peak hour trips can be expected from the existing residential lands to the east (200 lots) and Stage 1 approval (40 lots).

Whilst it is appreciated that the future traffic situation in the subject subdivision is not necessarily an extension of existing low volume conditions, we believe the following factors are relevant in indicating a worst case trip generation scenario for the proposal:

- Car ownership rates are likely to increase in line with those for new middle income subdivision, housing young couples and families; and

- As a worst case the morning and evening peak hour is estimated at 10% of the daily rate.

5.2 Trip Distribution

RMS Guidelines also suggest that a distribution of peak hour arrival and departure journeys be undertaken to evaluate the traffic impacts on the adjoining road system. Normally as 80% outbound in the AM peak and 20% inbound and the reciprocal in the PM peak.

Given the limited access to the west via Turner Road, we have assumed all future traffic enter and exit the area from Narellan Road via Currans Hill Road.

The peak hour distribution of traffic to/from the site will be ultimately influenced by future traffic conditions, levels of service and vehicles origins/destinations regionally.

For the purpose of distributing the projected traffic generation to the existing road network and ultimately determining the extent of any future traffic impacts on the adjoining intersections, we have displaced the estimated AM and PM traffic generation (62 trips) in a proportion north and south of the site as follows:

TABLE 5.1

STAGE 2 - PEAK HOUR TRAFFIC DISTRIBUTION

Origins and Destinations	AM Peak			PM Peak		
	In Trips	Out Trips	Total	In Trips	Out Trips	Total
Narellan and Camden	2	7	9	7	2	9
M5, Macarthur, Campbelltown (Narellan Rd)	4	16	20	16	4	20
Oran Park and Liverpool (Camden Valley Way)	4	17	21	17	4	21
Bringelly and Penrith (Old Northern Road)	2	10	12	10	2	12
Total Trips	**12**	**50**	**62**	**50**	**12**	**62**

The above Stage 2 traffic distribution equates to an additional 50 outbound and 12 inbound trips on the adjoining access roads during the (Monday-Friday) AM peak hour with a reciprocal flow during the PM peak.

NB. This does not include the 172 peak hour trips, still to be fully realised, from the existing adjoining lands under development.

5.3 Post Development Traffic Conditions

Currently Ascot Drove, Geraldton Drive and Newmarket Street are under utilised low volume local access roads. The future development of the subject and adjoining land will increase both daily and peak hour traffic volumes but not beyond any unacceptable threshold levels.

The ease at which traffic can enter or leave the development site will be directly related to future gaps in opposing traffic flows along the adjoining access roads and at the Hartley Road/Narellan Road traffic signals.

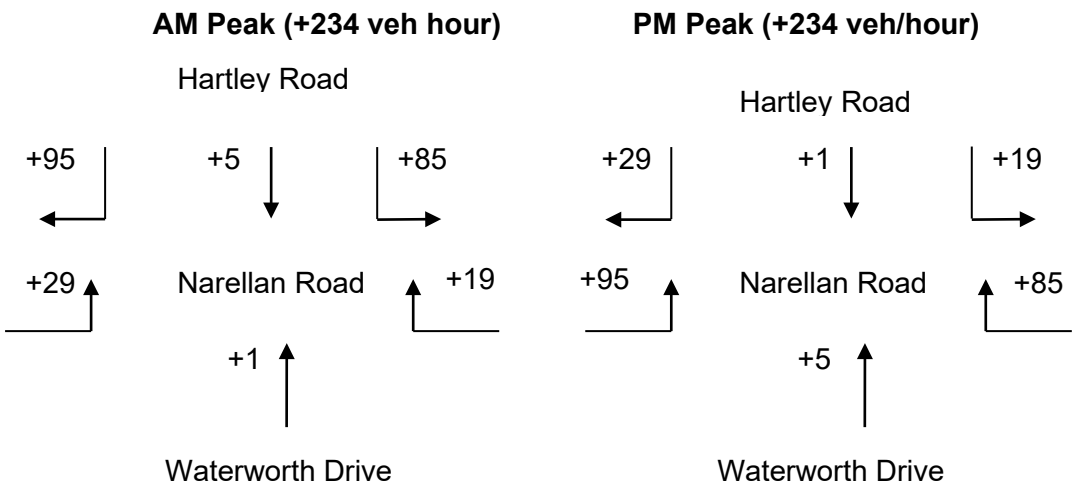
Additional traffic movements to/from the Stage 2 subject land parcels are likely to be around +62veh/hr. The total two way flow of traffic on Ascot Drive at Turner Road will increase to about or approximately 1 vehicle every 50 seconds on average.

In our view, it is unlikely the existing traffic service levels, road safety or amenity threshold will be compromised by the additional traffic volumes or the interaction of traffic entering and exiting the two new (mid block) ‘Tee’ intersections as proposed at Ascot Drive, Newmarket Street or Geraldton Drive.

5.4 Traffic Impacts and Level of Service

The likely post development traffic impacts at Geraldton Drive and Newmarket Street are not likely to be significant however for the purpose of evaluating the likely traffic impact at the Hartley Road and Narellan Road intersection we have run SIDRA models for the existing and post development AM and PM scenarios, assuming all new traffic only to utilise Hartley Road to access and egress the Currans Hill area.

The additional post development peak hour traffic volume for the subject lands (+62 trips) plus adjoining land under development (172 trips) have been assigned to the existing Hartley Road intersection as follows:



A revised summary of the SIDRA output data is shown in Table 5.2 below.

TABLE 5.2

NARELLAN ROAD & HARTLEY ROAD
EXISTING SIGNAL OPERATION – (AT 140 SECOND CL)

Criteria	AM Peak		PM Peak	
	Intersection	Hartley Road	Intersection	Hartley Road
Level of Service	E	D	F	F
Degree of Saturation	0.925	0.881	1.270	1.083
Average Vehicle Delay Hartley Rd	53.8	54.8	103.5	137.3

TABLE 5.3

NARELLAN ROAD & HARTLEY ROAD – (AT 140 SECOND CL)
PROJECTED POST DEVELOPMENT SIGNAL OPERATION

Criteria	AM Peak		PM Peak	
	Intersection	Hartley Road	Intersection	Hartley Road
Level of Service	E	D	F	F
Degree of Saturation	0.941	0.911	1.278	1.091
Average Vehicle Delay Hartley Rd	55.3	56.2	105.7	139.4

NB: This output also includes +172 future trips from the adjoining precinct under construction.

In the AM peak the additional post development traffic will not increase the intersection LoS with an average vehicle delay increasing by around 2 seconds per vehicle. In the PM peak intersection LoS F is unchanged with average vehicle delay increased by around 2 sec per vehicle.

In both the AM and PM peak, with Stage 2 development, average vehicle delays in Hartley Road can be expected to increase by around 2 seconds per vehicle.

In reality, and keeping with the RMS arterial road co-ordination strategy, the LoS on Narellan Road and rate of delay is likely to be better than LOS F due to the favourable signal co-ordination bias to Narellan Road but delay and queue lengths in the side streets (i.e. Hartley Road and Waterworth Drive) may be marginally worse.

Alternatively if access to/from the area was available via Turner Road to Camden Valley Way or through to Gregory Hills to Camden Valley Way the likely post development peak hour traffic impacts at Hartley Road and Narellan Road would reduce significantly (by up to 63%).

5.4.1 Narellan Road and Tramway Drive

Attached at **Appendix 3** are recent AM/PM peak hour traffic counts undertaken for this assessment. Peak hour SIDRA traffic modelling of this major signalised intersection for existing and post development traffic conditions.

Existing peak hour traffic signal operation and service levels are summarised as follows:

TABLE 5.4

EXISTING CONDITIONS – TRAFFIC SIGNALS
NARELLAN ROAD AND TRAMWAY DRIVE

Intersection	AM Peak	PM Peak
Level of Service	C	D
Degree of Saturation	0.903	0.983
Average Movement Delay	34.6 (sec)	53.2 (sec)

At a 150 second cycle time the intersection operates at a congested but, RMS acceptable, LoS C in the AM and LoS D in the PM peaks.

Assuming all post DA peak hour traffic arising from the proposed subdivision, i.e. 62 peak hour additional trips, approaches and leaves the area via Tramway Drive at Narellan road to Currans Hill Drive.

We have re-run our SIDRA models for the following outputs, with 12 inbound + 50 outbound AM trips and reciprocal PM traffic movements as follows.

TABLE 5.5

POST DA CONDITIONS – TRAFFIC SIGNALS
NARELLAN ROAD AND TRAMWAY DRIVE

Intersection	AM Peak	PM Peak
Level of Service	C	D
Degree of Saturation	0.921	0.983
Average Movement Delay	35.3 (sec)	55.4 (sec)

The post development traffic impacts do not alter AM/PM service levels at the intersection and increase average intersection movement delay times per vehicle by less than 1 second AM and 2 seconds in the PM peak.

6.0 SUMMARY AND CONCLUSIONS

Rezoning proposes an additional 6 lots ie. the total lots in Stage 2 increases from 63 to 69 lots.

It is our view that the rezoning to allow 69 lots in Stage 2 as opposed to the existing potential of 63 lots represents an appropriate use of the site economically from both a traffic planning and road safety viewpoint. The conceptual design measures incorporated therein are intended to minimise any affect on adjoining lands. The proposed access treatments to the lands from the state road network are minimal and should not impede the operation, efficiency or safety of the adjoining local road system.

The projected AM and PM peak hour traffic generation based on RMS Guidelines, is +62 peak vehicle trips up from 57 with 63 lots.

The proposed pavement width will allow vehicles to proceed safely at the operating speed (i.e. 40-50 km/h) intended for that level of road in the local and internal network and with only minimal delays in the peak period.

A comprehensive network of on and off road pedestrian links is proposed.

The safety of pedestrians and cyclists where it is intended they use the carriageway will also be assured by providing sufficient width and reducing travel speeds.

The pavement widths and sight lines will also provide for unobstructed access to individual allotments. Motorists should be able to comfortably enter or reverse from an allotment in a single movement, taking into consideration the possibility of a vehicle being parked on the carriageway opposite the driveway.

In accord with RMS traffic generation rates the full development of all allotments (Stage 1 and Stage 2) is likely to result in an additional 234 peak hour trips along Ascot Street. These 234 vehicle movements represents significant increase over existing low volumes during the AM/PM peak hour. However, combined future traffic volumes (i.e. existing plus projected) are still likely to result in two way totals of around 300 vehicles per hour, which is in keeping with the recommended RMS/AMCORD threshold for collector roads.

Importantly, this rezoning application to create 6 additional lots, ie. up to +6 peak hour trips in insignificant when viewed in the context of all Stage 1 and 2 peak traffic projections.

The impact of the additional traffic (6 peak hour trips) generated by this proposal should not diminish the acceptable level of service to existing traffic flows on Ascot Street or Currans Hill Drive in the short term and in the broader sense have a marginal impact on other major road or intersections on the adjacent road network given the existing poor intersection service levels accessing Narellan Road.

Existing local road safety and traffic amenity should not be compromised by the additional traffic likely to arrive and depart the residential development.

The proposed access to/from Ascot Drive, Geraldton Drive and Newmarket Street is in keeping with the intent and function of these routes within the residential precinct. Generally traffic service levels and road safety on these streets will not be adversely impeded by either traffic volumes or vehicle speeds.

Longer term pedestrian and bicycle facilities will be provided in accordance with the DCP throughout existing Currans Hill area.

On site residential parking for each allotment so as not to obstruct through traffic as described in this report is considered to be reasonable and in accordance with Council's residential code.

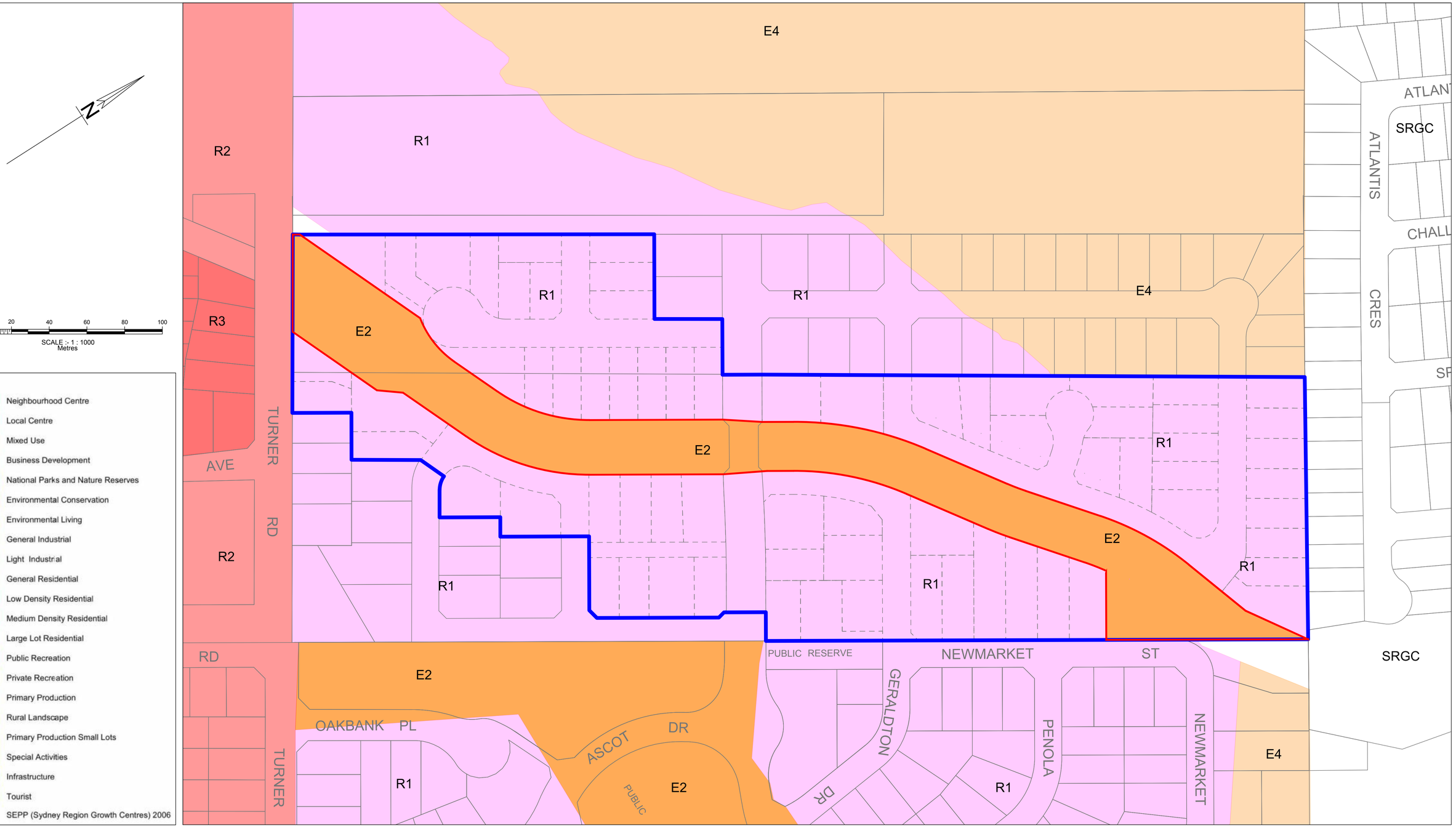
Recommendations

Our findings are that the proposed rezoning for future residential development of this land as proposed above, will not have any detrimental impact on surrounding land uses or the community, and is in keeping with the adjoining zoning and development within the Currans Hill residential precinct.

Conversely, there may be benefits for the local community and traffic conditions generally in that the development of this land to satisfy the demands for residential sites in accordance with Council's residential development strategy may negate the economic and social demand for similar such residential sub divisions in other less desirable locations.

On the basis of these findings, the traffic modelling and assessments made in sections of this report, it is **recommended** that Camden Council approve this proposed rezoning for which will increase the expected number of residential lots within Stage 2 of the development from 63 to 69. It is expected that following the rezoning being approved, a DA will be lodged for Stage 2 almost immediately.

APPENDIX 1



Issue	App	Date	Description
C	S.G.	16-10-2019	LOTS AND SHARED PATHWAYS AMENDED - LOT SIZING PLANS REMOVED
B	S.G.	20-09-2019	REZONING PLANS WITH UPDATED LOTS & DRAINAGE RESERVE BOUNDARY
A	T.H.	22-08-2018	REZONING PLANS COMBINED FOR PLANNING PROPOSAL

Client: TURNER ROAD ROAD DEVELOPMENTS P/L

Designed by : T.H.

Date of Drawing : 22-08-2018

Ratio (A1) : 1:2000

Datum : AHD

Origin of Levels :

Date of Survey :

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators
32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560
PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

Sheet 1 of 4 sheets

TURNER ROAD PROPOSED ZONING PLAN

Ref: 14194E13

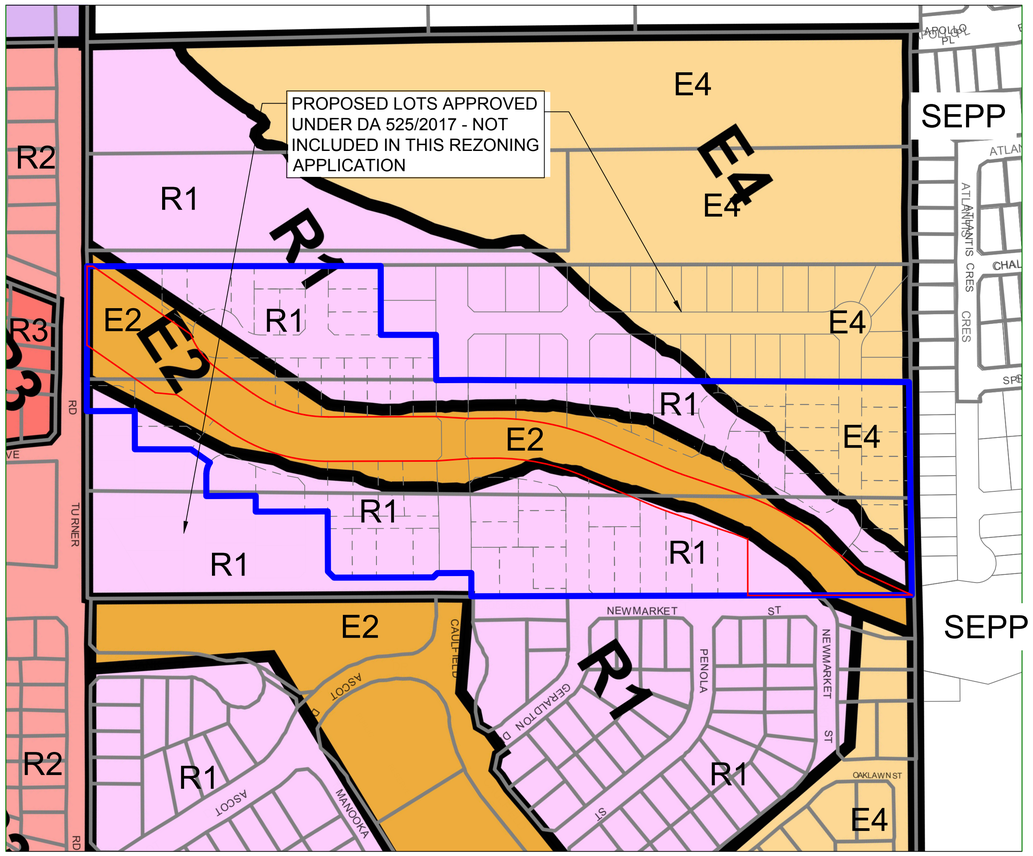
Locality : CURRANS HILL

L.G.A. : CAMDEN

CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EMW\ENG\CAD\E13 - PLANNING PROPOSAL\ZONING PLAN

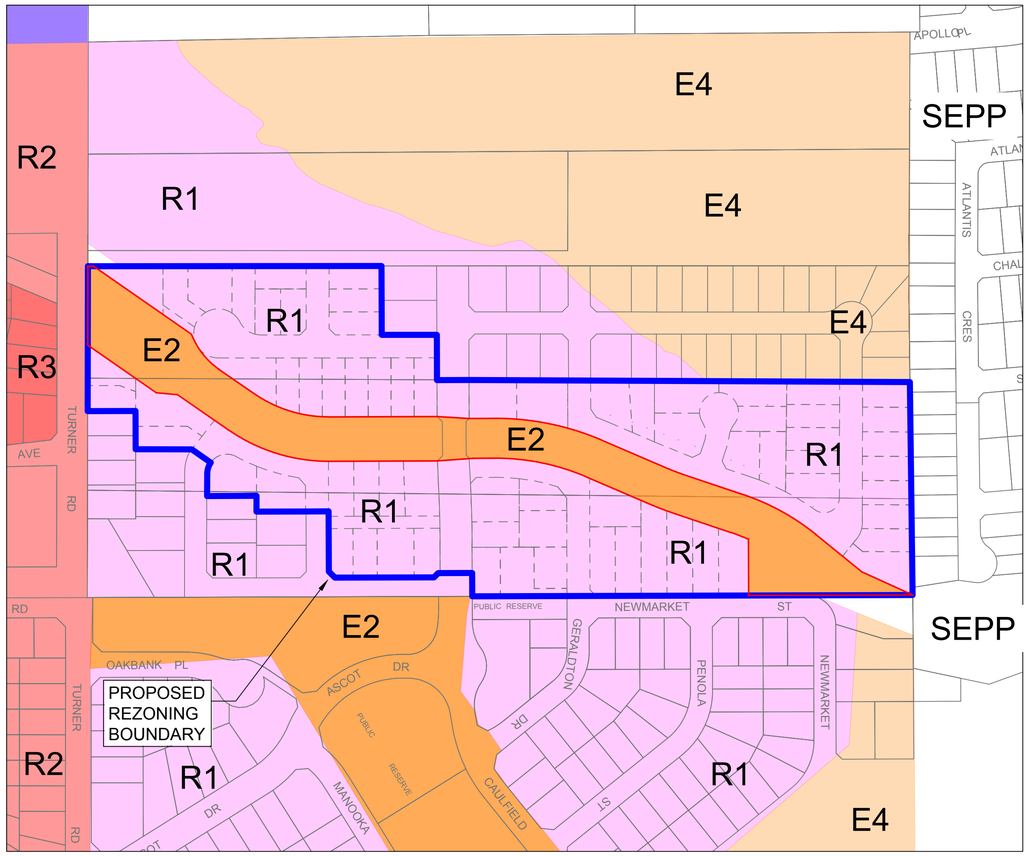
The ratio shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.

Zone	
B1	Neighbourhood Centre
B2	Local Centre
B4	Mixed Use
B5	Business Development
E1	National Parks and Nature Reserves
E2	Environmental Conservation
E4	Environmental Living
IN1	General Industrial
IN2	Light Industrial
R1	General Residential
R2	Low Density Residential
R3	Medium Density Residential
R5	Large Lot Residential
RE1	Public Recreation
RE2	Private Recreation
RU1	Primary Production
RU2	Rural Landscape
RU4	Primary Production Small Lots
SP1	Special Activities
SP2	Infrastructure
SP3	Tourist
SRGC	SEPP (Sydney Region Growth Centres) 2006



PLAN OF REZONING BOUNDARIES OVERLAID ON CAMDEN COUNCIL'S EXISTING LAND ZONING MAP - LZN_017

SCALE 1:2000



PLAN OF PROPOSED REZONING LAND ZONING MAP

SCALE 1:2000

SUMMARY OF AREAS*

LAND ZONING	EXISTING AREAS (SQM)**	NEW AREAS (SQM)
E2	26,650	17,533
E4	7,820	0
R1	42,290	59,227
TOTAL AREA	76,760	76,760

* ONLY AREAS WITHIN THE REZONING BOUNDARY HAVE BEEN COMPARED

** EXISTING AREAS BASED ON INTERPOLATION OF PDF VERSION OF EXISTING ZONING MAP IN AUTOCAD

DENOTES REZONING BOUNDARY

DENOTES PROPOSED E2 / R1 ZONING BOUNDARY

0 20 40 80 120 160 200

SCALE :- 1 : 2000
Metres

Issue	App	Date	Description
C	S.G.	16-10-2019	LOTS AND SHARED PATHWAYS AMENDED - LOT SIZING PLANS REMOVED
B	S.G.	20-09-2019	REZONING PLANS WITH UPDATED LOTS & DRAINAGE RESERVE BOUNDARY
A	T.H.	22-08-2018	REZONING PLANS COMBINED FOR PLANNING PROPOSAL

Client: TURNER ROAD ROAD DEVELOPMENTS P/L

Designed by : T.H.

Date of Drawing : 22-08-2018

Ratio (A1) : 1:2000

Datum : AHD

Origin of Levels :

Date of Survey :

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators

32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560

PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

Sheet 2 of 4 sheets

COMPARISON PLAN DETAILING THE PROPOSED CHANGES TO THE LAND ZONING MAP

Ref: 14194E13

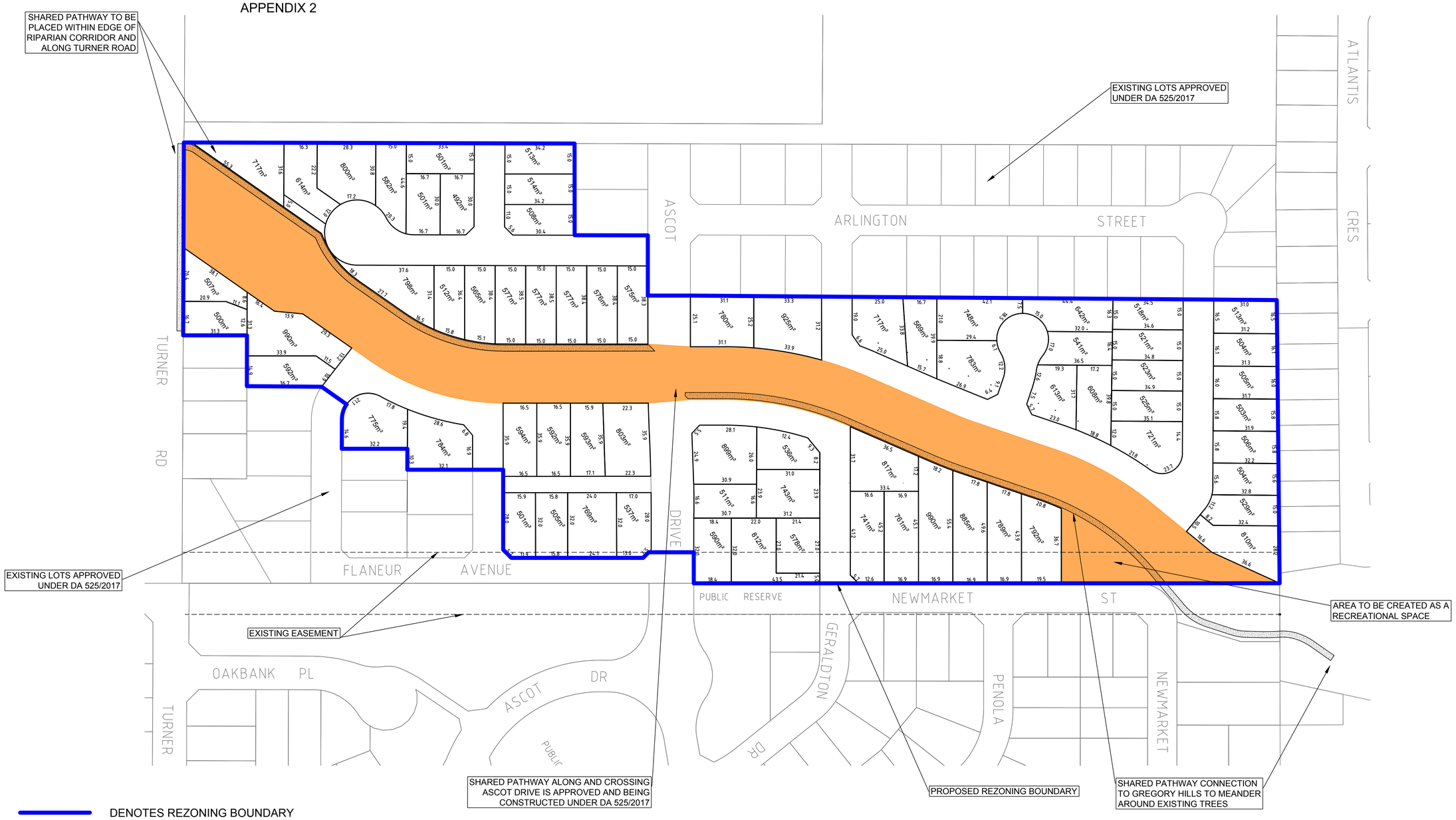
Locality : CURRANS HILL

L.G.A. : CAMDEN

CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EMW\ENG\CAD\E13 - PLANNING PROPOSAL\ZONING PLAN

The ratio shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.

APPENDIX 2



DENOTES REZONING BOUNDARY

DENOTES PROPOSED E2 BOUNDARY

0 20 40 60 80 100

SCALE :- 1 : 1000
Metres

Issue	App	Date	Description
C	S.G.	16-10-2019	LOTS AND SHARED PATHWAYS AMENDED - LOT SIZING PLANS REMOVED
B	S.G.	20-09-2019	REZONING PLANS WITH UPDATED LOTS & DRAINAGE RESERVE BOUNDARY
A	T.H.	22-08-2018	REZONING PLANS COMBINED FOR PLANNING PROPOSAL

Client: TURNER ROAD ROAD DEVELOPMENTS P/L

Designed by : T.H.

Date of Drawing : 22-08-2018

Ratio (A1) : 1:2000

Datum : AHD

Origin of Levels :

Date of Survey :

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators

32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560

PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

Sheet 3 of 4 sheets

TURNER ROAD STAGE 2 MASTERPLAN - WITH NEARMAP IMAGE

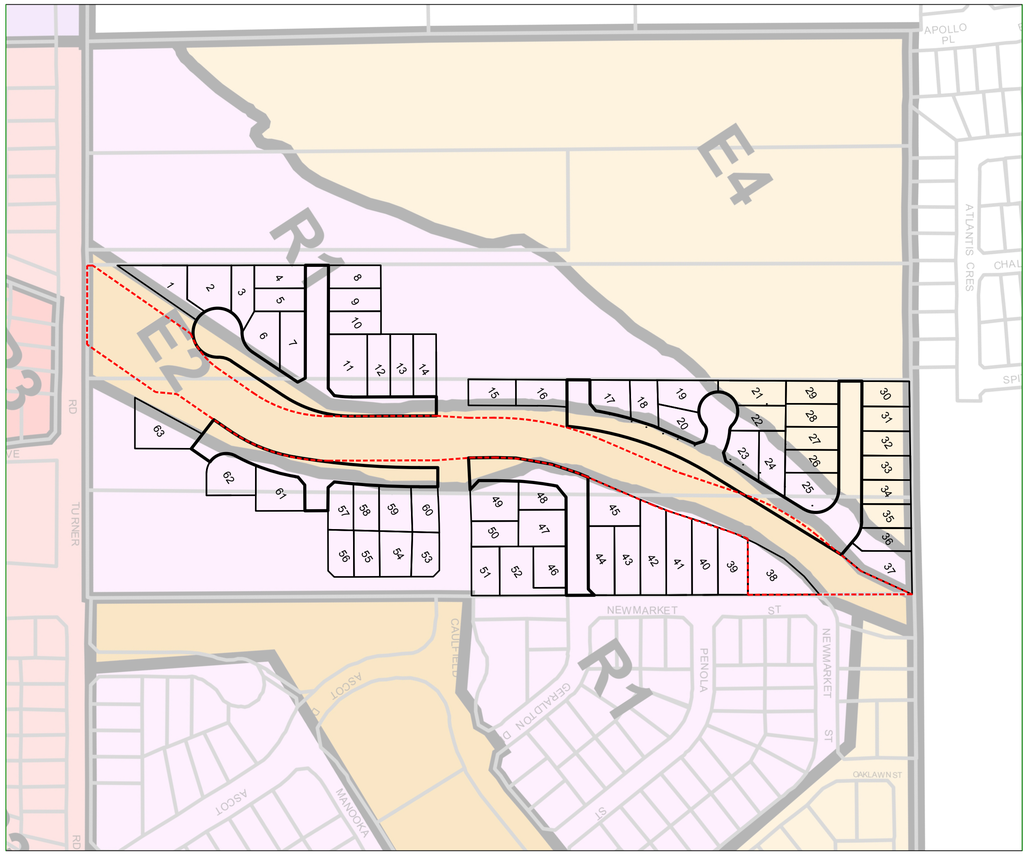
Ref: 14194E13

Locality : CURRANS HILL

L.G.A. : CAMDEN

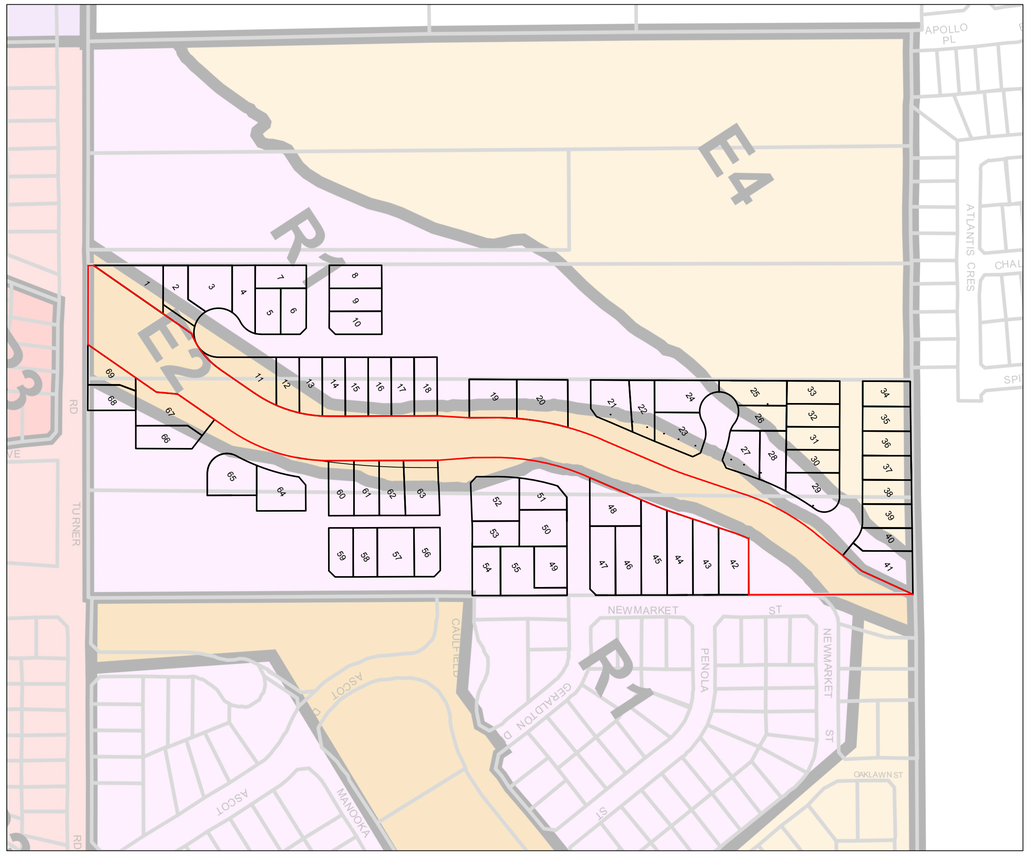
CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EMW\ENG\CAD\E13 - PLANNING PROPOSAL\14194E13 - MASTER ALTERNATIVE

This ratio shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.



PLAN OF POSSIBLE DEVELOPMENT LAYOUT OVERLAID ON CAMDEN COUNCIL'S EXISTING LAND ZONING MAP - LZN_017

SCALE 1:2000



PLAN OF PROPOSED DEVELOPMENT LAYOUT OVERLAID ON CAMDEN COUNCIL'S EXISTING LAND ZONING MAP - LZN_017

SCALE 1:2000

SUMMARY OF LOTS*

LOT TYPE	EXISTING ZONING	NEW AREAS (SQM)
SINGLE RESIDENTIAL LOT	57	64
DUAL OCCUPANCY LOT	6	5
TOTAL No. OF LOTS	63	69

* ONLY AREAS WITHIN THE REZONING BOUNDARY HAVE BEEN COMPARED
** LOTS ARE BASED ON INTERPOLATION OF PDF VERSION OF EXISTING ZONING MAP IN AUTOCAD
*** TOTAL No. OF LOTS SHOWN UNDER THE EXISTING ZONING IS BASED ON ROADS BEING PERMISSIBLE IN THE E2 ZONE WHILE STILL ACHIEVING A RIPARIAN CORRIDOR THAT MEETS ALL GUIDELINES.

0 20 40 80 120 160 200

SCALE :- 1 : 2000
Metres

DENOTES PROPOSED LOT LAYOUT

DENOTES PROPOSED E2 / R1 ZONING BOUNDARY

Issue	App	Date	Description
C	S.G.	16-10-2019	LOTS AND SHARED PATHWAYS AMENDED - LOT SIZING PLANS REMOVED
B	S.G.	20-09-2019	REZONING PLANS WITH UPDATED LOTS & DRAINAGE RESERVE BOUNDARY
A	T.H.	22-08-2018	REZONING PLANS COMBINED FOR PLANNING PROPOSAL

Client: TURNER ROAD ROAD DEVELOPMENTS P/L

Designed by : T.H.

Date of Drawing : 22-08-2018

Ratio (A1) : 1:2000

Datum : AHD

Origin of Levels :

Date of Survey :

JMD Development Consultants

John M. Daly & Associates PTY LTD
Surveying Engineering Project Management Licensed Water Service Co ordinators
A.B.N. 88051977989
32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560
PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

Sheet 4 of 4 sheets

COMPARISON PLAN COMPARING THE POSSIBLE LOT LAYOUTS FOR THE CURRENT ZONING AND THE PROPOSED REZONING

Ref: 14194E13

Locality : CURRANS HILL

L.G.A. : CAMDEN

CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EMW\ENG\CAD\E13 - PLANNING PROPOSAL\LOT COMPARISON.DWG

The ratio shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.

R.O.A.R. DATA APPENDIX 3

Reliable, Original & Authentic Results

Ph.88196847, Mob. 0418 239019

Client : TUPA
Job No/Name : 6939 CURRANS HILL Tramway Dr
Day/Date : Wednesday 24th October 2018

Lights

Time Per	NORTH Tramway Dr L	T	R	WEST Narellan Rd L	T	R	SOUTH Mount Annan Dr L	T	R	EAST Narellan Rd L	T	R	TOT
0630 - 0645	76	2	2	1	652	2	2	5	167	22	388	19	**1338**
0645 - 0700	92	0	0	1	691	2	0	6	179	25	418	32	**1446**
0700 - 0715	107	1	0	0	708	2	5	6	183	31	335	28	**1406**
0715 - 0730	101	4	6	0	729	2	6	8	238	32	391	28	**1545**
0730 - 0745	116	1	1	1	685	1	4	5	175	37	392	24	**1442**
0745 - 0800	107	7	5	0	765	5	5	5	180	40	556	48	**1723**
0800 - 0815	82	2	2	1	684	8	9	6	193	34	485	38	**1544**
0815 - 0830	94	8	5	4	753	7	2	7	154	47	565	33	**1679**
Period End	**775**	**25**	**21**	**8**	**5667**	**29**	**33**	**48**	**1469**	**268**	**3530**	**250**	**12123**

Heavies

Time Per	NORTH Tramway Dr L	T	R	WEST Narellan Rd L	T	R	SOUTH Mount Annan Dr L	T	R	EAST Narellan Rd L	T	R	TOT
0630 - 0645	0	0	0	0	39	0	0	0	0	0	30	1	**70**
0645 - 0700	0	0	0	0	39	0	0	0	0	0	27	0	**66**
0700 - 0715	0	0	0	1	40	1	0	0	0	0	45	2	**89**
0715 - 0730	1	0	0	0	23	1	0	0	0	0	38	3	**66**
0730 - 0745	0	0	0	0	40	0	0	0	1	0	31	1	**73**
0745 - 0800	1	0	0	2	43	0	0	0	0	1	29	0	**76**
0800 - 0815	0	0	1	3	34	2	0	0	1	0	28	2	**71**
0815 - 0830	1	0	0	4	31	0	0	0	1	1	29	1	**68**
Period End	**3**	**0**	**1**	**10**	**289**	**4**	**0**	**0**	**3**	**2**	**257**	**10**	**579**

Lights

Peak Time	NORTH Tramway Dr L	T	R	WEST Narellan Rd L	T	R	SOUTH Mount Annan Dr L	T	R	EAST Narellan Rd L	T	R	TOT
0630 - 0730	376	7	8	2	2780	8	13	25	767	110	1532	107	**5735**
0645 - 0745	416	6	7	2	2813	7	15	25	775	125	1536	112	**5839**
0700 - 0800	431	13	12	1	2887	10	20	24	776	140	1674	128	**6116**
0715 - 0815	406	14	14	2	2863	16	24	24	786	143	1824	138	**6254**
0730 - 0830	399	18	13	6	2887	21	20	23	702	158	1998	143	**6388**
PEAK HOUR	**399**	**18**	**13**	**6**	**2887**	**21**	**20**	**23**	**702**	**158**	**1998**	**143**	**6388**

Heavies

Peak Time	NORTH Tramway Dr L	T	R	WEST Narellan Rd L	T	R	SOUTH Mount Annan Dr L	T	R	EAST Narellan Rd L	T	R	TOT
0630 - 0730	1	0	0	1	141	2	0	0	0	0	140	6	**291**
0645 - 0745	1	0	0	1	142	2	0	0	1	0	141	6	**294**
0700 - 0800	2	0	0	3	146	2	0	0	1	1	143	6	**304**
0715 - 0815	2	0	1	5	140	3	0	0	2	1	126	6	**286**
0730 - 0830	2	0	1	9	148	2	0	0	3	2	117	4	**288**
PEAK HOUR	**2**	**0**	**1**	**9**	**148**	**2**	**0**	**0**	**3**	**2**	**117**	**4**	**288**

Combined

Time Per	NORTH Tramway Dr L	T	R	WEST Narellan Rd L	T	R	SOUTH Mount Annan Dr L	T	R	EAST Narellan Rd L	T	R	TOT
0630 - 0645	76	2	2	1	691	2	2	5	167	22	418	20	**1408**
0645 - 0700	92	0	0	1	730	2	0	6	179	25	445	32	**1512**
0700 - 0715	107	1	0	1	748	3	5	6	183	31	380	30	**1495**
0715 - 0730	102	4	6	0	752	3	6	8	238	32	429	31	**1611**
0730 - 0745	116	1	1	1	725	1	4	5	176	37	423	25	**1515**
0745 - 0800	108	7	5	2	808	5	5	5	180	41	585	48	**1799**
0800 - 0815	82	2	3	4	718	10	9	6	194	34	513	40	**1615**
0815 - 0830	95	8	5	8	784	7	2	7	155	48	594	34	**1747**
Period End	**778**	**25**	**22**	**18**	**5956**	**33**	**33**	**48**	**1472**	**270**	**3787**	**260**	**12702**

Peds

Time Per	NORTH Tramway Dr UNCLASSIFIED	WEST Narellan Rd UNCLASSIFIED	SOUTH Mount Annan Dr UNCLASSIFIED	EAST Narellan Rd UNCLASSIFIED	TOT
0630 - 0645	0	0	0	0	**0**
0645 - 0700	1	5	0	0	**6**
0700 - 0715	0	0	0	0	**0**
0715 - 0730	2	3	0	0	**5**
0730 - 0745	3	2	0	2	**7**
0745 - 0800	1	2	0	0	**3**
0800 - 0815	0	2	0	0	**2**
0815 - 0830	0	0	0	1	**1**
Period End	**7**	**14**	**0**	**3**	**24**

Combined

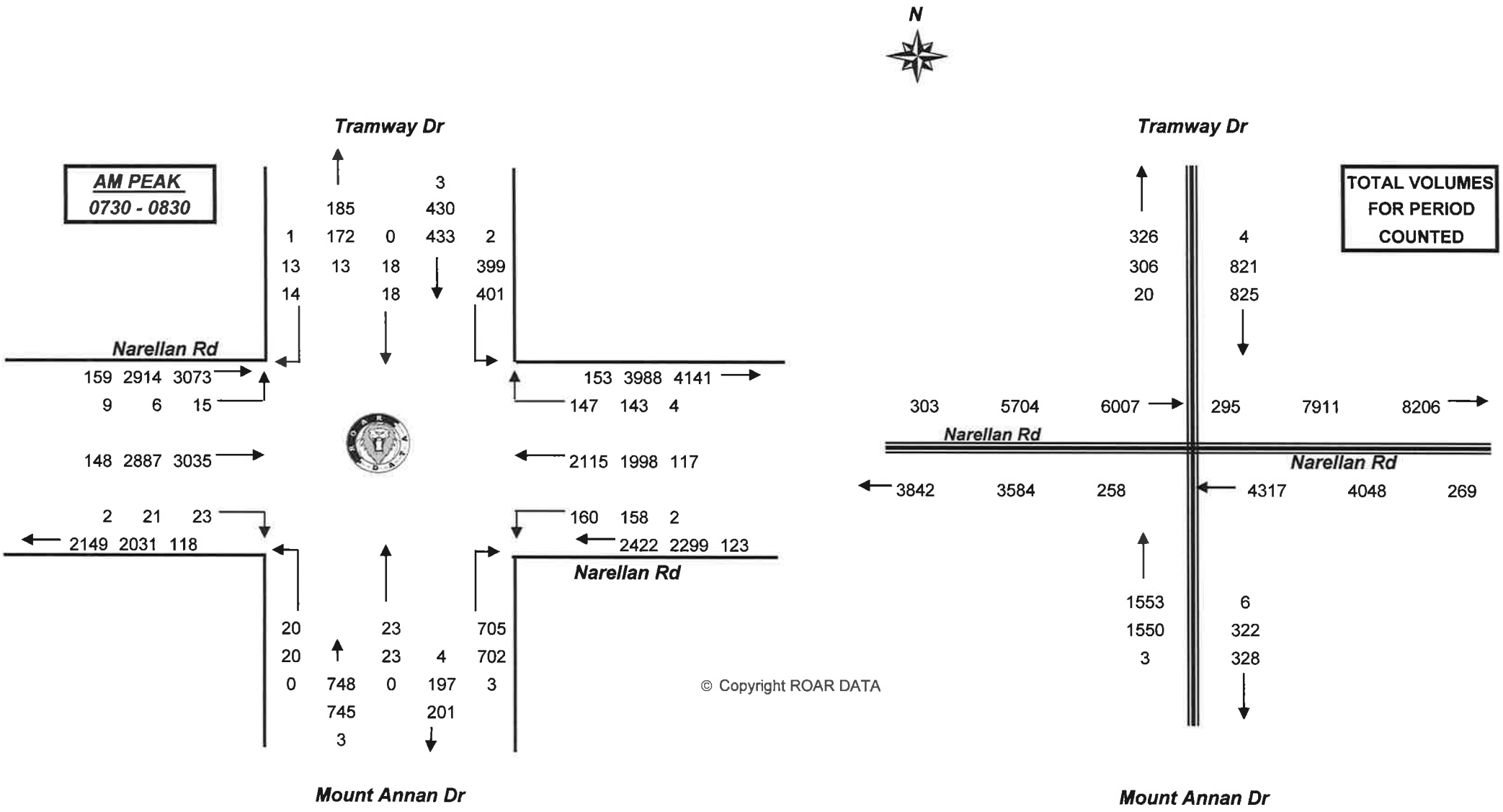
Peak Time	NORTH Tramway Dr L	T	R	WEST Narellan Rd L	T	R	SOUTH Mount Annan Dr L	T	R	EAST Narellan Rd L	T	R	TOT
0630 - 0730	377	7	8	3	2921	10	13	25	767	110	1672	113	**6026**
0645 - 0745	417	6	7	3	2955	9	15	25	776	125	1677	118	**6133**
0700 - 0800	433	13	12	4	3033	12	20	24	777	141	1817	134	**6420**
0715 - 0815	408	14	15	7	3003	19	24	24	788	144	1950	144	**6540**
0730 - 0830	401	18	14	15	3035	23	20	23	705	160	2115	147	**6676**
PEAK HOUR	**401**	**18**	**14**	**15**	**3035**	**23**	**20**	**23**	**705**	**160**	**2115**	**147**	**6676**

Peds

Peak Per	NORTH Tramway Dr UNCLASSIFIED	WEST Narellan Rd UNCLASSIFIED	SOUTH Mount Annan Dr UNCLASSIFIED	EAST Narellan Rd UNCLASSIFIED	TOT
0630 - 0730	3	8	0	0	**11**
0645 - 0745	6	10	0	2	**18**
0700 - 0800	6	7	0	2	**15**
0715 - 0815	6	9	0	2	**17**
0730 - 0830	4	6	0	3	**13**
PEAK HR	**4**	**6**	**0**	**3**	**13**

R.O.A.R DATA
Reliable, Original & Authentic Results
Ph.88196847, Mob. 0418 239019

Client : TUPA
Job No/Name : 6939 CURRANS HILL Tramway Dr
Day/Date : Wednesday 24th October 2018



R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Mob. 0418 239019

Client : TUPA
Job No/Name : 6939 CURRANS HILL Tramway Dr
Day/Date : Wednesday 24th October 2018

Lights

Time Per	NORTH Tramway Dr			WEST Narellan Rd			SOUTH Mount Annan Dr			EAST Narellan Rd			TOT
	L	T	R	L	T	R	L	T	R	L	T	R	
1600 - 1615	41	8	4	12	524	11	7	4	48	123	678	65	1525
1615 - 1630	46	8	6	5	606	9	12	6	49	109	856	55	1767
1630 - 1645	38	9	8	7	582	10	11	6	65	129	633	68	1566
1645 - 1700	35	9	7	7	496	7	9	12	59	150	712	70	1573
1700 - 1715	52	14	13	2	603	9	6	13	55	160	704	75	1706
1715 - 1730	31	10	9	5	637	15	8	10	53	158	828	83	1847
1730 - 1745	39	9	9	13	557	6	8	7	48	149	746	80	1671
1745 - 1800	39	11	7	4	443	11	9	9	39	142	795	90	1599
Period End	321	78	63	55	4448	78	70	67	416	1120	5952	586	13254

Heavies

Time Per	NORTH Tramway Dr			WEST Narellan Rd			SOUTH Mount Annan Dr			EAST Narellan Rd			TOT
	L	T	R	L	T	R	L	T	R	L	T	R	
1600 - 1615	0	0	0	0	16	0	0	0	0	0	21	2	39
1615 - 1630	0	0	0	0	17	0	0	0	0	0	36	1	54
1630 - 1645	0	0	0	0	19	0	0	0	0	0	14	0	33
1645 - 1700	1	0	0	0	16	0	0	0	0	0	24	0	41
1700 - 1715	0	0	0	0	14	0	0	0	0	0	27	1	42
1715 - 1730	1	0	0	0	12	0	0	0	0	0	17	1	31
1730 - 1745	0	0	0	0	12	0	0	0	0	0	12	0	24
1745 - 1800	1	0	0	0	12	0	0	0	0	0	19	1	33
Period End	3	0	0	0	118	0	0	0	0	0	170	6	297

Lights

Peak Time	NORTH Tramway Dr			WEST Narellan Rd			SOUTH Mount Annan Dr			EAST Narellan Rd			TOT
	L	T	R	L	T	R	L	T	R	L	T	R	
1600 - 1700	160	34	25	31	2208	37	39	28	221	511	2879	258	6431
1615 - 1715	171	40	34	21	2287	35	38	37	228	548	2905	268	6612
1630 - 1730	156	42	37	21	2318	41	34	41	232	597	2877	296	6692
1645 - 1745	157	42	38	27	2293	37	31	42	215	617	2990	308	6797
1700 - 1800	161	44	38	24	2240	41	31	39	195	609	3073	328	6823
PEAK HOUR	161	44	38	24	2240	41	31	39	195	609	3073	328	6823

Heavies

Peak Time	NORTH Tramway Dr			WEST Narellan Rd			SOUTH Mount Annan Dr			EAST Narellan Rd			TOT
	L	T	R	L	T	R	L	T	R	L	T	R	
1600 - 1700	1	0	0	0	68	0	0	0	0	0	95	3	167
1615 - 1715	1	0	0	0	66	0	0	0	0	0	101	2	170
1630 - 1730	2	0	0	0	61	0	0	0	0	0	82	2	147
1645 - 1745	2	0	0	0	54	0	0	0	0	0	80	2	138
1700 - 1800	2	0	0	0	50	0	0	0	0	0	75	3	130
PEAK HOUR	2	0	0	0	50	0	0	0	0	0	75	3	130

Combined

Time Per	NORTH Tramway Dr			WEST Narellan Rd			SOUTH Mount Annan Dr			EAST Narellan Rd			TOT
	L	T	R	L	T	R	L	T	R	L	T	R	
1600 - 1615	41	8	4	12	540	11	7	4	48	123	699	67	1564
1615 - 1630	46	8	6	5	623	9	12	6	49	109	892	56	1821
1630 - 1645	38	9	8	7	601	10	11	6	65	129	647	68	1599
1645 - 1700	36	9	7	7	512	7	9	12	59	150	736	70	1614
1700 - 1715	52	14	13	2	617	9	6	13	55	160	731	76	1748
1715 - 1730	32	10	9	5	649	15	8	10	53	158	845	84	1878
1730 - 1745	39	9	9	13	569	6	8	7	48	149	758	80	1695
1745 - 1800	40	11	7	4	455	11	9	9	39	142	814	91	1632
Period End	324	78	63	55	4566	78	70	67	416	1120	6122	592	13551

Peds

Time Per	NORTH Tramway Dr	WEST Narellan Rd	SOUTH Mount Annan Dr	EAST Narellan Rd	TOT
	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	
1600 - 1615	0	0	0	0	0
1615 - 1630	1	0	0	1	2
1630 - 1645	0	2	0	0	2
1645 - 1700	0	0	0	1	1
1700 - 1715	0	0	0	2	2
1715 - 1730	0	0	0	0	0
1730 - 1745	0	1	0	1	2
1745 - 1800	1	1	0	0	2
Period End	2	4	0	5	11

Combined

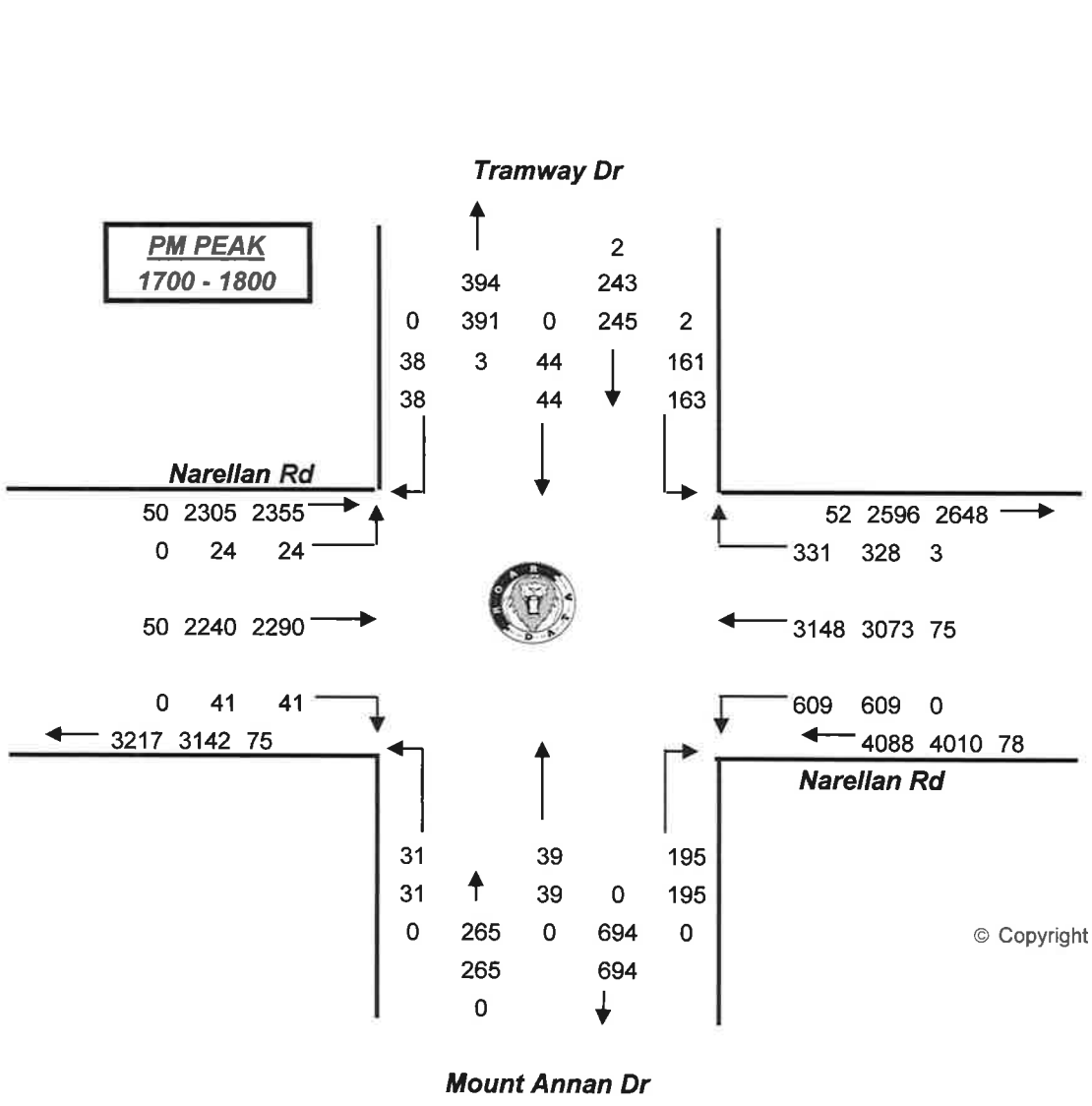
Peak Time	NORTH Tramway Dr			WEST Narellan Rd			SOUTH Mount Annan Dr			EAST Narellan Rd			TOT
	L	T	R	L	T	R	L	T	R	L	T	R	
1600 - 1700	161	34	25	31	2276	37	39	28	221	511	2974	261	6598
1615 - 1715	172	40	34	21	2353	35	38	37	228	548	3006	270	6782
1630 - 1730	158	42	37	21	2379	41	34	41	232	597	2959	298	6839
1645 - 1745	159	42	38	27	2347	37	31	42	215	617	3070	310	6935
1700 - 1800	163	44	38	24	2290	41	31	39	195	609	3148	331	6953
PEAK HOUR	163	44	38	24	2290	41	31	39	195	609	3148	331	6953

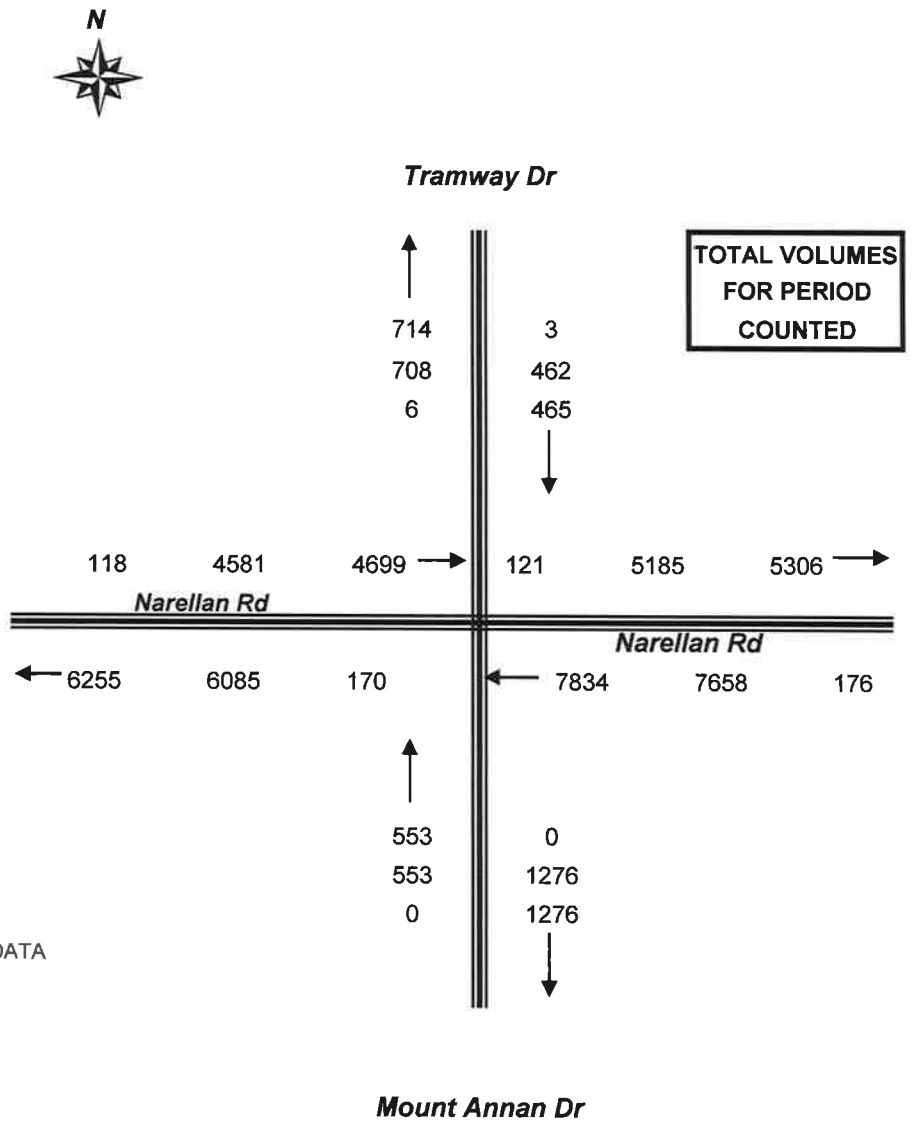
Peds

Peak Per	NORTH Tramway Dr	WEST Narellan Rd	SOUTH Mount Annan Dr	EAST Narellan Rd	TOT
	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	
1600 - 1700	1	2	0	2	5
1615 - 1715	1	2	0	4	7
1630 - 1730	0	2	0	3	5
1645 - 1745	0	1	0	4	5
1700 - 1800	1	2	0	3	6
PEAK HR	1	2	0	3	6

R.O.A.R DATA
Reliable, Original & Authentic Results
Ph.88196847, Mob. 0418 239019

Client : TUPA
Job No/Name : 6939 CURRANS HILL Tramway Dr
Day/Date : Wednesday 24th October 2018





R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob. 0418 239019

Client : TUPA
Job No/Name : 5672 MT. ANNAN Hartley Rd
Day/Date : Thursday 25th June 2015

Lights

	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
0630 - 0645	45	17	16	29	386	10	12	73	159	47	185	63	**1042**
0645 - 0700	59	19	17	51	283	28	21	93	234	84	254	87	**1230**
0700 - 0715	82	40	23	35	298	16	27	70	212	39	195	83	**1120**
0715 - 0730	57	29	15	50	252	11	36	71	179	64	233	46	**1043**
0730 - 0745	58	34	11	45	301	37	24	115	149	77	258	52	**1161**
0745 - 0800	62	56	24	51	268	22	22	116	169	77	285	51	**1203**
0800 - 0815	60	59	63	37	194	25	22	110	161	96	207	69	**1103**
0815 - 0830	48	65	34	43	220	36	24	93	144	107	284	69	**1167**
Period End	**471**	**319**	**203**	**341**	**2202**	**185**	**188**	**741**	**1407**	**591**	**1901**	**520**	**9069**

Heavies

	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
0630 - 0645	16	0	0	1	27	0	0	2	4	2	10	8	**70**
0645 - 0700	22	6	0	2	12	1	0	1	2	6	17	13	**82**
0700 - 0715	26	0	3	1	16	1	2	1	2	4	19	8	**83**
0715 - 0730	15	5	0	0	18	0	0	1	3	1	15	8	**66**
0730 - 0745	14	4	2	0	15	0	1	4	3	4	23	14	**84**
0745 - 0800	28	3	1	3	19	1	0	1	5	0	12	11	**84**
0800 - 0815	22	4	5	1	8	1	2	1	4	4	23	11	**86**
0815 - 0830	16	1	2	2	11	0	0	2	1	3	21	9	**68**
Period End	**159**	**23**	**13**	**10**	**126**	**4**	**5**	**13**	**24**	**24**	**140**	**82**	**623**

Lights

	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
0630 - 0730	243	105	71	165	1219	65	96	307	784	234	867	279	**4435**
0645 - 0745	256	122	66	181	1134	92	108	349	774	264	940	268	**4554**
0700 - 0800	259	159	73	181	1119	86	109	372	709	257	971	232	**4527**
0715 - 0815	237	178	113	183	1015	95	104	412	658	314	983	218	**4510**
0730 - 0830	228	214	132	176	983	120	92	434	623	357	1034	241	**4634**
PEAK HOUR	**228**	**214**	**132**	**176**	**983**	**120**	**92**	**434**	**623**	**357**	**1034**	**241**	**4634**

Heavies

	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
0630 - 0730	79	11	3	4	73	2	2	5	11	13	61	37	**301**
0645 - 0745	77	15	5	3	61	2	3	7	10	15	74	43	**315**
0700 - 0800	83	12	6	4	68	2	3	7	13	9	69	41	**317**
0715 - 0815	79	16	8	4	60	2	3	7	15	9	73	44	**320**
0730 - 0830	80	12	10	6	53	2	3	8	13	11	79	45	**322**
PEAK HOUR	**80**	**12**	**10**	**6**	**53**	**2**	**3**	**8**	**13**	**11**	**79**	**45**	**322**

Combined

	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
0630 - 0645	61	17	16	30	413	10	12	75	163	49	195	71	**1112**
0645 - 0700	81	25	17	53	295	29	21	94	236	90	271	100	**1312**
0700 - 0715	108	40	26	36	314	17	29	71	214	43	214	91	**1203**
0715 - 0730	72	34	15	50	270	11	36	72	182	65	248	54	**1109**
0730 - 0745	72	38	13	45	316	37	25	119	152	81	281	66	**1245**
0745 - 0800	90	59	25	54	287	23	22	117	174	77	297	62	**1287**
0800 - 0815	82	63	68	38	202	26	24	111	165	100	230	80	**1189**
0815 - 0830	64	66	36	45	231	36	24	95	145	110	305	78	**1235**
Period End	**630**	**342**	**216**	**351**	**2328**	**189**	**193**	**754**	**1431**	**615**	**2041**	**602**	**9692**

Peds

	NORTH	WEST	SOUTH	EAST	
	Hartley Rd	*Narellan Rd*	*Waterworth Dr*	*Narellan Rd*	
Time Per	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	TOT
0630 - 0645	0	2	0	0	**2**
0645 - 0700	1	0	0	0	**1**
0700 - 0715	0	0	1	0	**1**
0715 - 0730	0	1	0	0	**1**
0730 - 0745	0	2	0	0	**2**
0745 - 0800	1	2	0	1	**4**
0800 - 0815	3	13	0	0	**16**
0815 - 0830	0	2	1	0	**3**
Period End	**5**	**22**	**2**	**1**	**30**

Combined

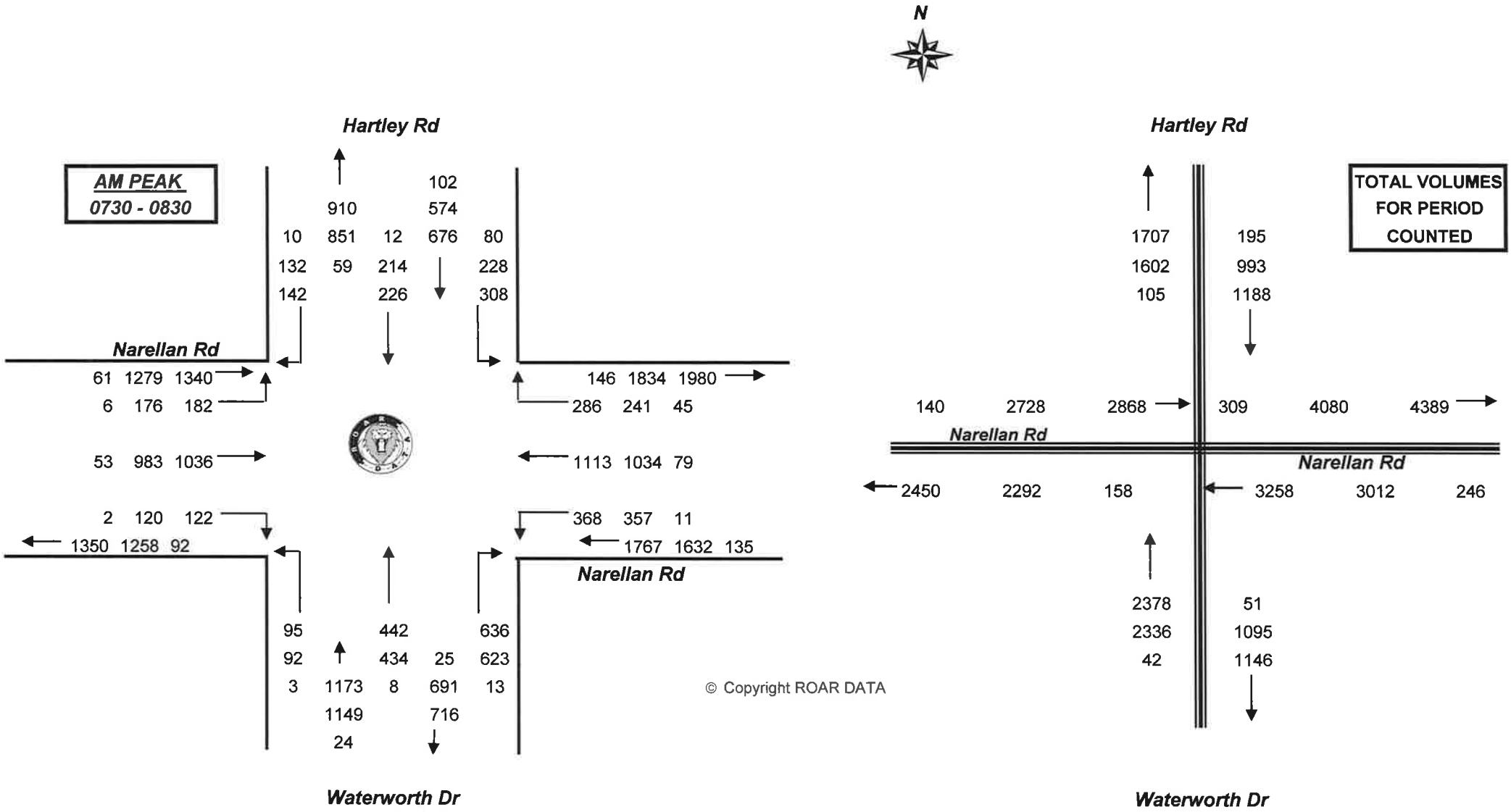
	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
0630 - 0730	322	116	74	169	1292	67	98	312	795	247	928	316	**4736**
0645 - 0745	333	137	71	184	1195	94	111	356	784	279	1014	311	**4869**
0700 - 0800	342	171	79	185	1187	88	112	379	722	266	1040	273	**4844**
0715 - 0815	316	194	121	187	1075	97	107	419	673	323	1056	262	**4830**
0730 - 0830	308	226	142	182	1036	122	95	442	636	368	1113	286	**4956**
PEAK HOUR	**308**	**226**	**142**	**182**	**1036**	**122**	**95**	**442**	**636**	**368**	**1113**	**286**	**4956**

Peds

	NORTH	WEST	SOUTH	EAST	
	Hartley Rd	*Narellan Rd*	*Waterworth Dr*	*Narellan Rd*	
Peak Per	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	TOT
0630 - 0730	1	3	1	0	**5**
0645 - 0745	1	3	1	0	**5**
0700 - 0800	1	5	1	1	**8**
0715 - 0815	4	18	0	1	**23**
0730 - 0830	4	19	1	1	**25**
PEAK HR	**4**	**19**	**1**	**1**	**25**

R.O.A.R DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob. 0418 239019

Client : TUPA
Job No/Name : 5672 MT. ANNAN Hartley Rd
Day/Date : Thursday 25th June 2015



R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob. 0418 239019

Client : TUPA
Job No/Name : 5672 MT. ANNAN Hartley Rd
Day/Date : Thursday 25th June 2015

Lights

	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1600 - 1615	146	126	47	54	339	103	39	77	125	196	336	67	1655
1615 - 1630	109	128	31	46	314	108	27	74	115	199	344	61	1556
1630 - 1645	114	120	35	38	335	98	26	53	97	215	340	59	1530
1645 - 1700	95	146	38	39	286	149	29	53	107	212	294	59	1507
1700 - 1715	118	115	64	34	271	137	34	67	101	221	317	38	1517
1715 - 1730	72	104	26	58	337	134	29	64	86	230	385	61	1586
1730 - 1745	62	126	40	51	365	133	32	80	144	222	375	48	1678
1745 - 1800	81	120	32	25	188	111	25	83	101	192	364	57	1379
Period End	797	985	313	345	2435	973	241	551	876	1687	2755	450	12408

Heavies

	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1600 - 1615	4	2	1	0	8	0	0	0	4	4	19	16	58
1615 - 1630	17	1	1	0	3	0	0	1	1	2	8	10	44
1630 - 1645	12	2	1	1	6	0	1	0	3	3	15	9	53
1645 - 1700	10	0	2	1	6	0	0	1	1	3	25	11	60
1700 - 1715	14	1	0	1	4	0	0	1	2	2	12	6	43
1715 - 1730	13	0	0	1	3	0	0	1	1	2	11	5	37
1730 - 1745	9	2	1	1	4	0	0	0	3	0	6	5	31
1745 - 1800	5	1	1	0	4	0	0	1	1	3	7	3	26
Period End	84	9	7	5	38	0	1	5	16	19	103	65	352

Lights

	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1600 - 1700	464	520	151	177	1274	458	121	257	444	822	1314	246	6248
1615 - 1715	436	509	168	157	1206	492	116	247	420	847	1295	217	6110
1630 - 1730	399	485	163	169	1229	518	118	237	391	878	1336	217	6140
1645 - 1745	347	491	168	182	1259	553	124	264	438	885	1371	206	6288
1700 - 1800	333	465	162	168	1161	515	120	294	432	865	1441	204	6160
PEAK HOUR	464	520	151	177	1274	458	121	257	444	822	1314	246	6248

Heavies

	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1600 - 1700	43	5	5	2	23	0	1	2	9	12	67	46	215
1615 - 1715	53	4	4	3	19	0	1	3	7	10	60	36	200
1630 - 1730	49	3	3	4	19	0	1	3	7	10	63	31	193
1645 - 1745	46	3	3	4	17	0	0	3	7	7	54	27	171
1700 - 1800	41	4	2	3	15	0	0	3	7	7	36	19	137
PEAK HOUR	43	5	5	2	23	0	1	2	9	12	67	46	215

Combined

	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1600 - 1615	150	128	48	54	347	103	39	77	129	200	355	83	1713
1615 - 1630	126	129	32	46	317	108	27	75	116	201	352	71	1600
1630 - 1645	126	122	36	39	341	98	27	53	100	218	355	68	1583
1645 - 1700	105	146	40	40	292	149	29	54	108	215	319	70	1567
1700 - 1715	132	116	64	35	275	137	34	68	103	223	329	44	1560
1715 - 1730	85	104	26	59	340	134	29	65	87	232	396	66	1623
1730 - 1745	71	128	41	52	369	133	32	80	147	222	381	53	1709
1745 - 1800	86	121	33	25	192	111	25	84	102	195	371	60	1405
Period End	881	994	320	350	2473	973	242	556	892	1706	2858	515	12760

Peds

	NORTH	WEST	SOUTH	EAST	
	Hartley Rd	*Narellan Rd*	*Waterworth Dr*	*Narellan Rd*	
Time Per	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	TOT
1600 - 1615	0	1	0	1	2
1615 - 1630	1	1	0	0	2
1630 - 1645	0	0	0	0	0
1645 - 1700	1	0	0	0	1
1700 - 1715	0	2	0	2	4
1715 - 1730	0	0	1	0	1
1730 - 1745	0	1	0	0	1
1745 - 1800	0	0	0	0	0
Period End	2	5	1	3	11

Combined

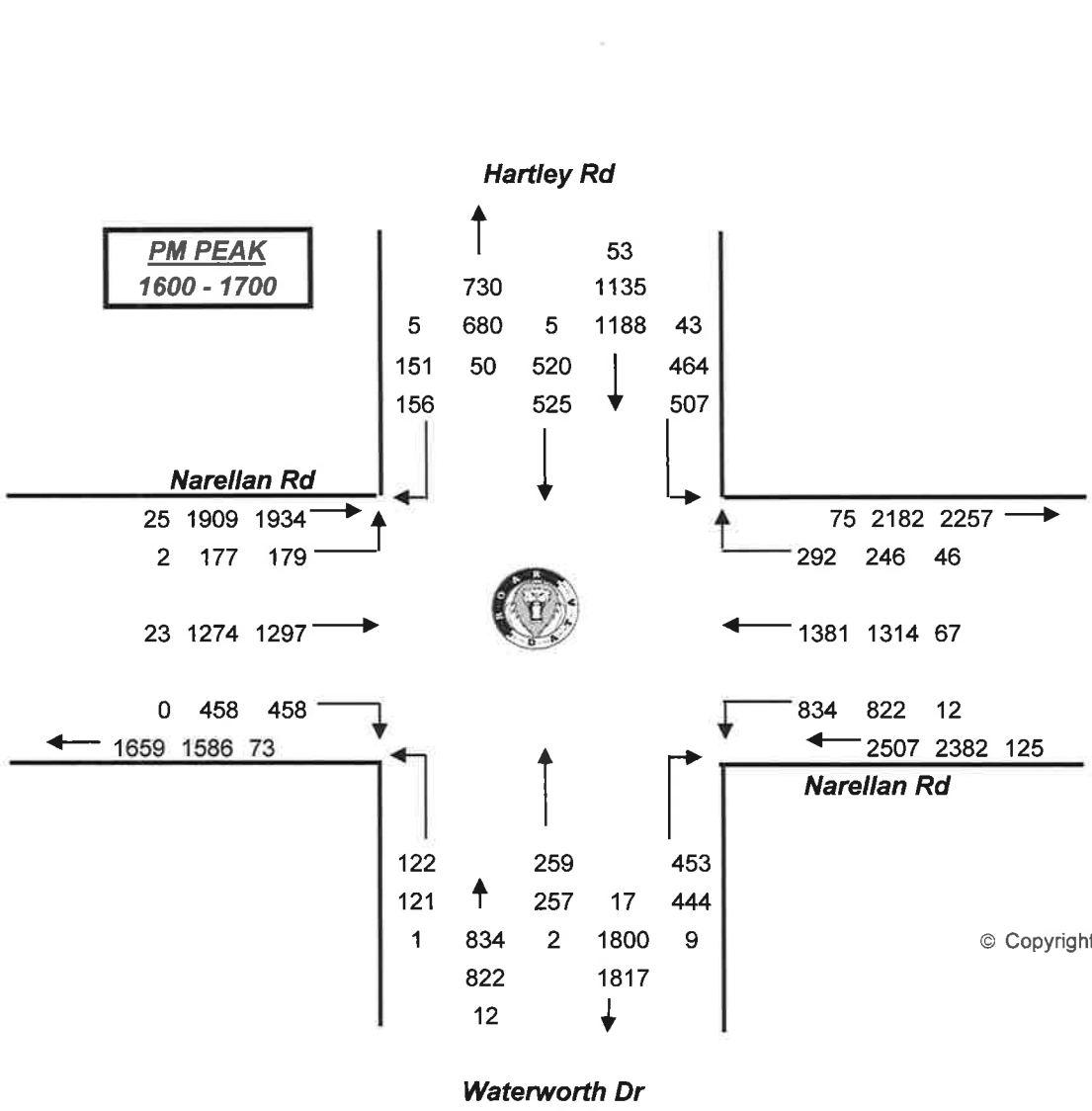
	NORTH			WEST			SOUTH			EAST			
	Hartley Rd			*Narellan Rd*			*Waterworth Dr*			*Narellan Rd*			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1600 - 1700	507	525	156	179	1297	458	122	259	453	834	1381	292	6463
1615 - 1715	489	513	172	160	1225	492	117	250	427	857	1355	253	6310
1630 - 1730	448	488	166	173	1248	518	119	240	398	888	1399	248	6333
1645 - 1745	393	494	171	186	1276	553	124	267	445	892	1425	233	6459
1700 - 1800	374	469	164	171	1176	515	120	297	439	872	1477	223	6297
PEAK HOUR	507	525	156	179	1297	458	122	259	453	834	1381	292	6463

Peds

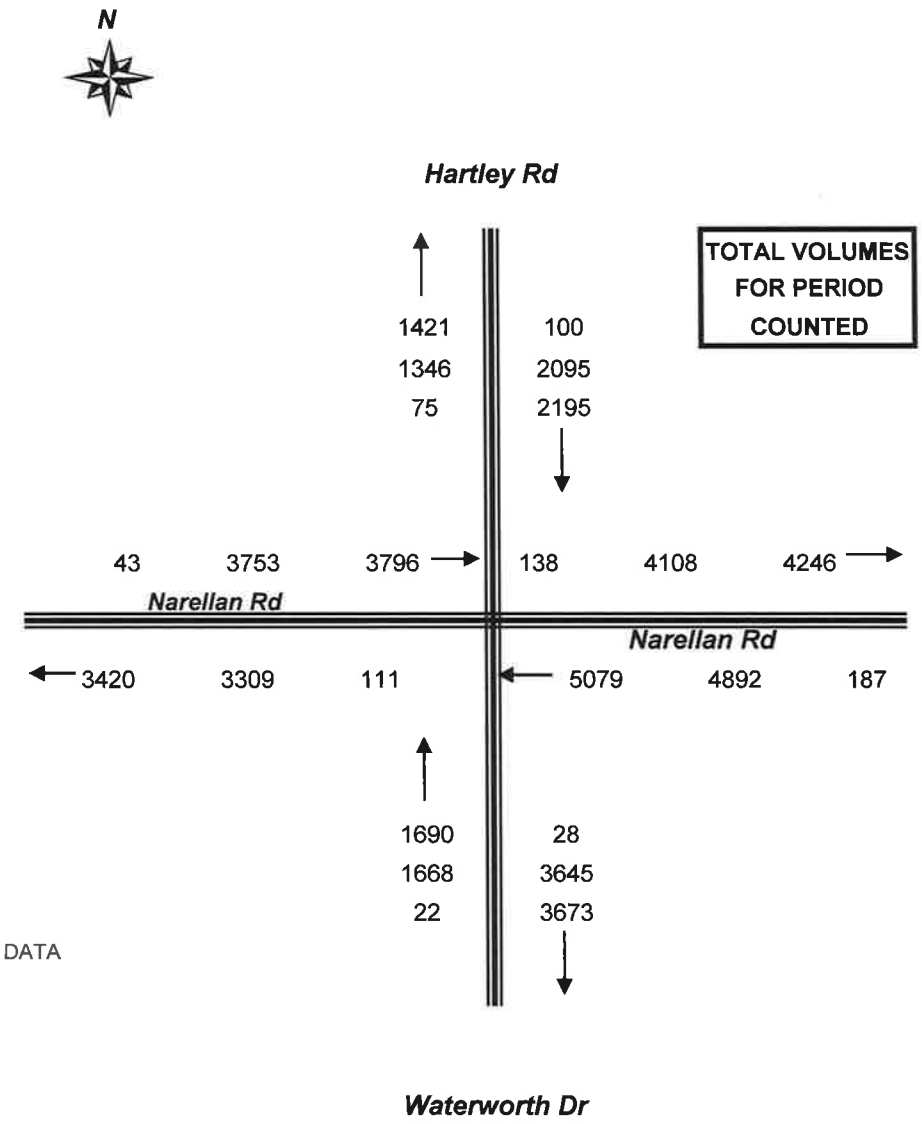
	NORTH	WEST	SOUTH	EAST	
	Hartley Rd	*Narellan Rd*	*Waterworth Dr*	*Narellan Rd*	
Peak Per	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	TOT
1600 - 1700	2	2	0	1	5
1615 - 1715	2	3	0	2	7
1630 - 1730	1	2	1	2	6
1645 - 1745	1	3	1	2	7
1700 - 1800	0	3	1	2	6
PEAK HR	2	2	0	1	5

R.O.A.R DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob. 0418 239019

Client : TUPA
Job No/Name : 5672 MT. ANNAN Hartley Rd
Day/Date : Thursday 25th June 2015



© Copyright ROAR DATA

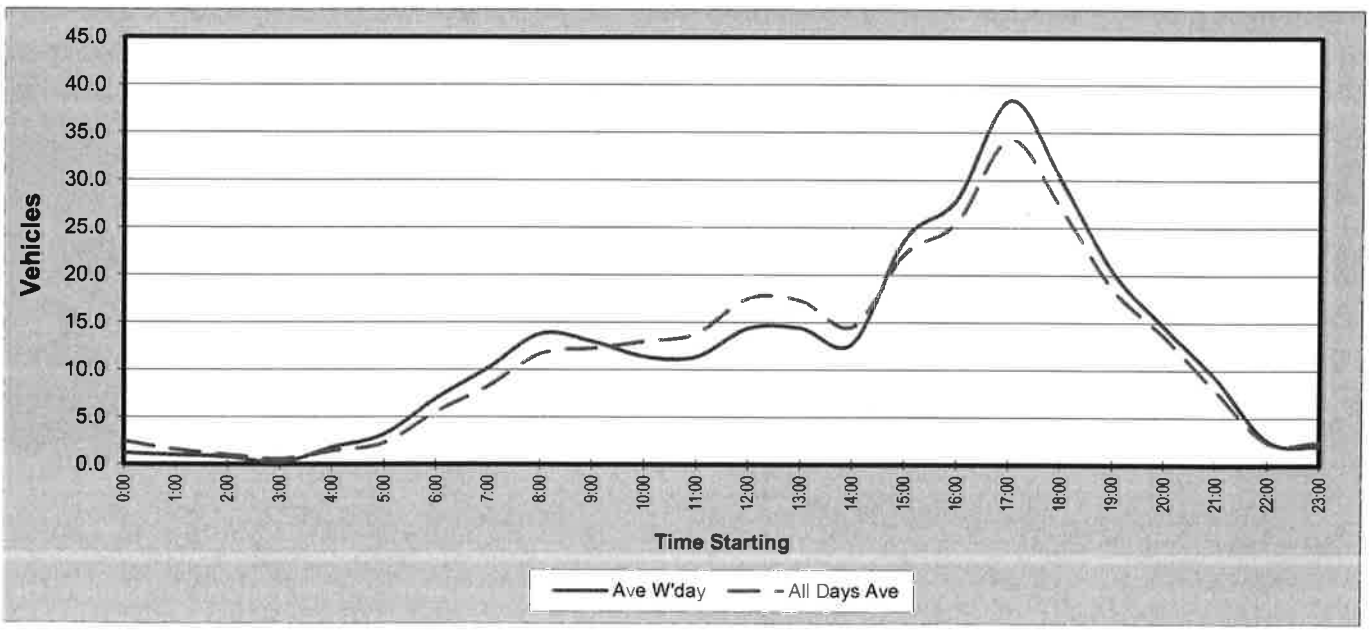


austraffic

Road	Ascot Drive
Location	At Turner Road (North/South of Turner Road)
Suburb	Currans Hill
Site No.	850304
Start Date	Friday 26/10/2018
Direction	Northbound

Average Weekday	286
All Day Average	277
Weekday Heavy's	13.2%
All Day Heavy's	12.1%

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	29-Oct	30-Oct	31-Oct	1-Nov	26-Oct	27-Oct	28-Oct		
AM Peak	**13**	**21**	**20**	**16**	**16**	**18**	**23**		
PM Peak	**32**	**39**	**43**	**41**	**39**	**26**	**26**		
0:00	0	0	1	2	3	4	7	1	2
1:00	1	1	0	2	1	1	5	1	2
2:00	0	1	2	1	0	2	1	1	1
3:00	1	0	0	0	0	1	2	0	1
4:00	2	4	0	2	1	1	0	2	1
5:00	4	2	4	1	5	0	0	3	2
6:00	5	5	9	10	6	2	2	7	6
7:00	12	7	14	9	9	5	2	10	8
8:00	8	15	20	16	10	6	7	14	12
9:00	11	21	13	14	6	7	14	13	12
10:00	7	13	8	13	16	18	16	11	13
11:00	13	11	11	7	15	17	23	11	14
12:00	22	10	12	14	14	26	25	14	18
13:00	15	13	11	21	12	23	26	14	17
14:00	15	17	12	9	11	19	19	13	15
15:00	28	22	20	20	29	17	20	24	22
16:00	32	26	25	35	22	17	22	28	26
17:00	30	39	43	41	39	23	25	38	34
18:00	25	34	23	35	33	26	13	30	27
19:00	18	19	20	23	22	19	9	20	19
20:00	16	12	13	20	12	16	6	15	14
21:00	10	9	10	9	8	6	3	9	8
22:00	3	2	2	4	2	4	0	3	2
23:00	2	0	2	4	2	5	2	2	2
Total	**280**	**283**	**275**	**312**	**278**	**265**	**249**	**286**	**277**
% Heavies	**13.9%**	**14.8%**	**11.3%**	**12.8%**	**12.9%**	**9.8%**	**8.4%**	**13.2%**	**12.1%**



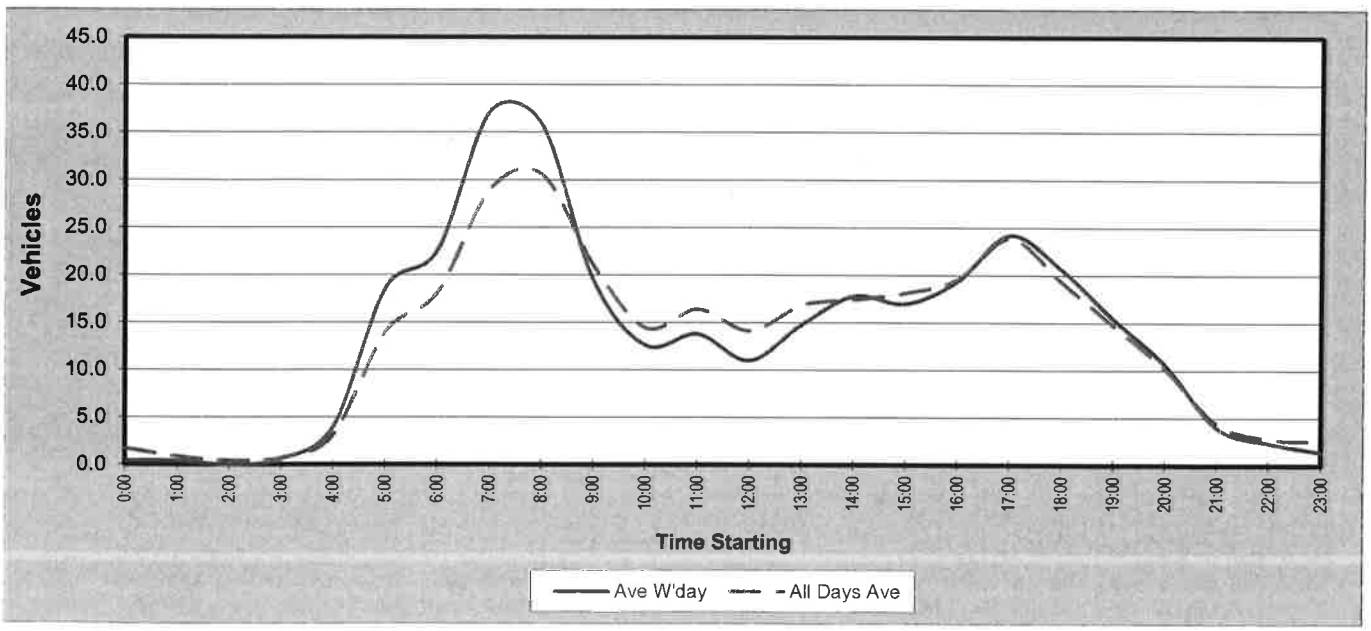
Copyright Austraffic, 1983-2016 (DatXL 3.1.18: 2.37)

austraffic

Road	Ascot Drive
Location	At Turner Road (North/South of Turner Road)
Suburb	Currans Hill
Site No.	850304
Start Date	Friday 26/10/2018
Direction	Southbound

Average Weekday	324
All Day Average	314
Weekday Heavy's	8.0%
All Day Heavy's	7.0%

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	29-Oct	30-Oct	31-Oct	1-Nov	26-Oct	27-Oct	28-Oct		
AM Peak	**37**	**39**	**45**	**36**	**39**	**27**	**27**		
PM Peak	**25**	**25**	**26**	**26**	**26**	**23**	**29**		
0:00	0	0	1	1	0	2	8	0	2
1:00	1	1	0	0	0	1	3	0	1
2:00	0	0	0	0	0	1	2	0	0
3:00	1	1	0	0	1	1	1	1	1
4:00	6	5	3	2	4	0	2	4	3
5:00	15	16	18	21	23	4	1	19	14
6:00	23	24	22	25	19	10	4	23	18
7:00	37	36	41	33	39	10	7	37	29
8:00	31	39	45	36	28	24	11	36	31
9:00	21	23	24	16	13	23	27	19	21
10:00	16	11	9	15	12	15	23	13	14
11:00	12	10	20	11	16	27	19	14	16
12:00	13	7	13	8	14	20	24	11	14
13:00	18	12	14	13	17	21	23	15	17
14:00	20	18	20	17	14	16	17	18	17
15:00	18	20	14	14	19	13	29	17	18
16:00	25	20	18	21	13	20	20	19	20
17:00	19	25	26	25	26	23	23	24	24
18:00	21	19	16	26	21	21	11	21	19
19:00	14	18	14	13	18	17	9	15	15
20:00	9	7	11	14	12	13	5	11	10
21:00	6	2	1	3	8	10	1	4	4
22:00	5	1	1	4	1	7	1	2	3
23:00	0	0	1	1	5	9	2	1	3
Total	**331**	**315**	**332**	**319**	**323**	**308**	**273**	**324**	**314**
% Heavies	**10.0%**	**7.0%**	**9.0%**	**6.6%**	**7.4%**	**3.6%**	**4.4%**	**8.0%**	**7.0%**



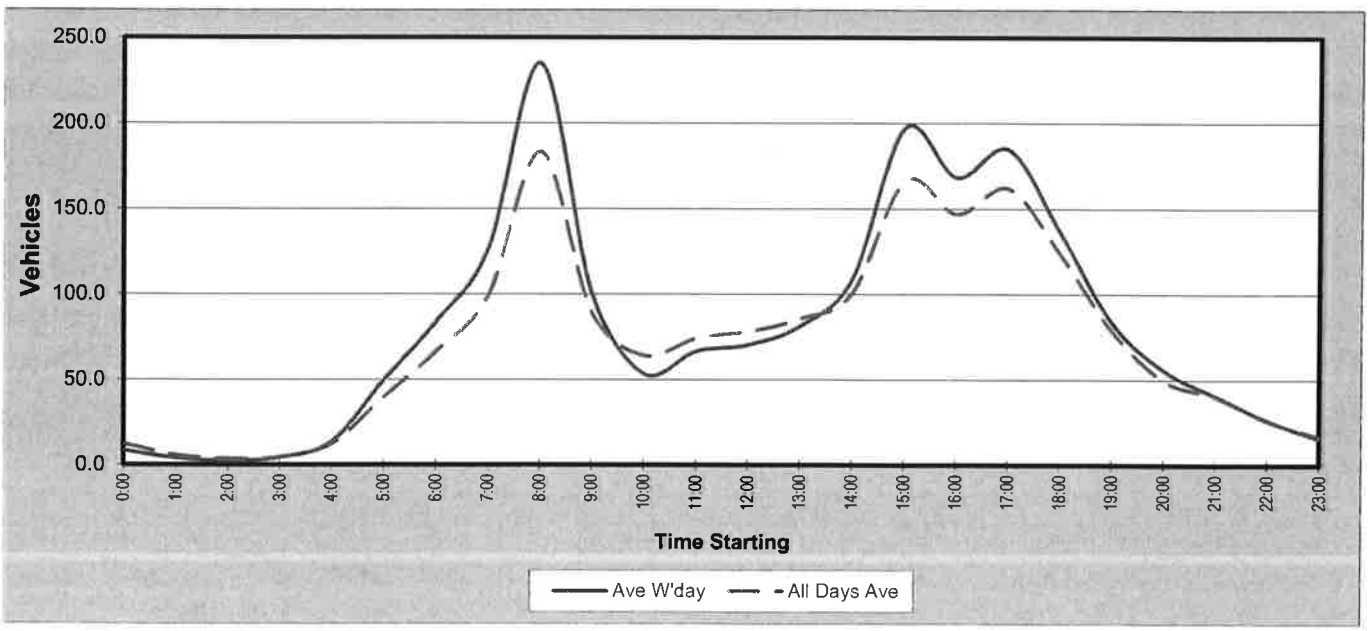
Copyright Austraffic, 1983-2016 (DatXL 3.1.18: 2.37)

austraffic

Road	Tramway Drive
Location	At Currans Hill Drive
Suburb	Currans Hill
Site No.	850302
Start Date	Friday 26/10/2018
Direction	Northbound

Average Weekday	1918
All Day Average	1728
Weekday Heavy's	4.6%
All Day Heavy's	4.1%

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	29-Oct	30-Oct	31-Oct	1-Nov	26-Oct	27-Oct	28-Oct		
AM Peak	**235**	**217**	**250**	**230**	**243**	**104**	**93**		
PM Peak	**190**	**206**	**209**	**210**	**181**	**116**	**96**		
0:00	6	5	11	11	9	23	21	8	12
1:00	2	4	1	6	7	13	7	4	6
2:00	2	0	3	3	4	8	6	2	4
3:00	4	3	4	5	6	6	4	4	5
4:00	15	15	12	12	15	14	5	14	13
5:00	39	59	58	48	45	21	9	50	40
6:00	89	87	79	85	80	33	13	84	67
7:00	134	124	131	130	114	42	19	127	99
8:00	235	217	250	230	243	79	26	235	183
9:00	116	102	84	105	95	75	46	100	89
10:00	34	69	46	53	65	104	78	53	64
11:00	57	69	65	68	74	93	93	67	74
12:00	67	69	70	71	75	107	88	70	78
13:00	67	87	67	88	98	97	96	81	86
14:00	116	90	95	116	127	89	71	109	101
15:00	190	196	209	210	181	108	68	197	166
16:00	173	170	189	149	161	99	88	168	147
17:00	174	206	196	179	168	116	94	185	162
18:00	131	121	156	141	132	104	80	136	124
19:00	80	69	97	89	83	67	65	84	79
20:00	41	65	72	44	56	41	28	56	50
21:00	30	28	42	48	56	46	31	41	40
22:00	21	20	21	29	41	36	14	26	26
23:00	8	15	7	19	29	32	7	16	17
Total	**1831**	**1890**	**1965**	**1939**	**1964**	**1453**	**1057**	**1918**	**1728**
% Heavies	**5.0%**	**5.1%**	**4.7%**	**4.7%**	**3.5%**	**2.5%**	**2.2%**	**4.6%**	**4.1%**



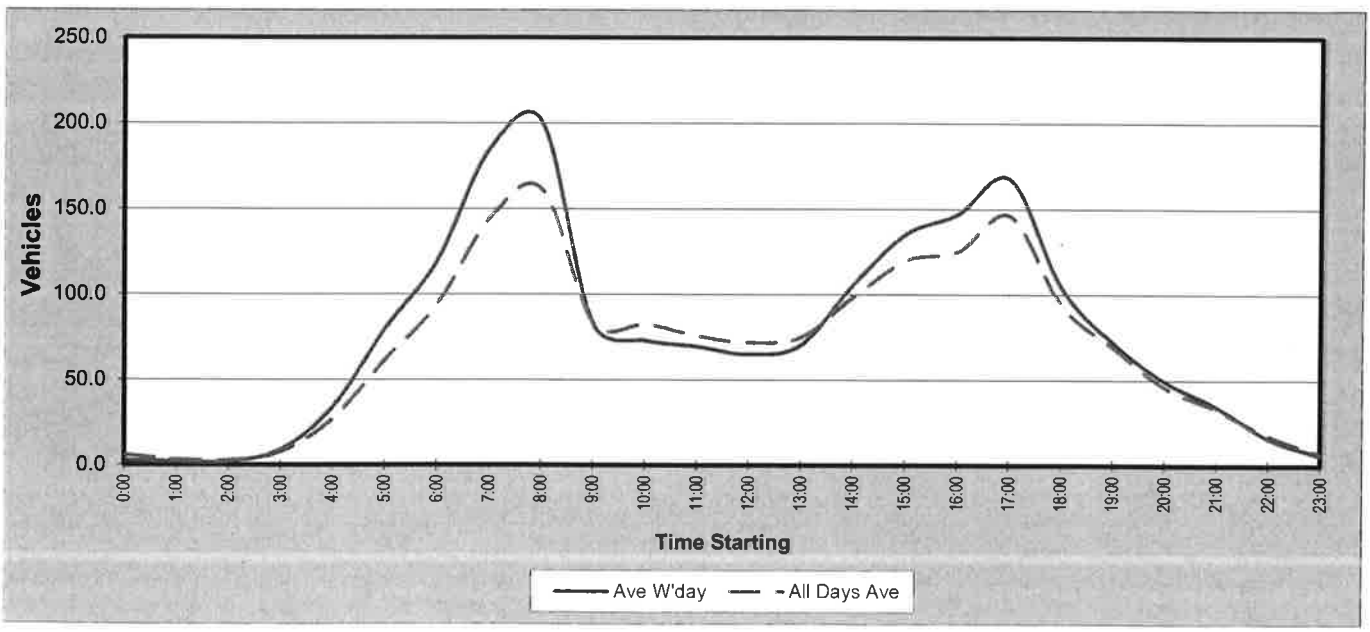
Copyright Austraffic, 1983-2016 (DatXL 3.1.18; 2.37)

austraffic

Road	Tramway Drive
Location	At Currans Hill Drive
Suburb	Currans Hill
Site No.	850302
Start Date	Friday 26/10/2018
Direction	Southbound

Average Weekday	1834
All Day Average	1653
Weekday Heavy's	3.5%
All Day Heavy's	3.1%

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	29-Oct	30-Oct	31-Oct	1-Nov	26-Oct	27-Oct	28-Oct		
AM Peak	**193**	**200**	**238**	**206**	**190**	**110**	**102**		
PM Peak	**148**	**159**	**182**	**194**	**168**	**110**	**84**		
0:00	3	0	2	4	4	8	21	3	6
1:00	1	4	3	1	1	5	7	2	3
2:00	2	3	1	1	3	6	3	2	3
3:00	9	9	12	7	9	7	2	9	8
4:00	36	33	37	33	31	11	9	34	27
5:00	71	79	82	89	78	23	10	80	62
6:00	123	119	111	134	112	47	13	120	94
7:00	185	200	189	188	164	56	27	185	144
8:00	193	178	238	206	190	70	56	201	162
9:00	90	88	85	76	74	97	74	83	83
10:00	75	81	71	68	70	110	102	73	82
11:00	62	68	73	79	66	96	85	70	76
12:00	72	49	59	75	70	92	84	65	72
13:00	75	57	70	72	79	101	72	71	75
14:00	100	100	93	104	132	101	60	106	99
15:00	123	127	141	135	150	97	64	135	120
16:00	148	112	171	160	144	67	72	147	125
17:00	134	159	182	194	168	110	76	167	146
18:00	90	92	125	103	112	78	58	104	94
19:00	61	70	89	78	62	74	51	72	69
20:00	28	46	63	49	61	45	29	49	46
21:00	27	29	40	39	38	42	17	35	33
22:00	14	16	8	16	26	37	6	16	18
23:00	6	6	0	5	13	12	7	6	7
Total	**1728**	**1725**	**1945**	**1916**	**1857**	**1392**	**1005**	**1834**	**1653**
% Heavies	**3.7%**	**3.9%**	**3.5%**	**3.2%**	**3.1%**	**1.9%**	**1.4%**	**3.5%**	**3.1%**



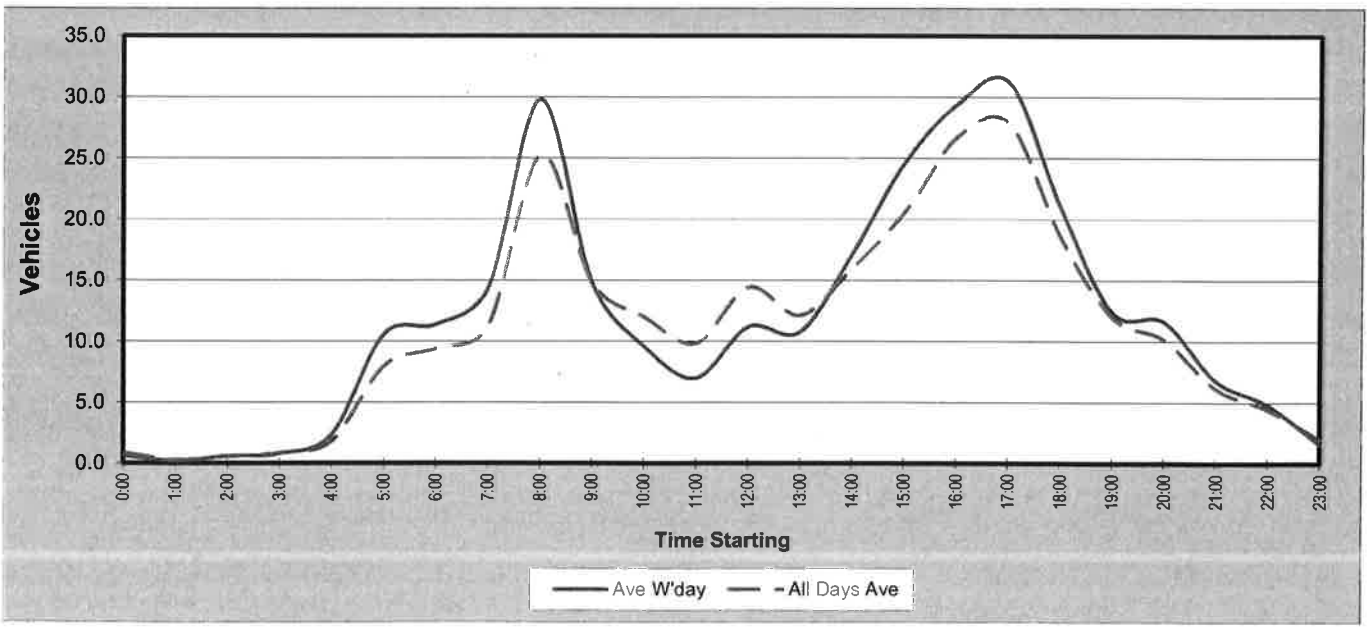
Copyright Austraffic, 1983-2016 (DatXL 3.1.18; 2.37)

austraffic

Road	Turner Road
Location	At Ascot Drive (West of Ascot Dr)
Suburb	Currans Hill
Site No.	850303
Start Date	Friday 26/10/2018
Direction	Eastbound

Average Weekday	285
All Day Average	266
Weekday Heavy's	2.5%
All Day Heavy's	2.3%

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	29-Oct	30-Oct	31-Oct	1-Nov	26-Oct	27-Oct	28-Oct		
AM Peak	**27**	**32**	**30**	**34**	**26**	**19**	**18**		
PM Peak	**27**	**34**	**38**	**31**	**34**	**31**	**19**		
0:00	1	1	0	0	1	0	3	1	1
1:00	1	0	0	0	0	0	1	0	0
2:00	0	2	1	0	0	0	1	1	1
3:00	1	1	0	0	2	0	2	1	1
4:00	2	3	3	4	0	0	1	2	2
5:00	11	11	8	11	12	2	1	11	8
6:00	15	10	9	11	12	7	2	11	9
7:00	13	13	23	12	11	6	1	14	11
8:00	27	32	30	34	26	19	9	30	25
9:00	13	21	15	13	12	13	17	15	15
10:00	11	8	5	11	13	18	18	10	12
11:00	7	2	8	9	9	19	15	7	10
12:00	12	10	11	15	8	31	14	11	14
13:00	13	8	9	15	9	16	15	11	12
14:00	19	17	19	15	16	13	13	17	16
15:00	27	24	20	22	30	9	12	25	21
16:00	23	34	30	29	31	21	19	29	27
17:00	27	26	38	31	34	20	19	31	28
18:00	14	23	26	21	21	14	11	21	19
19:00	7	13	25	11	6	12	10	12	12
20:00	9	7	13	17	12	10	3	12	10
21:00	9	8	3	9	5	8	1	7	6
22:00	2	5	4	4	9	6	1	5	4
23:00	0	0	1	5	2	6	0	2	2
Total	**264**	**279**	**301**	**299**	**281**	**250**	**189**	**285**	**266**
% Heavies	**1.9%**	**2.2%**	**2.3%**	**3.3%**	**2.8%**	**2.0%**	**1.1%**	**2.5%**	**2.3%**



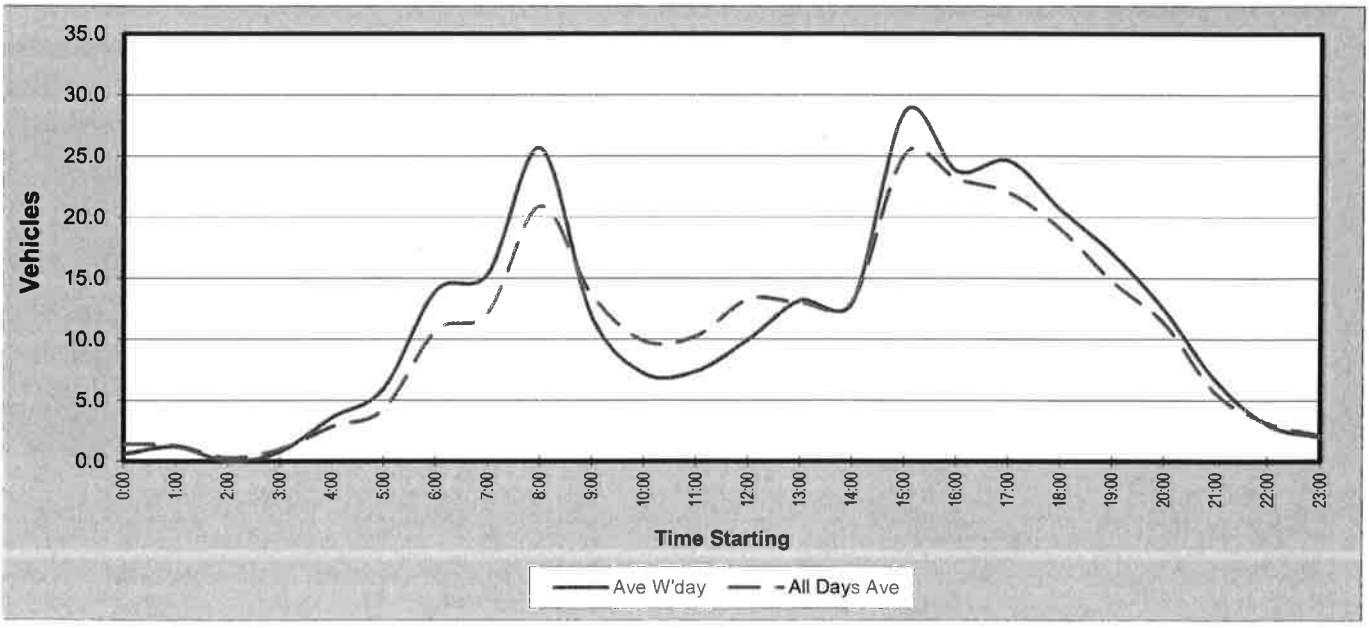
Copyright Austraffic, 1983-2016 (DatXL 3.1.18: 2.37)

austraffic

Road	Turner Road
Location	At Ascot Drive (West of Ascot Dr)
Suburb	Currans Hill
Site No.	850303
Start Date	Friday 26/10/2018
Direction	Westbound

Average Weekday	268
All Day Average	254
Weekday Heavy's	2.4%
All Day Heavy's	2.0%

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	29-Oct	30-Oct	31-Oct	1-Nov	26-Oct	27-Oct	28-Oct		
AM Peak	**27**	**24**	**26**	**26**	**25**	**21**	**17**		
PM Peak	**27**	**26**	**30**	**30**	**32**	**25**	**21**		
0:00	1	1	0	0	1	4	3	1	1
1:00	2	1	1	1	1	0	3	1	1
2:00	0	0	0	0	0	1	1	0	0
3:00	1	2	0	0	1	1	2	1	1
4:00	2	4	4	5	3	1	1	4	3
5:00	7	6	6	3	8	0	0	6	4
6:00	16	14	15	15	10	3	2	14	11
7:00	12	19	11	17	18	6	2	15	12
8:00	27	24	26	26	25	11	7	26	21
9:00	11	14	12	12	10	21	15	12	14
10:00	5	4	14	9	4	16	17	7	10
11:00	12	2	5	9	9	18	17	7	10
12:00	10	5	12	12	11	25	18	10	13
13:00	13	9	15	16	13	9	16	13	13
14:00	13	15	13	16	8	16	11	13	13
15:00	27	26	30	28	32	17	16	29	25
16:00	23	26	15	30	25	22	21	24	23
17:00	26	25	27	21	24	15	16	25	22
18:00	17	19	26	28	13	16	14	21	19
19:00	13	14	25	20	13	8	10	17	15
20:00	10	14	17	11	10	10	7	12	11
21:00	6	6	6	7	8	5	1	7	6
22:00	1	4	5	2	3	7	0	3	3
23:00	1	3	2	2	2	4	1	2	2
Total	**256**	**257**	**287**	**290**	**252**	**236**	**201**	**268**	**254**
% Heavies	**3.1%**	**2.7%**	**2.4%**	**1.4%**	**2.4%**	**0.8%**	**1.0%**	**2.4%**	**2.0%**



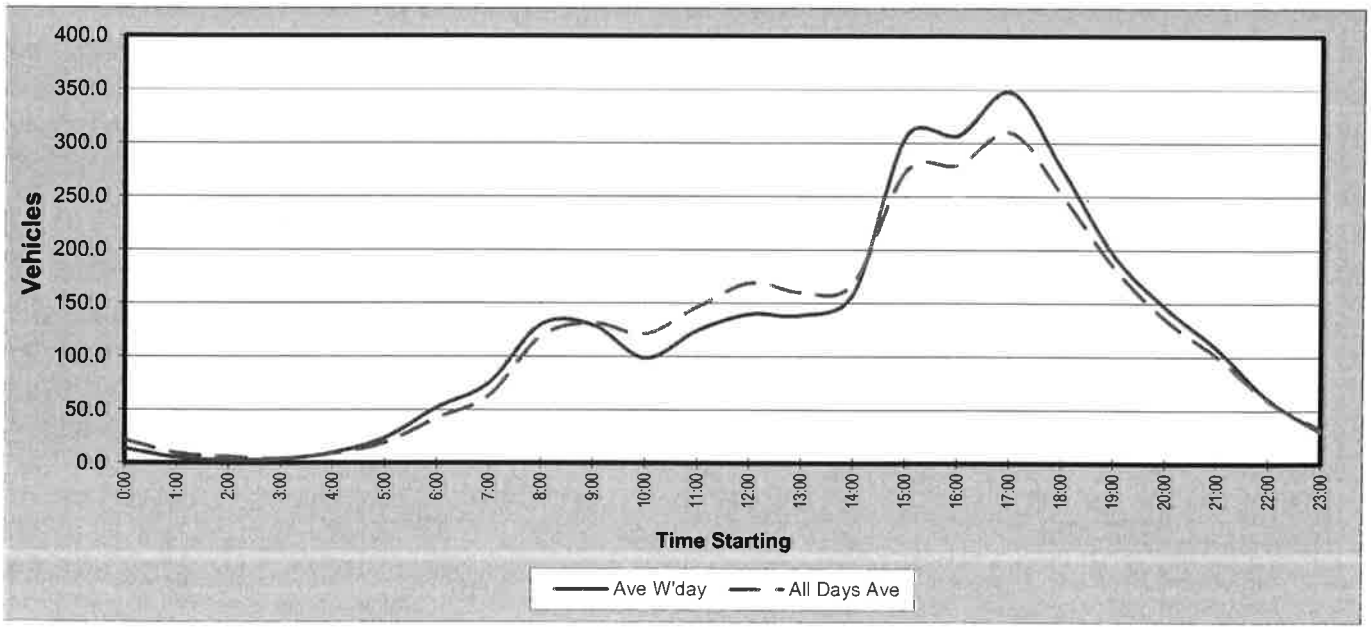
Copyright Austraffic, 1983-2016 (DatXL 3.1.18; 2.37)

austraffic

Road	Currans Hill Drive
Location	East of Tramway Drive
Suburb	Currans Hill
Site No.	850301
Start Date	Friday 26/10/2018
Direction	Eastbound

Average Weekday	2885
All Day Average	2817
Weekday Heavy's	4.6%
All Day Heavy's	4.3%

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	29-Oct	30-Oct	31-Oct	1-Nov	26-Oct	27-Oct	28-Oct		
AM Peak	**132**	**152**	**140**	**138**	**142**	**214**	**187**		
PM Peak	**338**	**374**	**335**	**336**	**356**	**260**	**224**		
0:00	10	10	17	12	19	35	47	14	21
1:00	3	4	4	6	9	16	23	5	9
2:00	1	4	4	1	3	11	16	3	6
3:00	5	2	4	3	5	2	7	4	4
4:00	11	15	6	10	7	11	4	10	9
5:00	21	25	26	26	21	6	10	24	19
6:00	48	57	52	60	44	25	11	52	42
7:00	72	69	91	68	77	44	24	75	64
8:00	132	111	128	138	142	112	70	130	119
9:00	125	152	140	112	118	166	108	129	132
10:00	106	77	95	95	120	201	153	99	121
11:00	114	120	140	112	137	214	187	125	146
12:00	125	136	136	130	172	260	224	140	169
13:00	132	133	141	144	144	217	207	139	160
14:00	170	143	149	151	184	203	184	159	169
15:00	307	291	326	283	327	209	176	307	274
16:00	315	301	320	294	306	225	192	307	279
17:00	338	374	335	336	356	226	205	348	310
18:00	252	264	307	288	266	207	176	275	251
19:00	173	184	218	199	204	158	154	196	184
20:00	117	125	186	174	130	134	81	146	135
21:00	75	96	128	131	111	108	55	108	101
22:00	33	57	53	76	82	82	30	60	59
23:00	16	27	24	35	49	60	16	30	32
Total	**2701**	**2777**	**3030**	**2884**	**3033**	**2932**	**2360**	**2885**	**2817**
% Heavies	**5.0%**	**5.1%**	**4.1%**	**4.2%**	**4.7%**	**3.5%**	**3.1%**	**4.6%**	**4.3%**



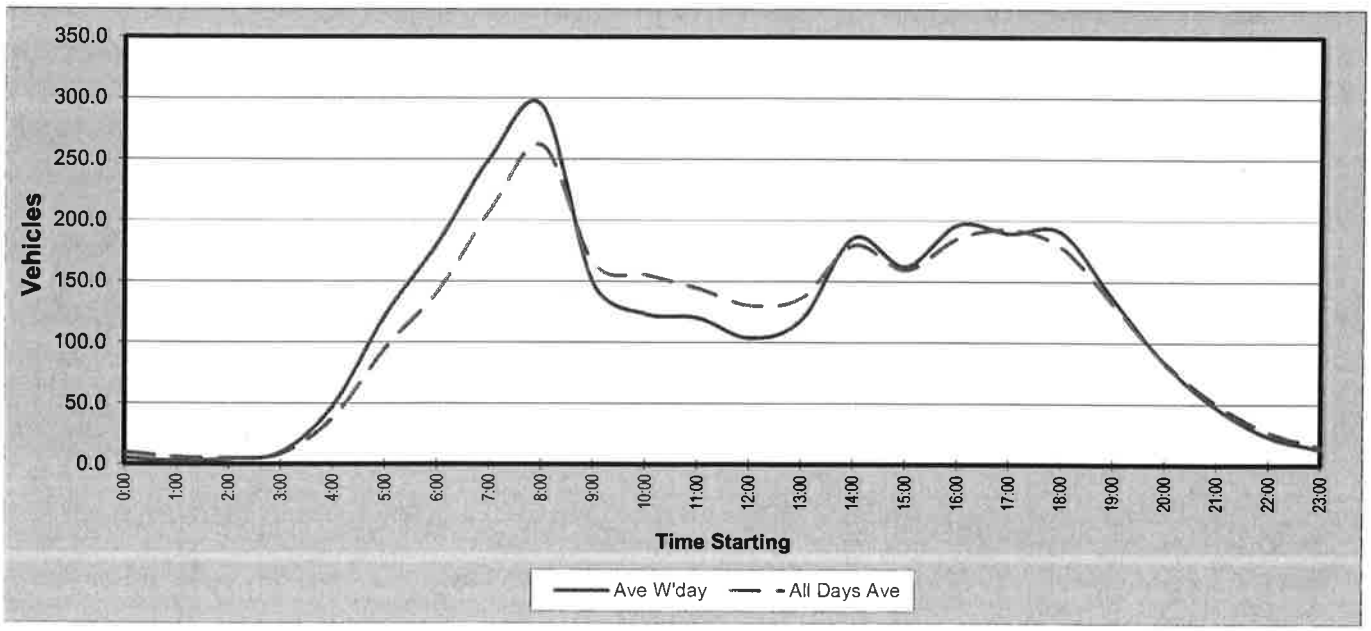
Copyright Austraffic, 1983-2016 (DatXL 3.1.18; 2.37)

austraffic

Road	Currans Hill Drive
Location	East of Tramway Drive
Suburb	Currans Hill
Site No.	850301
Start Date	Friday 26/10/2018
Direction	Westbound

Average Weekday	2760
All Day Average	2710
Weekday Heavy's	5.5%
All Day Heavy's	5.0%

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	29-Oct	30-Oct	31-Oct	1-Nov	26-Oct	27-Oct	28-Oct		
AM Peak	**284**	**291**	**318**	**276**	**299**	**245**	**225**		
PM Peak	**202**	**187**	**222**	**200**	**216**	**211**	**194**		
0:00	4	2	5	9	5	13	30	5	10
1:00	3	3	2	4	1	10	19	3	6
2:00	4	7	5	2	4	3	9	4	5
3:00	10	8	12	9	10	5	6	10	9
4:00	47	51	48	51	43	14	13	48	38
5:00	116	115	124	136	121	41	15	122	95
6:00	170	180	194	192	171	66	21	181	142
7:00	253	260	257	246	241	133	70	251	209
8:00	284	291	318	276	299	219	143	294	261
9:00	144	145	163	135	154	225	187	148	165
10:00	135	134	103	107	138	245	225	123	155
11:00	105	111	141	123	121	218	192	120	144
12:00	86	89	106	105	133	200	194	104	130
13:00	121	116	127	98	131	195	171	119	137
14:00	180	184	174	183	208	163	165	186	180
15:00	147	155	167	156	186	167	140	162	160
16:00	202	176	219	186	200	177	138	197	185
17:00	145	187	200	200	216	211	188	190	192
18:00	164	178	222	179	208	173	123	190	178
19:00	108	125	174	139	133	137	106	136	132
20:00	61	71	90	94	101	113	58	83	84
21:00	38	47	50	40	61	81	35	47	50
22:00	18	23	16	24	36	54	19	23	27
23:00	8	7	10	14	27	34	6	13	15
Total	**2553**	**2665**	**2927**	**2708**	**2948**	**2897**	**2273**	**2760**	**2710**
% Heavies	**5.5%**	**5.6%**	**5.1%**	**5.6%**	**5.4%**	**4.2%**	**3.3%**	**5.5%**	**5.0%**



Copyright Austraffic, 1983-2016 (DatXL 3.1.18: 2.37)

Annexure "G"
Landscape Plans



PLAN
1:750



LOT42 PARK PLAN
1:200

LEGEND

- SITE BOUNDARY
- ROCK WORK / RIP RAP
- SANDSTONE BLOCK WALL
- ACCESS PATH
- EXISTING CULVERT (APPROXIMATE LOCATION BASED ON AERIAL)
- EXISTING CREEKLINE (APPROXIMATE LOCATION BASED ON AERIAL)
- EXISTING TREES TO BE RETAINED (APPROXIMATE LOCATION BASED ON AERIAL)
- STREET TREE PLANTING
- RIPARIAN TREE PLANTING
- ZONE 1: LOW FLOW AREAS
- ZONE 2: DETENTION BASIN BATTERS
- ZONE 3: REVEGETATION
- VERGE
- ROCK DROP STRUCTURES

INDICATIVE PLANT LIST

STREETSCAPES

Symbol	Botanical Name	Common Name
	STREET TREE PLANTING	
	Trisaniopsis laurina	Water Gum
	Elaeocarpus eumundi	Quandong
	Waterhousia floribunda	Weeping Lilly Pilly

RIPARIAN ZONE PLANTING

Symbol	Botanical Name	Common Name
	TREE PLANTING	
	Eucalyptus tereticornis	Forest Red Gum
	Angophora floribunda	Rough-Barked Apple
	SEDGES	
	Baumea articulata	Jointed Twig-rush
	Bolboschenus fluviatilis	Marsh Club-rush
	Carex appressa	Tall Sedge
	Juncus usitatus	Common Rush
	SEDGES, RUSH, REEDS & GRASSES	
	Carex appressa	Tall Sedge
	Dianella longifolia	Blueberry Lily
	Juncus usitatus	Common Rush
	NATIVE GRASSES AND GROUNDCOVERS	
	Dichondra repens	Kidney Weed
	Microleana stipoides	Weeping Meadow Grass
	Rytidosperma racemosa	Wallaby Grass

DIALOGUE

1. 1:5 Turf embankment provides a transition from road to park
2. Open turf kickabout area centrally located
3. Screen planting to edge of park provides a buffer to residential lot
4. Exercise area for groups to meet
5. Public Art opportunity
6. Timber viewing deck with seating
7. 3000mm wide shared path

DRAFT

TaylorBrammer

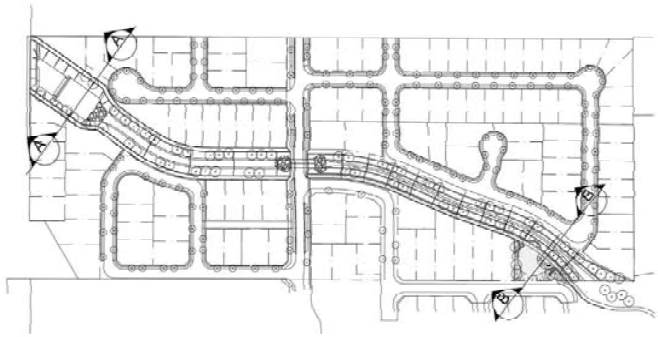
TURNER ROAD
CURRENS HILL

DARTANYON PTY LTD

LC01 F



SECTION ELEVATION AA
1:100



KEY PLAN



SECTION ELEVATION BB
1:100

DRAFT

B For DA Submission 29.10.2015
1. Section CC Removed.
Footpaths removed from sections.
A For DA Submission 14.10.2015
ISSUE DESCRIPTION DATE

TaylorBrammer

TAYLOR BRAMMER LANDSCAPE ARCHITECTS PTY LTD.

AUSTRALIA STUDIO

28 Moore Street, Austinmer
PO Box 64 Austinmer NSW 2515

T 61 2 4267 5250
F 61 2 4267 4250
E austinmer@taylorbrammer.com.au

PROJECT:
TURANDA ROAD
CURRENT HILL

DRAWING TITLE:
LANDSCAPE CROSS SECTIONS

CLIENT:
DARTANYON PTY LTD

SCALE: 1:100 @ B1 DRAWN: IB DRAWING NO: REVISION:
DATE: 30.09.2015 JOB NO: 15.4079 LC02 B
CHKD: MB DESIGNED: IB

Copyright of Taylor Brammer Landscape Architects Pty Ltd. ABN 61 064 724 588

Annexure "H"
Stormwater Management Assessment

Proposed Rezoning of

Lot 36 in DP28024 and Lot 105 in DP 1210084
Turner Road, Currans Hill

Stormwater Management Report

Prepared by

JMD Development Consultants
Consultants in Surveying, Engineering, Water & Sewer Design & Project Management
Ph 02 4625 5055, Fax 02 4628 2013
Email: admin@jmd.com.au

For

Turner Road Developments & Broome

Date

Issue B – 29 October 2019

Contents

1. Introduction 4
2. Background 6
2.1. Site Description 6
2.2. Previous Applications 6
2.3. Existing Conditions 7
2.4. Drainage Concepts 7
3. Stormwater Quantity Issues 9
3.1. Existing Conditions 9
3.2. Ultimate Conditions 10
4. Stormwater Quality Issues 13
4.1. Water Quality for Ultimate Development Conditions 13
5. Main Channel Hydraulics – Ultimate Development Conditions 15
5.1. Ultimate Development 15
6. Erosion and sediment control 18
7. Conclusions 19

List of Figures

Figure 1-1: Locality Sketch of the Site 4
Figure 2-1: Current Zoning 6
Figure 5-1: HEC-Ras model of central creek system 15

List of Tables

Table 3-1: Existing Catchment Details 9
Table 3-2: XP-Rafts Loss Factors 9
Table 3-3: Catchment Area Summary 10
Table 3-4: Summary of XP-Rafts Modelling – Existing Conditions 10
Table 3-5: Ultimate Catchment Details 11
Table 3-6: Summary of XP-Rafts Modelling 11
Table 4-1: Oran Park DCP Water Quality Objectives 13
Table 4-2: Music Modelling Results 14

Annexures

Annexure A. Preliminary Zoning Plan prepared by JMD Ref: 14194E13 Issue C dated 16th October 2019

Annexure B. Concept Engineering Plans
14194E8 – Concept Engineering Plans dated 29-10-2019 - Issue B

Annexure C. Water Quantity Modelling – XP Rafts Modelling for Existing Conditions
Annexure D. Water Quantity Modelling – XP Rafts Modelling for the Ultimate Development
Annexure E. Central Channel Hydraulics – Ultimate Development Conditions
E.1 – Hec-Ras Profile Section – Ultimate Development
E.2 – Hec-Ras cross sections
E.3 – Table of Results

1. Introduction

JMD has been retained by Turner Road Developments and Broome to prepare a stormwater management report summarising drainage concept and stormwater management in support of a proposed rezoning of Lots 36, in DP28024 and Lot 105 in DP 1210084, Turner Road, Currans Hill.

Turner Road Developments is the owner of Lot 105 in DP 1210084 while Broome is the owner of Lot 36 in DP 28024. It is proposed that all three (3) lots, known as the "Site" are developed together in a number of stages.



Figure 1-1: Locality Sketch of the Site

The site will ultimately be developed for residential housing to the maximum extent permitted by the planning for the site. The rezoning application aims to realign the zoning of the site to be consistent with the proposed trunk drainage facilities for the ultimate development. It is noted that the first stages of the development are not affected by the rezoning and are being developed separately under DA528/2008 & DA525/2017.

While the catchment area of the existing watercourse extending through the site conveys runoff from multiple land holdings, Council have not developed a s94 works concept for the drainage within the site. In the absence of the support of a s94 funded works plan, JMD have developed a trunk drainage scheme for the catchment which will cater for the control of stormwater off the entire catchment and our clients have commenced negotiations with the adjoining land owners for the equitable sharing of development costs associated with the trunk drainage works.

Ultimately it is proposed that a formalised drainage channel trunk drainage system which is compliant with the requirements of the Camden Council Design Specification be constructed through the site.

The current proposal is for the rezoning of the portion of the site surrounding the existing land zoned E2 and its realignment. JMD have established a trunk drainage system that caters for the entire catchment and therefore this rezoning application aims to adjust the boundaries in accordance with the ultimate drainage concept.

This report documents the proposed ultimate trunk drainage components and the design principles used to develop the scheme which supports this application.

It is proposed that the new drainage corridor will be dedicated to council.

2. Background

2.1. Site Description

The site is approximately 11.59ha in area and is located on the northern side of Turner Road opposite the intersection of William Mannix Avenue. The site fronts Turner Road (running East-West) and currently has three zonings as described and detailed in Figure 1-1 below:

- the north western corner of the lot is zoned "E4 – Environmental Living";
- the central portion of the site contains an existing channel and has therefore been zoned "E2 – Environmental Conservation";
- the remaining portion of the site is zoned "R1 – General Residential";

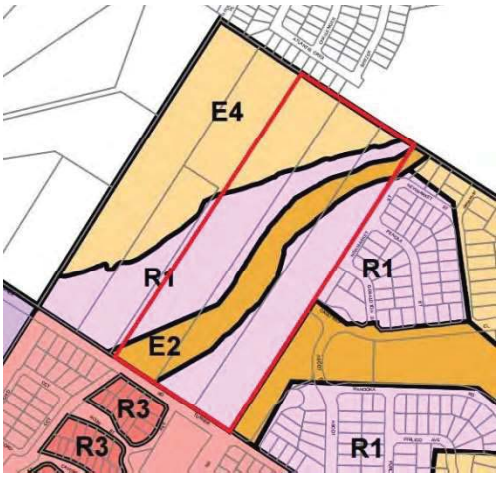


Figure 2-1: Current Zoning

This rezoning application is being prepared for the site which will define the actual limits of the area zoned "E2 – Environmental Conservation".

2.2. Previous Applications

A portion of the site has already been subdivided under DA582/2008, this subdivision created lot 105 in DP1210084.

DA525/2017, approved by Camden Council 28 November 2017 affects all lots and will result in the subdivision of those lots in two stages to create 40 residential lots and 2 residue lots. Stage 1 of this DA is currently under construction.

2.3. Existing Conditions

The subject site generally consisted of open pasture with little tree cover of which much has recently been subject to earthworks recently CC approved for DA525/2017.

A large dwelling currently exists in the northern end of Lot 36 in DP 28024. Surrounding this dwelling is a tennis court, sheds and a paved driveway / court area. It is proposed that this dwelling and the surrounding structures, elements etc. will be demolished as part of the previous application (DA525/2017).

The site is affected by an informal gully system which has been significantly altered from a natural creek system to contain a number of dams as a result of past pasture usage of the site. This gully conveys the flows from a catchment area upstream of the site (to the north) measuring some 20.4ha in area. This upstream catchment has in recent years, been developed as part of the Gregory Hills development area and it is understood that the developed flows off that catchment are being collected in a detention system on the upstream property which retards the stormwater flows off the developed catchment such that the peak stormwater flow is reduced to the pre-developed conditions. The final design details of that detention system were not known at the time of the preparation of this report and so for the purposes of this assessment, it has been assumed that the upstream catchment remains in an undeveloped condition.

In addition, to the upstream catchment from Gregory Hills there are two other external catchments that also drain on to the site. These being a portion of the Manooka Valley subdivision east of the subject site and a portion of the existing rural land west of the subject site. While the western external catchment area contains minor rural dwellings and associated outbuildings, the catchment area to the channel remains largely undeveloped. All flow from this catchment area to the subject site can be considered overland sheet flow.

The eastern external catchment area is different in the fact that it has recently been developed into a residential subdivision. Prior to its development in 2012 it had similar catchment properties as the subject site i.e. rural open pasture. Following the Manooka Valley development, the developed catchment area is captured by street drainage and piped to a raingarden/OSD basin before being discharged into the subject site via a 525mm pipe at ground level.

Downstream of the site, the central creek system discharges to an existing drainage channel which has been constructed on the other side of Turner Road. Water discharges under Turner Road via a number of 600mm high concrete culverts which total 5.4m wide under Turner Road.

The extent of the catchment considered by this study is detailed in the Catchment Plans included with the Concept Engineering Plans located in Annexure B.

2.4. Drainage Concepts

Camden Council have developed a Master Drainage Plan for most development areas in the LGA and then supported that Plan with developer contributions levied pursuant to the Camden s94 Contributions Plan which provides for a level of equity among the properties to be developed in a locality. The s94 Plan provides a vehicle for the funding of local infrastructure required to be constructed as a result of the development of the locality.

Unfortunately the Camden Contributions Plan does not consider the drainage requirements for the development of this catchment. There is therefore no official mechanism for the funding of the trunk drainage works required to be constructed within this site.

JMD have completed a review of the catchment area and assessed the extent of works required to produce a drainage scheme for the site which is compliant with the Camden Council design Specification. These works include the construction of a central channel, road culverts, rain garden and stormwater detention basin together with trunk stormwater pipes to convey flows from upstream properties to the central channel system.

For the purposes of that 'whole of catchment' investigation, it has been assumed that the south-eastern portion of the western external catchment (currently known as Lots 351 and 352 in DP809159 and Lot 34 in DP28024) will be developed for residential development and that the stormwater flows off that land will be directed to the central creek system within the subject site via the future road drainage system. These catchment areas are identified as Catch 1 and Catch 2 in the "Catchment Plan for the Ultimate Development" Drawing. The north-western corner of these parcels is severed from the local catchment by the natural topography of the site. It has been assumed that this northern catchment will drain away from the subject site towards the western Turner Road Precinct drainage system.

The current rezoning proposal seeks to adjust the existing zoning boundaries to allow the Ultimate Drainage Concept described in the catchment plans to be developed.

3. Stormwater Quantity Issues

It is understood that all development within the catchment area will need to provide adequate on-site detention such that the discharge from the developed site is less than that which occurs under current conditions.

3.1. Existing Conditions

It is noted that the XP-Rafts model for the existing catchment has been set-up as a snapshot of what the existing flows were prior to the development of the Manooka Valley subdivision and corresponding Raingarden / OSD basin. This modelling also assumes that the Stage 1 & 2 development (DA 525/2017) hasn't been developed yet. Sheet 5 of the concept engineering plans describes the existing catchment areas and flows. These are also detailed below.

Table 3-1: Existing Catchment Details

EXISTING CATCHMENT AREA	Area (ha)	% Impervious	Area Impervious (ha)	Area Pervious (ha)	All areas added?
A	7.293	0%	0.0	7.293	Y
B	4.741	9.2%	0.436	4.305	Y
MV**	3.54	0%	0.0	3.54	Y
C	3.596	0%	0.0	3.596	Y
D	0.968	0%	0.0	0.968	Y
E	0.973	0%	0.0	0.973	Y
U/S	20.4	0%	0.0	20.4	Y
TURNER RD***	41.511		0.436	41.075	Y

An XP-Rafts model for the site under current conditions was constructed to establish the base line peak flows off the site against which the developed flows would be compared, this is described in the "Catchment Plan under Existing Conditions". This XP-Rafts file was then adapted to reflect the developed conditions. Loss factors for the models were adopted from Council's design code as listed in Table 3-2 below:-

Table 3-2: XP-Rafts Loss Factors

Condition	Loss Factor
Pervious Initial Loss	10mm
Pervious Continuing Loss	3mm/hr
Impervious Loss	1.5mm
Impervious Continuing Loss	0mm/hr
'B' Multiplier	1.0

Roughness factors adopted for the models were 0.06 for existing grassed pervious surfaces, 0.03 for developed grassed pervious surfaces and 0.013 for all impervious surfaces. Each catchment was divided into the different development zones and assigned the appropriate % impervious areas as per Table 3-3 below.

Table 3-3: Catchment Area Summary

Catchment type	% Impervious
Residential	75%
Open space areas	5%
Drainage reserve	0%
External Catchment	0%

A summary of the existing peak flows extending through the Turner Road culverts is detailed in Table 3-4.

Table 3-4: Summary of XP-Rafts Modelling – Existing Conditions

	STORM EVENT					
FLOW IN TURNER ROAD CULVERT***	2yr peak flow (cum/s)*	5yr peak flow (cum/s)*	10yr peak flow (cum/s)*	20yr peak flow (cum/s)*	50yr peak flow (cum/s)*	100yr peak flow (cum/s)*
EXISTING CATCHMENT	2.224	3.666	4.520	5.740	6.968	7.907

3.2. Ultimate Conditions

JMD have prepared the ultimate model for the site using the XP-Rafts computer program. For the purposes of this study, the site has been divided into a number of catchments as detailed in the Catchment Plan for the Ultimate Development (Sheet 6 of the concept engineering plans in Annexure B). The catchment plan details an indicative ultimate development layout based on this rezoning application being lodged with Council. The Catchment Plan for the Ultimate Development has been prepared to provide for the likely maximum development potential on the site and hence the expected "worst case" stormwater outcomes. The layout in the catchment plan is not intended to "fix" any development rights for the site.

In the "Catchment Plan for the Ultimate Development", Catchments 1 and 2 denote the future development sites to the west of the site. Catchments 3 to 6 cover the proposed development site. Each catchment area has been divided into residential and drainage reserve areas with residential areas assumed to be 75% impervious and drainage reserve areas assumed to be 0% impervious. The upstream (U/S) and Manooka Valley catchments (MV) have been included as detailed in Section 2.4 above.

The same loss factors and percentage impervious attributes detailed in Tables 3-2 and 3-3 were adopted for the Ultimate Development model.

Table 3-5: Ultimate Catchment Details

DEVELOPED CATCHMENT AREA	Area (ha)	% Imperv	Area Imperv (ha)	Area Pervious (ha)	All areas added?
1	3.575	75%	2.681	0.894	Y
2	2.403	75%	1.802	0.601	Y
3	1.586	75%	1.190	0.396	Y
4	4.173	75%	3.130	1.043	Y
MV**	3.54	75%	2.655	0.885	Y
5	2.487	75%	1.865	0.622	Y
6	1.681	75%	1.261	0.420	Y
U/S	20.4	0%	0.0	20.4	Y
CULVERT	0.780	0%	0.0	0.780	Y
TURNER RD***	0.882	0%	0.0	0.882	Y
SUM	41.507		14.584	26.923	Y

It is noted that the minor differences in total area is a result of rounding areas. Details of the XP-Rafts modelling and results are detailed in Annexure C of this report and summarised in Table 3-6 below.

Table 3-6: Summary of XP-Rafts Modelling

	STORM EVENT					
FLOW IN TURNER ROAD CULVERT***	Dev 2yr peak flow (cum/s)*	Dev 5yr peak flow (cum/s)*	Dev 10yr peak flow (cum/s)*	Dev 20yr peak flow (cum/s)*	Dev 50yr peak flow (cum/s)*	Dev 100yr peak flow (cum/s)*
EXISTING CATCHMENT	2.224	3.666	4.520	5.740	6.968	7.907
ULTIMATE DEVELOPED CATCHMENT	2.121	2.856	3.484	4.804	6.092	7.360
PONDING LEVEL IN TURNER ROAD OSD BASIN	94.287	94.793	94.95	95.124	95.255	95.37

The Ultimate Developed Scenario has been modelled with an on-line detention basin located at the downstream end of the drainage channel immediately upstream of Turner Road. The basin proposed represents a formalisation and widening of the existing channel to form an open basin with flat floor and banks sloping at 1 in 4 (V:H). Where the floor of the basin is not affected by the proposed rain garden, the bed is graded to the primary outlet at 1%. A low mound will be constructed across the base of the basin area immediately downstream of the proposed rain garden to provide the required extended detention in the rain garden. The rain garden and basin walls will be vegetated to improve performance of the rain garden and to reduce maintenance of the banks.

The modelling was carried out for multiple storm durations ranging from 20 minutes to 3 hours for 1 in 2 year Average Recurrence Interval (ARI), 1 in 5 year ARI, 1 in 10 year ARI, 1 in 20 year ARI, 1 in 50 year ARI and 1 in 100 year ARI storm events. The 2 hour event was found to be the critical duration for most models. Flows out of the basin are proposed to be controlled by the construction of discharge control outlets in a retaining wall (control wall) to be constructed immediately upstream of the Turner Road Weir. The proposed control wall and outlet are detailed in the concept engineering plans in Annexure B. As mentioned above, the proposed basin for the ultimate

development includes a rain garden bed in the base to manage water quality issues for the catchment, details regarding the raingarden are included in chapter 4 below.

The proposed depth of ponding in the basin in peak 1 in 100 year ARI storm conditions will be 2.07m and not cross the shared pathway that is to be located along the outer edge of the riparian corridor. Council's design code requires all basins with a ponding depth in excess of 0.3m to be fenced for safety of the public and so such fencing will be provided to the basin. The proposed 1 in 4 embankment batters then, are not therefore considered to be a significant risk. The basin will be provided with a sealed vehicular access ramp off Turner Road which grades at about 13% and so will provide a pedestrian traversable exit point should such be required during flooding.

4. Stormwater Quality Issues

The site is located within the Currans Hill Release Area and as such developments are required to comply with the requirements of Camden Council's Engineering Design Specification. This document has been in existence for some time and as such only specifies generic water quality objectives. Previous discussions with the officers of Camden Council have revealed that Council acknowledge that the requirements of the Engineering Design Specification are outdated and new developments are now required to satisfy the water quality objectives contained in the Oran Park DCP which are detailed in Table 4-1 below.

Table 4-1: Oran Park DCP Water Quality Objectives

	Water Quality (% reduction in pollutant loads)			
	Gross Pollutants	Total Suspended Solids (TSS)	Total Phosphorus (TP)	Total Nitrogen (TN)
Stormwater Management Objective	90	85	65	45

The objectives prescribed represent the reduction in pollutant loads in the developed condition required to be met by a particular development. In accordance with the current requirements of Camden Council, the water quality assessment has been completed by JMD using the MUSIC computer program (version 6.1 build 0.767).

Similarly to the water quantity modelling described in Section 4 of this report, a MUSIC model for each catchment was created adopting the same % impervious details described in Table 3-3. The outputs from these models were then adopted as the base line data against which the effectiveness of the proposed treatment measures would be measured.

Although the project does not lie within an area controlled by Sydney Catchment Authority, that Agency has invested a significant amount of time and effort into the development and use of the MUSIC program and their manual titled "Using MUSIC in Sydney's Drinking Water Catchment" (The SCA Manual) provides a detailed explanation of the concepts involved in the use of the program. The source and treatment nodes for this assessment have been set up in accordance with the recommendations of the SCA Manual.

The residential source nodes have been established using the % impervious data described above and pollutant loads have been input as described in the SCA Manual. It has been assumed that each dwelling will be supplied with a rainwater collection tank with the collected water being reused for toilet, laundry and hot water (309kL/yr total usage).

4.1. Water Quality for Ultimate Development Conditions

It has been assumed that ultimately, all stormwater outlets to the central drainage channel will be screened via a GPT constructed at the outlet prior to discharge and that low flows in the channel will pass through a rain garden to be constructed in the base of the proposed detention basin.

A base model of the developed site with no treatment measures was created to establish the control data. The required treatment objectives were then applied to this control data and the size of the rain garden was adjusted until the resultant pollutant loads from the developed site with treatment

met the target loads. The model indicates that the rain garden for this site is required to be 945sqm in area.

Table 4-2: Music Modelling Results

Data	No Treatment	Required % reductions	Target mean annual loads	Treatment - tanks, GPT & Raingarden (945sqm)	% reduction compared to no treatment
Flow (ML/yr)	110			88.4	
Peak Flow (m3/s)	4.76			4.32	
Total Suspended Solids (kg/yr)	1.94E+04	85%	2910	2.75E+03	85.8%
Total Phosphorus (kg/yr)	36.1	65%	12.64	11.9	67.0%
Total Nitrogen (kg/yr)	238	45%	130.90	98.7	58.5%
Gross Pollutants (kg/yr)	3.15E+03	90%	315.00	2.48E+01	99.2%

For the purposes of this assessment, the treatment nodes have been established as follows:-

GPT – Assumed to be Humegard GPT with following treatment capacities as published by the manufacturer.

TSS 41% removal
TP 34% removal
TN 24% removal
GP 90% removal

If at the time of detailed design it is found that a Humegard GPT doesn't meet these requirements, an Ecosol GPT unit will be used as the treatment capacities published by this manufacturer exceed the capacities used in the music modelling.

Pollutant	Removal Rate (%)	Entered Input Value	Entered Output Value
Total Suspended Solids (20 - 2000µm)	55	1000	450
Total Phosphorus	40	1000	600
Total Nitrogen	40	1000	600
Gross Pollutants (>2000µm)	99	1000	10
Heavy Metals	25	n/a	n/a
Total Petroleum/Hydrocarbons (Dry weather spill situation)	99	n/a	n/a

Table 6 - Ecosol™ Gross Pollutant Trap – High Flow, input and output values

The rain garden adopted for the site has an extended detention depth of 0.3m with 1 in 4 banks, a media (sandy loam) bed area of 945sqm and depth of 0.4m of media (min hydraulic conductivity of 200mm/hr (modelled as 100mm/hr to allow for degradation of media over time) and a 200mm deep submerged zone with 5% by volume of hardwood chip.

The MUSIC model indicates that the combination of the rain water tanks, gross pollutant traps and rain garden will combine to result in pollutant loads from the site complying with the target objectives.

5. Main Channel Hydraulics – Ultimate Development Conditions

5.1. Ultimate Development

The concept design of the main channel within the site has been modelled using the HEC-Ras hydraulic program. The channel is linear in nature and so the use of this one-dimensional hydraulic program produced by the US Army Corp is considered appropriate.

The channel has been modelled using the flows obtained from the XP-Rafts model and an assumed channel profile based on the site survey data. The site is quite steep in hydraulic terms and it has been determined that a number of drop structures will need to be incorporated in the channel in order to meet the following requirements detailed within Camden Council's Engineering Design Specification for the channel.

Velocity	<2m/s
Freeboard	0.5m to top of channel
Froude No	<0.8
Min Cross fall	1%

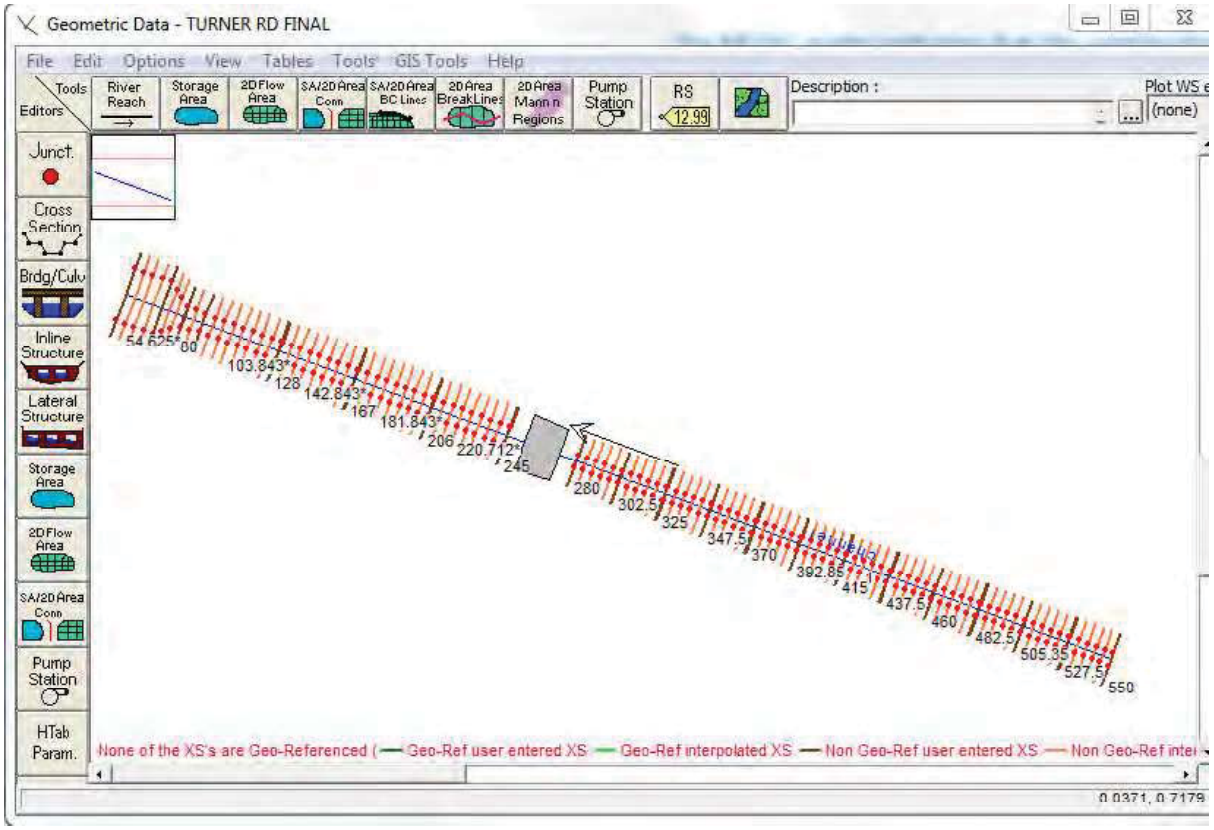


Figure 5-1: HEC-Ras model of central creek system

Figure 5-1 depicts the final model adopted for the channel. The river stations used in the model reflect the central channel chainages depicted in the JMD plans.

The Council requirement for the Froude Number to be less than 0.8 resulted in the need to reduce the channel bed slope to below 0.75%. The natural grade on the catchment is somewhat steeper than this and so the inclusions of regular stacked rock drop structures in the channel bed have been included to lower this effect. Below Road No. 1 these rock drop structures will be 0.77m high and

spaced approximately 39m centres and north of the Road No.2 culverts, the drop structures will be 0.75m high and spaced on average at 22.9m centres.

The central channel north of the Road No. 2 culverts will be 8m wide (4m each side of the centreline) with 1 in 10 batters for 1.5m to create the main channel. This centre part of the channel will be rock lined with some vegetation. The outer banks (each 7.5m wide) vary from 5 – 20% due to the need to transition between successive drop structures and will contain some sandstone block retaining walls as required. A shared pedestrian pathway is proposed to be located along one of the sides to provide access from Turner Road to Gregory Hills.

The central channel south of Road No. 2 will also consist of an 8m wide main channel with 1 in 10 batters for 1.5m. The outer banks of the channel (each 9m wide) will vary in slope from 5% to 20% due to the need to transition between successive drop structures. Like the northern section a shared pedestrian pathway is proposed to be located along one of the sides to provide access from Turner Road to Gregory Hills and retaining walls will be used as required.

It is understood that the channel will be planted out as riparian land. A roughness factor of 0.05 was adopted for the central channel as it will also be rock lined and 0.05 for the outer banks as it will be more vegetated.

The Road No. 2 culvert has been modelled as twin 3.6m wide by 1.2m high precast concrete box culverts. The design 1 in 100 year ARI flow at the culvert is 6.61cumecs resulting in an average flow per m width of culvert of 0.91m^3/s. Using these inputs in the nomogram provided in the manual titled “Hydraulics of Precast Concrete Conduits” published by the Concrete Pipe Association of Australasia, the estimated depth of flow through the culverts is approximately 0.66m. Adopting an internal height of the culvert of 1.20m, the freeboard to the soffit of the culvert is calculated as being 1.20-0.66 = 0.54m. Therefore, the 1.2m high culverts provide at least the 0.5m freeboard required by Council.

In accordance with Council’s design code requirement the culverts are also to be assessed for a 50% blockage factor in the 1% AEP (1 in 100 Year ARI) flow. As such, if we assume that one of the culverts is fully blocked (i.e. 50% blockage factor) and the entire flow is conveyed through only one of the culverts, the resulting average flow per m width of culvert is 1.84m^2/s. Using these inputs in the nomogram provided in the manual titled “Hydraulics of Precast Concrete Conduits” published by the Concrete Pipe Association of Australasia, the estimated depth of flow through the culverts is approximately 1.09m. Adopting an internal height of the culvert of 1.20m, the freeboard to the soffit of the culvert is calculated as being 1.20-1.09 = 0.11m. Therefore, the 1.2m high culverts still provide a 0.11m freeboard when a 50% blockage factor is applied to the culverts. This water level equates to RL 99.27 + 1.09m = RL 100.36. The top of water level in the 1:100yr ARI storm event under a 50% blockage factor is 1.10m below the Road No.2 centreline level which has a level of RL101.46.

The existing culverts under Turner Road will need to be amplified to provide adequate capacity in accordance with the requirements of Council’s code. The total catchment flow under current conditions has been estimated at 7.907cumecs and under the ultimate developed conditions the peak flow is estimated at 7.36cumecs. It is understood that Council has engaged Calibre Consulting to complete the design for the Turner Road upgrades. Council has provided a preliminary copy of these plans which identified that the existing Turner Road culverts will be replaced with twin 2.4m x 1.8m Reinforced Concrete Box Culverts resulting in an average flow per m width of culvert of 1.53m^3/s (ultimate developed scenario). Using these inputs in the nomogram provided in the manual titled “Hydraulics of Precast Concrete Conduits” published by the Concrete Pipe Association of Australasia, the estimated depth of flow through the culverts is approximately 0.51m. Adopting an

internal height of the culvert of 1.80m, the freeboard to the soffit of the culvert is calculated as being 1.80-0.51 = 1.29m. The depth of the culvert is therefore more than three times the depth of flow.

These culverts therefore satisfy the 0.5m freeboard requirement and based on the argument mounted for the Road No.1 culvert above they also satisfy the 50% blockage issue as well.

The design peak flow rate through the Turner Road culverts in the 1 in 5 year event is 2.856cumecs in the Ultimate Development scenario. The average flow per metre width of culvert of 0.595m^3/s and using these inputs in the nomogram provided in the manual titled "Hydraulics of Precast Concrete Conduits" published by the Concrete Pipe Association of Australasia, the estimated depth of flow through the culverts is less than 0.3m.

With an invert of RL93.00, the top water level at the culvert in the peak 1 in 5 year event is less than 93.30. The primary orifice for the detention basin has an invert level of 93.3 and a centreline RL93.50. Thus the tail water level in the proposed Turner Road culverts do not impact on the operation of the discharge control structure for the basin.

The results from the Hec-Ras modelling is included in Appendix E. Included is a profile section of the channel as well as the cross-sections and table of results. The channel has been modelled under the assumption that the flows from catchments 2 and 4 join the channel upstream of the culverts while catchment 6 is diverted into the channel south of the culverts.

6. Erosion and sediment control

During construction of the proposed road and drainage works, sufficient measures will be put in place to ensure that the site is not subject to significant erosion and that the adjoining creek systems are not impacted by the earthworks. All required measures will be installed prior to commencement of works and maintained during construction to ensure their effectiveness. Certain measures will also be implemented as required during the works.

As part of the erosion and sediment control measures it is proposed that a temporary sediment basin be constructed for duration of works. For this purpose, the proposed rain garden structure will be excavated and used as sediment basins then once the upstream catchments have been stabilised, the basins will be emptied and converted to rain gardens.

It is possible that one of the existing dams and existing raingardens constructed under previous DA's to and treat stormwater during construction. All clean water is to be pumped/piped around the construction site to the existing culverts under Turner Road. It is noted that when required, any sediment basins collecting "dirty" water will be flocculated before any basins are pumped dry to be ready to capture the flows from the next storm event.

Post downstream development, mounds / diversion drains will be constructed to divert all dirty water to the raingarden sediment basins. As required, these basins will be flocculated and pumped dry to be ready for the next storm event. A clean water basin will be constructed upstream of the culvert works. All "clean" water from this basin will pumped around the work zone into an existing stabilised section of the downstream gully.

All measures will be maintained on site until the disturbed surfaces have been stabilised to the satisfaction of Camden Council. Once stable, the basins will be removed and the areas affected by the sediment basins restored to design levels.

7. Conclusions

JMD has been retained by Turner Road Developments and Broome to prepare an engineering report summarising road design, drainage concept and stormwater management in support of the proposed rezoning of Lots 36 in DP28024 and Lot 105 in DP1210084, Turner Road, Currans Hill.

The current proposal is for the rezoning of the subject site only. Ultimately, it is proposed that the site be fully developed in accordance with the planning for the site; however, the residential layout detailed in the catchment plans is not intended to "fix" any development rights for the site. This report details the proposed drainage concepts, analysis and/or design of the ultimate system central channel, OSD basin and raingarden and supports the rezoning proposal.

The site is currently affected by a gully system which conveys stormwater flows from a number of external catchments outside the subject development land. It is proposed that the existing gully be replaced with a constructed channel trunk drainage system located within the adjusted E2 zoning boundaries and compliant with Council's Design Code requirements.

The construction of this central channel involves significant costs which do not form the part of any s94 Contributions Plan. In the absence of any formal funding arrangement, the developers are endeavouring to negotiate a private funding arrangement between the parties which will benefit from the ultimate drainage system. This arrangement is yet to be finalised.

The total catchment area drained by the creek is approx. 41.51ha in area with the majority of this catchment being external to the subject site. The external catchment to the west of the site will ultimately be developed for residential and drain to the drainage system within the subject site. This land has been allowed for in the proposed design of the central channel, OSD basin and raingarden assuming that the funding arrangement will be finalised. The site is also affected by runoff from an external catchment to the north which has been assessed as being 20.4ha in area and an existing catchment to the east which has been assessed as being 3.54ha in area. As these sites are already developed and have their own OSD systems it is assumed that the existing OSD basins reduce flows back to pre-development conditions.

The stormwater runoff from the site has been modelled by JMD using the XP-Rafts computer program. Various storm durations in the 1 in 2 year ARI, 1 in 5 year ARI, 1 in 10 year ARI, 1 in 20 year ARI, 1 in 50 year ARI and 1 in 100 year ARI storm events were analysed. The modelling results which are detailed in the annexures and summarised in Chapter 3 of this report demonstrate that in the ultimate developed conditions the proposed detention basin will operate to satisfy Council's on-site detention requirements. Peak flows from the developed site in all ARI events are reduced to less than that which occurs under current site conditions.

The ultimate development of the site will require stormwater flows discharging from the site to be treated and enhanced to ensure that stormwater meets current water quality targets. The target objectives defined in Council's design code are outdated and so the water quality measures to be incorporated into the development have been designed to meet the water quality objectives outlined in the more recent Oran Park DCP. The proposed water quality measures including the proposed raingarden for the proposed trunk drainage channel meet council's requirements.

The modelling of water quality measures has been undertaken using the MUSIC computer program. It has been determined that the incorporation of 2500L water tanks and water reuse for toilet, laundry and hot water on each lot, gross pollutant traps on all stormwater discharge points to the central drainage channel and construction of a raingarden complying with the specification in

Chapter 4 of this report with a minimum bed area of 945m² will ensure that the water quality outcomes are satisfied for the ultimate development conditions.

Chapter 5 of this report documents the channel design and channel flow as modelled in HEC-RAS. All flows meet Council's specifications and the Froude number is reduced to below 0.8 for main portions of the channel.

It is proposed that the riparian corridor contain a rock lined channel and be landscaped appropriately to make it maintenance free but still enhance the environmental aspects of the channel and achieve a good outcome for the overall area.

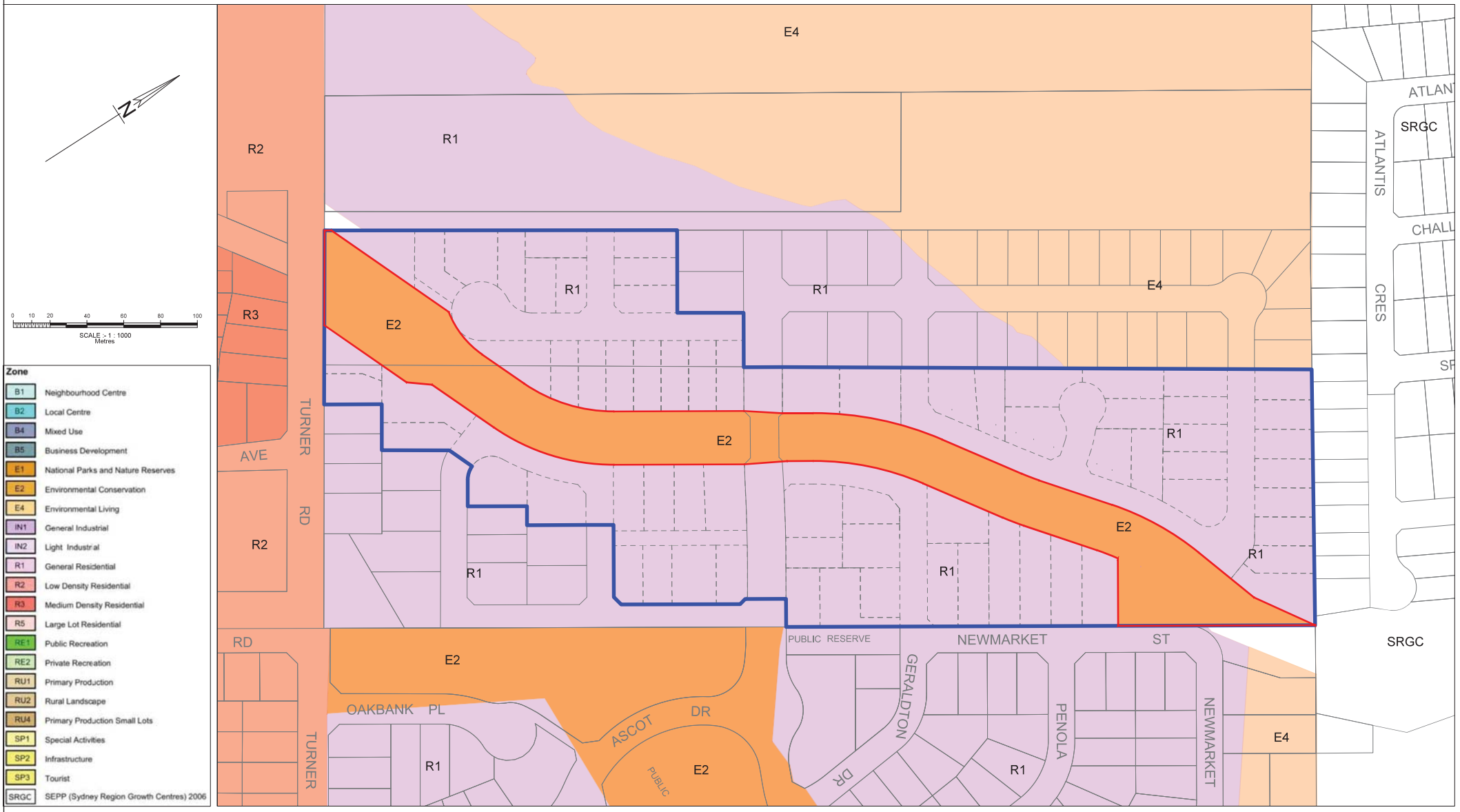
The above measures will act to ensure that the proposed development is compliant with the stormwater outcome objectives identified in the planning documents for the site.

Yours faithfully

.....

Terry Hams
BE (Civil) MIE Aust (409949)
CP Eng

Annexure A – Preliminary Zoning Plan prepared by JMD Ref: 14194E13 dated 16th October 2019 - Issue C



Issue	App	Date	Description
C	S.G.	16-10-2019	LOTS AND SHARED PATHWAYS AMENDED - LOT SIZING PLANS REMOVED
B	S.G.	20-09-2019	REZONING PLANS WITH UPDATED LOTS & DRAINAGE RESERVE BOUNDARY
A	T.H.	22-08-2018	REZONING PLANS COMBINED FOR PLANNING PROPOSAL

Client: TURNER ROAD ROAD DEVELOPMENTS P/L
Designed by : T.H.
Date of Drawing : 22-08-2018
Ratio (A1) : 1:2000

Datum : AHD
Origin of Levels :
Date of Survey :

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators
32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560
PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

Sheet 1 of 4 sheets

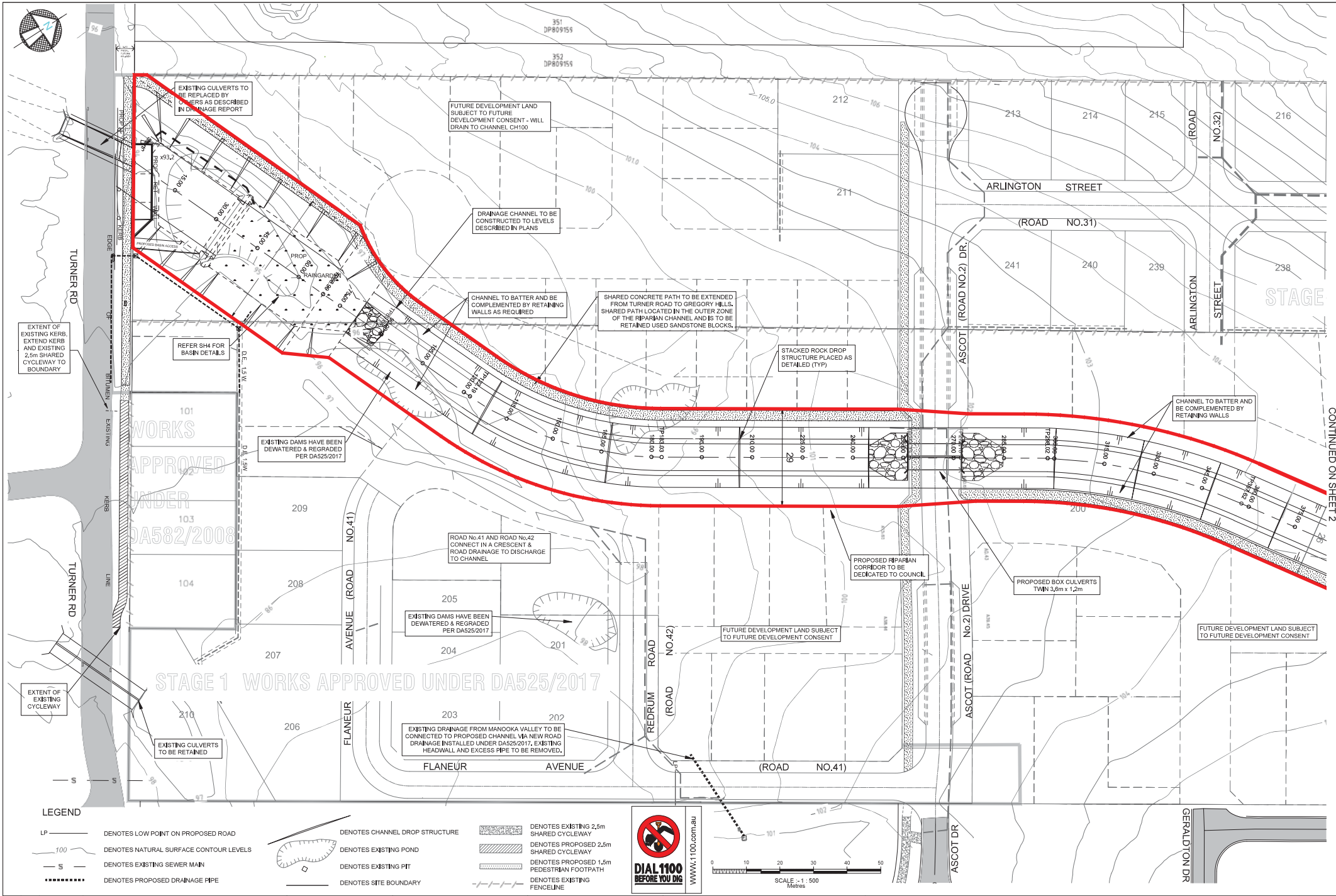
TURNER ROAD PROPOSED ZONING PLAN

Ref: 14194E13

Locality : CURRANS HILL | L.G.A. : CAMDEN | CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EMM\ENG\CAD\E13 - PLANNING PROPOSAL\ZONING PLAN

The ratio shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.

Annexure B – Concept Engineering Plans by JMD Ref: 14194E8 – dated 29-10-2019 – Issue B



Issue	App	Date	Description
B	S.G.	29-10-2019	UPDATED PER AMENDMENTS TO RIPARIAN CHANNEL
A	T.H.	06-12-2017	ORIGINAL ISSUE

Client: TURNER ROAD DEVELOPMENT

Designed by : T.H.

Date of Drawing : 06-12-2017

Ratio (A1) : 1:500

Datum : AHD

Origin of Levels : PM46777 - RL103.276

Date of Survey : 23-09-2016

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators
32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560
PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

CONCEPT CIVIL PLAN
ULTIMATE DRAINAGE CONCEPT PART A

Locality : CURRANS HILL

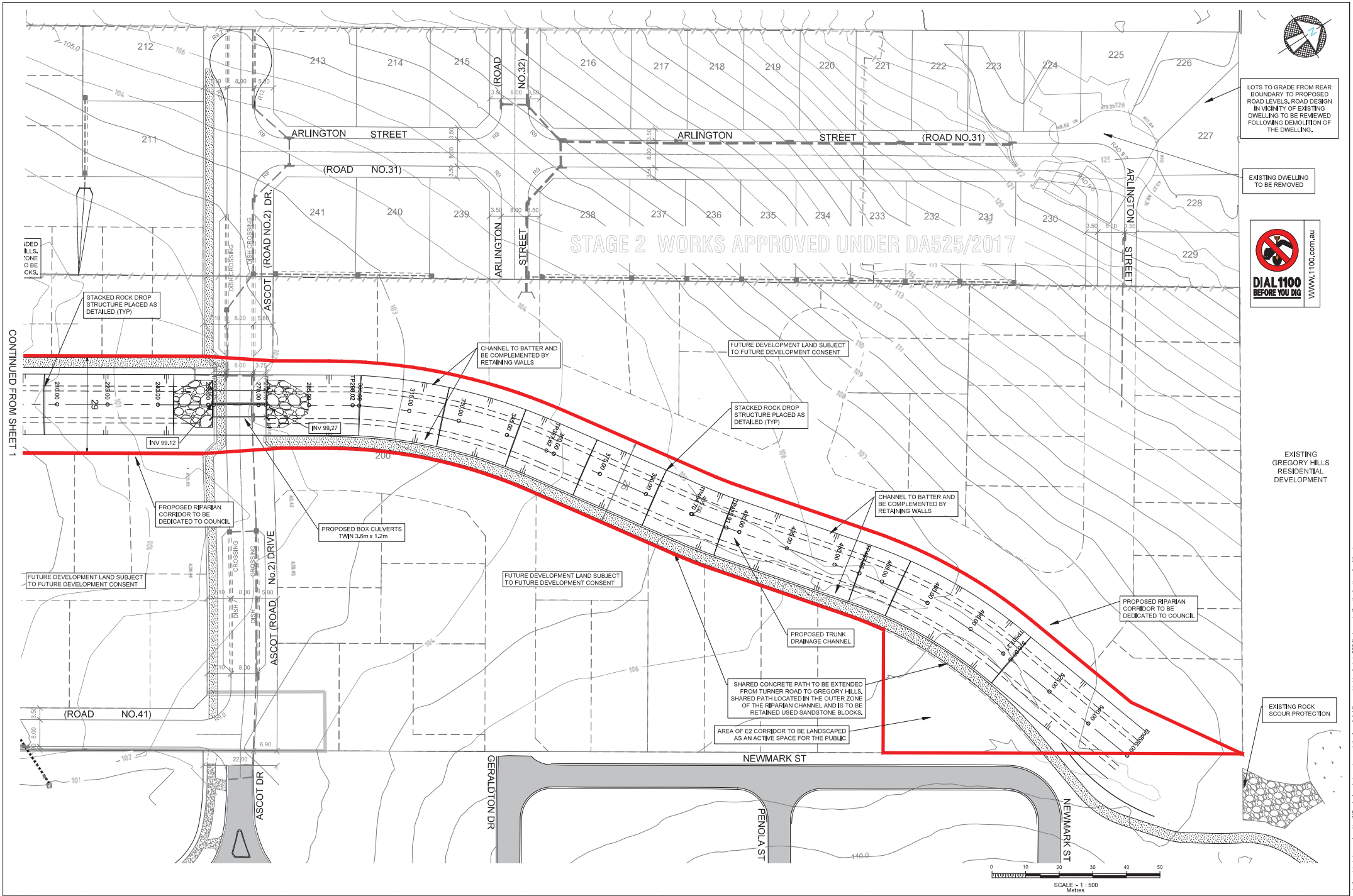
L.G.A. : CAMDEN

CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EMW\ENG\CAD\E8-REZONING PLANS\14194E8-TRB

Sheet 1 of 6 sheets

Ref: 14194E8

Copyright: The ideas shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.



Issue	App	Date	Description
B	S.G.	29-10-2019	UPDATED PER AMENDMENTS TO RIPARIAN CHANNEL
A	T.H.	06-12-2017	ORIGINAL ISSUE

Client: TURNER ROAD DEVELOPMENT
Designed by : T.H.
Date of Drawing : 06-12-2017
Ratio (A1) : 1:500

Datum : AHD
Origin of Levels : PM46777 - RL103.276
Date of Survey : 23-09-2016

Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators
32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560
PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

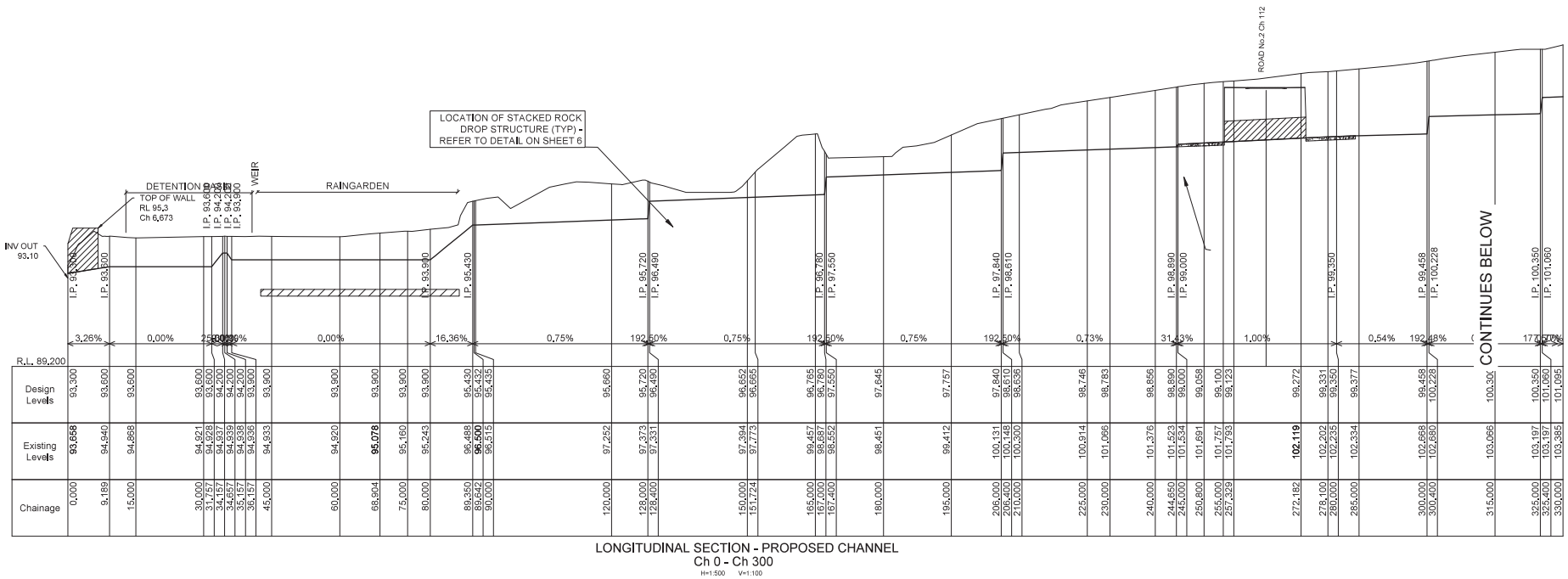
CONCEPT CIVIL PLAN
ULTIMATE DRAINAGE CONCEPT PART B

Locality : CURRANS HILL
L.G.A. : CAMDEN

CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EMW\ENG\CAD\E8-REZONING PLANS\14194E8-TRB

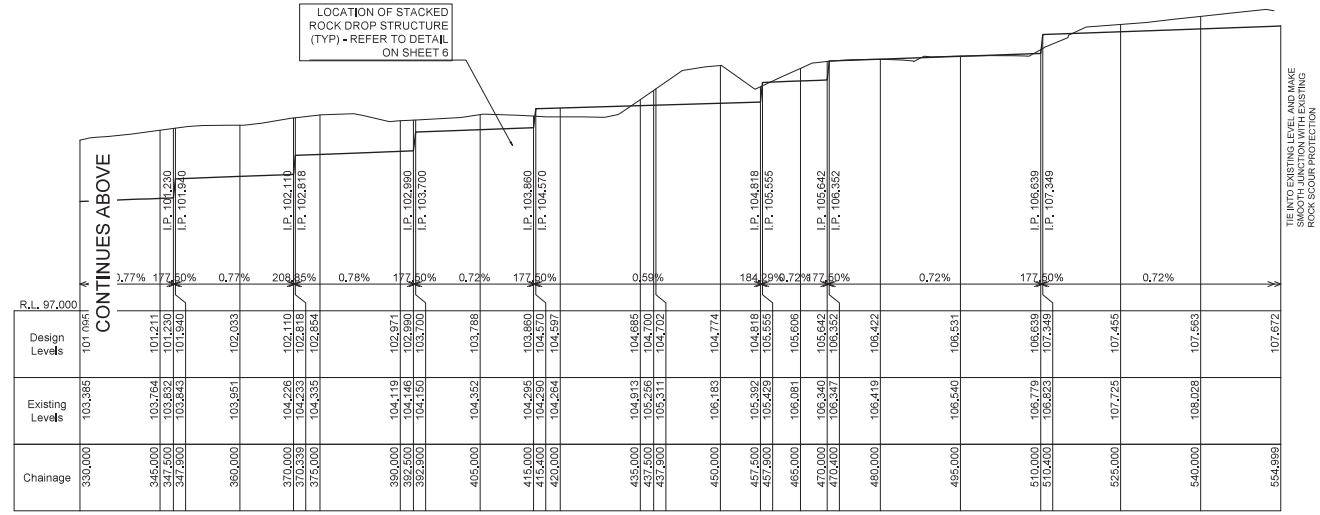
Sheet 2 of 6 sheets
Ref: 14194E8

The ratio shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.



LONGITUDINAL SECTION - PROPOSED CHANNEL
Ch 0 - Ch 300
H=1:500 V=1:100

NOTE:
REFER DWG. - CATCHMENT PLAN FOR TYPICAL SECTION DETAILS OF TRUNK DRAINAGE



LONGITUDINAL SECTION - PROPOSED CHANNEL
Ch 300 - END
H=1:500 V=1:100

SCALE :- 1 : 100 Metres

SCALE :- 1 : 500 Metres

DIAL 1100 BEFORE YOU DIG
WWW.1100.com.au

Issue	App	Date	Description
B	S.G.	29-10-2019	CHANNEL GRADES IN THE UPPER PORTION AMENDED TO RETAIN TREES
A	T.H.	06-12-2017	ORIGINAL ISSUE

Client: TURNER ROAD DEVELOPMENT
Designed by : T.H.
Date of Drawing : 06-12-2017
Ratio (A1) : 1:500/1:100

Datum : AHD
Origin of Levels : PM46777 - RL103.276
Date of Survey : 23-09-2016

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators
32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560
PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

Sheet 3 of 6 sheets

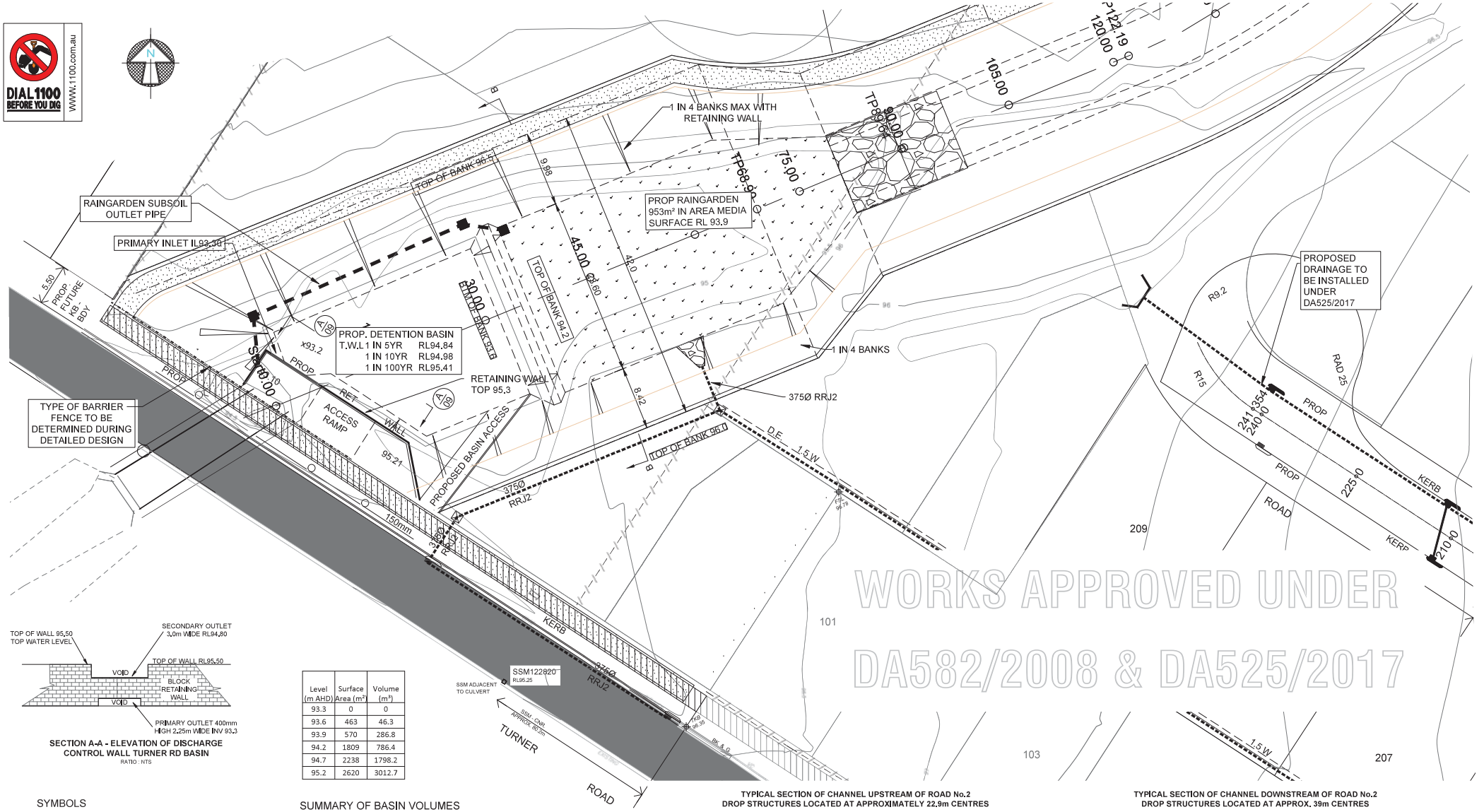
PROPOSED CHANNEL LONGITUDINAL SECTION- ULTIMATE CONCEPT

Ref: 14194E8

Locality : CURRANS HILL
L.G.A. : CAMDEN
CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EMW\ENG\CAD\E8-REZONING PLANS\14194E8-CHANNEL LS

Data shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.

DIAL 1100 BEFORE YOU DIG
WWW.1100.com.au



SECTION A-A - ELEVATION OF DISCHARGE CONTROL WALL TURNER RD BASIN
RATIO : NTS

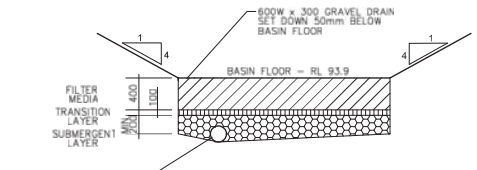
SUMMARY OF BASIN VOLUMES

Level (m AHD)	Surface Area (m²)	Volume (m³)
93.3	0	0
93.6	463	46.3
93.9	570	286.8
94.2	1809	786.4
94.7	2238	1798.2
95.2	2620	3012.7

SYMBOLS

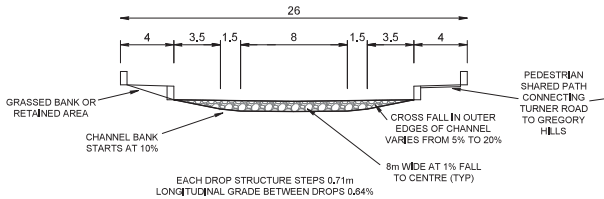
- EXISTING NATURAL SURFACE CONTOUR
- EXISTING 150mm BARRIER KERB & GUTTER
- EXISTING VEHICULAR CROSSING / EXISTING TOP OF KERB LEVEL
- EXISTING STREET NAME SIGN POST
- PROPOSED FINISHED SURFACE LEVEL

SCALE :- 1 : 250
Metres



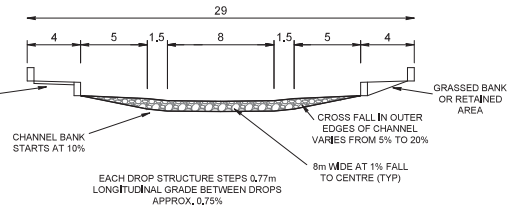
SECTION B-B THROUGH RAIN GARDEN
NOT TO SCALE

TYPICAL SECTION OF CHANNEL UPSTREAM OF ROAD No.2
DROP STRUCTURES LOCATED AT APPROXIMATELY 22.9m CENTRES



EACH DROP STRUCTURE STEPS 0.71m
LONGITUDINAL GRADE BETWEEN DROPS 0.64%

TYPICAL SECTION OF CHANNEL DOWNSTREAM OF ROAD No.2
DROP STRUCTURES LOCATED AT APPROX. 39m CENTRES



EACH DROP STRUCTURE STEPS 0.77m
LONGITUDINAL GRADE BETWEEN DROPS APPROX. 0.75%

Issue	App	Date	Description
B	S.G.	29-10-2019	UPDATED PER AMENDMENTS TO RIPARIAN CHANNEL
A	T.H.	06-12-2017	ORIGINAL ISSUE

Client: TURNER ROAD DEVELOPMENT
Designed by : T.H.
Date of Drawing : 06-12-2017
Ratio (A1) : 1:250
Datum : AHD
Origin of Levels : PM46777 - RL103.276
Date of Survey : 23-09-2016

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators
32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560
PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

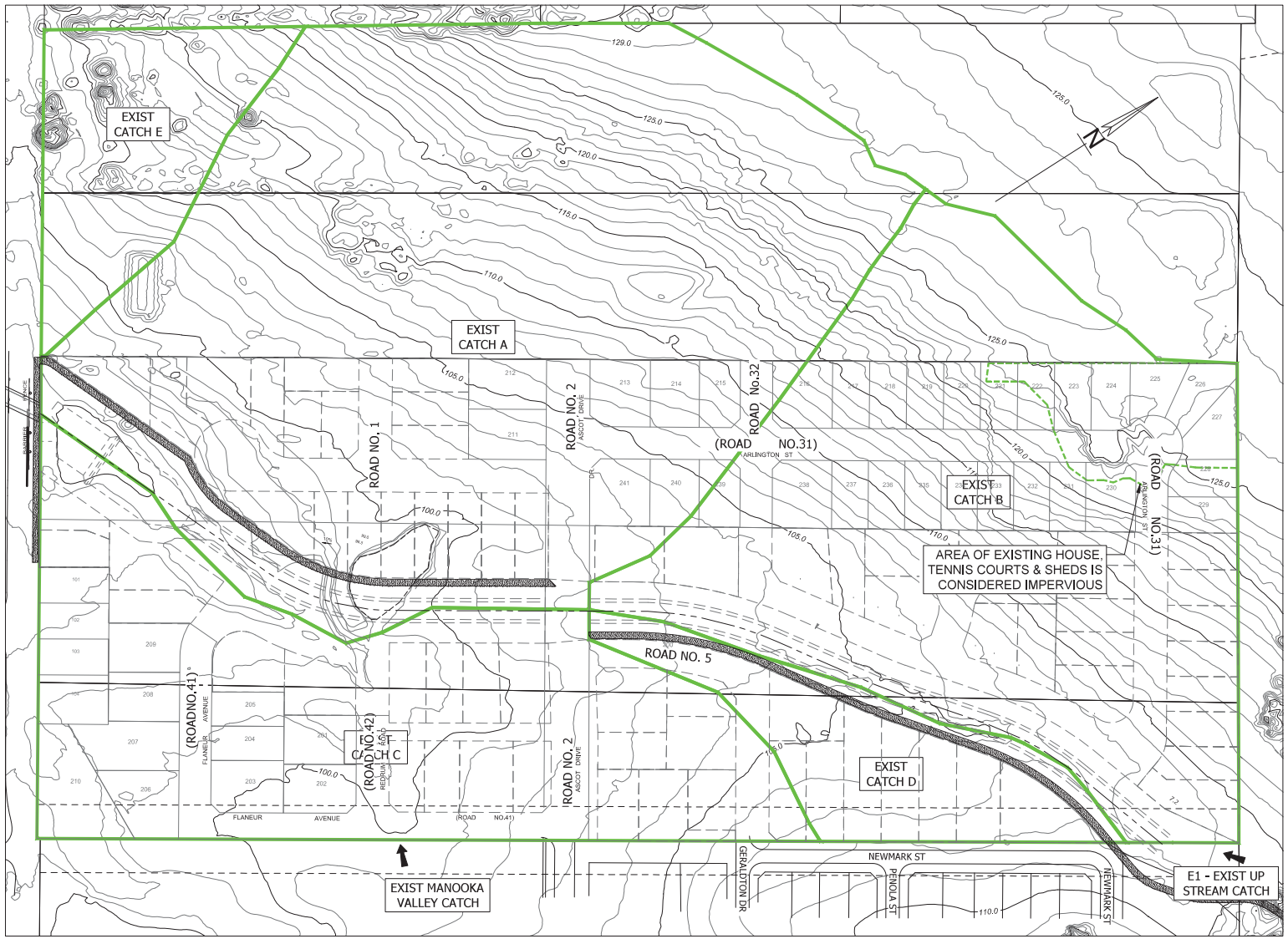
Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

PLAN OF PROPOSED DETENTION BASIN AND RAIN GARDEN- ULTIMATE CONCEPT

Sheet 4 of 6 sheets
Ref: 14194E8

Locality : CURRANS HILL
L.G.A. : CAMDEN
CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EWW\ENG\CAD\E6-REZONING PLANS\14194E8-BASIN DETAIL

The data shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.



EXISTING CATCHMENT PLAN

EXISTING CATCHMENT SUMMARY

EXISTING CATCHMENT AREA	Area (ha)	% Impervious	Area Impervious (ha)	Area Pervious (ha)	All areas added?
A	7.293	0%	0.0	7.293	Y
B	4.741	9.2%	0.436	4.305	Y
MV**	3.54	0%	0.0	3.54	Y
C	3.596	0%	0.0	3.596	Y
D	0.968	0%	0.0	0.968	Y
E	0.973	0%	0.0	0.973	Y
U/S	20.4	0%	0.0	20.4	Y
TURNER RD***	41.511		0.436	41.075	Y

EXISTING CATCHMENT HYDRAULIC SUMMARY

	STORM EVENT					
FLOW IN TURNER ROAD CULVERT***	2yr peak flow (cum/s)*	5yr peak flow (cum/s)*	10yr peak flow (cum/s)*	20yr peak flow (cum/s)*	50yr peak flow (cum/s)*	100yr peak flow (cum/s)*
EXISTING CATCHMENT	2.224	3.666	4.520	5.740	6.968	7.907

* PEAK FLOWS FOR THE 2yr, 5yr, 10yr 20yr, 50yr & 100yr STORM EVENTS HAVE BEEN CALCULATED IN XP RAFTS.

** THE MANOOKA VALLEY FLOWS ARE BASED ON CATCHMENT AREAS SHOWN IN THE CARDNO REPORT DATED JANUARY 2011 (VERSION 3 - 17-01-2011).

*** TURNER ROAD AREAS ARE A SUM OF ALL OTHER CATCHMENT AREAS. TURNER ROAD PEAK FLOWS ARE BASED ON THE RESULTS OF THE XP RAFTS MODELLING AND NOT A SUM OF THE INDIVIDUAL CATCHMENT PEAK FLOWS.

LEGEND

- DENOTES EXISTING CATCHMENT BOUNDARY
- DENOTES DEVELOPED CATCHMENT BOUNDARY
- DENOTES STG 1&2 DEVELOPED CATCHMENT BOUNDARY
- CATCH 4 — DENOTES CATCHMENT LABELS
- 125.0 — DENOTES EXISTING SURFACE CONTOURS
- DENOTES PROPOSED ROCK RIP RAP SCOUR PROTECTION
- DENOTES PROPOSED DIRECTION OF STORMWATER FLOWS
- DENOTES EXTENT OF PROPOSED RAIN GARDEN

Issue	App	Date	Description
B	S.G.	29-10-2019	UPDATED PER AMENDMENTS TO RIPARIAN CHANNEL
A	T.H.	06-12-2017	ORIGINAL ISSUE

Client: TURNER ROAD DEVELOPMENT
Designed by : T.H.
Date of Drawing : 06-12-2017
Ratio (A1) : 1:1000

Datum : AHD
Origin of Levels : PM46777 - RL103.276
Date of Survey : 23-09-2016

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators
32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560
PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

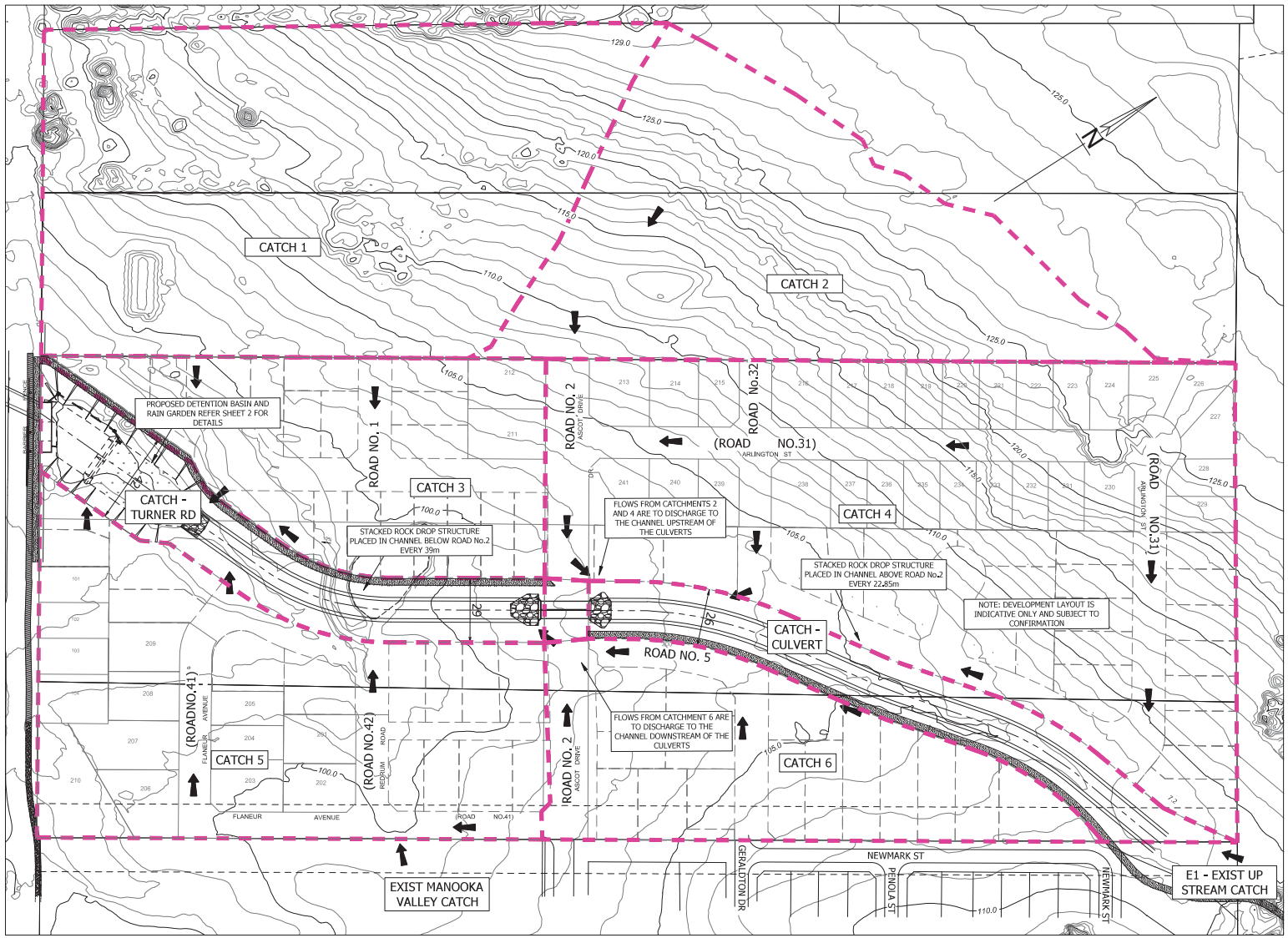
Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

CATCHMENT PLAN UNDER EXISTING CONDITIONS

Sheet 5 of 6 sheets
Ref: 14194E8

Locality : CURRANS HILL
L.G.A. : CAMDEN
CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EMW\ENG\CAD\E8-REZONING PLANS\14194E8-CATCHM

© This plan and ratio shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.



CATCHMENT PLAN

DEVELOPED CATCHMENT SUMMARY

DEVELOPED CATCHMENT AREA	Area (ha)	% Imperv	Area Imperv (ha)	Area Pervious (ha)	All areas added?
1	3.575	75%	2.681	0.894	Y
2	2.403	75%	1.802	0.601	Y
3	1.586	75%	1.190	0.396	Y
4	4.173	75%	3.130	1.043	Y
MV	3.54	0%	0	3.54	Y
5	2.487	75%	1.865	0.622	Y
6	1.681	75%	1.261	0.420	Y
U/S	20.4	0%	0.0	20.4	Y
CULVERT	0.780	0%	0.0	0.780	Y
TURNER RD***	0.882	0%	0.0	0.882	Y
SUM	41.507		11.929	29.578	Y

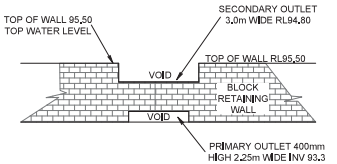
HYDRAULIC ANALYSIS SUMMARY

	STORM EVENT					
FLOW IN TURNER ROAD CULVERT	Dev 2yr peak flow (cum/s)*	Dev 5yr peak flow (cum/s)*	Dev 10yr peak flow (cum/s)*	Dev 20yr peak flow (cum/s)*	Dev 50yr peak flow (cum/s)*	Dev 100yr peak flow (cum/s)*
EXISTING CATCHMENT	2.224	3.666	4.520	5.740	6.968	7.907
ULTIMATE DEVELOPED CATCHMENT	2.137	2.966	3.699	5.11	6.445	7.81
PONDING LEVEL IN TURNER ROAD OSD BASIN	94.298	94.836	94.979	95.155	95.291	95.41

* PEAK FLOWS HAVE BEEN CALCULATED IN XP RAFTS.

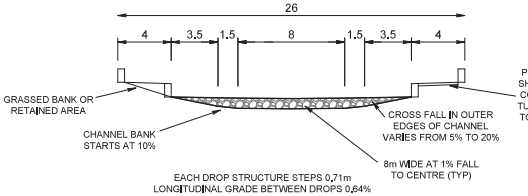
LEGEND

- DENOTES EXISTING CATCHMENT BOUNDARY
- DENOTES DEVELOPED CATCHMENT BOUNDARY
- DENOTES STG 1&2 DEVELOPED CATCHMENT BOUNDARY
- CATCH 4 — DENOTES CATCHMENT LABELS
- 125.0 — DENOTES EXISTING SURFACE CONTOURS
- DENOTES PROPOSED ROCK RIP RAP SCOUR PROTECTION
- DENOTES PROPOSED DIRECTION OF STORMWATER FLOWS
- DENOTES EXTENT OF PROPOSED RAIN GARDEN

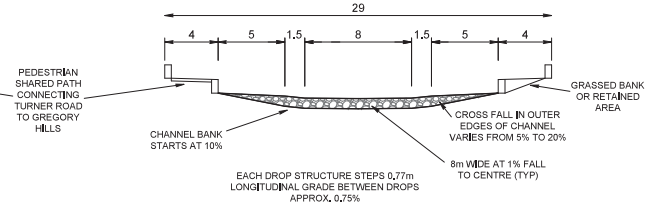


SECTION A-A - ELEVATION OF DISCHARGE CONTROL WALL TURNER RD BASIN
RATIO : NTS

TYPICAL SECTION OF CHANNEL UPSTREAM OF ROAD No.2 DROP STRUCTURES LOCATED AT APPROXIMATELY 22.9m CENTRES



TYPICAL SECTION OF CHANNEL DOWNSTREAM OF ROAD No.2 DROP STRUCTURES LOCATED AT APPROX. 39m CENTRES



Issue	App	Date	Description
B	S.G.	29-10-2019	UPDATED PER AMENDMENTS TO RIPARIAN CHANNEL
A	T.H.	06-12-2017	ORIGINAL ISSUE

Client: TURNER ROAD DEVELOPMENT
Designed by : T.H.
Date of Drawing : 06-12-2017
Ratio (A1) : 1:1000
Datum : AHD
Origin of Levels : PM46777 - RL103.276
Date of Survey : 23-09-2016

JMD Development Consultants

John M. Daly & Associates PTY LTD
A.B.N. 88051977989
Surveying
Engineering
Project Management
Licensed Water Service Co ordinators
32 Iolanthe Street
P.O. BOX 25
CAMPBELLTOWN N.S.W. 2560
PH. (02) 4625 5055
FAX (02) 4628 2013
email: admin@jmd.com.au

Project : 187 - 203 TURNER ROAD, CURRANS HILL
LOT 36 in DP 28024 & LOT 105 in DP1210084

CATCHMENT PLAN FOR THE ULTIMATE DEVELOPMENT

Locality : CURRANS HILL
L.G.A. : CAMDEN
CAD Ref: S:\JOBS\TURNER RD\14194 TURNER RD DEV\EMW\ENG\CAD\E8-REZONING PLANS\14194E8-CATCHM

Sheet 6 of 6 sheets
Ref: 14194E8

© This plan and the ratio shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.

Annexure C - Water Quantity Modelling – XP Rafts Modelling for Existing Conditions

C.1 – Existing Conditions

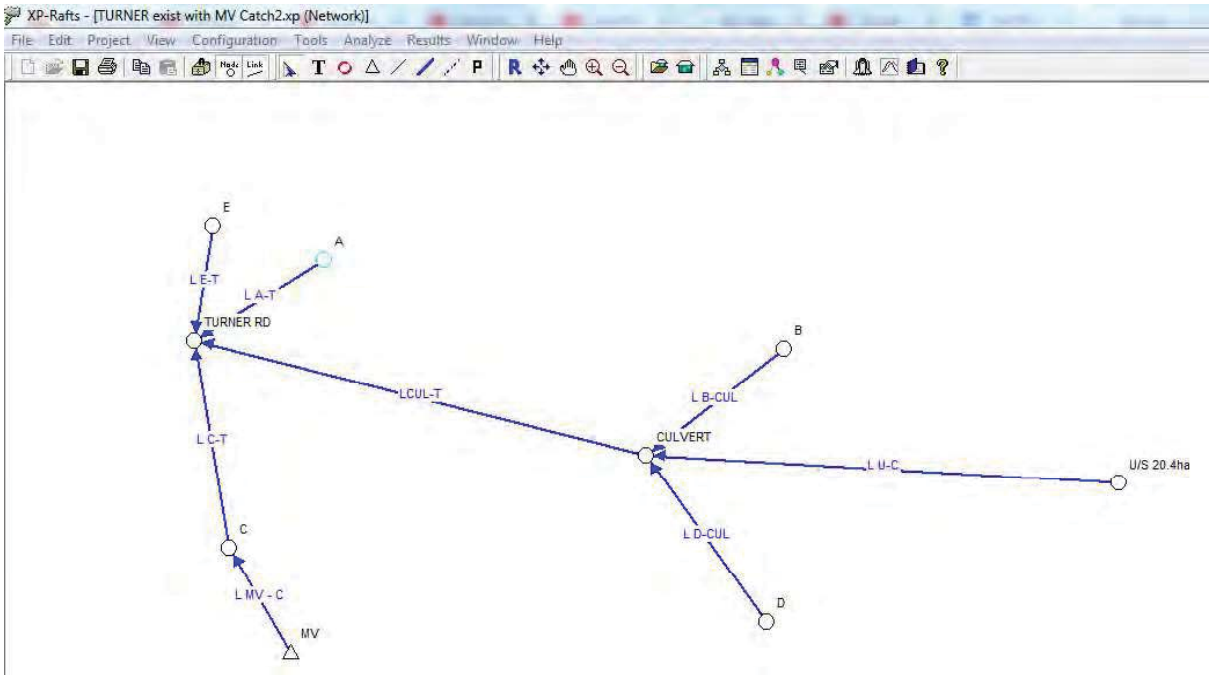


Figure C.1 – Image of XP-Rafts Existing Conditions Model.

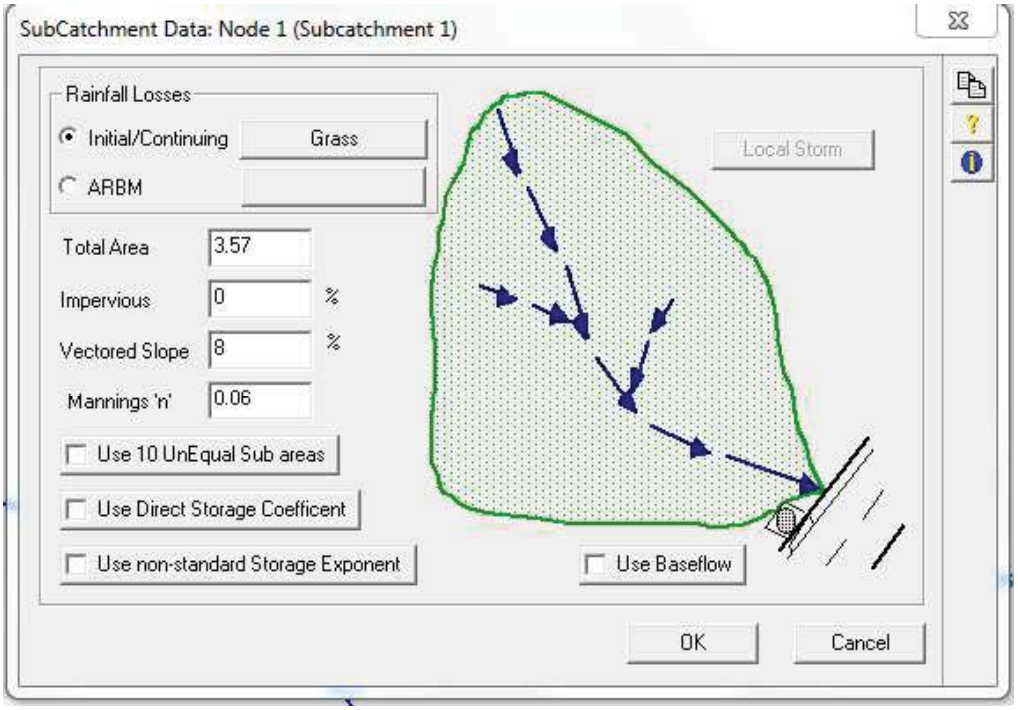


Figure C.2 – Typical node catchment details for existing conditions

TURNER exist with MV Catch2.out
Run started at: 30th August 2017 12:53:22

##
#####
RUNTIME RESULTS
##
#####

Max. no. of links allowed = 2000

Max. no. of routng increments allowed = 25000

Max. no. of rating curve points = 25000

Max. no. of storm temporal points = 25000

Max. no. of channel subreaches = 25

Max link stack level = 25

Input Version number = 650

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3486
ESTIMATED PEAK FLOW (CUMECS) = 0.11
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK C 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 0.6995
ESTIMATED PEAK FLOW (CUMECS) = 0.27
ESTIMATED TIME TO PEAK (MINS) = 27.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.033
ESTIMATED PEAK FLOW (CUMECS) = 0.41
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK B 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5080
ESTIMATED PEAK FLOW (CUMECS) = 0.21
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK D 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.9602E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.05
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.636
ESTIMATED PEAK FLOW (CUMECS) = 0.62
ESTIMATED TIME TO PEAK (MINS) = 31.00

TURNER exist with MV Catch2.out

LINK A 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.7257
ESTIMATED PEAK FLOW (CUMECS) = 0.24
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK E 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.9650E-01
ESTIMATED PEAK FLOW (CUMECS) = 0.05
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK TURNER RD 1.002

ESTIMATED VOLUME (CU METRES*10**3) = 4.158
ESTIMATED PEAK FLOW (CUMECS) = 1.15
ESTIMATED TIME TO PEAK (MINS) = 34.00

##########

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006

##########

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 25.
RETURN PERIOD (YRS) = 2.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 41.08
TOTAL OF SECOND SUB-AREAS (ha) = 0.44
TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Perm #1	#2	B #1	#2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	49.364	10.00	0.000	3.000	0.000	9.818	0.000	0.1147	26.00	0.000

C	49.364	10.00	1.500	3.000	0.000	9.818	19.068	0.2663	27.00	0.000
U/S 20.4ha	49.364	10.00	0.000	3.000	0.000	9.818	0.000	0.4078	26.00	0.000
B	49.364	10.00	1.500	3.000	0.000	9.818	19.068	0.2069	15.00	0.000
D	49.364	10.00	1.500	3.000	0.000	9.818	19.068	0.0525	26.00	0.000
CULVERT	49.364	10.00	0.000	3.000	0.000	9.818	0.000	0.6223	31.00	0.000
A	49.364	10.00	1.500	3.000	0.000	9.818	19.068	0.2414	26.00	0.000
E	49.364	10.00	1.500	3.000	0.000	9.818	19.068	0.0527	26.00	0.000
TURNER RD	49.364	10.00	0.000	3.000	0.000	9.818	0.000	1.147	34.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.417	.0600	0.0387	0.1148	1.0	0.000	0.000	0.000
C	0.582	.0600	0.0641	0.2664	1.0	0.000	0.000	0.000
U/S 20.4ha	0.683	.0600	0.1617	0.4077	1.0	0.000	0.000	0.000
B	0.505	.0600	0.0551	0.1984	1.0	0.000	0.000	0.000
D	0.306	.0600	0.0242	0.0526	1.0	0.000	0.000	0.000
CULVERT	0.785	.0600	0.2047	0.6216	1.0	0.000	0.000	0.000
A	0.560	.0600	0.0605	0.2419	1.0	0.000	0.000	0.000
E	0.668	.0600	0.0773	0.0528	1.0	0.000	0.000	0.000

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.7771
ESTIMATED PEAK FLOW (CUMECS) = 0.21
ESTIMATED TIME TO PEAK (MINS) = 48.00

LINK C 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 1.560
ESTIMATED PEAK FLOW (CUMECS) = 0.48
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.410
ESTIMATED PEAK FLOW (CUMECS) = 0.98
ESTIMATED TIME TO PEAK (MINS) = 60.00

LINK B 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.089
ESTIMATED PEAK FLOW (CUMECS) = 0.33
ESTIMATED TIME TO PEAK (MINS) = 45.00

LINK D 4.000

```
 ESTIMATED VOLUME (CU METRES*10**3) =          0.2105
 ESTIMATED PEAK FLOW          (CUMECS) =      0.09
 ESTIMATED TIME TO PEAK          (MINS) =     35.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          5.709
 ESTIMATED PEAK FLOW          (CUMECS) =      1.27
 ESTIMATED TIME TO PEAK          (MINS) =     59.00

 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.596
 ESTIMATED PEAK FLOW          (CUMECS) =      0.48
 ESTIMATED TIME TO PEAK          (MINS) =     45.00

 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.2116
 ESTIMATED PEAK FLOW          (CUMECS) =      0.09
 ESTIMATED TIME TO PEAK          (MINS) =     35.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          9.077
 ESTIMATED PEAK FLOW          (CUMECS) =      2.16
 ESTIMATED TIME TO PEAK          (MINS) =     49.00
```

##
#####

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006

##
#####

```
                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =       90.
                              RETURN PERIOD (YRS)      =        2.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      41.08
                              TOTAL OF SECOND SUB-AREAS (ha) =       0.44
                              TOTAL OF ALL SUB-AREAS (ha)    =      41.51
```

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	Catch. Area (ha) #2	Slope (%) #1	Slope (%) #2	% Impervious #1	% Impervious #2	Perm #1	Perm #2	B #1	B #2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000

E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	23.555	10.00	0.000	3.000	0.000	21.682	0.000	0.2149	48.00	0.000
C	23.555	10.00	1.500	3.000	0.000	21.682	33.832	0.4765	46.00	0.000
U/S 20.4ha	23.555	10.00	0.000	3.000	0.000	21.682	0.000	0.9766	60.00	0.000
B	23.555	10.00	1.500	3.000	0.000	21.682	33.832	0.3289	45.00	0.000
D	23.555	10.00	1.500	3.000	0.000	21.682	33.832	0.0891	35.00	0.000
CULVERT	23.555	10.00	0.000	3.000	0.000	21.682	0.000	1.267	59.00	0.000
A	23.555	10.00	1.500	3.000	0.000	21.682	33.832	0.4798	45.00	0.000
E	23.555	10.00	1.500	3.000	0.000	21.682	33.832	0.0896	35.00	0.000
TURNER RD	23.555	10.00	0.000	3.000	0.000	21.682	0.000	2.163	49.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.536	.0600	0.0563	0.2149	1.0	0.000	0.000	0.000
C	0.731	.0600	0.0910	0.4765	1.0	0.000	0.000	0.000
U/S 20.4ha	0.906	.0600	0.2625	0.9757	1.0	0.000	0.000	0.000
B	0.633	.0600	0.0727	0.3290	1.0	0.000	0.000	0.000
D	0.377	.0600	0.0332	0.0890	1.0	0.000	0.000	0.000
CULVERT	0.978	.0600	0.3031	1.266	1.0	0.000	0.000	0.000
A	0.732	.0600	0.0914	0.4794	1.0	0.000	0.000	0.000
E	0.809	.0600	0.1078	0.0895	1.0	0.000	0.000	0.000

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.8622
ESTIMATED PEAK FLOW (CUMECS) = 0.22
ESTIMATED TIME TO PEAK (MINS) = 61.00

LINK C 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 1.743
ESTIMATED PEAK FLOW (CUMECS) = 0.48
ESTIMATED TIME TO PEAK (MINS) = 53.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.940
ESTIMATED PEAK FLOW (CUMECS) = 1.03

```
 ESTIMATED TIME TO PEAK          (MINS) =     66.00

 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.212
 ESTIMATED PEAK FLOW          (CUMECS) =      0.33
 ESTIMATED TIME TO PEAK          (MINS) =     51.00

 LINK D                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.2358
 ESTIMATED PEAK FLOW          (CUMECS) =      0.10
 ESTIMATED TIME TO PEAK          (MINS) =     42.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          6.388
 ESTIMATED PEAK FLOW          (CUMECS) =      1.34
 ESTIMATED TIME TO PEAK          (MINS) =     66.00

 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.772
 ESTIMATED PEAK FLOW          (CUMECS) =      0.48
 ESTIMATED TIME TO PEAK          (MINS) =     52.00

 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.2371
 ESTIMATED PEAK FLOW          (CUMECS) =      0.10
 ESTIMATED TIME TO PEAK          (MINS) =     42.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          10.14
 ESTIMATED PEAK FLOW          (CUMECS) =      2.22
 ESTIMATED TIME TO PEAK          (MINS) =     65.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =       120.
                                RETURN PERIOD (YRS)      =         2.
                                BX                       =    1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      41.08
                                TOTAL OF SECOND SUB-AREAS (ha) =       0.44
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)          (%)
MV         3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

C          3.596 .00001  8.000 5.000  0.000 100.0  .060 .013  .0346 0.000  1.001
```

U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak mins	Link Lag mins
MV	19.535	10.00	0.000	3.000	0.000	24.320	0.000	0.2200	61.00	0.000
C	19.535	10.00	1.500	3.000	0.000	24.320	37.570	0.4769	53.00	0.000
U/S 20.4ha	19.535	10.00	0.000	3.000	0.000	24.320	0.000	1.033	66.00	0.000
B	19.535	10.00	1.500	3.000	0.000	24.320	37.570	0.3276	51.00	0.000
D	19.535	10.00	1.500	3.000	0.000	24.320	37.570	0.1010	42.00	0.000
CULVERT	19.535	10.00	0.000	3.000	0.000	24.320	0.000	1.338	66.00	0.000
A	19.535	10.00	1.500	3.000	0.000	24.320	37.570	0.4751	52.00	0.000
E	19.535	10.00	1.500	3.000	0.000	24.320	37.570	0.1017	42.00	0.000
TURNER RD	19.535	10.00	0.000	3.000	0.000	24.320	0.000	2.224	65.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.541	.0600	0.0570	0.2200	1.0	0.000	0.000	0.000
C	0.731	.0600	0.0910	0.4770	1.0	0.000	0.000	0.000
U/S 20.4ha	0.915	.0600	0.2719	1.030	1.0	0.000	0.000	0.000
B	0.630	.0600	0.0727	0.3273	1.0	0.000	0.000	0.000
D	0.401	.0600	0.0359	0.1026	1.0	0.000	0.000	0.000
CULVERT	0.992	.0600	0.3125	1.335	1.0	0.000	0.000	0.000
A	0.731	.0600	0.0906	0.4749	1.0	0.000	0.000	0.000
E	0.856	.0600	0.1172	0.1031	1.0	0.000	0.000	0.000

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5560
ESTIMATED PEAK FLOW (CUMECS) = 0.20
ESTIMATED TIME TO PEAK (MINS) = 26.00

```
 LINK C                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          1.122
 ESTIMATED PEAK FLOW         (CUMECS) =      0.48
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.263
 ESTIMATED PEAK FLOW         (CUMECS) =      0.82
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.7987
 ESTIMATED PEAK FLOW         (CUMECS) =      0.36
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK D                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.1532
 ESTIMATED PEAK FLOW         (CUMECS) =      0.11
 ESTIMATED TIME TO PEAK         (MINS) =     21.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          4.215
 ESTIMATED PEAK FLOW         (CUMECS) =      1.20
 ESTIMATED TIME TO PEAK         (MINS) =     29.00

 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.152
 ESTIMATED PEAK FLOW         (CUMECS) =      0.49
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.1541
 ESTIMATED PEAK FLOW         (CUMECS) =      0.11
 ESTIMATED TIME TO PEAK         (MINS) =     21.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          6.644
 ESTIMATED PEAK FLOW         (CUMECS) =      2.19
 ESTIMATED TIME TO PEAK         (MINS) =     29.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =        25.
                              RETURN PERIOD (YRS)      =         5.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      41.08
                              TOTAL OF SECOND SUB-AREAS (ha) =       0.44
                              TOTAL OF ALL SUB-AREAS (ha)    =      41.51
```

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	#2	Slope #1 (%)	#2	% Impervious #1	#2	Pern #1	#2	B #1	#2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	64.073	10.00	0.000	3.000	0.000	15.847	0.000	0.2029	26.00	0.000
C	64.073	10.00	1.500	3.000	0.000	15.847	25.197	0.4795	26.00	0.000
U/S 20.4ha	64.073	10.00	0.000	3.000	0.000	15.847	0.000	0.8221	26.00	0.000
B	64.073	10.00	1.500	3.000	0.000	15.847	25.197	0.3553	15.00	0.000
D	64.073	10.00	1.500	3.000	0.000	15.847	25.197	0.1061	21.00	0.000
CULVERT	64.073	10.00	0.000	3.000	0.000	15.847	0.000	1.198	29.00	0.000
A	64.073	10.00	1.500	3.000	0.000	15.847	25.197	0.4924	26.00	0.000
E	64.073	10.00	1.500	3.000	0.000	15.847	25.197	0.1066	21.00	0.000
TURNER RD	64.073	10.00	0.000	3.000	0.000	15.847	0.000	2.186	29.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.523	.0600	0.0545	0.2032	1.0	0.000	0.000	0.000
C	0.732	.0600	0.0914	0.4796	1.0	0.000	0.000	0.000
U/S 20.4ha	0.857	.0600	0.2391	0.8211	1.0	0.000	0.000	0.000
B	0.638	.0600	0.0762	0.3476	1.0	0.000	0.000	0.000
D	0.405	.0600	0.0369	0.1064	1.0	0.000	0.000	0.000
CULVERT	0.962	.0600	0.2938	1.195	1.0	0.000	0.000	0.000
A	0.737	.0600	0.0930	0.4912	1.0	0.000	0.000	0.000

```
E         0.863   .0600 0.1203  0.1069    1.0  0.000    0.000     0.000


 LINK MV                 1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.139
 ESTIMATED PEAK FLOW          (CUMECS) =      0.34
 ESTIMATED TIME TO PEAK          (MINS) =     45.00

 LINK C                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.297
 ESTIMATED PEAK FLOW          (CUMECS) =      0.75
 ESTIMATED TIME TO PEAK          (MINS) =     41.00

 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          6.575
 ESTIMATED PEAK FLOW          (CUMECS) =      1.57
 ESTIMATED TIME TO PEAK          (MINS) =     55.00

 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.575
 ESTIMATED PEAK FLOW          (CUMECS) =      0.53
 ESTIMATED TIME TO PEAK          (MINS) =     39.00

 LINK D                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.3101
 ESTIMATED PEAK FLOW          (CUMECS) =      0.15
 ESTIMATED TIME TO PEAK          (MINS) =     34.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          8.460
 ESTIMATED PEAK FLOW          (CUMECS) =      1.99
 ESTIMATED TIME TO PEAK          (MINS) =     49.00

 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.343
 ESTIMATED PEAK FLOW          (CUMECS) =      0.77
 ESTIMATED TIME TO PEAK          (MINS) =     42.00

 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.3118
 ESTIMATED PEAK FLOW          (CUMECS) =      0.15
 ESTIMATED TIME TO PEAK          (MINS) =     34.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          13.41
 ESTIMATED PEAK FLOW          (CUMECS) =      3.51
 ESTIMATED TIME TO PEAK          (MINS) =     44.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                      to  3: 0.0 24/ 5/2006
################################################################################
```

#####

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 5.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 41.08
TOTAL OF SECOND SUB-AREAS (ha) = 0.44
TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1 (%)	% Impervious #2 (%)	Perm #1	Perm #2	B #1	B #2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak mins	Link Lag mins
MV	30.568	10.00	0.000	3.000	0.000	32.052	0.000	0.3429	45.00	0.000
C	30.568	10.00	1.500	3.000	0.000	32.052	44.352	0.7519	41.00	0.000
U/S 20.4ha	30.568	10.00	0.000	3.000	0.000	32.052	0.000	1.566	55.00	0.000
B	30.568	10.00	1.500	3.000	0.000	32.052	44.352	0.5335	39.00	0.000
D	30.568	10.00	1.500	3.000	0.000	32.052	44.352	0.1534	34.00	0.000
CULVERT	30.568	10.00	0.000	3.000	0.000	32.052	0.000	1.986	49.00	0.000
A	30.568	10.00	1.500	3.000	0.000	32.052	44.352	0.7736	42.00	0.000
E	30.568	10.00	1.500	3.000	0.000	32.052	44.352	0.1540	34.00	0.000
TURNER RD	30.568	10.00	0.000	3.000	0.000	32.052	0.000	3.511	44.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.642	.0600	0.0746	0.3425	1.0	0.000	0.000	0.000
C	0.874	.0600	0.1195	0.7515	1.0	0.000	0.000	0.000

U/S 20.4ha	1.03	.0600	0.3406	1.564	1.0	0.000	0.000	0.000
B	0.761	.0600	0.0977	0.5331	1.0	0.000	0.000	0.000
D	0.467	.0600	0.0461	0.1533	1.0	0.000	0.000	0.000
CULVERT	1.11	.0600	0.3859	1.984	1.0	0.000	0.000	0.000
A	0.882	.0600	0.1219	0.7737	1.0	0.000	0.000	0.000
E	0.977	.0600	0.1531	0.1547	1.0	0.000	0.000	0.000

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.279
ESTIMATED PEAK FLOW (CUMECS) = 0.35
ESTIMATED TIME TO PEAK (MINS) = 50.00

LINK C 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.577
ESTIMATED PEAK FLOW (CUMECS) = 0.80
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 7.330
ESTIMATED PEAK FLOW (CUMECS) = 1.64
ESTIMATED TIME TO PEAK (MINS) = 65.00

LINK B 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.766
ESTIMATED PEAK FLOW (CUMECS) = 0.58
ESTIMATED TIME TO PEAK (MINS) = 45.00

LINK D 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3473
ESTIMATED PEAK FLOW (CUMECS) = 0.16
ESTIMATED TIME TO PEAK (MINS) = 42.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 9.443
ESTIMATED PEAK FLOW (CUMECS) = 2.07
ESTIMATED TIME TO PEAK (MINS) = 65.00

LINK A 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.621
ESTIMATED PEAK FLOW (CUMECS) = 0.80
ESTIMATED TIME TO PEAK (MINS) = 48.00

LINK E 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3491
ESTIMATED PEAK FLOW (CUMECS) = 0.16
ESTIMATED TIME TO PEAK (MINS) = 42.00

LINK TURNER RD 1.002

ESTIMATED VOLUME (CU METRES*10**3) = 14.99
ESTIMATED PEAK FLOW (CUMECS) = 3.67
ESTIMATED TIME TO PEAK (MINS) = 49.00

##
#####

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006
##
#####

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 120.
RETURN PERIOD (YRS) = 5.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 41.08
TOTAL OF SECOND SUB-AREAS (ha) = 0.44
TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Perm #1	#2	B #1	#2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	25.371	10.00	0.000	3.000	0.000	35.842	0.000	0.3491	50.00	0.000
C	25.371	10.00	1.500	3.000	0.000	35.842	49.242	0.8015	46.00	0.000
U/S 20.4ha	25.371	10.00	0.000	3.000	0.000	35.842	0.000	1.641	65.00	0.000
B	25.371	10.00	1.500	3.000	0.000	35.842	49.242	0.5817	45.00	0.000
D	25.371	10.00	1.500	3.000	0.000	35.842	49.242	0.1612	42.00	0.000
CULVERT	25.371	10.00	0.000	3.000	0.000	35.842	0.000	2.069	65.00	0.000
A	25.371	10.00	1.500	3.000	0.000	35.842	49.242	0.8006	48.00	0.000
E	25.371	10.00	1.500	3.000	0.000	35.842	49.242	0.1619	42.00	0.000
TURNER RD	25.371	10.00	0.000	3.000	0.000	35.842	0.000	3.666	49.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.647	.0600	0.0754	0.3491	1.0	0.000	0.000	0.000
C	0.895	.0600	0.1242	0.8007	1.0	0.000	0.000	0.000
U/S 20.4ha	1.05	.0600	0.3484	1.639	1.0	0.000	0.000	0.000
B	0.789	.0600	0.1023	0.5800	1.0	0.000	0.000	0.000
D	0.478	.0600	0.0475	0.1615	1.0	0.000	0.000	0.000
CULVERT	1.13	.0600	0.3938	2.067	1.0	0.000	0.000	0.000
A	0.895	.0600	0.1242	0.8004	1.0	0.000	0.000	0.000
E	0.992	.0600	0.1578	0.1619	1.0	0.000	0.000	0.000

```
 LINK MV                 1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.6719
 ESTIMATED PEAK FLOW          (CUMECS) =      0.26
 ESTIMATED TIME TO PEAK          (MINS) =     26.00

 LINK C                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          1.362
 ESTIMATED PEAK FLOW          (CUMECS) =      0.62
 ESTIMATED TIME TO PEAK          (MINS) =     26.00

 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.931
 ESTIMATED PEAK FLOW          (CUMECS) =      1.08
 ESTIMATED TIME TO PEAK          (MINS) =     26.00

 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.9464
 ESTIMATED PEAK FLOW          (CUMECS) =      0.45
 ESTIMATED TIME TO PEAK          (MINS) =     25.00

 LINK D                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.1859
 ESTIMATED PEAK FLOW          (CUMECS) =      0.14
 ESTIMATED TIME TO PEAK          (MINS) =     21.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          5.064
 ESTIMATED PEAK FLOW          (CUMECS) =      1.57
 ESTIMATED TIME TO PEAK          (MINS) =     26.00

 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.401
 ESTIMATED PEAK FLOW          (CUMECS) =      0.64
 ESTIMATED TIME TO PEAK          (MINS) =     26.00

 LINK E                  6.000
```

TURNER exist with MV Catch2.out

ESTIMATED VOLUME (CU METRES*10**3) = 0.1869
ESTIMATED PEAK FLOW (CUMECS) = 0.14
ESTIMATED TIME TO PEAK (MINS) = 21.00

LINK TURNER RD 1.002

ESTIMATED VOLUME (CU METRES*10**3) = 8.013
ESTIMATED PEAK FLOW (CUMECS) = 2.86
ESTIMATED TIME TO PEAK (MINS) = 27.00

##########

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006

##########

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 25.
RETURN PERIOD (YRS) = 10.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 41.08
TOTAL OF SECOND SUB-AREAS (ha) = 0.44
TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Perm #1	#2	B #1	#2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	72.056	10.00	0.000	3.000	0.000	19.123	0.000	0.2613	26.00	0.000
C	72.056	10.00	1.500	3.000	0.000	19.123	28.523	0.6223	26.00	0.000
U/S 20.4ha	72.056	10.00	0.000	3.000	0.000	19.123	0.000	1.082	26.00	0.000
B	72.056	10.00	1.500	3.000	0.000	19.123	28.523	0.4496	25.00	0.000
D	72.056	10.00	1.500	3.000	0.000	19.123	28.523	0.1393	21.00	0.000

CULVERT	72.056	10.00	0.000	3.000	0.000	19.123	0.000	1.567	26.00	0.000
A	72.056	10.00	1.500	3.000	0.000	19.123	28.523	0.6377	26.00	0.000
E	72.056	10.00	1.500	3.000	0.000	19.123	28.523	0.1401	21.00	0.000
TURNER RD	72.056	10.00	0.000	3.000	0.000	19.123	0.000	2.858	27.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.579	.0600	0.0633	0.2616	1.0	0.000	0.000	0.000
C	0.808	.0600	0.1070	0.6211	1.0	0.000	0.000	0.000
U/S 20.4ha	0.933	.0600	0.2781	1.081	1.0	0.000	0.000	0.000
B	0.709	.0600	0.0879	0.4465	1.0	0.000	0.000	0.000
D	0.451	.0600	0.0434	0.1394	1.0	0.000	0.000	0.000
CULVERT	1.03	.0600	0.3406	1.559	1.0	0.000	0.000	0.000
A	0.817	.0600	0.1086	0.6373	1.0	0.000	0.000	0.000
E	0.949	.0600	0.1438	0.1409	1.0	0.000	0.000	0.000

```
 LINK MV                1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.340
 ESTIMATED PEAK FLOW         (CUMECS) =      0.42
 ESTIMATED TIME TO PEAK         (MINS) =     42.00

 LINK C                 1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.698
 ESTIMATED PEAK FLOW         (CUMECS) =      0.92
 ESTIMATED TIME TO PEAK         (MINS) =     39.00

 LINK U/S 20.4ha        2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          7.713
 ESTIMATED PEAK FLOW         (CUMECS) =      1.89
 ESTIMATED TIME TO PEAK         (MINS) =     53.00

 LINK B                 3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.836
 ESTIMATED PEAK FLOW         (CUMECS) =      0.67
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK D                 4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.3666
 ESTIMATED PEAK FLOW         (CUMECS) =      0.19
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK CULVERT           2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          9.916
 ESTIMATED PEAK FLOW         (CUMECS) =      2.45
```

```
 ESTIMATED TIME TO PEAK          (MINS) =     46.00

 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.755
 ESTIMATED PEAK FLOW         (CUMECS) =      0.94
 ESTIMATED TIME TO PEAK          (MINS) =     40.00

 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.3685
 ESTIMATED PEAK FLOW         (CUMECS) =      0.19
 ESTIMATED TIME TO PEAK          (MINS) =     32.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          15.74
 ESTIMATED PEAK FLOW         (CUMECS) =      4.30
 ESTIMATED TIME TO PEAK          (MINS) =     42.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                      to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =        90.
                                RETURN PERIOD (YRS)      =        10.
                                BX                       =    1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      41.08
                                TOTAL OF SECOND SUB-AREAS (ha) =       0.44
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)           (%)
MV         3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

C          3.596 .00001  8.000 5.000  0.000 100.0  .060 .013  .0346 0.000  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

B          4.305 0.4360  8.000 8.000  0.000 100.0  .060 .013  .0380 .0003  3.000

D         0.9680 .00001  8.000 5.000  0.000 100.0  .060 .013  .0175 0.000  4.000

CULVERT   .00001  0.000  2.800 0.000  0.000 0.000  .060 0.00  0.000 0.000  2.001

A          7.293 .00001  8.000 5.000  0.000 100.0  .060 .013  .0500 0.000  5.000

E         0.9730 .00001  8.000 .0010  0.000 0.000  .060 .025  .0176 .0021  6.000

TURNER RD .00001  0.000  2.500 0.000  0.000 0.000  .060 0.00  0.000 0.000  1.002


 Link    Average  Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2      #1    #2    Inflow   to     Lag
```

	(mm/h)	(mm)		(mm/h)		(mm)		(m^3/s)	Peak	mins
MV	34.373	10.00	0.000	3.000	0.000	37.710	0.000	0.4194	42.00	0.000
C	34.373	10.00	1.500	3.000	0.000	37.710	50.060	0.9180	39.00	0.000
U/S 20.4ha	34.373	10.00	0.000	3.000	0.000	37.710	0.000	1.885	53.00	0.000
B	34.373	10.00	1.500	3.000	0.000	37.710	50.060	0.6703	30.00	0.000
D	34.373	10.00	1.500	3.000	0.000	37.710	50.060	0.1868	32.00	0.000
CULVERT	34.373	10.00	0.000	3.000	0.000	37.710	0.000	2.447	46.00	0.000
A	34.373	10.00	1.500	3.000	0.000	37.710	50.060	0.9449	40.00	0.000
E	34.373	10.00	1.500	3.000	0.000	37.710	50.060	0.1874	32.00	0.000
TURNER RD	34.373	10.00	0.000	3.000	0.000	37.710	0.000	4.304	42.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.694	.0600	0.0844	0.4195	1.0	0.000	0.000	0.000
C	0.942	.0600	0.1352	0.9178	1.0	0.000	0.000	0.000
U/S 20.4ha	1.10	.0600	0.3750	1.885	1.0	0.000	0.000	0.000
B	0.828	.0600	0.1117	0.6648	1.0	0.000	0.000	0.000
D	0.506	.0600	0.0520	0.1873	1.0	0.000	0.000	0.000
CULVERT	1.18	.0600	0.4313	2.445	1.0	0.000	0.000	0.000
A	0.953	.0600	0.1375	0.9452	1.0	0.000	0.000	0.000
E	1.04	.0600	0.1734	0.1878	1.0	0.000	0.000	0.000

```
 LINK MV                 1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.504
 ESTIMATED PEAK FLOW          (CUMECS) =      0.44
 ESTIMATED TIME TO PEAK          (MINS) =     46.00

 LINK C                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          3.022
 ESTIMATED PEAK FLOW          (CUMECS) =      1.01
 ESTIMATED TIME TO PEAK          (MINS) =     46.00

 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          8.579
 ESTIMATED PEAK FLOW          (CUMECS) =      1.96
 ESTIMATED TIME TO PEAK          (MINS) =     62.00

 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.062
 ESTIMATED PEAK FLOW          (CUMECS) =      0.70
 ESTIMATED TIME TO PEAK          (MINS) =     45.00
```

```
 LINK D                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.4085
 ESTIMATED PEAK FLOW         (CUMECS) =      0.19
 ESTIMATED TIME TO PEAK         (MINS) =     41.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          11.05
 ESTIMATED PEAK FLOW         (CUMECS) =      2.51
 ESTIMATED TIME TO PEAK         (MINS) =     50.00

 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.070
 ESTIMATED PEAK FLOW         (CUMECS) =      0.99
 ESTIMATED TIME TO PEAK         (MINS) =     46.00

 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.4107
 ESTIMATED PEAK FLOW         (CUMECS) =      0.19
 ESTIMATED TIME TO PEAK         (MINS) =     41.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          17.55
 ESTIMATED PEAK FLOW         (CUMECS) =      4.52
 ESTIMATED TIME TO PEAK         (MINS) =     48.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =       120.
                              RETURN PERIOD (YRS)      =        10.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      41.08
                              TOTAL OF SECOND SUB-AREAS (ha) =       0.44
                              TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link       Catch. Area       Slope     % Impervious      Pern          B        Link
 Label       #1     #2      #1    #2       #1   #2      #1    #2     #1   #2      No.
             (ha)             (%)           (%)
MV          3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

C           3.596 .00001  8.000 5.000  0.000 100.0  .060 .013  .0346 0.000  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

B           4.305 0.4360  8.000 8.000  0.000 100.0  .060 .013  .0380 .0003  3.000

D          0.9680 .00001  8.000 5.000  0.000 100.0  .060 .013  .0175 0.000  4.000

CULVERT    .00001  0.000  2.800 0.000  0.000 0.000  .060 0.00  0.000 0.000  2.001
```

A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	28.541	10.00	0.000	3.000	0.000	42.132	0.000	0.4429	46.00	0.000
C	28.541	10.00	1.500	3.000	0.000	42.132	55.582	1.006	46.00	0.000
U/S 20.4ha	28.541	10.00	0.000	3.000	0.000	42.132	0.000	1.959	62.00	0.000
B	28.541	10.00	1.500	3.000	0.000	42.132	55.582	0.7031	45.00	0.000
D	28.541	10.00	1.500	3.000	0.000	42.132	55.582	0.1933	41.00	0.000
CULVERT	28.541	10.00	0.000	3.000	0.000	42.132	0.000	2.511	50.00	0.000
A	28.541	10.00	1.500	3.000	0.000	42.132	55.582	0.9897	46.00	0.000
E	28.541	10.00	1.500	3.000	0.000	42.132	55.582	0.1941	41.00	0.000
TURNER RD	28.541	10.00	0.000	3.000	0.000	42.132	0.000	4.520	48.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.711	.0600	0.0871	0.4438	1.0	0.000	0.000	0.000
C	0.981	.0600	0.1422	1.006	1.0	0.000	0.000	0.000
U/S 20.4ha	1.11	.0600	0.3828	1.958	1.0	0.000	0.000	0.000
B	0.848	.0600	0.1148	0.7003	1.0	0.000	0.000	0.000
D	0.513	.0600	0.0529	0.1938	1.0	0.000	0.000	0.000
CULVERT	1.19	.0600	0.4375	2.507	1.0	0.000	0.000	0.000
A	0.969	.0600	0.1414	0.9891	1.0	0.000	0.000	0.000
E	1.04	.0600	0.1781	0.1938	1.0	0.000	0.000	0.000

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.8448
ESTIMATED PEAK FLOW (CUMECS) = 0.36
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK C 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 1.699
ESTIMATED PEAK FLOW (CUMECS) = 0.84
ESTIMATED TIME TO PEAK (MINS) = 25.00

LINK U/S 20.4ha 2.000

```
 ESTIMATED VOLUME (CU METRES*10**3) =          4.857
 ESTIMATED PEAK FLOW         (CUMECS) =      1.44
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.162
 ESTIMATED PEAK FLOW         (CUMECS) =      0.60
 ESTIMATED TIME TO PEAK         (MINS) =     25.00

 LINK D                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.2311
 ESTIMATED PEAK FLOW         (CUMECS) =      0.18
 ESTIMATED TIME TO PEAK         (MINS) =     21.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          6.250
 ESTIMATED PEAK FLOW         (CUMECS) =      2.09
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.742
 ESTIMATED PEAK FLOW         (CUMECS) =      0.85
 ESTIMATED TIME TO PEAK         (MINS) =     25.00

 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.2323
 ESTIMATED PEAK FLOW         (CUMECS) =      0.18
 ESTIMATED TIME TO PEAK         (MINS) =     21.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          9.922
 ESTIMATED PEAK FLOW         (CUMECS) =      3.85
 ESTIMATED TIME TO PEAK         (MINS) =     26.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =        25.
                                RETURN PERIOD (YRS)      =        20.
                                BX                       =     1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      41.08
                                TOTAL OF SECOND SUB-AREAS (ha) =       0.44
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)           (%)
MV         3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000
```

C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	83.043	10.00	0.000	3.000	0.000	23.701	0.000	0.3632	26.00	0.000
C	83.043	10.00	1.500	3.000	0.000	23.701	33.101	0.8448	25.00	0.000
U/S 20.4ha	83.043	10.00	0.000	3.000	0.000	23.701	0.000	1.442	26.00	0.000
B	83.043	10.00	1.500	3.000	0.000	23.701	33.101	0.5997	25.00	0.000
D	83.043	10.00	1.500	3.000	0.000	23.701	33.101	0.1809	21.00	0.000
CULVERT	83.043	10.00	0.000	3.000	0.000	23.701	0.000	2.090	26.00	0.000
A	83.043	10.00	1.500	3.000	0.000	23.701	33.101	0.8534	25.00	0.000
E	83.043	10.00	1.500	3.000	0.000	23.701	33.101	0.1816	21.00	0.000
TURNER RD	83.043	10.00	0.000	3.000	0.000	23.701	0.000	3.848	26.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.655	.0600	0.0773	0.3625	1.0	0.000	0.000	0.000
C	0.913	.0600	0.1281	0.8423	1.0	0.000	0.000	0.000
U/S 20.4ha	1.01	.0600	0.3250	1.439	1.0	0.000	0.000	0.000
B	0.797	.0600	0.1047	0.5994	1.0	0.000	0.000	0.000
D	0.499	.0600	0.0508	0.1808	1.0	0.000	0.000	0.000
CULVERT	1.12	.0600	0.3969	2.084	1.0	0.000	0.000	0.000
A	0.921	.0600	0.1289	0.8552	1.0	0.000	0.000	0.000
E	1.02	.0600	0.1703	0.1814	1.0	0.000	0.000	0.000

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.616
ESTIMATED PEAK FLOW (CUMECS) = 0.53

```
 ESTIMATED TIME TO PEAK          (MINS) =     40.00

 LINK C                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          3.249
 ESTIMATED PEAK FLOW          (CUMECS) =      1.19
 ESTIMATED TIME TO PEAK          (MINS) =     37.00

 WARNING 12 - DRDH = -ve
 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          9.321
 ESTIMATED PEAK FLOW          (CUMECS) =      2.38
 ESTIMATED TIME TO PEAK          (MINS) =     47.00

 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.211
 ESTIMATED PEAK FLOW          (CUMECS) =      0.85
 ESTIMATED TIME TO PEAK          (MINS) =     30.00

 LINK D                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.4422
 ESTIMATED PEAK FLOW          (CUMECS) =      0.23
 ESTIMATED TIME TO PEAK          (MINS) =     31.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =         11.97
 ESTIMATED PEAK FLOW          (CUMECS) =      3.12
 ESTIMATED TIME TO PEAK          (MINS) =     44.00

 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.330
 ESTIMATED PEAK FLOW          (CUMECS) =      1.18
 ESTIMATED TIME TO PEAK          (MINS) =     39.00

 WARNING 12 - DRDH = -ve
 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.4443
 ESTIMATED PEAK FLOW          (CUMECS) =      0.23
 ESTIMATED TIME TO PEAK          (MINS) =     31.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =         19.00
 ESTIMATED PEAK FLOW          (CUMECS) =      5.54
 ESTIMATED TIME TO PEAK          (MINS) =     41.00



#############################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
#############################################################################
#####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =       90.
                              RETURN PERIOD (YRS)      =       20.
```

TURNER exist with MV Catch2.out

BX = 1.0000

TOTAL OF FIRST SUB-AREAS (ha) = 41.08

TOTAL OF SECOND SUB-AREAS (ha) = 0.44

TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1 (%)	% Impervious #2 (%)	Perm #1	Perm #2	B #1	B #2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	39.611	10.00	0.000	3.000	0.000	45.517	0.000	0.5339	40.00	0.000
C	39.611	10.00	1.500	3.000	0.000	45.517	57.917	1.186	37.00	0.000
U/S 20.4ha	39.611	10.00	0.000	3.000	0.000	45.517	0.000	2.385	47.00	0.000
B	39.611	10.00	1.500	3.000	0.000	45.517	57.917	0.8535	30.00	0.000
D	39.611	10.00	1.500	3.000	0.000	45.517	57.917	0.2279	31.00	0.000
CULVERT	39.611	10.00	0.000	3.000	0.000	45.517	0.000	3.124	44.00	0.000
A	39.611	10.00	1.500	3.000	0.000	45.517	57.917	1.183	39.00	0.000
E	39.611	10.00	1.500	3.000	0.000	45.517	57.917	0.2286	31.00	0.000
TURNER RD	39.611	10.00	0.000	3.000	0.000	45.517	0.000	5.540	41.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.762	.0600	0.0977	0.5336	1.0	0.000	0.000	0.000
C	0.990	.0600	0.1641	1.184	1.0	0.000	0.000	0.000
U/S 20.4ha	1.17	.0600	0.4250	2.383	1.0	0.000	0.000	0.000
B	0.904	.0600	0.1289	0.8400	1.0	0.000	0.000	0.000
D	0.550	.0600	0.0584	0.2291	1.0	0.000	0.000	0.000

CULVERT	1.27	.0600	0.4891	3.122	1.0	0.000	0.000	0.000
A	1.00	.0600	0.1625	1.182	1.0	0.000	0.000	0.000
E	1.11	.0600	0.1977	0.2284	1.0	0.000	0.000	0.000

```
 LINK MV                 1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.798
 ESTIMATED PEAK FLOW         (CUMECS) =      0.57
 ESTIMATED TIME TO PEAK         (MINS) =     46.00

 LINK C                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          3.626
 ESTIMATED PEAK FLOW         (CUMECS) =      1.26
 ESTIMATED TIME TO PEAK         (MINS) =     45.00

 WARNING 12 - DRDH = -ve
 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          10.36
 ESTIMATED PEAK FLOW         (CUMECS) =      2.44
 ESTIMATED TIME TO PEAK         (MINS) =     58.00

 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.467
 ESTIMATED PEAK FLOW         (CUMECS) =      0.87
 ESTIMATED TIME TO PEAK         (MINS) =     40.00

 LINK D                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.4921
 ESTIMATED PEAK FLOW         (CUMECS) =      0.24
 ESTIMATED TIME TO PEAK         (MINS) =     41.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          13.32
 ESTIMATED PEAK FLOW         (CUMECS) =      3.22
 ESTIMATED TIME TO PEAK         (MINS) =     49.00

 WARNING 12 - DRDH = -ve
 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.715
 ESTIMATED PEAK FLOW         (CUMECS) =      1.26
 ESTIMATED TIME TO PEAK         (MINS) =     46.00

 WARNING 12 - DRDH = -ve
 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.4946
 ESTIMATED PEAK FLOW         (CUMECS) =      0.24
 ESTIMATED TIME TO PEAK         (MINS) =     41.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          21.16
 ESTIMATED PEAK FLOW         (CUMECS) =      5.74
 ESTIMATED TIME TO PEAK         (MINS) =     49.00
```

##
#####

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006

##
#####

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 120.
RETURN PERIOD (YRS) = 20.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 41.08
TOTAL OF SECOND SUB-AREAS (ha) = 0.44
TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Area #2	Slope #1 (%)	Slope #2	% Impervious #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	32.901	10.00	0.000	3.000	0.000	50.753	0.000	0.5680	46.00	0.000
C	32.901	10.00	1.500	3.000	0.000	50.753	64.303	1.261	45.00	0.000
U/S 20.4ha	32.901	10.00	0.000	3.000	0.000	50.753	0.000	2.435	58.00	0.000
B	32.901	10.00	1.500	3.000	0.000	50.753	64.303	0.8740	40.00	0.000
D	32.901	10.00	1.500	3.000	0.000	50.753	64.303	0.2365	41.00	0.000
CULVERT	32.901	10.00	0.000	3.000	0.000	50.753	0.000	3.223	49.00	0.000
A	32.901	10.00	1.500	3.000	0.000	50.753	64.303	1.256	46.00	0.000
E	32.901	10.00	1.500	3.000	0.000	50.753	64.303	0.2375	41.00	0.000
TURNER RD	32.901	10.00	0.000	3.000	0.000	50.753	0.000	5.740	49.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.781	.0600	0.1012	0.5674	1.0	0.000	0.000	0.000
C	0.987	.0600	0.1734	1.261	1.0	0.000	0.000	0.000
U/S 20.4ha	1.18	.0600	0.4297	2.435	1.0	0.000	0.000	0.000
B	0.924	.0600	0.1313	0.8742	1.0	0.000	0.000	0.000
D	0.554	.0600	0.0598	0.2363	1.0	0.000	0.000	0.000
CULVERT	1.27	.0600	0.4969	3.214	1.0	0.000	0.000	0.000
A	0.994	.0600	0.1719	1.256	1.0	0.000	0.000	0.000
E	1.12	.0600	0.2031	0.2376	1.0	0.000	0.000	0.000

```
 LINK MV                1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.042
 ESTIMATED PEAK FLOW         (CUMECS) =      0.51
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK C                 1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.111
 ESTIMATED PEAK FLOW         (CUMECS) =      1.15
 ESTIMATED TIME TO PEAK         (MINS) =     25.00

 WARNING 12 - DRDH = -ve
 LINK U/S 20.4ha        2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          6.072
 ESTIMATED PEAK FLOW         (CUMECS) =      2.04
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK B                 3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.438
 ESTIMATED PEAK FLOW         (CUMECS) =      0.81
 ESTIMATED TIME TO PEAK         (MINS) =     25.00

 LINK D                 4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.2890
 ESTIMATED PEAK FLOW         (CUMECS) =      0.22
 ESTIMATED TIME TO PEAK         (MINS) =     21.00

 LINK CULVERT           2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          7.799
 ESTIMATED PEAK FLOW         (CUMECS) =      2.86
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK A                 5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.172
 ESTIMATED PEAK FLOW         (CUMECS) =      1.15
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 WARNING 12 - DRDH = -ve
 LINK E                 6.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.2906
```

TURNER exist with MV Catch2.out

ESTIMATED PEAK FLOW (CUMECS) = 0.22
ESTIMATED TIME TO PEAK (MINS) = 21.00

LINK TURNER RD 1.002

ESTIMATED VOLUME (CU METRES*10**3) = 12.37
ESTIMATED PEAK FLOW (CUMECS) = 5.18
ESTIMATED TIME TO PEAK (MINS) = 27.00

##########

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006

##########

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 25.
RETURN PERIOD (YRS) = 50.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 41.08
TOTAL OF SECOND SUB-AREAS (ha) = 0.44
TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Perm #1	#2	B #1	#2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	97.422	10.00	0.000	3.000	0.000	29.642	0.000	0.5094	26.00	0.000
C	97.422	10.00	1.500	3.000	0.000	29.642	39.092	1.154	25.00	0.000
U/S 20.4ha	97.422	10.00	0.000	3.000	0.000	29.642	0.000	2.036	26.00	0.000
B	97.422	10.00	1.500	3.000	0.000	29.642	39.092	0.8073	25.00	0.000
D	97.422	10.00	1.500	3.000	0.000	29.642	39.092	0.2225	21.00	0.000

CULVERT	97.422	10.00	0.000	3.000	0.000	29.642	0.000	2.862	28.00	0.000
A	97.422	10.00	1.500	3.000	0.000	29.642	39.092	1.146	26.00	0.000
E	97.422	10.00	1.500	3.000	0.000	29.642	39.092	0.2234	21.00	0.000
TURNER RD	97.422	10.00	0.000	3.000	0.000	29.642	0.000	5.182	27.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.753	.0600	0.0945	0.5104	1.0	0.000	0.000	0.000
C	0.998	.0600	0.1594	1.155	1.0	0.000	0.000	0.000
U/S 20.4ha	1.12	.0600	0.3906	2.030	1.0	0.000	0.000	0.000
B	0.891	.0600	0.1250	0.8016	1.0	0.000	0.000	0.000
D	0.542	.0600	0.0574	0.2222	1.0	0.000	0.000	0.000
CULVERT	1.23	.0600	0.4672	2.854	1.0	0.000	0.000	0.000
A	1.00	.0600	0.1578	1.147	1.0	0.000	0.000	0.000
E	1.10	.0600	0.1953	0.2240	1.0	0.000	0.000	0.000

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.978
ESTIMATED PEAK FLOW (CUMECS) = 0.66
ESTIMATED TIME TO PEAK (MINS) = 39.00

LINK C 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 3.984
ESTIMATED PEAK FLOW (CUMECS) = 1.43
ESTIMATED TIME TO PEAK (MINS) = 36.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 11.40
ESTIMATED PEAK FLOW (CUMECS) = 2.92
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK B 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.690
ESTIMATED PEAK FLOW (CUMECS) = 1.03
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK D 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5411
ESTIMATED PEAK FLOW (CUMECS) = 0.26
ESTIMATED TIME TO PEAK (MINS) = 31.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 14.63
ESTIMATED PEAK FLOW (CUMECS) = 3.79
ESTIMATED TIME TO PEAK (MINS) = 44.00

```
 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          4.055
 ESTIMATED PEAK FLOW         (CUMECS) =      1.42
 ESTIMATED TIME TO PEAK         (MINS) =     38.00

 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.5439
 ESTIMATED PEAK FLOW         (CUMECS) =      0.27
 ESTIMATED TIME TO PEAK         (MINS) =     31.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          23.21
 ESTIMATED PEAK FLOW         (CUMECS) =      6.65
 ESTIMATED TIME TO PEAK         (MINS) =     40.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =        90.
                                RETURN PERIOD (YRS)      =        50.
                                BX                       =    1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      41.08
                                TOTAL OF SECOND SUB-AREAS (ha) =       0.44
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B       Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)          (%)
MV         3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

C          3.596 .00001  8.000 5.000  0.000 100.0  .060 .013  .0346 0.000  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

B          4.305 0.4360  8.000 8.000  0.000 100.0  .060 .013  .0380 .0003  3.000

D         0.9680 .00001  8.000 5.000  0.000 100.0  .060 .013  .0175 0.000  4.000

CULVERT   .00001  0.000  2.800 0.000  0.000 0.000  .060 0.00  0.000 0.000  2.001

A          7.293 .00001  8.000 5.000  0.000 100.0  .060 .013  .0500 0.000  5.000

E         0.9730 .00001  8.000 .0010  0.000 0.000  .060 .025  .0176 .0021  6.000

TURNER RD .00001  0.000  2.500 0.000  0.000 0.000  .060 0.00  0.000 0.000  1.002


 Link    Average  Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2      #1    #2    Inflow   to     Lag
          (mm/h)    ( mm )      (mm/h)        ( mm )    (m^3/s)  Peak  mins
```

MV	46.466	10.00	0.000	3.000	0.000	55.749	0.000	0.6551	39.00	0.000
C	46.466	10.00	1.500	3.000	0.000	55.749	68.199	1.432	36.00	0.000
U/S 20.4ha	46.466	10.00	0.000	3.000	0.000	55.749	0.000	2.921	46.00	0.000
B	46.466	10.00	1.500	3.000	0.000	55.749	68.199	1.030	30.00	0.000
D	46.466	10.00	1.500	3.000	0.000	55.749	68.199	0.2643	31.00	0.000
CULVERT	46.466	10.00	0.000	3.000	0.000	55.749	0.000	3.785	44.00	0.000
A	46.466	10.00	1.500	3.000	0.000	55.749	68.199	1.416	38.00	0.000
E	46.466	10.00	1.500	3.000	0.000	55.749	68.199	0.2655	31.00	0.000
TURNER RD	46.466	10.00	0.000	3.000	0.000	55.749	0.000	6.647	40.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.828	.0600	0.1102	0.6551	1.0	0.000	0.000	0.000
C	0.992	.0600	0.1906	1.432	1.0	0.000	0.000	0.000
U/S 20.4ha	1.24	.0600	0.4719	2.919	1.0	0.000	0.000	0.000
B	0.980	.0600	0.1445	1.022	1.0	0.000	0.000	0.000
D	0.583	.0600	0.0637	0.2652	1.0	0.000	0.000	0.000
CULVERT	1.06	.0600	0.5969	3.784	1.0	0.000	0.000	0.000
A	0.992	.0600	0.1891	1.416	1.0	0.000	0.000	0.000
E	1.16	.0600	0.2188	0.2647	1.0	0.000	0.000	0.000

```
 LINK MV                 1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.200
 ESTIMATED PEAK FLOW          (CUMECS) =      0.68
 ESTIMATED TIME TO PEAK          (MINS) =     46.00

 LINK C                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          4.434
 ESTIMATED PEAK FLOW          (CUMECS) =      1.50
 ESTIMATED TIME TO PEAK          (MINS) =     44.00

 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          12.69
 ESTIMATED PEAK FLOW          (CUMECS) =      2.95
 ESTIMATED TIME TO PEAK          (MINS) =     58.00

 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.014
 ESTIMATED PEAK FLOW          (CUMECS) =      1.08
 ESTIMATED TIME TO PEAK          (MINS) =     40.00

 LINK D                  4.000
```

```
 ESTIMATED VOLUME (CU METRES*10**3) =          0.6011
 ESTIMATED PEAK FLOW         (CUMECS) =      0.27
 ESTIMATED TIME TO PEAK         (MINS) =     41.00

 LINK CULVERT           2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          16.31
 ESTIMATED PEAK FLOW         (CUMECS) =      3.89
 ESTIMATED TIME TO PEAK         (MINS) =     49.00

 LINK A                 5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          4.539
 ESTIMATED PEAK FLOW         (CUMECS) =      1.50
 ESTIMATED TIME TO PEAK         (MINS) =     45.00

 LINK E                 6.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.6044
 ESTIMATED PEAK FLOW         (CUMECS) =      0.27
 ESTIMATED TIME TO PEAK         (MINS) =     41.00

 LINK TURNER RD         1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          25.89
 ESTIMATED PEAK FLOW         (CUMECS) =      6.97
 ESTIMATED TIME TO PEAK         (MINS) =     47.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                            ROUTING INCREMENT (MINS) =       1.00
                            STORM DURATION (MINS)    =       120.
                            RETURN PERIOD (YRS)      =        50.
                            BX                       =     1.0000
                            TOTAL OF FIRST SUB-AREAS  (ha) =      41.08
                            TOTAL OF SECOND SUB-AREAS (ha) =       0.44
                            TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)          (%)
MV          3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

C           3.596 .00001  8.000 5.000  0.000 100.0  .060 .013  .0346 0.000  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

B           4.305 0.4360  8.000 8.000  0.000 100.0  .060 .013  .0380 .0003  3.000

D          0.9680 .00001  8.000 5.000  0.000 100.0  .060 .013  .0175 0.000  4.000

CULVERT    .00001  0.000  2.800 0.000  0.000 0.000  .060 0.00  0.000 0.000  2.001

A           7.293 .00001  8.000 5.000  0.000 100.0  .060 .013  .0500 0.000  5.000
```

E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	38.609	10.00	0.000	3.000	0.000	62.068	0.000	0.6834	46.00	0.000
C	38.609	10.00	1.500	3.000	0.000	62.068	75.718	1.502	44.00	0.000
U/S 20.4ha	38.609	10.00	0.000	3.000	0.000	62.068	0.000	2.950	58.00	0.000
B	38.609	10.00	1.500	3.000	0.000	62.068	75.718	1.083	40.00	0.000
D	38.609	10.00	1.500	3.000	0.000	62.068	75.718	0.2730	41.00	0.000
CULVERT	38.609	10.00	0.000	3.000	0.000	62.068	0.000	3.894	49.00	0.000
A	38.609	10.00	1.500	3.000	0.000	62.068	75.718	1.503	45.00	0.000
E	38.609	10.00	1.500	3.000	0.000	62.068	75.718	0.2744	41.00	0.000
TURNER RD	38.609	10.00	0.000	3.000	0.000	62.068	0.000	6.968	47.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.839	.0600	0.1133	0.6834	1.0	0.000	0.000	0.000
C	0.996	.0600	0.1969	1.502	1.0	0.000	0.000	0.000
U/S 20.4ha	1.25	.0600	0.4750	2.950	1.0	0.000	0.000	0.000
B	1.00	.0600	0.1492	1.079	1.0	0.000	0.000	0.000
D	0.585	.0600	0.0652	0.2726	1.0	0.000	0.000	0.000
CULVERT	1.06	.0600	0.6031	3.893	1.0	0.000	0.000	0.000
A	0.995	.0600	0.1969	1.501	1.0	0.000	0.000	0.000
E	1.18	.0600	0.2234	0.2753	1.0	0.000	0.000	0.000

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.213
ESTIMATED PEAK FLOW (CUMECS) = 0.62
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK C 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.444
ESTIMATED PEAK FLOW (CUMECS) = 1.38
ESTIMATED TIME TO PEAK (MINS) = 25.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 6.924

```
 ESTIMATED PEAK FLOW          (CUMECS) =      2.39
 ESTIMATED TIME TO PEAK          (MINS) =     26.00

 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.658
 ESTIMATED PEAK FLOW          (CUMECS) =      0.96
 ESTIMATED TIME TO PEAK          (MINS) =     24.00

 LINK D                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.3341
 ESTIMATED PEAK FLOW          (CUMECS) =      0.26
 ESTIMATED TIME TO PEAK          (MINS) =     20.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          8.916
 ESTIMATED PEAK FLOW          (CUMECS) =      3.39
 ESTIMATED TIME TO PEAK          (MINS) =     26.00

 WARNING 12 - DRDH = -ve
 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.507
 ESTIMATED PEAK FLOW          (CUMECS) =      1.37
 ESTIMATED TIME TO PEAK          (MINS) =     25.00

 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.3358
 ESTIMATED PEAK FLOW          (CUMECS) =      0.26
 ESTIMATED TIME TO PEAK          (MINS) =     20.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          14.20
 ESTIMATED PEAK FLOW          (CUMECS) =      6.06
 ESTIMATED TIME TO PEAK          (MINS) =     27.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =       25.
                                RETURN PERIOD (YRS)      =       100.
                                BX                       =    1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      41.08
                                TOTAL OF SECOND SUB-AREAS (ha) =       0.44
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)           (%)
MV         3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000
```

C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	108.36	10.00	0.000	3.000	0.000	34.151	0.000	0.6154	26.00	0.000
C	108.36	10.00	1.500	3.000	0.000	34.151	43.651	1.383	25.00	0.000
U/S 20.4ha	108.36	10.00	0.000	3.000	0.000	34.151	0.000	2.390	26.00	0.000
B	108.36	10.00	1.500	3.000	0.000	34.151	43.651	0.9604	24.00	0.000
D	108.36	10.00	1.500	3.000	0.000	34.151	43.651	0.2618	20.00	0.000
CULVERT	108.36	10.00	0.000	3.000	0.000	34.151	0.000	3.390	26.00	0.000
A	108.36	10.00	1.500	3.000	0.000	34.151	43.651	1.373	25.00	0.000
E	108.36	10.00	1.500	3.000	0.000	34.151	43.651	0.2630	20.00	0.000
TURNER RD	108.36	10.00	0.000	3.000	0.000	34.151	0.000	6.062	27.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.808	.0600	0.1063	0.6167	1.0	0.000	0.000	0.000
C	0.988	.0600	0.1859	1.380	1.0	0.000	0.000	0.000
U/S 20.4ha	1.17	.0600	0.4250	2.383	1.0	0.000	0.000	0.000
B	0.963	.0600	0.1383	0.9612	1.0	0.000	0.000	0.000
D	0.576	.0600	0.0637	0.2618	1.0	0.000	0.000	0.000
CULVERT	1.07	.0600	0.5625	3.357	1.0	0.000	0.000	0.000
A	0.989	.0600	0.1852	1.373	1.0	0.000	0.000	0.000
E	1.16	.0600	0.2172	0.2633	1.0	0.000	0.000	0.000

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.259
ESTIMATED PEAK FLOW (CUMECS) = 0.77

```
 ESTIMATED TIME TO PEAK          (MINS) =     38.00

 LINK C                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          4.549
 ESTIMATED PEAK FLOW          (CUMECS) =      1.68
 ESTIMATED TIME TO PEAK          (MINS) =     34.00

 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          12.98
 ESTIMATED PEAK FLOW          (CUMECS) =      3.42
 ESTIMATED TIME TO PEAK          (MINS) =     46.00

 WARNING 12 - DRDH = -ve
 LINK B                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.073
 ESTIMATED PEAK FLOW          (CUMECS) =      1.24
 ESTIMATED TIME TO PEAK          (MINS) =     30.00

 WARNING 12 - DRDH = -ve
 LINK D                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.6141
 ESTIMATED PEAK FLOW          (CUMECS) =      0.31
 ESTIMATED TIME TO PEAK          (MINS) =     31.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          16.66
 ESTIMATED PEAK FLOW          (CUMECS) =      4.33
 ESTIMATED TIME TO PEAK          (MINS) =     45.00

 LINK A                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          4.644
 ESTIMATED PEAK FLOW          (CUMECS) =      1.66
 ESTIMATED TIME TO PEAK          (MINS) =     36.00

 LINK E                  6.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.6174
 ESTIMATED PEAK FLOW          (CUMECS) =      0.31
 ESTIMATED TIME TO PEAK          (MINS) =     31.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          26.47
 ESTIMATED PEAK FLOW          (CUMECS) =      7.60
 ESTIMATED TIME TO PEAK          (MINS) =     40.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =        90.
                              RETURN PERIOD (YRS)      =       100.
```

TURNER exist with MV Catch2.out

BX = 1.0000

TOTAL OF FIRST SUB-AREAS (ha) = 41.08

TOTAL OF SECOND SUB-AREAS (ha) = 0.44

TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1	% Impervious #2	Perm #1	Perm #2	B #1	B #2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	51.681	10.00	0.000	3.000	0.000	63.572	0.000	0.7675	38.00	0.000
C	51.681	10.00	1.500	3.000	0.000	63.572	76.022	1.680	34.00	0.000
U/S 20.4ha	51.681	10.00	0.000	3.000	0.000	63.572	0.000	3.416	46.00	0.000
B	51.681	10.00	1.500	3.000	0.000	63.572	76.022	1.242	30.00	0.000
D	51.681	10.00	1.500	3.000	0.000	63.572	76.022	0.3051	31.00	0.000
CULVERT	51.681	10.00	0.000	3.000	0.000	63.572	0.000	4.335	45.00	0.000
A	51.681	10.00	1.500	3.000	0.000	63.572	76.022	1.665	36.00	0.000
E	51.681	10.00	1.500	3.000	0.000	63.572	76.022	0.3066	31.00	0.000
TURNER RD	51.681	10.00	0.000	3.000	0.000	63.572	0.000	7.601	40.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV	0.881	.0600	0.1211	0.7675	1.0	0.000	0.000	0.000
C	0.998	.0600	0.2125	1.680	1.0	0.000	0.000	0.000
U/S 20.4ha	1.06	.0600	0.5688	3.407	1.0	0.000	0.000	0.000
B	0.987	.0600	0.1703	1.233	1.0	0.000	0.000	0.000
D	0.614	.0600	0.0695	0.3052	1.0	0.000	0.000	0.000

CULVERT	1.11	.0600	0.6219	4.332	1.0	0.000	0.000	0.000
A	1.00	.0600	0.2109	1.665	1.0	0.000	0.000	0.000
E	1.21	.0600	0.2406	0.3063	1.0	0.000	0.000	0.000

LINK MV 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.504
ESTIMATED PEAK FLOW (CUMECS) = 0.80
ESTIMATED TIME TO PEAK (MINS) = 45.00

LINK C 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 5.040
ESTIMATED PEAK FLOW (CUMECS) = 1.76
ESTIMATED TIME TO PEAK (MINS) = 42.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 14.45
ESTIMATED PEAK FLOW (CUMECS) = 3.43
ESTIMATED TIME TO PEAK (MINS) = 53.00

WARNING 12 - DRDH = -ve
LINK B 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.415
ESTIMATED PEAK FLOW (CUMECS) = 1.26
ESTIMATED TIME TO PEAK (MINS) = 40.00

WARNING 12 - DRDH = -ve
LINK D 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.6843
ESTIMATED PEAK FLOW (CUMECS) = 0.31
ESTIMATED TIME TO PEAK (MINS) = 41.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 18.55
ESTIMATED PEAK FLOW (CUMECS) = 4.47
ESTIMATED TIME TO PEAK (MINS) = 49.00

LINK A 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 5.172
ESTIMATED PEAK FLOW (CUMECS) = 1.76
ESTIMATED TIME TO PEAK (MINS) = 44.00

LINK E 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.6877
ESTIMATED PEAK FLOW (CUMECS) = 0.31
ESTIMATED TIME TO PEAK (MINS) = 41.00

LINK TURNER RD 1.002

ESTIMATED VOLUME (CU METRES*10**3) = 29.45
ESTIMATED PEAK FLOW (CUMECS) = 7.91
ESTIMATED TIME TO PEAK (MINS) = 47.00

#####

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006

##
#####

ROUTING INCREMENT (MINS)	=	1.00
STORM DURATION (MINS)	=	120.
RETURN PERIOD (YRS)	=	100.
BX	=	1.0000
TOTAL OF FIRST SUB-AREAS (ha)	=	41.08
TOTAL OF SECOND SUB-AREAS (ha)	=	0.44
TOTAL OF ALL SUB-AREAS (ha)	=	41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	#2	Slope #1 (%)	#2	% Impervious #1 (%)	#2	Perm #1	#2	B #1	#2	Link No.
MV	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
C	3.596	.00001	8.000	5.000	0.000	100.0	.060	.013	.0346	0.000	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
B	4.305	0.4360	8.000	8.000	0.000	100.0	.060	.013	.0380	.0003	3.000
D	0.9680	.00001	8.000	5.000	0.000	100.0	.060	.013	.0175	0.000	4.000
CULVERT	.00001	0.000	2.800	0.000	0.000	0.000	.060	0.00	0.000	0.000	2.001
A	7.293	.00001	8.000	5.000	0.000	100.0	.060	.013	.0500	0.000	5.000
E	0.9730	.00001	8.000	.0010	0.000	0.000	.060	.025	.0176	.0021	6.000
TURNER RD	.00001	0.000	2.500	0.000	0.000	0.000	.060	0.00	0.000	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV	42.954	10.00	0.000	3.000	0.000	70.657	0.000	0.8019	45.00	0.000
C	42.954	10.00	1.500	3.000	0.000	70.657	84.407	1.759	42.00	0.000
U/S 20.4ha	42.954	10.00	0.000	3.000	0.000	70.657	0.000	3.431	53.00	0.000
B	42.954	10.00	1.500	3.000	0.000	70.657	84.407	1.263	40.00	0.000
D	42.954	10.00	1.500	3.000	0.000	70.657	84.407	0.3097	41.00	0.000
CULVERT	42.954	10.00	0.000	3.000	0.000	70.657	0.000	4.467	49.00	0.000
A	42.954	10.00	1.500	3.000	0.000	70.657	84.407	1.761	44.00	0.000
E	42.954	10.00	1.500	3.000	0.000	70.657	84.407	0.3109	41.00	0.000
TURNER RD	42.954	10.00	0.000	3.000	0.000	70.657	0.000	7.907	47.00	0.000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link	Ave.	Ave.	Flow	Max.	No.	Pipe	Pipe	Pipe

Label	Vel. (m/s)	Rough. (n)	Depth (m)	Flow (m^3/s)	of Pipes	Dia. (m)	Slope (%)	Flow (m3^/s)
MV	0.895	.0600	0.1242	0.8009	1.0	0.000	0.000	0.000
C	1.00	.0600	0.2180	1.760	1.0	0.000	0.000	0.000
U/S 20.4ha	1.06	.0600	0.5688	3.426	1.0	0.000	0.000	0.000
B	0.980	.0600	0.1734	1.253	1.0	0.000	0.000	0.000
D	0.618	.0600	0.0703	0.3104	1.0	0.000	0.000	0.000
CULVERT	1.12	.0600	0.6281	4.463	1.0	0.000	0.000	0.000
A	1.00	.0600	0.2188	1.761	1.0	0.000	0.000	0.000
E	1.23	.0600	0.2422	0.3119	1.0	0.000	0.000	0.000

Run completed at: 30th August 2017 12:53:28

mik open 0

Annexure D - Water Quantity Modelling – XP Rafts Modelling for the Ultimate Development

D.2 – Developed Conditions

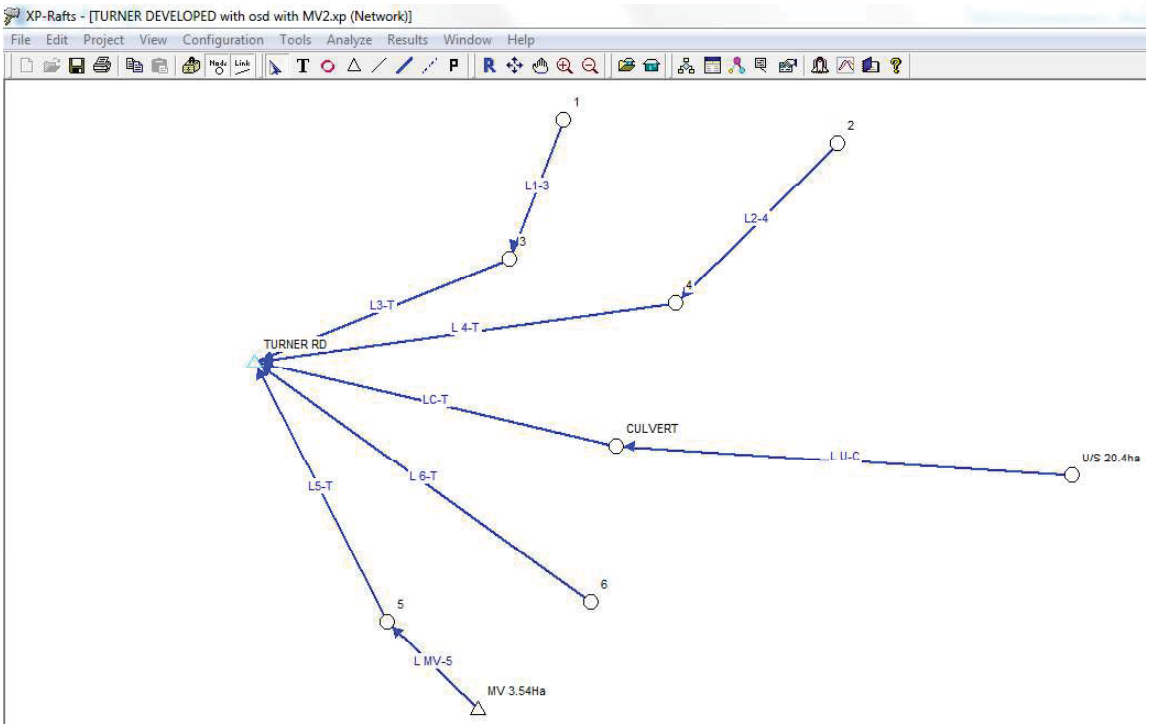


Figure D.1 – Image of XP-Rafts Ultimate Developed Conditions Model.

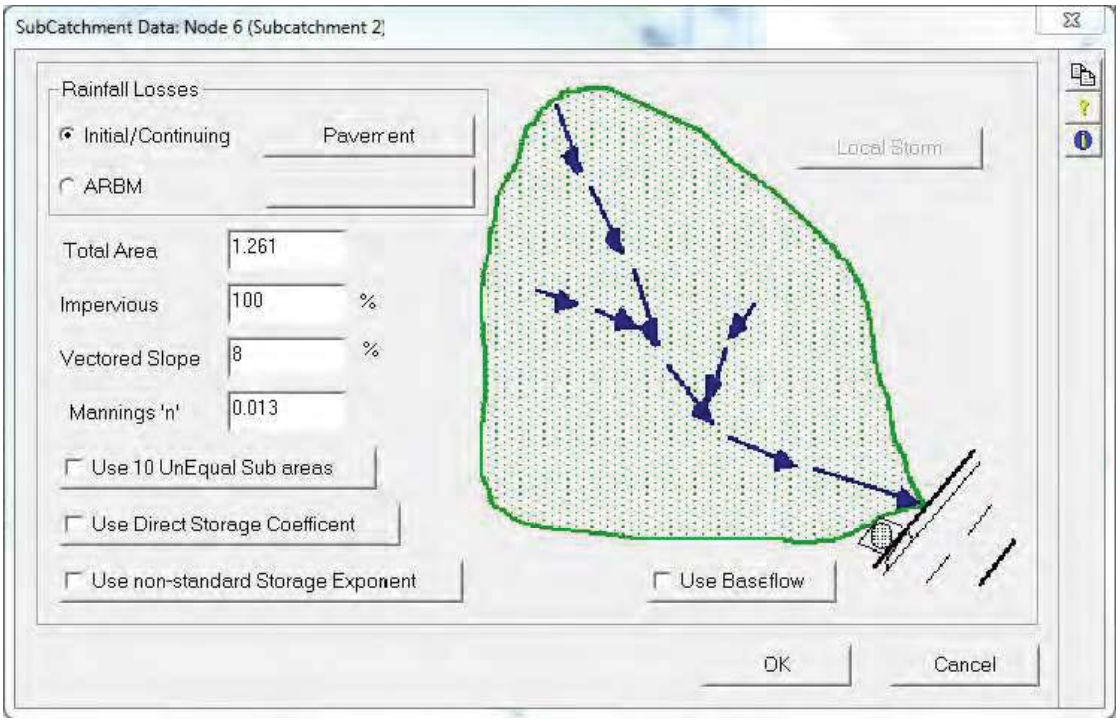


Figure D.2 – Typical node catchment details for the Ultimate Developed Conditions

TURNER DEVELOPED with osd with MV2.out
Run started at: 24th October 2017 7:10:52

##
#####
RUNTIME RESULTS
##
#####

Max. no. of links allowed = 2000

Max. no. of routng increments allowed = 25000

Max. no. of rating curve points = 25000

Max. no. of storm temporal points = 25000

Max. no. of channel subreaches = 25

Max link stack level = 25

Input Version number = 650

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3486
ESTIMATED PEAK FLOW (CUMECS) = 0.11
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 0.7657
ESTIMATED PEAK FLOW (CUMECS) = 0.58
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.033
ESTIMATED PEAK FLOW (CUMECS) = 0.41
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.109
ESTIMATED PEAK FLOW (CUMECS) = 0.45
ESTIMATED TIME TO PEAK (MINS) = 29.00

LINK 1 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5982
ESTIMATED PEAK FLOW (CUMECS) = 0.77
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK 3 3.001

ESTIMATED VOLUME (CU METRES*10**3) = 0.8643
ESTIMATED PEAK FLOW (CUMECS) = 1.14
ESTIMATED TIME TO PEAK (MINS) = 15.00

```
 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.2820
 ESTIMATED PEAK FLOW         (CUMECS) =      0.37
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.4027
 ESTIMATED PEAK FLOW         (CUMECS) =      0.52
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          1.100
 ESTIMATED PEAK FLOW         (CUMECS) =      1.43
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          5.208
 ESTIMATED PEAK FLOW         (CUMECS) =      3.34
 ESTIMATED TIME TO PEAK         (MINS) =     15.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =        25.
                                RETURN PERIOD (YRS)      =         2.
                                BX                       =     1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                                TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
MV 3.54Ha  3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

5          0.6220  1.865  5.000 5.000  0.000 100.0  .030 .013  .0103 .0008  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

CULVERT    0.7800  0.000  2.800 0.000  0.000 0.000  .030 0.00  .0155 0.000  2.001

1          0.8940  2.681  8.000 8.000  0.000 100.0  .030 .013  .0098 .0008  3.000

3          0.3960  1.190  8.000 8.000  0.000 100.0  .030 .013  .0064 .0005  3.001

6          0.4200  1.261  8.000 8.000  0.000 100.0  .030 .013  .0066 .0005  4.000

2          0.6010  1.802  8.000 8.000  0.000 100.0  .030 .013  .0080 .0007  5.000

4           1.043  3.130  8.000 8.000  0.000 100.0  .030 .013  .0107 .0009  5.001
```

TURNER RD 0.8820 0.000 2.500 0.000 0.000 0.000 .030 0.00 .0175 0.000 1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	49.364	10.00	0.000	3.000	0.000	9.818	0.000	0.1147	26.00	0.000
5	49.364	10.00	1.500	3.000	0.000	9.818	19.068	0.5755	15.00	0.000
U/S 20.4ha	49.364	10.00	0.000	3.000	0.000	9.818	0.000	0.4078	26.00	0.000
CULVERT	49.364	10.00	0.000	3.000	0.000	9.818	0.000	0.4491	29.00	0.000
1	49.364	10.00	1.500	3.000	0.000	9.818	19.068	0.7732	15.00	0.000
3	49.364	10.00	1.500	3.000	0.000	9.818	19.068	1.140	15.00	0.000
6	49.364	10.00	1.500	3.000	0.000	9.818	19.068	0.3719	15.00	0.000
2	49.364	10.00	1.500	3.000	0.000	9.818	19.068	0.5225	15.00	0.000
4	49.364	10.00	1.500	3.000	0.000	9.818	19.068	1.434	15.00	0.000
TURNER RD	49.364	10.00	0.000	3.000	0.000	9.818	0.000	3.338	15.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	15.00	3.337	19.00	1.955	5208.2	0.0000	739.28	94.172

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	0.767	.0600	0.2734	0.1147	1.0	0.000	0.000	0.000
5	2.00	.0130	0.0406	0.5783	1.0	0.000	0.000	0.000
U/S 20.4ha	1.08	.0300	0.1086	0.4080	1.0	0.000	0.000	0.000
CULVERT	1.11	.0300	0.1148	0.4475	1.0	0.000	0.000	0.000
1	2.28	.0130	0.0484	0.7880	1.0	0.000	0.000	0.000
3	2.56	.0130	0.0613	1.122	1.0	0.000	0.000	0.000
6	0.553	.0600	0.0922	0.3612	1.0	0.000	0.000	0.000
2	1.96	.0130	0.0383	0.5344	1.0	0.000	0.000	0.000
4	0.924	.0600	0.2094	1.374	1.0	0.000	0.000	0.000

```
LINK MV 3.54Ha          1.000

ESTIMATED VOLUME (CU METRES*10**3) =          0.7771
ESTIMATED PEAK FLOW          (CUMECS) =      0.21
ESTIMATED TIME TO PEAK          (MINS) =     48.00

LINK 5                  1.001

ESTIMATED VOLUME (CU METRES*10**3) =           1.543
ESTIMATED PEAK FLOW          (CUMECS) =      0.67
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK U/S 20.4ha         2.000

ESTIMATED VOLUME (CU METRES*10**3) =           4.410
ESTIMATED PEAK FLOW          (CUMECS) =      0.98
ESTIMATED TIME TO PEAK          (MINS) =     60.00

LINK CULVERT            2.001

ESTIMATED VOLUME (CU METRES*10**3) =           4.579
ESTIMATED PEAK FLOW          (CUMECS) =      1.01
ESTIMATED TIME TO PEAK          (MINS) =     62.00

LINK 1                  3.000

ESTIMATED VOLUME (CU METRES*10**3) =           1.100
ESTIMATED PEAK FLOW          (CUMECS) =      0.81
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK 3                  3.001

ESTIMATED VOLUME (CU METRES*10**3) =           1.588
ESTIMATED PEAK FLOW          (CUMECS) =      1.18
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK 6                  4.000

ESTIMATED VOLUME (CU METRES*10**3) =          0.5176
ESTIMATED PEAK FLOW          (CUMECS) =      0.38
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK 2                  5.000

ESTIMATED VOLUME (CU METRES*10**3) =          0.7400
ESTIMATED PEAK FLOW          (CUMECS) =      0.55
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK 4                  5.001

ESTIMATED VOLUME (CU METRES*10**3) =           2.025
ESTIMATED PEAK FLOW          (CUMECS) =      1.51
ESTIMATED TIME TO PEAK          (MINS) =     30.00

LINK TURNER RD          1.002

ESTIMATED VOLUME (CU METRES*10**3) =           10.44
ESTIMATED PEAK FLOW          (CUMECS) =      3.65
ESTIMATED TIME TO PEAK          (MINS) =     30.00
```

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006
##
#####

ROUTING INCREMENT (MINS)	=	1.00
STORM DURATION (MINS)	=	90.
RETURN PERIOD (YRS)	=	2.
BX	=	1.0000
TOTAL OF FIRST SUB-AREAS (ha)	=	29.58
TOTAL OF SECOND SUB-AREAS (ha)	=	11.93
TOTAL OF ALL SUB-AREAS (ha)	=	41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Perm #1	#2	B #1	#2	Link No.
MV 3.54Ha	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
5	0.6220	1.865	5.000	5.000	0.000	100.0	.030	.013	.0103	.0008	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001
1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	23.555	10.00	0.000	3.000	0.000	21.682	0.000	0.2149	48.00	0.000
5	23.555	10.00	1.500	3.000	0.000	21.682	33.832	0.6722	30.00	0.000
U/S 20.4ha	23.555	10.00	0.000	3.000	0.000	21.682	0.000	0.9766	60.00	0.000
CULVERT	23.555	10.00	0.000	3.000	0.000	21.682	0.000	1.010	62.00	0.000
1	23.555	10.00	1.500	3.000	0.000	21.682	33.832	0.8133	30.00	0.000
3	23.555	10.00	1.500	3.000	0.000	21.682	33.832	1.175	30.00	0.000
6	23.555	10.00	1.500	3.000	0.000	21.682	33.832	0.3820	30.00	0.000
2	23.555	10.00	1.500	3.000	0.000	21.682	33.832	0.5542	30.00	0.000
4	23.555	10.00	1.500	3.000	0.000	21.682	33.832	1.506	30.00	0.000
TURNER RD	23.555	10.00	0.000	3.000	0.000	21.682	0.000	3.652	30.00	0.000

TURNER DEVELOPED with osd with MV2.out

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	30.00	3.652	41.00	2.077	10443.4	0.0000	900.91	94.257

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	0.894	.0600	0.4219	0.2149	1.0	0.000	0.000	0.000
5	2.14	.0130	0.0445	0.6798	1.0	0.000	0.000	0.000
U/S 20.4ha	1.45	.0300	0.1789	0.9764	1.0	0.000	0.000	0.000
CULVERT	1.47	.0300	0.1820	1.010	1.0	0.000	0.000	0.000
1	2.29	.0130	0.0500	0.8156	1.0	0.000	0.000	0.000
3	2.61	.0130	0.0625	1.166	1.0	0.000	0.000	0.000
6	0.559	.0600	0.0938	0.3718	1.0	0.000	0.000	0.000
2	1.98	.0130	0.0398	0.5620	1.0	0.000	0.000	0.000
4	0.925	.0600	0.2156	1.417	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.8622
ESTIMATED PEAK FLOW (CUMECS) = 0.22
ESTIMATED TIME TO PEAK (MINS) = 61.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 1.714
ESTIMATED PEAK FLOW (CUMECS) = 0.55
ESTIMATED TIME TO PEAK (MINS) = 35.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.940
ESTIMATED PEAK FLOW (CUMECS) = 1.03
ESTIMATED TIME TO PEAK (MINS) = 66.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 5.130
ESTIMATED PEAK FLOW (CUMECS) = 1.07
ESTIMATED TIME TO PEAK (MINS) = 68.00

LINK 1 3.000

TURNER DEVELOPED with osd with MV2.out

```
 ESTIMATED VOLUME (CU METRES*10**3) =          1.225
 ESTIMATED PEAK FLOW         (CUMECS) =      0.73
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 3                  3.001

 ESTIMATED VOLUME (CU METRES*10**3) =          1.768
 ESTIMATED PEAK FLOW         (CUMECS) =      1.05
 ESTIMATED TIME TO PEAK         (MINS) =     35.00

 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.5757
 ESTIMATED PEAK FLOW         (CUMECS) =      0.35
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.8230
 ESTIMATED PEAK FLOW         (CUMECS) =      0.50
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.253
 ESTIMATED PEAK FLOW         (CUMECS) =      1.35
 ESTIMATED TIME TO PEAK         (MINS) =     35.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          11.66
 ESTIMATED PEAK FLOW         (CUMECS) =      3.22
 ESTIMATED TIME TO PEAK         (MINS) =     39.00
```

##
#####

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006

##
#####

```
                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =       120.
                              RETURN PERIOD (YRS)      =         2.
                              BX                       =    1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                              TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                              TOTAL OF ALL SUB-AREAS (ha)    =      41.51
```

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Perm #1	#2	B #1	#2	Link No.
MV 3.54Ha	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
5	0.6220	1.865	5.000	5.000	0.000	100.0	.030	.013	.0103	.0008	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001

1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	19.535	10.00	0.000	3.000	0.000	24.320	0.000	0.2200	61.00	0.000
5	19.535	10.00	1.500	3.000	0.000	24.320	37.570	0.5455	35.00	0.000
U/S 20.4ha	19.535	10.00	0.000	3.000	0.000	24.320	0.000	1.033	66.00	0.000
CULVERT	19.535	10.00	0.000	3.000	0.000	24.320	0.000	1.070	68.00	0.000
1	19.535	10.00	1.500	3.000	0.000	24.320	37.570	0.7336	32.00	0.000
3	19.535	10.00	1.500	3.000	0.000	24.320	37.570	1.053	35.00	0.000
6	19.535	10.00	1.500	3.000	0.000	24.320	37.570	0.3478	32.00	0.000
2	19.535	10.00	1.500	3.000	0.000	24.320	37.570	0.4973	32.00	0.000
4	19.535	10.00	1.500	3.000	0.000	24.320	37.570	1.351	35.00	0.000
TURNER RD	19.535	10.00	0.000	3.000	0.000	24.320	0.000	3.215	39.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Stage Used
TURNER RD	39.00	3.215	47.00	2.137	11656.0	0.0000	985.62	94.298

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	0.893	.0600	0.4313	0.2200	1.0	0.000	0.000	0.000
5	1.98	.0130	0.0395	0.5562	1.0	0.000	0.000	0.000
U/S 20.4ha	1.48	.0300	0.1844	1.032	1.0	0.000	0.000	0.000
CULVERT	1.49	.0300	0.1883	1.069	1.0	0.000	0.000	0.000

1	2.18	.0130	0.0471	0.7321	1.0	0.000	0.000	0.000
3	2.54	.0130	0.0586	1.064	1.0	0.000	0.000	0.000
6	0.531	.0600	0.0883	0.3324	1.0	0.000	0.000	0.000
2	1.86	.0130	0.0373	0.4938	1.0	0.000	0.000	0.000
4	0.919	.0600	0.2016	1.316	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5560
ESTIMATED PEAK FLOW (CUMECS) = 0.20
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 1.125
ESTIMATED PEAK FLOW (CUMECS) = 0.86
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 3.263
ESTIMATED PEAK FLOW (CUMECS) = 0.82
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 3.385
ESTIMATED PEAK FLOW (CUMECS) = 0.88
ESTIMATED TIME TO PEAK (MINS) = 28.00

LINK 1 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.8181
ESTIMATED PEAK FLOW (CUMECS) = 1.09
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK 3 3.001

ESTIMATED VOLUME (CU METRES*10**3) = 1.181
ESTIMATED PEAK FLOW (CUMECS) = 1.59
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK 6 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.3845
ESTIMATED PEAK FLOW (CUMECS) = 0.52
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK 2 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.5499
ESTIMATED PEAK FLOW (CUMECS) = 0.75
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK 4 5.001

ESTIMATED VOLUME (CU METRES*10**3) = 1.504
ESTIMATED PEAK FLOW (CUMECS) = 2.01
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK TURNER RD 1.002

```
 ESTIMATED VOLUME (CU METRES*10**3) =          7.720
 ESTIMATED PEAK FLOW         (CUMECS) =      4.75
 ESTIMATED TIME TO PEAK         (MINS) =     15.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =        25.
                                RETURN PERIOD (YRS)      =         5.
                                BX                       =     1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                                TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
MV 3.54Ha  3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

5          0.6220  1.865  5.000 5.000  0.000 100.0  .030 .013  .0103 .0008  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

CULVERT    0.7800  0.000  2.800 0.000  0.000 0.000  .030 0.00  .0155 0.000  2.001

1          0.8940  2.681  8.000 8.000  0.000 100.0  .030 .013  .0098 .0008  3.000

3          0.3960  1.190  8.000 8.000  0.000 100.0  .030 .013  .0064 .0005  3.001

6          0.4200  1.261  8.000 8.000  0.000 100.0  .030 .013  .0066 .0005  4.000

2          0.6010  1.802  8.000 8.000  0.000 100.0  .030 .013  .0080 .0007  5.000

4           1.043  3.130  8.000 8.000  0.000 100.0  .030 .013  .0107 .0009  5.001

TURNER RD 0.8820  0.000  2.500 0.000  0.000 0.000  .030 0.00  .0175 0.000  1.002


 Link    Average  Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2      #1    #2    Inflow   to     Lag
          (mm/h)    ( mm )      (mm/h)        ( mm )     (m^3/s)  Peak  mins
MV 3.54Ha 64.073 10.00 0.000  3.000 0.000  15.847  0.000  0.2029  26.00 0.000

5          64.073 10.00 1.500  3.000 0.000  15.847 25.197  0.8564  15.00 0.000

U/S 20.4ha64.073 10.00 0.000  3.000 0.000  15.847  0.000  0.8221  26.00 0.000

CULVERT    64.073 10.00 0.000  3.000 0.000  15.847  0.000  0.8827  28.00 0.000

1          64.073 10.00 1.500  3.000 0.000  15.847 25.197   1.087  15.00 0.000

3          64.073 10.00 1.500  3.000 0.000  15.847 25.197   1.594  15.00 0.000
```

6	64.073	10.00	1.500	3.000	0.000	15.847	25.197	0.5223	15.00	0.000
2	64.073	10.00	1.500	3.000	0.000	15.847	25.197	0.7507	15.00	0.000
4	64.073	10.00	1.500	3.000	0.000	15.847	25.197	2.015	15.00	0.000
TURNER RD	64.073	10.00	0.000	3.000	0.000	15.847	0.000	4.752	15.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	15.00	4.751	23.00	2.394	7719.7	0.0000	1397.4	94.502

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	0.880	.0600	0.4062	0.2028	1.0	0.000	0.000	0.000
5	2.31	.0130	0.0516	0.8516	1.0	0.000	0.000	0.000
U/S 20.4ha	1.36	.0300	0.1625	0.8215	1.0	0.000	0.000	0.000
CULVERT	1.40	.0300	0.1688	0.8811	1.0	0.000	0.000	0.000
1	2.58	.0130	0.0598	1.103	1.0	0.000	0.000	0.000
3	2.96	.0130	0.0750	1.588	1.0	0.000	0.000	0.000
6	0.647	.0600	0.1133	0.5200	1.0	0.000	0.000	0.000
2	2.22	.0130	0.0477	0.7542	1.0	0.000	0.000	0.000
4	1.12	.0600	0.2578	2.064	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.139
ESTIMATED PEAK FLOW (CUMECS) = 0.34
ESTIMATED TIME TO PEAK (MINS) = 45.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.166
ESTIMATED PEAK FLOW (CUMECS) = 0.97
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 6.575
ESTIMATED PEAK FLOW (CUMECS) = 1.57

```
 ESTIMATED TIME TO PEAK          (MINS) =     55.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          6.826
 ESTIMATED PEAK FLOW          (CUMECS) =      1.62
 ESTIMATED TIME TO PEAK          (MINS) =     57.00

 LINK 1                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.476
 ESTIMATED PEAK FLOW          (CUMECS) =      1.08
 ESTIMATED TIME TO PEAK          (MINS) =     30.00

 LINK 3                  3.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.130
 ESTIMATED PEAK FLOW          (CUMECS) =      1.57
 ESTIMATED TIME TO PEAK          (MINS) =     30.00

 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.6938
 ESTIMATED PEAK FLOW          (CUMECS) =      0.52
 ESTIMATED TIME TO PEAK          (MINS) =     29.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.9913
 ESTIMATED PEAK FLOW          (CUMECS) =      0.74
 ESTIMATED TIME TO PEAK          (MINS) =     27.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.714
 ESTIMATED PEAK FLOW          (CUMECS) =      1.99
 ESTIMATED TIME TO PEAK          (MINS) =     30.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          14.81
 ESTIMATED PEAK FLOW          (CUMECS) =      5.41
 ESTIMATED TIME TO PEAK          (MINS) =     30.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =        90.
                              RETURN PERIOD (YRS)      =         5.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                              TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                              TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B       Link
```

Label	#1 (ha)	#2	#1 (%)	#2	#1 (%)	#2	#1	#2	#1	#2	No.
MV 3.54Ha	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
5	0.6220	1.865	5.000	5.000	0.000	100.0	.030	.013	.0103	.0008	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001
1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	30.568	10.00	0.000	3.000	0.000	32.052	0.000	0.3429	45.00	0.000
5	30.568	10.00	1.500	3.000	0.000	32.052	44.352	0.9711	30.00	0.000
U/S 20.4ha	30.568	10.00	0.000	3.000	0.000	32.052	0.000	1.566	55.00	0.000
CULVERT	30.568	10.00	0.000	3.000	0.000	32.052	0.000	1.615	57.00	0.000
1	30.568	10.00	1.500	3.000	0.000	32.052	44.352	1.076	30.00	0.000
3	30.568	10.00	1.500	3.000	0.000	32.052	44.352	1.573	30.00	0.000
6	30.568	10.00	1.500	3.000	0.000	32.052	44.352	0.5173	29.00	0.000
2	30.568	10.00	1.500	3.000	0.000	32.052	44.352	0.7390	27.00	0.000
4	30.568	10.00	1.500	3.000	0.000	32.052	44.352	1.992	30.00	0.000
TURNER RD	30.568	10.00	0.000	3.000	0.000	32.052	0.000	5.408	30.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	30.00	5.408	58.00	2.861	14814.7	0.0000	2029.8	94.795

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	0.986	.0600	0.5844	0.3427	1.0	0.000	0.000	0.000
5	2.45	.0130	0.0557	0.9732	1.0	0.000	0.000	0.000
U/S 20.4ha	1.68	.0300	0.2328	1.565	1.0	0.000	0.000	0.000
CULVERT	1.70	.0300	0.2375	1.615	1.0	0.000	0.000	0.000
1	2.57	.0130	0.0594	1.089	1.0	0.000	0.000	0.000
3	2.96	.0130	0.0742	1.574	1.0	0.000	0.000	0.000
6	0.648	.0600	0.1125	0.5166	1.0	0.000	0.000	0.000
2	2.21	.0130	0.0473	0.7464	1.0	0.000	0.000	0.000
4	1.12	.0600	0.2563	2.049	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.279
ESTIMATED PEAK FLOW (CUMECS) = 0.35
ESTIMATED TIME TO PEAK (MINS) = 50.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.420
ESTIMATED PEAK FLOW (CUMECS) = 0.84
ESTIMATED TIME TO PEAK (MINS) = 35.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 7.330
ESTIMATED PEAK FLOW (CUMECS) = 1.64
ESTIMATED TIME TO PEAK (MINS) = 65.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 7.609
ESTIMATED PEAK FLOW (CUMECS) = 1.69
ESTIMATED TIME TO PEAK (MINS) = 66.00

LINK 1 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.641
ESTIMATED PEAK FLOW (CUMECS) = 1.00
ESTIMATED TIME TO PEAK (MINS) = 35.00

LINK 3 3.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.369
ESTIMATED PEAK FLOW (CUMECS) = 1.46
ESTIMATED TIME TO PEAK (MINS) = 35.00

LINK 6 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.7712
ESTIMATED PEAK FLOW (CUMECS) = 0.48
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK 2 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.103

```
                    TURNER DEVELOPED with osd with MV2.out
 ESTIMATED PEAK FLOW          (CUMECS) =      0.68
 ESTIMATED TIME TO PEAK          (MINS) =     32.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          3.017
 ESTIMATED PEAK FLOW          (CUMECS) =      1.85
 ESTIMATED TIME TO PEAK          (MINS) =     35.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          16.50
 ESTIMATED PEAK FLOW          (CUMECS) =      4.73
 ESTIMATED TIME TO PEAK          (MINS) =     38.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =       120.
                                RETURN PERIOD (YRS)      =         5.
                                BX                       =    1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                                TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B       Link
 Label      #1     #2      #1   #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
MV 3.54Ha  3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

5          0.6220  1.865  5.000 5.000  0.000 100.0  .030 .013  .0103 .0008  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

CULVERT    0.7800  0.000  2.800 0.000  0.000 0.000  .030 0.00  .0155 0.000  2.001

1          0.8940  2.681  8.000 8.000  0.000 100.0  .030 .013  .0098 .0008  3.000

3          0.3960  1.190  8.000 8.000  0.000 100.0  .030 .013  .0064 .0005  3.001

6          0.4200  1.261  8.000 8.000  0.000 100.0  .030 .013  .0066 .0005  4.000

2          0.6010  1.802  8.000 8.000  0.000 100.0  .030 .013  .0080 .0007  5.000

4           1.043  3.130  8.000 8.000  0.000 100.0  .030 .013  .0107 .0009  5.001

TURNER RD 0.8820  0.000  2.500 0.000  0.000 0.000  .030 0.00  .0175 0.000  1.002


 Link    Average  Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2      #1    #2    Inflow   to     Lag
          (mm/h)    ( mm )      (mm/h)        ( mm )     (m^3/s)  Peak  mins
MV 3.54Ha 25.371 10.00 0.000  3.000 0.000  35.842  0.000  0.3491  50.00 0.000
```

5	25.371	10.00	1.500	3.000	0.000	35.842	49.242	0.8422	35.00	0.000
U/S 20.4ha	25.371	10.00	0.000	3.000	0.000	35.842	0.000	1.641	65.00	0.000
CULVERT	25.371	10.00	0.000	3.000	0.000	35.842	0.000	1.690	66.00	0.000
1	25.371	10.00	1.500	3.000	0.000	35.842	49.242	0.9988	35.00	0.000
3	25.371	10.00	1.500	3.000	0.000	35.842	49.242	1.458	35.00	0.000
6	25.371	10.00	1.500	3.000	0.000	35.842	49.242	0.4763	32.00	0.000
2	25.371	10.00	1.500	3.000	0.000	35.842	49.242	0.6776	32.00	0.000
4	25.371	10.00	1.500	3.000	0.000	35.842	49.242	1.853	35.00	0.000
TURNER RD	25.371	10.00	0.000	3.000	0.000	35.842	0.000	4.729	38.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	38.00	4.728	67.00	2.966	16502.9	0.0000	2129.6	94.836

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	0.986	.0600	0.5938	0.3490	1.0	0.000	0.000	0.000
5	2.35	.0130	0.0512	0.8577	1.0	0.000	0.000	0.000
U/S 20.4ha	1.71	.0300	0.2391	1.640	1.0	0.000	0.000	0.000
CULVERT	1.73	.0300	0.2430	1.690	1.0	0.000	0.000	0.000
1	2.51	.0130	0.0566	1.017	1.0	0.000	0.000	0.000
3	2.85	.0130	0.0711	1.451	1.0	0.000	0.000	0.000
6	0.620	.0600	0.1070	0.4703	1.0	0.000	0.000	0.000
2	2.19	.0130	0.0449	0.7019	1.0	0.000	0.000	0.000
4	1.06	.0600	0.2445	1.843	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.6719
ESTIMATED PEAK FLOW (CUMECS) = 0.26
ESTIMATED TIME TO PEAK (MINS) = 26.00

```
 LINK 5                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          1.323
 ESTIMATED PEAK FLOW         (CUMECS) =      1.01
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.931
 ESTIMATED PEAK FLOW         (CUMECS) =      1.08
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          4.081
 ESTIMATED PEAK FLOW         (CUMECS) =      1.15
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 1                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.9368
 ESTIMATED PEAK FLOW         (CUMECS) =      1.25
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK 3                  3.001

 ESTIMATED VOLUME (CU METRES*10**3) =          1.352
 ESTIMATED PEAK FLOW         (CUMECS) =      1.83
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.4401
 ESTIMATED PEAK FLOW         (CUMECS) =      0.61
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.6293
 ESTIMATED PEAK FLOW         (CUMECS) =      0.86
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          1.722
 ESTIMATED PEAK FLOW         (CUMECS) =      2.32
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          9.089
 ESTIMATED PEAK FLOW         (CUMECS) =      5.67
 ESTIMATED TIME TO PEAK         (MINS) =     15.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       1.00
```

TURNER DEVELOPED with osd with MV2.out

STORM DURATION (MINS)	=	25.
RETURN PERIOD (YRS)	=	10.
BX	=	1.0000
TOTAL OF FIRST SUB-AREAS (ha)	=	29.58
TOTAL OF SECOND SUB-AREAS (ha)	=	11.93
TOTAL OF ALL SUB-AREAS (ha)	=	41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Pern #1	#2	B #1	#2	Link No.
MV 3.54Ha	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
5	0.6220	1.865	5.000	5.000	0.000	100.0	.030	.013	.0103	.0008	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001
1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	72.056	10.00	0.000	3.000	0.000	19.123	0.000	0.2613	26.00	0.000
5	72.056	10.00	1.500	3.000	0.000	19.123	28.523	1.010	15.00	0.000
U/S 20.4ha	72.056	10.00	0.000	3.000	0.000	19.123	0.000	1.082	26.00	0.000
CULVERT	72.056	10.00	0.000	3.000	0.000	19.123	0.000	1.148	28.00	0.000
1	72.056	10.00	1.500	3.000	0.000	19.123	28.523	1.252	15.00	0.000
3	72.056	10.00	1.500	3.000	0.000	19.123	28.523	1.835	15.00	0.000
6	72.056	10.00	1.500	3.000	0.000	19.123	28.523	0.6086	15.00	0.000
2	72.056	10.00	1.500	3.000	0.000	19.123	28.523	0.8584	15.00	0.000
4	72.056	10.00	1.500	3.000	0.000	19.123	28.523	2.324	15.00	0.000
TURNER RD	72.056	10.00	0.000	3.000	0.000	19.123	0.000	5.666	15.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	15.00	5.666	25.00	2.690	9089.0	0.0000	1865.4	94.728

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	0.930	.0600	0.4844	0.2609	1.0	0.000	0.000	0.000
5	2.48	.0130	0.0570	1.010	1.0	0.000	0.000	0.000
U/S 20.4ha	1.50	.0300	0.1891	1.081	1.0	0.000	0.000	0.000
CULVERT	1.52	.0300	0.1961	1.147	1.0	0.000	0.000	0.000
1	2.71	.0130	0.0648	1.256	1.0	0.000	0.000	0.000
3	3.14	.0130	0.0816	1.836	1.0	0.000	0.000	0.000
6	0.665	.0600	0.1242	0.5862	1.0	0.000	0.000	0.000
2	2.37	.0130	0.0516	0.8719	1.0	0.000	0.000	0.000
4	1.17	.0600	0.2813	2.359	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.340
ESTIMATED PEAK FLOW (CUMECS) = 0.42
ESTIMATED TIME TO PEAK (MINS) = 42.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.507
ESTIMATED PEAK FLOW (CUMECS) = 1.13
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 7.713
ESTIMATED PEAK FLOW (CUMECS) = 1.89
ESTIMATED TIME TO PEAK (MINS) = 53.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 8.007
ESTIMATED PEAK FLOW (CUMECS) = 1.95
ESTIMATED TIME TO PEAK (MINS) = 49.00

LINK 1 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.679
ESTIMATED PEAK FLOW (CUMECS) = 1.21
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK 3 3.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.424
ESTIMATED PEAK FLOW (CUMECS) = 1.78
ESTIMATED TIME TO PEAK (MINS) = 30.00

```
 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          0.7894
 ESTIMATED PEAK FLOW         (CUMECS) =      0.59
 ESTIMATED TIME TO PEAK         (MINS) =     27.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =           1.128
 ESTIMATED PEAK FLOW         (CUMECS) =      0.83
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =           3.088
 ESTIMATED PEAK FLOW         (CUMECS) =      2.25
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =           17.15
 ESTIMATED PEAK FLOW         (CUMECS) =      6.36
 ESTIMATED TIME TO PEAK         (MINS) =     30.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =        90.
                                RETURN PERIOD (YRS)      =        10.
                                BX                       =    1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                                TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)            (%)          (%)
MV 3.54Ha  3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

5          0.6220  1.865  5.000 5.000  0.000 100.0  .030 .013  .0103 .0008  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

CULVERT    0.7800  0.000  2.800 0.000  0.000 0.000  .030 0.00  .0155 0.000  2.001

1          0.8940  2.681  8.000 8.000  0.000 100.0  .030 .013  .0098 .0008  3.000

3          0.3960  1.190  8.000 8.000  0.000 100.0  .030 .013  .0064 .0005  3.001

6          0.4200  1.261  8.000 8.000  0.000 100.0  .030 .013  .0066 .0005  4.000

2          0.6010  1.802  8.000 8.000  0.000 100.0  .030 .013  .0080 .0007  5.000

4           1.043  3.130  8.000 8.000  0.000 100.0  .030 .013  .0107 .0009  5.001
```

TURNER RD 0.8820 0.000 2.500 0.000 0.000 0.000 .030 0.00 .0175 0.000 1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	34.373	10.00	0.000	3.000	0.000	37.710	0.000	0.4194	42.00	0.000
5	34.373	10.00	1.500	3.000	0.000	37.710	50.060	1.133	30.00	0.000
U/S 20.4ha	34.373	10.00	0.000	3.000	0.000	37.710	0.000	1.885	53.00	0.000
CULVERT	34.373	10.00	0.000	3.000	0.000	37.710	0.000	1.947	49.00	0.000
1	34.373	10.00	1.500	3.000	0.000	37.710	50.060	1.211	30.00	0.000
3	34.373	10.00	1.500	3.000	0.000	37.710	50.060	1.780	30.00	0.000
6	34.373	10.00	1.500	3.000	0.000	37.710	50.060	0.5889	27.00	0.000
2	34.373	10.00	1.500	3.000	0.000	37.710	50.060	0.8272	30.00	0.000
4	34.373	10.00	1.500	3.000	0.000	37.710	50.060	2.248	30.00	0.000
TURNER RD	34.373	10.00	0.000	3.000	0.000	37.710	0.000	6.364	30.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	30.00	6.364	44.00	3.607	17149.6	0.0000	2445.6	94.967

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	1.02	.0600	0.6719	0.4195	1.0	0.000	0.000	0.000
5	2.60	.0130	0.0609	1.134	1.0	0.000	0.000	0.000
U/S 20.4ha	1.79	.0300	0.2578	1.885	1.0	0.000	0.000	0.000
CULVERT	1.80	.0300	0.2625	1.947	1.0	0.000	0.000	0.000
1	2.71	.0130	0.0637	1.235	1.0	0.000	0.000	0.000
3	3.11	.0130	0.0801	1.784	1.0	0.000	0.000	0.000
6	0.666	.0600	0.1219	0.5755	1.0	0.000	0.000	0.000
2	2.34	.0130	0.0506	0.8429	1.0	0.000	0.000	0.000

```
4          1.17   .0600 0.2750   2.295    1.0  0.000   0.000    0.000


 LINK MV 3.54Ha          1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.504
 ESTIMATED PEAK FLOW          (CUMECS) =      0.44
 ESTIMATED TIME TO PEAK          (MINS) =     46.00

 LINK 5                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.801
 ESTIMATED PEAK FLOW          (CUMECS) =      0.99
 ESTIMATED TIME TO PEAK          (MINS) =     35.00

 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          8.579
 ESTIMATED PEAK FLOW          (CUMECS) =      1.96
 ESTIMATED TIME TO PEAK          (MINS) =     62.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          8.908
 ESTIMATED PEAK FLOW          (CUMECS) =      2.02
 ESTIMATED TIME TO PEAK          (MINS) =     63.00

 LINK 1                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.867
 ESTIMATED PEAK FLOW          (CUMECS) =      1.15
 ESTIMATED TIME TO PEAK          (MINS) =     32.00

 LINK 3                  3.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.695
 ESTIMATED PEAK FLOW          (CUMECS) =      1.67
 ESTIMATED TIME TO PEAK          (MINS) =     35.00

 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.8777
 ESTIMATED PEAK FLOW          (CUMECS) =      0.55
 ESTIMATED TIME TO PEAK          (MINS) =     32.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.255
 ESTIMATED PEAK FLOW          (CUMECS) =      0.78
 ESTIMATED TIME TO PEAK          (MINS) =     32.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          3.433
 ESTIMATED PEAK FLOW          (CUMECS) =      2.10
 ESTIMATED TIME TO PEAK          (MINS) =     35.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          19.09
 ESTIMATED PEAK FLOW          (CUMECS) =      5.55
 ESTIMATED TIME TO PEAK          (MINS) =     40.00
```

#####

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006

##
#####

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 120.
RETURN PERIOD (YRS) = 10.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.58
TOTAL OF SECOND SUB-AREAS (ha) = 11.93
TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Area #2	Slope #1 (%)	Slope #2	% Impervious #1 (%)	% Impervious #2	Perm #1	Perm #2	B #1	B #2	Link No.
MV 3.54Ha	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
5	0.6220	1.865	5.000	5.000	0.000	100.0	.030	.013	.0103	.0008	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001
1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	28.541	10.00	0.000	3.000	0.000	42.132	0.000	0.4429	46.00	0.000
5	28.541	10.00	1.500	3.000	0.000	42.132	55.582	0.9857	35.00	0.000
U/S 20.4ha	28.541	10.00	0.000	3.000	0.000	42.132	0.000	1.959	62.00	0.000
CULVERT	28.541	10.00	0.000	3.000	0.000	42.132	0.000	2.018	63.00	0.000
1	28.541	10.00	1.500	3.000	0.000	42.132	55.582	1.150	32.00	0.000
3	28.541	10.00	1.500	3.000	0.000	42.132	55.582	1.669	35.00	0.000
6	28.541	10.00	1.500	3.000	0.000	42.132	55.582	0.5467	32.00	0.000
2	28.541	10.00	1.500	3.000	0.000	42.132	55.582	0.7819	32.00	0.000
4	28.541	10.00	1.500	3.000	0.000	42.132	55.582	2.101	35.00	0.000
TURNER RD	28.541	10.00	0.000	3.000	0.000	42.132	0.000	5.547	40.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	40.00	5.546	49.00	3.699	19088.5	0.0000	2476.9	94.979

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	1.03	.0600	0.7000	0.4432	1.0	0.000	0.000	0.000
5	2.49	.0130	0.0563	1.001	1.0	0.000	0.000	0.000
U/S 20.4ha	1.80	.0300	0.2641	1.958	1.0	0.000	0.000	0.000
CULVERT	1.82	.0300	0.2680	2.018	1.0	0.000	0.000	0.000
1	2.63	.0130	0.0617	1.160	1.0	0.000	0.000	0.000
3	3.03	.0130	0.0770	1.667	1.0	0.000	0.000	0.000
6	0.647	.0600	0.1164	0.5340	1.0	0.000	0.000	0.000
2	2.27	.0130	0.0488	0.7908	1.0	0.000	0.000	0.000
4	1.11	.0600	0.2641	2.095	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.8448
ESTIMATED PEAK FLOW (CUMECS) = 0.36
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 1.608
ESTIMATED PEAK FLOW (CUMECS) = 1.22
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.857
ESTIMATED PEAK FLOW (CUMECS) = 1.44
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 5.042
ESTIMATED PEAK FLOW (CUMECS) = 1.51
ESTIMATED TIME TO PEAK (MINS) = 28.00

LINK 1 3.000

```
 ESTIMATED VOLUME (CU METRES*10**3) =          1.101
 ESTIMATED PEAK FLOW         (CUMECS) =      1.48
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK 3                  3.001

 ESTIMATED VOLUME (CU METRES*10**3) =          1.589
 ESTIMATED PEAK FLOW         (CUMECS) =      2.18
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.5172
 ESTIMATED PEAK FLOW         (CUMECS) =      0.72
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =         0.7389
 ESTIMATED PEAK FLOW         (CUMECS) =      1.01
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.023
 ESTIMATED PEAK FLOW         (CUMECS) =      2.73
 ESTIMATED TIME TO PEAK         (MINS) =     15.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          10.99
 ESTIMATED PEAK FLOW         (CUMECS) =      6.91
 ESTIMATED TIME TO PEAK         (MINS) =     15.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =        25.
                              RETURN PERIOD (YRS)      =        20.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                              TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                              TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
MV 3.54Ha  3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

5          0.6220  1.865  5.000 5.000  0.000 100.0  .030 .013  .0103 .0008  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

CULVERT    0.7800  0.000  2.800 0.000  0.000 0.000  .030 0.00  .0155 0.000  2.001
```

1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	83.043	10.00	0.000	3.000	0.000	23.701	0.000	0.3632	26.00	0.000
5	83.043	10.00	1.500	3.000	0.000	23.701	33.101	1.220	15.00	0.000
U/S 20.4ha	83.043	10.00	0.000	3.000	0.000	23.701	0.000	1.442	26.00	0.000
CULVERT	83.043	10.00	0.000	3.000	0.000	23.701	0.000	1.513	28.00	0.000
1	83.043	10.00	1.500	3.000	0.000	23.701	33.101	1.480	15.00	0.000
3	83.043	10.00	1.500	3.000	0.000	23.701	33.101	2.176	15.00	0.000
6	83.043	10.00	1.500	3.000	0.000	23.701	33.101	0.7186	15.00	0.000
2	83.043	10.00	1.500	3.000	0.000	23.701	33.101	1.007	15.00	0.000
4	83.043	10.00	1.500	3.000	0.000	23.701	33.101	2.729	15.00	0.000
TURNER RD	83.043	10.00	0.000	3.000	0.000	23.701	0.000	6.914	15.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	15.00	6.913	24.00	3.489	10988.9	0.0000	2406.1	94.950

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	0.996	.0600	0.6094	0.3633	1.0	0.000	0.000	0.000
5	2.67	.0130	0.0639	1.219	1.0	0.000	0.000	0.000
U/S 20.4ha	1.65	.0300	0.2219	1.441	1.0	0.000	0.000	0.000

CULVERT	1.67	.0300	0.2281	1.512	1.0	0.000	0.000	0.000
1	2.91	.0130	0.0719	1.497	1.0	0.000	0.000	0.000
3	3.33	.0130	0.0906	2.162	1.0	0.000	0.000	0.000
6	0.717	.0600	0.1375	0.6994	1.0	0.000	0.000	0.000
2	2.51	.0130	0.0570	1.021	1.0	0.000	0.000	0.000
4	1.24	.0600	0.3094	2.737	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.616
ESTIMATED PEAK FLOW (CUMECS) = 0.53
ESTIMATED TIME TO PEAK (MINS) = 40.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.980
ESTIMATED PEAK FLOW (CUMECS) = 1.38
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 9.321
ESTIMATED PEAK FLOW (CUMECS) = 2.38
ESTIMATED TIME TO PEAK (MINS) = 47.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 9.677
ESTIMATED PEAK FLOW (CUMECS) = 2.46
ESTIMATED TIME TO PEAK (MINS) = 48.00

LINK 1 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.959
ESTIMATED PEAK FLOW (CUMECS) = 1.41
ESTIMATED TIME TO PEAK (MINS) = 27.00

LINK 3 3.001

ESTIMATED VOLUME (CU METRES*10**3) = 2.828
ESTIMATED PEAK FLOW (CUMECS) = 2.06
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK 6 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.9216
ESTIMATED PEAK FLOW (CUMECS) = 0.68
ESTIMATED TIME TO PEAK (MINS) = 27.00

LINK 2 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.317
ESTIMATED PEAK FLOW (CUMECS) = 0.95
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK 4 5.001

ESTIMATED VOLUME (CU METRES*10**3) = 3.603
ESTIMATED PEAK FLOW (CUMECS) = 2.60
ESTIMATED TIME TO PEAK (MINS) = 30.00

TURNER DEVELOPED with osd with MV2.out

LINK TURNER RD 1.002

ESTIMATED VOLUME (CU METRES*10**3) = 20.41
ESTIMATED PEAK FLOW (CUMECS) = 7.72
ESTIMATED TIME TO PEAK (MINS) = 30.00

##########

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006

##########

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 20.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.58
TOTAL OF SECOND SUB-AREAS (ha) = 11.93
TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1 (%)	% Impervious #2 (%)	Pern #1	Pern #2	B #1	B #2	Link No.
MV 3.54Ha	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
5	0.6220	1.865	5.000	5.000	0.000	100.0	.030	.013	.0103	.0008	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001
1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak mins	Link Lag mins
MV 3.54Ha	39.611	10.00	0.000	3.000	0.000	45.517	0.000	0.5339	40.00	0.000
5	39.611	10.00	1.500	3.000	0.000	45.517	57.917	1.376	30.00	0.000
U/S 20.4ha	39.611	10.00	0.000	3.000	0.000	45.517	0.000	2.385	47.00	0.000
CULVERT	39.611	10.00	0.000	3.000	0.000	45.517	0.000	2.459	48.00	0.000
1	39.611	10.00	1.500	3.000	0.000	45.517	57.917	1.405	27.00	0.000
3	39.611	10.00	1.500	3.000	0.000	45.517	57.917	2.063	30.00	0.000

6	39.611	10.00	1.500	3.000	0.000	45.517	57.917	0.6842	27.00	0.000
2	39.611	10.00	1.500	3.000	0.000	45.517	57.917	0.9541	30.00	0.000
4	39.611	10.00	1.500	3.000	0.000	45.517	57.917	2.601	30.00	0.000
TURNER RD	39.611	10.00	0.000	3.000	0.000	45.517	0.000	7.719	30.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	30.00	7.719	38.00	4.823	20411.1	0.0000	2832.7	95.126

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	1.07	.0600	0.7938	0.5338	1.0	0.000	0.000	0.000
5	2.80	.0130	0.0688	1.375	1.0	0.000	0.000	0.000
U/S 20.4ha	1.92	.0300	0.2938	2.385	1.0	0.000	0.000	0.000
CULVERT	1.93	.0300	0.2984	2.458	1.0	0.000	0.000	0.000
1	2.89	.0130	0.0695	1.435	1.0	0.000	0.000	0.000
3	3.30	.0130	0.0875	2.068	1.0	0.000	0.000	0.000
6	0.704	.0600	0.1328	0.6638	1.0	0.000	0.000	0.000
2	2.47	.0130	0.0551	0.9727	1.0	0.000	0.000	0.000
4	1.22	.0600	0.3016	2.626	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.798
ESTIMATED PEAK FLOW (CUMECS) = 0.57
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 3.313
ESTIMATED PEAK FLOW (CUMECS) = 1.18
ESTIMATED TIME TO PEAK (MINS) = 35.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 10.36

```
 ESTIMATED PEAK FLOW          (CUMECS) =      2.44
 ESTIMATED TIME TO PEAK          (MINS) =     58.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          10.76
 ESTIMATED PEAK FLOW          (CUMECS) =      2.51
 ESTIMATED TIME TO PEAK          (MINS) =     60.00

 LINK 1                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.178
 ESTIMATED PEAK FLOW          (CUMECS) =      1.33
 ESTIMATED TIME TO PEAK          (MINS) =     32.00

 LINK 3                  3.001

 ESTIMATED VOLUME (CU METRES*10**3) =          3.144
 ESTIMATED PEAK FLOW          (CUMECS) =      1.93
 ESTIMATED TIME TO PEAK          (MINS) =     35.00

 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.024
 ESTIMATED PEAK FLOW          (CUMECS) =      0.64
 ESTIMATED TIME TO PEAK          (MINS) =     32.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.463
 ESTIMATED PEAK FLOW          (CUMECS) =      0.92
 ESTIMATED TIME TO PEAK          (MINS) =     32.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          4.005
 ESTIMATED PEAK FLOW          (CUMECS) =      2.43
 ESTIMATED TIME TO PEAK          (MINS) =     35.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          22.70
 ESTIMATED PEAK FLOW          (CUMECS) =      6.71
 ESTIMATED TIME TO PEAK          (MINS) =     40.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       1.00
                              STORM DURATION (MINS)    =       120.
                              RETURN PERIOD (YRS)      =        20.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                              TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                              TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
```

TURNER DEVELOPED with osd with MV2.out

Link Label	Catch. Area #1 (ha)	#2	Slope #1 (%)	#2	% Impervious #1 (%)	#2	Pern #1	#2	B #1	#2	Link No.
MV 3.54Ha	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
5	0.6220	1.865	5.000	5.000	0.000	100.0	.030	.013	.0103	.0008	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001
1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	32.901	10.00	0.000	3.000	0.000	50.753	0.000	0.5680	46.00	0.000
5	32.901	10.00	1.500	3.000	0.000	50.753	64.303	1.179	35.00	0.000
U/S 20.4ha	32.901	10.00	0.000	3.000	0.000	50.753	0.000	2.435	58.00	0.000
CULVERT	32.901	10.00	0.000	3.000	0.000	50.753	0.000	2.505	60.00	0.000
1	32.901	10.00	1.500	3.000	0.000	50.753	64.303	1.331	32.00	0.000
3	32.901	10.00	1.500	3.000	0.000	50.753	64.303	1.931	35.00	0.000
6	32.901	10.00	1.500	3.000	0.000	50.753	64.303	0.6432	32.00	0.000
2	32.901	10.00	1.500	3.000	0.000	50.753	64.303	0.9153	32.00	0.000
4	32.901	10.00	1.500	3.000	0.000	50.753	64.303	2.431	35.00	0.000
TURNER RD	32.901	10.00	0.000	3.000	0.000	50.753	0.000	6.711	40.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	40.00	6.711	46.00	5.110	22696.3	0.0000	2903.9	95.155

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	1.09	.0600	0.8250	0.5679	1.0	0.000	0.000	0.000
5	2.67	.0130	0.0625	1.191	1.0	0.000	0.000	0.000
U/S 20.4ha	1.93	.0300	0.2969	2.435	1.0	0.000	0.000	0.000
CULVERT	1.95	.0300	0.3016	2.505	1.0	0.000	0.000	0.000
1	2.80	.0130	0.0672	1.347	1.0	0.000	0.000	0.000
3	3.20	.0130	0.0844	1.934	1.0	0.000	0.000	0.000
6	0.684	.0600	0.1281	0.6213	1.0	0.000	0.000	0.000
2	2.39	.0130	0.0537	0.9162	1.0	0.000	0.000	0.000
4	1.17	.0600	0.2891	2.421	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.042
ESTIMATED PEAK FLOW (CUMECS) = 0.51
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 1.954
ESTIMATED PEAK FLOW (CUMECS) = 1.34
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 6.072
ESTIMATED PEAK FLOW (CUMECS) = 2.04
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 6.303
ESTIMATED PEAK FLOW (CUMECS) = 2.15
ESTIMATED TIME TO PEAK (MINS) = 28.00

LINK 1 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.315
ESTIMATED PEAK FLOW (CUMECS) = 1.59
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK 3 3.001

ESTIMATED VOLUME (CU METRES*10**3) = 1.897
ESTIMATED PEAK FLOW (CUMECS) = 2.34
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK 6 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 0.6175
ESTIMATED PEAK FLOW (CUMECS) = 0.77
ESTIMATED TIME TO PEAK (MINS) = 15.00

LINK 2 5.000

```
                    TURNER DEVELOPED with osd with MV2.out
 ESTIMATED VOLUME (CU METRES*10**3) =          0.8835
 ESTIMATED PEAK FLOW          (CUMECS) =      1.08
 ESTIMATED TIME TO PEAK          (MINS) =     15.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =           2.418
 ESTIMATED PEAK FLOW          (CUMECS) =      2.95
 ESTIMATED TIME TO PEAK          (MINS) =     15.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =           13.45
 ESTIMATED PEAK FLOW          (CUMECS) =      7.77
 ESTIMATED TIME TO PEAK          (MINS) =     15.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =        1.00
                                STORM DURATION (MINS)    =         25.
                                RETURN PERIOD (YRS)      =         50.
                                BX                       =     1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                                TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)           (%)
MV 3.54Ha  3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

5          0.6220  1.865  5.000 5.000  0.000 100.0  .030 .013  .0103 .0008  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

CULVERT    0.7800  0.000  2.800 0.000  0.000 0.000  .030 0.00  .0155 0.000  2.001

1          0.8940  2.681  8.000 8.000  0.000 100.0  .030 .013  .0098 .0008  3.000

3          0.3960  1.190  8.000 8.000  0.000 100.0  .030 .013  .0064 .0005  3.001

6          0.4200  1.261  8.000 8.000  0.000 100.0  .030 .013  .0066 .0005  4.000

2          0.6010  1.802  8.000 8.000  0.000 100.0  .030 .013  .0080 .0007  5.000

4           1.043  3.130  8.000 8.000  0.000 100.0  .030 .013  .0107 .0009  5.001

TURNER RD 0.8820  0.000  2.500 0.000  0.000 0.000  .030 0.00  .0175 0.000  1.002


 Link    Average  Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2      #1    #2    Inflow   to     Lag
          (mm/h)    ( mm )      (mm/h)        ( mm )     (m^3/s)  Peak  mins
MV 3.54Ha 97.422 10.00 0.000  3.000 0.000  29.642  0.000  0.5094  26.00 0.000
```

5	97.422	10.00	1.500	3.000	0.000	29.642	39.092	1.341	15.00	0.000
U/S 20.4ha	97.422	10.00	0.000	3.000	0.000	29.642	0.000	2.036	26.00	0.000
CULVERT	97.422	10.00	0.000	3.000	0.000	29.642	0.000	2.147	28.00	0.000
1	97.422	10.00	1.500	3.000	0.000	29.642	39.092	1.587	15.00	0.000
3	97.422	10.00	1.500	3.000	0.000	29.642	39.092	2.344	15.00	0.000
6	97.422	10.00	1.500	3.000	0.000	29.642	39.092	0.7701	15.00	0.000
2	97.422	10.00	1.500	3.000	0.000	29.642	39.092	1.083	15.00	0.000
4	97.422	10.00	1.500	3.000	0.000	29.642	39.092	2.949	15.00	0.000
TURNER RD	97.422	10.00	0.000	3.000	0.000	29.642	0.000	7.771	15.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	15.00	7.771	25.00	4.765	13453.4	0.0000	2818.3	95.120

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	1.06	.0600	0.7688	0.5104	1.0	0.000	0.000	0.000
5	2.79	.0130	0.0676	1.346	1.0	0.000	0.000	0.000
U/S 20.4ha	1.83	.0300	0.2688	2.036	1.0	0.000	0.000	0.000
CULVERT	1.86	.0300	0.2766	2.149	1.0	0.000	0.000	0.000
1	3.01	.0130	0.0750	1.615	1.0	0.000	0.000	0.000
3	3.42	.0130	0.0945	2.318	1.0	0.000	0.000	0.000
6	0.794	.0600	0.1430	0.8053	1.0	0.000	0.000	0.000
2	2.61	.0130	0.0594	1.107	1.0	0.000	0.000	0.000
4	1.26	.0600	0.3250	2.934	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.978
ESTIMATED PEAK FLOW (CUMECS) = 0.66
ESTIMATED TIME TO PEAK (MINS) = 39.00

```
 LINK 5                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          3.596
 ESTIMATED PEAK FLOW         (CUMECS) =      1.59
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          11.40
 ESTIMATED PEAK FLOW         (CUMECS) =      2.92
 ESTIMATED TIME TO PEAK         (MINS) =     46.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          11.83
 ESTIMATED PEAK FLOW         (CUMECS) =      3.01
 ESTIMATED TIME TO PEAK         (MINS) =     48.00

 LINK 1                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.326
 ESTIMATED PEAK FLOW         (CUMECS) =      1.54
 ESTIMATED TIME TO PEAK         (MINS) =     27.00

 LINK 3                  3.001

 ESTIMATED VOLUME (CU METRES*10**3) =          3.359
 ESTIMATED PEAK FLOW         (CUMECS) =      2.26
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.094
 ESTIMATED PEAK FLOW         (CUMECS) =      0.74
 ESTIMATED TIME TO PEAK         (MINS) =     27.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.564
 ESTIMATED PEAK FLOW         (CUMECS) =      1.04
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          4.279
 ESTIMATED PEAK FLOW         (CUMECS) =      2.84
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          24.65
 ESTIMATED PEAK FLOW         (CUMECS) =      8.86
 ESTIMATED TIME TO PEAK         (MINS) =     30.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####
```

TURNER DEVELOPED with osd with MV2.out

ROUTING INCREMENT (MINS)	=	1.00
STORM DURATION (MINS)	=	90.
RETURN PERIOD (YRS)	=	50.
BX	=	1.0000
TOTAL OF FIRST SUB-AREAS (ha)	=	29.58
TOTAL OF SECOND SUB-AREAS (ha)	=	11.93
TOTAL OF ALL SUB-AREAS (ha)	=	41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Pern #1	#2	B #1	#2	Link No.
MV 3.54Ha	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
5	0.6220	1.865	5.000	5.000	0.000	100.0	.030	.013	.0103	.0008	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001
1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	46.466	10.00	0.000	3.000	0.000	55.749	0.000	0.6551	39.00	0.000
5	46.466	10.00	1.500	3.000	0.000	55.749	68.199	1.593	30.00	0.000
U/S 20.4ha	46.466	10.00	0.000	3.000	0.000	55.749	0.000	2.921	46.00	0.000
CULVERT	46.466	10.00	0.000	3.000	0.000	55.749	0.000	3.006	48.00	0.000
1	46.466	10.00	1.500	3.000	0.000	55.749	68.199	1.536	27.00	0.000
3	46.466	10.00	1.500	3.000	0.000	55.749	68.199	2.257	30.00	0.000
6	46.466	10.00	1.500	3.000	0.000	55.749	68.199	0.7381	27.00	0.000
2	46.466	10.00	1.500	3.000	0.000	55.749	68.199	1.039	30.00	0.000
4	46.466	10.00	1.500	3.000	0.000	55.749	68.199	2.844	30.00	0.000
TURNER RD	46.466	10.00	0.000	3.000	0.000	55.749	0.000	8.860	30.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	30.00	8.860	35.00	6.215	24654.5	0.0000	3177.4	95.268

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	1.11	.0600	0.9094	0.6551	1.0	0.000	0.000	0.000
5	2.96	.0130	0.0750	1.590	1.0	0.000	0.000	0.000
U/S 20.4ha	2.03	.0300	0.3281	2.922	1.0	0.000	0.000	0.000
CULVERT	2.05	.0300	0.3328	3.005	1.0	0.000	0.000	0.000
1	2.99	.0130	0.0734	1.569	1.0	0.000	0.000	0.000
3	3.41	.0130	0.0922	2.255	1.0	0.000	0.000	0.000
6	0.788	.0600	0.1391	0.7777	1.0	0.000	0.000	0.000
2	2.57	.0130	0.0578	1.060	1.0	0.000	0.000	0.000
4	1.25	.0600	0.3187	2.849	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.200
ESTIMATED PEAK FLOW (CUMECS) = 0.68
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 3.999
ESTIMATED PEAK FLOW (CUMECS) = 1.38
ESTIMATED TIME TO PEAK (MINS) = 40.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 12.69
ESTIMATED PEAK FLOW (CUMECS) = 2.95
ESTIMATED TIME TO PEAK (MINS) = 58.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 13.18
ESTIMATED PEAK FLOW (CUMECS) = 3.03
ESTIMATED TIME TO PEAK (MINS) = 59.00

LINK 1 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.583
ESTIMATED PEAK FLOW (CUMECS) = 1.46
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK 3 3.001

ESTIMATED VOLUME (CU METRES*10**3) = 3.730
ESTIMATED PEAK FLOW (CUMECS) = 2.11

```
                    TURNER DEVELOPED with osd with MV2.out
 ESTIMATED TIME TO PEAK          (MINS) =     35.00

 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.215
 ESTIMATED PEAK FLOW          (CUMECS) =      0.71
 ESTIMATED TIME TO PEAK          (MINS) =     32.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.737
 ESTIMATED PEAK FLOW          (CUMECS) =      0.99
 ESTIMATED TIME TO PEAK          (MINS) =     32.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          4.755
 ESTIMATED PEAK FLOW          (CUMECS) =      2.66
 ESTIMATED TIME TO PEAK          (MINS) =     35.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          27.43
 ESTIMATED PEAK FLOW          (CUMECS) =      7.91
 ESTIMATED TIME TO PEAK          (MINS) =     40.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =       120.
                                RETURN PERIOD (YRS)      =        50.
                                BX                       =     1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                                TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
MV 3.54Ha  3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

5          0.6220  1.865  5.000 5.000  0.000 100.0  .030 .013  .0103 .0008  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000

CULVERT    0.7800  0.000  2.800 0.000  0.000 0.000  .030 0.00  .0155 0.000  2.001

1          0.8940  2.681  8.000 8.000  0.000 100.0  .030 .013  .0098 .0008  3.000

3          0.3960  1.190  8.000 8.000  0.000 100.0  .030 .013  .0064 .0005  3.001

6          0.4200  1.261  8.000 8.000  0.000 100.0  .030 .013  .0066 .0005  4.000

2          0.6010  1.802  8.000 8.000  0.000 100.0  .030 .013  .0080 .0007  5.000
```

4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	38.609	10.00	0.000	3.000	0.000	62.068	0.000	0.6834	46.00	0.000
5	38.609	10.00	1.500	3.000	0.000	62.068	75.718	1.378	40.00	0.000
U/S 20.4ha	38.609	10.00	0.000	3.000	0.000	62.068	0.000	2.950	58.00	0.000
CULVERT	38.609	10.00	0.000	3.000	0.000	62.068	0.000	3.032	59.00	0.000
1	38.609	10.00	1.500	3.000	0.000	62.068	75.718	1.455	32.00	0.000
3	38.609	10.00	1.500	3.000	0.000	62.068	75.718	2.114	35.00	0.000
6	38.609	10.00	1.500	3.000	0.000	62.068	75.718	0.7112	32.00	0.000
2	38.609	10.00	1.500	3.000	0.000	62.068	75.718	0.9913	32.00	0.000
4	38.609	10.00	1.500	3.000	0.000	62.068	75.718	2.660	35.00	0.000
TURNER RD	38.609	10.00	0.000	3.000	0.000	62.068	0.000	7.908	40.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	40.00	7.907	44.00	6.445	27428.7	0.0000	3234.4	95.291

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	1.12	.0600	0.9375	0.6837	1.0	0.000	0.000	0.000
5	2.78	.0130	0.0688	1.369	1.0	0.000	0.000	0.000
U/S 20.4ha	2.04	.0300	0.3297	2.951	1.0	0.000	0.000	0.000
CULVERT	2.06	.0300	0.3344	3.031	1.0	0.000	0.000	0.000
1	2.90	.0130	0.0711	1.475	1.0	0.000	0.000	0.000
3	3.31	.0130	0.0891	2.111	1.0	0.000	0.000	0.000
6	0.707	.0600	0.1359	0.6817	1.0	0.000	0.000	0.000
2	2.50	.0130	0.0563	1.003	1.0	0.000	0.000	0.000

```
4          1.21   .0600 0.3063   2.643    1.0  0.000   0.000    0.000


 LINK MV 3.54Ha          1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.213
 ESTIMATED PEAK FLOW          (CUMECS) =      0.62
 ESTIMATED TIME TO PEAK          (MINS) =     26.00

 LINK 5                  1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.240
 ESTIMATED PEAK FLOW          (CUMECS) =      1.56
 ESTIMATED TIME TO PEAK          (MINS) =     15.00

 LINK U/S 20.4ha         2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          6.924
 ESTIMATED PEAK FLOW          (CUMECS) =      2.39
 ESTIMATED TIME TO PEAK          (MINS) =     26.00

 LINK CULVERT            2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          7.190
 ESTIMATED PEAK FLOW          (CUMECS) =      2.52
 ESTIMATED TIME TO PEAK          (MINS) =     28.00

 LINK 1                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.475
 ESTIMATED PEAK FLOW          (CUMECS) =      1.78
 ESTIMATED TIME TO PEAK          (MINS) =     15.00

 LINK 3                  3.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.130
 ESTIMATED PEAK FLOW          (CUMECS) =      2.63
 ESTIMATED TIME TO PEAK          (MINS) =     15.00

 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =        0.6941
 ESTIMATED PEAK FLOW          (CUMECS) =      0.86
 ESTIMATED TIME TO PEAK          (MINS) =     15.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =        0.9925
 ESTIMATED PEAK FLOW          (CUMECS) =      1.21
 ESTIMATED TIME TO PEAK          (MINS) =     15.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          2.715
 ESTIMATED PEAK FLOW          (CUMECS) =      3.33
 ESTIMATED TIME TO PEAK          (MINS) =     15.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          15.27
 ESTIMATED PEAK FLOW          (CUMECS) =      8.97
 ESTIMATED TIME TO PEAK          (MINS) =     15.00
```

##
#####

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006

##
#####

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 25.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.58
TOTAL OF SECOND SUB-AREAS (ha) = 11.93
TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
MV 3.54Ha	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
5	0.6220	1.865	5.000	5.000	0.000	100.0	.030	.013	.0103	.0008	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001
1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	108.36	10.00	0.000	3.000	0.000	34.151	0.000	0.6154	26.00	0.000
5	108.36	10.00	1.500	3.000	0.000	34.151	43.651	1.562	15.00	0.000
U/S 20.4ha	108.36	10.00	0.000	3.000	0.000	34.151	0.000	2.390	26.00	0.000
CULVERT	108.36	10.00	0.000	3.000	0.000	34.151	0.000	2.520	28.00	0.000
1	108.36	10.00	1.500	3.000	0.000	34.151	43.651	1.783	15.00	0.000
3	108.36	10.00	1.500	3.000	0.000	34.151	43.651	2.627	15.00	0.000
6	108.36	10.00	1.500	3.000	0.000	34.151	43.651	0.8619	15.00	0.000
2	108.36	10.00	1.500	3.000	0.000	34.151	43.651	1.212	15.00	0.000
4	108.36	10.00	1.500	3.000	0.000	34.151	43.651	3.327	15.00	0.000
TURNER RD	108.36	10.00	0.000	3.000	0.000	34.151	0.000	8.966	15.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	15.00	8.965	23.00	5.761	15271.5	0.0000	3065.0	95.222

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	1.10	.0600	0.8719	0.6166	1.0	0.000	0.000	0.000
5	2.95	.0130	0.0742	1.569	1.0	0.000	0.000	0.000
U/S 20.4ha	1.92	.0300	0.2938	2.390	1.0	0.000	0.000	0.000
CULVERT	1.94	.0300	0.3031	2.519	1.0	0.000	0.000	0.000
1	3.16	.0130	0.0801	1.812	1.0	0.000	0.000	0.000
3	3.59	.0130	0.1012	2.606	1.0	0.000	0.000	0.000
6	0.822	.0600	0.1531	0.8933	1.0	0.000	0.000	0.000
2	2.74	.0130	0.0637	1.247	1.0	0.000	0.000	0.000
4	1.31	.0600	0.3500	3.274	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.259
ESTIMATED PEAK FLOW (CUMECS) = 0.77
ESTIMATED TIME TO PEAK (MINS) = 38.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 4.072
ESTIMATED PEAK FLOW (CUMECS) = 1.82
ESTIMATED TIME TO PEAK (MINS) = 30.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 12.98
ESTIMATED PEAK FLOW (CUMECS) = 3.42
ESTIMATED TIME TO PEAK (MINS) = 46.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 13.47
ESTIMATED PEAK FLOW (CUMECS) = 3.52
ESTIMATED TIME TO PEAK (MINS) = 47.00

```
 LINK 1                  3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.607
 ESTIMATED PEAK FLOW         (CUMECS) =      1.71
 ESTIMATED TIME TO PEAK         (MINS) =     27.00

 LINK 3                  3.001

 ESTIMATED VOLUME (CU METRES*10**3) =          3.764
 ESTIMATED PEAK FLOW         (CUMECS) =      2.52
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 6                  4.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.225
 ESTIMATED PEAK FLOW         (CUMECS) =      0.82
 ESTIMATED TIME TO PEAK         (MINS) =     27.00

 LINK 2                  5.000

 ESTIMATED VOLUME (CU METRES*10**3) =          1.752
 ESTIMATED PEAK FLOW         (CUMECS) =      1.16
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 4                  5.001

 ESTIMATED VOLUME (CU METRES*10**3) =          4.794
 ESTIMATED PEAK FLOW         (CUMECS) =      3.18
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK TURNER RD          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          27.89
 ESTIMATED PEAK FLOW         (CUMECS) =     10.17
 ESTIMATED TIME TO PEAK         (MINS) =     30.00



################################################################################
#####


Results for period from 12: 0.0 23/ 5/2006
                     to  3: 0.0 24/ 5/2006
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       1.00
                                STORM DURATION (MINS)    =        90.
                                RETURN PERIOD (YRS)      =       100.
                                BX                       =    1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      29.58
                                TOTAL OF SECOND SUB-AREAS (ha) =      11.93
                                TOTAL OF ALL SUB-AREAS (ha)    =      41.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)          (%)
MV 3.54Ha  3.540  0.000  5.000 0.000  0.000 0.000  .060 0.00  .0434 0.000  1.000

5         0.6220  1.865  5.000 5.000  0.000 100.0  .030 .013  .0103 .0008  1.001

U/S 20.4ha20.400  0.000  6.000 0.000  0.000 0.000  .060 0.00  .0986 0.000  2.000
```

TURNER DEVELOPED with osd with MV2.out

CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001
1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	51.681	10.00	0.000	3.000	0.000	63.572	0.000	0.7675	38.00	0.000
5	51.681	10.00	1.500	3.000	0.000	63.572	76.022	1.824	30.00	0.000
U/S 20.4ha	51.681	10.00	0.000	3.000	0.000	63.572	0.000	3.416	46.00	0.000
CULVERT	51.681	10.00	0.000	3.000	0.000	63.572	0.000	3.516	47.00	0.000
1	51.681	10.00	1.500	3.000	0.000	63.572	76.022	1.714	27.00	0.000
3	51.681	10.00	1.500	3.000	0.000	63.572	76.022	2.521	30.00	0.000
6	51.681	10.00	1.500	3.000	0.000	63.572	76.022	0.8175	27.00	0.000
2	51.681	10.00	1.500	3.000	0.000	63.572	76.022	1.155	30.00	0.000
4	51.681	10.00	1.500	3.000	0.000	63.572	76.022	3.175	30.00	0.000
TURNER RD	51.681	10.00	0.000	3.000	0.000	63.572	0.000	10.169	30.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	30.00	10.17	34.00	7.697	27888.4	0.0000	3496.3	95.399

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	1.14	.0600	1.013	0.7676	1.0	0.000	0.000	0.000
5	3.14	.0130	0.0813	1.828	1.0	0.000	0.000	0.000
U/S 20.4ha	2.13	.0300	0.3563	3.415	1.0	0.000	0.000	0.000

CULVERT	2.15	.0300	0.3625	3.514	1.0	0.000	0.000	0.000
1	3.13	.0130	0.0781	1.751	1.0	0.000	0.000	0.000
3	3.55	.0130	0.0988	2.521	1.0	0.000	0.000	0.000
6	0.814	.0600	0.1484	0.8570	1.0	0.000	0.000	0.000
2	2.69	.0130	0.0617	1.184	1.0	0.000	0.000	0.000
4	1.29	.0600	0.3406	3.145	1.0	0.000	0.000	0.000

LINK MV 3.54Ha 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.504
ESTIMATED PEAK FLOW (CUMECS) = 0.80
ESTIMATED TIME TO PEAK (MINS) = 45.00

LINK 5 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 4.517
ESTIMATED PEAK FLOW (CUMECS) = 1.59
ESTIMATED TIME TO PEAK (MINS) = 40.00

LINK U/S 20.4ha 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 14.45
ESTIMATED PEAK FLOW (CUMECS) = 3.43
ESTIMATED TIME TO PEAK (MINS) = 53.00

LINK CULVERT 2.001

ESTIMATED VOLUME (CU METRES*10**3) = 15.00
ESTIMATED PEAK FLOW (CUMECS) = 3.53
ESTIMATED TIME TO PEAK (MINS) = 52.00

LINK 1 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 2.895
ESTIMATED PEAK FLOW (CUMECS) = 1.62
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK 3 3.001

ESTIMATED VOLUME (CU METRES*10**3) = 4.179
ESTIMATED PEAK FLOW (CUMECS) = 2.36
ESTIMATED TIME TO PEAK (MINS) = 35.00

LINK 6 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.361
ESTIMATED PEAK FLOW (CUMECS) = 0.79
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK 2 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 1.946
ESTIMATED PEAK FLOW (CUMECS) = 1.10
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK 4 5.001

ESTIMATED VOLUME (CU METRES*10**3) = 5.324
ESTIMATED PEAK FLOW (CUMECS) = 2.97
ESTIMATED TIME TO PEAK (MINS) = 35.00

TURNER DEVELOPED with osd with MV2.out

LINK TURNER RD 1.002

ESTIMATED VOLUME (CU METRES*10**3) = 31.00
ESTIMATED PEAK FLOW (CUMECS) = 9.08
ESTIMATED TIME TO PEAK (MINS) = 40.00

##
#####

Results for period from 12: 0.0 23/ 5/2006
to 3: 0.0 24/ 5/2006
##
#####

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 120.
RETURN PERIOD (YRS) = 100.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 29.58
TOTAL OF SECOND SUB-AREAS (ha) = 11.93
TOTAL OF ALL SUB-AREAS (ha) = 41.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1 (%)	% Impervious #2 (%)	Perm #1	Perm #2	B #1	B #2	Link No.
MV 3.54Ha	3.540	0.000	5.000	0.000	0.000	0.000	.060	0.00	.0434	0.000	1.000
5	0.6220	1.865	5.000	5.000	0.000	100.0	.030	.013	.0103	.0008	1.001
U/S 20.4ha	20.400	0.000	6.000	0.000	0.000	0.000	.060	0.00	.0986	0.000	2.000
CULVERT	0.7800	0.000	2.800	0.000	0.000	0.000	.030	0.00	.0155	0.000	2.001
1	0.8940	2.681	8.000	8.000	0.000	100.0	.030	.013	.0098	.0008	3.000
3	0.3960	1.190	8.000	8.000	0.000	100.0	.030	.013	.0064	.0005	3.001
6	0.4200	1.261	8.000	8.000	0.000	100.0	.030	.013	.0066	.0005	4.000
2	0.6010	1.802	8.000	8.000	0.000	100.0	.030	.013	.0080	.0007	5.000
4	1.043	3.130	8.000	8.000	0.000	100.0	.030	.013	.0107	.0009	5.001
TURNER RD	0.8820	0.000	2.500	0.000	0.000	0.000	.030	0.00	.0175	0.000	1.002

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
MV 3.54Ha	42.954	10.00	0.000	3.000	0.000	70.657	0.000	0.8019	45.00	0.000
5	42.954	10.00	1.500	3.000	0.000	70.657	84.407	1.587	40.00	0.000
U/S 20.4ha	42.954	10.00	0.000	3.000	0.000	70.657	0.000	3.431	53.00	0.000
CULVERT	42.954	10.00	0.000	3.000	0.000	70.657	0.000	3.532	52.00	0.000
1	42.954	10.00	1.500	3.000	0.000	70.657	84.407	1.624	32.00	0.000

3	42.954	10.00	1.500	3.000	0.000	70.657	84.407	2.358	35.00	0.000
6	42.954	10.00	1.500	3.000	0.000	70.657	84.407	0.7899	32.00	0.000
2	42.954	10.00	1.500	3.000	0.000	70.657	84.407	1.102	32.00	0.000
4	42.954	10.00	1.500	3.000	0.000	70.657	84.407	2.966	35.00	0.000
TURNER RD	42.954	10.00	0.000	3.000	0.000	70.657	0.000	9.079	40.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
TURNER RD	40.00	9.079	43.00	7.810	31004.7	0.0000	3519.5	95.409

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
TURNER RD	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

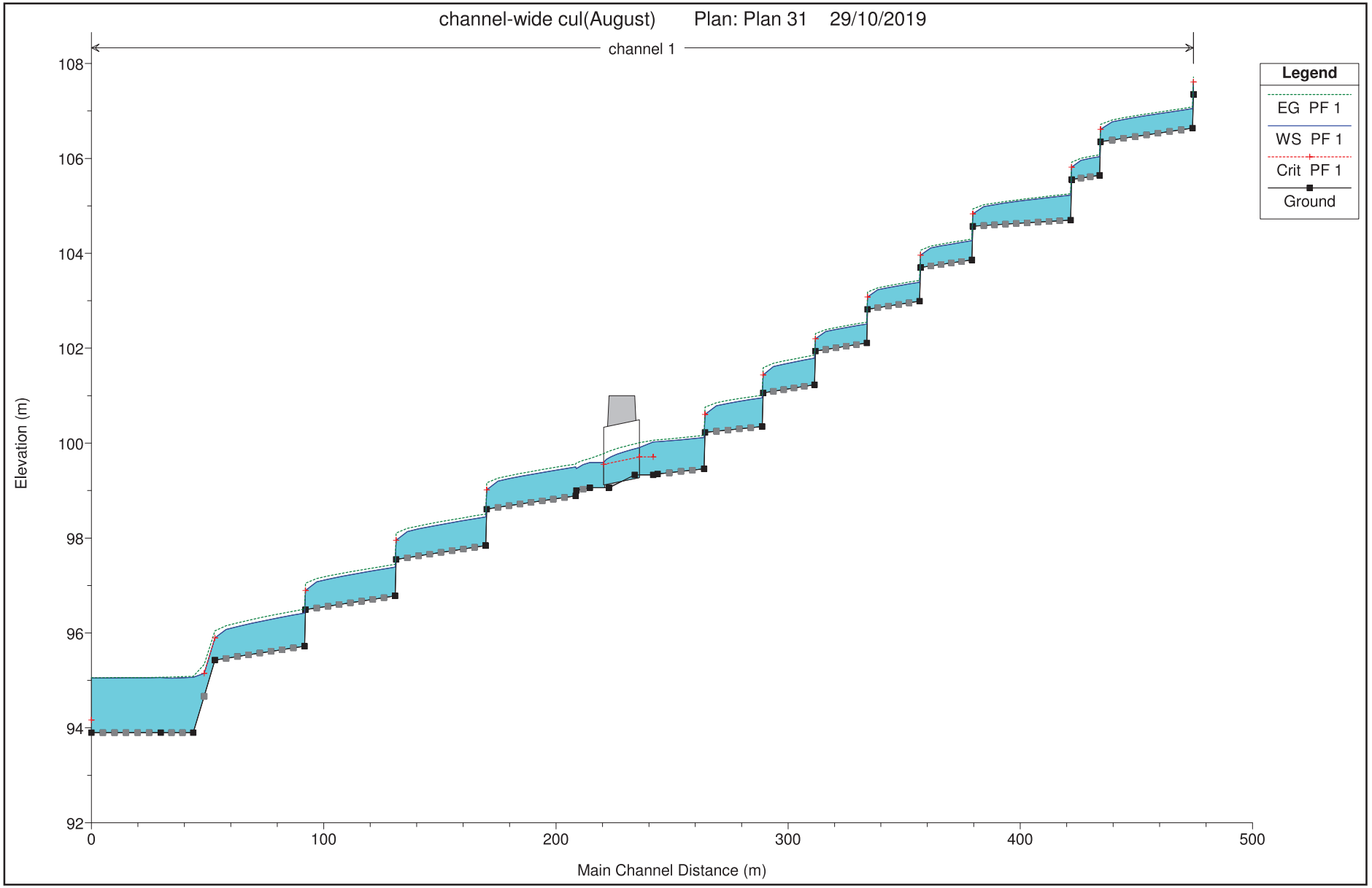
Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
MV 3.54Ha	1.16	.0600	1.038	0.8010	1.0	0.000	0.000	0.000
5	2.96	.0130	0.0746	1.583	1.0	0.000	0.000	0.000
U/S 20.4ha	2.14	.0300	0.3563	3.430	1.0	0.000	0.000	0.000
CULVERT	2.16	.0300	0.3625	3.532	1.0	0.000	0.000	0.000
1	3.03	.0130	0.0758	1.644	1.0	0.000	0.000	0.000
3	3.47	.0130	0.0949	2.361	1.0	0.000	0.000	0.000
6	0.749	.0600	0.1453	0.7721	1.0	0.000	0.000	0.000
2	2.61	.0130	0.0602	1.120	1.0	0.000	0.000	0.000
4	1.26	.0600	0.3266	2.939	1.0	0.000	0.000	0.000

Run completed at: 24th October 2017 7:10:58

mik open 0

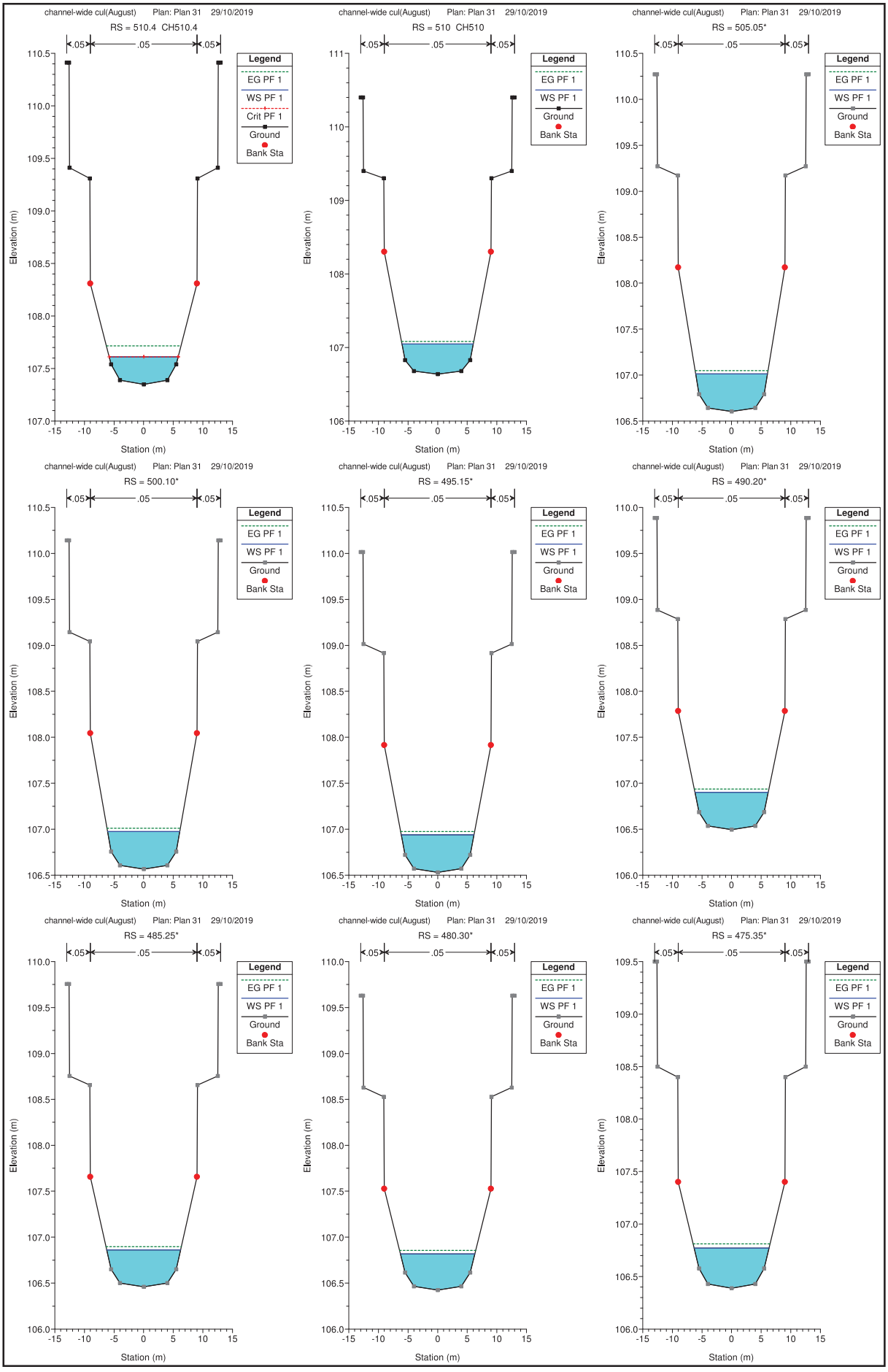
Annexure E – Central Channel Hydraulics – Ultimate Development Conditions

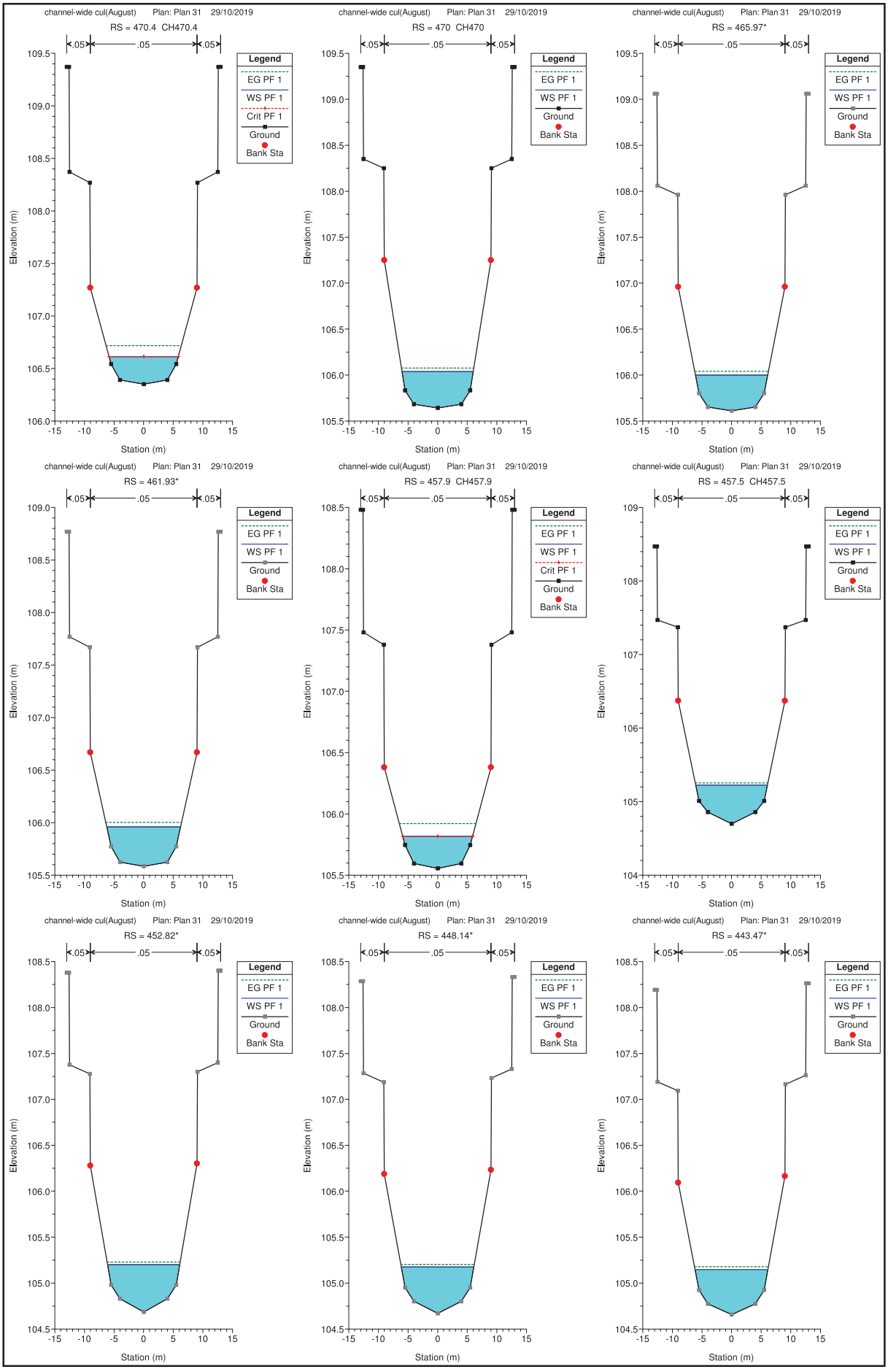
E.1 – Hec-Ras Profile Section – Ultimate Development

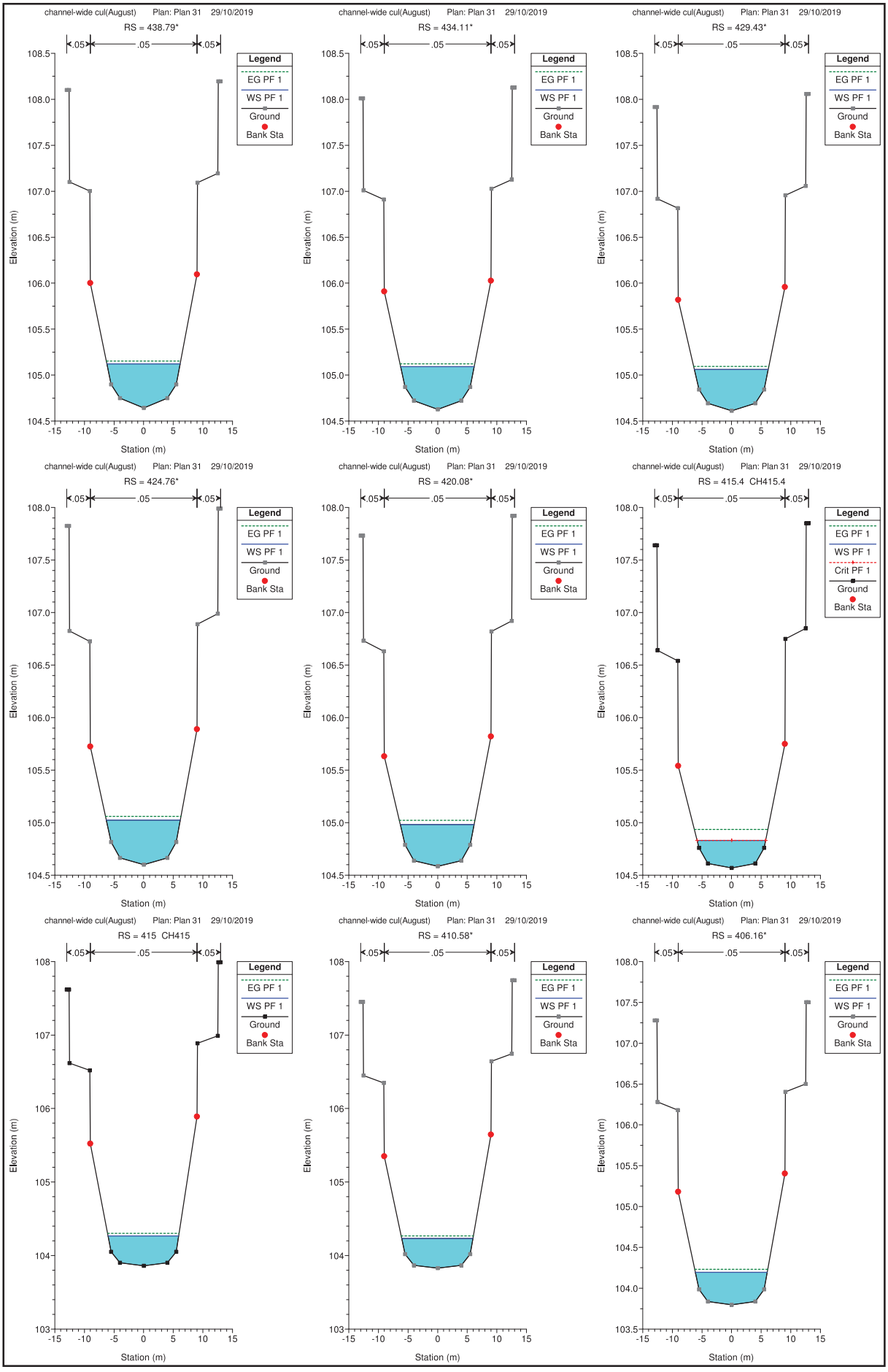

channel-wide cul(August) Plan: Plan 31 29/10/2019
channel 1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (m)
Main Channel Distance (m)
92
94
96
98
100
102
104
106
108
0
100
200
300
400
500

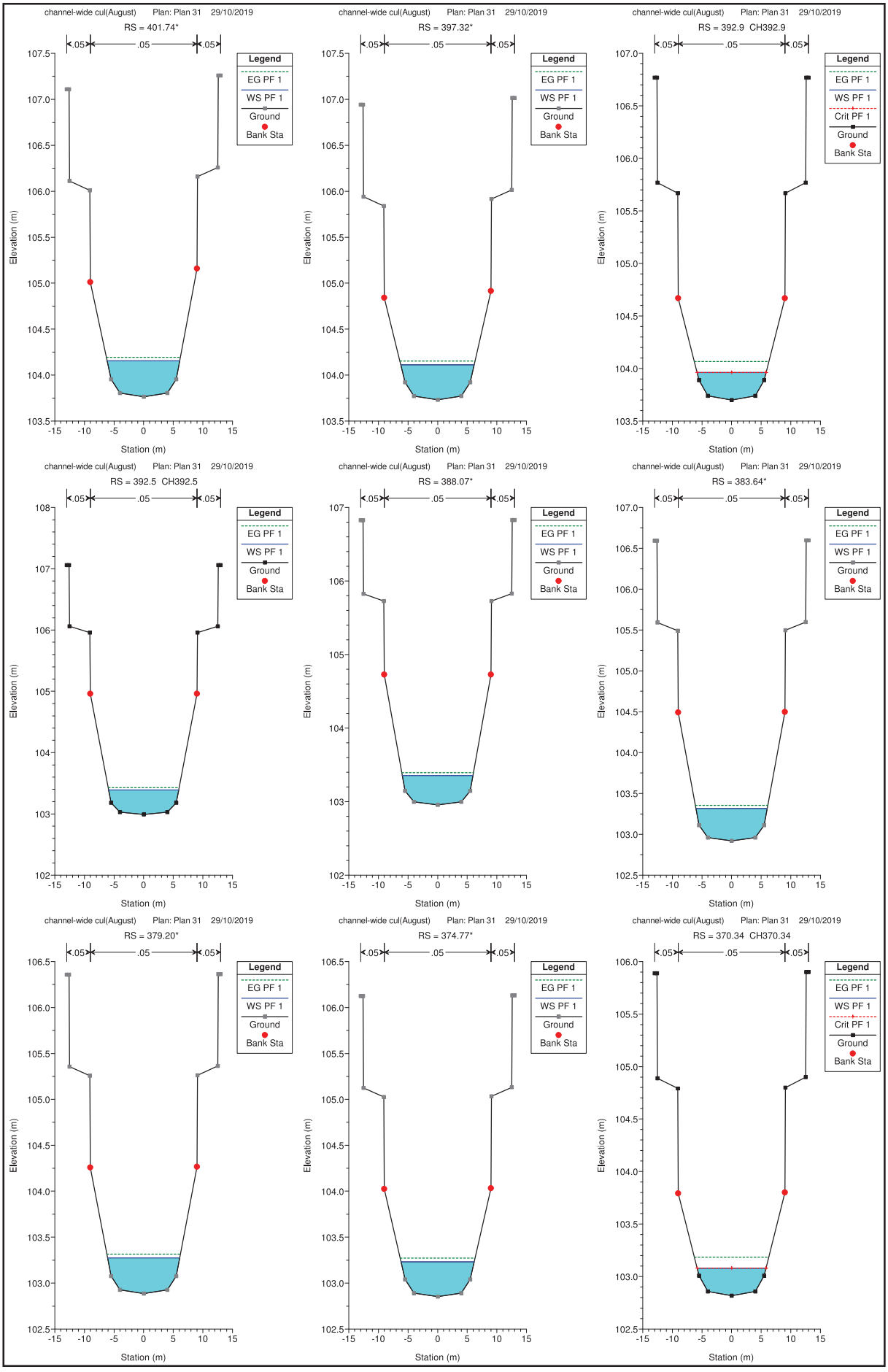
Annexure E – Central Channel Hydraulics – Ultimate Development Conditions

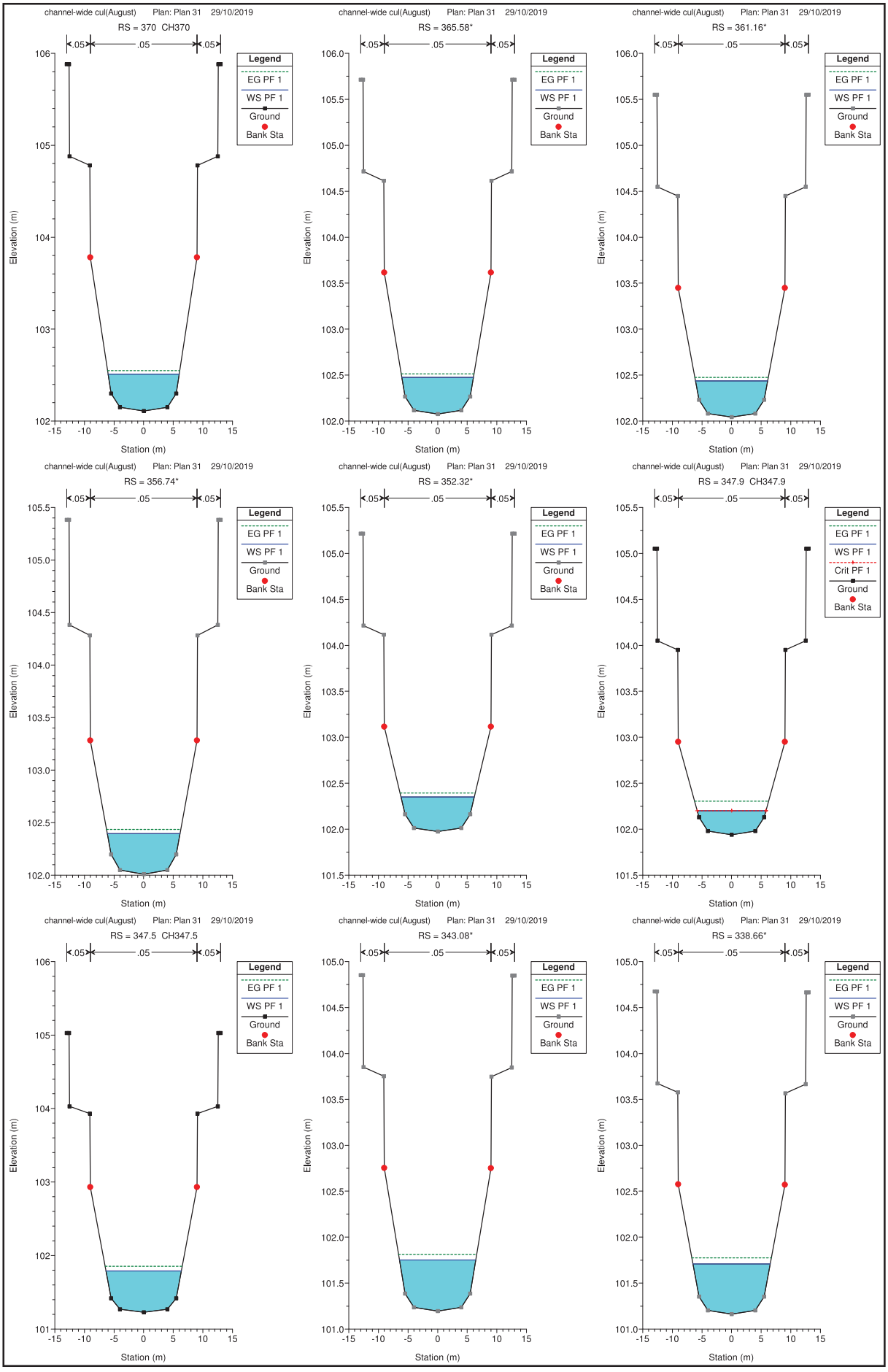
E.2 – Hec-Ras cross sections

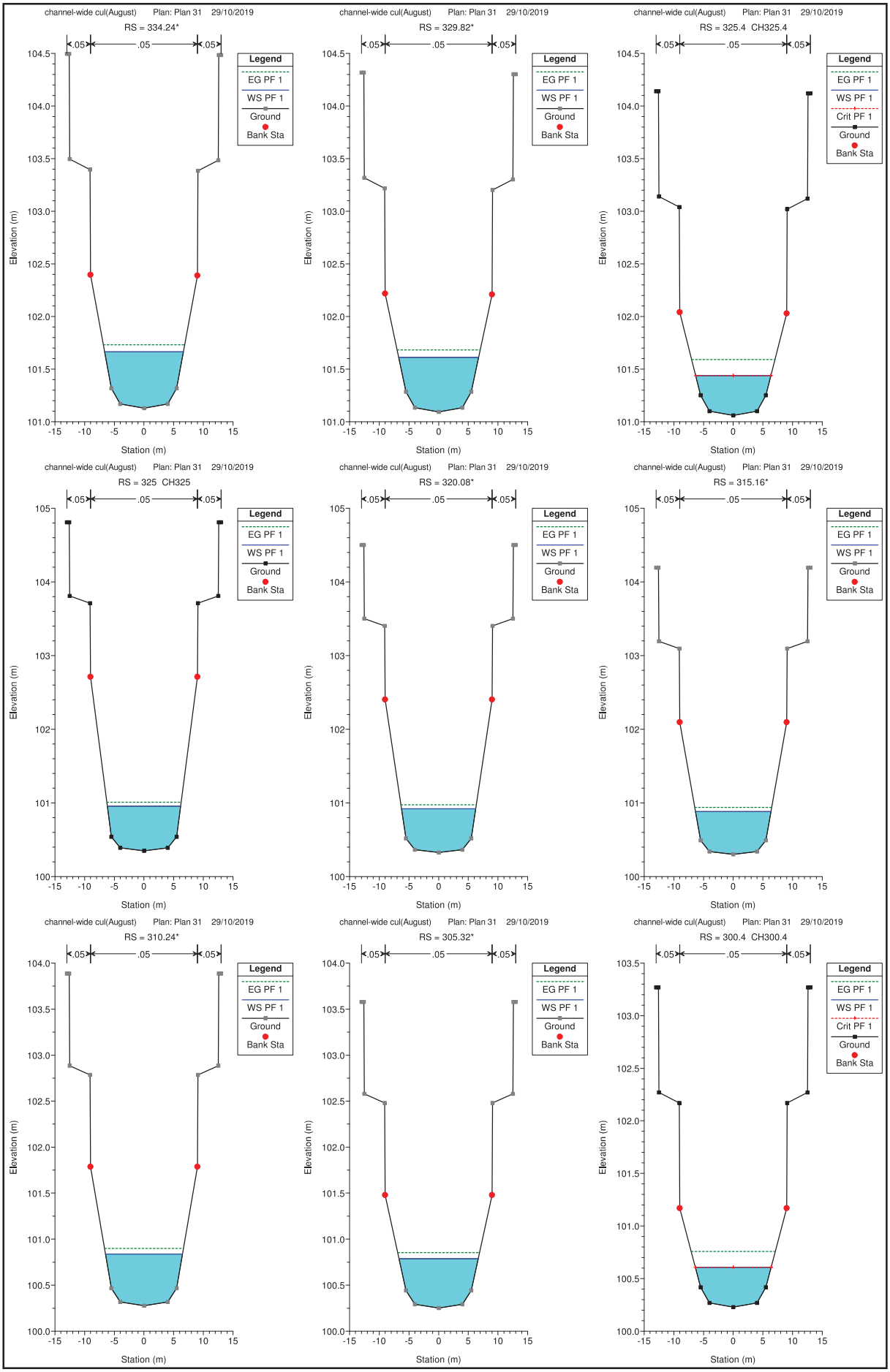

channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 510.4 CH510.4
.05 .05 .05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 510 CH510
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 505.05*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 500.10*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 495.15*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 490.20*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 485.25*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 480.30*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 475.35*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)

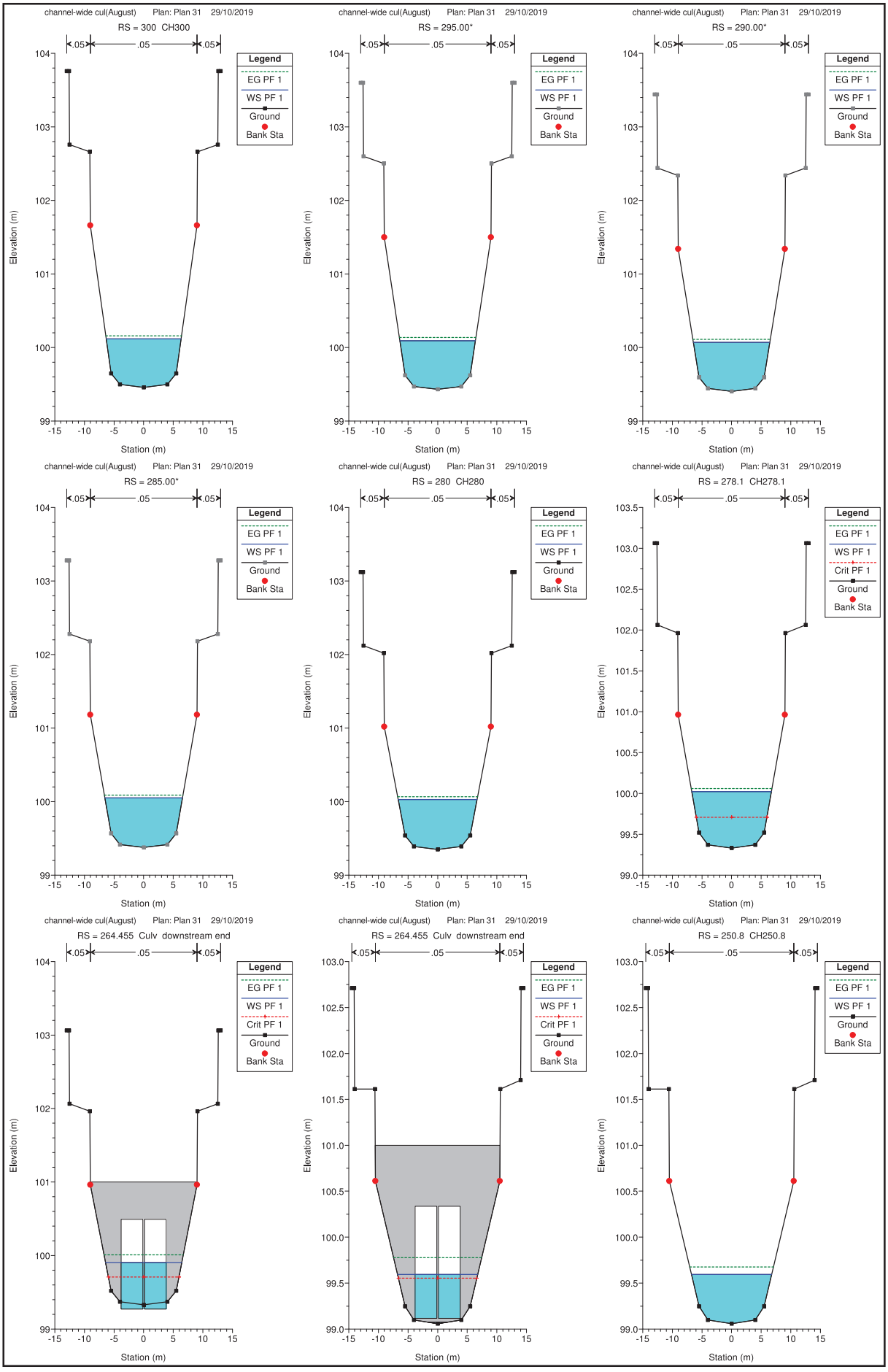

channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 470.4 CH470.4
.05 .05 .05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 470 CH470
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 465.97*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 461.93*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 457.9 CH457.9
.05 .05 .05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 457.5 CH457.5
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 452.82*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 448.14*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 443.47*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)

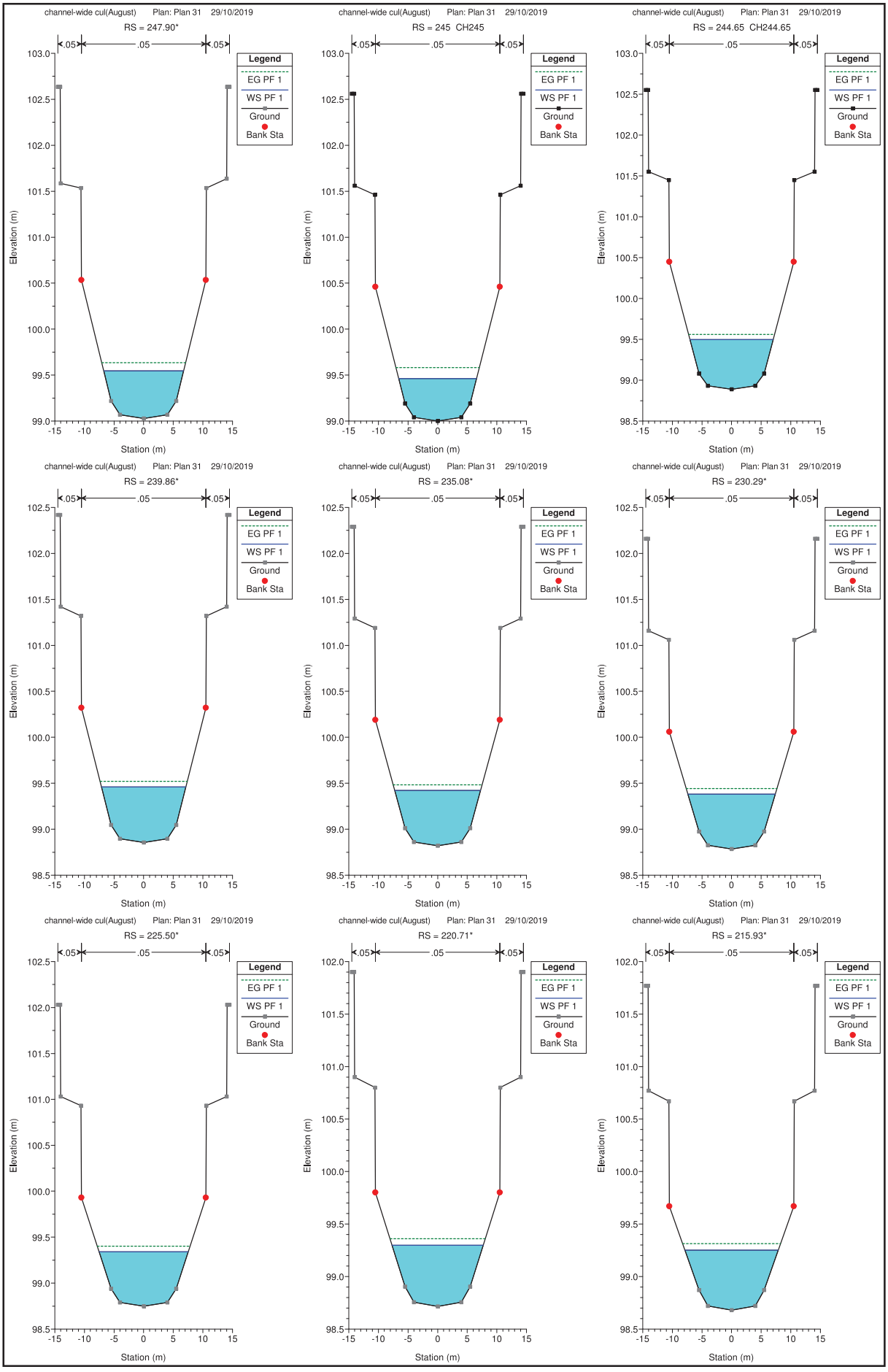

channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 438.79*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 434.11*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 429.43*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 424.76*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 420.08*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 415.4 CH415.4
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 415 CH415
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 410.58*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 406.16*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)

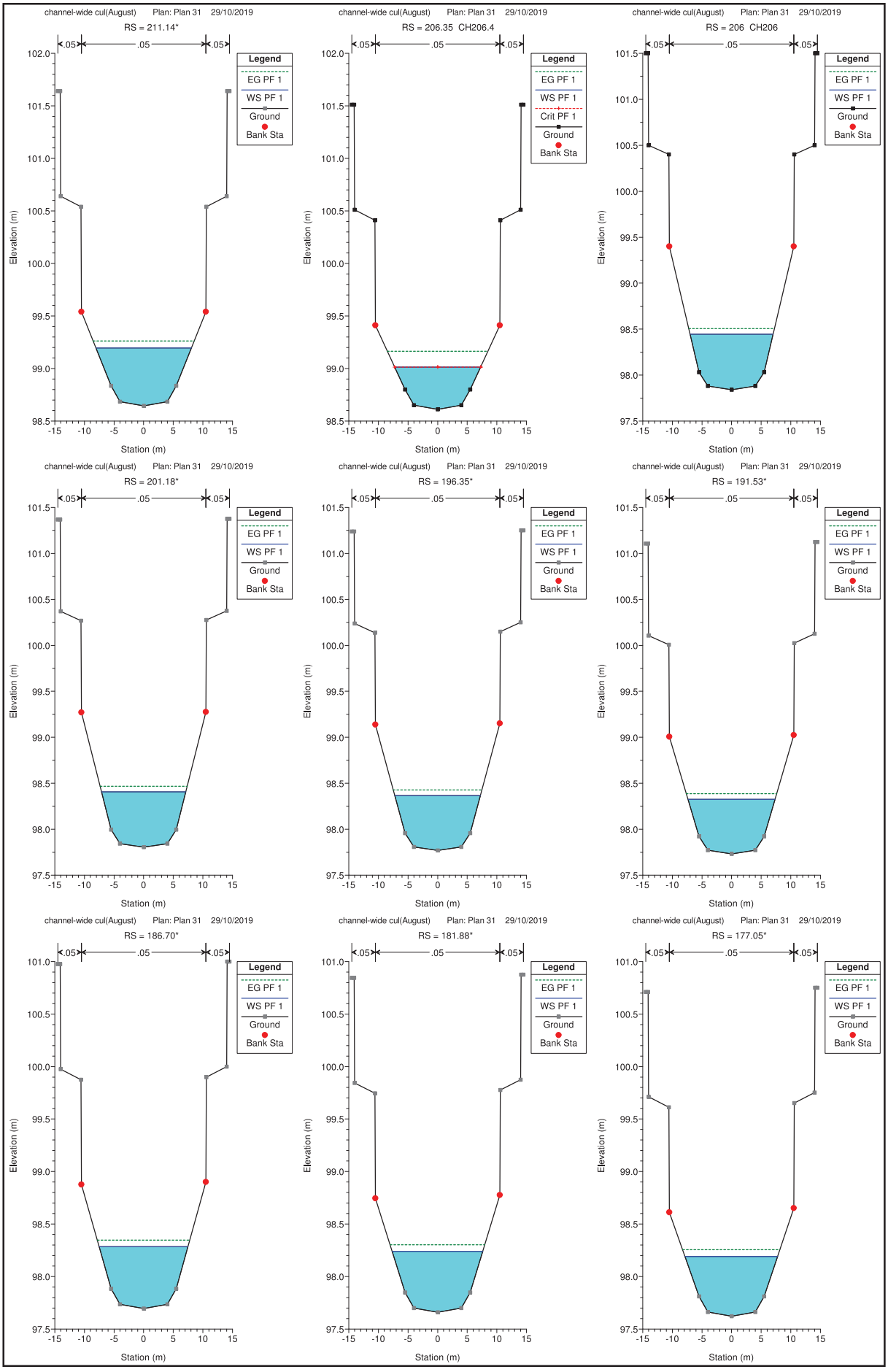

channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 401.74*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 397.32*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 392.9 CH392.9
.05 .05 .05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 392.5 CH392.5
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 388.07*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 383.64*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 379.20*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 374.77*
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 370.34 CH370.34
.05 .05 .05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)

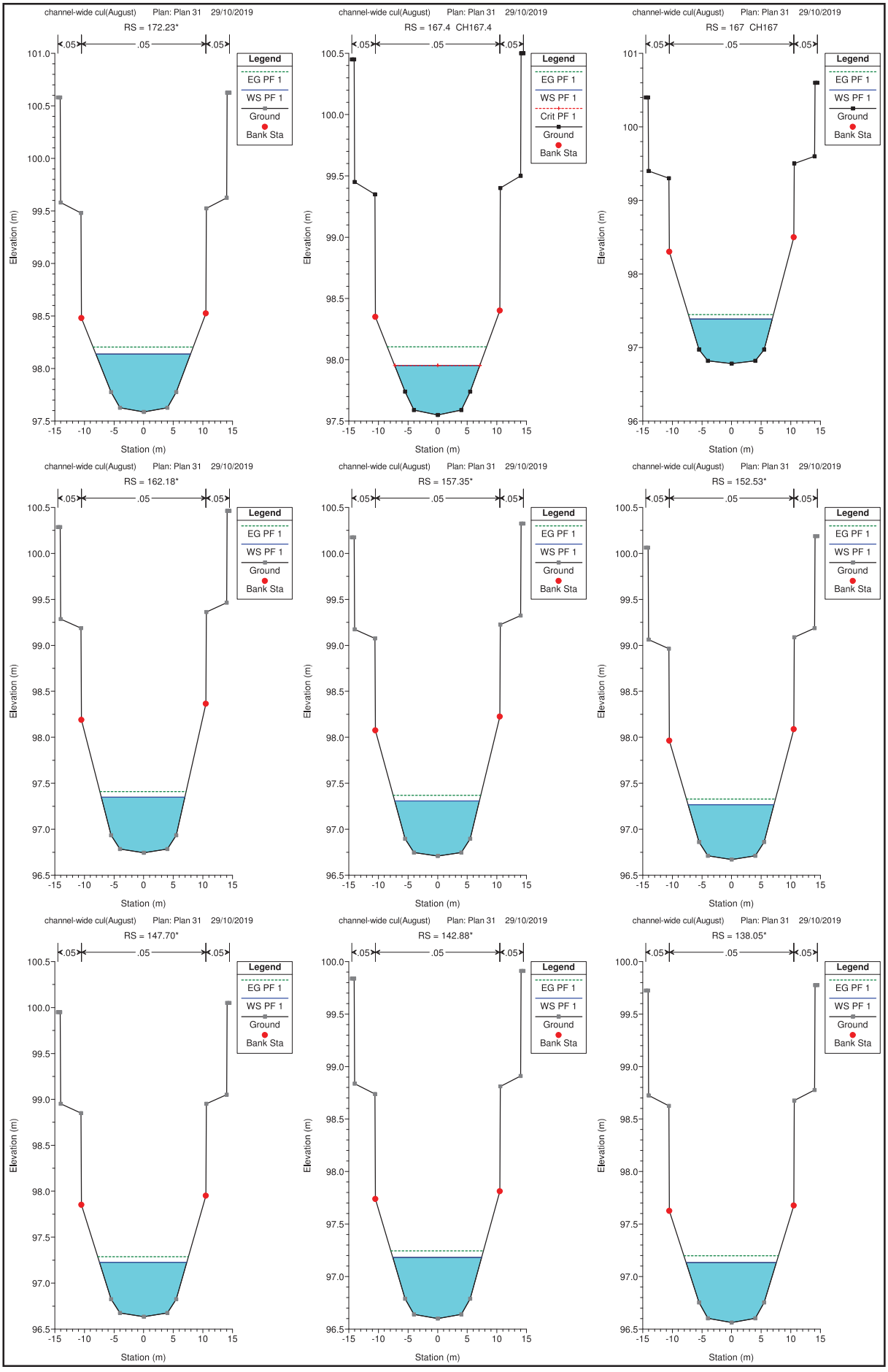

channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 370 CH370
RS = 365.58*
RS = 361.16*
RS = 356.74*
RS = 352.32*
RS = 347.9 CH347.9
RS = 347.5 CH347.5
RS = 343.08*
RS = 338.66*
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)

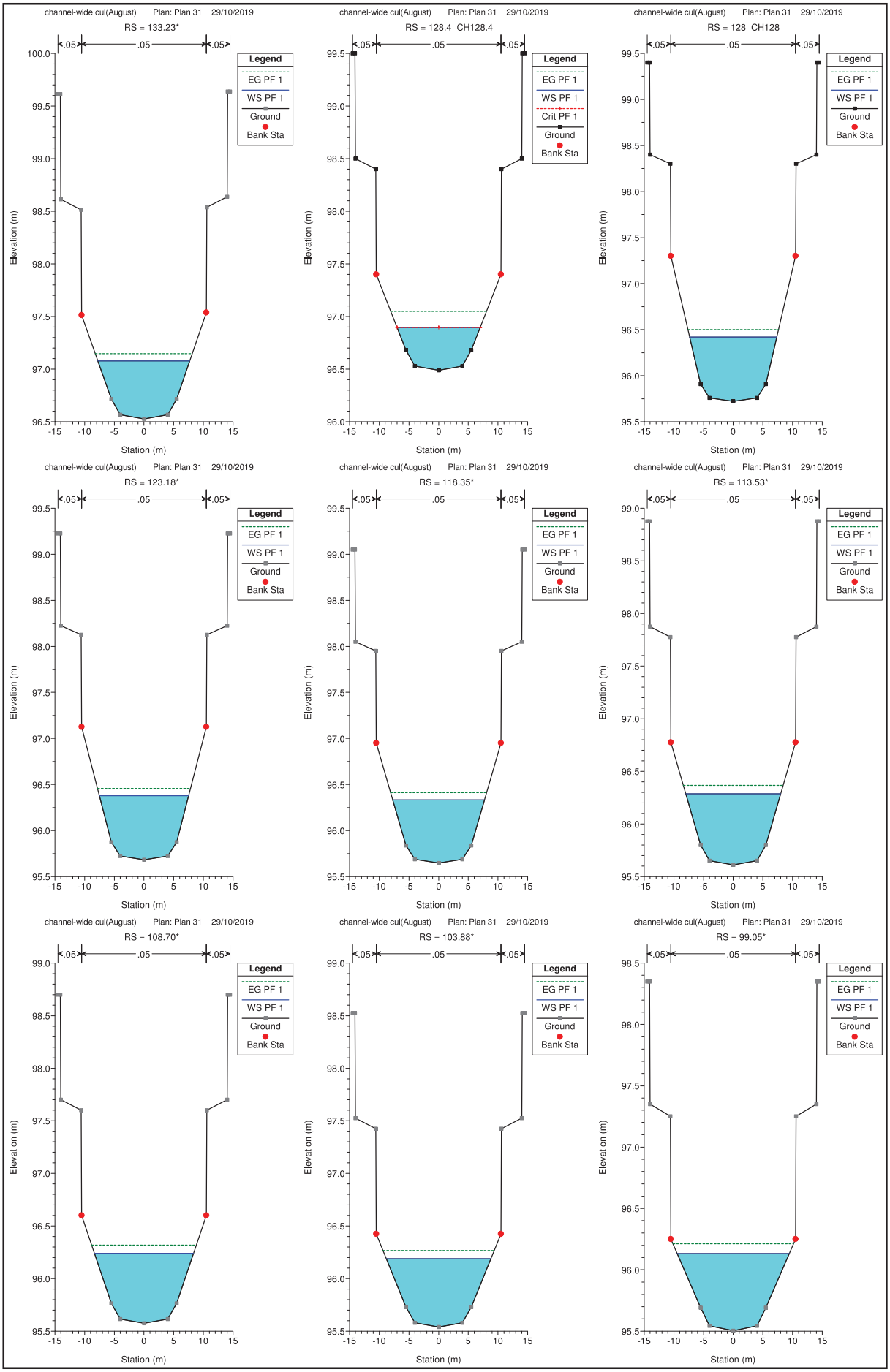

channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 334.24*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 329.82*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 325.4 CH325.4
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 325 CH325
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 320.08*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 315.16*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 310.24*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 305.32*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 300.4 CH300.4
.05
.05
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)

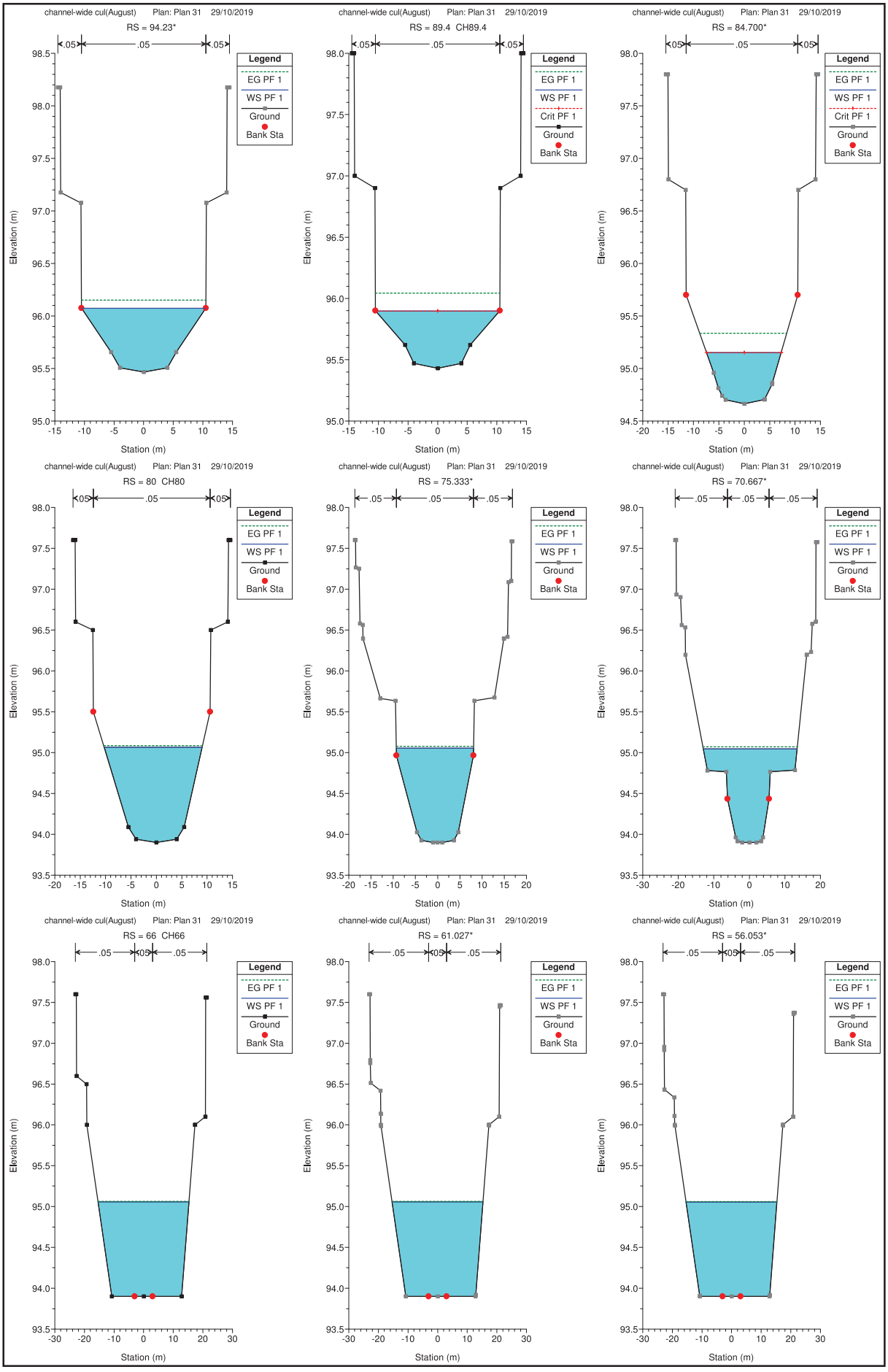

channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 300 CH300
RS = 295.00*
RS = 290.00*
RS = 285.00*
RS = 280 CH280
RS = 278.1 CH278.1
RS = 264.455 Culv downstream end
RS = 264.455 Culv downstream end
RS = 250.8 CH250.8
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)

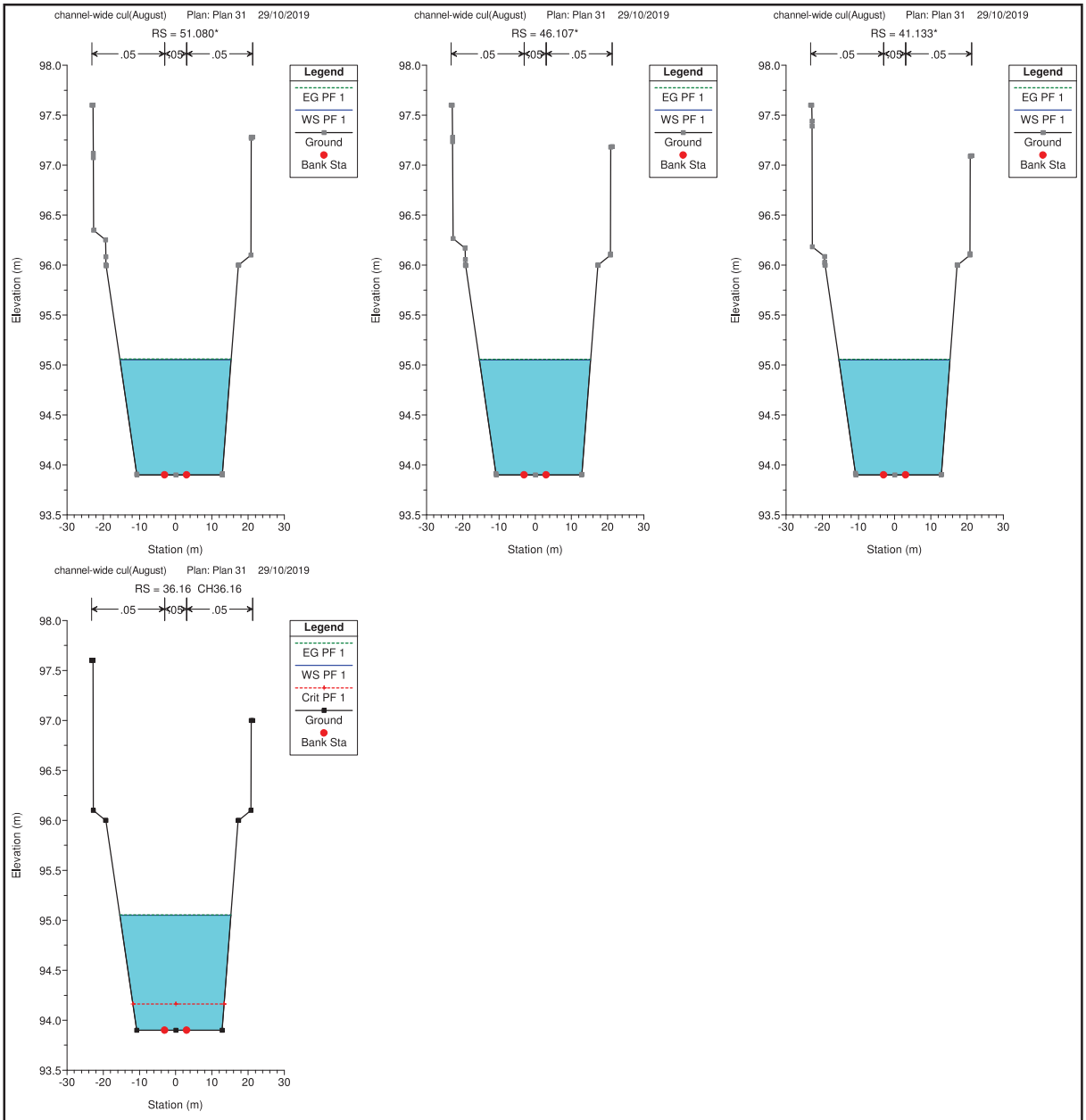

channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 247.90*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 245 CH245
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 244.65 CH244.65
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 239.86*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 235.08*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 230.29*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 225.50*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 220.71*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 215.93*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)


channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 211.14*
RS = 206.35 CH206.4
RS = 206 CH206
RS = 201.18*
RS = 196.35*
RS = 191.53*
RS = 186.70*
RS = 181.88*
RS = 177.05*
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)


channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 172.23*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 167.4 CH167.4
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 167 CH167
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 162.18*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 157.35*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 152.53*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 147.70*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 142.88*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 138.05*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)


channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 133.23*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 128.4 CH128.4
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 128 CH128
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 123.18*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 118.35*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 113.53*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 108.70*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 103.88*
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 99.05*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)


channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 94.23*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 89.4 CH89.4
.05
.05
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 84.700*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 80 CH80
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 75.333*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 70.667*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 66 CH66
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 61.027*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 56.053*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)


channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 51.080*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 46.107*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 41.133*
.05
.05
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)
channel-wide cul(August) Plan: Plan 31 29/10/2019
RS = 36.16 CH36.16
.05
.05
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (m)
Station (m)

Annexure E – Central Channel Hydraulics – Ultimate Development Conditions

E.3 – Hec-Ras Table of Results

HEC-RAS Plan: Plan 31 River: channel Reach: 1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	510.4	PF 1	3.43	107.35	107.61	107.61	107.72	0.042075	1.43	2.40	11.65	1.00
1	510	PF 1	3.43	106.64	107.05		107.08	0.007345	0.83	4.12	12.05	0.46
1	505.05*	PF 1	3.43	106.60	107.01		107.05	0.007382	0.83	4.12	12.11	0.46
1	500.10*	PF 1	3.43	106.57	106.98		107.01	0.007424	0.83	4.12	12.19	0.46
1	495.15*	PF 1	3.43	106.53	106.94		106.97	0.007509	0.83	4.12	12.28	0.46
1	490.20*	PF 1	3.43	106.50	106.90		106.94	0.007667	0.84	4.10	12.37	0.46
1	485.25*	PF 1	3.43	106.46	106.86		106.90	0.008010	0.84	4.06	12.47	0.47
1	480.30*	PF 1	3.43	106.42	106.82		106.86	0.008521	0.86	4.00	12.57	0.49
1	475.35*	PF 1	3.43	106.39	106.77		106.81	0.009561	0.89	3.87	12.65	0.51
1	470.4	PF 1	3.43	106.35	106.61	106.61	106.72	0.042394	1.43	2.40	11.69	1.01
1	470	PF 1	3.43	105.64	106.04		106.08	0.008350	0.87	3.96	12.02	0.48
1	465.97*	PF 1	3.43	105.61	106.00		106.04	0.009040	0.88	3.88	12.20	0.50
1	461.93*	PF 1	3.43	105.58	105.96		106.00	0.010345	0.91	3.76	12.45	0.53
1	457.9	PF 1	3.43	105.56	105.82	105.82	105.92	0.042477	1.43	2.41	11.79	1.01
1	457.5	PF 1	3.43	104.70	105.23		105.25	0.005228	0.75	4.57	12.12	0.39
1	452.82*	PF 1	3.43	104.69	105.20		105.23	0.005312	0.75	4.56	12.18	0.39
1	448.14*	PF 1	3.43	104.67	105.17		105.20	0.005445	0.76	4.53	12.24	0.40
1	443.47*	PF 1	3.43	104.66	105.15		105.18	0.005595	0.76	4.50	12.30	0.40
1	438.79*	PF 1	3.43	104.64	105.12		105.15	0.005826	0.77	4.46	12.36	0.41
1	434.11*	PF 1	3.43	104.63	105.09		105.12	0.006141	0.78	4.39	12.42	0.42
1	429.43*	PF 1	3.43	104.61	105.06		105.09	0.006629	0.80	4.30	12.47	0.43
1	424.76*	PF 1	3.43	104.60	105.03		105.06	0.007412	0.82	4.16	12.50	0.46
1	420.08*	PF 1	3.43	104.58	104.98		105.02	0.008978	0.87	3.93	12.47	0.50
1	415.4	PF 1	3.43	104.57	104.83	104.83	104.94	0.042208	1.43	2.39	11.57	1.01
1	415	PF 1	3.43	103.86	104.27		104.30	0.007642	0.85	4.05	11.92	0.46
1	410.58*	PF 1	3.43	103.83	104.23		104.27	0.007847	0.85	4.03	12.02	0.47
1	406.16*	PF 1	3.43	103.80	104.19		104.23	0.008184	0.86	3.99	12.13	0.48
1	401.74*	PF 1	3.43	103.76	104.16		104.19	0.008785	0.87	3.93	12.25	0.49
1	397.32*	PF 1	3.43	103.73	104.11		104.15	0.009961	0.90	3.79	12.39	0.52
1	392.9	PF 1	3.43	103.70	103.96	103.96	104.07	0.042112	1.43	2.40	11.65	1.01
1	392.5	PF 1	3.43	102.99	103.39		103.43	0.007938	0.86	4.00	11.83	0.47
1	388.07*	PF 1	3.43	102.96	103.35		103.39	0.008152	0.86	3.97	11.92	0.48
1	383.64*	PF 1	3.43	102.92	103.32		103.35	0.008406	0.87	3.95	12.04	0.48
1	379.20*	PF 1	3.43	102.89	103.28		103.32	0.008996	0.88	3.89	12.18	0.50
1	374.77*	PF 1	3.43	102.85	103.23		103.27	0.009979	0.91	3.79	12.34	0.52
1	370.34	PF 1	3.43	102.82	103.08	103.08	103.18	0.042088	1.43	2.40	11.64	1.01
1	370	PF 1	3.43	102.11	102.51		102.55	0.008020	0.86	4.00	12.00	0.47
1	365.58*	PF 1	3.43	102.08	102.47		102.51	0.008186	0.86	3.99	12.08	0.48
1	361.16*	PF 1	3.43	102.04	102.44		102.47	0.008495	0.87	3.96	12.18	0.49
1	356.74*	PF 1	3.43	102.01	102.40		102.44	0.009042	0.88	3.89	12.28	0.50
1	352.32*	PF 1	3.43	101.97	102.35		102.39	0.010143	0.91	3.77	12.38	0.53
1	347.9	PF 1	3.43	101.94	102.20	102.20	102.31	0.042348	1.43	2.39	11.61	1.01
1	347.5	PF 1	6.61	101.23	101.79		101.85	0.008535	1.11	5.97	12.72	0.52
1	343.08*	PF 1	6.61	101.20	101.75		101.81	0.008823	1.11	5.94	12.87	0.52
1	338.66*	PF 1	6.61	101.16	101.71		101.77	0.009272	1.12	5.88	13.05	0.53
1	334.24*	PF 1	6.61	101.13	101.66		101.73	0.010006	1.14	5.78	13.25	0.55
1	329.82*	PF 1	6.61	101.09	101.61		101.68	0.011345	1.18	5.60	13.47	0.58
1	325.4	PF 1	6.61	101.06	101.44	101.44	101.59	0.037444	1.73	3.82	12.68	1.01
1	325	PF 1	6.61	100.35	100.95		101.01	0.006514	1.03	6.42	12.34	0.46
1	320.08*	PF 1	6.61	100.33	100.92		100.97	0.006943	1.05	6.32	12.50	0.47
1	315.16*	PF 1	6.61	100.30	100.88		100.94	0.007498	1.06	6.21	12.70	0.49
1	310.24*	PF 1	6.61	100.28	100.84		100.90	0.008457	1.10	6.03	12.97	0.51
1	305.32*	PF 1	6.61	100.25	100.79		100.85	0.010093	1.14	5.78	13.33	0.55
1	300.4	PF 1	6.61	100.23	100.61	100.61	100.76	0.037415	1.73	3.82	12.76	1.01
1	300	PF 1	6.61	99.46	100.12		100.16	0.004772	0.93	7.11	12.63	0.40
1	295.00*	PF 1	6.61	99.43	100.09		100.14	0.004655	0.92	7.19	12.76	0.39
1	290.00*	PF 1	6.61	99.40	100.07		100.11	0.004527	0.91	7.28	12.91	0.39
1	285.00*	PF 1	6.61	99.38	100.05		100.09	0.004377	0.89	7.40	13.09	0.38
1	280	PF 1	6.61	99.35	100.03		100.07	0.004216	0.88	7.52	13.31	0.37
1	278.1	PF 1	6.61	99.33	100.02	99.71	100.06	0.003935	0.86	7.71	13.43	0.36
1	264.455		Culvert									
1	250.8	PF 1	7.43	99.06	99.59		99.68	0.012668	1.28	5.82	13.54	0.62
1	247.90*	PF 1	7.43	99.03	99.54		99.64	0.014562	1.33	5.57	13.48	0.66
1	245	PF 1	7.43	99.00	99.46		99.58	0.022017	1.52	4.87	13.14	0.80
1	244.65	PF 1	7.43	98.89	99.50		99.56	0.007854	1.09	6.83	14.05	0.50
1	239.86*	PF 1	7.43	98.85	99.46		99.52	0.007976	1.09	6.83	14.26	0.50
1	235.08*	PF 1	7.43	98.82	99.42		99.48	0.008135	1.09	6.83	14.49	0.51
1	230.29*	PF 1	7.43	98.79	99.38		99.44	0.008344	1.09	6.83	14.75	0.51
1	225.50*	PF 1	7.43	98.75	99.34		99.40	0.008639	1.09	6.81	15.05	0.52
1	220.71*	PF 1	7.43	98.71	99.30		99.36	0.009082	1.10	6.77	15.39	0.53
1	215.93*	PF 1	7.43	98.68	99.25		99.31	0.009830	1.11	6.67	15.75	0.55
1	211.14*	PF 1	7.43	98.64	99.20		99.26	0.011149	1.15	6.48	16.12	0.58
1	206.35	PF 1	7.43	98.61	99.01	99.01	99.17	0.037475	1.72	4.32	14.51	1.01
1	206	PF 1	7.43	97.84	98.45		98.51	0.008008	1.10	6.78	14.03	0.50
1	201.18*	PF 1	7.43	97.80	98.41		98.47	0.008130	1.09	6.79	14.23	0.51
1	196.35*	PF 1	7.43	97.77	98.37		98.43	0.008247	1.09	6.80	14.46	0.51
1	191.53*	PF 1	7.43	97.73	98.33		98.39	0.008443	1.09	6.80	14.70	0.51
1	186.70*	PF 1	7.43	97.70	98.28		98.35	0.008748	1.10	6.77	14.98	0.52
1	181.88*	PF 1	7.43	97.66	98.24		98.30	0.009211	1.11	6.72	15.29	0.53
1	177.05*	PF 1	7.43	97.62	98.19		98.26	0.009840	1.12	6.65	15.64	0.55
1	172.23*	PF 1	7.43	97.59	98.14		98.20	0.011128	1.15	6.46	15.98	0.58
1	167.4	PF 1	7.43	97.55	97.95	97.95	98.11	0.037564	1.73	4.30	14.37	1.01
1	167	PF 1	7.43	96.78	97.39		97.45	0.007975	1.10	6.77	13.92	0.50

HEC-RAS Plan: Plan 31 River: channel Reach: 1 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	162.18*	PF 1	7.43	96.74	97.35		97.41	0.008102	1.10	6.77	14.09	0.51
1	157.35*	PF 1	7.43	96.71	97.31		97.37	0.008186	1.10	6.78	14.29	0.51
1	152.53*	PF 1	7.43	96.67	97.27		97.33	0.008386	1.10	6.77	14.50	0.51
1	147.70*	PF 1	7.43	96.64	97.23		97.29	0.008682	1.10	6.74	14.74	0.52
1	142.88*	PF 1	7.43	96.60	97.18		97.24	0.009138	1.11	6.68	14.99	0.53
1	138.05*	PF 1	7.43	96.56	97.13		97.20	0.009861	1.13	6.58	15.24	0.55
1	133.23*	PF 1	7.43	96.53	97.08		97.15	0.011154	1.17	6.37	15.47	0.58
1	128.4	PF 1	7.43	96.49	96.90	96.90	97.05	0.036686	1.74	4.28	13.99	1.00
1	128	PF 1	10.17	95.72	96.42		96.50	0.008693	1.25	8.14	14.67	0.54
1	123.18*	PF 1	10.17	95.68	96.38		96.46	0.008951	1.25	8.14	15.03	0.54
1	118.35*	PF 1	10.17	95.65	96.33		96.41	0.009257	1.25	8.14	15.46	0.55
1	113.53*	PF 1	10.17	95.61	96.29		96.37	0.009634	1.25	8.16	16.00	0.56
1	108.70*	PF 1	10.17	95.57	96.24		96.32	0.010198	1.25	8.15	16.68	0.57
1	103.88*	PF 1	10.17	95.54	96.19		96.27	0.010934	1.25	8.15	17.59	0.59
1	99.05*	PF 1	10.17	95.50	96.13		96.21	0.011954	1.25	8.16	18.89	0.61
1	94.23*	PF 1	10.17	95.47	96.07		96.15	0.013175	1.23	8.26	20.96	0.63
1	89.4	PF 1	10.17	95.43	95.90	95.90	96.04	0.037820	1.69	6.01	20.90	1.01
1	84.700*	PF 1	10.17	94.67	95.15	95.15	95.34	0.035033	1.90	5.34	14.68	1.01
1	80	PF 1	10.17	93.90	95.06		95.08	0.001226	0.62	16.35	19.30	0.22
1	75.333*	PF 1	10.17	93.90	95.05		95.08	0.001414	0.68	15.02	17.39	0.23
1	70.667*	PF 1	10.17	93.90	95.05		95.07	0.001337	0.75	15.98	26.40	0.23
1	66	PF 1	10.17	93.90	95.06		95.06	0.000256	0.35	31.44	30.71	0.10
1	61.027*	PF 1	10.17	93.90	95.06		95.06	0.000257	0.35	31.40	30.70	0.10
1	56.053*	PF 1	10.17	93.90	95.06		95.06	0.000258	0.35	31.36	30.70	0.11
1	51.080*	PF 1	10.17	93.90	95.05		95.06	0.000259	0.35	31.32	30.69	0.11
1	46.107*	PF 1	10.17	93.90	95.05		95.06	0.000260	0.35	31.29	30.68	0.11
1	41.133*	PF 1	10.17	93.90	95.05		95.06	0.000261	0.35	31.24	30.67	0.11
1	36.16	PF 1	10.17	93.90	95.05	94.16	95.06	0.000262	0.36	31.20	30.66	0.11

Annexure "I"
Salinity Assessment Update

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia
PO Box 1543, Macquarie Centre. North Ryde, NSW 2113
ABN: 62 084 294 762
Tel: (02) 9679 8733
Fax: (02) 9679 8744
Email: geoenviro@exemail.com.au

Report

Salinity Management Plan
Proposed Residential Development
Nos 187 and 195-203, Lots 36, 37 and 38 DP 28024
Turner Road, Currans Hills, NSW

Prepared for:-

JMD Development Consultants
PO Box 25
CAMPBELLTOWN NSW 2560

JC04031A-r12
October 2017

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia
PO Box 1543, Macquarie Centre. North Ryde, NSW 2113

ABN: 62 084 294 762
Tel: (02) 9679 8733
Fax: (02) 9679 8744
Email: geoenviro@exemail.com.au

11th October 2017

Our Ref: JC04031A-r12

JMD Development Consultants
PO Box 25
CAMPBELLTOWN NSW 2560

Attention: Mr Shane Gray

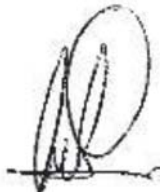
Dear Sir

Re: Salinity Management Plan
Proposed Residential Subdivision Development
Nos 187 and 195-203, Lots 36, 37 and 38 DP 28024 Turner Road
Currans Hills, NSW

Further to our Salinity Assessment Update report referenced JC04031A-r9 dated 2nd September 2015, this report presents our Salinity Management Plan for the above site.

Should you have any queries, please contact the undersigned.

Yours faithfully,
GeoEnviro Consultancy Pty Ltd



Solern Liew CPEng (NPER)
Director

C:\\04JOB\031\A\JC04031A-R12.DOC

TABLE OF CONTENTS

Section Page

1. INTRODUCTION ***1***

2. SITE INFORMATION ***1***

2.1 Site Location **1**

2.2 Geological and Topographical Setting **1**

2.3 Hydrogeology **2**

3. SALINITY INVESTIGATION ***2***

4. SUBSURFACE CONDITIONS ***3***

5. POLICIES AND GUIDELINES ***4***

5.1 Urban Salinity and Proposed Development **4**

5.2 Salinity Management Policy and Objectives **5**

5.3 Guidelines and Code of Practice **5**

6.0 LABORATORY TEST RESULTS ***7***

7.0 SALINITY HAZARD IDENTIFICATION AND ASSESSMENT ***11***

7.1 Surface Indicators **11**

7.2 Groundwater **11**

7.3 Salinity Assessment and Salt Profiles **11**

7.4 Salinity Hazards **13**

8.0 SALINITY MANAGEMENT PLAN ***14***

9.0 GENERAL RECOMMENDATIONS ***19***

9.1 Earthworks and Construction **19**

9.2 Building Structures and Infrastructures **22**

10.0 OTHER MANAGEMNET ISSUES ***23***

10.1 Health and Safety **23**

10.2 Records and Documentations **23**

10.3 Compliance and Corrective Actions **23**

11.0 LIMITATIONS ***24***

REFERENCES

LIST OF DRAWINGS

Drawing No 1	Site Locality and Previous Site Feature Plan
Drawing No 2	Salinity Zone Plan

LIST OF APPENDICES

Appendix A	Extracts of the Preliminary Contamination and Salinity Report (Reference 2)
Appendix B	Extracts of the Salinity/Contamination & RAP Report (Reference 3)
Appendix C	Important Information About Your Environmental Site Assessment Explanatory Notes

1. INTRODUCTION

This report presents the results of our Salinity Management Plan (SMP) for the site referred to as Nos 187 and 195-203, Lots 36, 37 and 38 DP 28024 Turner Road Currans Hills as shown on Drawing No 1.

The site was the subject of a number of salinity studies undertaken by GeoEnviro between 2004 and 2009 and an update report was compiled in our referenced JC04031A-r9 dated 2nd September 2015 (Reference 3).

The objective of this SMP was to provide a salinity management strategy to mitigate potential adverse impact of saline soils on the proposed development.

2. SITE INFORMATION

2.1 Site Location

The site is located on the northern side of Turner Road at Currans Hill and consists of three properties, Nos 187 and 195 to 203 Lots 36, 37 and 38 DP 28024. The overall property has an irregular shape with an approximate 225m frontage to Turner Road and extends about 530m to the north.

2.2 Geological and Topographical Setting

The site is situated on gentle undulating terrain with ground surface sloping down in a general direction to the southeast. Ground surface within the site generally slopes at angles of about 3 to 5 degrees. The ground surface steepens to the north at angles of about 8 to 12 degrees.

Based on the 1:100,000 Geological Map of Port Hacking-Wollongong (Reference 5), the site is underlain by Bringelly Shale (Rwa) of the Wianamatta Group comprising of shale, carbonaceous claystone, laminite and occasional coal.

The 1:100,000 Soil Landscape Map (Reference 6) indicates the overburden soil to consist of residual soil of the Blacktown soil landscape. The residual soil is typically highly plastic, low permeability and moderately reactive.

2.3 Hydrogeology

Based on our local knowledge and previous investigation of the general surrounding area, we expect permanent groundwater table to be at a significant depth (ie in excess of 3m from ground surface.). Some perched groundwater is expected to exist at shallower depths within close proximity to existing dams and drainage depression. Infiltration of surface water through subsurface ground is expected to be limited due to the relatively impervious nature of the insitu clayey soil.

2.4 Site Description

The site currently consists of vacant land will all previous buildings and sheds recently demolished and cleared. We understand that the site was mainly used for residential in the past. The dams (Site Features 7, 15, 16 and 19) remained undisturbed and there were a number of trees on property along the drainage depression.

3. SALINITY INVESTIGATION

The site was the subject of a number of salinity studies carried out between 2004 and 2009 by GeoEnviro Consultancy Pty Ltd (References 1 and 2). Refer to Appendix A and B for extracts of our previous report.

Our previous investigation (Reference 1) which was carried out between 24th February and 2nd March 2004 consisted of excavation of 210 test pits (TP 1 to TP 210) as shown in Appendix A. In February 2009, an additional contamination assessment involving excavation of 17 test pits (TP 1A to 17A) was carried out by GeoEnviro in order to further assess the contamination status of property Nos 195-203 (Reference 2) as shown in Appendix B. Salinity samples were collected and were analysed for the following;

- Emerson Dispersion Test
- pH
- Electrical Conductivity (Ec)
- Cation Exchange Capacity (CEC)
- Exchangeable Sodium Percentage (ESP)
- Chloride (Cl)
- Sulphate (S04)

4. SUBSURFACE CONDITIONS

Reference should be made to the attached Table 1 in Appendix A and B for details of subsurface profiles encountered. The following is a generalised subsurface profile;

Fill

Buried fill was encountered in a number of test pits such as TP 11, 12, 14, 16, 17, 18, 19, 22, 23, 24, 25 26, 27, 77, 78, 110 and 111 and in TP 11A to 16A , TP 131 to 135, 140 to 145, 165 to 168, rubbish fill was encountered.

Topsoil and Topsoil/Fill

Away from the above filled areas, topsoil and topsoil/fill was encountered on the surface in the majority of the test pits. The topsoil and topsoil/fill were found to consist predominantly of clayey silt of low liquid limit. Thickness of the topsoil and topsoil/fill were found to range from about 0.2m to 0.7m

Natural Soil

The underlying natural clay consists predominantly of high plasticity Silty Clay. The natural clay becomes more gravelly and medium plasticity at lower depths. In some deeper test pits, medium to high plasticity gravelly Silty Clay was encountered at lower depths.

Based on the hand penetrometer test results, the natural clay was generally assessed to be very stiff to hard. Moisture content of the natural clay was generally found to be less than to approximately equal to the plastic limit.

Bedrock

Shale/siltstone was encountered in a number of test pits with depths varying from 1.0m to 3.0m below existing ground surface.

Groundwater

All test pits were found to be dry during and upon completion of the site investigation. Based on our experience of the area, we anticipate that groundwater will generally be present at significant depths (ie greater than 3m). Some perched ground water may be present in the vicinity of the dam

All other test pits were found to be dry during and shortly after completion of the site investigation.

5. POLICIES AND GUIDELINES

5.1 Urban Salinity and Proposed Development

We understand that the proposed development will include the following;

- Bulk earthworks to regrade the site to design levels.
- Construction of roads including footpaths and pedestrian pavements.
- Laying of underground services including drainage pipes, sewer pipes, water supply pipes, gas pipes and conduits (electrical and telecommunication).
- Construction of water detention structures and basins.
- Formation of parklands and reserves.
- Construction of retaining walls and other amenities buildings

Salinity refers to the presence of excess salt in the environment and is able to occur if salts which are naturally found in soil or groundwater mobilise, allowing capillary rise and evaporation to concentrate the salt at the upper subsurface soil profile. Such movements are caused by changes in the natural water cycle. In urban areas, the processes which cause salinity are intensified by the increased volumes of water added to the natural system from irrigation of gardens, lawn and parks and from leaking infrastructures (eg pipes, sewer, stormwater, etc) and pool.

In recognition of the potential adverse impact of salinity to development, the Western Sydney Regional Organisation of Councils Ltd has a Salinity Code of Practice (Reference 7) to address the issue of salinity. It was acknowledged in the Code that salinity problems can change substantially over time and it is difficult to predict exactly where salinity will occur and how it will respond to the changing environment conditions.

5.2 Salinity Management Policy and Objectives

The salinity management policy to be adopted is as follows;

- The development of the site is carried out within the objectives and framework adopted by the Western Sydney Salinity Code of Practice. (Reference 7)
- The saline environment does not adversely impact on private and public assets.
- Adequate documentation and monitoring works are in placed and appropriate management practices are adopted.

The main objectives of this Salinity Management Plan (SMP) were to;

- Identify potential impacts of saline environment on the site during and after construction.
- Establish responsibilities and procedures for the various parties involved in the proposed development.
- Establish procedures to review the implementation process and corrective actions to improve the performance.

5.3 Guidelines and Code of Practice

The fundamental criterion for assessing soil salinity is based on Electrical Conductivity (Reference 4).

Class	**EC_e (ds/m)**
Non-Saline	<2
Slightly Saline	2-4
Moderately Saline	4-8
Very Saline	8-16
Highly Saline	>16

As soil salinity is a function of soil stability, other parameters such Emerson Dispersion, were used to assess saline soil. Soil dispersion relates to stability of the soil in the presence of water.

The following is a measure of soil dispersion;

Emerson Class No	Dispersibility
1	Very High
2	High
3	High to moderate
4	Moderate
5 and 6	Slight
7 and 8	Negligible/Aggregated

In addition to the above, the presence of Sulphate and Chloride in the soil has the potential to cause high soil aggressivity to concrete and steel structures, in particular if the structures are in direct contact with the soil. The following is a measure of soil aggressivity to concrete based on the Australian Standard (Reference 9).

Sulfate expressed as SO_3		PH	Chloride in water (ppm)	Soil conditions A*	Soil conditions B#
In Soil (ppm)	In Groundwater (ppm)				
<5000	<1000	>5.5	<6000	Non-aggressive	Non-aggressive
5000-1000	1000-3000	4.5-5.5	6000-12000	Mild	Mild
10000-20000	3000-10000	4-4.5	12000-30000	Severe	Moderate
>20000	>10000	<4	>30000	Very Severe	Severe

Approximate 100ppm of SO_4=80ppm of SO_3
* Soil condition A = High permeability soils (eg sands and gravels) which is below groundwater
# Soil conditions B = Low permeability soils (eg silts and clays) and all soils above groundwater

The following is a measure of soil aggressivity to steel piles based on the Australian Standard (Reference 9).

pH	Chlorides (Cl)		Resistivity Ohm.cm	Soil conditions A*	Soil conditions B#
	In Soil Ppm	In water ppm			
>5	<5000	<1000	>5000	Non-aggressive	Non-aggressive
4-5	5000-20000	1000-10000	2000-5000	Mild	Non-aggressive
3-4	20000-50000	10000-20000	1000-2000	Moderate	Mild
<3	>50000	>20000	<1000	Severe	Moderate

* Soil condition A = High permeability soils (eg sands and gravels) which is below groundwater
# Soil conditions B = Low permeability soils (eg silts and clays) and all soils above groundwater

6.0 LABORATORY TEST RESULTS

The following is a summary of the laboratory test results obtained from the initial salinity assessment of 2004 (Reference 1);

Sample	Depth (m)	pH	EC	EC_e	CEC	ESP	SAR	CL	SO4
TP 8	0.0-0.2	5.9	0.2	2.8	11.2	0.2	1		
	0.8-1.0	8.1	0.36	2.2	21.1	7.1	6	240	100
	1.8-2.0	8.2	0.4	2.8	19.2	15.6	8.4	350	120
TP 40	0.0-0.2	5.7	0.14	1.9	10	0.3	1.3		
	0.5-0.7	6.4	0.06	0.4	7.9	0.5	2.2	25	46
	1.0-1.2	7.0	0.08	0.6	13.8	4.9	3.1	45	32
TP 51	0.0-0.2	5.9	0.13	1.8	7.3	0.4	3.7		
	0.5-0.7	5.8	0.87	5.2	17.7	19.5	14.2	1170	90
	1.0-1.2	5.4	0.9	6.3	15.1	19.7	43	1350	27
TP 98	0.0-0.2	5.6	0.19	2.6	11.3	0.4	2.5		
	0.8-0.7	5.3	0.31	2.2	13.7	9.5	4.8	350	57
	1.0-1.2	5.5	0.38	3.2	14.2	12.7	16.9	530	32
TP 122	0.0-0.2	5.7	0.15	2.1	9.4	0.2	1.2		
	0.5-0.7	6.1	0.18	1.1	15.3	9.2	2.5	50	80
	1.0-1.2	6.2	0.39	3.1	10.9	12.8	8.3	560	37
TP 146	0.0-0.2	5.3	0.11	1.5	4.2	0.3	1		
	0.5-0.7	5.5	0.15	1.1	14.1	8.5	6	100	73
	1.8-2.0	5.6	0.55	4.4	18.8	10.6	34.3	850	150

Note: EC – Electrical Conductivity (dS/m)
EC_e-Electrical Conductivity (dS/m)
CEC – Cation Exchange Capacity (cmol+/kg)
ESP – Exchangeable Sodium Percentage (%)
Resistivity – ohm/cm
CL – Chloride (mg/kg)
SO4- Sulphate (mg/kg)

	Class	EC_e (ds/m)
	Non-Saline	<2
	Slightly Saline	2-4
	Moderately Saline	4-8
	Very Saline	8-16
	Highly Saline	>16

Emerson Class

Sample	Class	Description
TP 8 (0.8-1.0m)	2	Partial Dispersion
TP 8 (1.8-2.0m)	2	Partial Dispersion
TP 51 (0.5-0.7m)	1	Complete Dispersion
TP 98 (1.0-1.2m)	2	Partial Dispersion
TP 122 (0.5-0.7m)	3	Partial Dispersion
TP 146 (1.8-2.0m)	6	Non Dispersion
TP 171 (0.5-0.7m)	5	Non Dispersion
TP 185 (1.0-1.2m)	2	Partial Dispersion
TP 191 (0.5-0.7m)	3	Partial Dispersion
TP 191 (1.0-1.2m)	2	Partial Dispersion

Particle Size Distribution

Sample	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
TP 8 (0.8-1.0m)	54	26	18	2
TP 40 (1.0-1.2m)	34	20	45	1
TP 51 (0.5-0.7m)	50	30	20	0
TP 98 (1.0-1.2m)	41	31	25	3
TP 122 (0.5-0.7m)	58	26	15	1
TP 146 (1.8-2.0m)	44	34	22	0
TP 171 (1.0-1.2m)	43	45	9	3
TP 191 (0.5-0.7m)	61	25	12	2

The following is a summary of the laboratory test results obtained from the additional salinity assessment of 2009 (Reference 2).

Sample	Depth (m)	pH	EC	EC_e	CEC	ESP	CL	SO4
TP1A	0.0-0.1	6.0	0.075	1.1				
	1.1-1.2	6.2	0.91	7.3	22	39	1300	110
	2.4-3.0	8.4	0.15	1.3	15	22	160	<25
TP2A	0.0-0.1	6.3	0.044	0.6				
	0.4-0.5	7.8	0.21	1.7	29	11	370	61
	2.3-2.4	8.1	0.42	3.6	15	18	240	25
TP4A	0.0-0.1	5.9						
TP6A	0.0-0.1	6.2						
TP8A	0.0-0.1	6.1						
TP9A	0.0-0.1	6.5	0.018	0.3				
	1.5-1.6	8.2	0.43	3.4	26	22	530	57
	3.2-3.3	8.6	0.17	1.4	25	16	<100	26
TP10A	0.0-0.1	6.4	0.19	2.7				
	0.4-0.5	9.2	0.22	1.8	25	12	<100	<25
	2.2-2.3	8.4	0.33	2.8	44	8.5	220	<25
TP12A	0.0-0.1	6.7						
TP14A	0.0-0.1	7.5						
TP15A	0.0-0.1	7.8	0.094	1.3				
	0.5-0.6	6.2	0.62	5.0	11	37	910	<25
	2.4-2.5	7.8	0.76	6.5	21	32	1100	<25

Note: EC – Electrical Conductivity (dS/m)
EC_e-Electrical Conductivity (dS/m)
CEC – Cation Exchange Capacity (cmol+/kg)
ESP – Exchangeable Sodium Percentage (%)
Resistivity – ohm/cm
CL – Chloride (mg/kg)
SO4- Sulphate (mg/kg)

	Class	EC_e (ds/m)
	Non-Saline	<2
	Slightly Saline	2-4
	Moderately Saline	4-8
	Very Saline	8-16
	Highly Saline	>16

Emerson Class

Sample	Class	Description
TP1A(1.1-1.2m)	1	Very High Dispersion
TP 1A(2.4-3.0m)	1	Very High Dispersion
TP2A (0.4-0.5m)	2	High Dispersion
TP 2A (2.3-2.4m)	1	Very High Dispersion
TP 9A (1.5-1.6m)	1	Very High Dispersion
TP 9A (3.2-3.3m)	1	Very High Dispersion
TP 10A (0.4-0.5m)	2	High Dispersion
TP 10A (2.2-2.3m)	5	Slight Dispersion
TP 15A (0.5-0.6m)	1	Very High Dispersion
TP 15A (2.4-2.5m)	2	High Dispersion

7.0 SALINITY HAZARD IDENTIFICATION AND ASSESSMENT

7.1 Surface Indicators

The following are site indicators which are used to identify the presence of soil salinity;

- Scorching or absence of vegetation cover
- Salt encrustations on the ground surface.
- Dieback of trees or trees which show signs of distress.
- The existence of salt tolerant plants.

7.2 Groundwater

Groundwater was not encountered within the soil profile in our previous test pit investigation (maximum investigation depth of 3m) and moisture content of the underlying soil was found to be less than the plastic limit.

Some perched groundwater may be present during prolonged wet periods along the creeks and drainage depressions and in the vicinity of dams

7.3 Salinity Assessment and Salt Profiles

The fundamental measurement of soil salinity is EC_e values and based on the laboratory test results, the site salinity may be generalised as follows (refer to Drawing No 2 for salinity zones);

- The upper 0.5m of the subsurface profile was generally found to be predominantly Non to Slightly Saline with EC values ranging from 0.4 to 3.0 dS/m.
- The subsurface profile was generally found to be Moderately Saline soil was encountered in TP 51, 146. 1A, 2A and 15A with EC values ranging from 5.0 to 7.3 dS/m.

Drawing No 2 characterises the soil salinity of the site into Zone A and B as follows;

Zone A	Non to Slightly Saline over the entire subsurface profile.
Zone B	Moderately Saline over the entire subsurface profile.

The concentration of salts in the subsurface soil may be modelled to three different profiles as follows based on the DWLC (2002) guidelines (Reference 4);

- 'Normal' Salt Profiles – The salinity levels in this profile increase with depth and there is no rising groundwater effect to bring the salts to the surface. This profile commonly appeared over the central portion of the site.

- 'Recharge' Salt Profiles – The salinity levels in this profile are low and fairly constant with depth. This salt profile appeared to have occurred commonly over the northern and southern portions of the site.

- Discharge' Salt Profiles – The salinity levels in this profile reduce with depth and generally occurs when subsurface flows rises up due to the topography and vegetation uptake and salt is being brought up to the surface. This salt profile does not appear to have occurred on any part of the site.

The subsurface soil was found to have low Sulphate and Chloride concentrations however in an environment with the lowest pH being 5.3, the soil is considered to be Mildly-aggressive to buried concrete and steel structures.

7.4 Salinity Hazards

The impact of saline hazard on the development should be properly managed to ensure;

- The construction and maintenance of the proposed subdivision development do not result in a deterioration of the saline environment. Hazards derived from improper implementation of construction works and management of site may include;
    - Excavation and displacement of saline, sodic or dispersive soil during bulk earthworks.
    - Uncontrolled soil erosion and dispersion of sodic and dispersive soil down hill and into receiving waters.
    - Concentrations of salt due to altered surface and subsurface flows. Concentrations of salt may also occur from inadequate design of roads, drainage and footings resulting in impeded subsurface flows.
    - Rising of groundwater level due to basin construction and irrigation.
    - Increase in surface salt levels from poor management of parks and landscaping areas.
- The saline environment does not impact on the development. Hazards derived from improper design may include;
    - Damage to buildings and houses caused by deterioration of bricks, mortar and concrete when salt drawn up into capillaries of bricks and mortar expands resulting in spalling.
    - Deterioration of concrete kerbs and gutters as a result of chemical reaction between concrete and sulphates.
    - High chloride content in the soil may result in corrosion of steel reinforcement and buried metal structures.
    - Damage to underground pipes and infrastructures.
    - Water logging of ground surface due to sealing effect of sodic and dispersive soil.
    - Loss of vegetation cover and plants due to high salt content resulting in retardation of plants.

8.0 SALINITY MANAGEMENT PLAN

The salinity management plan takes into consideration the following;

- The assets to be constructed such as roads, buildings, services and parks.
- The construction activities during development and the maintenance required
- The associated salinity hazards and risks of the assets and activities (ie construction and maintenance)
- The likelihood of such hazards and risks eventuating
- The management of the hazards and risks including control measures
- The party responsible for the implementation and management of control measures.

The likelihood of hazards and risks eventuating may be categorised into three levels as follows;

Low : The risk is minimal and is not likely to occur unless under exceptional circumstances. Normal management procedures should be sufficient.

Moderate: The risk is likely to occur and some management procedures should be in placed to reduce such risk.

High: The risk is highly likely to occur and proper management and treatment will be required to mitigate the risk.

The following is a Salinity Management Plan considered relevant to the proposed development;

Assets and Procedures	Possible Hazards or Environmental Risks	Risk Class	Control Measures and Management	Action
Earthworks – Cut	1. Soil erosion and scouring of sodic soil from excavation works. 2. Instability of slope from disintegration of sodic and dispersive soils. 3. Concentration of runoff and deposition of salts.	Moderate – Zone A High - Zone B	1. Excavation in Zone B should avoid disturbance of Moderate Saline Soil at below 0.5m. 2. Avoid exposure and disturbance of sodic soil by minimising cut 3. Deeper excavations in excess of 0.9m should be covered and retained by retaining walls or batters to not steeper than 1 Vertical to 2 Horizontal 4. Vegetation of all batter slopes and bare surface. 5. Install adequate erosion controls such as silt fence. 6. Treatment of exposed surface with gypsum. 7. Install appropriate surface and subsurface drains	Developer/ Contractor
Earthworks – Fill and Stockpiling	1. Subsurface flows may be impeded. 2. Soil erosion and scouring of sodic fill. 3. Increase subsurface permeability potentially altering groundwater flows	Moderate – Zone A High - Zone B	1. All Moderate Saline Soil to be placed in Zone A should be placed at least 1.0m below proposed design level. This should be adopted in Zone B where possible. 2. Avoid exposure and disturbance of sodic soil 3. Avoid use of sodic soil 4. Vegetation of all batter slopes and bare surface. 5. Install adequate erosion controls such as silt fence. 6. Treatment of sodic and dispersive soil with gypsum. 7. Install appropriate surface and subsurface drains	Developer/ Contractor
Roadworks	1. Excavation and compaction of subgrade may impede subsurface flows resulting in accumulation of salts 2. Road construction will alter surface flows and salts will be deposited in a concentrated area	Moderate – Zone A High - Zone B	1. Excavation of Moderately Saline soil from Zone B and reusing in Zone A should be avoided. 2. Install appropriate subsoil drainage at the upgradient side of road to ease subsurface flows. 3. Design roads to minimise the effect of concentration of surface flows	Developer/ Contractor

Assets and Procedures	Possible Hazards or Environmental Risks	Risk Class	Control Measures and Management	Action
Trenching and Backfilling for Pipes and Services	1. Trenching will bring saline soil up to the surface. 2. Differential settlement of trench backfill due to erosion and tunnelling 3. Migration of fines from surrounding dispersive soil into the trench resulting in ground subsidence. 4. Migration of salts through the trenches and accumulation of salts downstream resulting in salt attack on concrete and steel infrastructures.	Moderate	1. Avoid displacement of saline soil from the bottom to the top, particularly in Zone B 2. It is recommended rubber-ring jointed pipes be used. 3. Special types of 'pipe-bedding' (eg clean coarse sand) are to be used. 4. Ensure adequate compaction of trench backfill to reduce the permeability of the trench. 5. Soil erosion and tunnelling may be treated by using gypsum or lime 6. Use of non-sodic and non-dispersive soil in the trench. 7. Use of geofabrics to prevent migration of fines into the trench.	Developer/ Contractor
Drainage Pipes and Pits	1. Structural degradation of concrete due to salt attack.	Moderate	1. Ensure use of appropriate concrete grade not less than 32 MPa characteristic strength. 2. Minimise excavation into sodic and dispersive soil 3. Ensure sufficient clearance above groundwater or construction of subsurface drains at the bottom	Developer/ Drainage Contractor
Conduits and Duct crossing	1. Structural degradation of steel due to salt attack	Moderate	1. Appropriate corrosion protection measures be in placed 2. Ensure sufficient clearance above groundwater or construction of subsurface drains at the bottom	Developer/ Electrical Contractor
Electrical conduits and Substations	1. Structural degradation of cables and earthing devices. 2. Salt attack on concrete structures	Moderate to High	1. Appropriate concrete grade be used. 2. Appropriate earthing devices with sacrificial element or anodic protection in place.	Developer/ Electrical Contractor
Street Lightings and Signage	1. Salt attack on steel and concrete structures	Moderate to High	3. Ensure sufficient clearance to ground water 4. Adopt Mildly aggressive soil for concrete and steel structures.	Developer/ Contractor

Assets and Procedures	Possible Hazards or Environmental Risks	Risk Class	Control Measures and Management	Action
House Floor slabs and Concrete Foundations	1. Structural degradation of concrete due to salt attack. 2. Corrosion of steel reinforcement and spalling of concrete	Moderate	1. Install appropriate waterproofing membranes under slab 2. Durability design based on Class A2 AS2870 3. Ensure use of appropriate concrete grade not less than 32 MPa characteristic strength. 4. Ensure adequate concrete cover from reinforcement. Normally concrete cover is not less than 50mm. A lesser cover may be appropriate subject to other protection measures in placed 5. Ensure structures are sufficiently elevated above groundwater table. 6. Placement of damp proof course and vapour barriers where required. 7. Construction of adequate surface and subsurface drainage around the house slab.	Owner/ Builder
House Steel Foundations and Buried Steel poles	1.Corrosion of steel	Moderate	1. Design for Mildly aggressive soils by adopting a corrosion rate of 0.01-0.02mm/year (AS2159)	Owner/ Builder
Masonry Walls	1. Structural degradation of brick and masonry walls	Moderate	1. Placement of damp proof course and vapour barriers. 2. Use correct mortar and ensure appropriate mix.	Owner/ Builder
Concrete and bitumen driveways	1. Structural degradation of concrete caused by salt. 2. Deformation and cracking of asphalt seal.	Moderate	1. Construct appropriate surface and subsoil drains to intercept flows. 2. Use appropriate concrete grade.	Owner/ Builder
Sewer and water pipes	1. Structural degradation caused by salt 2. Subsidence of service trenches caused by tunnelling and erosion. 3. Migration of fines into the trenches and transportation of salts downstream.	Low to moderate	1. Design system to minimis the interception of surface and subsurface flows. 2. Ensure service trenches do not intercept the groundwater. 3. Adequate compaction of the service trenches	Owner/ Builder
Steel fencing	1. Corrosion and pitting of steel members in contact with the soil generally limited to 1m depth.	Moderate	1. Use concrete footings with appropriate grade. 2. Ensure sufficient clearance to groundwater	Owner/ Builder

Assets and Procedures	Possible Hazards or Environmental Risks	Risk Class	Control Measures and Management	Action
Detention Basin and Ponds	1. Collection and accumulation of salt from runoffs 2. Leaching of salt into the underlying groundwater system. 3. Erosion and scouring of embankment and banks	Moderate – Zone A. High – Zone B	1. Ensure detention basins are adequately design to minimise leakage. Use of liners maybe necessary. 2. Use of gypsum to treat sodic and dispersive soil 3. Cover ground surface with appropriate vegetation to stabilise the slopes. 4. Adopt appropriate batter slopes for the embankment. Slope batters should not be steeper than 1 Vertical to 3 Horizontal.	Developer/ Council
Landscaping	1. Growth impairment or death	Low – Zone A Moderate -Zone B	1. Select appropriate tree planting schemes. 2. Avoid planting trees and vegetation which are sensitive to salts.	Developer
Parks and Reserve	1. Accumulation of salts on the ground surface from irrigation 2. Increase in salinity level from fertilisers	Low – Zone A Moderate -Zone B	1. Implementation of proper park management 2. Monitor salt levels in receiving waters and basins. 3. Avoid over irrigation and over fertilising of park areas.	Council

9.0 GENERAL RECOMMENDATIONS

9.1 Earthworks and Construction

In general, for earthworks and construction, the management plan recommends the following;

- Earthworks for redevelopment of site will require stripping of the topsoil to expose the natural clay. Though the topsoil was generally assessed to be Non to Slightly Saline, some form of treatment by mixing with lime and other additives is recommended to reduce salinity and improve topsoil properties.
- Avoid exposure and disturbance of sodic and dispersive soil to minimising erosion and siltation. Erosion and sediment control plans should be developed and implemented by the earthworks contractor in accordance with the NSW Department of Housing Document "Managing Urban Stormwater: Soils and Construction (1998). All erosion and sediment controls should be installed prior to commencement of any earthworks.
- Trenching for underground services should be carried out in a manner such that there is minimal rotation and vertical displacement of the original soil profile as the lower soil profile is generally assessed to be more saline. Generally, excavation deeper than 1m should be backfilled in the same order, alternatively the excavated Moderately Saline material may be treated by using lime and/or placed at depths greater than 1m from finished level.
- Site regrading by earthworks particularly involving excavation should be kept to a minimum to avoid disturbing the Moderately Saline soils. Moderately Saline soil may be capped with 1.0m of Non to Slightly saline soil to improve site salinity. Surplus Moderate Saline soils for use on site to form building platforms may be treated by mixing with 3% by weight of lime.

- Appropriate batter slopes for excavations should be adopted to prevent erosion and scouring. Under good drainage conditions, the following batter slopes or less may be adopted;

Material	Recommended Minimum Batter Slopes
Compacted Fill	2.5 Horizontal : 1 Vertical
Very stiff residual clay	2 Horizontal : 1 Vertical
Weathered Shale/Siltstone	0.5 Horizontal : 1 Vertical

- The roadworks should be planned to reduce cutting and filling to a minimum and the earthworks undertaken in stages to alleviate erosion and localised instability problem. To minimise the effects of erosion, all road batters, whether in cut or fill should be stabilised by planting (or the application of a sprayed-on mulch) with appropriate species of vegetation as soon as practical after construction.
- Special considerations must be given to the design, bedding of pipework for stormwater and other services, as the soils within these areas are generally 'erodible' or 'dispersive'. It is recommended rubber-ring jointed pipes be used. Special types of 'pipe-bedding' (eg clean coarse sand) may also be required.
- The insitu soil was found to be sodic and dispersive, therefore unstable in the presence of water resulting in tunnelling. Construction of infrastructures should include adequate compaction of service trenches and construction of cut-off walls (eg concrete collars) to prevent migration of fines and prevent breakdown of soil structures.
- Prevention of soil erosion, tunnelling and salt scalds may be treated by using gypsum or lime.
- All excavation works into the Moderately Saline soil should be minimised by staging the construction into small areas to prevent salinity from developing. Any High Saline soil encountered is not recommended for use as building platform fill and this material may be buried beneath proposed roadways at depths greater than 1.0m below design level and covered with non to slightly saline fill.

- Time of exposure of bare ground (without vegetation) should be kept to a minimum and this will depend on weather conditions. Weather forecasts should be regularly updated and if extended periods of rain are forecast, the bare ground should be covered with stable fill such as ripped sandstone or stabilised with lime proportioned to 3% by weight.

- Temporary detention ponds in construction sites should be regularly monitored for water quality and cloudy water should be appropriately treated by flocculation with gypsum. This process is considered critical particularly before a storm event.

- During construction, hay bales and other temporary erosion control devices should be placed at appropriate locations in areas where concentrated flows are expected and suitable dish drains should be constructed to retard flow and trap silt particles during heavy runoff.

- Length of overland flow slopes which are bare of vegetation from the earthworks should be kept to a minimum not exceeding 20m. Overland flow slopes may be reduced by bunding and placement of silt fencing or hay bales.

- Further sampling and laboratory analysis may be required out in areas showing signs of instability in order to determine preventative course of action and minimise potential salinity problems.

- Adequate revegetation of the site should be carried out and this may involve treatment of topsoil material and planting appropriate plant species which are salt-tolerant.

9.2 Building Structures and Infrastructures

Reference should be made to AS 2159 (Reference 9), AS 3600 (Reference 12) and AS2870 (Reference 10) for recommendations on protection of buried concrete and steel structures. Based on the laboratory test results, the site may be generally classified as Mildly Aggressive - Class A2 (AS2870) for the buried concrete and steel structures.

As the site is situated within a saline prone environment, the following are general recommendations for future building and infrastructure construction;

- A high impact waterproof membrane, not just a vapour proof membrane, should be lain under house slabs (refer to NSW Building Code of Australia). The waterproof membrane must be extended to the outside face of the external edge beam up to the finishing ground level, as detailed in the Building Code of Australia (BCA).
- For masonry building construction, the damp proof course must consist of poly-ethylene or poly-ethylene coated metal and correctly placed in accordance with BCA. Ground levels immediately adjacent to masonry walls must be kept below the damp proof course
- For slab on ground construction, a layer of bedding sand at least 50mm thick should be laid under the slab to allow free drainage of water and to prevent pooling of water potentially carrying salts.
- Concrete floor slabs house comprises of Class 32MPa concrete or sulphate resisting Type SR cement with a water cement ratio of 0.5. Similar concrete should be used for bored piers or footings.
- Slabs must be vibrated and cured for a minimum 3 days
- The minimum cover to reinforcement should be 30mm from a membrane in contact with the ground.
- The minimum cover to reinforcement should be 50mm for strip footings and beams.
- Admixtures for waterproofing and /or corrosion prevention may be used.

- Use of salt tolerant masonry and mortar below the damp proof course
- Constant monitoring of water pipes to detect any leakages and the repair of damages pipes as soon as possible after detection
- Use Copper or non-metallic pipes instead of galvanised iron
- Ensure any underground services are provided with adequate corrosion protection

10.0 OTHER MANAGEMNET ISSUES

10.1 Health and Safety

Contractors and subcontractors performing work activities are expected to meet all Workcover's and other applicable Commonwealth and State/Territory requirements for employee's health and safety.

Appropriate personal protective equipment and clothings and on-site monitoring during fieldwork should be observed.

10.2 Records and Documentations

The entire process of the remedial works shall be sufficiently recorded and documented. Such information shall be systematically stored by the Project Manager and Council.

10.3 Compliance and Corrective Actions

The salinity management plan shall be taken to ensure the objectives outlined in above Section 4.3 are met and the works comply with the current regulations and practices. This will include;

- The monitoring of environmental performance on a regularly basis;
- Regularly perform audit of the environmental management system
- Record, investigate and analysis accidents/incidents

In the event where the objectives are not met, appropriate documentation should be made, and corrective actions be undertaken.

11.0 LIMITATIONS

The findings contained in this report are the results of discreet/specific sampling methodologies used in accordance with normal practices and standards. There is no investigation which is thorough enough to preclude the presence of material which presently, or in future, may be considered hazardous to the site. The site may subject of dumping of rubbish fill in the past and the scope of this report do not cover for future dumping and burial of such material on the subject site.

As regulatory evaluation criteria are constantly updated, concentrations of contaminants presently considered low, may in the future fall short of regulatory standards that require further investigation/redemption.

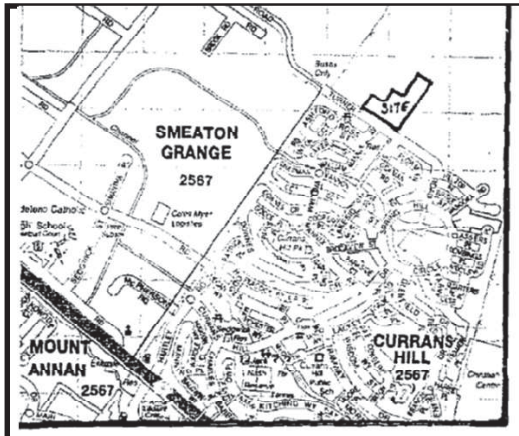
The statements presented in these documents are intended to advise you of what should be your realistic expectations of this report, and to present you with recommendations on how to minimise the risks associated with the groundworks for this project. The document is not intended to reduce the level of responsibility accepted by GeoEnviro Consultancy Pty Ltd, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

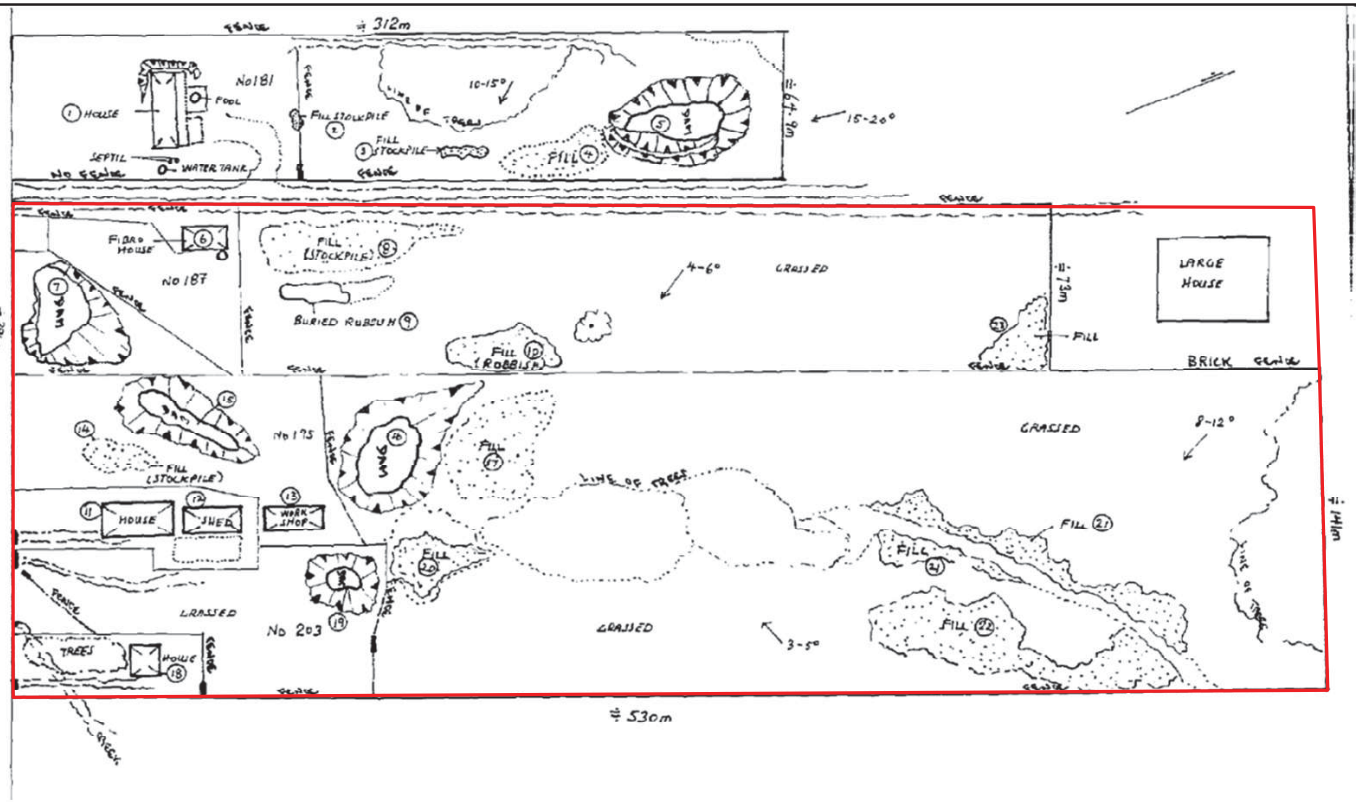
Attached in Appendix C are documents entitled "Important Information about Your Environmental Site Assessment" in conjunction with which this report must be read, as it details important limitations regarding the investigation undertaken and this report.

C:\\15JOB\031\A\JC04031A-R12
16/10/17 10:43 AM

REFERENCES

1. *Salinity Assessment Update, No 187, 195-203 Turner Road Currans Hill – GeoEnviro Consultancy Pty Ltd Ref JC04031A-r9 dated September 2015*
2. *Preliminary Contamination, Geotechnical and Salinity Assessment, No 181, 187, 195-203 Turner Road Currans Hill – GeoEnviro Consultancy Pty Ltd Ref JC04031A dated March 2004*
3. *Additional Salinity/Contamination Assessment and RAP, No 195-203 Lots 37 and 38 DP 28024 Turner Road Currans Hill – GeoEnviro Consultancy Pty Ltd Ref JC04031A-r5 dated March 2009*
4. *Department of Land and Water Conservation – "Site Investigation for Urban Salinity".2002*
5. *1:100,000 Geological Map of Penrith – Geological Series Sheet 9029-9129 (Edition 1) 1985*
6. *1:100,000 Soil Landscape Map of Penrith – Soil Conservation Service of NSW; Sheet 9029-9129*
7. *Salinity Code of Practice – Western Sydney Regional Organisation of Councils Ltd – 2002*
8. *What do all the numbers mean? A guide for the interpretation of soil test results. – Department of Conservation and Land Management, 1992*
9. *Australian Standard, AS 2159-2009 "Piling – Design and Installation", 2009*
10. *Australian Standard, AS 2870 -2013 "Residential Slabs and Footings".*
11. *Australian Standard, AS 3798 - 1996"Bulk Earthworks for Commercial and Residential Site*
12. *Australian Standard, AS 3600- 2009"Concete Structures"*

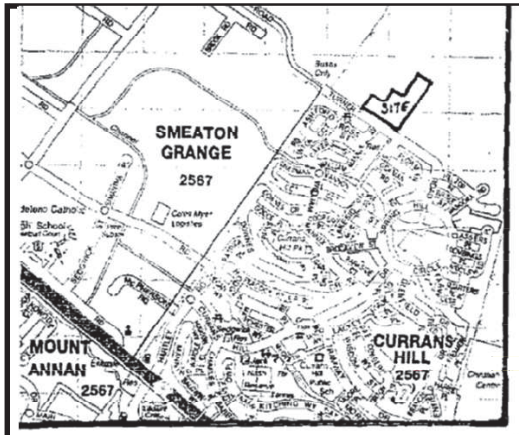


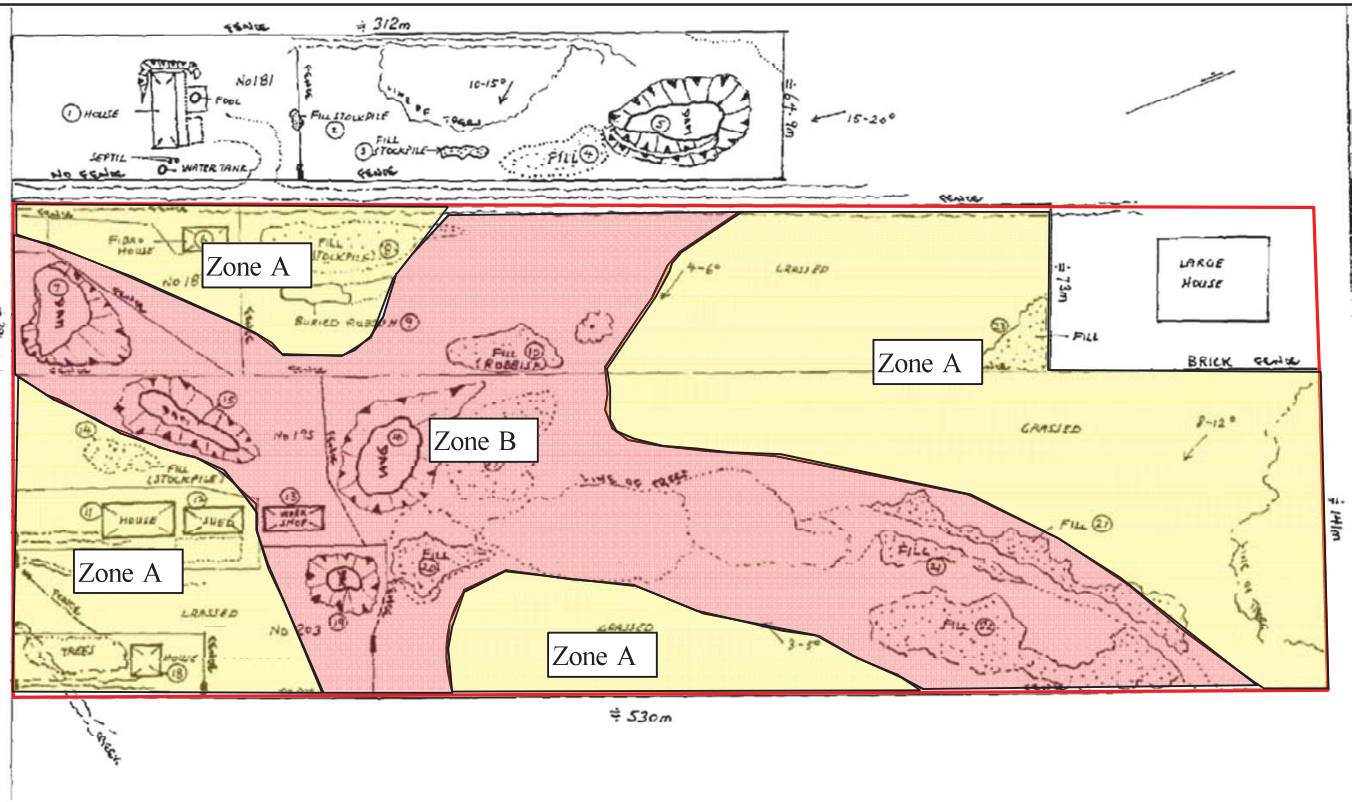


Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, tiles and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

GeoEnviro Consultancy
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Drawn By: AT	Date: 11/10/17	Dartanyon Pty Ltd	
Checked By: SL	Date: 11/10/17	No 187 and 195-203 Turner Road Currans Hill	
Revision By:	Date:	Site Locality and Previous Site Feature Plan	
Scale: Proportional	A3	Project No: JC04031A-r12	Drawing No: 1





Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, tiles and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

LEGEND

6° → SLOPE DOWN AT 6°

GeoEnviro Consultancy
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Drawn By: AT	Date: 11/10/17	Dartanyon Pty Ltd	
Checked By: SL	Date: 11/10/17	No 187 and 195-203 Turner Road Currans Hill	
Revision By:	Date:	Salinity Zone Plan	
Scale: Proportional	A3	Project No: JC04031A-r12	Drawing No: 1

APPENDIX A

Extracts of the Preliminary Contamination and Salinity Report (Reference 2)

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia
PO Box 1543, Macquarie Centre. North Ryde, NSW 2113

ABN 62 084 294 762
Tel : (02) 9679 8733
Fax : (02) 9679 8744

Report

Additional Salinity/Contamination Assessment and Remediation Action Plan
Nos 195-203, Lots 37 and 38 DP 28024
Turner Road, Currans Hills, NSW

Prepared for
Mr Jim and Ms Vanessa Driver
"Beltie Park"
941, Old South Road
MITTAGONG NSW 2575

Ref: JC04031A-r5
March 2009

Sodic soils are dispersible and are vulnerable to erosion and tunnelling. Sodicity is a measure of Exchangeable Sodium Percentage (ESP) and Cation Exchangeable Capacity (CEC). The following is a measure of soil sodicity;

ESP (%)	**Rating**
Less than 5	Non-Sodic
5 to 15	Sodic
Greater than 15	Highly Sodic

The measure of Cation Exchangeable Capacity is as follows;

CEC ($cmol^+/kg$)	**Rating**
Less than 6	Very Low
6 to 12	Low
12 to 25	Moderate
25 to 40	High
Greater than 40	Very High

In addition to the above, the presence of Sulphate and Chloride in the soil has the potential to cause high soil aggressivity to concrete and steel structures, in particular if the structures are in direct contact with the soil. The following is a measure of soil aggressivity based on the Australian Standard (Reference 14).

Sulfate expressed as SO_3		**PH**	**Chloride in water (ppm)**	**Soil conditions A***	**Soil conditions B#**
In Soil (%)	**In Groundwater (ppm)**				
<0.2	<300	>6.5	<2000	Non-aggressive	Non-aggressive
0.2-0.5	300-1000	5-6	2000-6000	Mild	Non-aggressive
0.5-1.0	1000-2500	4.5-5	6000-12000	Moderate	Mild
1.0-2.0	2500-5000	4-4.5	12000-30000	Severe	Moderate
>2.0	>5000	<4	>30000	Very Severe	Severe

Approximate 100ppm of SO_4=80ppm of SO_3
* Soil condition A = High permeability soils (eg sands and gravels) which is below groundwater
# Soil conditions B = Low permeability soils (eg silts and clays) and all soils above groundwater

8.2 Laboratory Test Results

The following is a summary of the laboratory test results;

Sample	Depth (m)	Ph	EC	EC_e	CEC	ESP	CL	SO4
TP1A	0.0-0.1	6	0.075	1.1				
	1.1-1.2	6.2	0.91	7.3	22	39	1300	110
	2.4-3.0	8.4	0.15	1.3	15	22	160	<25
TP2A	0.0-0.1	6.3	0.044	0.6				
	0.4-0.5	7.8	0.21	1.7	29	11	370	61
	2.3-2.4	8.1	0.42	3.6	15	18	240	25
TP4A	0.0-0.1	5.9						
TP6A	0.0-0.1	6.2						
TP8A	0.0-0.1	6.1						
TP9A	0.0-0.1	6.5	0.018	0.3				
	1.5-1.6	8.2	0.43	3.4	26	22	530	57
	3.2-3.3	8.6	0.17	1.4	25	16	<100	26
TP10A	0.0-0.1	6.4	0.19	2.7				
	0.4-0.5	9.2	0.22	1.8	25	12	<100	<25
	2.2-2.3	8.4	0.33	2.8	44	8.5	220	<25
TP12A	0.0-0.1	6.7						

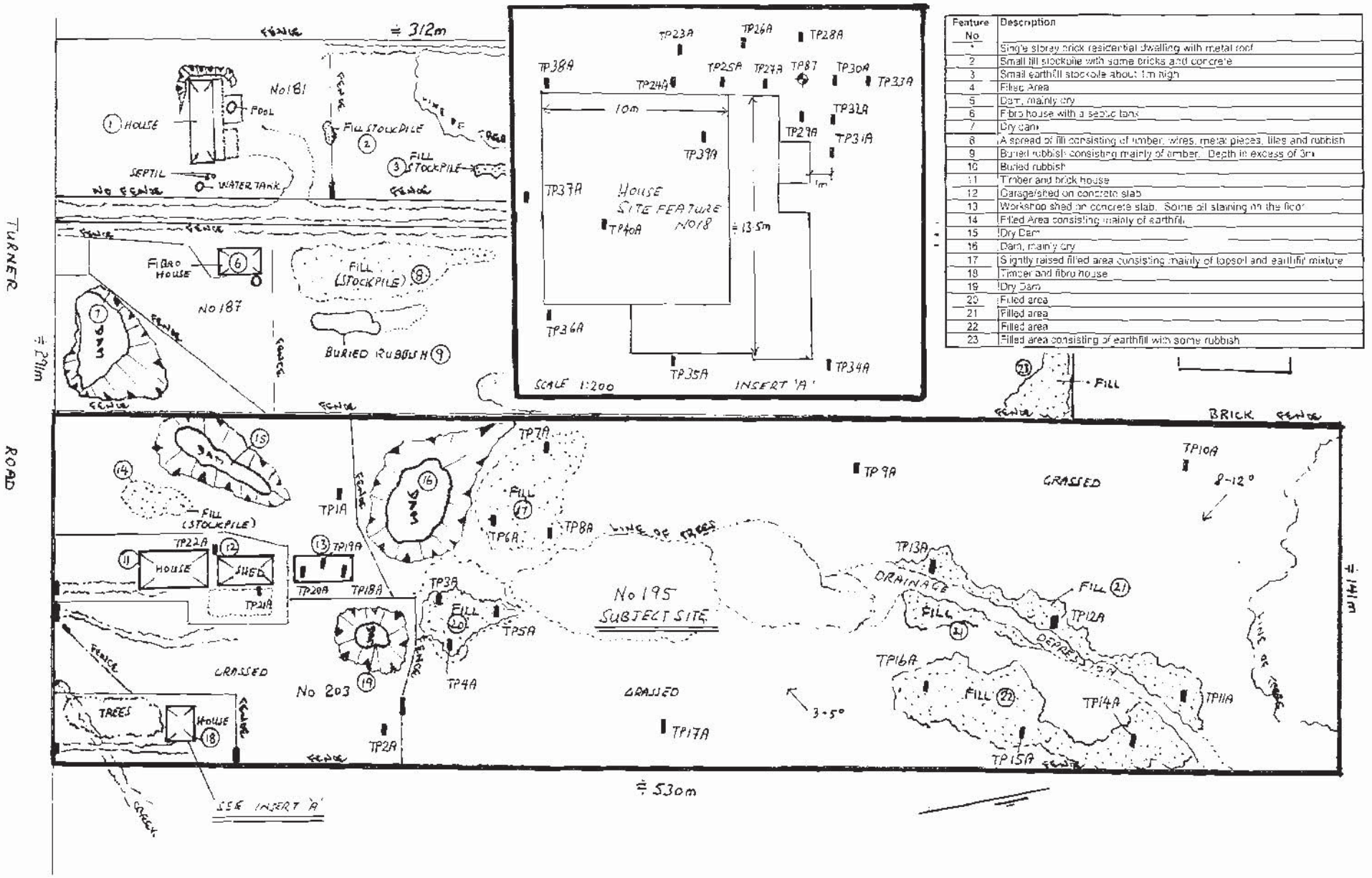
Note: EC – Electrical Conductivity (ds/m)
EC_e-Electrical Conducivity (ds/m)
CEC – Cation Exchange Capacity ($cmol^+/kg$)
ESP – Exchangeable Sodium Percentage (%)
SAR – Sodium Absorption Ratio
CL – Chloride (mg/kg)
SO4- Sulphate (mg.kg)

Sample	Depth (m)	Ph	EC	EC_e	CEC	ESP	CL	SO4
TP14A	0.0-0.1	7.5						
TP15A	0.0-0.1	7.8	0.094	1.3				
	0.5-0.6	6.2	0.62	5	11	37	910	<25
	2.4-2.5	7.8	0.76	6.5	21	32	1100	<25
TP16A	0.0-0.1	6.9						
TP18A	0.3-0.4	8						
TP19A	0.1-0.2	6.3						
TP20A	0.1-0.2	6.6						
TP21A	0.0-0.1	7.7						
TP22A	0.0-0.1	5.7						
TP40A	0.0-0.1	5.5						

Note: EC – Electrical Conductivity (ds/m)
EC_e-Electrical Conducivity (ds/m)
CEC – Cation Exchange Capacity ($cmol^+/kg$)
ESP – Exchangeable Sodium Percentage (%)
SAR – Sodium Absorption Ratio
CL – Chloride (mg/kg)
SO4- Sulphate (mg.kg)

Emerson Class

Sample	Material Description	Class	Description
TP1A(1.1-1.2m)	Silty Clay, high plasticity, red brown	1	Very High Dispersion
TP 1A(2.4-3.0m)	Gravelly Silty Clay, medium plasticity, yellow brown	1	Very High Dispersion
TP2A (0.4-0.5m)	Silty Clay, high plasticity, yellow brown	2	High Dispersion
TP 2A (2.3-2.4m)	Gravelly Silty Clay: medium plasticity, orange brown	1	Very High Dispersion
TP 9A (1.5-1.6m)	Silty Clay/Gravelly Silty Clay, medium plasticity, grey brown	1	Very High Dispersion
TP 9A (3.2-3.3m)	Gravelly Shaley Clay, medium plasticity, brown	1	Very High Dispersion
TP 10A (0.4-0.5m)	Silty Clay: high plasticity, yellow brown	2	High Dispersion
TP 10A (2.2-2.3m)	Silty Clay, medium plasticity, grey mottled yellow brown	5	Slight Dispersion
TP 15A (0.5-0.6m)	Silty Clay, medium to high plasticity, yellow brown	1	Very High Dispersion
TP 15A (2.4-2.5m)	Gravelly Silty Clay: medium plasticity, grey brown	2	High Dispersion



Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, tiles and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

Legend

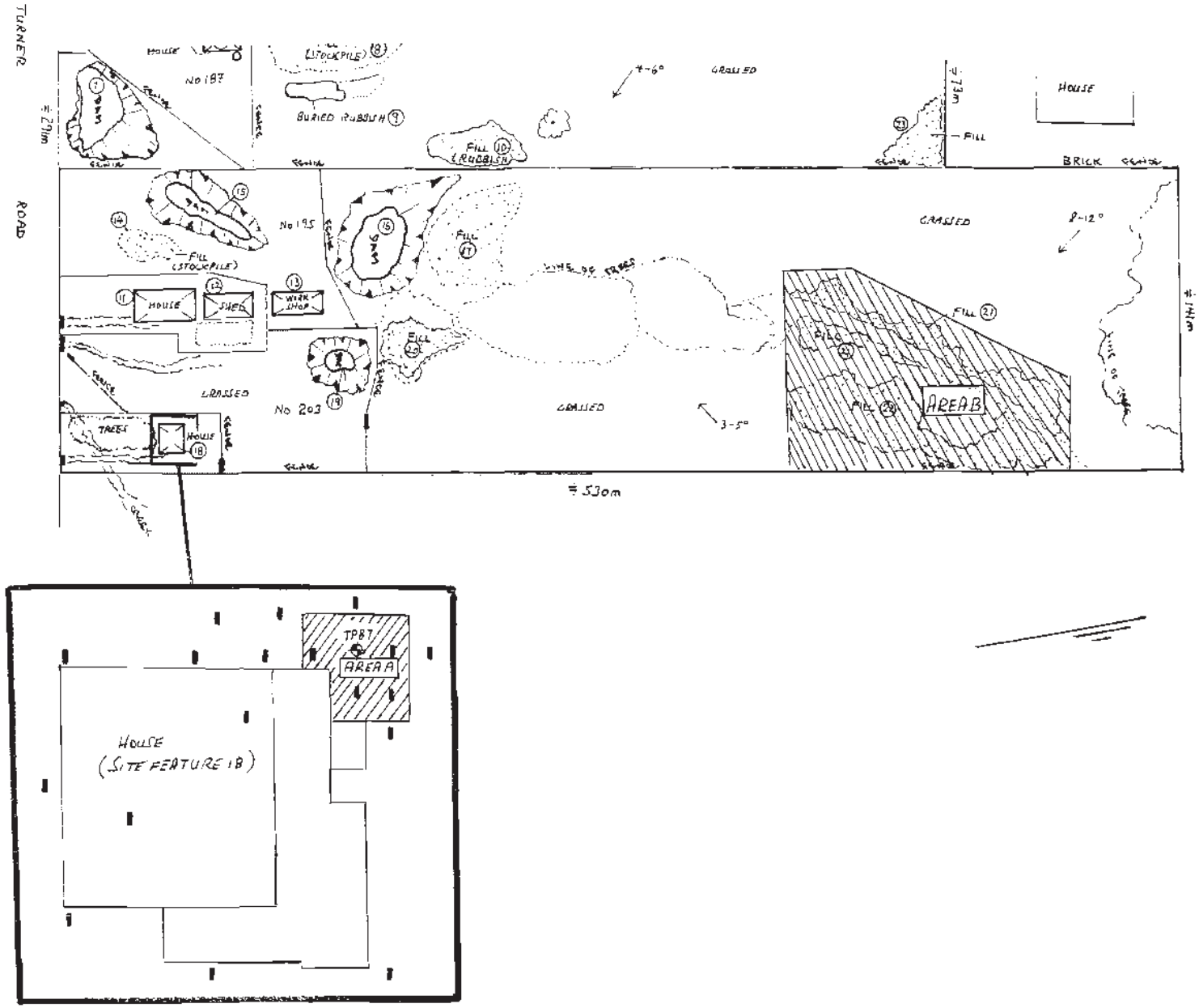
- Test Pit
- (11) SITE FEATURE No 11
- PREVIOUS TEST PIT 2004

GeoEnviro Consultancy

Drawn By:	SL	Date: 16/3/09	
Checked By:	SL	Date: 16/3/09	
Revision By:		Date:	
Scale:	Proportional	A3	

Mr Jim and Ms Vanessa Driver
Nos 195-203 Turner Road Currans Hill
Sampling Location Plan

Project No: JC04031A-r5 | Drawing No: 1A



Legend

Remediation Area B

GeoEnviro Consultancy

Drawn By: SL	Date: 16/3/09	Mr Jim and Ms Vanessa Driver	
Checked By: SL	Date: 16/3/09	Nos 195-203 Turner Road Currans Hill	
Revision By:	Date:	Remediation Area Plan	
Scale: Proportional	A3	Project No: JC04031A-rs	Drawing No: 2A

Test Pit Number	Depth (m)	Profile Type	Description
100	0.0-0.5	Topsoil/Fill	Clayey silt mixed with silt and some gravel, light grey and brown, dry
	0.5-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and grey, MC<=PL, PP>600kPa
101	0.0-0.7	Topsoil/Fill	Silt with gravel and some clayey silt, grey, dry to moist
	0.7-1.0	Natural	(CI) Silty Clay: medium plasticity, yellow and red/brown, MC<=PL, hard
102	Dam Embankment	Fill	Clayey silt and silty clay high plasticity and some gravel, brown, moist
103	0.0-0.3	Topsoil/Fill	Clayey silt with some gravel, brown, dry to moist
	0.3-0.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown, dry, hard
104	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.4	Natural	(CH) Silty Clay: high plasticity, red and brown, with some gravel, dry to moist, hard, MC<=PL, PP>600kPa
105	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
	1.0-1.9	Natural	(CI) Gravelly Silty Clay: medium plasticity, brown, very hard, MC<PL, PP>600kPa
106	0.0-0.8	Fill	Silty clay and some silt mixed with some gravel, grey and brown, dry
	0.8-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, dry, hard
107	Dam Embankment	Fill	Mixture of clayey silt, silty clay of high plasticity and some gravel, yellow/brown and dark brown/grey, moist
108	Dam Embankment	Fill	Mixed clayey silt, silty clay of high/medium to high plasticity, some gravel, yellow and brown and dark brown/grey, moist
109	Dam Embankment	Fill	Mixture of silty clay and clayey silt, silty clay of high plasticity with some gravel, yellow/brown and dark grey and dark brown, moist
110	0.0-0.7	Fill	Silty clay of medium plasticity mixed with gravel, some silt, some clayey silt, some sandstone cobbles, brown, dry to moist
	0.7-1.0	Topsoil	Silt, low liquid limit, light grey, dry
	1.0-1.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, MC<=PL, hard
111	0.0-0.8	Fill	Mixed silty clay with silt and sandstone gravel/cobbles, brown, moist
	0.8-1.0	Topsoil	Silt, with some clayey silt, grey, dry
	1.0-1.3	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and yellow, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

TABLE 1 (Page 10 of 11)
SUMMARY OF SOIL PROFILE

Test Pit Number	Depth (m)	Profile Type	Description
112	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
113	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry to moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, MC<=PL, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 11 of 11)
SUMMARY OF SOIL PROFILE

Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Test Pit Number	Depth (m)	Profile Type	Description
1A	0.0-0.1	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.1-0.6	Fill	Silty Clay: medium to high plasticity, brown loose
	0.6-0.7	Natural	Clayey Silt, low liquid limit, brown dry
	0.7-1.7	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
	1.7-2.7	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey brown, moist to wet with a trace of fine gravel
	2.7-3.3	Natural	(CI) Silty Clay: medium plasticity, brown and grey some minor groundwater seepage at about 3.0m
2A	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.3-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
	1.2-2.1	Natural	As above but pale brown, MC<PL, hard, PP>600kPa
	2.1-3.1	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey brown, with some ironstone gravel, MC<PL
	3.1-3.5	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
3A	0.0-0.2	Fill	Clayey Silt, low liquid limit, brown and grey, dry, a trace of fine gravel
	0.2-0.8	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, dark red and brown, MC<PL, PP>600kPa
4A	0.0-0.3	Fill	Mixture of silty clay medium plasticity with some gravel and with some silt, yellow brown and grey, moist to wet
	0.3-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, some sand, dark red and brown, MC<PL, PP>600kPa
5A	0.0-0.4	Fill/Topsoil	Mixture of silty clay medium plasticity with some gravel and with some silt, yellow brown and grey, moist to wet
	0.4-1.1	Natural	(CI-CH) Silty Clay: medium to high plasticity, some sand, brown, very stiff
6A	0.0-0.2	Fill/Topsoil	Clayey Silt with gravel and some sand, some clayey silt, grey and red/brown, dry
	0.2-0.5	Fill	Silty Clay: medium plasticity, red brown and dark brown , MC<PL
	0.5-1.1	Natural	(CI) Sillty Clay: medium plasticity, orange brown , MC<PL, PP>600kPa
7A	0.0-0.2	Fill/Topsoil	Clayey Silt/Silty Clay: low liquid limit, low plasticity with gravel dry
	0.2-0.5	Fill	Silty Clay: medium plasticity, red brown , a trace of gravel
	0.5-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, MC<PL, PP>600kPa
8A	0.0-0.2	Fill/Topsoil	Silty clay with gravel and some sand, some clayey silt, grey and red/brown, dry
	0.2-0.8	Fill	Silty Clay/Clayey Silt : low to medium plasticity, red brown , a trace of gravel and sand
	0.8-1.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, MC<PL, PP>600kPa

Note:
PP = Pocket Penetrometer
MC = Moisture Content
PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1A (Page 1 of 4)
SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009
Checked By:_____Date:_____

Test Pit Number	Depth (m)	Profile Type	Description
9A	0.0-0.35	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.35-1.3	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.3-2.0	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	2.0-3.0	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey, with layers/bands of extremely weathered shale
	3.0-3.5	Natural	As above but medium to high plasticity, brown grey MC=PL
10A	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.2-2.0	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and brown, dry, MC<PL, PP>600kPa
	2.0-2.4	Natural	(CI) Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	2.4-3.0	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey, with layers/bands of extremely weathered shale
	3.0-3.7	Bedrock	Shale/Siltstone: extremely weathered, extremely low strength, grey and brown
11A	0.0-0.2	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.2-0.35	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.35-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, very hard, dry
12A	0.0-0.6	Fill	Mixture of silty clay and sandstone gravel, some shale and roadbase
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
13A	0.0-0.7	Fill	Silty Clay/Clayey Silt: low to medium plasicity, brown with a trace of concrete fragments
	0.7-1.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
14A	0.0-0.6	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
15A	0.0-0.4	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.4-0.5	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.5-1.3	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and brown, dry, MC<PL, PP>600kPa
	1.3-2.4	Natural	(CI) Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	2.4-3.1	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey, with layers/bands of extremely weathered shale

Note:

PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1A (Page 2 of 4)

SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009

Checked By:_____Date:_____

Test Pit Number	Depth (m)	Profile Type	Description
16A	0.0-0.2	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.2-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
17A	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.0-1.7	Natural	(CI) Silty Clay: medium plasticity, grey, some shale gravel, MC<=PL, PP>600kPa
	1.7-1.8	Bedrock	Shale: extremely weathered/Interbedded with gravelly shaley clay, grey and brown, dry to moist
18A	0.0-0.15	Slab	Concrete : 150mm thick
	0.15-0.3	Subbase	Sand: fine to medium grained, brown
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown MC<PL, some gravel
	0.6-0.7	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey
19A	0.0-0.07	Slab	Concrete : 150mm thick
	0.07-0.5	Fill	Silty Clay: medium plasticity, brown, MC<PL some gravel
	0.5-0.9	Fill	Gravelly Silty Clay: medium plasticity, some ironstone gravel,
20A	0.0-0.11	Slab	Concrete : 150mm thick
	0.11-0.25	Fill	Gravelly Silty Clay: medium plasticity, some ironstone gravel,
21A	0.0-0.1	Fill	Silty Sandy Gravel
	0.1-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, hard, PP>600kPa
22A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
23A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
24A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity,grey mottled brown, MC<=PL, hard
25A	0.0-0.1	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.1-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa

Note:

PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1A (Page 3 of 4)

SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009

Checked By:_____Date:_____

Test Pit Number	Depth (m)	Profile Type	Description
26A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
27A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, red brown, MC<=PL, hard
28A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
29A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey brown, hard, PP>600kPa
30A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, red brown and grey, MC<=PL, hard, PP>600kPa
31A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red brown
32A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
33A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.45	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red brown
34A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red brown
35A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.45	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
36A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.45	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey brown, hard, PP>600kPa
37A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
38A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey brown, hard, PP>600kPa
39A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
40A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa

Note:

PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1A (Page 4 of 4)

SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009

Checked By:_____Date:_____

Sample	Depths	Sample Date	Sample Type	Analysis														
					Heavy Metals								OCP	OPP	PCB	TRH	BTEX	PAH
				pH	Cu	Pb	Zn	Cd	Cr	Ni	As	Hg						
TP1A	0.0-0.1	9/02/2009	Soil	o														
TP1A	1.1-1.2	9/02/2009	Soil	o														
TP1A	2.4-3.0	9/02/2009	Soil	o														
TP2A	0.0-0.1	9/02/2009	Soil	o														
TP2A	0.4-0.5	9/02/2009	Soil	o														
TP2A	2.3-2.4	9/02/2009	Soil	o														
TP3A	0.0-0.1	9/02/2009	Soil															
TP3A	0.4-0.5	9/02/2009	Soil															
TP4A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP4A	0.4-0.5	9/02/2009	Soil															
TP5A	0.0-0.1	9/02/2009	Soil															
TP5A	0.4-0.5	9/02/2009	Soil															
TP6A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP6A	0.4-0.5	9/02/2009	Soil															
TP8A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
TP8A	0.4-0.5	9/02/2009	Soil															
TP8A	1.0-1.1	9/02/2009	Soil															
TP9A	0.0-0.1	9/02/2009	Soil	o														
TP9A	1.5-1.6	9/02/2009	Soil	o														
TP9A	3.2-3.3	9/02/2009	Soil	o														
TP10A	0.0-0.1	9/02/2009	Soil	o														
TP10A	0.4-0.5	9/02/2009	Soil	o														
TP10A	2.2-2.3	9/02/2009	Soil	o														
TP11A	0.0-0.1	9/02/2009	Soil															
TP11A	0.4-0.5	9/02/2009	Soil															
TP12A	0.0-0.1	9/02/2009	Soil	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o

Note: O denotes tested

GeoEnviro Consultancy

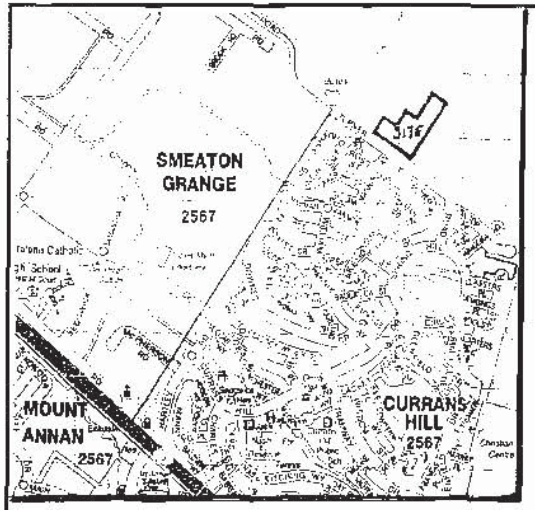
TABLE 2A (Page 1 of 3)

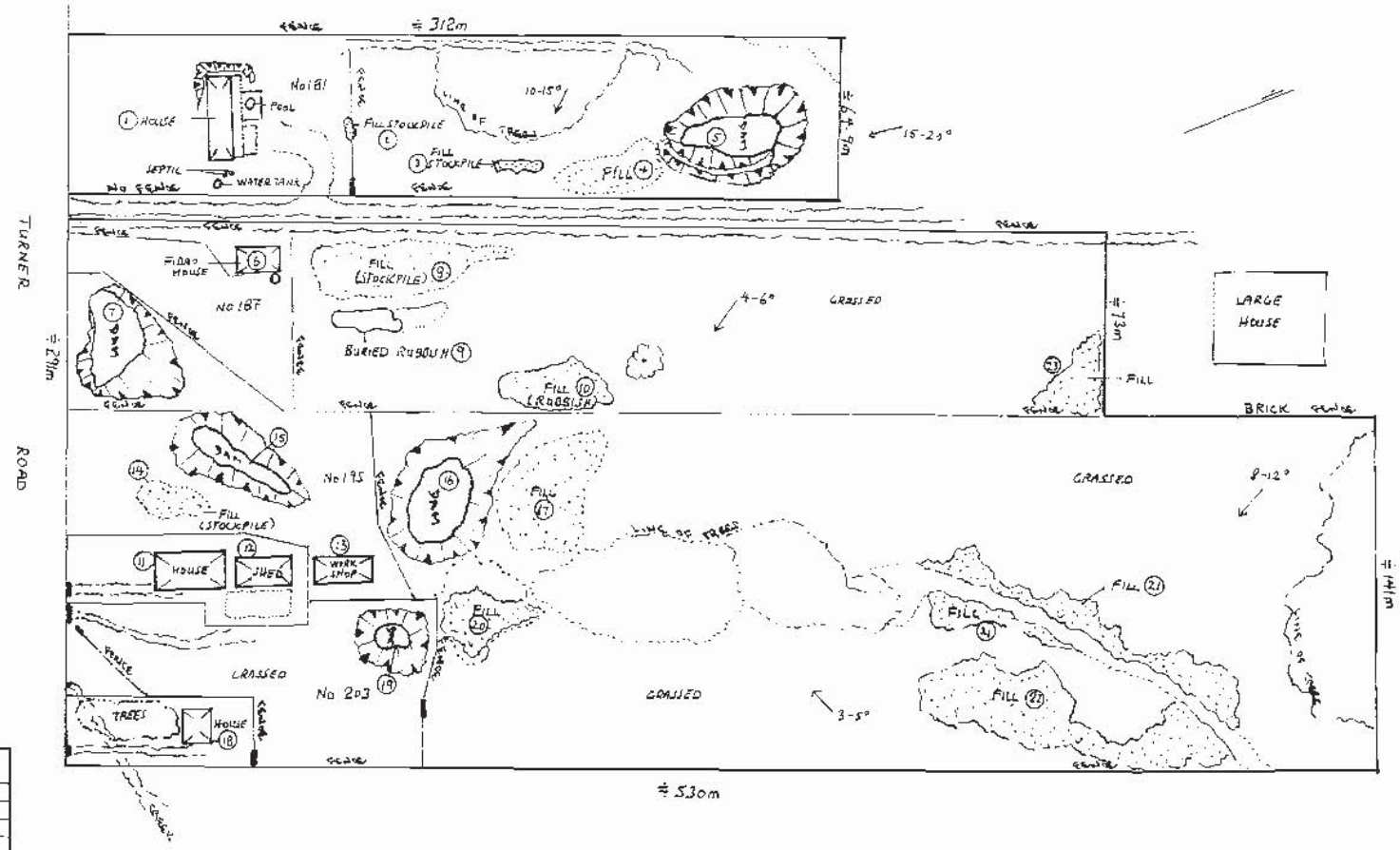
Analytical Program

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie





Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, ties and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

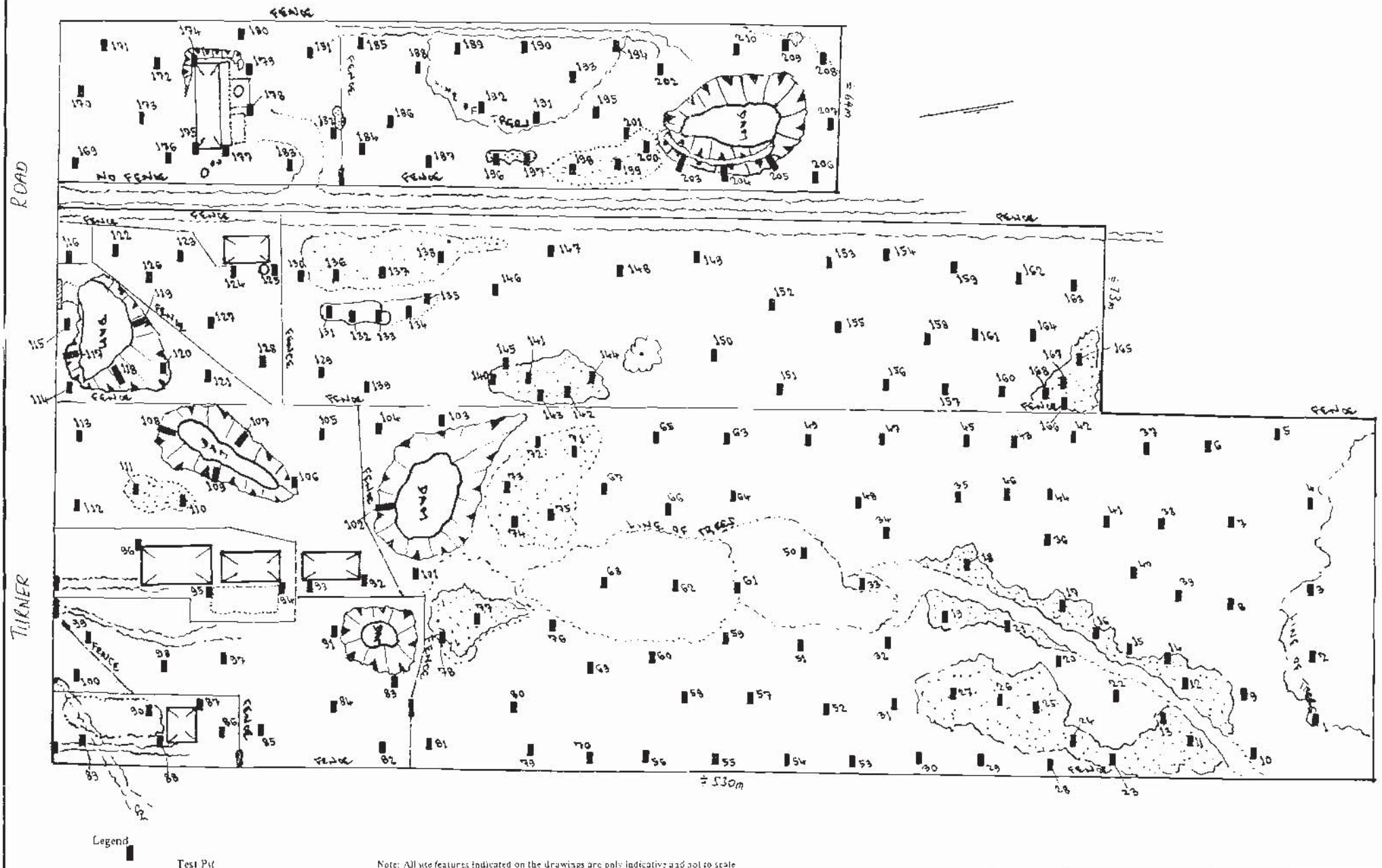
LEGEND

6° → SLOPE DOWN AT 6°

Note: All site features indicated on the drawings are only indicative and not to scale

GeoEnviro Consultancy

Drawn By:	SL	Date: 22/0/04	Australand Holdings Ltd
Checked By:	SL	Date: 22/0/04	No 181, 187, 195-203 Turner Road, Currans Hill
Revision By:		Date:	Site Locality and Features Plan
Scale:	1:2000 (approx)	A3	Project No: JC04031A / Drawing No: 1



Note: All site features indicated on the drawings are only indicative and not to scale

GeoEnviro Consultancy

Drawn By:	SL	Date : 22/3/04	Australand Holdings Ltd
Checked By:	SL	Date : 22/3/04	No 181, 187, 195-203 Turner Road, Currans Hill
Revision By:		Date:	Test Pit Location Plan
Scale:	Proportional	A3	Project No: JC04031A / Drawing No: 2

Test Pit Number	Depth (m)	Profile Type	Description
1	0.0-0.4	Topsoil	Silt, low liquid limit, light grey, dry
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, with some gravel, MC<=PL, hard, PP>600kPa
2	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, MC<PL, PP>600kPa
3	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, very hard, MC<PL, PP>600kPa
	1.2-1.4	Natural	(CI) Gravelly Silty Clay: medium plasticity, red brown and grey, MC<PL, PP>600kPa
4	0.0-0.4	Topsoil	Clayey Silt, some gravel, brown, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, red and grey, MC<PL, PP>600kPa
5	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.1	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<PL, hard, PP>600kPa
	1.1-1.3	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey, MC<PL, PP>600kPa
	1.3-1.6	Bedrock	Shale/Siltstone: extremely to distinctly weathered, extremely to very low strength, grey and brown
	1.6		Backhoe refusal
6	0.0-0.7	Topsoil/Fill	Clayey silt with silt, dark brown and brown, dry, hard
	0.7-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and brown, MC<PL, PP>600kPa
7	0.0-0.5	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.5-0.9	Natural	(CH) Silty Clay: high plasticity, grey and brown, MC<=PL, PP>600kPa
8	0.0-0.6	Topsoil	Clayey Silt, dark grey and dark brown, dry to moist
	0.6-1.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<PL, PP>600kPa
	1.5-2.8	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, red/grey and brown, some sand, MC<=PL, PP>600kPa
	2.8-3.3	Bedrock	Shale/Siltstone: extremely weathered, extremely low strength, grey and brown
9	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<PL, PP>600kPa
10	0.0-0.5	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.5-0.7	Natural	(CH) Silty Clay: high plasticity, yellow brown, dry, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 1 of 11)
SUMMARY OF SOIL PROFILE

Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Test Pit Number	Depth (m)	Profile Type	Description
11	0.0-0.3	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete, with some shale gravel, grey and brown
	0.3-0.6	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, very hard, dry
12	0.0-1.0	Fill	Mixture of sandstone gravel/cobbles with silty clay and some roadbase, small pieces of asphaltic concrete, small pieces of concrete, brown and grey, moist
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry
13	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.4-0.8	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow, dry, PP>600kPa
14	0.0-0.4	Fill	Mixture of sandstone gravel/cobbles, silty clay, some roadbase, small pieces of asphaltic concrete, small pieces of concrete, brown/grey, moist
	0.4-0.6	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.6-0.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<PL, hard, PP>600kPa
15	0.0-0.3	Topsoil	Clayey Silt and Silt, low liquid limit, grey, dry
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow brown, dry, PP>600kPa
16	0.0-0.6	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete, some shale gravel, grey and brown
	0.6-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, PP>600kPa
17	0.0-1.0	Fill	Mixture of silty clay, sandstone gravel, shale, roadbase, asphalt pieces, some small pieces of concrete, brown and grey, moist
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry
18	0.0-0.7	Fill	Mixture of silty clay and sandstone gravel, some shale and roadbase, asphalt pieces, some small pieces of concrete, brown and grey, moist
	0.7-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
19	0.0-0.2	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete and with shale gravel, grey and brown, dry to moist
	0.2-0.4	Topsoil	Clayey Silt, brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, MC<PL, hard, PP>600kPa
20	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow/brown, hard, MC<PL
21	0.0-0.1	Fill	Mixed silty clay and clayey silt and sandstone gravel, some roadbase, dark grey, moist
	0.1-0.4	Topsoil	Clayey Silt, low liquid limit, some gravel, grey and brown, dry
	0.4-0.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

TABLE 1 (Page 2 of 11)
SUMMARY OF SOIL PROFILE

Test Pit Number	Depth (m)	Profile Type	Description
22	0.0-0.3	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete and with shale gravel, brown and dark grey, dry
	0.3-0.6	Topsoil	Clayey Silt, some gravel, brown, dry
	0.6-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, MC<PL, hard, PP>600kPa
23	0.0-0.2	Fill	Mixture of silty clay and some silt with sandstone gravel/cobbles and roadbase, some small pieces of concrete, some pieces of asphaltic concrete, some sand, dark grey and brow
	0.2-0.4	Topsoil	Clayey Silt, brown, dry
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
24	0.0-0.4	Fill	Mixture of silty clay, silt, some sandstone gravel/cobbles and roadbase, some small pieces of concrete, some pieces of asphaltic concrete, some sand, brown and grey, dry
	0.4-0.7	Topsoil	Clayey Silt, brown, dry
	0.7-1.0	Natural	(CH) Silty Clay: high plasticity, yellow/brown, MC<=PL, hard
25	0.0-0.6	Fill	Mixed silty clay and clayey silt and concrete pieces, sandstone, some asphalt, brown, dry to moist
	0.6-0.9	Topsoil	Clayey Silt and Silt, some gravel, grey, dry
	0.9-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, PP>600kPa
26	0.0-0.4	Fill	Mixed silty clay/clayey silt and some concrete pieces, sandstone gravel, with some asphalt, brown and grey, dry to moist
	0.4-0.7	Topsoil	Clayey Silt and Silt, some gravel, grey, dry
	0.7-0.9	Natural	(CH) Silty Clay: high plasticity, yellow, dry, hard
27	0.0-0.8	Fill	Mixed silty clay and topsoil, silt and some concrete pieces, sandstone gravel, with some asphalt, dark brown and grey, dry to moist
	0.8-1.0	Topsoil	Silt and Clayey Silt, with some gravel, grey, dry
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, yellow/brown, dry, hard
28	0.0-0.2	Topsoil	Clayey Silt, with some gravel, brown and grey, dry
	0.2-0.4	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, MC<PL, PP>600kPa
29	0.0-0.3	Topsoil	Clayey Silt and Silt, low liquid limit, brown/grey, dry
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, PP>600kPa
30	0.0-0.4	Topsoil	Silt with some Clayey Silt, grey, dry
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, MC<PL, hard
31	0.0-0.4	Topsoil	Clayey Silt, brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 3 of 11)
SUMMARY OF SOIL PROFILE

Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Test Pit Number	Depth (m)	Profile Type	Description
32	0.0-0.4	Topsoil	Clayey Silt, brown and grey, dry
	0.4-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<PL, PP>600kPa
33	0.0-0.6	Topsoil	Silt, some Clayey Silt, dark grey and light grey, dry
	0.6-1.2	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<PL, dry, PP>600kPa
	1.2-1.4	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey and red, MC<=PL, hard, PP>600kPa
34	0.0-0.5	Topsoil	Clayey Silt and Silt, low liquid limit, grey, dry
	0.5-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard
35	0.0-0.4	Topsoil	Clayey Silt, brown and grey, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow, MC<PL, hard
36	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, grey brown, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard
37	0.0-0.6	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.6-1.8	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<=PL, PP>600kPa
	1.8-2.6	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey and brown, MC<=PL, hard, PP>600kPa
38	0.0-0.5	Topsoil	Clayey Silt, dark brown and brown, dry
	0.5-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, PP>600kPa
39	0.0-0.4	Topsoil/Fill	Clayey silt, some gravel, dark brown and brown/grey, dry
	0.4-0.8	Topsoil	Silt with some Clayey Silt, grey, dry
	0.8-1.6	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and dark brown, very hard, very dry, MC<PL, PP>600kPa
40	0.0-0.4	Topsoil/Fill	Clayey silt, dark brown, dry
	0.4-0.7	Topsoil	Silt, some Clayey Silt, light grey, dry
	0.7-1.6	Natural	(CI-CH) Silty Clay/Gravelly Silty-Sandy Clay: medium to high plasticity, dark red and dark brown, very hard, very dry, MC<PL, PP>600kPa
41	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.3-1.0	Natural	(CI) Silty Clay: medium plasticity, dark brown and red, some gravel, MC<=PL, PP>600kPa
42	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-1.6	Natural	(CH) Silty Clay: high plasticity, yellow, dry/moist, MC<=PL, PP>600kPa
	1.6-2.2	Natural	(CI-CH) Gravelly Silty Clay: medium to high plasticity, red/brown and dark red, some sand, MC<PL, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

TABLE 1 (Page 4 of 11)
SUMMARY OF SOIL PROFILE

GeoEnviro Consultancy

Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Test Pit Number	Depth (m)	Profile Type	Description
43	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<=PL, PP>600kPa
44	0.0-0.4	Topsoil	Clayey Silt, some gravel, dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow, MC<=PL, PP>600kPa
45	0.0-0.3	Topsoil	Clayey silt, brown and dark brown, dry
	0.3-0.5	Topsoil	Silt, light grey, very dry
	0.5-1.3	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, hard
46	0.0-0.3	Topsoil	Clayey silt, dark brown, moist
	0.3-0.4	Topsoil	Silt, light grey, very dry
	0.4-0.9	Natural	(CH) Silty Clay: high plasticity, yellow/brown, moist, MC<=PL, PP>600kPa
47	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, brown and yellow, moist, hard
48	0.0-0.4	Topsoil	Clayey Silt and Silt, brown, dry to moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry and hard, some gravel, MC<=PL, PP>600kPa
49	0.0-0.3	Topsoil	Clayey Silt and Silt with some gravel, brown and grey, moist
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and yellow , MC<PL, hard
50	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.3-1.1	Natural	(CH) Silty Clay: high plasticity, red/orange and yellow, some gravel, moist, hard
51	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.0-1.5	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and brown, dry, MC<PL, PP>600kPa
	1.5-1.7	Bedrock	Shale/Siltstone: extremely weathered, extremely low strength, grey and brown
52	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry to moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, hard
53	0.0-0.3	Topsoil	Clayey Silt, some gravel, brown, dry to moist
	0.3-0.8	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, very dry and very hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

TABLE 1 (Page 5 of 11)
SUMMARY OF SOIL PROFILE

Test Pit Number	Depth (m)	Profile Type	Description
54	0.0-0.3	Topsoil	Clayey Silt, some gravel, brown, moist
	0.3-0.5	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, PP>600kPa
55	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.2-1.8	Natural	(CI) Silty Clay: medium plasticity, grey, some shale gravel, MC<=PL, PP>600kPa
	1.8-2.4	Bedrock	Shale: extremely weathered/Interbedded with gravelly shaley clay, grey and brown, dry to moist
56	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, hard
57	0.0-0.3	Topsoil	Clayey Silt, some gravel, brown, moist
	0.3-0.9	Natural	(CH) Silty Clay: high plasticity, yellow, hard, MC<=PL, PP>600kPa
58	0.0-0.3	Topsoil	Clayey Silt, with some gravel, brown, dry/moist
	0.3-0.5	Natural	(CH) Silty Clay: high plasticity, yellow/brown, MC<PL, hard
59	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown and brown, dry to moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and red/brown, MC<=PL, hard
60	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-1.3	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.3-1.9	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	1.9-2.2	Natural	(CL) Gravelly Shaley Clay: low plasticity, grey, with layers/bands of extremely weathered shale
	2.2-2.4	Bedrock	Shale: extremely weathered, extremely low strength, grey and brown
61	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, dark brown, dry to moist
	0.2-0.5	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, PP:480-560kPa
62	0.0-0.3	Topsoil	Clayey Silt, brown, moist
	0.3-0.9	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
63	0.0-0.2	Topsoil	Clayey Silt, brown, some gravel, moist
	0.2-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard
64	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and red, MC<PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

TABLE 1 (Page 6 of 11)
SUMMARY OF SOIL PROFILE

GeoEnviro Consultancy

Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Test Pit Number	Depth (m)	Profile Type	Description
65	0.0-0.3	Topsoil	Clayey Silt, brown, dry to moist
	0.3-1.4	Natural	(CH) Silty Clay: high plasticity, red/grey and brown, MC<PL, very hard
66	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry/moist
	0.3-1.6	Natural	(CH) Silty Clay: high plasticity, red/brown and grey, with some gravel, MC<=PL, hard, PP>600kPa
	1.6-2.4	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, dark red and dark brown/grey, very dry and very hard, MC<PL, PP>600kPa
67	0.0-0.3	Topsoil	Clayey Silt with Silt, grey and brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, dry to moist, hard
68	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, with some gravel, dry/moist
	0.4-0.8	Natural	Silt/(CL) Silty Clay: low plasticity, grey and brown, dry, MC<PL, hard, PP>600kPa, with some fine to coarse gravel
	0.8-1.2	Natural	(CH) Silty Clay: high plasticity, red/brown and grey, with some gravel, MC<PL, hard, PP>600kPa
69	0.0-0.2	Topsoil	Clayey Silt, brown, moist
	0.2-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown/red, MC<=PL, PP>600kPa
70	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.2-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
71	0.0-0.7	Fill/Topsoil	Clayey silt and silty clay with gravel, brown/red and grey, dry
	0.7-1.2	Natural	(CI-CH) Silty Clay/Gravelly Silty-Sandy Clay: medium to high plasticity, dark brown and red, very hard, MC<PL, PP>600kPa
72	0.0-0.6	Fill/Topsoil	Clayey silt/silty clay with some gravel, brown and grey, dry
	0.6-1.5	Natural	(CI-CH) Gravelly Silty Clay: medium to high plasticity, some sand, MC<PL, PP>600kPa
73	0.0-0.8	Fill/Topsoil	Silty clay with gravel and some sand, some clayey silt, grey and red/brown, dry
	0.8-1.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, MC<PL, PP>600kPa
74	0.0-0.7	Fill/Topsoil	Clayey silt with silty clay and some gravel, brown/red and grey, dry
	0.7-1.2	Natural	(CI-CH) Silty Sandy Clay: medium to high plasticity, brown and red, dry, hard
75	0.0-0.5	Topsoil/Fill	Clayey silt mixed with some gravel, brown and grey, dry
	0.5-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry
76	0.0-0.6	Topsoil/Fill	Clayey silt and silty clay with some gravel, brown and grey, dry
	0.6-1.0	Natural	(CI-CH) Silty Sandy Clay: medium to high plasticity, red and grey, MC<=PL, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

TABLE 1 (Page 7 of 11)
SUMMARY OF SOIL PROFILE

GeoEnviro Consultancy

Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Test Pit Number	Depth (m)	Profile Type	Description
77	0.0-0.6	Fill	Silty clay mixed with sandstone gravel, some asphaltic concrete pieces, some clayey silt, dark brown and grey, moist to wet profile
	0.6-1.0	Topsoil	Silt, with some clayey silt, light grey and brown, dry
	1.0-1.4	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, MC<PL, hard
78	0.0-0.7	Fill	Mixture of silty clay medium plasticity with some gravel and with some silt, yellow brown and grey, moist to wet
	0.7-0.9	Topsoil	Silt and some clayey silt, light grey, dry
	0.9-1.1	Natural	(CI) Silty Sandy Clay: medium plasticity, red and dark grey, MC<=PL, PP>600kPa
79	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.4-1.1	Natural	(CH) Silty Clay: high plasticity, yellow and red/brown, MC<=PL, hard, PP>600kPa
	1.1-1.9	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, dark red and brown, MC<PL, PP>600kPa
80	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.3-0.5	Natural	(CH) Silty Clay: high plasticity, red and grey, MC<PL, PP>600kPa
81	0.0-0.6	Fill/Topsoil	Clayey silt with silty clay, some gravel, brown/grey and yellow, moist
	0.6-1.0	Natural	(CI-CH) Silty Sandy Clay: medium to high plasticity, brown, MC<PL, hard
82	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
83	0.0-0.3	Topsoil/Fill	Silty clay and clayey silt with gravel, brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard
84	0.0-0.5	Topsoil/Fill	Clayey silt with silt and with some gravel, brown, moist
	0.5-1.4	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, grey yellow and brown, MC<PL, PP>600kPa, very hard and very dry
85	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, moist
	0.4-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow/brown and grey, MC<PL, PP>600kPa
86	0.0-0.4	Topsoil/Fill	Clayey silt, some gravel, brown and grey, moist
	0.4-0.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey and brown, dry, hard
87	0.0-0.3	Topsoil/Fill	Clayey silt with some gravel, brown, dry to moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

TABLE 1 (Page 8 of 11)
SUMMARY OF SOIL PROFILE

GeoEnviro Consultancy

Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Test Pit Number	Depth (m)	Profile Type	Description
88	0.0-0.4 0.4-0.6	Topsoil/Fill Natural	Clayey silt, some gravel, brown, dry to moist (CI-CH) Silty Clay: medium to high plasticity, brown, dry, hard
89	0.0-0.4 0.4-0.9	Topsoil/Fill Natural	Clayey silt with some gravel, dark brown and grey, moist (CH) Silty Clay: high plasticity, yellow and brown, dry, hard, PP>600kPa
90	0.0-0.4 0.4-0.6	Topsoil Natural	Clayey Silt, low liquid limit, dark grey and brown, dry (CH) Silty Clay: high plasticity, red and grey, MC<PL, PP>600kPa
91	0.0-0.6 0.6-1.0	Fill/Topsoil Natural	Clayey silt with gravel, brown and grey, moist (CI-CH) Silty Clay: medium to high plasticity, yellow and brown, MC<PL, hard
92	0.0-0.2 0.2-0.6	Fill Natural	Silty clay with sandstone and clayey silt, grey, moist (CH) Silty Clay: high plasticity, yellow/brown, dry, MC<PL, PP>600kPa
93	0.0-0.4 0.4-0.7	Fill Natural	Silty clay with gravel, some clayey silt, dark grey, moist (CI-CH) Silty Clay: medium to high plasticity, brown, MC<PL, hard
94	0.0-0.3 0.3-0.6	Fill/Topsoil Natural	Clayey silt with gravel, brown and grey, dry (CI-CH) Silty Clay: medium to high plasticity, brown, MC<PL, hard
95	0.0-0.3 0.3-0.6	Fill/Topsoil Natural	Clayey silt with some gravel, brown and grey, dry (CI-CH) Silty Clay: medium to high plasticity, brown, dry, hard
96	0.0-0.3 0.3-0.6	Fill/Topsoil Natural	Clayey silt with gravel, brown and grey, dry (CI-CH) Silty Clay: medium to high plasticity, brown, very hard, dry
97	0.0-0.3 0.3-0.5	Topsoil Natural	Clayey Silt, low liquid limit, dark brown, dry (CI-CH) Silty Clay: medium to high plasticity, brown and dark red, MC<PL, hard, PP>600kPa
98	0.0-0.4 0.4-0.9	Topsoil/Fill Natural	Clayey silt with some gravel, brown and grey, dry (CI-CH) Silty Clay: medium to high plasticity, yellow and brown, dry, MC<PL, hard, PP>600kPa
99	0.0-0.4 0.4-1.0	Topsoil Natural	Clayey Silt, low liquid limit, brown, moist (CH) Silty Clay: high plasticity, red and brown, with some gravel, MC<=PL, PP:380-460kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

TABLE 1 (Page 9 of 11)
SUMMARY OF SOIL PROFILE

GeoEnviro Consultancy

Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

APPENDIX B

Extracts of the Salinity/Contamination & RAP Report (Reference 3)

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia
PO Box 1543, Macquarie Centre. North Ryde, NSW 2113
ABN: 62 084 294 762
Tel: (02) 9679 8733
Fax: (02) 9679 8744
Email: geoenviro@exemail.com.au

Report

Salinity Assessment Update
Proposed Residential Development
Nos 187 and 195-203, Lots 36, 37 and 38 DP 28024
Turner Road, Currans Hills, NSW

Prepared for:-
Turner Developments
Harrington Park Plaza
Level 1, 23 Fairwater Drive
HARRINGTON PARK NSW 2567

Ref: JC04031A-r9
September 2015

3.2 Laboratory Test Results

The following is a summary of the laboratory test results obtained from the initial salinity assessment of 2004 (Reference 1);

Sample	Depth (m)	pH	EC	EC_e	CEC	ESP	SAR	CL	SO4
TP 8	0.0-0.2	5.9	0.2	2.8	11.2	0.2	1		
	0.8-1.0	8.1	0.36	2.2	21.1	7.1	6	240	100
	1.8-2.0	8.2	0.4	2.8	19.2	15.6	8.4	350	120
TP 40	0.0-0.2	5.7	0.14	1.9	10	0.3	1.3		
	0.5-0.7	6.4	0.06	0.4	7.9	0.5	2.2	25	46
	1.0-1.2	7	0.08	0.6	13.8	4.9	3.1	45	32
TP 51	0.0-0.2	5.9	0.13	1.8	7.3	0.4	3.7		
	0.5-0.7	5.8	0.87	5.2	17.7	19.5	14.2	1170	90
	1.0-1.2	5.4	0.9	6.3	15.1	19.7	43	1350	27
TP 98	0.0-0.2	5.6	0.19	2.6	11.3	0.4	2.5		
	0.8-0.7	5.3	0.31	2.2	13.7	9.5	4.8	350	57
	1.0-1.2	5.5	0.38	3.2	14.2	12.7	16.9	530	32
TP 122	0.0-0.2	5.7	0.15	2.1	9.4	0.2	1.2		
	0.5-0.7	6.1	0.18	1.1	15.3	9.2	2.5	50	80
	1.0-1.2	6.2	0.39	3.1	10.9	12.8	8.3	560	37
TP 146	0.0-0.2	5.3	0.11	1.5	4.2	0.3	1		
	0.5-0.7	5.5	0.15	1.1	14.1	8.5	6	100	73
	1.8-2.0	5.6	0.55	4.4	18.8	10.6	34.3	850	150
TP 171	0.0-0.2	5.6	0.22	3.0	14.3	0.4	1.5		
	0.5-0.7	5.7	0.17	1.2	19.4	5.2	1.9	75	85
	1.0-1.2	5.6	0.21	1.7	18.3	7.7	3.1	180	66
TP 185	0.0-0.2	5.7	0.16	2.2	7.7	0.3	0.5		
	0.5-0.7	6.7	0.46	2.8	20.2	18.3	8.9	570	44
	1.0-1.2	6.7	0.41	2.9	14.3	17.5	8.6	530	46
TP 191	0.0-0.2	5.1	0.37	5.0	13.7	0.4	1.6		
	0.5-0.7	4.3	0.29	1.7	19.3	4.6	7.1	120	150
	1.0-1.2	4.8	0.42	2.9	15.1	19.9	5.2	420	200

Note: EC – Electical Conductivity (ds/m)
EC_e-Electrical Conducivity (ds/m)
CEC – Cation Exchange Capacity ($cmol^+/kg$)
ESP – Exchangeable Sodium Percentage (%)
SAR – Sodium Absorption Ratio
CL – Chloride (mg/kg)
SO4- Sulphate (mg.kg)

Emerson Class

Sample	Class	Description
TP 8 (0.8-1.0m)	2	Partial Dispersion
TP 8 (1.8-2.0m)	2	Partial Dispersion
TP 51 (0.5-0.7m)	1	Complete Dispersion
TP 98 (1.0-1.2m)	2	Partial Dispersion
TP 122 (0.5-0.7m)	3	Partial Dispersion
TP 146 (1.8-2.0m)	6	Non Dispersion
TP 171 (0.5-0.7m)	5	Non Dispersion
TP 185 (1.0-1.2m)	2	Partial Dispersion
TP 191 (0.5-0.7m)	3	Partial Dispersion
TP 191 (1.0-1.2m)	2	Partial Dispersion

Particle Size Distribution

Sample	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
TP 8 (0.8-1.0m)	54	26	18	2
TP 40 (1.0-1.2m)	34	20	45	1
TP 51 (0.5-0.7m)	50	30	20	0
TP 98 (1.0-1.2m)	41	31	25	3
TP 122 (0.5-0.7m)	58	26	15	1
TP 146 (1.8-2.0m)	44	34	22	0
TP 171 (1.0-1.2m)	43	45	9	3
TP 191 (0.5-0.7m)	61	25	12	2

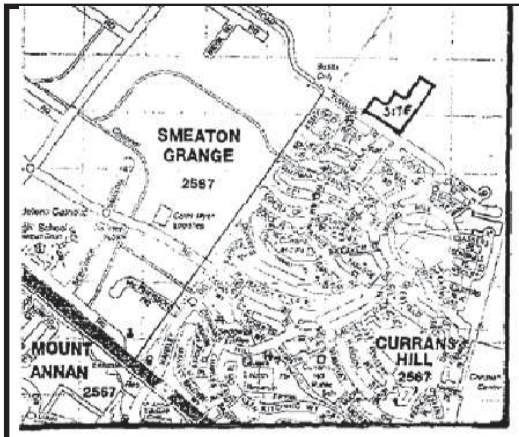
The following is a summary of the laboratory test results obtained from the additional salinity assessment of 2009 (Reference 2)

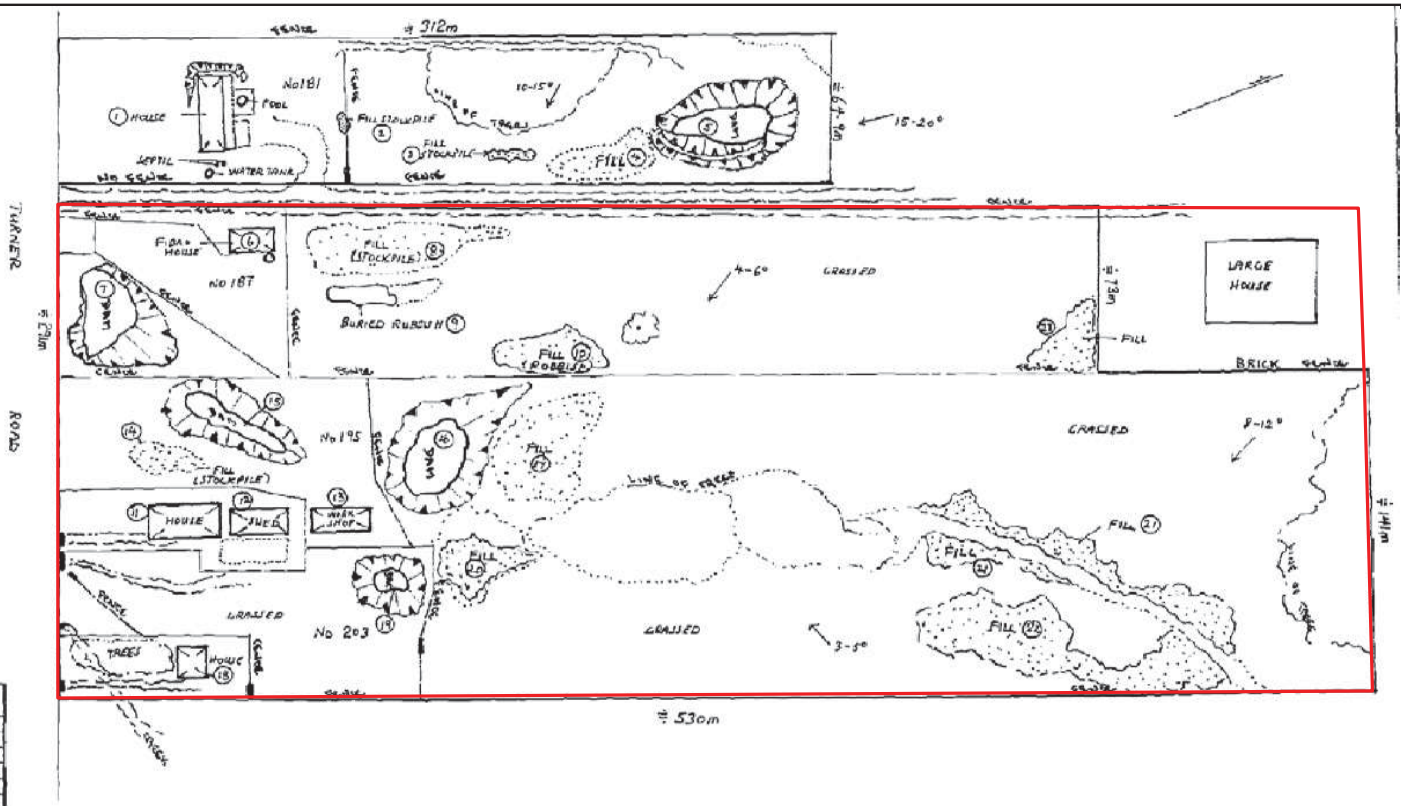
Sample	Depth (m)	Ph	EC	EC_e	CEC	ESP	CL	SO4
TP1A	0.0-0.1	6	0.075	1.1				
	1.1-1.2	6.2	0.91	7.3	22	39	1300	110
	2.4-3.0	8.4	0.15	1.3	15	22	160	<25
TP2A	0.0-0.1	6.3	0.044	0.6				
	0.4-0.5	7.8	0.21	1.7	29	11	370	61
	2.3-2.4	8.1	0.42	3.6	15	18	240	25
TP4A	0.0-0.1	5.9						
TP6A	0.0-0.1	6.2						
TP8A	0.0-0.1	6.1						
TP9A	0.0-0.1	6.5	0.018	0.3				
	1.5-1.6	8.2	0.43	3.4	26	22	530	57
	3.2-3.3	8.6	0.17	1.4	25	16	<100	26
TP10A	0.0-0.1	6.4	0.19	2.7				
	0.4-0.5	9.2	0.22	1.8	25	12	<100	<25
	2.2-2.3	8.4	0.33	2.8	44	8.5	220	<25
TP12A	0.0-0.1	6.7						
TP14A	0.0-0.1	7.5						
TP15A	0.0-0.1	7.8	0.094	1.3				
	0.5-0.6	6.2	0.62	5	11	37	910	<25
	2.4-2.5	7.8	0.76	6.5	21	32	1100	<25

Note: EC – Electrical Conductivity (ds/m)
EC_e-Electrical Conducivity (ds/m)
CEC – Cation Exchange Capacity ($cmol^+/kg$)
ESP – Exchangeable Sodium Percentage (%)
SAR – Sodium Absorption Ratio
CL – Chloride (mg/kg)
SO4- Sulphate (mg.kg)

Emerson Class

Sample	Material Description	Class	Description
TP1A(1.1-1.2m)	Silty Clay, high plasticity, red brown	1	Very High Dispersion
TP 1A(2.4-3.0m)	Gravelly Silty Clay, medium plasticity, yellow brown	1	Very High Dispersion
TP2A (0.4-0.5m)	Silty Clay, high plasticity, yellow brown	2	High Dispersion
TP 2A (2.3-2.4m)	Gravelly Silty Clay: medium plasticity, orange brown	1	Very High Dispersion
TP 9A (1.5-1.6m)	Silty Clay/Gravelly Silty Clay, medium plasticity, grey brown	1	Very High Dispersion
TP 9A (3.2-3.3m)	Gravelly Shaley Clay, medium plasticity, brown	1	Very High Dispersion
TP 10A (0.4-0.5m)	Silty Clay: high plasticity, yellow brown	2	High Dispersion
TP 10A (2.2-2.3m)	Silty Clay, medium plasticity, grey mottled yellow brown	5	Slight Dispersion
TP 15A (0.5-0.6m)	Silty Clay, medium to high plasticity, yellow brown	1	Very High Dispersion
TP 15A (2.4-2.5m)	Gravelly Silty Clay: medium plasticity, grey brown	2	High Dispersion





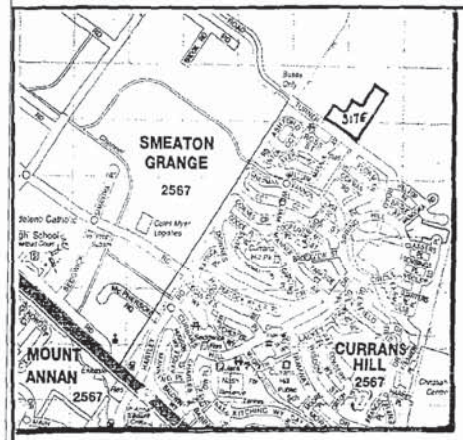
Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, tiles and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

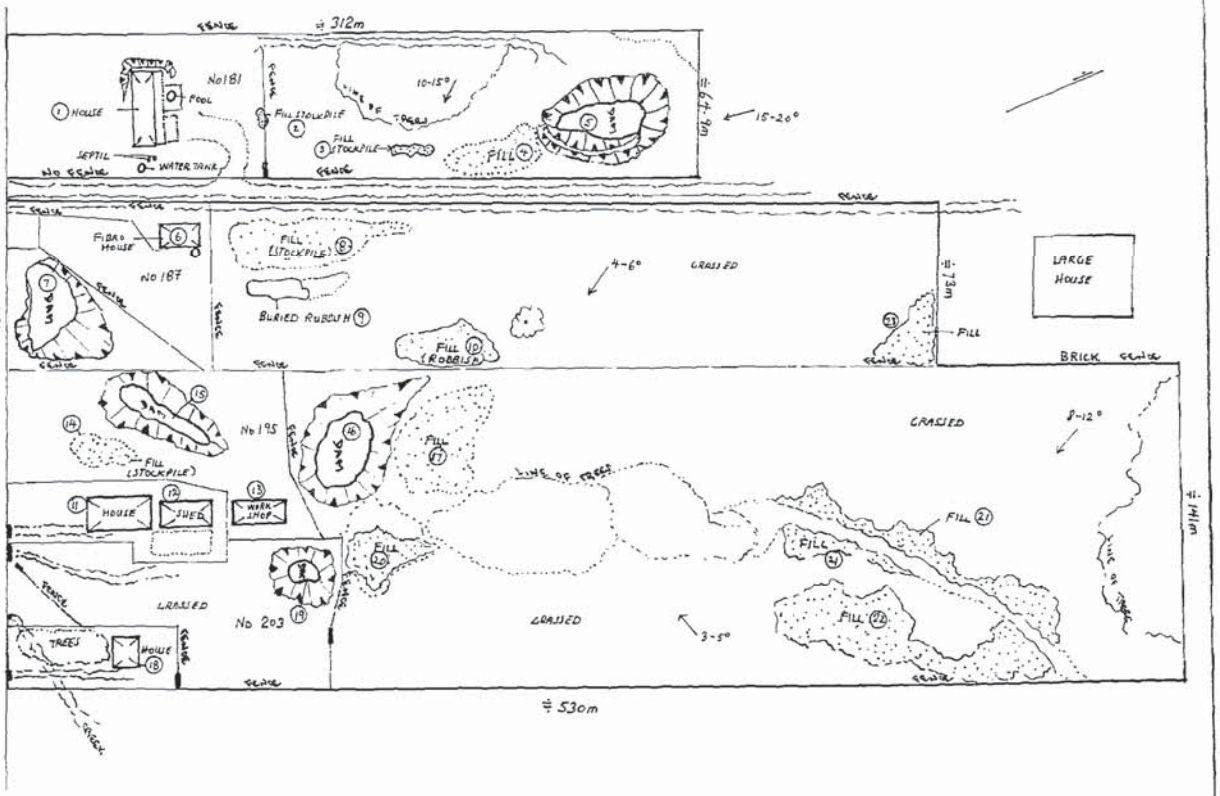
LEGEND

6° → SLOPE DOWN AT 6°

GeoEnviro Consultancy
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Drawn By: AT	Date: 12/08/15	Dartanyon Pty Ltd	
Checked By: SL	Date: 12/08/15	No 187 and 195-203 Turner Road Currans Hill	
Revision By:	Date:	Site Locality and Previous Site Feature Plan	
Scale: Proportional	A3	Project No: JC04031A-r9	Drawing No: 1





Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, tiles and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

LEGEND

6° → SLOPE DOWN AT 6°

Note: All site features indicated on the drawings are only indicative and not to scale

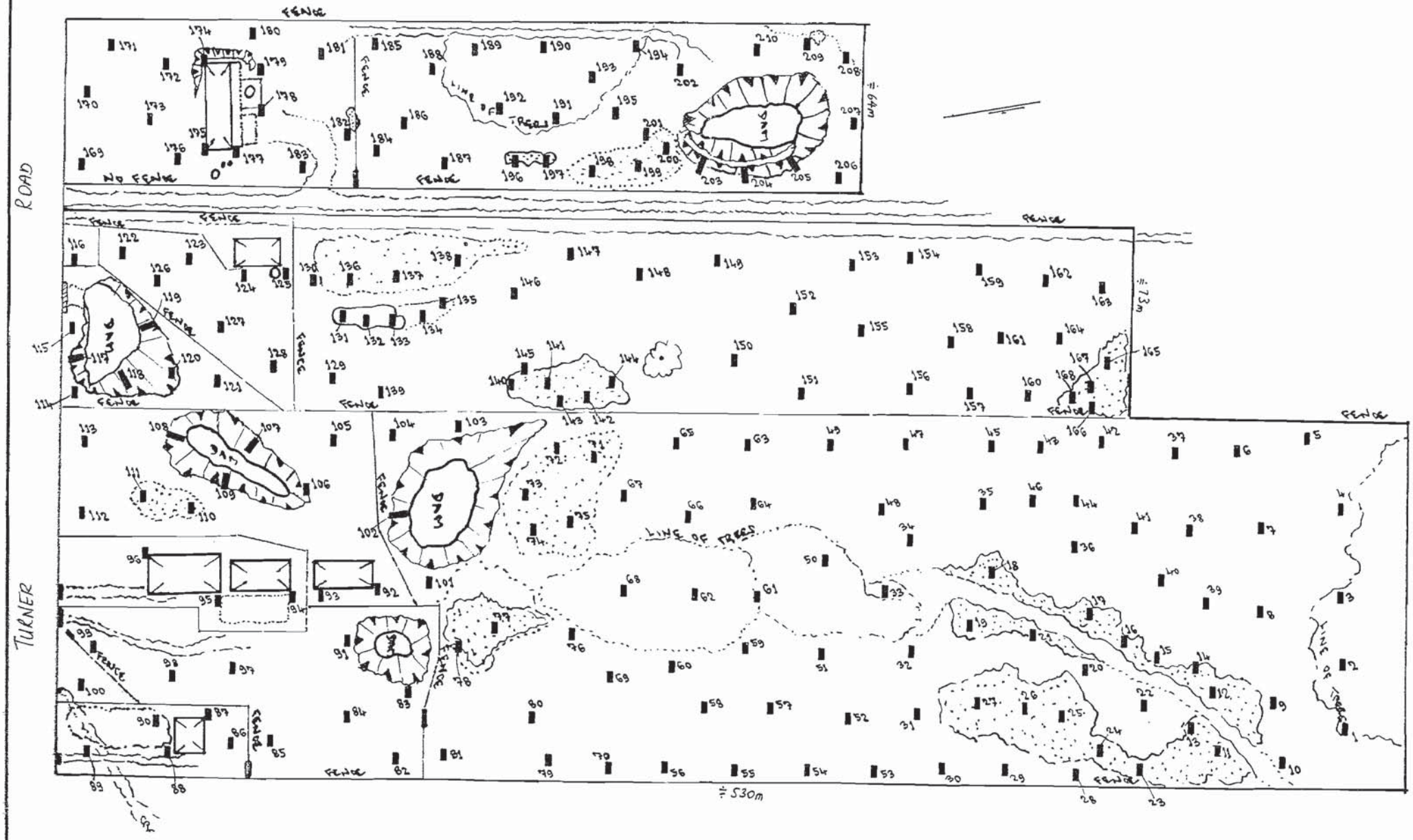
GeoEnviro Consultancy

Drawn By:	SL	Date: 22/3/04	
Checked By:	SL	Date: 22/3/04	
Revision By:		Date:	
Scale:	1:2000 (approx)		A3

Australand Holdings Ltd
No 181, 187, 195-203 Turner Road, Currans Hill
Site Locality and Features Plan

Project No: JC04031A

Drawing No: 1



Legend

Test Pit

Note: All site features indicated on the drawings are only indicative and not to scale

GeoEnviro Consultancy	Drawn By: SL	Date : 22/3/04	Australand Holdings Ltd
	Checked By: SL	Date : 22/3/04	No 181, 187, 195-203 Turner Road, Currans Hill
	Revision By:	Date:	Test Pit Location Plan
	Scale: Proportional	A3	Project No: JC04031A / Drawing No: 2

Test Pit Number	Depth (m)	Profile Type	Description
1	0.0-0.4	Topsoil	Silt, low liquid limit, light grey, dry
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, with some gravel, MC<=PL, hard, PP>600kPa
2	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, MC<PL, PP>600kPa
3	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, very hard, MC<PL, PP>600kPa
	1.2-1.4	Natural	(CI) Gravelly Silty Clay: medium plasticity, red brown and grey, MC<PL, PP>600kPa
4	0.0-0.4	Topsoil	Clayey Silt, some gravel, brown, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, red and grey, MC<PL, PP>600kPa
5	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.1	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<PL, hard, PP>600kPa
	1.1-1.3	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey, MC<PL, PP>600kPa
	1.3-1.6	Bedrock	Shale/Siltstone: extremely to distinctly weathered, extremely to very low strength, grey and brown
	1.6		Backhoe refusal
6	0.0-0.7	Topsoil/Fill	Clayey silt with silt, dark brown and brown, dry, hard
	0.7-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and brown, MC<PL, PP>600kPa
7	0.0-0.5	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.5-0.9	Natural	(CH) Silty Clay: high plasticity, grey and brown, MC<=PL, PP>600kPa
8	0.0-0.6	Topsoil	Clayey Silt, dark grey and dark brown, dry to moist
	0.6-1.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<PL, PP>600kPa
	1.5-2.8	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, red/grey and brown, some sand, MC<=PL, PP>600kPa
	2.8-3.3	Bedrock	Shale/Siltstone: extremely weathered, extremely low strength, grey and brown
9	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<PL, PP>600kPa
10	0.0-0.5	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.5-0.7	Natural	(CH) Silty Clay: high plasticity, yellow brown, dry, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 1 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
11	0.0-0.3	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete, with some shale gravel, grey and brown
	0.3-0.6	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, very hard, dry
12	0.0-1.0	Fill	Mixture of sandstone gravel/cobbles with silty clay and some roadbase, small pieces of asphaltic concrete, small pieces of concrete, brown and grey, moist
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry
13	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.4-0.8	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow, dry, PP>600kPa
14	0.0-0.4	Fill	Mixture of sandstone gravel/cobbles, silty clay, some roadbase, small pieces of asphaltic concrete, small pieces of concrete, brown/grey, moist
	0.4-0.6	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.6-0.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<PL, hard, PP>600kPa
15	0.0-0.3	Topsoil	Clayey Silt and Silt, low liquid limit, grey, dry
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow brown, dry, PP>600kPa
16	0.0-0.6	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete, some shale gravel, grey and brown
	0.6-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, PP>600kPa
17	0.0-1.0	Fill	Mixture of silty clay, sandstone gravel, shale, roadbase, asphalt pieces, some small pieces of concrete, brown and grey, moist
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry
18	0.0-0.7	Fill	Mixture of silty clay and sandstone gravel, some shale and roadbase, asphalt pieces, some small pieces of concrete, brown and grey, moist
	0.7-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
19	0.0-0.2	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete and with shale gravel, grey and brown, dry to moist
	0.2-0.4	Topsoil	Clayey Silt, brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, MC<PL, hard, PP>600kPa
20	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow/brown, hard, MC<PL
21	0.0-0.1	Fill	Mixed silty clay and clayey silt and sandstone gravel, some roadbase, dark grey, moist
	0.1-0.4	Topsoil	Clayey Silt, low liquid limit, some gravel, grey and brown, dry
	0.4-0.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 2 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road, Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
22	0.0-0.3	Fill	Mixture of sandstone and roadbase, some pieces of asphaltic concrete and with shale gravel, brown and dark grey, dry
	0.3-0.6	Topsoil	Clayey Silt, some gravel, brown, dry
	0.6-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, MC<PL, hard, PP>600kPa
23	0.0-0.2	Fill	Mixture of silty clay and some silt with sandstone gravel/cobbles and roadbase, some small pieces of concrete, some pieces of asphaltic concrete, some sand, dark grey and brown, dry
	0.2-0.4	Topsoil	Clayey Silt, brown, dry
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
24	0.0-0.4	Fill	Mixture of silty clay, silt, some sandstone gravel/cobbles and roadbase, some small pieces of concrete, some pieces of asphaltic concrete, some sand, brown and grey, dry
	0.4-0.7	Topsoil	Clayey Silt, brown, dry
	0.7-1.0	Natural	(CH) Silty Clay: high plasticity, yellow/brown, MC<=PL, hard
25	0.0-0.6	Fill	Mixed silty clay and clayey silt and concrete pieces, sandstone, some asphalt, brown, dry to moist
	0.6-0.9	Topsoil	Clayey Silt and Silt, some gravel, grey, dry
	0.9-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, PP>600kPa
26	0.0-0.4	Fill	Mixed silty clay/clayey silt and some concrete pieces, sandstone gravel, with some asphalt, brown and grey, dry to moist
	0.4-0.7	Topsoil	Clayey Silt and Silt, some gravel, grey, dry
	0.7-0.9	Natural	(CH) Silty Clay: high plasticity, yellow, dry, hard
27	0.0-0.8	Fill	Mixed silty clay and topsoil, silt and some concrete pieces, sandstone gravel, with some asphalt, dark brown and grey, dry to moist
	0.8-1.0	Topsoil	Silt and Clayey Silt, with some gravel, grey, dry
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, yellow/brown, dry, hard
28	0.0-0.2	Topsoil	Clayey Silt, with some gravel, brown and grey, dry
	0.2-0.4	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, MC<PL, PP>600kPa
29	0.0-0.3	Topsoil	Clayey Silt and Silt, low liquid limit, brown/grey, dry
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, PP>600kPa
30	0.0-0.4	Topsoil	Silt with some Clayey Silt, grey, dry
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, MC<PL, hard
31	0.0-0.4	Topsoil	Clayey Silt, brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow, dry, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 3 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 17/4/04

Test Pit Number	Depth (m)	Profile Type	Description
32	0.0-0.4	Topsoil	Clayey Silt, brown and grey, dry
	0.4-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<PL, PP>600kPa
33	0.0-0.6	Topsoil	Silt, some Clayey Silt, dark grey and light grey, dry
	0.6-1.2	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<PL, dry, PP>600kPa
	1.2-1.4	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey and red, MC<=PL, hard, PP>600kPa
34	0.0-0.5	Topsoil	Clayey Silt and Silt, low liquid limit, grey, dry
	0.5-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard
35	0.0-0.4	Topsoil	Clayey Silt, brown and grey, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow, MC<PL, hard
36	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, grey brown, dry
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard
37	0.0-0.6	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.6-1.8	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<=PL, PP>600kPa
	1.8-2.6	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey and brown, MC<=PL, hard, PP>600kPa
38	0.0-0.5	Topsoil	Clayey Silt, dark brown and brown, dry
	0.5-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, PP>600kPa
39	0.0-0.4	Topsoil/Fill	Clayey silt, some gravel, dark brown and brown/grey, dry
	0.4-0.8	Topsoil	Silt with some Clayey Silt, grey, dry
	0.8-1.6	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and dark brown, very hard, very dry, MC<PL, PP>600kPa
40	0.0-0.4	Topsoil/Fill	Clayey silt, dark brown, dry
	0.4-0.7	Topsoil	Silt, some Clayey Silt, light grey, dry
	0.7-1.6	Natural	(CI-CH) Silty Clay/Gravelly Silty-Sandy Clay: medium to high plasticity, dark red and dark brown, very hard, very dry, MC<PL, PP>600kPa
41	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.3-1.0	Natural	(CI) Silty Clay: medium plasticity, dark brown and red, some gravel, MC<=PL, PP>600kPa
42	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-1.6	Natural	(CH) Silty Clay: high plasticity, yellow, dry/moist, MC<=PL, PP>600kPa
	1.6-2.2	Natural	(CI-CH) Gravelly Silty Clay: medium to high plasticity, red/brown and dark red, some sand, MC<PL, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 4 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
43	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<=PL, PP>600kPa
44	0.0-0.4	Topsoil	Clayey Silt, some gravel, dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow, MC<=PL, PP>600kPa
45	0.0-0.3	Topsoil	Clayey silt, brown and dark brown, dry
	0.3-0.5	Topsoil	Silt, light grey, very dry
	0.5-1.3	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, hard
46	0.0-0.3	Topsoil	Clayey silt, dark brown, moist
	0.3-0.4	Topsoil	Silt, light grey, very dry
	0.4-0.9	Natural	(CH) Silty Clay: high plasticity, yellow/brown, moist, MC<=PL, PP>600kPa
47	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, brown and yellow, moist, hard
48	0.0-0.4	Topsoil	Clayey Silt and Silt, brown, dry to moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry and hard, some gravel, MC<=PL, PP>600kPa
49	0.0-0.3	Topsoil	Clayey Silt and Silt with some gravel, brown and grey, moist
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and yellow , MC<PL, hard
50	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.3-1.1	Natural	(CH) Silty Clay: high plasticity, red/orange and yellow, some gravel, moist, hard
51	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.0-1.5	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and brown, dry, MC<PL, PP>600kPa
	1.5-1.7	Bedrock	Shale/Siltstone: extremely weathered, extremely low strength, grey and brown
52	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, dry to moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, hard
53	0.0-0.3	Topsoil	Clayey Silt, some gravel, brown, dry to moist
	0.3-0.8	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, very dry and very hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 5 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
54	0.0-0.3	Topsoil	Clayey Silt, some gravel, brown, moist
	0.3-0.5	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, PP>600kPa
55	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.2-1.8	Natural	(CI) Silty Clay: medium plasticity, grey, some shale gravel, MC<=PL, PP>600kPa
	1.8-2.4	Bedrock	Shale: extremely weathered/Interbedded with gravelly shaley clay, grey and brown, dry to moist
56	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, hard
57	0.0-0.3	Topsoil	Clayey Silt, some gravel, brown, moist
	0.3-0.9	Natural	(CH) Silty Clay: high plasticity, yellow, hard, MC<=PL, PP>600kPa
58	0.0-0.3	Topsoil	Clayey Silt, with some gravel, brown, dry/moist
	0.3-0.5	Natural	(CH) Silty Clay: high plasticity, yellow/brown, MC<PL, hard
59	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown and brown, dry to moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and red/brown, MC<=PL, hard
60	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-1.3	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.3-1.9	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	1.9-2.2	Natural	(CL) Gravelly Shaley Clay: low plasticity, grey, with layers/bands of extremely weathered shale
	2.2-2.4	Bedrock	Shale: extremely weathered, extremely low strength, grey and brown
61	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, dark brown, dry to moist
	0.2-0.5	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, PP:480-560kPa
62	0.0-0.3	Topsoil	Clayey Silt, brown, moist
	0.3-0.9	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
63	0.0-0.2	Topsoil	Clayey Silt, brown, some gravel, moist
	0.2-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard
64	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and red, MC<PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 6 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
65	0.0-0.3	Topsoil	Clayey Silt, brown, dry to moist
	0.3-1.4	Natural	(CH) Silty Clay: high plasticity, red/grey and brown, MC<PL, very hard
66	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry/moist
	0.3-1.6	Natural	(CH) Silty Clay: high plasticity, red/brown and grey, with some gravel, MC<=PL, hard, PP>600kPa
	1.6-2.4	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, dark red and dark brown/grey, very dry and very hard, MC<PL, PP>600kPa
67	0.0-0.3	Topsoil	Clayey Silt with Silt, grey and brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, dry to moist, hard
68	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, with some gravel, dry/moist
	0.4-0.8	Natural	Silt/(CL) Silty Clay: low plasticity, grey and brown, dry, MC<PL, hard, PP>600kPa, with some fine to coarse gravel
	0.8-1.2	Natural	(CH) Silty Clay: high plasticity, red/brown and grey, with some gravel, MC<PL, hard, PP>600kPa
69	0.0-0.2	Topsoil	Clayey Silt, brown, moist
	0.2-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown/red, MC<=PL, PP>600kPa
70	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.2-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
71	0.0-0.7	Fill/Topsoil	Clayey silt and silty clay with gravel, brown/red and grey, dry
	0.7-1.2	Natural	(CI-CH) Silty Clay/Gravelly Silty-Sandy Clay: medium to high plasticity, dark brown and red, very hard, MC<PL, PP>600kPa
72	0.0-0.6	Fill/Topsoil	Clayey silt/silty clay with some gravel, brown and grey, dry
	0.6-1.5	Natural	(CI-CH) Gravelly Silty Clay: medium to high plasticity, some sand, MC<PL, PP>600kPa
73	0.0-0.8	Fill/Topsoil	Silty clay with gravel and some sand, some clayey silt, grey and red/brown, dry
	0.8-1.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, MC<PL, PP>600kPa
74	0.0-0.7	Fill/Topsoil	Clayey silt with silty clay and some gravel, brown/red and grey, dry
	0.7-1.2	Natural	(CI-CH) Silty Sandy Clay: medium to high plasticity, brown and red, dry, hard
75	0.0-0.5	Topsoil/Fill	Clayey silt mixed with some gravel, brown and grey, dry
	0.5-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, dry
76	0.0-0.6	Topsoil/Fill	Clayey silt and silty clay with some gravel, brown and grey, dry
	0.6-1.0	Natural	(CI-CH) Silty Sandy Clay: medium to high plasticity, red and grey, MC<=PL, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 7 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: CL Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
77	0.0-0.6	Fill	Silty clay mixed with sandstone gravel, some asphaltic concrete pieces, some clayey silt, dark brown and grey, moist to wet profile
	0.6-1.0	Topsoil	Silt, with some clayey silt, light grey and brown, dry
	1.0-1.4	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, MC<PL, hard
78	0.0-0.7	Fill	Mixture of silty clay medium plasticity with some gravel and with some silt, yellow brown and grey, moist to wet
	0.7-0.9	Topsoil	Silt and some clayey silt, light grey, dry
	0.9-1.1	Natural	(CI) Silty Sandy Clay: medium plasticity, red and dark grey, MC<=PL, PP>600kPa
79	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.4-1.1	Natural	(CH) Silty Clay: high plasticity, yellow and red/brown, MC<=PL, hard, PP>600kPa
	1.1-1.9	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, dark red and brown, MC<PL, PP>600kPa
80	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry
	0.3-0.5	Natural	(CH) Silty Clay: high plasticity, red and grey, MC<PL, PP>600kPa
81	0.0-0.6	Fill/Topsoil	Clayey silt with silty clay, some gravel, brown/grey and yellow, moist
	0.6-1.0	Natural	(CI-CH) Silty Sandy Clay: medium to high plasticity, brown, MC<PL, hard
82	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
83	0.0-0.3	Topsoil/Fill	Silty clay and clayey silt with gravel, brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard
84	0.0-0.5	Topsoil/Fill	Clayey silt with silt and with some gravel, brown, moist
	0.5-1.4	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, grey yellow and brown, MC<PL, PP>600kPa, very hard and very dry
85	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, moist
	0.4-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow/brown and grey, MC<PL, PP>600kPa
86	0.0-0.4	Topsoil/Fill	Clayey silt, some gravel, brown and grey, moist
	0.4-0.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey and brown, dry, hard
87	0.0-0.3	Topsoil/Fill	Clayey silt with some gravel, brown, dry to moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 8 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
88	0.0-0.4	Topsoil/Fill	Clayey silt, some gravel, brown, dry to moist
	0.4-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, dry, hard
89	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, dark brown and grey, moist
	0.4-0.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown, dry, hard, PP>600kPa
90	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark grey and brown, dry
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, red and grey, MC<PL, PP>600kPa
91	0.0-0.6	Fill/Topsoil	Clayey silt with gravel, brown and grey, moist
	0.6-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, MC<PL, hard
92	0.0-0.2	Fill	Silty clay with sandstone and clayey silt, grey, moist
	0.2-0.6	Natural	(CH) Silty Clay: high plasticity, yellow/brown, dry, MC<PL, PP>600kPa
93	0.0-0.4	Fill	Silty clay with gravel, some clayey silt, dark grey, moist
	0.4-0.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<PL, hard
94	0.0-0.3	Fill/Topsoil	Clayey silt with gravel, brown and grey, dry
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<PL, hard
95	0.0-0.3	Fill/Topsoil	Clayey silt with some gravel, brown and grey, dry
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, dry, hard
96	0.0-0.3	Fill/Topsoil	Clayey silt with gravel, brown and grey, dry
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, very hard, dry
97	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.3-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and dark red, MC<PL, hard, PP>600kPa
98	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, brown and grey, dry
	0.4-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, dry, MC<PL, hard, PP>600kPa
	0.9-1.8	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, grey yellow and brown, MC<PL, PP>600kPa, dry
99	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, with some gravel, MC<=PL, PP:380-460kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 9 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 22/03/2004
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
100	0.0-0.5	Topsoil/Fill	Clayey silt mixed with silt and some gravel, light grey and brown, dry
	0.5-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and grey, MC<=PL, PP>600kPa
101	0.0-0.7	Topsoil/Fill	Silt with gravel and some clayey silt, grey, dry to moist
	0.7-1.0	Natural	(CI) Silty Clay: medium plasticity, yellow and red/brown, MC<=PL, hard
102	Dam Embankment	Fill	Clayey silt and silty clay high plasticity and some gravel, brown, moist
103	0.0-0.3	Topsoil/Fill	Clayey silt with some gravel, brown, dry to moist
	0.3-0.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown, dry, hard
104	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.4	Natural	(CH) Silty Clay: high plasticity, red and brown, with some gravel, dry to moist, hard, MC<=PL, PP>600kPa
105	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
	1.0-1.9	Natural	(CI) Gravelly Silty Clay: medium plasticity, brown, very hard, MC<PL, PP>600kPa
106	0.0-0.8	Fill	Silty clay and some silt mixed with some gravel, grey and brown, dry
	0.8-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, dry, hard
107	Dam Embankment	Fill	Mixture of clayey silt, silty clay of high plasticity and some gravel, yellow/brown and dark brown/grey, moist
108	Dam Embankment	Fill	Mixed clayey silt, silty clay of high/medium to high plasticity, some gravel, yellow and brown and dark brown/grey, moist
109	Dam Embankment	Fill	Mixture of silty clay and clayey silt, silty clay of high plasticity with some gravel, yellow/brown and dark grey and dark brown, moist
110	0.0-0.7	Fill	Silty clay of medium plasticity mixed with gravel, some silt, some clayey silt, some sandstone cobbles, brown, dry to moist
	0.7-1.0	Topsoil	Silt, low liquid limit, light grey, dry
	1.0-1.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, MC<=PL, hard
111	0.0-0.8	Fill	Mixed silty clay with silt and sandstone gravel/cobbles, brown, moist
	0.8-1.0	Topsoil	Silt, with some clayey silt, grey, dry
	1.0-1.3	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and yellow, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 10 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
112	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
113	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry to moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, MC<=PL, hard, PP>600kPa
114	0.0-0.4	Topsoil/Fill	Clayey silt, dark brown, dry to moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard
115	0.0-1.5	Fill	Mixture of silty clay high and medium to high plasticity with gravel and some topsoil, brown/yellow and grey, moist
	1.5-2.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and grey, MC<=PL, PP>600kPa
116	0.0-1.0	Fill	Silty clay mixed with some ironstone and shale gravel, some topsoil, brown, moist
	1.0-1.1	Natural	(CH) Silty Clay: high plasticity, yellow/brown, moist, hard
117	Dam Embankment	Fill	Mixture of silty clay high plasticity with some clayey silt/topsoil and some gravel, brown and dark brown/grey, moist
118	Dam Embankment	Fill	Mixed clayey silt, silty clay of high plasticity, some gravel, yellow and brown and grey, moist
119	Dam Embankment	Fill	Mixture of silty clay and clayey silt, silty clay of high plasticity, some gravel, yellow/brown and dark grey, moist
120	0.0-1.0	Topsoil/Fill	Clayey silt with some gravel and some silty clay, dark brown/grey, some silt, moist
	1.0-1.3	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, brown, MC>=PL, very stiff
121	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, grey and brown, dry to moist
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and brown, MC<PL, PP>600kPa
122	0.0-0.5	Topsoil	Clayey Silt and Silt, low liquid limit, some fine gravel, dark brown and grey, moist
	0.5-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, MC<=PL, very hard, PP>600kPa
	1.0-1.9	Natural	(CI) Silty Sandy Clay/Gravelly Silty Clay: medium plasticity, red/orange and brown, MC<PL, very hard, PP>600kPa
123	0.0-0.4	Topsoil	Clayey Silt and Silt with some gravel, brown and grey, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and grey, moist, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 11 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ea Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
124	0.0-0.3	Topsoil/Fill	Clayey silt, dark brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown/grey, moist, hard
125	0.0-0.4	Topsoil/Fill	Clayey silt mixed with some gravel, dark brown and grey, moist
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, PP>600kPa
126	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.5	Topsoil	Silt, light grey, dry
	0.5-1 2	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and grey, moist, hard
127	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, some gravel, dark brown, dry to moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown/yellow, moist, hard
128	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and red, MC<=PL, PP>600kPa
129	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, some gravel, dark brown, moist
	0.3-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and grey, moist, hard
130	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, brown, dry
	0.4-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, orange and red, MC<PL, PP>600kPa
131	0.0-0.4	Fill	Topsoil mixed with silty clay high plasticity and gravel, brown/red and grey, moist
	0.4-3.0	Fill	Timber and topsoil mixture with corrugated iron, broken timber poles, cloth, plastic pieces, tiles, bricks, some silty clay, one small piece of bonded asbestos, dry
132	0.0-0.6	Fill	Silty clay/topsoil mixed with some silty clay high plasticity and gravel, red and brown grey, moist
	0.6-2.8	Fill	Topsoil and some silty clay mixed with broken timber pieces, poles, tree stumps, fence posts, some pieces of brick and concrete, some plastic and rusty metal pieces, very dry
	2.8		Test pit terminated due to collapsing and test pit started caving in
133	0.0-0.8	Fill	Silty clay and clayey silt /topsoil mixture with some silty clay medium/high plasticity and gravel, red/brown and grey, moist
	0.8-2.6	Fill	Topsoil and silty clay with broken timber poles, tree stumps, fence posts, some pieces of brick and concrete, some plastic and rusty metal pieces, dry to very dry
	2.6		Test pit terminated due to collapsing and test pit started caving in
134	0.0-0.8	Fill	Mixed silty clay with topsoil and brick/concrete fragments, brown and grey, moist
	0.8-1.0	Topsoil	Silt and Clayey Silt, grey and brown, dry
	1.0-1.2	Natural	(CH) Silty Clay: high plasticity, red/brown and grey, MC<=PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 12 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
135	0.0-0.4	Fill/Topsoil	Clayey silt with concrete fragments, dark grey and brown, moist
	0.4-0.8	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and grey, MC<PL, hard
136	0.0-0.6	Fill	Silty clay with gravel and topsoil, yellow and brown, dry to moist
	0.6-0.9	Topsoil	Clayey Silt and Silt, light grey and brown, dry
	0.9-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP:>600kPa
137	0.0-0.5	Fill/Topsoil	Clayey silt with gravel, brown, moist
	0.5-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, hard
138	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, yellow/red, MC<PL, PP>600kPa
139	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, PP>600kPa
			board, timber pieces, rusty metal car parts, brown, dry
140	0.0-0.7	Fill	Mixed topsoil and silty clay with some gravel, some concrete fragments, brown, moist
	0.7-1.0	Topsoil	Silt and Clayey Silt, grey and brown, dry
	1.0-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
141	0.0-1.0	Fill	Silty clay mixed with topsoil, some small brick and concrete fragments, some sandstone gravel, brown and grey, moist
	1.0-2.4	Natural	(CI) Silty Sandy Clay/Gravelly Silty Clay: medium plasticity, brown and grey, MC<=PL, very hard, PP>600kPavery stiff
142	0.0-1.5	Fill	Topsoil and some silty clay mixed with large concrete boulders up to 0.8-1.0m, bricks and cloth, plastic, steel mesh, rusty metal pieces, grey/dark grey and brown, moist
	1.5-2.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, MC<=PL, PP>600kPa
143	0.0-2.0	Fill	Mixture of dark brown topsoil and some silty clay with bricks, timber, large concrete boulders, steel (mesh and wire), plastic pieces, glass, two small asbestos pieces, some sandstone and crushed rock gravel, dark brown and grey, moist
	2.0-2.4	Natural	(CI) Silty Sandy Clay/Gravelly Silty Clay: medium plasticity, dark grey and brown, moist, hard
144	0.0-0.6	Fill	Silty clay and topsoil mixed with brick and concrete fragments, some crushed rock, brown and grey, moist
	0.6-0.9	Topsoil/Fill	Clayey silt and silt, grey and brown, moist
	0.9-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red, dry, hard, PP>600kPa
145	0.0-0.7	Fill	Mixed topsoil and silty clay with sandstone, concrete and brick rubble, some steel, plastic, crushed rock, brown/grey, moist
	0.7-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and dark red, MC<PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 13 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
146	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.4-1.8	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark red/brown and orange, some sand, some gravel, MC<=PL, hard, PP>600kPa
	1.8-2.2	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey with yellow mottling, MC<=PL, moist, hard, PP>600kPa
147	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.4-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and brown, MC<=PL, PP>600kPa
148	0.0-0.6	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.6-0.9	Natural	(CH) Silty Clay: high plasticity, yellow/brown and red, MC<=PL, PP>600kPa
149	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, with some gravel, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, hard, PP>600kPa
150	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown and brown, some gravel, moist
	0.4-1.2	Natural	(CH) Silty Clay: high plasticity, brown and dark red, MC<=PL, PP>600kPa
151	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and grey, some gravel, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, PP>600kPa
152	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, yellow/brown, hard, with some gravel, moist
153	0.0-0.6	Topsoil/Fill	Clayey silt mixed with some gravel, dark brown and brown/grey, moist
	0.6-1.4	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, PP>600kPa
	1.4-1.8	Bedrock	Shale/Gravelly Shaley Clay: extremely weathered, extremely low strength, grey and brown
154	0.0-0.5	Topsoil/Fill	Clayey silt with gravel, brown, moist
	0.5-0.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard
155	0.0-0.3	Topsoil/Fill	Clayey silt, with low liquid limit, dark brown, moist
	0.3-0.6	Topsoil	Silt, with some gravel, light grey, dry
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow/brown, moist, hard
156	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, with some gravel, dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, moist

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 14 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
157	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, dry to moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and grey, MC<=PL, PP>600kPa
158	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow/brown and grey, hard, some gravel, moist
159	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow brown, MC<=PL, PP>600kPa
160	0.0-0.3	Topsoil	Clayey Silt, with some gravel, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, grey yellow/brown, moist, MC<=PL, PP>600kPa
	0.8-1.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, PP>600kPa, with some gravel
161	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, PP>600kPa
162	0.0-0.6	Topsoil/Fill	Silty clay and clayey silt mixed with some shale gravel, brown/dark brown and grey, moist
	0.6-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown/grey, moist, hard
163	0.0-0.3	Topsoil/Fill	Clayey silt with gravel and some sandy silt, brown, moist
	0.3-1.2	Natural	(CH) Silty Clay: high plasticity, yellow brown and grey, with some gravel, MC<=PL, hard, PP>600kPa
	1.2-1.7	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey and brown, MC<=PL, hard, PP>600kPa
	1.7-2.2	Bedrock	Siltstone: extremely weathered, extremely to very low strength, grey and brown
164	0.0-0.5	Topsoil	Clayey Silt, low liquid limit, some gravel, dark brown and black, moist
	0.5-1.0	Natural	(CH) Silty Clay: high plasticity, yellow/brown, moist, PP>600kPa
165	0.0-0.6	Fill	Mixed topsoil with silty clay and with bricks, pieces of concrete, timber, plastic, metal wires, some gravel, brown and grey, moist
	0.6-1.9	Natural	(CH) Silty Clay: high plasticity, yellow and brown/grey, with some gravel, MC<=PL, hard, PP>600kPa
	1.9-2.3	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey and brown, some sand, MC<=PL, hard
166	0.0-0.6	Topsoil/Fill	Clayey silt with some gravel, some sand, brown and grey, moist
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, hard
167	0.0-1.0	Fill	Topsoil mixed with silty clay and bricks/concrete pieces, timber, plastic, metal wires, some gravel, brown/dark brown and grey, moist
	1.0-1.3	Natural	(CH) Silty Clay: high plasticity, yellow and grey, some gravel, MC<=PL, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 15 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
168	0.0-0.7	Fill	Mixture of topsoil with some silty clay, bricks, concrete pieces, plastic, cloth, timber and some metal wires, some gravel, brown and grey, moist
	0.7-1.0	Natural	(CH) Silty Clay: high plasticity, brown and yellow, MC<PL, PP>600kPa
169	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, dark brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and red, MC<=PL, hard
170	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.2-0.8	Natural	(CH) Silty Clay: high plasticity, red/yellow and brown, MC<=PL, PP>600kPa
171	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.2-0.9	Natural	(CH) Silty Clay: high plasticity, red and brown, some fine to coarse ironstone gravel, MC<=PL, moist, PP>600kPa
	0.9-1.2	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey and brown, MC<PL, hard and dry clays, PP>600kPa
	1.2-1.5	Bedrock	Siltstone/Shale: extremely weathered, extremely low strength, grey
172	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, PP>600kPa
173	0.0-0.4	Topsoil/Fill	Clayey silt, with some gravel, brown and dark brown, moist
	0.4-0.6	Topsoil	Silt/Clayey Silt, light grey, very dry
	0.6-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, hard
174	0.0-0.2	Fill/Topsoil	Clayey silt with silty clay and some gravel, brown and grey, moist
	0.2-0.4	Natural	(CH) Silty Clay: high plasticity, brown, hard, MC<=PL
175	0.0-0.4	Topsoil/Fill	Clayey silt with gravel, brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, MC<=PL, hard
176	0.0-0.7	Topsoil/Fill	Clayey silt with silt and some gravel, light grey/dark brown, moist
	0.7-0.9	Natural	(CH) Silty Clay: high plasticity, brown and red, MC<=PL, PP>600kPa
177	0.0-0.3	Fill/Topsoil	Silty clay with clayey silt, brown and grey, moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, brown and grey, hard, MC<=PL
178	0.0-0.2	Topsoil/Fill	Clayey silt with gravel, brown, moist
	0.2-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown, dry, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 16 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road, Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
179	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, dry, hard, PP>600kPa
180	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, some gravel, brown, dry to moist
	0.2-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<PL, PP>600kPa
	0.6-1.0	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey and brown, MC<PL, dry, PP>600kPa
	1.0-1.6	Bedrock	Siltstone: extremely weathered, extremely low strength, grey and brown, with some shale bands/layers
181	0.0-0.4	Topsoil	Clayey Silt, some gravel, dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, MC<=PL, PP>600kPa
182	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, brown, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown with grey mottling, MC<=PL, hard, PP>600kPa
183	0.0-0.5	Fill	Silty clay with some ash, shale and sandstone gravel, grey and dark brown
	0.5-0.8	Natural	(CH) Silty Clay: high plasticity, red and grey, moist, MC<=PL, PP>600kPa
184	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, some gravel, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, red and grey, dry, PP>600kPa
185	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry to moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<=PL, PP>600kPa
	0.8-1.6	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, red and grey, hard, MC<PL, dry, PP>600kPa
	1.6-2.0	Bedrock	Siltstone/Shale: extremely weathered, extremely low strength, brown and grey
186	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, grey and brown/dark brown, moist
	0.4-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and red/brown, dry/moist, hard, PP>600kPa
187	0.0-0.3	Topsoil	Clayey Silt, some gravel, dark brown, moist
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, MC<=PL, PP>600kPa
188	0.0-0.4	Topsoil	Clayey Silt, with some gravel, brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 17 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road, Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 21/4/04

Test Pit Number	Depth (m)	Profile Type	Description
189	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, dry to moist
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red/yellow and brown, some gravel, MC<=PL, PP>600kPa
	1.0-1.6	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey, hard, MC<PL, PP>600kPa
	1.6-1.8	Bedrock	Siltstone: extremely weathered, extremely low strength, brown and grey
190	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-1.1	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, PP>600kPa
	1.1-1.4	Natural	(CI) Silty Clay: medium plasticity, grey and brown, with gravel, moist, hard
	1.4-1.8	Bedrock	Siltstone/Shale: extremely weathered, extremely low strength, grey/brown
191	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, MC<=PL, PP>600kPa
	1.0-1.6	Natural	(CI) Silty Clay: medium plasticity, grey and brown, with some gravel, moist, PP>600kPa
	1.6-2.0	Bedrock	Siltstone: extremely weathered, extremely low to very strength, grey
192	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, some gravel, brown and dark brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, hard, PP>600kPa
193	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown, moist, PP>600kPa
194	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown/dark brown, moist
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red brown, with some gravel, MC<=PL, PP>600kPa
	1.0-1.6	Natural	(C-CH) Silty Clay: medium to high plasticity, brown/red and grey, with gravel, MC<=PL, hard clays, PP>600kPa
	1.6-2.4	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey with red mottling, MC<=PL, hard
195	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, moist
	0.3-0.7	Natural	(CH) Silty Clay: high plasticity, brown, moist, PP>600kPa
196	0.0-0.6	Fill	Mixed silty clay with sandstone and some shale gravel, brown and grey, moist
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, red/grey, moist, PP>600kPa, hard
197	0.0-0.5	Fill	Mixed silty clay with sandstone/shale gravel, brown, moist
	0.5-0.8	Natural	(CH) Silty Clay: high plasticity, brown and red, MC<=PL, PP>600kPa
198	0.0-0.8	Topsoil/Fill	Clayey silt with silty clay and some gravel, dark brown, moist
	0.8-1.1	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 18 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ____ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
199	0.0-0.9	Topsoil/Fill	Clayey silt mixed with some silty clay and some gravel, dark brown, moist
	0.9-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, PP>600kPa
200	0.0-0.6	Topsoil/Fill	Clayey silt with some gravel, dark brown, moist
	0.6-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown, with some gravel, MC<=PL, PP>600kPa, hard
201	0.0-0.5	Topsoil/Fill	Clayey silt, brown and dark brown, moist
	0.5-0.7	Natural	(CH) Silty Clay: high plasticity, red/grey and brown, moist, hard
202	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown/dark brown, some gravel, moist
	0.2-1.2	Natural	(CH) Silty Clay: high plasticity, red and brown with grey mottling, with some gravel, MC<=PL, PP>600kPa
	1.2-2.2	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey and brown, MC<=PL, hard
203	Dam Embankment	Fill	Mixed silty clay of high plasticity with some gravel and topsoil, brown/red and grey, moist
204	Dam Embankment	Fill	Mixed clayey silt, silty clay of high plasticity, some gravel, red/grey and yellow/brown, moist
205	Dam Embankment	Fill	Mixture of silty clay high plasticity and clayey silt, with some gravel, brown and red/grey, moist
206	0.0-0.5	Topsoil	Clayey Silt, low liquid limit, dark brown, some gravel, moist
	0.5-1.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, with some gravel, MC<=PL, PP>600kPa
	1.5-2.4	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey, MC<=PL, hard, PP>600kPa
207	0.0-0.4	Topsoil/Fill	Silt/Clayey silt with some gravel, brown, moist
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, red and grey, some gravel, MC<=PL, PP>600kPa, hard
208	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, some gravel, moist
	0.4-1.1	Natural	(CH) Silty Clay: high plasticity, red/grey and brown, MC<=PL, PP>600kPa
	1.1-2.0	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey and brown, dry and very hard,
	2.0-2.5	Bedrock	Siltstone/Shale: extremely weathered, extremely low strength, brown and grey, with frequent gravelly shaley clay bands

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1 (Page 19 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

Test Pit Number	Depth (m)	Profile Type	Description
209	0.0-0.4	Topsoil/Fill	Clayey silt with some gravel, dark brown and brown, moist
	0.4-0.6	Natural	(CH) Silty Clay: high plasticity, red and brown/grey, with some gravel, MC<=PL, hard, PP>600kPa
210	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown, some gravel, dry
	0.3-0.8	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 20 of 20)
SUMMARY OF SOIL PROFILE

Australand Holdings Ltd
Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Prepared By: SL 21/03/04
Checked By: ___ Date: 1/4/04

SL4260/1-AO JR : LEA
17 March 2004

GeoEnviro Consultancy Pty Ltd
PO Box 1543
Macquarie Centre
NORTH RYDE NSW 2113

Attention: Mr Solern Liew

Dear Sloern,

RE: MATERIAL ASSESSMENT-JOB NO. JC040331A

Please find attached three copies of the results of laboratory testing carried out on eight samples supplied on the 5/3/04.

Please contact the undersigned if you have questions regarding the test results.

For and on behalf of

COFFEY GEOSCIENCES PTY LTD

JAMES RUSSELL

Encl: Test Result Sheets

Copies Issued: 3 No.

RECEIVED
BY DATE 19/3/04

142 Wicks Road North Ryde
NSW 2113 Australia
PO Box 125 North Ryde
NSW 1670 Australia
Telephone +61 2 **9888 7444**
Facsimile +61 2 9888 9977
Email sydney@coffey.com.au

Coffey Geosciences Pty Ltd A.C.N.0 56 335 516

Geotechnical | **Resources** | Environmental | **Technical** | Project Management

142 Wicks Road, North Ryde, NSW, 2113
Ph:(02) 9888 7444 Fax (02) 9878 8155

particle size distribution

client : *GEOENVIRO CONSULTANCY PTY LTD.*

job no : *SL4260/1*

principal :

laboratory : *SYDNEY*

project : *MATERIAL ASSESSMENT - JOB No.JC040331A*

report date : *March 16, 2004*

location : *CURRANS HILL*

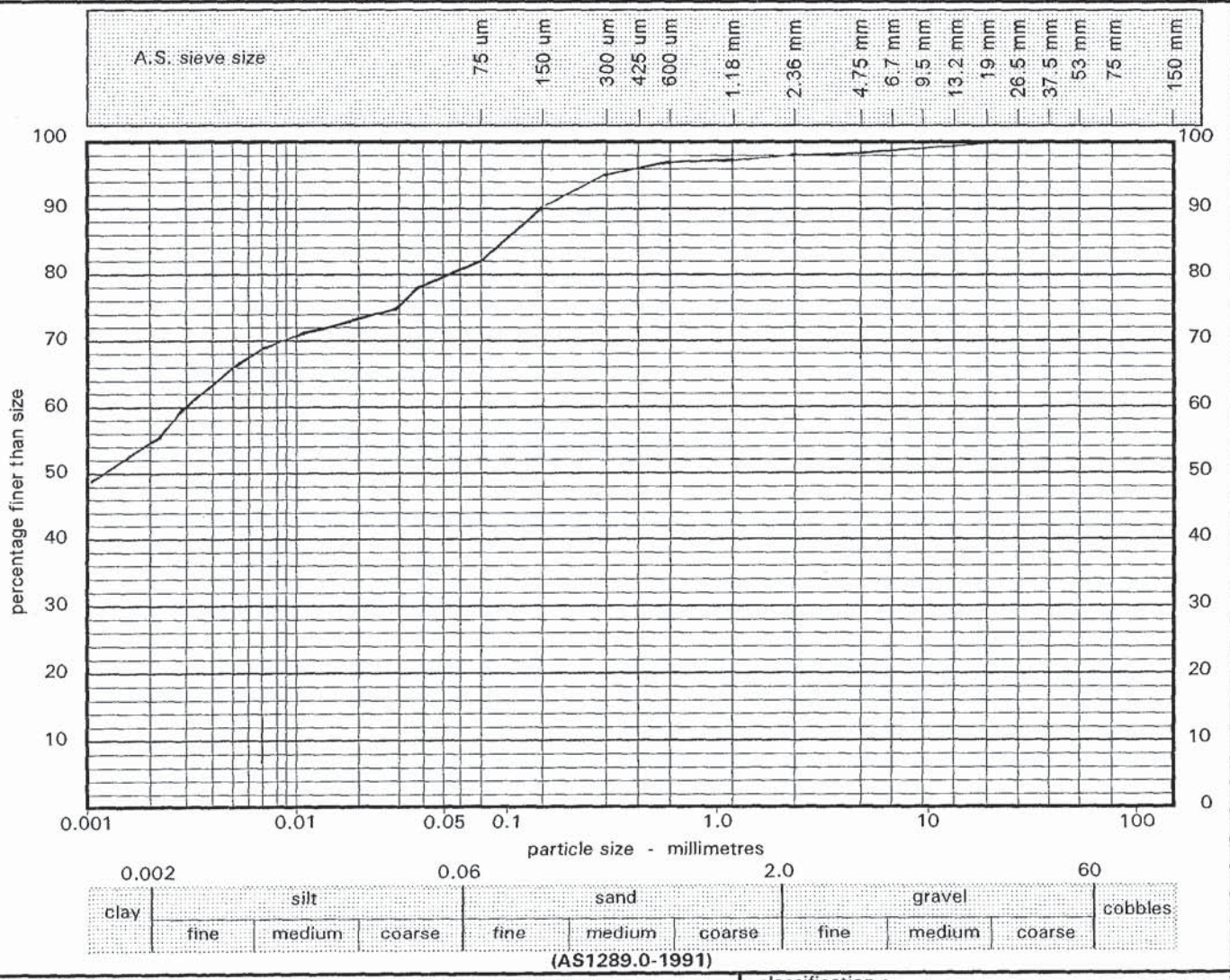
test report : -

test procedure : *AS1289.3.6.1,3.6.3*

depth : *0.80 to 1.00m*

sample no : *T.P No 8*

sample identification: *Sample supplied by the client on the 5/03/04.*



Atterberg Limit :

liquid limit	%	-
plastic limit	%	-
plasticity index	%	-
linears hrinkage	%	-
natural moisture	%	-

Sample History

- natural state ☐
- aird ried ☐
- oven dried ☐
- other ☐

Preparation Method

- dry sieving ☐
- wet sieving ☐

LinearS hrinkage

- Mould size mm
- crumbing ☐
- curling ☐

classification :

Thet ests, calibrations or measurements covered by this documenth ave been performed in accordance with NATA requirements whichi nclude the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced except in full.

NATA Accredited Laboratory No. 431

Date : *16 March, 2004*

Authorised Signature:

James Russell
Laboratory Manager

Form Number L1.8R2 Version 5.2

COPYRIGHT (c) Coffey Geosciences Pty Ltd - 1998

Coffey Geosciences Pty Ltd A.C.N.0 56 335 516

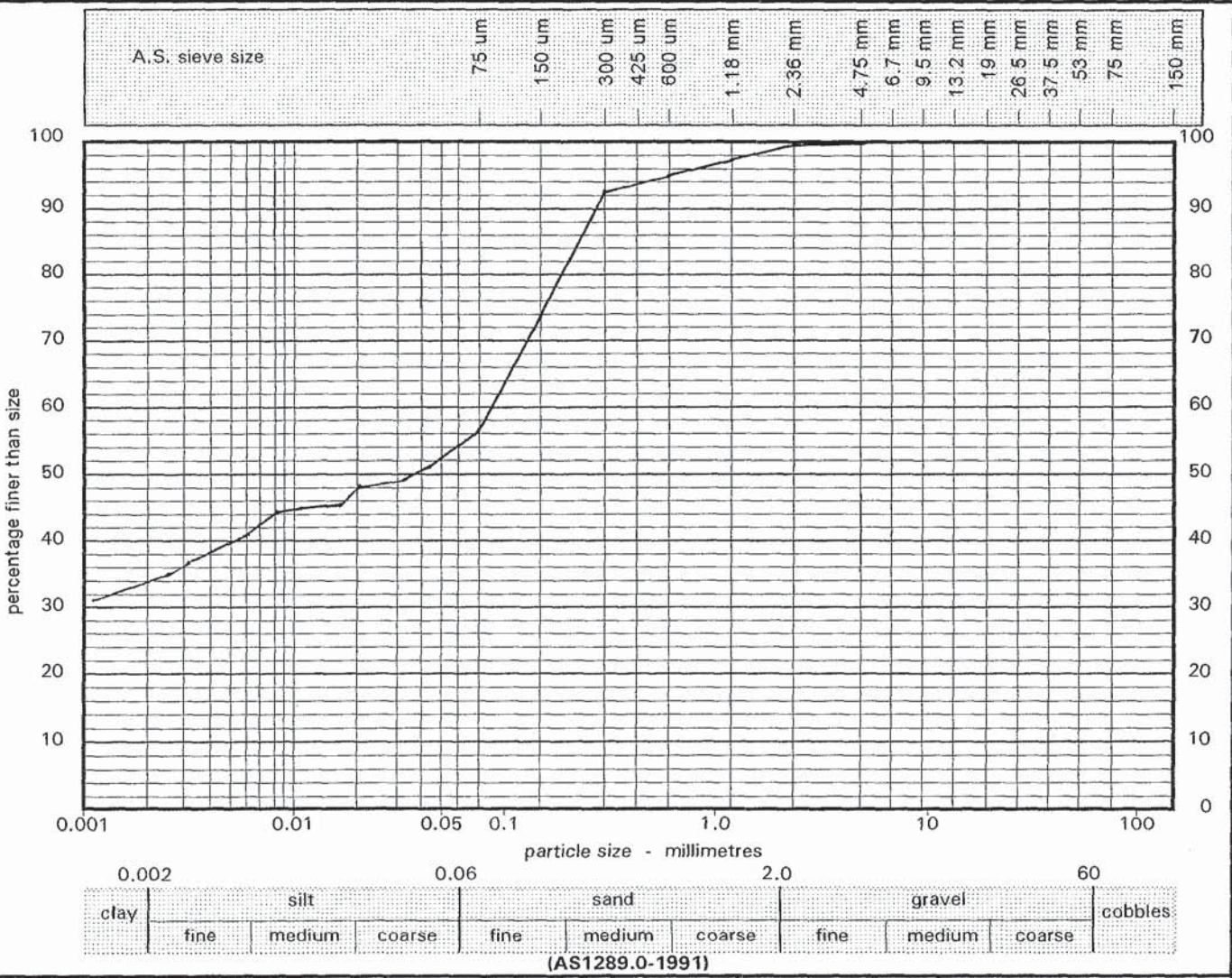
Geotechnical | **Resources** | Environmental | **Technical** | Project Management

142 Wicks Road, North Ryde, NSW, 2113
Ph:(02) 9888 7444 Fax (02) 9878 8155

particle size distribution

client : *GEOENVIRO CONSULTANCY PTY LTD.*
job no : *SL4260/1*
principal :
laboratory : *SYDNEY*
project : *MATERIAL ASSESSMENT - JOB No.JC040331A*
report date : *March 16, 2004*
location : *CURRANS HILL*
test report : -

test procedure : *AS1289.3.6.1,3.6.3*
depth : *1.00 to 1.20m*
sample no : *T.P No 40*
sample identification: *Sample supplied by the client on the 5/03/04.*



(AS1289.0-1991)

Atterberg Limit :

liquid limit	%	-
plastic limit	%	-
plasticity index	%	-
linears hrinkage	%	-
natural moisture	%	-

Sample History

- natural state ☐
- aird ried ☐
- oven dried ☐
- other ☐

Preparation Method

- dry sieving ☐
- wet sieving ☐

LinearS hrinkage

- Mould size mm
- crumbing ☐
- curling ☐

classification :

Thet ests, calibrations or measurements covered by this documenth ave been performed in accordance with NATA requirements whichi nclude the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced except in full.

NATA Accredited Laboratory No. 431

Date : *16 March, 2004*

Authorised Signature:
James Russell
Laboratory Manager

Form Number L1.8R2 Version 5.2

COPYRIGHT (c) Coffey Geosciences Pty Ltd - 1998

Coffey Geosciences Pty Ltd A.C.N.0 56 335 516

Geotechnical | **Resources** | Environmental | **Technical** | Project Management

142 Wicks Road, North Ryde, NSW, 2113
Ph:(02) 9888 7444 Fax (02) 9878 8155

particle size distribution

client : ***GEOENVIRO CONSULTANCY PTY LTD.***

job no : ***SL4260/1***

principal :

laboratory : ***SYDNEY***

project : ***MATERIAL ASSESSMENT - JOB No.JC040331A***

report date : ***March 16, 2004***

location : ***CURRANS HILL***

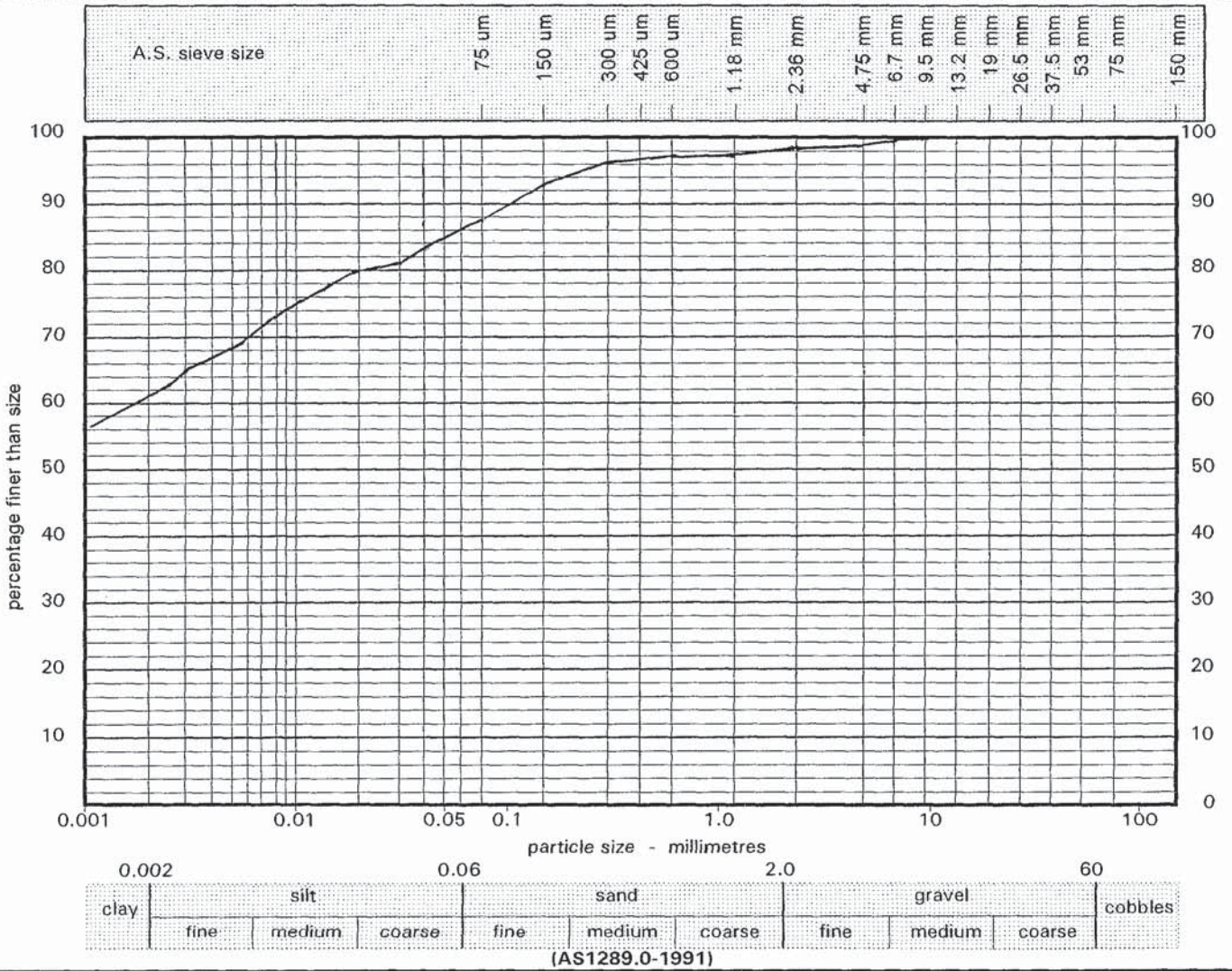
test report : -

test procedure : ***AS1289.3.6.1,3.6.3***

depth : ***0.50 to 0.70m***

sample no : ***T.P No 191***

sample identification: ***Sample supplied by the client on the 5/03/04.***



Atterberg Limit :

liquid limit	%	-
plastic limit	%	-
plasticity index	%	-
linears hrinkage	%	-
natural moisture	%	-

Sample History

- natural state ☐
- aird ried ☐
- oven dried ☐
- other ☐

Preparation Method

- dry sieving ☐
- wet sieving ☐

LinearS hrinkage

- Mould size mm
- crumbing ☐
- curling ☐

classification :

Thet ests, calibrations or measurements covered by this documenth ave been performed in accordance with NATA *requirements* whichi nclude the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced except in full.

NATA Accredited Laboratory No. 431

Date : ***16 March, 2004***

Authorised Signature:

James Russell
Laboratory Manager

Form Number L1.8R2 Version 5.2

COPYRIGHT (c) Coffey Geosciences Pty Ltd - 1998

Coffey Geosciences Pty Ltd A.C.N.0 56 335 516

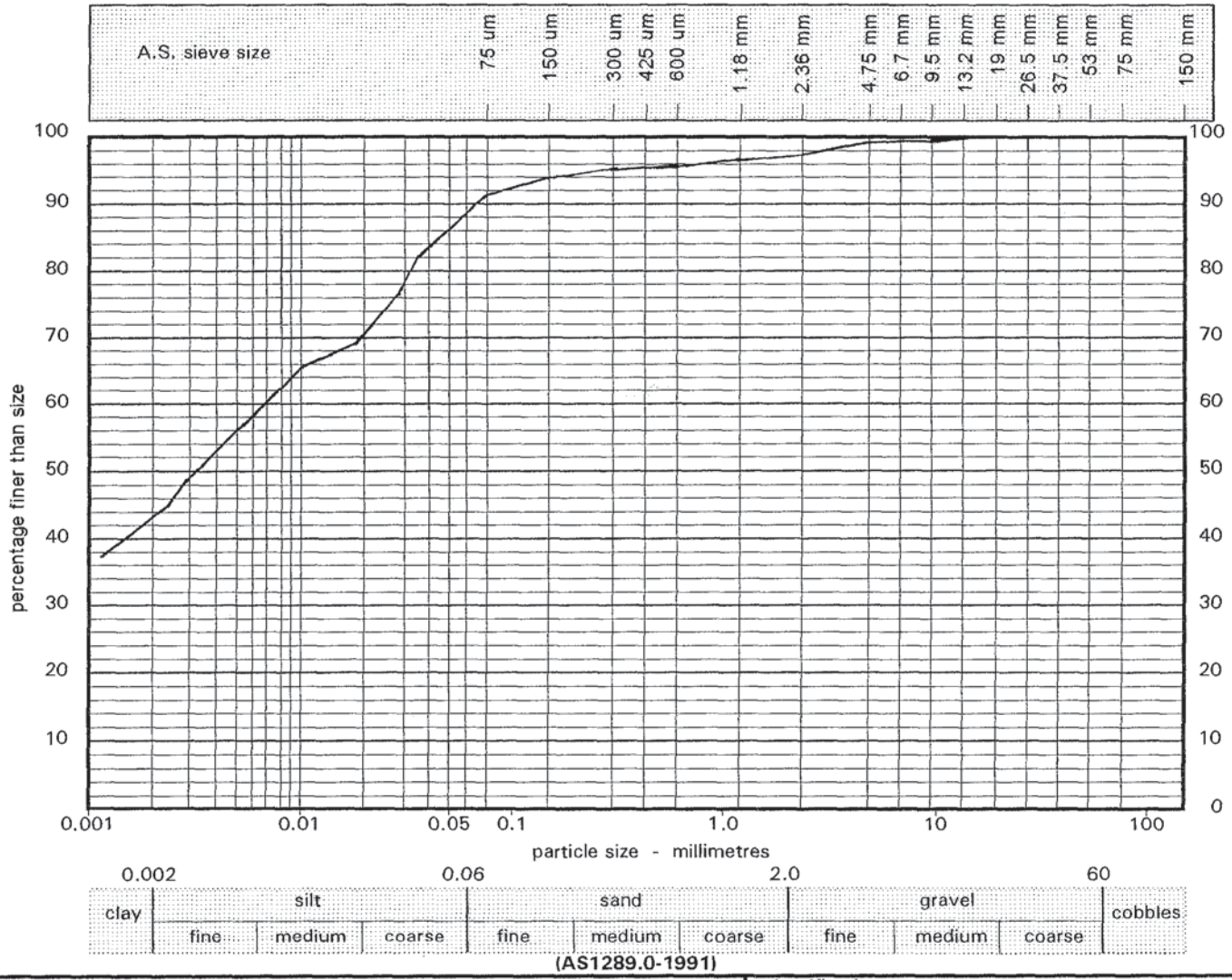
Geotechnical | **Resources** | Environmental | **Technical** | Project Management

142 Wicks Road, North Ryde, NSW, 2113
Ph:(02) 9888 7444 Fax (02) 9878 8155

particle size distribution

client : *GEOENVIRO CONSULTANCY PTY LTD.*
job no : *SL4260/1*
principal :
laboratory : *SYDNEY*
project : *MATERIAL ASSESSMENT - JOB No.JC040331A*
report date : *March 16, 2004*
location : *CURRANS HILL*
test report : -

test procedure : *AS1289.3.6.1,3.6.3*
depth : *1.00 to 1.20m*
sample no : *T.P No 171*
sample identification: *Sample supplied by the client on the 5/03/04.*



(AS1289.0-1991)

Atterberg Limit :

liquid limit	%	-
plastic limit	%	-
plasticity index	%	-
linears hrinkage	%	-
natural moisture	%	-

Sample History

- natural state ☐
- aird ried ☐
- oven dried ☐
- other ☐

Preparation Method

- dry sieving ☐
- wet sieving ☐

LinearS hrinkage

- Mould size mm
- crumbing ☐
- curling ☐

classification :

Thet ests, calibrations or measurements covered by this documenth ave been performed in accordance with NATA requirements whichi nclude the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced except in full.

NATA Accredited Laboratory No. 431

Date : *16 March, 2004*

Authorised Signature:

James Russell
Laboratory Manager

Form Number 11.882 Version 5.2

COPYRIGHT (c) Coffey Geosciences Pty Ltd - 1998

Coffey Geosciences Pty Ltd A.C.N.0 56 335 516

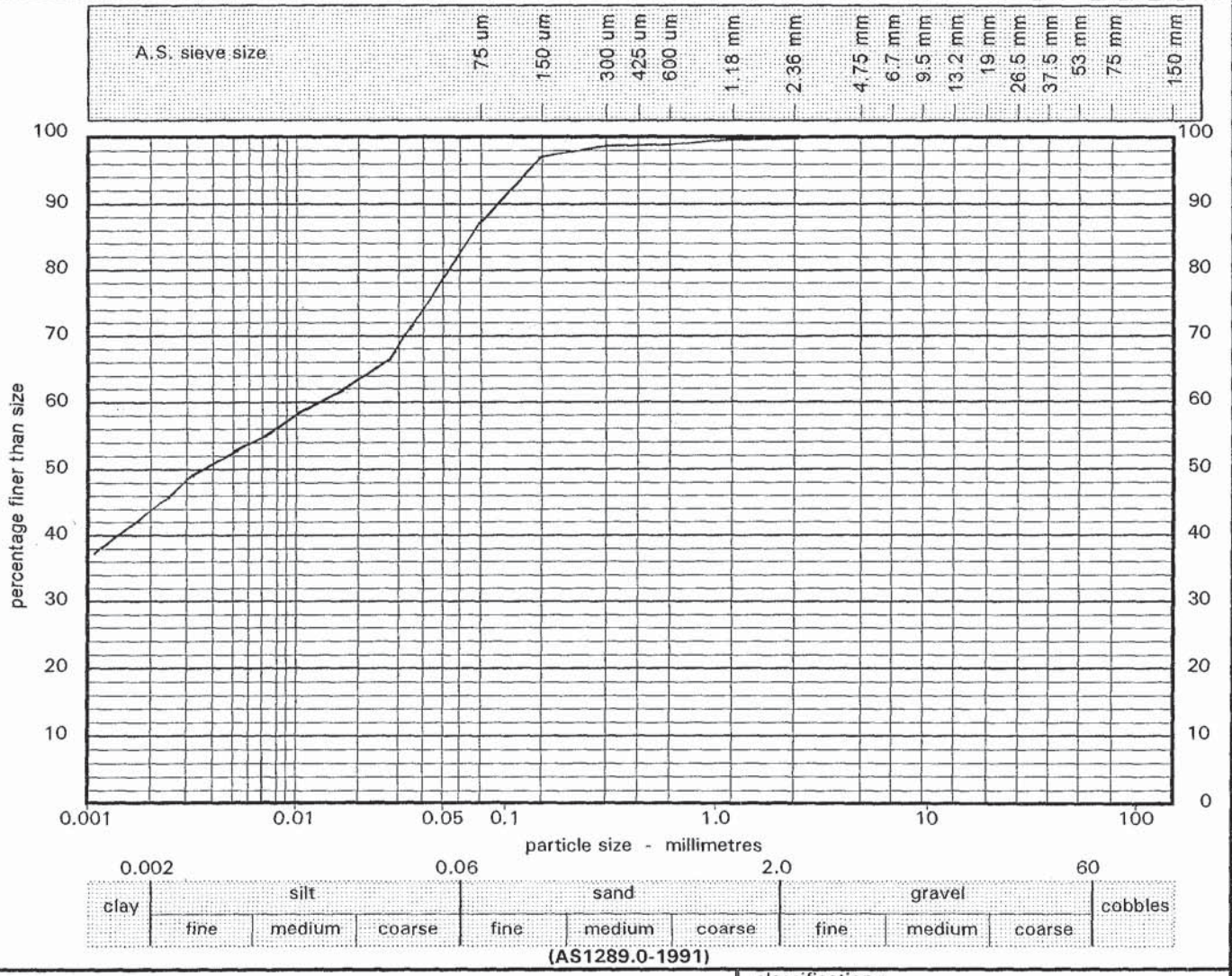
Geotechnical | **Resources** | Environmental | **Technical** | Project Management

142 Wicks Road, North Ryde, NSW, 2113
Ph:(02) 9888 7444 Fax (02) 9878 8155

particle size distribution

client : *GEOENVIRO CONSULTANCY PTY LTD.*
job no : *SL4260/1*
principal :
laboratory : *SYDNEY*
project : *MATERIAL ASSESSMENT - JOB No.JC040331A*
report date : *March 16, 2004*
location : *CURRANS HILL*
test report : -

test procedure : *AS1289.3.6.1,3.6.3*
depth : *1.80 to 2.00m*
sample no : *T.P No 146*
sample identification: *Sample supplied by the client on the 5/03/04.*



Atterberg Limit :

liquid limit	%	-
plastic limit	%	-
plasticity index	%	-
linears hrinkage	%	-
natural moisture	%	-

Sample History

- natural state ☐
- aird ried ☐
- oven dried ☐
- other ☐

Preparation Method

- dry sieving ☐
- wet sieving ☐

LinearS hrinkage

- Mould size mm
- crumbing ☐
- curling ☐

classification :

Thet ests, calibrations or measurements covered by this documenth ave been performed in accordance with NATA requirements whichi nclude the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced except in full.

NATA Accredited Laboratory No. 431

Date : *16 March, 2004*

Authorised Signature:
James Russell
Laboratory Manager

Form Number L1.8R2 Version 5.2

COPYRIGHT (c) Coffey Geosciences Pty Ltd - 1998

Coffey Geosciences Pty Ltd A.C.N.0 56 335 516

Geotechnical | **Resources** | Environmental | **Technical** | Project Management

142 Wicks Road, North Ryde, NSW, 2113
Ph:(02) 9888 7444 Fax (02) 9878 8155

particle size distribution

client : *GEOENVIRO CONSULTANCY PTY LTD.*

job no : *SL4260/1*

principal :

laboratory : *SYDNEY*

project : *MATERIAL ASSESSMENT - JOB No.JC040331A*

report date : *March 16, 2004*

location : *CURRANS HILL*

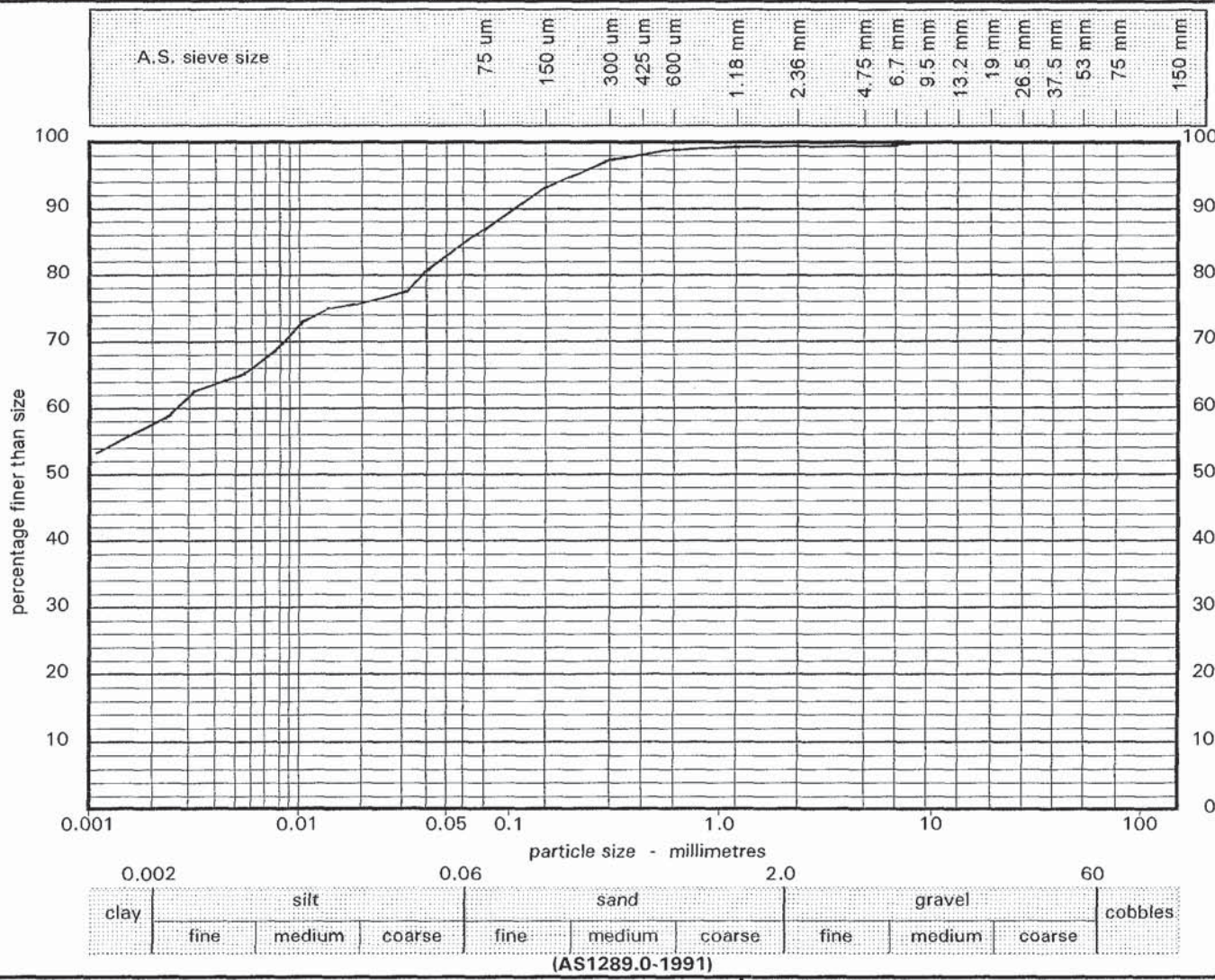
test report : -

test procedure : *AS1289.3.6.1,3.6.3*

depth : *0.50 to 0.70m*

sample no : *T.P No 122*

sample identification: *Sample supplied by the client on the 5/03/04.*



Atterberg Limit :

liquid limit	%	-
plastic limit	%	-
plasticity index	%	-
linears hrinkage	%	-
natural moisture	%	-

Sample History

- natural state ☐
- aird ried ☐
- oven dried ☐
- other ☐

Preparation Method

- dry sieving ☐
- wet sieving ☐

LinearS hrinkage

- Mould size mm
- crumbing ☐
- curling ☐

classification :

Thet ests, calibrations or measurements covered by this documenth ave been performed in accordance with NATA requirements whichi nclude the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced except in full.

NATA Accredited Laboratory No. 431

Date : *16 March, 2004*

Authorised Signature:

James Russell
Laboratory Manager

Form Number L4.8R2 Version 5.2

COPYRIGHT (c) Coffey Geosciences Pty Ltd - 1998

Coffey Geosciences Pty Ltd A.C.N.0 56 335 516

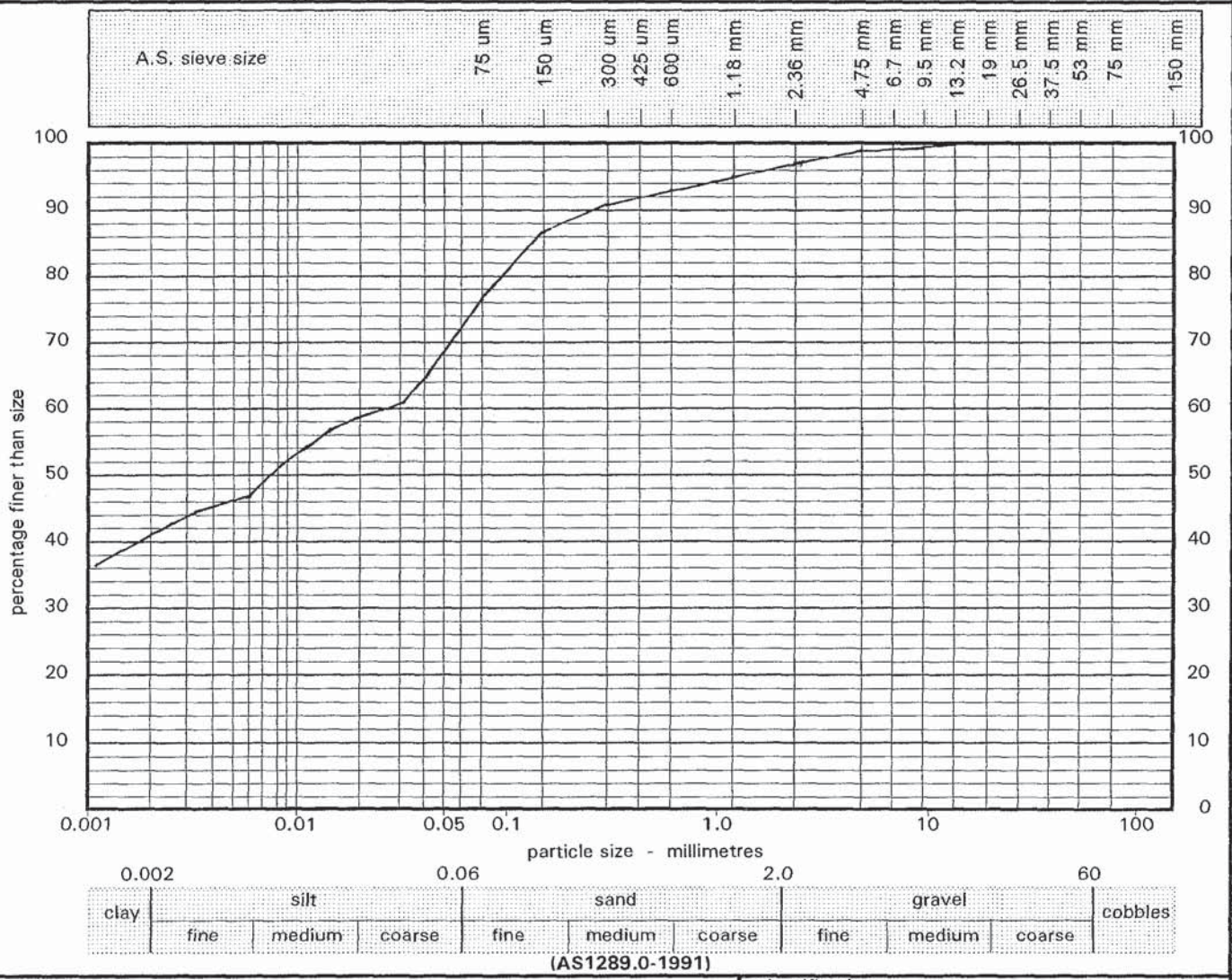
Geotechnical | **Resources** | Environmental | **Technical** | Project Management

142 Wicks Road, North Ryde, NSW, 2113
Ph:(02) 9888 7444 Fax (02) 9878 8155

particle size distribution

client : *GEOENVIRO CONSULTANCY PTY LTD.*
job no : *SL4260/1*
principal :
laboratory : *SYDNEY*
project : *MATERIAL ASSESSMENT - JOB No.JC040331A*
report date : *March 16, 2004*
location : *CURRANS HILL*
test report : -

test procedure : *AS1289.3.6.1,3.6.3*
depth : *1.00 to 1.20m*
sample no : *T.P No 98*
sample identification: *Sample supplied by the client on the 5/03/04.*



(AS1289.0-1991)

Atterberg Limit :

liquid limit	%	-
plastic limit	%	-
plasticity index	%	-
linears hrinkage	%	-
natural moisture	%	-

Sample History

natural state ☐
aird ried ☐
oven dried ☐
other ☐

Preparation Method

dry sieving ☐
wet sieving ☐

LinearS hrinkage

Mould size mm
crumbing ☐
curling ☐

classification :

Thet ests, calibrations or measurements covered by this documenth ave been performed in accordance with NATA requirements whichi nclude the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced except in full.

NATA Accredited Laboratory No. 431

Authorised Signature:
James Russell
Laboratory Manager

Date : *16 March, 2004*

Form Number L1.8R2 Version 5.2

COPYRIGHT (c) Coffey Geosciences Pty Ltd - 1998

Coffey Geosciences Pty Ltd A.C.N.0 56 335 516

Geotechnical | **Resources** | Environmental | **Technical** | Project Management

142 Wicks Road, North Ryde, NSW, 2113
Ph:(02) 9888 7444 Fax (02) 9878 8155

particle size distribution

client : *GEOENVIRO CONSULTANCY PTY LTD.*

job no : *SL4260/1*

principal :

laboratory : *SYDNEY*

project : *MATERIAL ASSESSMENT - JOB No.JC040331A*

report date : *March 16, 2004*

location : *CURRANS HILL*

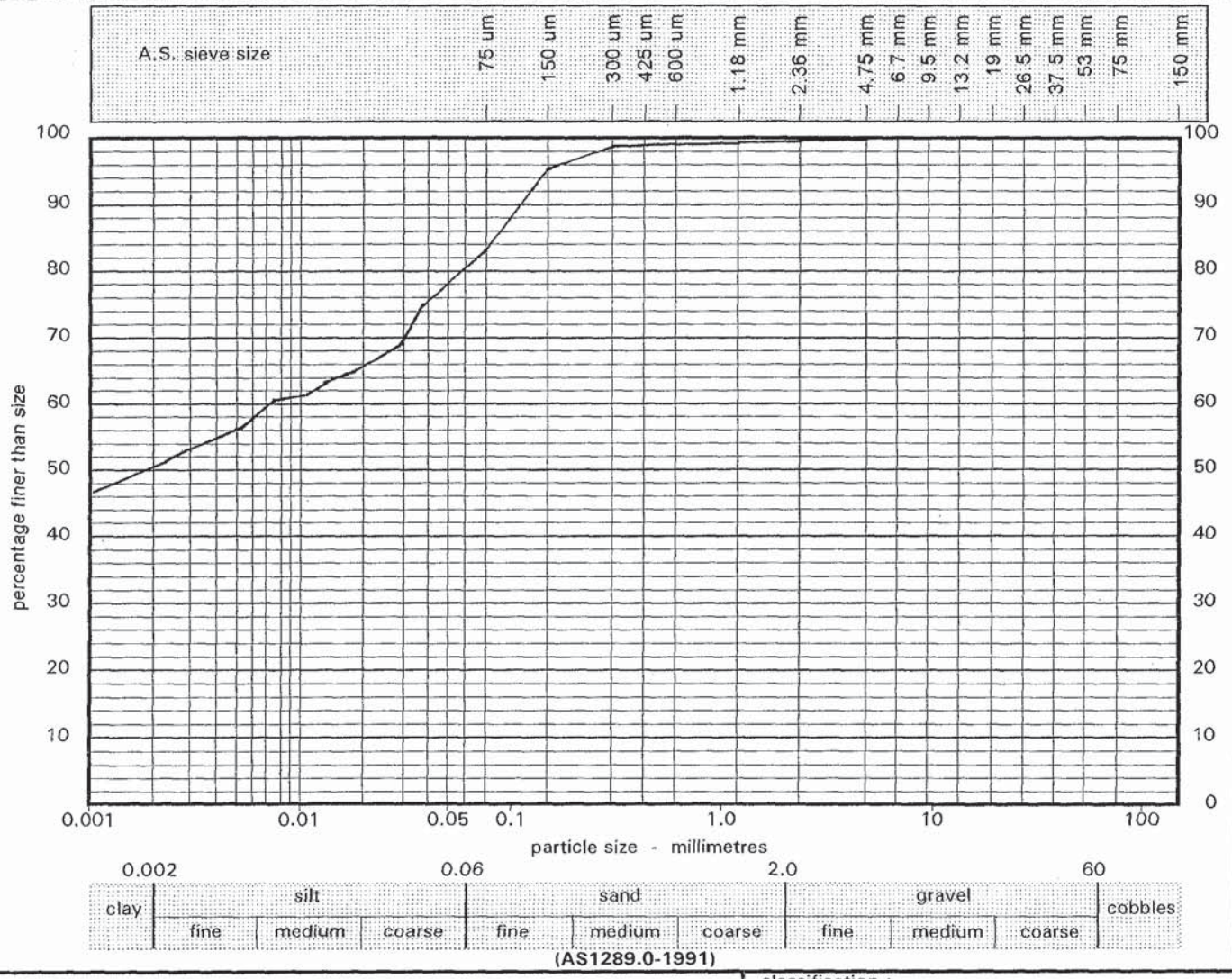
test report : -

test procedure : *AS1289.3.6.1,3.6.3*

depth : *0.50 to 0.70m*

sample no : *T.P No 51*

sample identification: *Sample supplied by the client on the 5/03/04.*



Atterberg Limit :

liquid limit	%	-
plastic limit	%	-
plasticity index	%	-
linears hrinkage	%	-
natural moisture	%	-

Sample History

- natural state ☐
- aird ried ☐
- oven dried ☐
- other ☐

Preparation Method

- dry sieving ☐
- wet sieving ☐

LinearS hrinkage

- Mould size mm
- crumbing ☐
- curling ☐

classification :

Thet ests, calibrations or measurements covered by this documenth ave been performed in accordance with NATA requirements whichi nclude the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced except in full.

NATA Accredited Laboratory No. 431

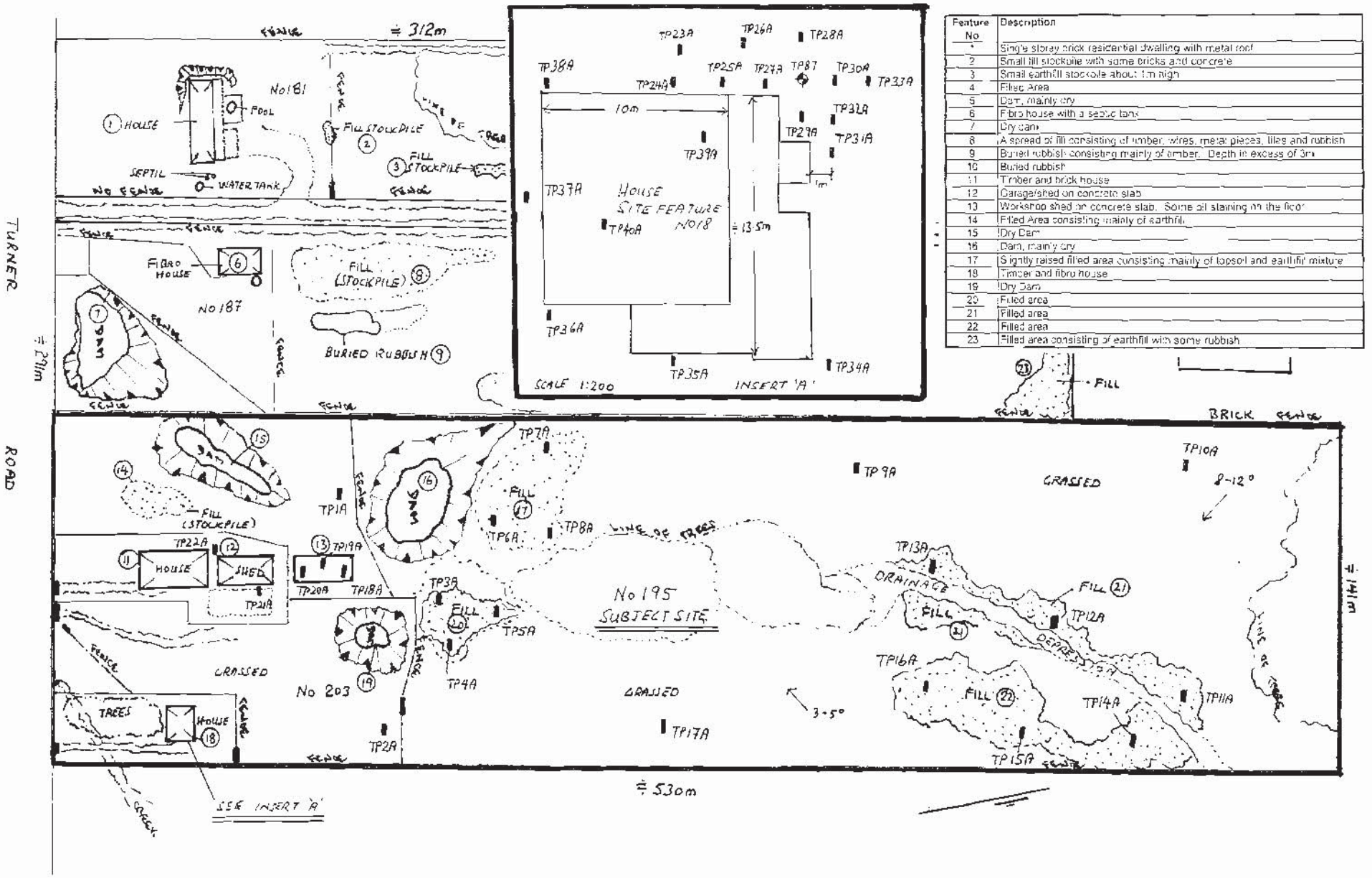
Authorised Signature:

James Russell
Laboratory Manager

Date : *16 March, 2004*

Form Number L1.8R2 Version 5.2

COPYRIGHT (c) Coffey Geosciences Pty Ltd - 1998



Feature No	Description
1	Single storey brick residential dwelling with metal roof
2	Small fill stockpile with some bricks and concrete
3	Small earthfill stockpile about 1m high
4	Filled Area
5	Dam, mainly dry
6	Fibro house with a septic tank
7	Dry dam
8	A spread of fill consisting of timber, wires, metal pieces, tiles and rubbish
9	Buried rubbish consisting mainly of timber. Depth in excess of 3m
10	Buried rubbish
11	Timber and brick house
12	Garage/shed on concrete slab
13	Workshop shed on concrete slab. Some oil staining on the floor
14	Filled Area consisting mainly of earthfill
15	Dry Dam
16	Dam, mainly dry
17	Slightly raised filled area consisting mainly of topsoil and earthfill mixture
18	Timber and fibro house
19	Dry Dam
20	Filled area
21	Filled area
22	Filled area
23	Filled area consisting of earthfill with some rubbish

Legend

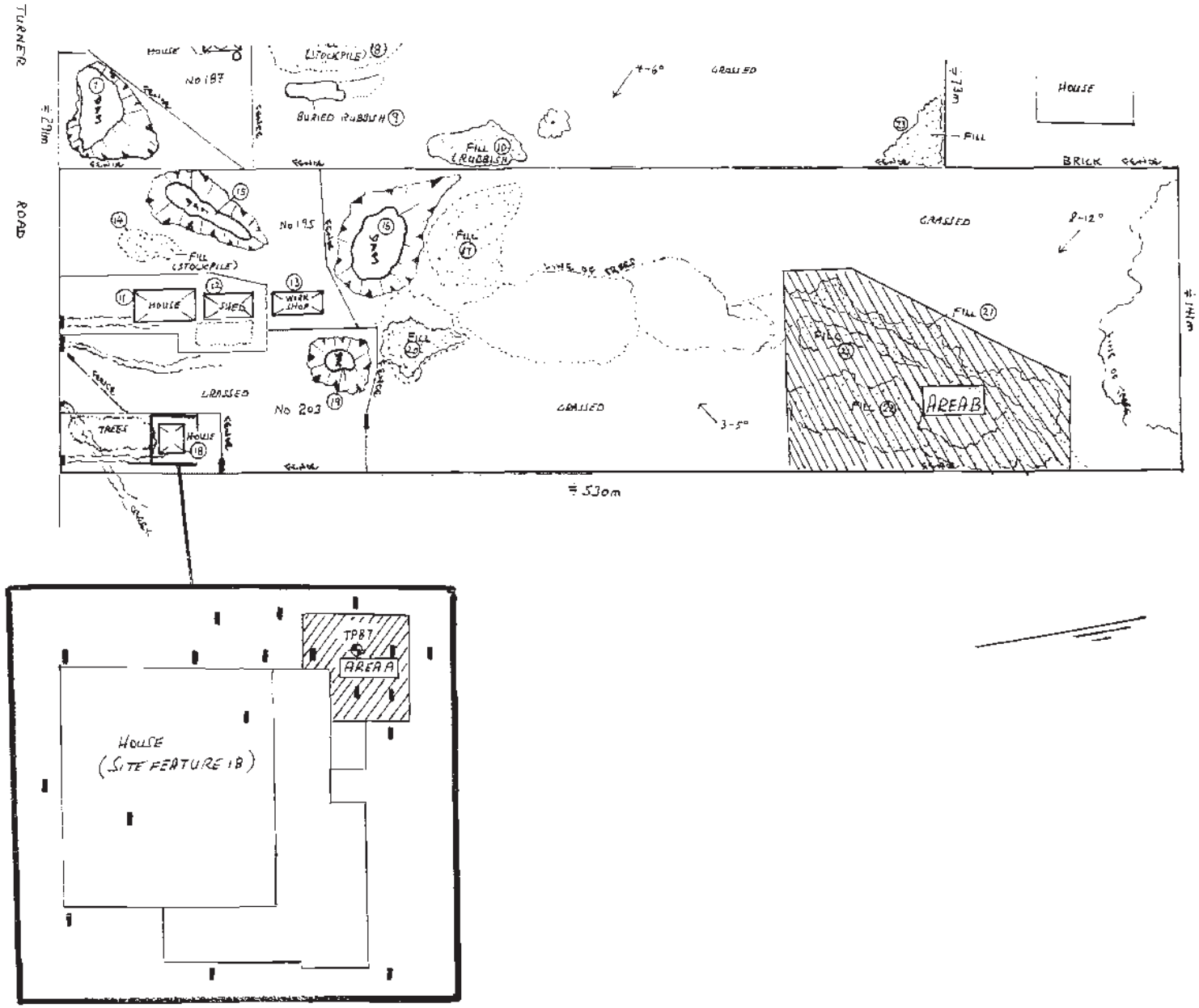
- Test Pit
- (11) SITE FEATURE No 11
- PREVIOUS TEST PIT 2004

GeoEnviro Consultancy

Drawn By:	SL	Date: 16/3/09	
Checked By:	SL	Date: 16/3/09	
Revision By:		Date:	
Scale:	Proportional	A3	

Mr Jim and Ms Vanessa Driver
Nos 195-203 Turner Road Currans Hill
Sampling Location Plan

Project No: JC04031A-r5 | Drawing No: 1A



Legend

Remediation Area B

GeoEnviro Consultancy

Drawn By: SL	Date: 16/3/09	Mr Jim and Ms Vanessa Driver	
Checked By: SL	Date: 16/3/09	Nos 195-203 Turner Road Currans Hill	
Revision By:	Date:	Remediation Area Plan	
Scale: Proportional	A3	Project No: JC04031A-rs	Drawing No: 2A

Test Pit Number	Depth (m)	Profile Type	Description
100	0.0-0.5	Topsoil/Fill	Clayey silt mixed with silt and some gravel, light grey and brown, dry
	0.5-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, red and grey, MC<=PL, PP>600kPa
101	0.0-0.7	Topsoil/Fill	Silt with gravel and some clayey silt, grey, dry to moist
	0.7-1.0	Natural	(CI) Silty Clay: medium plasticity, yellow and red/brown, MC<=PL, hard
102	Dam Embankment	Fill	Clayey silt and silty clay high plasticity and some gravel, brown, moist
103	0.0-0.3	Topsoil/Fill	Clayey silt with some gravel, brown, dry to moist
	0.3-0.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown, dry, hard
104	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry
	0.4-1.4	Natural	(CH) Silty Clay: high plasticity, red and brown, with some gravel, dry to moist, hard, MC<=PL, PP>600kPa
105	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
	1.0-1.9	Natural	(CI) Gravelly Silty Clay: medium plasticity, brown, very hard, MC<PL, PP>600kPa
106	0.0-0.8	Fill	Silty clay and some silt mixed with some gravel, grey and brown, dry
	0.8-1.0	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, dry, hard
107	Dam Embankment	Fill	Mixture of clayey silt, silty clay of high plasticity and some gravel, yellow/brown and dark brown/grey, moist
108	Dam Embankment	Fill	Mixed clayey silt, silty clay of high/medium to high plasticity, some gravel, yellow and brown and dark brown/grey, moist
109	Dam Embankment	Fill	Mixture of silty clay and clayey silt, silty clay of high plasticity with some gravel, yellow/brown and dark grey and dark brown, moist
110	0.0-0.7	Fill	Silty clay of medium plasticity mixed with gravel, some silt, some clayey silt, some sandstone cobbles, brown, dry to moist
	0.7-1.0	Topsoil	Silt, low liquid limit, light grey, dry
	1.0-1.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, yellow and brown, MC<=PL, hard
111	0.0-0.8	Fill	Mixed silty clay with silt and sandstone gravel/cobbles, brown, moist
	0.8-1.0	Topsoil	Silt, with some clayey silt, grey, dry
	1.0-1.3	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and yellow, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

TABLE 1 (Page 10 of 11)
SUMMARY OF SOIL PROFILE

Test Pit Number	Depth (m)	Profile Type	Description
112	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, dry
	0.4-0.7	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
113	0.0-0.4	Topsoil	Clayey Silt, low liquid limit, dark brown, dry to moist
	0.4-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, moist, MC<=PL, hard, PP>600kPa

Note: PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1 (Page 11 of 11)
SUMMARY OF SOIL PROFILE

Preliminary Contamination, Geotechnical and Salinity Investigation
No. 181, 187, 195-203 Turner Road , Currans Hill

Test Pit Number	Depth (m)	Profile Type	Description
1A	0.0-0.1	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry
	0.1-0.6	Fill	Silty Clay: medium to high plasticity, brown loose
	0.6-0.7	Natural	Clayey Silt, low liquid limit, brown dry
	0.7-1.7	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
	1.7-2.7	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey brown, moist to wet with a trace of fine gravel
	2.7-3.3	Natural	(CI) Silty Clay: medium plasticity, brown and grey some minor groundwater seepage at about 3.0m
2A	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.3-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, MC<=PL, hard, PP>600kPa
	1.2-2.1	Natural	As above but pale brown, MC<PL, hard, PP>600kPa
	2.1-3.1	Natural	(CI) Gravelly Silty Clay: medium plasticity, grey brown, with some ironstone gravel, MC<PL
	3.1-3.5	Natural	(CH) Silty Clay: high plasticity, red and brown, MC<=PL, hard, PP>600kPa
3A	0.0-0.2	Fill	Clayey Silt, low liquid limit, brown and grey, dry, a trace of fine gravel
	0.2-0.8	Natural	(CI-CH) Silty Clay/Gravelly Silty Clay: medium to high plasticity, some sand, dark red and brown, MC<PL, PP>600kPa
4A	0.0-0.3	Fill	Mixture of silty clay medium plasticity with some gravel and with some silt, yellow brown and grey, moist to wet
	0.3-0.9	Natural	(CI-CH) Silty Clay: medium to high plasticity, some sand, dark red and brown, MC<PL, PP>600kPa
5A	0.0-0.4	Fill/Topsoil	Mixture of silty clay medium plasticity with some gravel and with some silt, yellow brown and grey, moist to wet
	0.4-1.1	Natural	(CI-CH) Silty Clay: medium to high plasticity, some sand, brown, very stiff
6A	0.0-0.2	Fill/Topsoil	Clayey Silt with gravel and some sand, some clayey silt, grey and red/brown, dry
	0.2-0.5	Fill	Silty Clay: medium plasticity, red brown and dark brown , MC<PL
	0.5-1.1	Natural	(CI) Sillty Clay: medium plasticity, orange brown , MC<PL, PP>600kPa
7A	0.0-0.2	Fill/Topsoil	Clayey Silt/Silty Clay: low liquid limit, low plasticity with gravel dry
	0.2-0.5	Fill	Silty Clay: medium plasticity, red brown , a trace of gravel
	0.5-1.2	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, MC<PL, PP>600kPa
8A	0.0-0.2	Fill/Topsoil	Silty clay with gravel and some sand, some clayey silt, grey and red/brown, dry
	0.2-0.8	Fill	Silty Clay/Clayey Silt : low to medium plasticity, red brown , a trace of gravel and sand
	0.8-1.7	Natural	(CI-CH) Silty Clay: medium to high plasticity, dark brown and red, MC<PL, PP>600kPa

Note:
PP = Pocket Penetrometer
MC = Moisture Content
PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1A (Page 1 of 4)
SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009
Checked By:_____Date:_____

Test Pit Number	Depth (m)	Profile Type	Description
9A	0.0-0.35	Topsoil	Clayey Silt, low liquid limit, dark brown, moist
	0.35-1.3	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.3-2.0	Natural	(CI) Silty Clay/Gravelly Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	2.0-3.0	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey, with layers/bands of extremely weathered shale
	3.0-3.5	Natural	As above but medium to high plasticity, brown grey MC=PL
10A	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-1.2	Natural	(CH) Silty Clay: high plasticity, yellow and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.2-2.0	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and brown, dry, MC<PL, PP>600kPa
	2.0-2.4	Natural	(CI) Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	2.4-3.0	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey, with layers/bands of extremely weathered shale
	3.0-3.7	Bedrock	Shale/Siltstone: extremely weathered, extremely low strength, grey and brown
11A	0.0-0.2	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.2-0.35	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.35-0.8	Natural	(CH) Silty Clay: high plasticity, yellow and brown, very hard, dry
12A	0.0-0.6	Fill	Mixture of silty clay and sandstone gravel, some shale and roadbase
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
13A	0.0-0.7	Fill	Silty Clay/Clayey Silt: low to medium plasicity, brown with a trace of concrete fragments
	0.7-1.5	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
14A	0.0-0.6	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.6-1.0	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
15A	0.0-0.4	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.4-0.5	Topsoil	Silt and Clayey Silt, brown and grey, dry
	0.5-1.3	Natural	(CI-CH) Silty Sandy Clay/Gravelly Silty Clay: medium to high plasticity, dark red and brown, dry, MC<PL, PP>600kPa
	1.3-2.4	Natural	(CI) Silty Clay: medium plasticity, grey, with some shale fragments, MC<=PL, hard, PP>600kPa
	2.4-3.1	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey, with layers/bands of extremely weathered shale

Note:

PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1A (Page 2 of 4)

SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009

Checked By:_____Date:_____

Test Pit Number	Depth (m)	Profile Type	Description
16A	0.0-0.2	Fill	Gravelly Silty Clay: medium plasticity, brown with some of sandstone and a trace of asphalt
	0.2-0.6	Natural	(CH) Silty Clay: high plasticity, yellow and brown, hard, MC<PL
17A	0.0-0.3	Topsoil	Clayey Silt, low liquid limit, brown and dark brown, moist
	0.3-1.0	Natural	(CH) Silty Clay: high plasticity, red and brown, some gravel, MC<=PL, hard, PP>600kPa
	1.0-1.7	Natural	(CI) Silty Clay: medium plasticity, grey, some shale gravel, MC<=PL, PP>600kPa
	1.7-1.8	Bedrock	Shale: extremely weathered/Interbedded with gravelly shaley clay, grey and brown, dry to moist
18A	0.0-0.15	Slab	Concrete : 150mm thick
	0.15-0.3	Subbase	Sand: fine to medium grained, brown
	0.3-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown MC<PL, some gravel
	0.6-0.7	Natural	(CI) Gravelly Shaley Clay: medium plasticity, grey
19A	0.0-0.07	Slab	Concrete : 150mm thick
	0.07-0.5	Fill	Silty Clay: medium plasticity, brown, MC<PL some gravel
	0.5-0.9	Fill	Gravelly Silty Clay: medium plasticity, some ironstone gravel,
20A	0.0-0.11	Slab	Concrete : 150mm thick
	0.11-0.25	Fill	Gravelly Silty Clay: medium plasticity, some ironstone gravel,
21A	0.0-0.1	Fill	Silty Sandy Gravel
	0.1-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, hard, PP>600kPa
22A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
23A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
24A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity,grey mottled brown, MC<=PL, hard
25A	0.0-0.1	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.1-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa

Note:

PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit

GeoEnviro Consultancy

TABLE 1A (Page 3 of 4)

SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009

Checked By:_____Date:_____

Test Pit Number	Depth (m)	Profile Type	Description
26A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
27A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, red brown, MC<=PL, hard
28A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
29A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey brown, hard, PP>600kPa
30A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, red brown and grey, MC<=PL, hard, PP>600kPa
31A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red brown
32A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
33A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.45	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red brown
34A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown and red brown
35A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.45	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard
36A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.45	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey brown, hard, PP>600kPa
37A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
38A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.4	Natural	(CI-CH) Silty Clay: medium to high plasticity, grey brown, hard, PP>600kPa
39A	0.0-0.2	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.2-0.5	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa
40A	0.0-0.15	Topsoil	Clayey Silt, low liquid limit, brown and grey, dry to moist
	0.15-0.6	Natural	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<=PL, hard, PP>600kPa

Note:

PP = Pocket Penetrometer

MC = Moisture Content

PL = Plastic Limit



GeoEnviro Consultancy

TABLE 1A (Page 4 of 4)

SUMMARY OF SOIL PROFILE

Mr Jim and Vanessa Driver

Proposed Residential Development

Nos 195-203 Turner Street Elderslie

Prepared By: SL 23/03/2009

Checked By:_____Date:_____

APPENDIX C

Important Information About Your Environmental Site Assessment
Explanatory Notes

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia
PO Box 1543, Macquarie Centre. North Ryde, NSW 2113
ABN: 62 084 294 762
Tel: (02) 9679 8733
Fax: (02) 9679 8744
Email: geoenviro@exemail.com.au

IMPORTANT INFORMATION REGARDING YOUR ENVIRONMENTAL SITE ASSESSMENT

This Environmental Assessment Report was performed in general conformance with our understanding of the guidelines by the Australian and New Zealand Conservation Council (ANZECC), the Office of Environment and Heritage (OEH) and the National Environmental Protection (Assessment of Site Contamination) Measure 1999 (amended 2013).

These accompanying notes have been prepared by GeoEnviro Consultancy Pty Ltd, using guidelines prepared by ASFE; The Association of Engineering Firms Practising in the Geosciences. The notes are offered as an aid in the interpretation of your environmental site assessment report.

REASONS FOR AN ENVIRONMENTAL SITE ASSESSMENT

Environmental site assessments are typically, though not exclusively, performed in the following circumstances:

- As a pre- acquisition assessment on behalf of either a purchaser or a vendor, when a property is to be sold
- As a pre-development assessment, when a property or area of land is to be redeveloped, or the land use has change, eg from a factory to a residential subdivision
- As a pre-development assessment of greenfield sites, to establish baseline conditions and assess environmental, geological and hydrological constraints to the development of, eg, a landfill
- As an audit of the environmental effects of previous and present site usage

Each circumstance requires a specific approach to the assessment of soil and groundwater contamination. In all cases the objective is to identify and if possible, quantify the risks which unrecognised contamination poses to the ongoing or proposed activity. Such risk may be both financial (clean-up costs or limitations in site use) and physical (health risks to site users or the public).

ENVIRONMENTAL SITE ASSESSMENT LIMITATIONS

Although information provided by an environmental site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination within a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which did not show signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur, only the most likely contaminants are screened.

AN ENVIRONMANTAL SITE ASSESSMENT REPORT IS BASED ON A UNIQUE SET OF PROJECT SPECIFIC FACTORS

Your environmental assessment report should not be used;

- When the nature of the proposed development is changed, eg, if a residential development is proposed, rather than a commercial development
- When the size or configuration of the proposed development is altered, eg, if a basement is added
- When the location or orientation of the proposed structure is modified
- When there is a change of land ownership, or
- For application to an adjacent site

In order to avoid costly problems, you should ask your consultant to assess any changes in the project since the assessment and the implications, if any, to recommendations made in the assessment.

ENVIRONMENTAL SITE ASSESSMENT FINDINGS ARE PROFESSIONAL ESTIMATES

Site assessment identifies actual sub-surface conditions only at those points where samples are taken, when they are taken. Data obtained from the sampling and subsequent laboratory analyses are interpreted by geologists, engineers or scientist and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on any proposed development and appropriate remediation measures. Actual conditions may differ from those inferred, because no professional, no matter how qualified and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, however, steps can be taken to help minimise the impact. For this reason, site owner should retain the services of their consultants throughout the development stage of the project in order to identify variances, conduct additional tests which may be necessary and to recommend solutions to problems encountered on site.

Soil and groundwater contamination is a field in which legislation and interpretation of legislation by government departments is changing rapidly. Whilst every attempt is made by GeoEnviro Consultancy Pty Ltd to be familiar with current policy, our interpretation of the investigation findings should not be taken to be that of the relevant authority. When approval from a statutory authority is required for a project, that approval should be directly sought.

STABILITY OF SUB-SURFACE CONDITIONS

Sub-surface conditions can change by natural processes and site activities. As an environmental site assessment is based on conditions existing at the time of the investigation, project decisions should not be based on environmental site assessment data which may have been affected by time. The consultant should be requested to advise if additional tests are required.

ENVIRONMENTAL SITE ASSESSMENTS ARE PERFORMED FOR SPECIFIC PURPOSES AND CLIENTS

Environmental site assessments are prepared in response to a specific scope of work required to meet the specific needs or specific individuals. An assessment prepared for a consulting civil engineer may not be adequate to a construction contractor or another civil engineer.

An assessment should not be used by other persons for any purpose, or by the client for a different purposes. No individual, other than the client, should apply an assessment, even for its intended purposes, without first conferring with the consultant. No person should apply an assessment for any purposes other than that originally contemplated, without first conferring with the consultant.

MISINTERPRETATION OF ENVIRONMENTAL SITE ASSESSMENTS

Costly problems can occur when design professionals develop plans based on misinterpretation of an environmental site assessment. In order to minimise problems, the environmental consultant should be retained to work with appropriate design professionals, to explain relevant findings and to review the adequacy of plans and specifications relative to contamination issues.

LOGS SHOULD NOT BE SEPARATED FORM THE REPORT

Borehole and test pit logs are prepared by environmental scientists, engineers or geologist, based upon interpretation of field conditions and laboratory evaluation of field samples. Field logs normally provided in our reports and these should not be redrawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however, contractors can still misinterpret the logs during bid preparation if separated from the test of the assessment. Should this occur, delays and disputes , or unanticipated costs may result.

To reduce the likelihood of boreholes and test pit logs misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of sub-surface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations, such as contractors.

READ RESPONSIBILITY CLAUSES CLOSELY

An environmental site assessment is based extensively on judgement and opinion, therefore, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claim being lodged against consultants. In order to aid in prevention of this problem, model clauses have been developed for use in written transmittals. These are definitive clauses, designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment and you are encouraged to read them closely. Your consultant will be happy to give full and frank answers to any questions you may have.

EXPLANATORY NOTES

Introduction

These notes have been provided to amplify the geotechnical report with regard to investigation procedures, classification methods and certain matters relating to the Discussion and Comments sections. Not all notes are necessarily relevant to all reports.

Geotechnical reports are based on information gained from finite sub-surface probing, excavation, boring, sampling or other means of investigation, supplemented by experience and knowledge of local geology. For this reason they must be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods
The methods the description and classification of soils and rocks used in this report are based on Australian standard 1726, the SSA Site investigation Code, in general descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions. Identification and classification of soil and rock involves to a large extent, judgement within the acceptable level commonly adopted by current geotechnical practices.

Soil types are described according to the predominating particle size, qualified by the grading or other particles present (eg sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	Less than 0.002mm
Silt	0.002 to 0.6mm
Sand	0.6 to 2.00mm
Gravel	2.00m to 60.00mm

Soil Classification	Particle size
Clay	less than 0.002mm
Silt	0.002 to 0.06mm
Sand	0.06 to 2.00mm
Gravel	2.00mm to 60.00mm

Cohesive soils are classified on the basis of strength, either by laboratory testing or engineering examination. The strength terms are defined as follows:

Classification	Undrained Shear Strength kPa
Very Soft	Less than 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer test (CPT), as below:

Relative Dense	SPT 'N' Value (blows/300mm)	CPT Cone Value (q_c-Mpa)
Very Loose	Less than 5	Less than 2
Loose	5 - 10	2 - 5
Medium Dense	10 - 30	5 - 15
Dense	30 - 50	15 - 25
Very Dense	> 50	> 25

Rock types are classified by their geological names, together with descriptive terms on degrees of weathering strength, defects and other minor components. Where relevant, further information regarding rock classification, is given on the following sheet.

Sampling
Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provided information on plasticity, grained size, colour, type, moisture content, inclusions and depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin walled sample tube (normally know as U_{50}) into the soil and withdrawing a sample of the soil in a relatively undisturbed state. Such Samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Details of the type and method of sampling are given in the report.

Field Investigation Methods
The following is a brief summary of investigation methods currently carried out by this company and comments on their use and application.

Hand Auger Drilling
The borehole is advanced by manually operated equipment. The diameter of the borehole ranges from 50mm to 100mm. Penetration depth of hand augered boreholes may be limited by premature refusal on a variety of materials, such as hard clay, gravels or ironstone.

Test Pits
These are excavated with a tractor-mounted backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descend into the pit. The depth of penetration is limited to about 3.0m for a backhoe and up to 6.0m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Care must be taken if construction is to be carried out near, or within the test pit locations, to either adequately recompact the backfill during construction, or to design the structure or accommodate the poorly compacted backfill.

Large Diameter Auger (eg Pengo)
The hole is advanced by a rotating plate or short spiral auger generally 300mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 05m) and are disturbed, but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers and is usually supplemented by occasional undisturbed tube sampling.

Continuous Spiral Flight Augers
The hole is advanced by using 90mm - 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the augers flights, but they are very disturbed and may be highly mixed with soil of other stratum.

Information from the drilling (as distinct from specific sampling by SPT or undisturbed samples) is of relatively low reliability due to remoulding, mixing or softening of samples by ground water, resulting in uncertainties of the original sample depth.

Continuous Spiral Flight Augers (continued)
The spiral augers are usually advanced by using a V - bit through the soil profile refusal, followed by Tungsten Carbide (TC) bit, to penetrate into bedrock. The quality and continuity of the bedrock may be assessed by examination of the recovered rock fragments and through observation of the drilling penetration resistance.

Non - core Rotary Drilling (Wash Boring)
The hole is advanced by a rotary bit, with water being pumped down the drill rod and returned up the annulus, carrying the cuttings, together with some information from the "feel" and rate of penetration.

Rotary Mud Stabilised Drilling
This is similar to rotary drilling, but uses drilling mud as a circulating fluid, which may consist of a range of products, from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg SPT and U_{50} samples).

Continuous Core Drilling
A continuous core sample is obtained using a diamond tipped core barrel. Providing full core recovery is achieved (which is not always possible in very weak rock and granular soils) this technique provides a very reliable (but relatively expensive) method of investigation. In rocks an NMLC triple tube core barrel which gives a core of about 50mm diameter, is usually used with water flush.

Portable Proline Drilling
This is manually operated equipment and is only used in sites which require bedrock core sampling and there is restricted site access to truck mounted drill rigs. The boreholes are usually advanced initially using a tricone roller bit and water circulation to penetrate the upper soil profile. In some instances a hand auger may be used to penetrate the soil profile. Subsequent drilling into bedrock involves the use of NMLC triple tube equipment, using water as a lubricant.

Standard Penetration Tests
Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils, as a means of determining density or strength and of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289 "Methods of testing Soils for Engineering Purpose"- Test F31.

The test is carried out in a borehole by driving a 50mm diameter split sample tube under the impact of a 63Kg hammer with a free fall of 769mm. It is normal for the tube to be driven in three successive 150mm increments and the "N" value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rocks, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In a case where full penetration is obtained with successive blows counts for each 150mm of, say 4, 6, and 7 blows.

  as 4, 6, 7
  N = 13

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm.

  as 15,30/40mm

The results of the tests can be related empirically to the engineering properties of the soil. Occasionally the test methods is used to obtain samples in 50mm diameter thin walled samples tubes in clays. In these circumstances, the best results are shown on the bore logs in brackets.

Dynamic Cone Penetration Test
A modification to the SPT test is where the same driving system is used with a solid 60^0 tipped steel cone of the same diameter as the SPT hollow sampler. The cone can be continuously driven into the borehole and is normally used in areas with thick layers of soft clays or loose sand. The results of this test are shown as 'N_c' on the bore logs, together with the number of blows per 150mm penetration.

Cone Penetrometer Testing and Interpretation
Cone penetrometer testing (sometimes referred to as Dutch Cone-CPT) described in this report, has been carried out using an electrical friction cone penetrometer and the test is described in Australian Standard 1289 test F5.1.

In the test, a 35mm diameter rod with cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig, which is fitted with a hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130mm long sleeve, immediately behind the cone. Transducer in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20mm per second) the information is output on continuous chart recorders. The plotted results in this report have been traced from the original records. The information provided on the charts comprises:

- Cone resistance - the actual end bearing force divided by the cross sectional area of the cone, expressed in Mpa.
- Sleeve friction - the frictional force on the sleeve divided by the surface area, expressed in kPa.
- Friction ratio - the ratio of sleeve friction to cone resistance, expressed in percentage.

There are two scales available for measurement of cone resistance. The lower "A" scale (0-5Mpa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main "B" scale (0-50Mpa) is less sensitive and is shown as a full line.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative frictions in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and very soft clays, rising to 4% to 10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:

$$q_c \text{ (Mpa)} = (0.4 \text{ to } 0.6)\ N \text{ (blows per 300mm)}$$

In clays the relationship between undrained shear strength and cone resistance is commonly in the range:

$$q_c = (12 \text{ to} 18)\ C_u$$

Interpretation of CPT values can also be made to allow estimate of modulus or compressibility values to allow calculation of foundation settlements. Inferred stratification, as shown on the attached report, is assessed from the cone and friction traces, from experience and information from nearby boreholes etc.

Cone Penetrometer Testing and Interpretation continued
This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties and where precise information or soil classification is required, direct drilling and sampling may be preferable.

Portable Dynamic Cone Penetrometer (AS1289)
Portable dynamic cone penetrometer tests are carried out by driving a rod in to the ground with a falling weight hammer and measuring the blows per successive 100mm increments of penetration.

There are two similar tests, Cone Penetrometer (commonly known as Scala Penetrometer) and the Perth Sand Penetrometer. Scala Penetrometer is commonly adopted by this company and consists of a 16mm rod with a 20mm diameter cone end, driven with a 9kg hammer, dropping 510mm (AS 1289 Test F3.2).

Laboratory Testing
Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedures are given on the individual report forms.

Engineering Logs
The engineering logs presented herein are an engineering and/or geological interpretation of the sub-surface conditions and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, however, this is not always practicable or possible to justify economically. As it is, the boreholes represent only a small sample of the total sub-surface profile. Interpretation of the information and its application to design and construction should take into account the spacing of boreholes, frequency of sampling and the possibility of other than "straight line" variations between the boreholes.

Ground water
Where ground water levels are measured in boreholes, there are several potential problems:

- In low permeability soils, ground water although present, may enter the hole slowly, or perhaps not at all, during the investigation period.
- A localised perched water table may lead to a erroneous indication of the true water table.
- Water table levels will vary from time to time, due to the seasons or recent weather changes. They may not be the same at the time of construction as indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole if any water observations are to be made.

More reliable measurements can be made by installing stand pipes, which are read at intervals over several days, or weeks for low permeability soils. Piezometers sealed in a particular stratum may be interference from a perched water table or surface water.

Engineering Reports
Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal is changed, say to a twenty storey building. If this occurs, the company will be pleased to review the report and sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of sub-surface conditions, discussions of geotechnical aspects and recommendations or suggestions for design and construction. However, the company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on bore spacing and sampling frequency.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of contractors responding to commercial pressures.

If these occur, the company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the company request immediate notification. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes
Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information trader Documents", published by the Institute of Engineers Australia. Where information obtained for this investigation is provided for tender purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or make additional copies of the report available for contract purpose, at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspect of work to which this report is related. This could range from a site visit to confirm that the conditions exposed are as expected, to full time engineering presence on site

Review of Design
Where major civil or structural developments are proposed, or where only a limited investigation has been completed, or where the geotechnical conditions are complex, it is prudent to have the design reviewed by a Senior Geotechnical Engineer.

Annexure "J"
Vegetation Management Plan

Vegetation Management Plan

Currans Hill, 187, 195 and 203 Turner Road

Prepared for
Turner Road Developments and Ken Broome
October 2019



DOCUMENT TRACKING

Item	Detail
Project Name	Vegetation Management Plan – 187, 195 and 203 Turner Road Currans Hill
Project Number	N: 15COR-1879 and 2099
Project Manager	Steven House (02) 4201 2201 Suite 204, Level 2, 62 Moore St Austinmer NSW 2515
Prepared by	Catherine Wade, Robyn Johnson
Reviewed by	Steven House
Approved by	Steven House
Status	Final
Version Number	1-3: Previously issued with original plans 4: Issued with revised plans
Last saved on	29 October 2019
Cover photo	Photo by Steven House

This report should be cited as 'Eco Logical Australia 2019. *Vegetation Management Plan – Currans Hill, Turner Rd*. Prepared for Turner Road Developments and Ken Broome'.

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Turner Road Developments and JMD Development Consultants.

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and Turner Road Developments and Ken Broome. The scope of services was defined in consultation with Turner Road Developments and Ken Broome, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.

Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

Template 08/05/2014

© ECO LOGICAL AUSTRALIA PTY LTD

Contents

Executive summary **7**

1 Introduction **8**
1.1 Objectives of the VMP 8

2 Description of the environment **10**
2.1 Existing drainage 10
2.1.1 North-south drainage line 10
2.3 Existing vegetation 12
2.3.1 Vegetation communities 12
2.3.2 Weed species 12

3 Management works **13**
3.1 Preliminary works 13
3.1.1 Fencing 13
3.1.2 Soil preparation 13
3.1.3 Seed collection and species substitution 13
3.1.4 Weed control treatments 13
3.1.5 Aboriginal Heritage 14
3.1.6 Adaptive management 14
3.2 Vegetative works 14
3.2.1 Management Zone 1: Low flow areas 16
3.2.2 Management Zone 2: Detention basin batters 16
3.2.3 Management Zone 3: Revegetation 16

4 Maintenance **18**

5 Monitoring and reporting **19**
5.1 Monitoring 19
5.1.1 Photo monitoring points 19
5.1.2 Quadrats 19
5.2 Reporting 19
5.3 Performance criteria 20

6 Implementation schedule and cost **22**
6.1 Fencing 22
6.2 Site preparation 22
6.3 Seed collection 22
6.4 Weed control treatments 22

© ECO LOGICAL AUSTRALIA PTY LTD

6.5 Soil and water management plan 22
6.6 Vegetation treatments 22
6.7 Monitoring and reporting 23
6.8 Implementation schedule 23

References 25

Appendix A : Proposed drainage plans 26

Appendix B : NoW correspondence: 27

Appendix C : Noxious Weed Categories 28

Appendix D : Techniques and specifications 29

Appendix E : Species list 33

List of figures

Figure 1: Location of site 9

Figure 2: Existing drainage 11

Figure 3: Vegetation management zones 15

List of tables

Table 1: Management actions 17

Table 2: Performance criteria 21

Table 3: Implementation schedule 23

Table 4: Indicative implementation costs 24

Abbreviations

Abbreviation	Description
BC Act	*Biodiversity Conservation Act 2016*
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd

© ECO LOGICAL AUSTRALIA PTY LTD

GIS	Geographic Information Systems
GPS	Global Positioning System
LGA	Local Government Area
LPI	Land and Property Information
NSW	New South Wales
VMP	Vegetation Management Plan
VRZ	Vegetated Riparian Zone

© ECO LOGICAL AUSTRALIA PTY LTD

Executive summary

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Turner Road Development for 187, 195 and 203 Turner Road, Currans Hill within the Camden Local Government Area (LGA). The Turner Rd, Currans Hill subdivision will comprise approximately 95 lots.

This VMP is related to the main drainage line within the site, which runs north-south. Up and downstream of the site has been highly modified by development, i.e. creeks were removed for road drainage and bio-retention, or replaced by grassed swales. The drainage line is approximately 570 m in length and comprises the following channel types from north to south: overland flow (no defined channel for 249 m); defined channel with riparian vegetation (137 m); modified channel (mechanically dug for 98 m) and two farm dams (86 m). The creek is in very poor condition with limited aquatic value only associated with the farm dams.

The threatened community Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) occurs within the subject site, in the form of approximately 25 scattered paddock trees surrounded by approximately 10.5 hectares (ha) of exotic pasture grasses. This community is a critically endangered ecological community (CEEC) under the NSW *Biodiversity Conservation Act 2016* (BC Act). Although CPW is also listed as critically endangered under the EPBC Act, the scattered trees present on the subject site do not meet the criteria to be considered part of the community under this Act. A small remnant (0.2 ha) of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (RFEF) occurs along the existing drainage line on the subject site. This community is an endangered ecological community (EEC) under the BC Act. The proposed creek alignment has been designed to facilitate the retention of these trees.

The proposed development seeks to realign and rehabilitate the north-south creek. Three management zones have been identified for the site: a low flow area; detention basin batters and a revegetation zone covering remaining areas within the 30 m vegetated riparian zone (VRZ). The proposed vegetation management works are outlined for each zone, including pre-construction, construction and post-construction phases. Three years of maintenance weeding are included in this VMP.

The monitoring and reporting requirements set out in this VMP include the establishment of photo monitoring points for observing vegetation changes over time; preparation of an annual report summarising the works undertaken to date and any issues encountered and reviewing site progress and compliance with the VMP, including whether the performance criteria indicated in this report have been met. The total cost of implementing the VMP has been estimated at **$418,814**.

© ECO LOGICAL AUSTRALIA PTY LTD

1 Introduction

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Turner Road Development for Turner Road, Currans Hill within the Camden Local Government Area (LGA). This VMP relates to the proposed subdivision of the area of land known as 187, 195 and 203 Turner Road, Currans Hill (**Figure 1**). The site is located just north of Narellan, approximately 50 km south west of Sydney.

The proposed works include subdivision of the land and realignment of the north-south drainage line as per the drainage plans in **Appendix A**.

1.1 Objectives of the VMP

The objectives of this VMP are to provide a guide to bush regeneration contractors to:

- Restore and stabilise the area of creek affected by the works
- Slow the water speed in the creek line and stabilise the bed and banks of the creek line
- Revegetate the riparian corridor through removal of weeds
- Revegetate an area of exotic pasture within the riparian corridor with species native to the Cumberland Plain Woodland (CPW) community
- Control priority and environmental weeds on the site
- Protect flora and fauna habitat
- Provide for a stable bed and bank
- Implement erosion and sediment control to reduce impacts to the creek.

The overall objective of the VMP is to emulate the native vegetation of the area and ensure a naturalised stable creek is functioning.

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 1: Location of site

© ECO LOGICAL AUSTRALIA PTY LTD

2 Description of the environment

2.1 Existing drainage

The 1:25,000 topographical map shows two second order streams and one first order stream within the site, as shown in **Figure 2**. Due to broad scale mapping, these drainage lines are not representative of the actual drainage lines within the site.

In 2014, ELA mapped the location of the two second order streams within the site, as shown in **Figure** 2. These were located running north-south through the site and also in the south-east corner. The first order stream entering the site from the east was not present and has previously been approved for removal as part of residential development to the east.

The second order stream in the south-east of the site is not the subject of this VMP. Its realignment has been approved and constructed to allow residential development to the east. A new culvert was constructed under Turner Road between January and May 2015.

2.1.1 North-south drainage line

The north-south drainage line is approximately 570 m in length and comprises the following channel types from north to south:

- Overland flow (no defined channel) = 249 m
- Defined channel with riparian vegetation = 137 m
- Modified channel (mechanically dug) = 98 m
- Farm dams = 86 m

The creek is in very poor condition with limited aquatic value only associated with farm dams. Small patches of established trees occur in two locations. These are the only areas that would hold water in a channel (0.5 – 2.5 m wide) with small incised banks (mostly <0.3 m, but up to 1 m in parts). These sections have a clay base with no aquatic or semi-aquatic flora.

This second order stream is considered to be waterfront land under the *Water Management Act 2000* (WM Act). The highly degraded drainage line has been subject to modification up and downstream and on site, and given its condition is considered suitable for treatment as a first order stream, as provided by DPI Water in **Appendix B.**

© ECO LOGICAL AUSTRALIA PTY LTD



Figure 2: Existing drainage

© ECO LOGICAL AUSTRALIA PTY LTD

2.3 Existing vegetation

2.3.1 Vegetation communities

The threatened community Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) occurs within the site, in the form of approximately 25 scattered paddock trees surrounded by approximately 10.5 hectares (ha) of exotic pasture. This community is a critically endangered ecological community (CEEC) under the BC Act. Although CPW is also listed as critically endangered under the EPBC Act, the scattered trees present on the site do not meet the criteria to be considered part of the Commonwealth community under this Act. The area of CPW is small, isolated and of low quality having low native diversity and cover.

A small remnant (0.2 ha) of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (RFEF) occurs along the main drainage line on the site. This community is an endangered ecological community (EEC) under the BC Act. The remnant patch has low structural diversity and is isolated from other patches of native vegetation. However, these trees will be retained and protected within the riparian corridor.

2.3.2 Weed species

Two species of priority weeds under the NSW *Biosecurity Act 2015* have been observed on the site: *Lycium ferocissimum* (African Boxthorn) and *Olea europaea* ssp. *cuspidata* (African Olive). Priority weed categories are explained in **Appendix C**.

© ECO LOGICAL AUSTRALIA PTY LTD

3 Management works

Several treatments are proposed to achieve the objectives identified in **Section 1.1** of this VMP:

- Preliminary works
- Vegetation Works.

3.1 Preliminary works

3.1.1 Fencing

Following the completion of stormwater construction works for the creek realignment, the vegetated riparian zone (VRZ) will be fenced to prevent construction machinery from entering the area, unless under supervision from a suitably qualified bush regenerator. Informational signage will be installed around the VRZ fencing to communicate the exclusion zone to contractors. Signage and fencing will remain in place until all civil construction works associated with the development are completed.

3.1.2 Soil preparation

Soil studies in Western Sydney have identified considerable chemical change in soils between the A and B horizons. The B horizons in particular are highly sodic and are prone to deflocculation, erosion and water logging. B horizon soils also significantly reduce the success of revegetation works.

Hence, areas where excavation works will be undertaken to a level at or below the B horizon, including rip-rap, battering and diverted creek lines, they will be required to be treated in the following way:

- Stockpile top soil and A horizon
- Excavate to a level 300 mm below finished surface level
- Place stockpiled A horizon and topsoil on top of B horizon soils, to a minimum depth of 200 mm

In addition, in these areas and in any areas of construction impact or broad scale revegetation (e.g. mulching / jute matting), the following works will be undertaken:

- Allow weed seed to germinate and spray with herbicide
- Place a minimum of 100 mm of topsoil (from stockpile or imported) on top of A horizon
- Improve as required to achieve a locally appropriate soil (e.g. gypsum, trace minerals, etc.)
- Rip and cultivate to ensure a soft, friable soil
- Jute matting or mulching as required.

Soil preparation other than installation of jute matting / mulch is to be undertaken by the civil contractor in consultation with a suitably qualified bush regenerator. The installation of jute matting / mulch will be carried out during vegetation works by the bush regeneration contractor as specified in **Table 4**.

3.1.3 Seed collection and species substitution

Where planting is required, seed must be collected from local provenance species. Specifications for local provenance are given in **Appendix D** and target species are given in **Appendix E**.

3.1.4 Weed control treatments

All bush regeneration, revegetation and maintenance work will be undertaken by a suitably qualified and experienced bush regeneration contractor. Bush regeneration and maintenance work will control pasture grasses, herbaceous species and woody weeds (see **Appendix D**). This weeding will include hand

© ECO LOGICAL AUSTRALIA PTY LTD

weeding, slashing, spot spraying, cut and paint or drill and fill. Where herbicide use is required, a non-selective herbicide and other additives identified for use near water will be used (i.e. RoundUp® Bioactive™) when works are being undertaken in or adjacent to the creekline or near standing water. Maintenance will occur on a weekly basis during warmer periods and monthly during cooler periods.

3.1.5 Aboriginal Heritage

An archaeologically sensitive area was identified in the north east of the site, including the patch of RFEF within known Aboriginal Heritage Information Management System (AHIMS) site number 52-2-2122. A salvage excavation is required via application for an Aboriginal Heritage Impact Permit (AHIP) to the NSW Office of Environment and Heritage (OEH).

This AHIP would need to be approved and all salvage works completed prior to commencement of any civil works for the creek realignment (and any subsequent vegetation management works).

If during the implementation of the VMP, suspected Aboriginal artefacts are uncovered, then works should cease and the OEH should be contacted immediately to assist in determining appropriate management.

3.1.6 Adaptive management

As this is a long term project that will be implemented over a number of years, an adaptive management approach will be implemented that enables the successful contractor to learn from and respond to successful and unsuccessful techniques used on the site. In its simplest form this may include the substitution of species identified in the planting table for advanced direct seeding techniques in place of manual planting techniques.

The success of the works will be determined by meeting the performance criteria identified in later sections of this document. Contractors have the flexibility to implement different techniques to those specified here providing that performance criteria are met. Any major departures from the VMP or change to performance criteria must be approved in writing by Camden Council.

3.2 Vegetative works

These works have been identified for the following individual treatment areas as shown in **Figure 3:**

- Zone 1: Low flow areas
- Zone 2: Detention basin batters
- Zone 3: Revegetation.

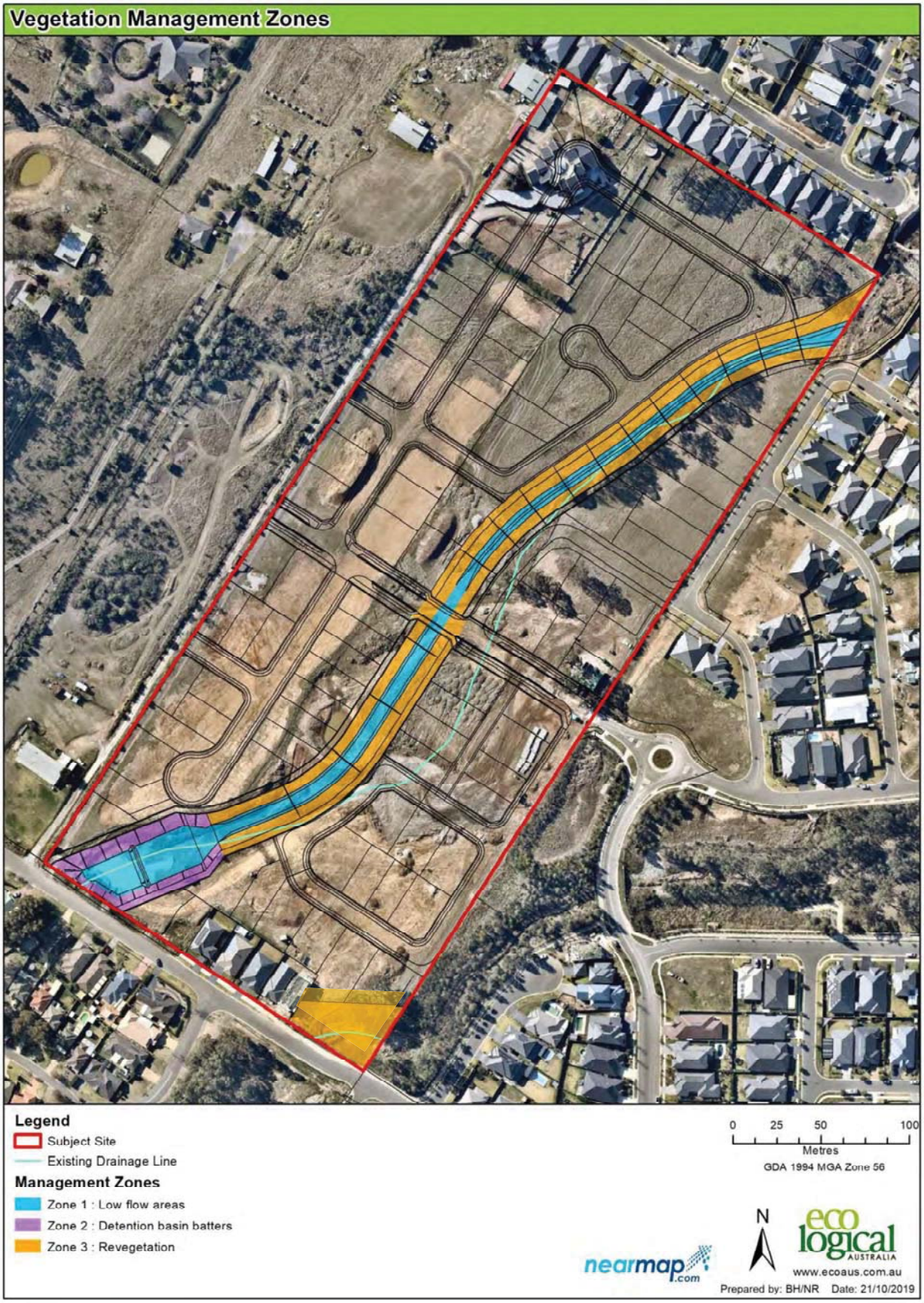


Figure 3: Vegetation management zones

© ECO LOGICAL AUSTRALIA PTY LTD

3.2.1 Management Zone 1: Low flow areas

Zone 1, an area of 0.508 ha, encompasses the new creek channel, the raingarden and the rock rip rap areas, which will be re-shaped during construction works. This zone will be covered in heavy weight jute matt (>850g / m^2) and revegetated using tubestock. Jute matt is to have a minimum 150 mm overlap with overlaps facing downstream.

Revegetation will be undertaken using a variety of sedge and rush species as identified in **Appendix E** at the densities specified in **Table 1**. The species selected will be a mix of groundcovers.

3.2.2 Management Zone 2: Detention basin batters

Zone 2, an area of 0.15 ha, encompasses the batters of the existing southernmost farm dam. The bank of the dam will be revegetated following construction of the gabion wall, access path, inlet and outlet structures. Intense weed control will be required to prevent new weed establishment in these areas. Sediment fences will be installed and maintained at all inlets to the farm dam until native vegetation is established. This zone will be covered in heavy weight jute matt (>850g / m^2) and revegetated using tubestock. Jute matt is to have a minimum 150 mm overlap with overlaps facing downslope into the dam.

Revegetation will be undertaken focusing on hardy sedge and grass species as identified in **Appendix E** to achieve the densities specified in **Table 1**. However, trees and shrubs from the CPW community will also be used.

3.2.3 Management Zone 3: Revegetation

Zone 3, an area of 0.93 ha, encompasses an area dominated by exotic pasture grasses and weeds. It will also include an area of RFEF which will be retained. Intense weed control will be required to prevent new weed establishment in these areas. This zone will be covered in heavy weight jute matt (>850g / m2) and revegetated using tubestock. Jute matt is to have a minimum 150 mm overlap with overlaps facing downslope into the channel.

A 3m shared pathway will be provided within the outer 50% of this zone to facilitate recreational enjoyment of the riparian corridor by residents.

Weed removal shall involve a primary control program using cut and paint woody weeds such as African Boxthorn and African Olive. A secondary / maintenance program will involve using spot spraying, hand-weeding and cut and paint techniques. Further detail on bush regeneration techniques is provided in **Appendix D**.

Revegetation will be undertaken using predominately CPW species as identified in **Appendix E** at the densities specified in **Table 1**.

3.3 Streamworks

The following instream works are required;

- Realignment of the central stream
- Construction of bioretention basins
- Construction of rock riprap adjacent culverts
- Culvert construction

The location of these works has been identified in the civil plans prepared by JMD and included as **Appendix A**.

© ECO LOGICAL AUSTRALIA PTY LTD

Table 1: Management actions

Zone	Description	Area (m2)	Revegetation densities (m^2)*				Totals
			Tree	Shrub	Herbs / Scramblers	Sedge / Grass	
Zone 1	Low-flow areas	5,080				6.00	30,481
Zone 2	Detention basin batter	1,507	0.005	0.02		6.00	9,076
Zone 3	Revegetation	9,310	0.01	0.04	1.00	3.00	37,706
Totals	**-**	**15,897**	**-**	**-**	**-**	**-**	**77,264**

*Includes equivalent amount of direct seeding

© ECO LOGICAL AUSTRALIA PTY LTD

4 Maintenance

The entire site will require ongoing maintenance to control weed regrowth from the soil seed bank for many of the weed species. Maintenance work is to be undertaken by a qualified bush regeneration contractor(s) to meet the performance criteria in **Table 2**.

Maintenance will be undertaken on a regular basis of at least weekly in the peak growing seasons (spring and summer) and monthly in cooler periods (autumn and winter). Maintenance will be undertaken for five years after practical completion of establishment works. Practical completion refers to the completion of all civil works, soil preparation, initial weed control and planting.

Completion of the maintenance period is dependent on achieving the required objectives for the VMP area. If the objectives identified in **Section 1.1** or the performance criteria outlined in **Table 2** are not met, the maintenance period will be extended until they have been. Alternately, if the performance objectives are met earlier than expected, Council may agree to an earlier handover. Therefore, maintenance must continue until Camden Council agrees that the objectives and performance criteria have been met and the maintenance period has concluded.

© ECO LOGICAL AUSTRALIA PTY LTD

5 Monitoring and reporting

5.1 Monitoring

The bush regeneration contractor will be engaged by the land owner to monitor the vegetation for changes over time. Monitoring will be required on a six monthly basis for the first two years and then annually until handover to Council, estimated to be five years from practical completion.

Short term (follow up) monitoring, is to be undertaken after the initial weed control works. This will determine if the initial treatment has been effective in controlling the target species or if follow up treatments are required and for how long. Follow up monitoring will prevent controlled areas from being reinfested. This monitoring is essential to inform the maintenance works and to get maximum value for money from the initial weed control works.

Long term (annual) weed monitoring will be used for initial work schedule planning, where and when to target weed control works in the coming year and appropriate works to be implemented noting that varying climatic conditions throughout the year may mean that the initial schedules need to be altered.

5.1.1 Photo monitoring points

A number of photo monitoring points will be established across the site to provide a visual reference of changes in the vegetation and performance of the stream works. This will be undertaken prior to the commencement of works and at the beginning of each summer season. The lead supervisor will set up 8 photo points across the site with the following distribution:

- Zone 1: Low flow areas – 3 photo points
- Zone 2: Detention basin batters – 2 photo points
- Zone 3: Revegetation – 3 photo points.

The following method will be used to establish and monitor the photo points:

- Mark the photo point with a six foot star picket and map the location of each photo point
- Take a digital photo of each photo point with the whole length of the star picket visible in the photo to act as a reference point
- Organise the digital photos logically with each image labelled with a unique reference number indicating the location of the photo point, the direction of the photo and the date the photo is taken.

5.1.2 Quadrats

Quadrats (1 m x 1 m) should be undertaken adjacent the photo points located in each zone during each monitoring period. Data collected will include:

- A species list of native species and their percentage cover
- A species list of exotic species and their percentage cover
- Survival rate of all planted vegetation per strata level: i.e. tree, shrub and groundcover
- Vegetation condition.

5.2 Reporting

The bush regeneration contractor will be engaged by the land owner to report on progress of the vegetation for changes over time. Reporting will be required on a six monthly basis for the first two years and then annually until handover to Council, estimated to be five years from practical completion.

© ECO LOGICAL AUSTRALIA PTY LTD

Each report will include:

- Works carried out, including a measure of effort (e.g. number of hours, change in weed densities, etc.) and other relevant information (e.g. weed species targeted, areas worked, dominant techniques used, etc.)
- Photos from monitoring points
- Quadrat information
- Any observations, such as the occurrence of new weed species
- A description of any problems or issues encountered (e.g. threatened species, rates of regeneration, etc) and how they were overcome
- A summary of how the site-specific objectives and performance criteria have been met (or not). If these have not been met, further explanation and a proposed response may be necessary
- Relevant maps.

This annual report will highlight the effectiveness of the program and identify any changes needed to improve (i.e. changes to weed control techniques, types of herbicides used or weed priority).

5.3 Performance criteria

The progress and compliance with the VMP will be monitored and reviewed every reporting period (i.e. six monthly for the first two years then annually afterwards). This process will involve the contractor(s), the land owner and the lead supervisor. Annual reports will be submitted to Camden Council. If required, reporting will be followed by a site visit to discuss.

The performance criteria are shown in **Table 2**. Where non-performance occurs and is not immediately rectified a 'stop the clock' notice on the maintenance period may be issued by Camden Council until the non-performance is rectified. In the case of performance criteria not being met due to extreme acts of nature (e.g. fire, flooding) or vandalism, discussions may be held with Camden Council to consider alternative performance criteria.

© ECO LOGICAL AUSTRALIA PTY LTD

Table 2: Performance criteria

Zone	Year 1	Year 2	Year 3	Year 4	Year 5
All zones	Commencement of all tasks outlined in the VMP or evidence of planning for their implementation. An increase in native cover and diversity and a decrease in exotic cover and diversity by the end of the maintenance period At the end of each year, a minimum of 85% survival rate of all vegetation strata planted in each zone (e.g. tree, shrub and groundcover) Any localised plant failure within planting areas are addressed with no area larger than 2 m x 2 m without surviving plants at the end of each year; Maintenance replanting is to replace plants by the same species, or where that species is not available, with the same growth form (i.e. tree for tree etc.) and must not decrease species diversity. Any new species to be planted must be from the community being emulated and of local provenance; Monitoring and reporting undertaken in accordance with Section 5				
	All adult seeding priority weed individuals to be controlled and no establishment of new priority species	No priority plants allowed to set seed and no establishment of new priority species	No priority plants allowed to set seed and no establishment of new priority species	No priority plants allowed to set seed and no establishment of new priority species	Complete eradication of priority weeds from the site and no establishment of new priority species
	Native groundcover vegetation no less than 30% of zone.	Native groundcover vegetation no less than 40% of zone.	Native groundcover vegetation no less than 50% of zone	Native groundcover vegetation no less than 60% of zone.	Native groundcover vegetation no less than 80% of zone
	Exotic groundcover vegetation no more than 40% of zone.	Exotic groundcover vegetation no more than 30% of zone.	Exotic groundcover vegetation no more than 20% of zone.	Exotic groundcover vegetation no more than 15% of zone.	Exotic groundcover vegetation no more than 10% of zone

© ECO LOGICAL AUSTRALIA PTY LTD

6 Implementation schedule and cost

The total indicative cost to implement this VMP is estimated at **$418,814** until the end of the five year maintenance period exclusive of GST. Costs may vary significantly over consecutive years of management according to the response to the management actions.

Rates and costs are based on ELA's commercial rates. As such, ELA requests that these figures not be provided to a third party, e.g. tenderers, without the knowledge or approval of ELA estimates of current standard commercial rates and there is potential for variation across the sector along with changes due to inflation. Other assumptions that have been made in regards to estimating costs have been outlined below.

6.1 Fencing

Costs for any fencing works required will be incurred by the client or contractors and have not been included in this budget.

6.2 Site preparation

The expense of machinery and staff time for the implementation of the site preparation works will be incurred by the client.

6.3 Seed collection

Budget for the collection of seed has been included as a separate task. If further seed collection works are required this may be an additional cost. The costs for propagation of these seeds are included as part of revegetation treatments in **Table 4** below.

6.4 Weed control treatments

Bush regeneration contractors will implement the weed control treatments identified in this VMP. These works have been estimated to cost $2,200 for a team of four bush regenerators, including a supervisor, per day. The cost of bush regeneration works includes the costs of herbicide, vehicles and equipment which are required to implement the VMP.

6.5 Soil and water management plan

A Soil and Water Management Plan for the site will be prepared and implemented prior to construction activities beginning. A copy of the Soil and Water Management Plan will be provided to the bush regeneration contractor by the site engineer. The bush regeneration contractor is not responsible for the installation or maintenance of any erosion or sediment controls required by the civil works.

6.6 Vegetation treatments

Bush regeneration contractors will implement the revegetation treatments identified in this VMP. The majority of the site will be revegetated via tubestock. A total of approximately 13,575 tubestock, or equivalent, will be required with a 10% replacement rate assumed. These replacement plantings would most likely be needed six months to one year after the initial tubestock were installed, and have been included within the costing.

© ECO LOGICAL AUSTRALIA PTY LTD

6.7 Monitoring and reporting

Bush regeneration contractors will undertake the monitoring and reporting identified within this VMP. This includes:

- Initial setup of the photo points and quadrats and conducting the baseline surveys
- Undertaking a report every six months for two year and annual for up to five years 12 months including photo points and quadrats
- Preparation of the 'Certificate of Practical Completion' annually

All monitoring, mapping and reporting works have been calculated using the rate for a qualified and trained Restoration Ecologist at $150 / hour (ex GST).

6.8 Implementation schedule

An implementation schedule for these works is provided in **Table 3**. Any natural regeneration should be assessed and taken into account before revegetation works begin.

Table 3: Implementation schedule

Establishment	Year 1	Years 2-5
Majority of seed collection undertaken	Remaining seed collection completed	-
Site preparation of revegetation areas, including jute matting and mulching	Replacement planting	Replacement planting, if required
Revegetation in all zones		
Primary and secondary control of all weeds	Secondary and Maintenance weed control	Maintenance weed control.
Monitoring and reporting	Monitoring and reporting	Monitoring and reporting

© ECO LOGICAL AUSTRALIA PTY LTD

Table 4: Indicative implementation costs

Treatment	Unit Costs for Treatment Zones			Total
	Zone 1	Zone 2	Zone 3	
Total Area (sqm)	5,080	1,507	9,310	**15,897**
Revegetation				
Seed collection, cleaning, storage	$3,048	$908	$3,771	**$7,726**
Site Preparation	$2,540	$753	$4,655	**$7,948**
Jute Matting / Mulch	$0	$10,922	$67,499	**$78,421**
Tubestock, supply and install	$68,583	$20,470	$85,421	**$174,474**
Replacement tubestock, supply and install	$6,858	$2,047	$8,542	**$17,447**
Irrigation	$3,810	$1,130	$6,983	**$11,923**
Weed control				
Establishment	$5,080	$1,507	$9,310	**$15,897**
Maintenance	$30,481	$9,039	$55,861	**$95,382**
Associated costs				
Monitoring & Reporting	$3,80	$1,130	$4,655	**$9,595**
Totals	**$124,212**	**$47,905**	**$246,698**	**$418,814**

© ECO LOGICAL AUSTRALIA PTY LTD

References

Brodie L (1999). *The National Trust Bush Regenerators Handbook*. National Trust of Australia (NSW).

Buchanan, R.A. 2000. *Bush regeneration: recovering Australian landscapes*. 2nd edition. TAFE NSW, Sydney.

DPI 2012. *Guidelines for riparian corridors on waterfront land.* Department of Primary Industries Office of Water NSW. Available at: http://www.water.nsw.gov.au/__data/assets/pdf_file/0004/547222/licensing_approvals_controlled_activities_riparian_corridors.pdf

Mortlock, W. 2000. *Florabank Guideline 10: Seed collection ranges for revegetation*. Florabank and the Hawkesbury-Nepean Catchment Management Trust. Available at: http://www.florabank.org.au/files/documents/Guideline%20No.%2010%20-%20Seed%20collection%20ranges%20for%20revegetation.pdf

Muyt, A. 2001. *Bush Invaders of South-East Australia*. R.G. & F.J. Richardson. Meredith, Victoria.

© ECO LOGICAL AUSTRALIA PTY LTD

Appendix A : Proposed drainage plans

© ECO LOGICAL AUSTRALIA PTY LTD

Appendix B : NoW correspondence:

From: Jeremy Morice <Jeremy.Morice@water.nsw.gov.au>
Date: 7 August 2014 2:00:26 PM AEST
To: Ian Dixon <IanD@ecoaus.com.au>
Subject: Re: FW: Merit based assessment - 195-203 Turner Road, Currans Hill (Manooka Valley West)

Hi Ian,

I have reviewed your riparian report prepared for the subject site. Based on the information provided the following NSW Office of Water comments apply to any future development of the site:

- The eastern mapped watercourse as referred to in your riparian report below can be removed.

  "To the east of the Driver Property, a residential development has removed a 1st order creek that once flowed into the Driver Property (water in that catchment will flow through road drainage to the larger creek further south). I am advised that this creek has been approved for removal within the Driver Property."

- The second order mapped watercourse from reaches A-I as specified in the report provided is considered to be waterfront land as defined by the *Water Management Act 2000*. It is acknowledged that this watercourse is highly degraded with some reaches of disconnected channel within the site. It is also modified or removed within adjacent properties.

  The following requirements for this watercourse apply:

  - Given the condition of this watercourse it is considered suitable for treatment as a 1st order stream as specified by the Guidelines for riparian corridors on waterfront land
  - The online wet detention basins as proposed in the concept plan are allowable subject to the assessment of detailed design by the NSW Office of Water. Basins require riparian planting including some trees and shrubs along the fringes of the basins. Designs will also require Council approval in regard to water quality and drainage requirements.

- The second order stream located in the south eastern corner of the site requires the establishment of a riparian corridor consistent with its treatment within the adjoining Manooka Valley development to the east of the site.

Any revisions to the current concept subdivision plan for the site should be provided to the NSW Office of Water for further comment prior to submission of a Development Application for the site.

Please give me a call if you wish to discuss any of the above.

Regards,

Jeremy Morice | Water Regulation Officer NSW Department of Primary Industries | NSW Office of Water
Level 0 | 84 Crown Street | Wollongong NSW 2500 PO Box 53 | Wollongong NSW 2520
T: 02 4224 9736 | F: 02 4224 9740 | E: jeremy.morice@water.nsw.gov.au
W: www.dpi.nsw.gov.au | www.water.nsw.gov.au

Appendix C : Noxious Weed Categories

Common name	Species name	Priority weed	WoNS	Legal requirements
Arican Boxthorn	*Lycium ferocissimum*	Y	Y	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction.
African Olive	*Olea europaea* subsp. *cuspidata*	Y	N	Land managers prevent spread from their land where feasible.

© ECO LOGICAL AUSTRALIA PTY LTD

Appendix D : Techniques and specifications

Weed control

Weed control involves a combination of mechanical, physical and chemical techniques to remove the weeds and prevent regrowth. Weed control will be undertaken in all management zones. A selection of the best suited weed control method within the site depends on a number of factors including:

- The species or combination of weeds being targeted
- The density of the weeds
- Resources available (time, labour, equipment and finances)
- Weather conditions of the day

Weed control techniques

Detail of specific weed control techniques to be used such as cut and paint, scrape and paint, herbicide spraying and hand weeding are given in Brodie (1999). The principles of bush regeneration and techniques to trigger natural regeneration are to be in accordance with the Bradley Method and other techniques described in Buchanan (2000). Management techniques for different types of weeds are provided below.

Annual grasses

Annual grasses, such as *Bromus catharticus* (Prairie Grass), should be hand removed or spot sprayed where isolated or in low concentrations. Larger patches of annual grasses may be slashed/brush cut in late spring to early summer, after flowering, but prior to seed set. For most species, slashing/brush cutting prior to late spring through to early summer will promote vigorous growth and should not occur. However, some annual grasses can grow and produce seed at any time of the year dependent on climatic conditions such as high rainfall and warm temperatures. Monitoring of annual species should be undertaken and if new growth occurs, the same treatment will be applied to the new growth to prevent seed production. Individual plants should be hand removed, bagged and disposed of appropriately offsite.

Perennial grasses

Perennial grasses, such as *Paspalum dilatatum* (Paspalum) and *Pennisetum clandestinum* (Kikuyu Grass), will be hand removed where isolated or in low concentrations. Larger patches may be slashed prior to seed production in spring or summer (depending on the growth cycle of the species) and the regrowth spot-sprayed 2-3 weeks later when it is actively growing and approximately 10 cm in length. Monitoring of these species will occur and if new seed production occurs, the same treatment will be applied again as required. However, slashing will not reduce the presence of exotic grasses on its own and must always be combined with targeted removal to reduce densities and allow for native regeneration. Individual plants should be hand removed, bagged and disposed of appropriately offsite.

Woody weeds

If woody weeds invade the site, including species that were present before earthworks such as African Boxthorn and African Olive will be controlled by the cut and paint or drill and fill method using a non-selective herbicide. The most appropriate method to be used depends on the size of the individual to be removed and will be determined by the bush regeneration contractor. Primary weed control should use

© ECO LOGICAL AUSTRALIA PTY LTD

techniques that will not encourage flushes of secondary weed growth. All seedlings of woody weeds will be hand pulled or spot-sprayed with a non-selective herbicide.

Creepers and climbers

The control of creepers, including *Asparagus asparagoides* (Bridal Creeper), *Anredera cordifolia* (Madeira Vine), *Rubus fruticosus sp. agg*. (Blackberry) and *Lonicera japonica* (Japanese Honeysuckle), varies depending on the species. For the most part, seedlings will be hand pulled, while mature plants can be controlled by the stem-scrape method or spot spraying using a non-selective herbicide. The precise method to be used will be determined by the bush regeneration contractor depending on the species, size and reproductive status of the individual. All vegetative material removed should be bagged, removed from site and disposed of appropriately.

Herbaceous weeds

Where individual plants of other herbaceous weeds, including *Conyza bonariensis* (Flax-leaf Fleabane) and *Verbena bonariensis* (Purpletop), are found, they will be hand pulled prior to flowering. Where large swaths of these species occur they will be sprayed using a non-selective herbicide. If high densities of mature stands occur, weeds may be slashed first using a brush cutter and any subsequent regrowth sprayed. Regular monitoring of these species will be required to prevent seed production. *Cirsium vulgare* (Spear Thistle) will not be hand-pulled due to its thorns and instead will be spot sprayed using a non-selective herbicide. All vegetative material that is pulled out and has the potential to regrow if deposited on ground will be bagged and removed from site.

Management of weed waste

All exotic vegetation material should be removed from site and composted at a registered green waste disposal facility. Fruiting parts and tubers should be bagged before being removed from site.

Herbicide use

The use of herbicide to control weeds should be carefully considered. Herbicide use should assess potential long-term impacts of the technique including whether the proposed works actually address the source of the weed infestation. However, herbicide application forms an important and useful component of an integrated weed management approach and can be the most appropriate method to control some weed species.

Herbicide use should occur during the active growing season for plants to encourage the chemical uptake into the plant. The selection of herbicides should also consider the type of weed and the location. Where non-selective herbicides are required for use, glyphosate is the most suitable. If herbicides are required to be used near waterways, a glyphosate-based herbicide formulated for use near waterways will be used (e.g. RoundUp© Biactive™).

Broad-leaf selective herbicide may be used as per the Noxious and environmental weed control handbook (DPI 2010). However, this type of herbicide is extremely toxic to aquatic life and must not be used in, or adjacent to, waterways. Registration and records must be kept in accordance with the NSW Pesticide Regulation 2009.

Revegetation works

Revegetation has the twin aims of both re-establishing the original native vegetation community at the site and reducing erosion along the length of the riparian corridor, which will carry greatly increased peak

flows due the increased run-off from the hard surfaces created by the associated residential development. The revegetation must be undertaken in accordance with the Standards for APZ (NSW Rural Fire Service, 2005). Any plantings should consist of local provenance stock. A summary of the revegetation densities is shown in **Table 1**.

Planting of Hiko for trees and shrub species and Hiko or Viro cells for grasses and other groundcover species is the preferred method. Planting should be done via a low impact method such as hand digging or hand auger. The holes dug for each plant should be at least 1.5x the width and 2x the depth of the rootball. Fertiliser should be added to each hole dug as per the label specifications. Water crystals or wetting agents should be added to each plant hole. This will increase the water holding capacity of the soil and reduce watering schedules. Initial irrigation of the plantings is essential to ensure that the soil forms around the rootball and no air pockets are left. This will be required unless sufficient rainfall (approx 10mm) occurs on the day of planting.

Tree guards will need to be installed on each tree or shrub to protect seedlings from extreme weather (frosts and heat), herbivorous grazing and herbicide drift during maintenance. Bio-degradable tree guards are recommended to protect the seedlings. Following the revegetation works, irrigation needs to be undertaken for at least 8 weeks following planting to ensure the establishment of the plants. The level of irrigation will be determined by rainfall and temperature experienced at the planting site.

Mulch should be used where identified. The use of mulch is very important because it provides organic matter to the top soil, improves soil structure and aeration, water infiltration, nutrient availability, and is also useful in the suppression of weed growth (Buchanan 2009). Mulch should be sourced from within the local area. Mulch must be free of weed propagules and invasive woody species such as Coral Tree (*Erythrina x sykesii*). Mulching should not be undertaken within areas of high potential erosion. It is recommended jute matting is used in these areas prior to revegetation.

A temporary irrigation system should be installed to assist in the establishment of vegetation. Timing of the planting of these areas will need to take into consideration surrounding civil works and erosion/sediment control requirements, these areas will not be planted until earthworks have been completed. A maximum rate of attrition of 10% is to be tolerated, with any plant loss above this rate to be replaced at the contractor's expense

Seed collection

For the growth of the plants used in the revegetation works, seed must be collected from local provenance species. Groundcovers, shrubs and trees should be collected in as close proximity (i.e. <20km) as possible to the site, however soil type, climate and aspect of the collections site should also be considered. Native grasses typically have much larger dispersal mechanisms and are to be collected from within the Cumberland Plain of Sydney. Wetland species are to be collected from within the Cumberland Plain component of the Hawkesbury Nepean Catchment.

Where species identified in this VMP cannot be sourced, they may be substituted for other Cumberland Plains Woodland / River-Flat Eucalypt Forest species as identified by Tozer (2003). Species must be substituted with species of a similar form, e.g. trees for tree, grasses for grasses, etc. Only wild native species are to be used. Plants are not to be substituted with horticultural varieties under any circumstances.

Record keeping of seed collection and planting locations are to follow the Florabank guidelines (Mortlock, 2000). A Section 132C licence under the NSW *National Parks and Wildlife Act 1974* will be required to

© ECO LOGICAL AUSTRALIA PTY LTD

undertake seed collection works. The bush regeneration contractor is responsible for recording this information and providing it to Camden Council.

Bush regeneration contractors

All vegetation management works in the establishment phase will be undertaken by suitably qualified and experienced bush regeneration contractors who are members of the Australian Association of Bush Regenerators or fulfil the membership criteria. In addition to this, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009). A flexible approach to this site is recommended since techniques may need to be changed or modified to suit site conditions. This approach is consistent with adaptive management and allows the contractor to develop and build on site knowledge whilst implementing this VMP. Monitoring will assist in the development of the VMP actions in subsequent years.

Works in the maintenance phase will be undertaken by the land manager in consultation with Camden Council.

© ECO LOGICAL AUSTRALIA PTY LTD

Appendix E : Species list

Type	Scientific name	Common name	Management zones		
			Zone 1	Zone 2	Zone 3
			FW	RFEF/FW	CPW
Tree Canopy Species (>6m)	*Angophora floribunda*	Rough-barked Apple			X
	Angophora subvelutina	Broad-leaved Apple			X
	Casuarina cunninghamiana subsp. *Cunninghamiana*	River Oak		X	
	Casuarina glauca	Swamp Oak		X	
	Eucalyptus amplifolia	Cabbage Gum		X	X
	Eucalyptus moluccana	Grey Box			X
	Eucalyptus tereticornis	Forest Red Gum			X
Small Trees / Shrub Species (1.5-6m)	*Acacia implexa*	Hickory Wattle			X
	Acmena smithii	Lilly Pilly		X	
	Backhousia myrtifolia	Grey Myrtle		X	
	Bursaria spinosa	Blackthorn			X
	Dillwynia sieberi	-			X
	Dodonaea viscosa subsp. cuneata	Wedge-leaf Hop-bush			X
	Indigofera australis	Australian Indigo			X
	Melaleuca decora	-		X	
	Melaleuca styphelioides	Prickly-leaved Tea Tree		X	
	Tristaniopsis laurina	Water gum		X	
Sedges, Rushes, Reeds & Grasses	*Aristida ramosa*	Purple Wiregrass			X
	Aristida vagans	Threeawn Speargrass			X
	Baumea articulata	Jointed Twig-rush	X		
	Baumea rubiginosa	Twig-rush	X		
	Bolboschoenus caldwellii	Salt Club-rush	X		

© ECO LOGICAL AUSTRALIA PTY LTD

Type	Scientific name	Common name	Management zones		
			Zone 1	Zone 2	Zone 3
			FW	RFEF/FW	CPW
	Bolboschoenus fluviatilis	Marsh Club-rush	X		
	Bothriochloa macra	Red Grass			X
	Carex appressa	Tall Sedge	X	X	
	Chloris truncata	Windmill Grass			X
	Cymbopogon refractus	Barb-wire Grass		X	X
	Cyperus gracilis	Slender Flat-sedge			X
	Dianella longifolia	Blueberry Lily		X	X
	Dichelachne micrantha	Shorthair Plumegrass			X
	Papalum distichum	Water couch	X		
	Einadia hastata	Berry Saltbush		X	X
	Eleocharis sphacelata	Tall Spike Sedge	X		
	Gahnia clarkei		X		
	Imperata cylindrica var. major	Blady Grass		X	
	Isolepis inundata	Swamp Club-sedge	X		
	Juncus kraussii subsp. australiensis	Sea Rush	X		
	Juncus usitatus	Common Rush	X	X	X
	Lomandra longifolia	Spiny-head Mat-rush		X	
	Microlaena stipoides var. stipoides	Weeping Meadow Grass			X
	Persicaria decipiens	Slender knotweed	X		
	Poa labillardieri var. labillardieri	Tussock Grass		X	X
	Rytidosperma caespitosum	Whitetop		X	X
	Rytidosperma racemosa var. racemosum	Wallaby Grass		X	X
	Rytidosperma tenuior	-		X	X
	Schoenoplectus mucronatus	A Club Sedge	X		
	Schoenoplectus validus	River Club-sedge	X		

© ECO LOGICAL AUSTRALIA PTY LTD

Type	Scientific name	Common name	Management zones		
			Zone 1	Zone 2	Zone 3
			FW	RFEF/FW	CPW
	Themeda australis	Kangaroo Grass		X	X
Groundcover Species & Vines/Scramblers	*Brunoniella australis*	Blue Trumpet			X
	Centella asiatica	Indian Pennywort			X
	Clematis glycinoides	Old Man's Beard			X
	Commelina cyanea	Creeping Christian			X
	Desmodium varians	Slender Tick-trefoil			X
	Dichondra repens	Kidney Weed			X
	Geranium solanderi	Native Geranium			X
	Glycine clandestina	Twining Glycine			X
	Hardenbergia violacea	Purple Coral Pea			X

ecological AUSTRALIA

1300 646 131
www.ecoaus.com.au