Appendix D – SafeWork NSW Dangerous Goods Search

NSW GOVERNMENT | SafeWork NSW

Locked Bag 2906, Lisarow NSW 2252
Customer Experience 13 10 50
ABN 81 913 830 179 | www.safework.nsw.gov.au

Our Ref: D17/222730
Your Ref: Iain Lindley

10 October 2017

Attention: Iain Lindley
GHD Pty Ltd
3/200 Crown Street
WOLLONGONG NSW 2500

Dear Mr Lindley

RE SITE: 1-21 Dillwynnia Grove, Heathcote NSW 2233

I refer to your site search request received by SafeWork NSW on 5 October 2017 requesting information on Storage of Hazardous Chemicals for the above site.

A search of the records held by SafeWork NSW has not located any records pertaining to the above mentioned premises.

For further information or if you have any questions, please call us on 13 10 50 or email licensing@safework.nsw.gov.au

Yours sincerely

Customer Service Officer
Customer Experience - Operations
SafeWork NSW

Appendix E – Council Records Extract

Heathcote Hall

Brief History of Council involvement since October 1998
Update by Environmental Compliance Unit

1998

October

- Site Inspection by the Environmental Compliance Unit (KA), Environmental Health Officer (RB) and Animal Controller (TH).
- Comprehensive report outlining non-compliance issues (KA).

November

- Further discussions with Brett Stratten
- Meeting with General Manager requesting that a report be prepared for Council to discuss the issues and a range of options.
- Correspondence from Abbott Tout Solicitors to the Heritage Council informing them of the state of disrepair and the unlawful uses of the property.

1999

January

- Correspondence from Mr Stratten and petition.

February

- Correspondence from Mr Stratten that he would like to address the Council meeting and representations received from Mrs Lorna Stone regarding the unlawful uses of Heathcote Hall.

March

- Further correspondence from Abbott Tout Solicitors to the Heritage Council asking for a response.
- Report to Council, **EHC210-99: Alleged unlawful land uses at 'Heathcote Hall' on 8 March 1999.**

  - Council Resolutions: dated 15 March 1999

    1. That the report prepared by the Environmental Compliance Unit (ECU) in respect to the alleged

unlawful land uses at the 'Heathcote Hall' estate Lots 1 & 2 DP 725184 (No 1-21) Dillwynnia Grove Heathcote be received and noted;

2. That the concurrence of the Heritage Council of NSW a regime of Orders pursuant to the EPAA and the LGA be pursued by the ECU against the owners of the 'Heathcote Hall' Mr J Farrelly seeking the cessation of the commercial horse boarding facility, removal of unauthorised buildings, removal of waste and fill material and the eradication of noxious weeds.

3. That Council requests the Heritage Council to pursue the matter of the demolition of the old coach house, which had been covered by a Permanent Conservation Order under s44 of the *Heritage Act 1977* (NSW), and such demolition was unauthorised, Council expresses its grave concern at the loss of this heritage building from its shire, and its history.

4. That Council expresses its concern to the Heritage Council in regard to Heathcote Hall, (which is greatly valued by the Sutherland Shire Historical Society, and Shire residents) which has fallen into such a state of disrepair. It should be noted that Heritage Assistance Grants are available for such work, and the owner should be urged to carry out necessary repairs.

- Response from Heritage Council stating that the 'Heathcote Hall is not **in imminent danger.** The Heritage Council also acknowledged that the current owners would probably not undertake further conservation work. The Heritage Council also indicates that the best course of action is to support actions proposed in the management plan.

April

- Site Inspection with Maxine Farrelly outlining Council's intention to give Notices and Orders to cease using the property for Commercial horse stabling and remove unlawful structures.

- Documents received proving that Maxine Farrelly has power of attorney of Joseph Farrelly.

- Notices issued (dated 13 April 1999) pursuant to:

  - *Environmental Planning and Assessment Act 1979* (NSW)
  - Order 1- Cease the use of the premises for the purpose of a commercial horse stabling operation;

- Order 2 – Demolish the horse stables in the grounds of the subject premises;
- Order 12- restore the premises to their original condition by removing the fill material placed in the southwest corner of the premises;

➢ *Local Government Act 1993 (NSW)*

- Order 21 – remove from the premises all accumulations of horse manure form the enclosures on the premises & remove from the premises all accumulations of vegetative material whether alive or dead which are likely to cause harbourage for rubbish or vermin.
- Order 22 – Remove the waste, comprising disused and/or second hand building materials (excluding materials originating form the coach house) and dilapidated and/or abandoned motor vehicles or ancillary parts and accessories or machinery from the subject premises and dispose of this waste at a regional tipping facility.

May

- Orders sent to the Heritage Council for their concurrence pursuant to s121S (3) of the *Heritage Act 1977* (NSW).

- Correspondence from Mr Stratten.

June

- Discussions with Heritage Council stating that there were some concerns with respect to 'Heathcote Hall' and that the Heritage Council will formally reply to the letter sent with respect of the intended Orders.

- Discussions with Glen Cowell expressing concern that the Orders should not be given as the horse stables are covered by the PCO and that she would like to speak with Paul Vergotis before the orders are given.

- Response from the Heritage Council outlining concerns about orders being carried out which may affect the heritage significance of the site. The Heritage Council was also concerned about the coach house, which was unlawfully demolished.

- Working bee organised by Glen Cowell attempts to clean up the site.

August

- A meeting was held with Glen Cowell, Paul Vergotis, John Brunton and John Rayner to discuss the issues. It was apparent from the meeting that

Ms Cowell is concerned that the removal of the stables might impact on the heritage significance of the site and that the Conservation Management Plan, which she is drafting, should be viewed before any decision is made. This report is due out in April 2000.

September

- Further correspondence from Mr Stratten.

November

- Representations made to Ian McManus MP from Mr Stratten.
- Correspondence received from Glen Cowell outlining her objection to the removal of the stables and the cessation of the use of the horse stables. This correspondence also included a petition signed by over 950 people.
- Representations received from Glen Cowell in response to Notices issued in April 1999. Reasons put forward for not issuing the orders include:
    - The age and physical condition of the owners;
    - The difficult economic position of the owners;
    - The owners desire to retain the property;
    - The fact that the stables have been an ancillary use of the building since the 1880s;
    - The rights of the owners to conduct certain activities on their premises; and
    - The responsibilities of the community to assist the owners of a heritage item to remain in their home.

December

- Report to Council, **EHC130-00: Hearing and Consideration of Representations made on behalf of Mr Joseph Farrelly in relation to Notices of Intention to Give Orders – Heathcote Hall Estate.**
    - Council Resolutions: (dated 20 December 1999)

    1. That pursuant to s135(1) of the LGA Orders 21 & 22 pursuant to s124 of the LGA not be given in relation to the Heathcote Hall Estate;

    2. That pursuant to s121K(1)(c) of the EPAA, Orders 1, 2 & 12 pursuant to s121B of the EPAA not be given in relation to the Heathcote Hall Estate;

    3. That approval in principle be given to the establishment of a working party to facilitate the development of a rehabilitation Management plan for

the Heathcote Hall Estate and the implementation of such a plan. The composition of the working party should be made up of representatives from:

(a) the owner of the subject premises;
(b) the Heritage Office of NSW;
(c) Sutherland Shire Council, including ward Councillors and other interested Councillors;
(d) The Heathcote Stables;
(e) The residents of Dillwynnia Grove, Tecoma Street and Boronia Grove and
(f) The Sutherland Shire Historical Society;

4. That the working party give priority to introducing a program to remove all of the horses, undertake a general clean up of the area and the eradication of the weeds; and

5. That the working party gives thought to the future ownership of the property.

- Further correspondence from the Heritage Council asking for further information concerning the coach house.

2000

April

- Working Party holds inaugural meeting.

June

- Further complaints from Mr Stratten and numerous enquires received from Councillors.

July

- Site inspection by Council Officers and Councillors.

Heathcote Hall
History and File Investigation from July 1945 to September 1998

1945

July

- "Notice of Transfer of Land" to Mrs Farrelly.

1972

February

- Heathcote Hall proclaimed a place of "historical interest".

October

- Letter from Council to the National Trust of Australia enquiring about a proclamation under clause 38 of the Country of Cumberland Planning Scheme Ordinance.

- Acknowledging Council's letter but acknowledging that an inspection had not taken place.

December

- Letter from the National Trust of Australia (NSW) that Heathcote Hall had been given a "C" classification with the proviso that it could be considered for a "B" classification if restored.

1973

February

- The recommendation of the National Trust of Australia (NSW) incorporated into Council minutes.

- Article concerning the "Shire's Historic Mansion"

March

- Article in Newspaper relating to the historical significance of Heathcote Hall.

April

- Letter to the State Planning Authority of NSW relating to the recommendations of the National Trust of Australia (NSW).

May

- The Development Committee Minute 45 adopts the above recommendation.

November

- Letter of complaint from a nearby resident complaining about the noise emanating from the premises. The operation of industry appeared to be present at the site. The construction and storage of timber pallets seemed to being carried out at the site.

- Site inspection of the premises revealed the presence of timber pallets and seemed to intensify since the last inspection. A recommendation was made to send a letter to the owners of the premises.

December

- Letter sent to the owners of Heathcote Hall reminding them of their responsibilities in relation to the residential zone.

1974

April

- Letter sent to Mr Farrelly demanding he stop using the premises for the timber pallets. If he does not stop, legal proceedings were to be instigated.

May

- Memo to file recommending legal proceedings be commenced against the owners in relation to the timber pallets. A written undertaking from Mr & Mrs Farrelly was given to Council saying they would cease the use by May.

1978

January

- Memo from Health Surveyor noting the presence of horse stables at Heathcote Hall. The matter referred to the health surveyor.

February

- A site inspection was carried out in response to the complaint concerning horse stables. The owner said that the stabling of horses was not a commercial operation. The report stated:

  > "it is considered that the activities can be accommodated on the site without adversely affecting surrounding residences."

- It was noted that trees concealed the stables from the street. It was suggested that the owners submit a development application so that some control can be exerted over the use of the site as horse stables.

March

- A letter to the owners of Heathcote Hall requesting again the submission of a development application for the keeping of horses. Failure to submit such an application may lead to legal action being instigated by Council.

August

- Report by Town Planner regarding Heathcote Hall:
  - Brief history
  - Present condition
  - Present status and zoning

1981

April

- The unauthorised use of Heathcote Hall for horse stables was acknowledged again in this letter to Mrs Farrelly. The submission of a development application was again requested and again legal action was threatened.

May

- A letter was again sent to Mrs Farrelly regarding the unauthorised use of the premises as a horse stable. The acknowledgment of no development application was again highlighted to Mrs Farrelly.

October

- A letter of complaint from a resident of Boronia Grove, indicating that the stables had "dramatically multiplied". The complaint is regarding noise and the minimum distance from buildings.

November

- Heritage Council of NSW has made an Interim Conservation Order pursuant to s26 of the *Heritage Act* 1977 (NSW).

1982

April

- **Heritage Council of NSW made Heathcote Hall subject to a Permanent Conservation Order (PCO) pursuant to s44 of the *Heritage Act* 1977 (NSW).**

1983

May

- A letter from the Department of the Valuer General. The value of the land is $60,000.

1984

February

- Complaint from resident in Dillwynnia Grove. The complaint was: *"stormwater containing manure, urine etc constantly flowing into complainant's yard. Fly and other nuisance. Additional stables being constructed. Council strip overgrown".*

- An additional complaint received outlining the same concerns.

July

- A letter from Council sent to Heathcote Hall outlining the complaints received and informing them that they must obtain building approval from Council for any additional stables.

1985

August

- Restoration of Heathcote Hall suggested for the Bicentennial.

October

- Letter from the Bicentennial Community Committee acknowledging the letter from the HPA.

December

- Letter to the Heritage Council of NSW from SSC initiating discussions concerning the restoration of Heathcote Hall.

1986

January

- Letter from the Heritage Council of NSW acknowledging the request.

February

- A letter from Councillor Andrews from Keith Lund referring to the refurbishment of Heathcote Hall.

May

- Site inspection of Heathcote Hall with Heritage Council of NSW, Council ant the owners to discuss the restoration of Heathcote Hall.
- Letter indicating that Mr Farrelly was keen to restore the Heathcote Hall
- HPA are keen to have Heathcote Hall restored as part of the bicentennial projects.
- Meeting arranged with the Council and the HPA that a meeting had been arranged to discuss the possibility of restoration.

July

- A letter from SSC to Heritage Council requiring information about finance of restoration work.

August

- Letter to Mr Robert Tickner concerning the dilapidated state of Heathcote Hall.

1987

January

- Letter to SSC from Mr Tickner concerning the dilapidated state of Heathcote Hall.
- A Response regarding the discussions with the Heritage Council of NSW regarding the restoration of Heathcote Hall was forwarded to Mr Tickner.

March

- A letter from GHD-VOGAN Pty Ltd detailing options available to Council in regards to the property and a current description of the property. This letter notes the presence of "..in excess of 20-25 horses stabled there at the time of our inspection".

- A photograph showing horses and stables and a Memo from Adam Mills from TPD.

- Letter from Council to the Heritage Council of NSW expressing concern about the deteriorating state of Heathcote Hall.

- Letter to Mr Farrelly regarding the use of the grounds of Heathcote Hall.

- Memo from Adam Mils indicating that Mr Farrelly had taken up the funding for the report from the Heritage Council after they were reminded about their obligations under the *Heritage Act* 1977 (NSW).

September

- A Health & Building complaint received regarding new stables being built. A site inspection by a council Officer revealed they were only repairing existing stables and fences.

October

- Conversation held with Ms Farrelly regarding fence requirements.

- A letter from the RSPCA to Mr Farrelly concerning forms for a "livery stable" to be established at "Heathcote Hall".

November

- A letter from the Department of Planning (Mr McManus) outlining the options available in relation to restoration and future uses of Heathcote Hall.

1988

January

- Memo regarding Mr Farrelly intentions to legalise the livery stable operation. The memo is questioning whether the se is a legal one.

February

- A letter of complaint from Mr Stratten outlining concerns such as odours, fencing, parking and dogs roaming the streets. A copy of letter sent to Mr Tickner.

- A letter from the HPA outlining concerns about the loss of vegetation on the boundary of "Heathcote Hall".

March

- A site inspection revealed that the stables were in good condition, although some required some maintenance. A "Notice to Comply" was issued for the stables to be repaired.
- A letter form SSC to HPA regarding a fence around the property.
- Memo from Adam Mills outlining there is no existing use rights for the stables.

April

- A memo to file indicated that the order had been complied with as the stables had been repaired and the surrounding area had been kept clean.

1989

January

- Report by Adam Mills indicates that horses have been present at Heathcote Hall since the mid 1960's. Mr Mills indicates that they **do not enjoy existing use rights.**

February

- Councillors request regarding the future uses of Heathcote Hall for the stabling of horses.

March

- Memo from SSC Property Officer detailing conversations with Ms Farrelly about the cultural assessment report by Partridge and Associates.
- SSC instructs *McLennan Steege and Associates* of Caringbah to prepare a valuation of the site.
- Letter of complaint form Mr Brett Stratten regarding the horses and associated stables at Heathcote Hall.

April

- Memo from Property Officer outlining the valuation on Heathcote Hall.
- Letter from Valuers indicating the property supports a value of $1.4million.

May

- The Heritage Council believes that the Farrelly's best option is to sell privately.

June

- Memo to file from Property Officer saying that JWR is wanting to pursue the matter, maybe looking at subdivision.
- Memo from SSC which discussed possible acquisition of the Heathcote Hall so that restoration could occur and/or subdivision.
- HPA questions the legality of the horse stables
- A complaint received from Brett Stratten concerned about horses and Council's lack of action.
- Brett Stratten sent the above letter to Mr Tickner.
- Brett Stratten makes a complaint to the Health and Building Department about the noise of horses kicking bins over etc.

July

- Councillors request (No 2806) from Councillor Hill, saying that she had received a letter form Mr Stratten, Several Councillors informed, Tynan & Downy
- Site inspection reveals that the site is very dusty and the manure is spread out all over the place, with the manure bins uncovered. Inadequate drainage was also noted.
- Complaint to the Health & Building Department was received from Mr Brett Stratten concerning manure dumped on the Boronia Grove entrance. The manure bin on the Tecoma St side was also cause for concern for Mr Stratten.

August

- Memo to Shire Clerk regarding alterations to Heathcote Hall.
- Councillor's request (No 3613) from Councillor Parker

September

- A brief history of complaints and concerns regarding Heathcote Hall and the unsightly condition of the stables.

- A letter sent to Heathcote Hall outlining the unsightly structures and the issuing of a notice under the Public Health Act.

October

- Ms Farrelly responds to suggestions that the horse stables are unsightly.
- Site inspection revealed that the maintenance ordered in the Notice had not been carried out.
- Another compliant received regarding the horses and the dilapidated state of Heathcote Hall.
- Mrs Farrelly rang SSC to enquire about a fence she wished to construct.

1990

February

- Letter from HPA requesting action from Council.

March

- Memo from Health Services outlining the dilapidated state of some of the stables.

April

- Letter sent to Mr Farrelly regarding the dilapidated structures on the property. It stated that SSC wanted the structures demolished or repaired to a specific standard. (ten sheds on total)
- A letter was sent to Mr Farrelly regarding the notice issued under the Public Health Act.
- Councillors Request No 2868 received from Councillor Cheryl Hill enquiring about the current situation with the stables.
- Councillors Request Number 3627 received from Councillor Parker regarding tan update on horse/stabling.
- Memo form Health Services regarding the planning and health issues of Heathcote Hall.
- Response from Mrs Farrelly.
- Memo concerning the possible shutdown of the stables.
- Memo from Health Services regarding the noise, dust etc form the stables.

July

- Memo to Director of Property from Robert Wilcher (Environment Lawyer) relating to the legality of the horse stables.
- Report on horse stables from Robert Wilcher
- Response to Councillors updating them on the issues concerning "Heathcote Hall".

September

- Memo from Robert Wilcher – **the stables do not enjoy existing use rights**.

1998

September

- A complaint received from Mr Stratten concerning the horse at "Heathcote Hall".

Appendix F – Photographs

Photograph 1: Heathcote Hall, seen from north-west

Photograph 2: Central stables and drums, seen from west

Photograph 3: Building materials stockpile near central stables

Photograph 4: Fill embankment, south-west corner, seen from Dillwynnia Grove

Photograph 5: Potential asbestos containing material fragments on ground, south-west corner of garden area

Photograph 6: Outhouse in garden area

Photograph 7: Septic tank, adjacent west of outhouse

Photograph 8: Hoarding and materials being stored onsite

GHD

Level 11, Crown Tower
200 Crown Street
T: 61 2 4222 2300 F: 61 2 4222 2301 E: wolmail@ghd.com

2316195-15872/https://projects.ghd.com/oc/Canberra/enviroandgeotservice/Delivery/Documents/2136195-REP_Heathcote Hall Phase 1.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	Christopher Cook	Colee Quayle		Stuart Clark		27/10/17

www.ghd.com

Land & Groundwater Consulting Pty Ltd
13/80-84 Illawarra Road
Marrickville NSW 2204
T: +61 2 9560 9760
F: +61 2 9572 6440
W: www.lgconsult.com.au
ABN 65 162 117 928

29 January 2018

Ref: LG17100.02 GEOTECH RPT 29-01-18.docx

Robert Orth and Nathan Fuz
Fuzortinn Pty Ltd
Unit 2, Level 2, 8 Lord Street
Botany NSW 2019

Via Email: robert.orth@cdconstruction.com.au
nathan@cdconstruction.com.au

Dear Robert and Nathan,

Geotechnical Investigation Report
1-21 Dillwynnia Grove, Heathcote, NSW

1. Introduction

Land & Groundwater Consulting Pty Ltd (LG) has been engaged by Fuzortinn Pty Ltd to prepare a geotechnical investigation report for 1-21 Dillwynnia Grove, Heathcote, NSW (the site). The site comprises of a semi-rectangular block legally identified as Lot 1 and 2 in Development Plan (DP) 725184 with an approximate area of 17,500 m^2. LG understands that the proposed development will comprise the refurbishment and restoration of Heathcote Hall Building, construction of 35 x 2 storey townhouses, 2 x 3 storey apartment buildings with 20 units, a 2-level basement car park and landscaping.

2. Scope and Investigation Findings

The geotechnical fieldworks were conducted on 8 August 2017 by Soilsrock Engineering Pty Ltd. The scope of works and investigation findings are presented in Appendix A. Should you have questions or require further information about this report, please contact the undersigned on (02) 9560 9760 or 0415 726 951.

Yours sincerely,

Gonzalo Parra
Managing Director
Mobile: 0415 726 951
Email: gparra@lgconsult.com.au

Appendix A: Geotechnical Report

DETAILED GEOTECHNICAL SITE INVESTIGATION REPORT

FOR

PROPOSED DEVELOPMENT

AT

1-21 DILLWYNNIA GROVE HEATHCOTE NSW 2233

Report Prepared for: FUZORTINN PTY LTD

Project No: SRE/275/HC/17

Date: 17/01/2018

Soilsrock Engineering Pty Ltd
5/110 Oaks Avenue, Dee Why NSW 2099
M 0457 1150 44 T 02 8065 2922
E info@soilsrock.com.au W www.soilsrock.com.au

Distribution and Revision Register

Document details

- **Project number:** P275
- **Document number:** SRE/275/HC/17
- **Document Title:** Detailed Geotechnical Site Investigation Report for Proposed Development
- **Site address:** 1-21 Dillwynnia Grove, Heathcote NSW 2233
- **Report prepared for:** FUZORTINN PTY LTD

Document status and review

Revision	Prepared by	Reviewed by	Approved by	Date issued
0	H.C	J.C	J.C	17/01/2018

Distribution of copies

Revision	Electronic	Paper	Issued to
0	1		FUZORTINN PTY LTD
0	1		GONZALO PARRA (LG CONSULT)

The undersigned, on behalf of SOILSROCK ENGINEERING PTY LTD, confirm that this document and all attached documents, drawings, and geotechnical results have been checked and reviewed for errors, omissions and inaccuracies.

For and on behalf of

Soilsrock Engineering Pty Ltd

Jorge Cabaco

BEng MEng MIEAust CPEng RPEQ NER

Principal Geotechnical Engineer

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APPENDIX G – Laboratory Test Results for Atterberg Limit Tests

APPENDIX H - Site Photographs

1. INTRODUCTION

This document presents the results of a geotechnical investigation carried out by Soilsrock Engineering Pty Ltd (SOILSROCK) for a proposed development of refurbishment and restoration of Heathcote Hall and construction of 36 townhouses and 21 apartments, associated landscape works and 58 lot strata subdivision at 1-21 Dillwynnia Grove, Heathcote NSW.

The investigation was commissioned on 5th December 2017 by Mr. Gonzalo Parra from LG Consults, who is the representative of the owner of the property FUZORTINN PTY LTD. The works was in general accordance with the email of 5th December and scope of works requirements provided by LG Consult on the email of 12th December 2018.

The present report assessment comprised a detailed geotechnical inspection and investigation of the subjected site and is based on the following documents supplied by LG Consult:

- Architectural Drawings carried by INK ARCHITECTS Pty Ltd (Project No: IA1633):
  - DA01 – Site Plan, Revision A, dated of 06th December 2017.
  - DA02 – Demolition Plan, Revision A, dated of 05th December 2017.
  - DA05 – Lower Basement Floor Plan – B2, Revision A, dated of 06th December 2017.
  - DA06 – Basement Floor Plan – B1, Revision A, dated of 06th December 2017.
  - DA07 – Ground Floor Plan, Revision A, dated of 06th December 2017.
  - DA08 – First Floor Plan, Revision A, dated of 06th December 2017.
  - DA09 – Second Floor Plan, Revision A, dated of 06th December 2017.
  - DA10 – East, North, West & South Elevations, Revision A, dated of 06th December 2017.
  - DA11 – Sections A-A, B-B, C-C & D-D, Revision A, dated of 06th December 2017.
  - DA12 – Sections E-E, F-F, G-G, H-H, I-I & J-J, Revision A, dated of 06th December 2017.
- Heathcote Hall Civil Engineering Package (DA) carried by NORTHROP Pty Ltd (Job No: 151903):
  - DA-C01.01 – Cover Sheet, Drawing Schedule and Locality Plan, Revision 4, dated of 07th December 2017.
  - DA-C02.01 – Concept Sediment and Erosion Control Plan, Revision 4, dated of 07th December 2017.
  - DA-C02.11 – Sediment and Erosion Control Details, Revision 4, dated of 077th 7december 2017.
  - DA-C04.01 – Stormwater Management Plan, Revision 4, dated of 07th December 2017.
  - DA-C04.61, DA-C04.62, DA-C04.71 – Stormwater Management Devices OSD 1 & 2, Revision 4, dated of 07th December 2017.
  - DA-C04.81, DA-C04.82 – Stormwater Management Devices OSD 3, Revision 1, dated of 07th December 2017.

  - DA-C04.91 – Stormwater Catchment Plan, Revision 4, dated of 07th December 2017.
  - DA-C05.61 - Site-works General Arrangement, Revision 4, dated of 07th December 2017.
  - DA-C05.71, DA-C05.72 – Site-works Driveway Plan, Revision 4, dated of 07th December 2017.

- Heathcote Hall Topographic Survey carried by CRUX SURVEYING Pty Ltd (Job No: 120131):

  - 120131-SU-DT001 - Residential Development "Heathcote Hall" 1-21 Dillwynnia Grove, Heathcote. Lots 1 & 2 in DP275184 Topographic Survey, Revision D, dated of 18th January 2017.

- Heathcote Hall Services Preliminary Geotechnical Assessment carried by GHD, Ref No: 2316195, dated November 2017.

- Heathcote Hall Services Phase 1 Contamination Assessment carried by GHD, Ref No: 2316195, dated October 2017.

The purpose of this investigation was to evaluated the subsurface conditions across the site as a basis for comments and recommendations on the following: geotechnical model and ground conditions; excavation and preliminary groundwater seepage conditions; excavation support and shoring retention systems; design bearing pressures for foundations including footings, piling, slabs; filling and pavement requirements; site classification in accordance with AS2870 (Residential Slabs and Footings), soils exposure classification in accordance with AS2159 (Piling Design and Installation).

2. PROPOSED DEVELOPMENT

The proposed development consists of two precincts which are Heritage Precinct and Development Precinct. The Heritage precinct will involve the restoration of the existing historic Heathcote Hall, renew turf and reinstate pleasure gardens, reinstate pathways, support landscaping regeneration area and introduce a community kitchen garden and orchard. The Development precinct involves the following: construction of 35 two storeys town houses; two walk-up unit blocks including 3 storeys apartment type A (15 units) and 2 storeys apartment type B (6 units); two levels basement car parking accessed from Boronia Grove and Dillwynnia Grove for both residents and visitors of the site; associated earthworks and landscaping.

Details of the proposed development are shown on architectural drawings provided within the DA application as mentioned above.

3. SCOPE OF WORKS

The field work for investigation was carried from the 14th December to 15th December 2017 and consisted of the following:

- Conduct an OH&S and walkover survey to assess local topography, geology, hydrology and existing site conditions;
- Photographic record of the site conditions;
- Drilling of six boreholes (BH7 to BH12) to depths ranging from 6.0 to 12.2m below existing ground level among the site by using a geotechnical hydraulic rig track mounted. All boreholes were initially drilled through soils to the weathered rock by Solid Flight Auger with Standard Penetration Tests (SPT) "N" values at 1.5m intervals to assess strength characteristics of overburden soils on all boreholes. Further rock coring drilling through the weathered rock by NMLC Diamond Coring by 74.8mm (75mm) diameter OD, with core size 51.94mm (52mmm) diameter;
- Two groundwater monitoring well standpipe was installed to 9.6m and 12.2m depth respectively in the BH8 and BH9 for subsequent monitoring of the groundwater before and during construction works.
- Two soil samples were taken from two boreholes up to maximum 2.0m depth within the SPT test sample recovery to carry laboratory testing to determine sulphate, chloride and resistivity for site exposure classification.
- Two soil samples were taken from two boreholes auguring process at 1.5m depths to determine soil plasticity index by laboratory Atterberg Limit Test.
- Recovery of representative soil and rock samples for visual and classification assessment and logging.
- Recovery and collection of rock core samples organised into steel core boxes, for further core logging analyses and selection of ten rock core samples for Point Load Strength Index ($Is_{(50)}$) and photographs reference to classify rock strength and bearing pressures.

The field works were conducted and supervised in the full-time presence of a senior geotechnical professional engineer, and two geotechnical/civil engineers from SOILSROCK office who logged the boreholes, recorded the in-situ test results and collected samples for laboratory testing. The Appendix A "Geotechnical Explanatory Notes" define and explain the logging terms and symbols used.

4. RESULTS AND ANALYSES OF THE INVESTIGATION

4.1 Site Location and Description

The site is located in the suburb of Heathcote, within the Sutherland Shire LGA and is legally described as Lot 1 and Lot 2 in DP275184. It is currently within E4 (Environmental Living) land use zoning.

The site is a rectangular shape with a site area approximately of 17,663m^2, it is located approximately 20km south of the Sydney CBD, 20km north of Wollongong and approximately 500m from Heathcote train station. It is bounded to the North by Boronia Grove followed by low density residential, to the South and the East by Dillwynnia Grove and Tecoma Street respectively followed by low density residential and the Royal National Park. The closest residences to the site are a single level dwelling at No. 24 Boronia Grove and a two storey dwelling house at No. 23A Dillwynnia Grove, which are both located adjacent to the west of the property sharing a common boundary along the site.

At the time of the site inspection, the site was mostly scattered with shrubs and mature plantings, a state heritage significant item Heathcote Hall is located in the south-eastern corner of the site. It is an imposing two storey sandstone villa designed in the Victorian Italianate style and is one of the oldest and grandest buildings in the Sutherland Shire. At present, the building is largely hidden from the surrounding public domain due to the dense vegetation on the site and currently in a very poor state of repair due to years neglecting. There are several abandon outbuildings observed includes WC, sheds and animal houses. Site boundaries are bounded by Paling/steel mesh fences. There are various access points to the site from the three street frontages and the main vehicular entry points to the site are from Boronia Grove.

The site features have an existing gradient that gentle slopes down from East to West within the site with a small hill located at south-western corner of the site where the terrain level drop down significantly with steeper slope near the Western boundary and the South-Western corner of the site. The site field work and location are shown in Appendix B and some photographs of the area are attached to this report in Appendix H.

4.2 Regional Geology

Reference to the Geological Map of Wollongong – Port Hacking 1:100,000 sheet 9029-9129, it is indicated that the site is underlain by shale lenses occurring in the Hawkesbury Sandstone classified as “Rhs - claystone, siltstone and laminate shale lenses” from period of Middle Triassic in Mesozoic Era.

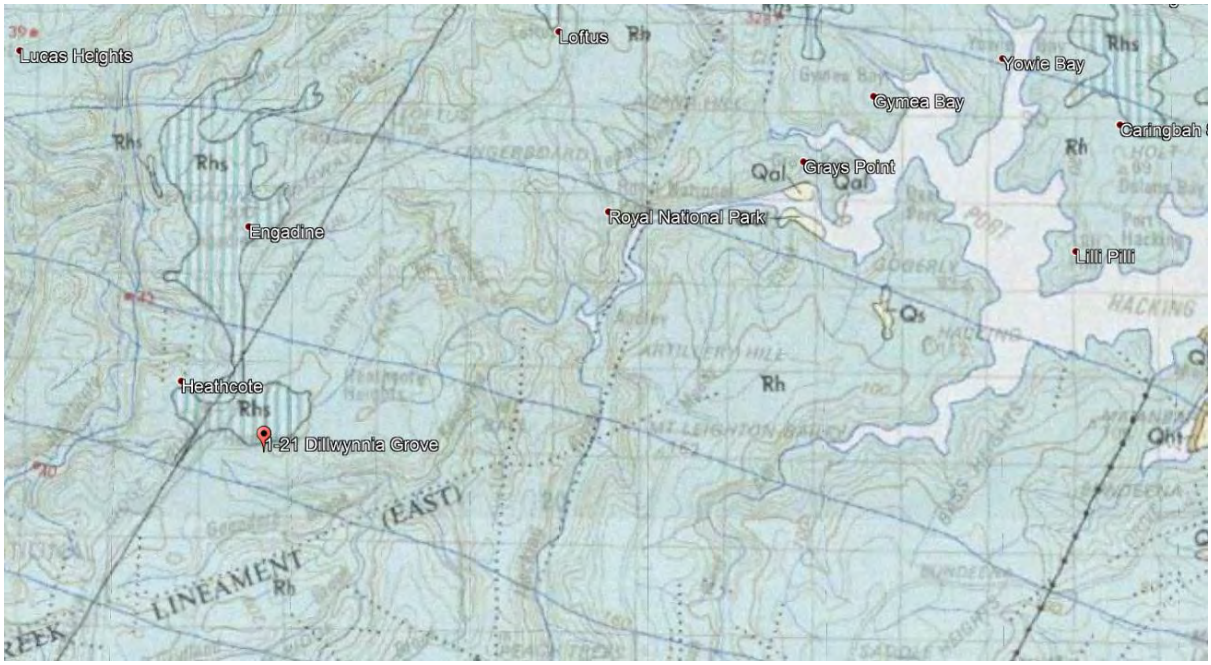

Figure 1 – Portion of the of Wollongong – Port Hacking 1:100,000 sheet 9029-9129. Site area location highlighted in red/black dot.

4.3 Subsurface Investigation

As mentioned above, six boreholes were carried at the site to investigate in deep, soil and rock ground conditions profile, which are summarized in the following table no. 1.

Details of the investigation results and ground conditions encountered along the boreholes are given in the borehole logs in the Appendix D.

Table No. 1 – Summary of Soil and Rock Profiles in Boreholes

Stratum	BH7	BH8	BH9	BH10	BH11	BH12
	R.L (Depths) of top of stratum in borehole (m AHD)					
FILL MATERIALS: (SILT/CLAYEY SILT)	211.3 (0.0)	212.0 (0.0)	210.0 (0.0)	211.0 (0.0)	212.5 (0.0)	211.8 (0.0)
GRAVELLY SILTY CLAY / SILTY CLAY	210.8 (0.5)	211.5 (0.5)	209.5 (0.5)	210.5 (0.5)	212.0 (0.5)	211.3 (0.5)
CORE LOSS	-	-	199.8 (10.2)	-	-	-
SHALE – EL	-	204.0 (8.0)	-	-	-	-
SHALE – VL	204.0 (7.3)	203.3 (8.7)	198.7 (11.3)	-	-	-
Bore Terminated	202.1 (9.2)	202.4 (9.6)	197.8 (12.2)	205.0 (6.0)	206.5 (6.0)	205.8 (6.0)

Notes: Rock Strength Description: EL=Extremely Low, VL=Very Low, L=Low, M=Medium, H=High

4.4 Laboratory Results

Ten rock samples selected from the rock core boxes were tested for Point Load Index Is (50) and Unconfined Compressive Strength "UCS" for selected rock samples were estimated. The "Is (50)" results ranged between 0.015 MPa and 0.098 MPa which indicates rock strength raging from extremely low to low strength rock classification as per summary results on the following table no. 2.

The details of the results are reported on the boreholes at the different depths and on the laboratory reports attached on the Appendix E.

Table No. 2 – Summary of Point Load Index Tests Is (50)/UCS Tests Results

Borehole ID	Sample ID	Depth (m)	Is (50) (MPa)	Estimated UCS Results (MPa)
BH7	SR1	7.75 – 7.78	0.068	1.36
	SR2	8.40 – 8.43	0.065	1.30
	SR2	8.75- 8.80	0.015	0.30
	SR4	9.15 – 9.19	0.058	1.16
BH8	SR5	8.4 – 8.43	0.015	0.29
	SR6	8.70 – 8.74	0.086	1.72
	SR7	9.10 – 9.13	0.098	1.95
	SR8	9.40 – 9.43	0.095	1.90
BH9	SR9	11.40 – 11.45	0.074	1.49
	SR10	11.80 – 11.85	0.068	1.37

Notes:

- Point Load Testing was completed in the Axial Direction;
- The above strength testes were completed at the "As Received" moisture content;
- The Estimated Unconfined Compressive Strength was calculated from the Is $_{(50)}$ index by assuming a ratio of 20:1 for UCS to Is $_{(50)}$;
- Test Method: RMS T223.

The exposure classification of the residual soil for aggressiveness to buried concrete and steel elements is based on two selected soil samples taken from the SPT tests "Terzaghi" sampler at Boreholes BH7 and BH11. The selected soil samples were tested in NATA accredited and registered laboratory to determine pH, sulphate, chloride and resistivity. The results are

summarized and present in the following table no. 3 and details of laboratory results are attached in Appendix F.

Table No. 3 – Laboratory Test Results for Exposure Classification – (pH, Sulphate, Chloride and Resistivity)

Sample ID	Depth Range (m)	Soil Description	pH	Sulphate (mg/kg)	Chloride (mg/kg)	Resistivity (ohm)
S1	0.5-1.0	Pale grey, brown gravelly silty clay	6.7	330	160	34
S2	1.5-2.0	Reddish brown, pale grey silty clay	4.7	<10	80	200

Based on the above summary table, the soil is classified as **Mild** for concrete and **Non-aggressive** for steel based on soil condition B (silts and clays) in accordance with standard criteria shown respectively in the Table 6.4.2 (C) and 6.5.2 (C) of AS2159-2009 "Pilling-Design and Installation".

Two soil samples collected from BH7 and BH10 were sent to laboratory for Atterberg Limit Testing to determine soil plasticity index. The following table no. 4 summarised laboratory results and details of laboratory report is attached in Appendix F.

Table No. 4 – Laboratory Atterberg Limit Test Results for Soil Plasticity

Borehole	Sample ID	Depth Range (m)	Soil Description	Plastic Limit (%)	Liquid limit (%)	Plasticity Index (%)
BH7	SP1	1.0-1.5	Pale grey, brown gravelly silty clay	26	78	52
S10	SP2	1.0-1.5	Reddish brown, pale grey silty clay	23	80	57

According to the obtained results as present in above table, the soil can be classified as inorganic clays, fat clays with high plasticity (CH). The soils can be identified as high potential expansive soil with high inherent swelling capacity, therefore, the site can be classified based on site reactivity as ***Class "H1"***, This type of high reactive clays can experience high ground movements from moisture changes. The Characteristic Surface Movement "y_s" is expected in the range between **40mm to 60mm**, according with the general definition of site classes required by AS2870-2011, Table 2.1 and section 2.2.3.

4.5 Geotechnical Model

A general geotechnical model of the site has been developed for the subsurface characteristics of the soil and rock based on the boreholes campaign which are summarised in the table no. 5 below, and in the form of interpreted geotechnical cross-section shown in Appendix C. The section shows the depth of overlying soils, together with the interpreted geotechnical boundaries limits for the underlying rock.

Table No. 5 – Interpreted Geotechnical Model

Unit	Material Description	Thickness of Unit (m)	Top of Unit RL (m AHD)
Unit 1 Top Soil & Fill Silty Clay	Top Soil & Fill: Approximately range from ground surface to 0.5m, it was well compacted. The materials are dark brown silt with trace of fine grained sand, clay and gravels.	0.0 to 0.5	212.5 to 209.5
Unit 2 Residual Soil (Silty Clay & Gravelly Silty Clay)	Residual Soil: Approximately range from 0.5m to 10.2m. Very stiff to hard pale grey, reddish brown silty clay, gravelly silty clay with fine to medium angular to sub-angular, sub-rounded black, red iron-stained gravels.	0.5 to 10.2	211.5 to 199.8
Unit 3 Bedrock Shale	Shale: Extremely weathered to highly weathered, extremely low to very low strength shale at depth range from 7.3m to 12.2m. Class V and Class IV Shale.	>1.0	204.0 to 197.8

Notes:

- The unit thickness and base of unit values are based on the borehole logs and may not represent extreme (maximum and minimum) values across the site.
- Rock Classification is based on Pells et.al (1998) and Bertuzzi and Pells (2002)

The table no. 6 below assesses the strength of the relevant soils materials crossed by the SPT tests, based in *situ tests* results, soil classification, visual interpretation and extrapolation.

For detailed description of the subsurface conditions, explanation sheets about geotechnical parameters are presented in Appendix A.

Table No. 6 – Recommended Geotechnical Design parameters for soil

Depth Range (m)	Material Conditions	Extrapolated Bearing Pressure (kPa)	Strength (ϕ°, *Cu* / kPa)
0.0-0.5	Medium Dense Silt	200	ϕ° = 30
0.5-1.5	Very Stiff Silty Clay	300	Cu = 150
1.5-10.2	Hard Silty Clay	400	Cu = 200

Notes:

- The geotechnical parameters interpretation and extrapolation is based and limited to SPT tests carried on site, which are only indicative for design proposes.

The shale encountered in the geotechnical boreholes has been classified in accordance with the procedure given in Pells et. al (1998) and Bertuzzi and Pells (2002).

The interpreted depth and reduced level (RL) at the upper surface of the various bedrock classes are shown in following tables nos. 7 and 8, it should be noted that the profiles are accurate at borehole location only, and some variation must be expected away from the borehole locations. Therefore, the strata units or layers have been shown on the cross-section by inferred strata boundaries only.

Table No. 7 – Summary of Geotechnical Model for Rock (Shale)

Stratum	Depth and Reduced Levels (RL) to Top of Various Rock Classes in Boreholes (m)		
	BH7	**BH8**	**BH9**
Top of Borehole	211.3	212.0	210.0
Core Loss	-	-	199.8
Class V*	-	204.0	198.7
Class IV*	204.0	203.3	-
End of Borehole	202.1	202.4	197.8

Notes:

- Rock Classification is based on Pells et.al (1998) and Bertuzzi and Pells (2002)
- *Some medium to high strength bands and extremely low strength carbonaceous are present in Class V and Class IV shale.

Table No. 8 – Recommended Geotechnical Parameters for Rock (Shale)

Foundation Stratum	Allowable End Bearing Pressure (kPa)	Ultimate End Bearing Pressure (kPa)	Ultimate Shaft Adhesion (kPa)	Typical Elastic Modulus (MPa)
Class V	700	2,000	100	75
Class IV	1,000	3,000	150	150

Notes:

- Rock Classification and bearing pressures based on P.J.N Pells "Substance and Mass Properties for The Design of Engineering Structures in The Hawkesbury Sandstone" AGM Vol No. 39 September 2004
- Ultimate end bearing pressures values occur at large settlements (>5% of minimum footing dimensions)
- Ultimate shaft adhesion values to depend on clean socket of roughness category R2 or better. Values may have to be reduced because of smear.
- Shaft adhesion applicable to the design of CFA or Bored Piles, uncased over the rock socket length, where adequate sidewall cleanliness and roughness are achieved.

4.6 Groundwater

During the drilling groundwater was not observed through the soils materials. At deeper levels during the rock core drilling it was not possible to determine groundwater levels due to the fluid water circulation used to cut the rock as per normal rock core drilling procedure.

As referred above, two monitoring standpipe wells were installed to a maximum of 9.6m and 12.2m deep in the BH8 and BH9 respectively.

The standpipe well would need to be further flushed and cleaned to remove any water resulted from the rock core drilling works, and further groundwater monitoring should be carried out prior start excavation works to confirm or not the presence of groundwater, to be able to design a proper retaining structures for the basements.

5. COMMENTS AND RECOMMENDATIONS

5.1 Excavation and Groundwater Seepage Conditions

The supplied architectural drawings plans indicate two basements levels for parking purposes are proposed for the building development. Bulk excavation levels depth ranges from approximately RL 204.8m to RL 207.8m, which is approximately 4.7m to 6.5m maximum range excavation depths below existing surface ground level.

Based on the in situ testing the overall excavation it is expected to intersect the very stiff to hard silty clay profiles for the proposed basement.

It is not expected the excavation depths to intersect rock materials, if encountered the shale should be extremely low to very low rock strength shale rock at the first meter's depth. Excavation within the filling, soils and Class V/IV rock should be readily achievable using hydraulic excavators with bucket attachments, hydraulic hammers will not be necessary to use.

In addition, a Waste Classification should be carried for all the excavated materials to be disposed in accordance with NSW Environment Protection Authority (EPA) Waste Classification Guidelines Nov 2014, and under the Protection of the Environment Operations Act 1997 (POEO Act). Environmental sampling and chemical laboratory testing will need to be carried out to classify the spoil resulted from the excavation prior to disposal. This includes filling and excavated natural materials (GSW/VENM/ENM), if it is intent to be removed from the site. The type and extent of testing undertaken will depend on the final use or destination of the spoil, and requirements of the site. SOILSROCK ENGINEERING can carry those works if required.

5.2 Excavation Support & Shoring Retention Systems

For the construction of the underground car parking, vertical excavations would need to be undertaken within the filling and silty clay which are unlikely to be self-supporting for any significant period. Unsupported excavation temporary batters it is not recommended, due to the time required to construct the basement and relatively deep excavations, therefore, temporary and permanent shoring support is required along all sides of the excavation.

Shoring Retentions Systems Options

Further to the above prior to excavation commencing, a retaining wall must be installed to maintain the stability of the fill and the silty clays for the basements.

A soldier bored piling wall method, using diameter piles such as 450mm or 600mm spaced at 1.5-2.5m, combined with reinforced shotcrete infill panels and temporary anchors would be suitable to supporting the excavation faces. The soldier piles must be installed prior excavation works, following reinforced shotcrete infill panels construction at about maximum 2.5m drops as the excavation proceeds. Temporary ground anchors or steel props can be considered to provide lateral restraint for the walls until the basement carpark floor slabs have been constructed to prop the walls in the longer term.

In addition, a temporary/permanent dewatering system by conventional water wells or sump pumps could be necessary to install to control water inflows if groundwater is confirmed. It should be possible to discharge water into the storm-water or sewer systems, providing appropriate water quality analysis are undertaken to determine the suitability of water discharge, an appropriate council license should be approved and obtained prior discharge. Further groundwater management plan could be required depending on the groundwater behaviour confirmation.

If an unexpected groundwater high flows are confirmed, and a permanent dewatering system is required but not approved, the basement would need to be tanked (fully watertight) and designed to take hydrostatic lateral and uplift pressures into account. Secant piling wall retaining solutions by 450mm or 600mm piles and ground anchors are recommend if ground water high flows are confirmed.

Earth Pressures

For the design of shoring system, limit the deformation and deflection occurring outside the excavation are the major consideration in selecting earth pressures.

Earth pressures will be affecting the excavation faces retained regarding they are temporarily or permanently retained, from the ground surface along the fill and clay down to the weathered rock materials. Table no. 9 below provides preliminary coefficient of lateral earth pressures for retaining design support which are based on horizontal ground surface for the soils and rock horizons encountered during the geotechnical investigation.

Table No. 9 – Preliminary Coefficients of Lateral Earth Pressure for Excavation Support

Material	Bulk Unit Weight (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of Earth Pressure at Rest (K_0)
Fill	18	0.42	0.59
Residual Soil - Clay	19	0.39	0.56
Class V Rock - Shale	20	0.26	0.41
Class IV - Shale	21	0.24*	0.38*

Notes: * applicable only for favourably rock joints;

Any surcharges load including construction, traffic nearby footings, inclined backfill surface affecting the walls should be considering in the design. Drainage of the ground behind impermeable walls should be provided otherwise the wall should be designed for full hydrostatic pressures.

For passive restraint, rock sockets below the bulk excavation level, should have a minimum length of three pile diameters below the lowest level of any nearby excavation and socket into competent rock strength. To reduce the risk of hydrostatic pressures acting on the walls, adequate drainage should also be provided behind the full height of the basement walls.

5.3 Ground Anchors

Temporary ground anchors may need to be used for the temporary lateral restraint of the perimeter piled wall systems during excavation works. It is recommended ground anchors to be designed inclined below the horizontal from 25º to 35º to allow anchorage into the stronger bedrock materials at depth, have a free length equal to their height above the base of the excavation and minimum 3.0m bond length.

Temporary anchors should be proof loaded to 125% of the design working load after installation and locked-off to no more than 80% of the working load. To ensure that lock-off load is maintained and not lost due to creep effects or other causes, periodic checks should be carried out during the construction phase.

The following table no. 10 presents the allowable average bond stresses at the grout-rock interface for design of temporary ground anchors to install for the support of piled wall systems.

Table No. 10 – Geotechnical Anchor Design Bond Stresses

Material Description	Allowable Average Bond Stress (kPa)
Class V Rock - Shale	100
Class IV Rock – Shale	150

To apply the parameters above it is assumed that the anchor drilling holes are properly clean and flushed and grouting operations to be undertaken with good anchoring practice using minimum water/cement ratio w/c=0.4 mixed properly in a colloidal high-speed grout mixer.

Centralizers must be installed in the anchors bodies prior installation in the hole to ensure anchors are centralized and has minimum grout cover. It is recommended to carry preliminary anchor testing prior start the anchoring construction works to confirm bond stresses and bond length requirements.

Preliminary anchors testing supervised by a qualified geotechnical engineer could allow increased bond stresses to be adopted during construction.

5.4 Foundations – Footings and Piles

The foundations conditions at the exposed base of the excavation for the basement it is expected to intersect hard residual soil silty clays to very low strength rock shale from bulk excavation level RL 207.8m to RL 198.7m. The foundations conditions for the residential buildings outside of the excavation it is expected to intersect dense fill material, stiff to hard silty clay and very to low shale rock strength.

For all foundations conditions referred above it is recommended to carry piled footings systems, with piles socket in the bedrock Shale rock strength CL. III with 3,500 kPa allowable bearing pressure preferably if can be reached in deep, or Shale rock strength CL. IV with minimum 1,000 kPa allowable bearing pressure assuming longer sockets, subject to rock strength and bearing pressures capacity in situ confirmation/inspection by a professional qualified geotechnical engineer and providing suitability of design loads. The geotechnical design bearing pressures recommended for foundations design are referred on the table no. 8 above. However, founding depths always must be adjusted and confirmed by the structural loads and foundations type required for the project.

Once the structural loads and footings and/or piers sizes have been determined, settlements analyses should be carried out to confirm the suitability of the foundations solution adopted.

Bored piles are recommended providing very low water seepage inflows to the holes, permitting to be dewatered by a normal water pump and cleaned prior concrete pour. If high water seepage inflows are expected CFA Contiguous Flight Auger piling system is recommended and indicated when water is present in the ground.

All footings/piles excavations should have their base levelled, clean, dewatered and free of any loose material prior to pouring, also ground pressures should be checked and confirmed on site by a qualified experienced geotechnical engineer. The concrete pouring should occur with the minimum delay to avoid deterioration, if delays are anticipated, it is recommended that the base of the footings be protected with a blinding layer of concrete with minimum strength of 25Mpa.

All footings/piers should be inspected by a geotechnical engineer to confirm the design allowable bearing pressures has been reached.

5.5 Engineering Fill

If backfill is to support landscaped areas and backfill retaining walls, an engineered fill should be carried comprising 'clean' sandy soils, free of organic matter and contain a maximum particle size of 37.5mm.

The engineered fill should be placed in a controlled and engineered manner compacted using a vibrating plate compactor and/or trench roller in layers not more than 150mm for non-sand materials not containing gravel-sized, or not more than 300mm for sand materials for controlled fill following AS2870-2011 "Residential Slab and Footings". Compaction should achieve minimum density index (ID) of 70%, to be proof tested by "DCP" tests Dynamic Cone Penetrometer with a blow count of 7 or more per 300mm layers as described in AS1289.6.3.3.

5.6 Subgrade Preparation for Slab on Ground and Pavements

Slab on Ground

Depending on the loads required, slab-on-grade construction is feasible for the ground level floor slab, according with the silty clay or extremely low to very low strength shale materials expected to be encounter after excavation, subgrade preparation would be required. A well compacted granular course material (with maximum particle size of 37.5mm) subgrade with maximum 150mm thick layers of crushed recycled concrete or crushed sandstone (DGB20 or similar) layers it is recommended to install and be properly compacted. The subgrade layers should be compacted using a vibratory roller (minimum 6-8 tonnes deadweight) to target density ratio of 98% of SMDD. Moistening of each layer (if the material is not moist) will facilitate compaction. Density/compaction tests should be carried out on each layer to confirm the above specification has been achieved in accordance with AS3798 Guidelines on Earthworks for Commercial and Residential Developments.

A qualified geotechnical engineering should supervise on site the subgrade preparation at minimum Level 2 Inspection and Testing as defined in AS3798, Soilsrock Engineering can supervise, testing and certify the works if required.

Pavements

For pavement design, minimum CBR values of the subgrade material must be determined by the design engineer depending on the pavement design type considered.

For pavements design where the subgrade is clay material the depth of 500mm should be considered for static/medium loads and rigid pavement types. For static/light loads and rigid/flexible pavement types 300mm subgrade depth should be considered.

Depending on the pavement type design, the subgrade depth shall be compacted to achieve minimum relative compaction of minimum dry density ratio of 100% obtained from Standard Compactive Effort “SMDD – Standard Maximum Dry Density”, following the same compaction methodology described for slab on ground subgrade preparation. For all pavements, it is essential that the specification for compaction of subgrade materials reflects the condition under which tests carried out for pavement thickness design are conducted.

Above the well compacted subgrade materials a subbase granular course material layer with minimum 150mm thick by crushed concrete or crushed sandstone (DGB20 or similar) should be installed. Subbase layers should be also compacted using the same compaction methods described above.

All pavements subgrade and subbase preparation geotechnical inspection and testing minimum level 2 should be allowed and follow the AS3798 Guidelines on Earthworks for Commercial and Residential Developments.

5.7 Final Comments

Following the above, further geotechnical input is required and summarized as follow:

- Groundwater further monitoring to confirm groundwater behavior for excavation conditions and support.
- Carry proper design for temporary or permanent piling shoring wall support after groundwater behavior confirmation.
- Geotechnical depths inspections to confirm piling socket for retaining walls stability.
- Geotechnical site inspections to footings and foundations piles to determine and confirm ground bearing pressures.
- Geotechnical site inspections for anchoring installation and testing;
- Density testing of all engineered fill if required;
- Geotechnical site inspections and compaction tests to confirm density targets for subgrade preparation and subbase installation below slab-on-grade and pavements.

Further to the results of the investigations, and geotechnical recommendations above, providing the works are carried accordingly with this report, an experienced qualified professional geotechnical engineer inspect the site to approve the founding levels and carry proper in situ tests, and good engineering and building construction practice is maintained the proposed development is suitable for the site.

Regarding the soils and rock depths with the geotechnical bearing capacities recommended above could vary across the site, the founding depth for foundations and geotechnical conditions for excavation support to be constructed could also vary. Therefore, it is recommended, an experienced professional and qualified geotechnical engineer inspect the site from the start of the excavation works and foundations installation, to approve the founding levels.

6. LIMITATIONS

The site geotechnical investigation undertaken for the present report is an estimate and interpretation of the characteristics of the soil and rock of the subsurface conditions encountered during the test locations investigated. Geological and geotechnical conditions can be unpredictable or can reveal unforeseen conditions, in other test locations investigated no matter how comprehensive the investigation is.

This present report analyses forms an engineering model interpretation and opinion of the actual subsurface conditions of the points where the tests were carried. The selected in-situ tests results are indicative of the actual conditions encountered. Recommendations are given based on the data testing results and visual interpretation carried by professional geotechnical and geological engineers from this office. Interpretation of the present report by others may differ from the interpretation given, there is the risk the report may be misinterpreted and Soilsrock cannot be held responsible for that reason.

Geotechnical reports rely on factual interpreted and judgement of information based on professional visual interpretation of soils and rock samples, in situ tests and sampling tests, which has some uncertainty due to changing unexpected ground conditions and it is far less exact than other design disciplines. Soilsrock Engineering accepts no responsibility if different unexpected ground conditions occur in locations where the investigations were not carried out.

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APPENDIX A

Geotechnical Explanatory Notes

APPENDIX A – GEOTECHNICAL EXPLANATORY NOTES

The following geotechnical notes are provided, to give a better understanding of the description and classification methods and field procedures used for the interpretation and compilation of this report which is entirely based on the AS 1726-1993 – Geotechnical Investigations.

INVESTIGATIONS METHODS

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3m for a backhoe and up to 6m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site. Samples can be taken from the test pits for soils testing and analyses.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 3000mm or large in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5m) 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 samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-125mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be mixed with soils from the sides of the hole. Information from the drilling (as a distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Dynamic Cone Penetromer Tests

Dynamic penetrometer tests (DCP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rood penetrates the soil the number of blows required to penetrate each successive 300mm depth are recorded. Normally there is a depth limitation of 1.2m, but this may be extended in certain conditions by the use of extension rods. A 16mm diameter rod with a 20mm diameter cone end is driven using a 9kg hammer dropping 510mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities. Also Correlations with SPT tests can be made for Cohesion less and cohesive soils.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Proposes – Test 6.3.1.

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 760mm. It is normal for the tube to be driven in three successive 150mm increments equal to 450mm in total. The first 150mm increment it not considered for the so-called “N” value (standard penetration resistance), which is taken from the number of blows of the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm may not be practicable and the test will be discontinued. The results are represented in the following example:

- In the case where full penetration is obtained with successive blow counts for each 150mm as follow:
  - 1st Increment (150mm) = 2 blows
  - 2nd Increment (150mm) = 8 blows
  - 3rd Increment (150mm) = 15 blows
  - Representation – 2,8,15 “N” Value = 23
- In the case where the test is discontinued before the full penetration:
  - 1st Increment (150mm) = 20 blows
  - 2nd Increment (100mm) = 40 blows – test interrupted
  - 3rd Increment (150mm) = not carried – test refusal
  - Representation – 20, 40/100 mm “N” Value = 40

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Correlation between DCP vs SPT for Cohesionless Soils

DCP (Blows/300mm)	SPT Value (Blows/300mm)	RELATIVE DENSITY
0-3	0-4	Very Loose
3-9	4-10	Loose
9-24	10-30	Medium Dense
24-45	30-50	Dense
>45	>50	Very Dense

Correlation Between DCP vs SPT for Cohesive Soils

DCP (Blows/300mm)	SPT Value (Blows/300mm)	CONSISTENCY
0-3	0-2	Very Soft
3-6	2-5	Soft
6-9	5-10	Medium/Firm
9-21	10-20	Stiff
21-36	20-40	Very Stiff
>36	>40	Hard

Continuous Diamond Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil rock.

Disturbed samples taken during drilling provide information on colour, type, 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 into the soil and withdrawing it to obtain 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 affective only in cohesive soils.

DESCRIPTION AND CLASSIFICATIONS METHODS FOR SOILS AND ROCK

Descriptions include strength or density, colour, structure, soil or rock type and inclusions.

SOIL DESCRIPTIONS

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 – 200
Gravel	0.6 – 63
Sand	0.075 – 0.6
Silt	0.002 – 0.075
Clay	<0.002

Type	Sand & Gravel Particle size
Coarse gravel	36mm – 19mm
Medium gravel	19mm – 6.7mm
Fine gravel	6.7mm – 2.36mm
Coarse sand	2.36mm – 600µm
Medium sand	600µm – 212µm
Fine sand	212µm – 75µm

The proportions of secondary constituents of soils are described as:

Coarse grained soils		Fine grained soils	
%Fines	**Modifier**	**%Coarse**	**Modifier**
≤5	Omit, or use 'trace'	≤15	Omit, or use 'trace'
>5 - ≤12	Describe as 'with clay/silt' as applicable	>15 - ≤30	Describe as 'with clay/silt' as applicable
>12	Describe as 'with silty/clayey' as applicable	>30	Describe as 'with silty/clayey' as applicable

Definitions of grading terms used are:

- Well graded – a good representation of all particle sizes;
- Poorly graded – an excess or deficiency of particular sizes within specified range;
- Uniformly graded – an excess of a particular particle size;
- Gap graded – a deficiency of a particular particle size with the range.

Cohesive Soils

Cohesive soils, such as clays, are classified on the basics of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defining as follows:

Description	Abbreviation	Undrained shears strength (kPa)
Very soft	vs	≤12
Soft	s	>12 – ≤25
Firm	f	>25 – ≤50
Stiff	st	>50 – ≤100
Very stiff	vst	>100 – ≤200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basics of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT), or dynamic penetrometers (PSP). The relative density terms are given below:

Relative density	Abbreviation	Density index %
Very loose	vl	≤15
Loose	l	>15 – ≤35
Medium dense	md	>35 – ≤65
Dense	d	>65 – ≤85
Very dense	vd	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil – derived from in-situ weathering of the underlying rock;
- Transported soils – formed somewhere else and transported by nature to the site;
- Filling – moved by man.

Transported soils may be further subdivided into:

- Alluvium – river deposits;
- Lacustrine – lake deposits;
- Aeolian – wind deposits;
- Littoral – beach deposits;
- Estuarine – tidal river deposits;
- Talus – coarse colluvium;
- Slop wash or Colluvium – transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

ROCK DESCRIPTIONS

Rock Strength

Rock strength is defined by the Point Load Strength (Is50) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standards 1726. The terms used to describe rocks strength are as follow:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx. Unconfined Compressive Strength MPa*
Extremely low	EL	≤0.03	<0.6
Very low	VL	>0.03 – ≤0.1	0.6 – 2
Low	L	>0.1 – ≤0.3	2 – 6
Medium	M	>0.3 – ≤1.0	6 – 20
High	H	>1 – ≤3	20 – 60
Very high	VH	>3 – ≤10	60 – 200
Extremely high	EH	>10	>200

*Assumes a ratio of 20:1 for UCS to $IS_{(50)}$

Degree of Weathering

The degree of weathering of rocks is classified as follows:

Term	Abbreviation	Description
Residual	RS	Soil developed on extremely weathered rock; the mass structure and substance are no longer evident.
Extremely weathered	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded in water, but the texture of the original rock is still evident.
Distinctly weathered	DW	Staining and discolouration of rock substance has taken place.
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20mm
Highly fragmented	Core lengths of 20 – 40mm with some fragments
Fractured	Core lengths of 40 – 200mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200 – 400mm with some shorter and longer sections
Unbroken	Core lengths mostly >1000mm

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$RQD\ \% = \frac{cumulative\ length\ of\ 'sound'\ core sections\ \geq 100mm\ long}{total\ drilled\ lenght\ of\ section\ being\ assessed}$$

Where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation or RQD.

Rock Quality Designation

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6mm
Laminated	6mm to 20mm
Very thinly bedded	20mm to 60mm
Thinly bedded	60mm to 0.2m
Medium Bedded	0.2m to 0.6m
Thickly bedded	0.6m to 2m
Very thickly bedded	> 2m

LOG SYMBOLS

Moisture Condition - Cohesive Soils:

MC > PL – Moisture content estimated to be greater than plastic limit
MC = PL - Moisture content estimated to be approximately equal to plastic limit
MC < PL - Moisture content estimated to be less than plastic limit

Moisture Condition - Cohesionless Soils:

D – Dry – Runs freely through fingers
M – Moist – Does not run freely but no free water visible on soil surface
W – Wet – Free water visible on soil surface

Strength (Consistency) - Cohesive Soils:

VS – Very Soft – Unconfined compressive strength less than 25 kPa
S – Soft – Unconfined compressive strength 25-50 kPa
F – Firm – Unconfined compressive strength 50-100 kPa
St – Stiff – Unconfined compressive strength 100-200 kPa
VSt – Very Stiff – Unconfined compressive strength 200-400 kPa
H – Hard - Unconfined compressive strength greater than 400 kPa

Density Index/Relative Density - Cohesionless Soils

Symbol	Density Index (ID)	Range %	SPT "N" Value Range (Blows/300mm)
VL	Very Loose	<15	0-4
L	Loose	15-35	4-10
MD	Medium Dense	35-65	10-30
D	Dense	65-85	30-50
VD	Very Dense	>85	>50

APPENDIX B

Boreholes & Photos Location Plan

LEGEND

- SITE BOUNDARY (APPROX.)
- EXCAVATION BOUNDARY (APPROX.)
- BOREHOLE
- PHOTO NUMBER WITH DIRECTION OF VIEW
- CROSS SECTION

soilsrock geotechnical engineering consultants

Soilsrock Engineering Pty. Ltd
5/110 Oaks Avenue, Dee Why, NSW 2099
M: 0457 115 044 | T: +61 2 8960 5291
Email: info@soilsrock.com.au
www.soilsrock.com.au

SSPP (Sydney South) revised and additional documentation - (2017SSH019) Part 8

CLIENT:

FUZORTINN PTY LTD

TITLE: BOREHOLE & PHOTOS LOCATIONS PLAN

1-21 DILLWYNNIA
HEATHCOTE, NSW 2233

Revision	Date

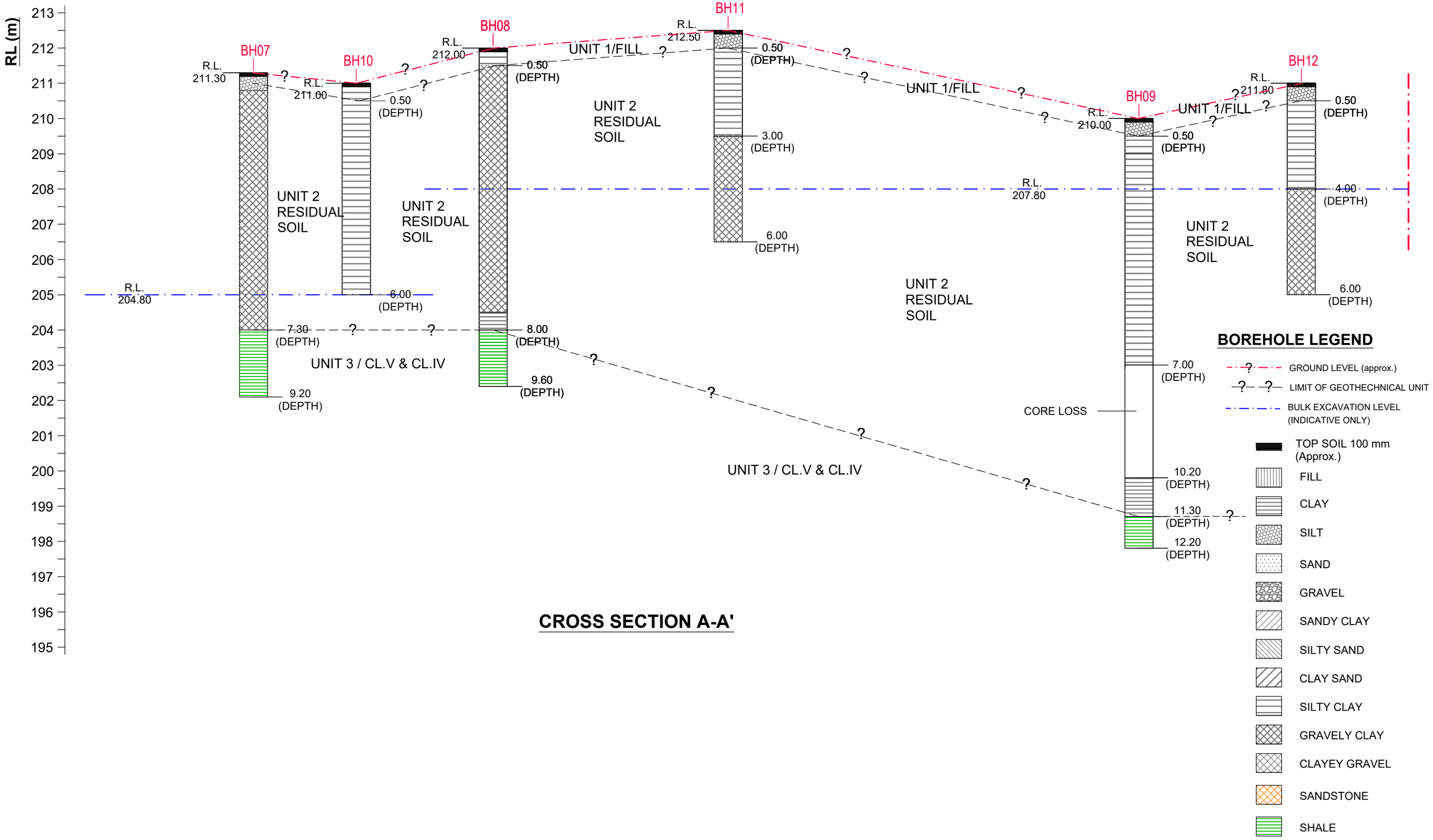
DATE:17/01/2018 | CHECKED BY: JC

SCALE: NTS | DESIGNED BY: MJ

PROJECT No: SRE/275/HC/17 | Drawing No: G01

APPENDIX C

Cross Section A-A'



CROSS SECTION A-A'

Soilsrock Engineering Pty. Ltd
5/110 Oaks Avenue, Dee Why, NSW 2099
M: 0457 115 044 | T: +61 2 8960 5291
Email: info@soilsrock.com.au
www.soilsrock.com.au

SSPP (Sydney South) revised and additional documentation - (2017SSH019) Part 8

CLIENT: FUZORTINN PTY LTD

TITLE: CROSS SECTION A-A'

1-21 DILLWYNNIA
HEATHCOTE, NSW 2233

Revision	Date

DATE:17/01/2018

SCALE: NTS

PROJECT No: SRE/275/HC/17

CHECKED BY: JC

DESIGNED BY: MJ

Drawing No: G02

APPENDIX D

Borehole Logs

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH07**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	1 of 3
Location:	1 - 21 DILLWYNIA GROVE, HEATHCOTE NSW	**Date Started:**	15/12/2017
Date:	5/01/2018	**Date Completed**	15/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	211.3
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER / WASH BORE	**Inclination:**	90˚	**Easting:**	-
						Northing:	-

Groundwater Record	Drilling Method	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING	90mm SOLID FLIGHT AUGER FROM 0.0m to 3.5mm			210.8	0.5		**SILT:** Dark brown silt with trace of fine grained sand, clay and some sub-angular to sub-rounded gravels.	D	-	-	Fill Material
				210.3	1.0		**GRAVELLY SILTY CLAY:** Pale grey, brown silty clay with red/orange motted and some dark brown, black sub-angular to sub-rounded gravels. Medium to high plasticity.				
				209.8	1.5						
		SPT (11,23,35) Np = 58		209.3	2.0			D	H	-	
				208.8	2.5						
				208.3	3.0						
		SPT (23,28,43) Np = 71		207.8	3.5		**GRAVELLY SILTY CLAY:** Pale grey to white clay with orange motted and sub-angular to sub-rounded dark brown, black gravels.				
	WASH BORE FROM 3.5m to 4.5m			207.3	4.0			M	H	-	
				206.8	4.5						
		SPT (11,25,24) Np = 49		206.3	5.0			M	H	-	(START CORING AT 4.5m) REFER TO CORE BOREHOLE LOG

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO:**	**BH07**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	2 of 3
Location:	1 - 21 DILLWYNIA GROVE, HEATHCOTE NSW	**Date Started:**	15/12/2017
Date:	5/01/2018	**Date Completed:**	15/12/2017
Project No:	SRE/275/HC/17	**Logged/ Checked by:**	H.C/J.C

Equipment	DANDO TERRIER	**Hole Diameter:**	76mm	**Coring Size:**	52mm	**R.L Surface Approx.**	211.3
Driller:	BG DRILLING	**Drilling Methoc**	NMLC	**Inclination:**	90˚	**Easting:**	-
						Northing:	-

Groundwater Record	Barrel Lift	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Rock Classification: Weathering (RS, XW, DW, SW, FR)	Rock Classification: Estimated Strength (EL, VL, L, M, H, VH, EH)	$Is_{(50)}$ (Mpa)	Estimated UCS (Mpa)	RQD% (0-25, 25-50, 50-75, 75-90, >90)	Defect Spacing (mm) (0-20, 20-60, 60-200, 200-600, > 600)	Remarks and Additional Observations
			206.8	4.5		(START CORING AT 4.5m)							
	1st		206.3	5.0		**CLAY:** Pale grey / brown hard clay with medium to high strength ironstone indulated bands throughout.							Residual Soil developed from extremely weathered shale with the rock mass structure and substance fabric are no longer evidence
	2nd		205.8	5.5		Band							
			205.3	6.0		Band							
			204.8	6.5		Band							
	3rd		204.3	7.0		Band							
			203.8	7.5		**SHALE:** Grey extremely weathered to highly weathered shale with siltstone laminations and carbonaceous. Extremely low to very low strength.			0.068	1.36			
			203.3	8.0									
	4th		202.8	8.5					0.065	1.3			
									0.015	0.3			
			202.3	9.0		**SHALE:** Dark grey highly weathered shale with siltstone laminations. Extremely low to very low strength.			0.058	1.16			
						(CORING TERMINATED AT 9.2m)							

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols: Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

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CLENT:	FUZORTINN PTY LTD	TITLE:	CORING PHOTOGRAPH
PROJECT:	HEATHCOTE HALL SERVICE	BOREHOLE NO:	BH07
ADDRESS:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE	SCALE:	NTS
PROJECT NO:	SRE/275/HC/17	DATE:	15/12/2017

CORING START AT 4.5m

CORING TERMINATED AT 9.2m

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www.soilsrock.com.au | info@soilsrock.com.au

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH 08**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	1 of 4
Location:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	15/12/2017
Date:	5/01/2018	**Date Completed**	15/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	212.0
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER	**Inclination:**	90°	**Easting:**	
						Northing:	

Groundwater Record	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING			211.5	0.1		**SILTY CLAY:** Dark brown silty clay with trace of fine grained sand and sub-augular to sub-rounded geavels.	D	-	-	Fill Material
			211.0	0.5		**GRAVELLY SILTY CLAY:** Pale grey, brown silty clay with red/orange motted and some dark brown, black sub-angular to sub-rounded gravels. Medium to high plasticity.	D to M	H	-	Augering slowly
			208.0	4.0		**GRAVELLY SILTY CLAY:** Pale grey to white clay with orange motted and sub-angular to sub-rounded dark brown, black gravels.	M	H	-	Augering slowly and difficulty
			207.0	5.0						

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols: Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

Water Table Level — REMARKS: Standpipe installed to 10.0m

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH 08**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	2 of 4
Location:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	15/12/2017
Date:	5/01/2018	**Date Completed**	15/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	212.0
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER	**Inclination:**	90°	**Easting:**	
						Northing:	

Groundwater Record	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING			206.5	5.5		**GRAVELLY SILTY CLAY:** Pale grey to white clay with orange motted and sub-angular to sub-rounded dark brown, black gravels.	M	H	-	Augering slowly and difficulty
			206.0	6.0						
			205.5	6.5						
			205.0	7.0						
			204.5	7.5		(START CORING AT 7.5m) REFER TO CORE BOREHOLE LOG				

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

= Water Table Level REMARKS: Standpipe installed to 10.0m

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO:**	**BH 08**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	3 of 4
Location:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	15/12/2017
Date:	5/01/2018	**Date Completed:**	15/12/2017
Project No:	SRE/275/HC/17	**Logged/ Checked by:**	H.C/J.C

Equipment	HANJIN D&B - 8D	**Hole Diameter**	76mm	**Coring Size:**	52mm	**R.L Surface Approx.**	212.0
Driller:	BG DRILLING	**Drilling Metho**	NMLC	**Inclination:**	90˚	**Easting:**	
						Northing:	

Groundwater Record	Barrel Lift	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Rock Classification: Weathering (RS XW DW SW FR)	Rock Classification: Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ (Mpa)	Estimated UCS (Mpa)	RQD% (0-25 25-50 50-75 75-90 >90)	Defect Spacing (mm) (0-20 20-60 60-200 200-600 > 600)	Remarks and Additional Observations
				7.5		(START CORING AT 7.5m)							
	1st		204.0	8.0		**CLAY:** Hard brown hard clay with silt, medium to high plasticity.							Residual Soil developed from extremly weathered shale with the rock mass structure and substance fabric are no longer evidence.
			203.5	8.5		**SHALE:** Pale grey extremely weathered to highly weathered shale with siltstone laminations and some medium to high ironstone indulated bands. Extremely low to very low strength.			0.015 0.086	0.29 1.72			
			203.0	9.0		**SHALE:** Grey highly weathered shale with siltstone laminations. Very low strength.			0.098	1.95			
			202.5	9.5					0.095	1.90			
						(CORING TERMINATED AT 9.6m)							

Symbols & Abbreviations:

R = Refusal N = SPT Value

Equipment/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

= Water Table Level REMARKS: Standpipe installed to 10.0m

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CLENT:	FUZORTINN PTY LTD	TITLE:	CORING PHOTOGRAPH
PROJECT:	HEATHCOTE HALL	BOREHOLE NO:	BH 08
ADDRESS:	1 - 21 DILLWYNNIA GROVE, HEATCOTE	SCALE:	NTS
PROJECT NO:	SRE/275/HC/17	DATE:	15/12/2017

CORING START AT 7.5m

CORING TERMINATED AT 9.6m

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BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH 09**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	1 of 4
Location:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	14/12/2017
Date:	5/01/2018	**Date Completed**	15/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	210.0
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER	**Inclination:**	90°	**Easting:**	
						Northing:	

Groundwater Record	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING			209.5	0.1		**SILT:** Dark brown silt with trace of fine grained sand, roots and sub-angular to sub-rounded gravels.	D	-	-	Fill Material
			209.0	0.5		**SILTY CLAY:** Greyish brown silty clay with angular to sub-angular and sub-rounded iron-stained gravels. Medium plasticity.				Hardsetting Residual Soil
			208.5	1.0						
	SPT (6,11,23) Np=34		208.0	1.5			D	H	-	
			207.5	2.0						
			207.0	2.5						
	SPT (8,17,25/30mm) Np=R		206.5	3.0		**SILTY CLAY:** Reddish brown, light grey silty clay with orange motted and some angular to sub-angular and sub-rounded iron-stained gravels.				Hardsetting Residual Soil
			206.0	3.5			D	H	-	
			205.5	4.0						
	SPT (22,30,25/70mm) Np=R		205.0	4.5						
				5.0						

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipment/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

= Water Table Level

REMARKS: Standpipe installed to 10.0m

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH 09**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	2 of 4
Location:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	14/12/2017
Date:	5/01/2018	**Date Completed**	15/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	210.0
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER	**Inclination:**	90˚	**Easting:**	
						Northing:	

Groundwater Record	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING			204.5	5.5		**SILTY CLAY:** Reddish brown, light grey silty clay with orange motted and some angular to sun-angular and sub-rounded iron-stained gravels.	D	H	-	
	SPT (16,27,32) Np=59		204.0	6.0		**SILTY CLAY:** Reddish brown, pale grey, white silty clay with orange motted and some angular to sub-angular and sub-rounded iron-stained gravels and trace of carbonaceous debris.	D	H	-	
			203.5	6.5						
			203.0	7.0		**CLAY:** Pale grey, brown clay with some silt and sub-angular and sub-rounded iron-stained gravels, medium to high plasticity.	M	H	-	Augering slow
			202.5	7.5						
			202.0	8.0						
			201.5	8.5						
			201.0	9.0						
			200.5	9.5						
			200.0	10.0						
						(START CORING AT 10.2m) REFER TO CORE BOREHOLE LOG				

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

= Water Table Level

REMARKS: Standpipe installed to 10.0m

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO:**	**BH 09**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	3 of 4
Location:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	14/12/2017
Date:	5/01/2018	**Date Completed:**	15/12/2017
Project No:	SRE/275/HC/17	**Logged/ Checked by:**	H.C/J.C

Equipment:	HANJIN D&B - 8D	**Hole Diameter:**	76mm	**Coring Size:**	52mm
Driller:	BG DRILLING	**Drilling Metho**	NMLC	**Inclination:**	90˚

R.L Surface Approx. 210.0
Easting:
Northing:

Groundwater Record	Barrel Lift	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Rock Classification: Weathering (RS, XW, DW, SW, FR)	Rock Classification: Estimated Strength (EL, VL, L, M, H, VH, EH)	$Is_{(50)}$ (Mpa)	Estimated UCS (Mpa)	RQD% (0-25, 25-50, 50-75, 75-90, >90)	Defect Spacing (mm) (0-20, 20-60, 60-200, 200-600, > 600)	Remarks and Additional Observations
			200.0	10.0		(START CORING AT 10.2m)							
	1st		199.5	10.5		CORE LOSS							
			199.0	11.0									
			198.5	11.5		**SHALE**: Extremely weathered grey shale with lense of carbonaceous. Very low strength.			0.07	1.48			
			198.0	12.0					0.07	1.36			
						(CORING TERMINATED AT 12.2m)							

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

= Water Table Level REMARKS: Standpipe installed to 10.0m

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CLENT:	FUZORTINN PTY LTD	TITLE:	CORING PHOTOGRAPH
PROJECT:	HEATHCOTE HALL	BOREHOLE NO:	BH 09
ADDRESS:	1 - 21 DILLWYNNIA GROVE, HEATCOTE	SCALE:	NTS
PROJECT NO:	SRE/275/HC/17	DATE:	15/12/2017

CORING START AT 10.2m

CORING TERMINATED AT 12.2m

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BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH 10**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	1 of 2
Location:	1 - 21 DILL WYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	14/12/2017
Date:	5/01/2018	**Date Completed**	14/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	211.0
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER	**Inclination:**	90°	**Easting:**	-
						Northing:	-

Groundwater Record	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING			210.5	0.1		**CLAYEY SILT:** Brown clayey silt with trace of fine grained sand and gravels.	D	Vst	-	Fill Material
	SPT (8,13,16) Np=29		210.0	0.5		**SILTY CLAY:** Reddish brown silty clay with trace of fine sub-angular to sub-rounded black gravels. Low to medium plasticity.	D	Vst	-	
			209.5	1.0						
	SPT (13,22,30) Np=52		209.0	1.5		**SILTY CLAY:** Reddish brown, pale grey silty clay with fine to medium iron-stained gravels. Medium to high plasticity.	D	H	-	
			208.5	2.0						
	SPT (12,15,21) Np=36		208.0	2.5						
			207.5	3.0						
			207.0	3.5						
			206.5	4.0						
	SPT (9,16,22) Np=38		206.0	4.5		**SILTY CLAY:** Grey, orange motted silty clay. Medium to high plasticity.	D	H	-	
				5.0						

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH 10**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	2 of 2
Location:	1 - 21 DILL WYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	14/12/2017
Date:	5/01/2018	**Date Completed**	14/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	211.0
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER	**Inclination:**	90°	**Easting:**	
						Northing:	

Groundwater Record	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING			205.5	5.5		**SILTY CLAY:** Grey, orange motted silty clay. Medium to high plasticity.	D	H	-	
			205.0	6.0		(AUGERING TERMINATED AT 6m)				

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH 11**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	1 of 2
Location:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	14/12/2017
Date:	5/01/2018	**Date Completed**	14/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	212.5
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER	**Inclination:**	90°	**Easting:**	
						Northing:	

Groundwater Record	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description		Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING				0.1		**SILT:**	Dark brown silt with trace of fine grained sand, roots and clay, fine sub-angular to sub-rounded gravels.	D	-	-	
			212.0	0.5		**SILTY CLAY:**	Brown grey silty clay with trace of fine sub-angualr to sub-rounded gravels. Medium plasticity.				
	SPT (7,12,16) Np=28							D	Vst	-	
			211.5	1.0							
			211.0	1.5		**SILTY CLAY:**	Reddish brown and pale grey silty clay, orange motted with fine to medium black, yellowish ironstained gravels. Medium to high plasticity.				
	SPT (16,21,34) Np=55										
			210.5	2.0				D	H	-	
			210.0	2.5							
			209.5	3.0							
	SPT (18,29,33) Np=62					**GRAVELLY SILTY CLAY:**	Reddish brown, pale grey and orange motted gravelly silty clay, medium to high plasticity. Fine to medium gravels.				
			209.0	3.5							
			208.5	4.0				D	H	-	
			208.0	4.5							
	SPT (17,32,35) Np=67										
			207.5	5.0							

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete		Silty Sand	
Fill		Clay Sand	
Clay		Silty Clay	
Silt		Gravelly Clay	
Sand		Gravelly Silty Clay	
Gravel		Sandstone	
Sandy Clay		Shale	

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH 11**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	2 of 2
Location:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	14/12/2017
Date:	5/01/2018	**Date Completed**	14/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	212.5
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER	**Inclination:**	90°	**Easting:**	
						Northing:	

Groundwater Record	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING			207.5	5.0		**GRAVELLY SILTY CLAY:** Reddish brown, pale grey and orange motted gravelly silty clay, medium to high plasticity. Fine to medium gravels.	D	H	-	
			206.5	6.0		(AUGERING TERMINATED AT 6m)				

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipment/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH 12**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	1 of 2
Location:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	14/12/2017
Date:	5/01/2018	**Date Completed**	14/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	211.8
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER	**Inclination:**	90°	**Easting:**	
						Northing:	

Groundwater Record	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING				0.1		**SILT:** Dark brown silt with fine grained sand, roots and trace of clay, fine sub-angular to sub-rounded gravels.	D	-	-	
			211.3	0.5						
	SPT (12,20,22) Np=42					**SILTY CLAY:** Reddish brown silty clay, low to medium plasticity with trace of fine sub-angular to sub-rounded black gravels.	D	H	-	
			210.8	1.0						
			210.3	1.5						
	SPT (10,15,22) Np=37					**SILTY CLAY:** Reddish brown silty clay , low to medium plasticity with fine to medium sub-angular to sub-rouned black gravels.	D	H	-	
			209.8	2.0						
			209.3	2.5						
			208.8	3.0						
	SPT (15,26,32) Np=58					**SILTY CLAY:** Brown pale grey silty clay, orange motted, medium to high plasticity with fine to medium sub-angular to sub-rounded black gravels.	D	H	-	
			208.3	3.5						
			207.8	4.0						
						GRAVELLY SILTY CLAY: Reddish brown, pale grey and orange motted gravelly silty clay, medium to high plasticity. Fine to medium sub-angular to sub-rounded black gravels.	D	H	-	
			207.3	4.5						
	SPT (11,18,24) Np=42									
			206.8	5.0						

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete, Fill, Clay, Silt, Sand, Gravel, Sandy Clay, Silty Sand, Clay Sand, Silty Clay, Gravelly Clay, Gravelly Silty Clay, Sandstone, Shale

BOREHOLE LOG

Client:	FUZORTINN PTY LTD	**BOREHOLE NO.**	**BH 12**
Project:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**Page:**	1 of 2
Location:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**Date Started:**	14/12/2017
Date:	5/01/2018	**Date Completed**	14/12/2017
Project No.:	SRE/275/HC/17	**Logged/Checked by:**	H.C/J.C

Equipment:	DANDO TERRIER	**Hole Diameter:**	90mm	**Coring Size:**	-	**RL Surface Approx.:**	211.8
Driller:	BG DRILLING	**Drilling Method:**	SOLID FLIGHT AUGER	**Inclination:**	90˚	**Easting:**	
						Northing:	

Groundwater Record	Field Tests SPT	Sample ID	RL	Depth (m)	Graphic Log	Material Description	Soils Classification: Moisture Condition	Soils Classification: Strength (Consistency)	Soils Classification: Density Index	Remarks and Additional Observations
DRY ON COMPLETION OF AUGERING			206.3	5.5		**GRAVELLY SILTY CLAY:** Reddish brown, pale grey and orange motted gravelly silty clay, medium to high plasticity. Fine to medium sub-angular to sub-rounded black gravels.	D	Vst	-	
	SPT (9,13,14) Np=27		205.8	6.0						
						(AUGERING TERMINATED AT 6m)				
				6.5						
				7.0						
				2.5						
				3.0						
				3.5						
				4.0						
				4.5						
				5.0						

Symbols & Abbreviations: R = Refusal N = SPT Value

Equipmemt/Method		Moisture Condition	Strength	Density Index	Weathering	Strength
HA	Hand Auger	PL=Plastic limit	Cohesive Soils	Cohesionless Soils	Rock Classification	EL = Extremly Low
TT56	Diamond Core-45mm	MC>PL	VS = Very Soft	VL = Very Loose	RS = Residual Soil	VL = Very Low
HQ	Diamond Core-63mm	MC=PL	S = Soft	L = Loose	XW = Extremely Weathered	L = Low
NMLC	Diamond Core-52mm	MC<PL	F = Firm	MD = Medium Dense	DW = Distinctly Weathered	M = Medium Strength
NQ	Diamond Cored-47mm	D=Dry	St = Stiff	D = Dense	SW = Slightly Weathered	High = H
PCD	Polycrystallation-Diamond	M=Moist	VSt = Very Stiff	VD = Very Dense	F = Fresh	VH = Very High
AV	Auger with V-bit	W=Wet	H = Hard			EH = Extremly High
AT	Auger with TC- bit					

Grafic Log Symbols

Concrete		Silty Sand	
Fill		Clay Sand	
Clay		Silty Clay	
Silt		Gravelly Clay	
Sand		Gravelly Silty Clay	
Gravel		Sandstone	
Sandy Clay		Shale	

APPENDIX E

Point Load Test Index Results

CLIENT:	FUZORTINN PTY LTD	**PAGE**	1 of 1
PROJECT:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**TESTED BY:**	H.C
LOCATION:	1 - 21 Dillwynnia Grove, Heathcote, NSW	**CHECKED BY:**	J.C
PROJECT NO:	SRE/275/HC/17		
TEST METHOD:	RMS T223	**DATE OF ISSUE:**	12/01/2018

POINT LOAD STRENGTH INDEX TEST RESULT REPORT

BH ID	DEPTH (m)	Test Type	SAMPLE DESCRIPTION			DIMENSIONS			RESULTS					
			ROCK TYPE	STRUCTURE	MOISTURE	D (mm)	W (mm)	De (mm)	LOAD, P (kN)	FAILURE MODE	Is (MPa)	$Is_{(50)}$ (MPa)	Estimated UCS (Mpa)	Estimated Strength
BH 07	7.75	A	SH	BE	AR	30	51	44.14	0.14	3	0.072	0.068	1.36	VL
	8.4	A	SH	BE	AR	29	51	43.39	0.13	3	0.069	0.065	1.30	VL
	8.75	A	SH	BE	AR	43	50	52.32	0.04	3	0.015	0.015	0.30	EL
	9.15	A	SH	BE	AR	40	51	50.96	0.15	3	0.058	0.058	1.16	VL
BH 08	8.4	A	SH	BE	AR	30.0	51	44.14	0.03	3	0.015	0.015	0.29	EL
	8.7	A	SH	BE	AR	35.0	51	47.67	0.20	3	0.088	0.086	1.72	VL
	9.1	A	SH	BE	AR	26.0	51	41.09	0.18	3	0.107	0.098	1.95	VL
	9.4	A	SH	BE	AR	27.0	51	41.87	0.18	3	0.103	0.095	1.90	VL
BH09	11.4	A	SH	BE	AR	45.0	51	54.06	0.21	3	0.072	0.074	1.49	VL
	11.8	A	SH	BE	AR	45.0	50	53.52	0.19	3	0.066	0.068	1.37	VL

NOTATION

Moisture
- (W) Wet
- (M) Moist
- (D) Dry
- (AD) As Drilled
- (AR) **As Received**

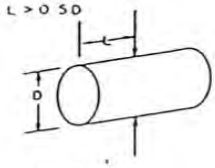
Rock Type
- (SS) Sandstone
- (ST) Siltstone
- (SH) Shale
- (G) Granitic
- (MSS) Meta Sandstone
- (MST) Meta Siltstone

Structure
- (MA) Massive
- (BE) Bedded
- (IB) Interbedded
- (LA) Laminated
- (CR) Crystalline

Failure Mode
- 1 - Fracture through fabric oblique to bedding
- 2 - Fracture along bedding
- 3 - Fracture through rock mass
- 4 - Fracpture influenced by pre-existing: (J) Joint Plan, (M) Microfracture, (F) Foliation, (V) Vein
- 5 - Partial fracture or Chip (Invalid Result)

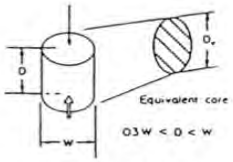
Test Type

D: Diametral Test



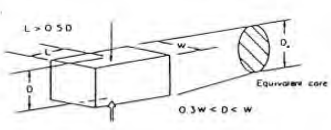
L > 0.5 D

A: Axial Test



0.3W < D < W

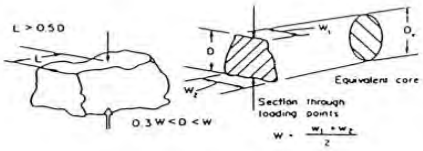
B: Block Test



0.3W < D < W

L > 0.5 D

I: Irregular Lump Test



0.3 W < D < W

L > 0.5 D W = (W1 + W2) / 2

APPENDIX F

Laboratory Test Results for Exposure Classification

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 424 344

Client: Soilsrock Engineering	**Client Project Name / Number / Site etc (ie report title):** 1-7 Dellwynnia Grove, Heathcote Sutherland
Contact Person: Jorge. Cabaco	**PO No.:**
Project Mgr:	**Envirolab Quote No. :**
Sampler: J.C	**Date results required:**
Address: 5/110, OAKS AVE, DEE WHY 2099 NSW	**Or choose:** standard / same day / 1 day / 2 day / 3 day *Note: Inform lab in advance if urgent turnaround is required - surcharges apply*
Phone: **Mob:** 0457115044	**Additional report format:** esdat / equis /
Email: Jorge.Cabaco@Soilsrock.com.au Henry@Soilsrock.com.au Sharon@Soilsrock.com.au	**Lab Comments:**

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph: 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt Myaree, WA 6154
Ph: 08 9317 2505 / lab@mpl.com.au

Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
Ph: 03 9763 2500 / melbourne@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
Ph: 08 7087 6800 / adelaide@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
Ph: 07 3266 9532 / brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 7, 17 Willes Rd, Berrimah, NT 0820
Ph: 08 8967 1201 / darwin@envirolab.com.au

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth (m)	Date sampled	Type of sample	pH	Sulphate	Chloride	Resistivity											Provide as much information about the sample as you can
1	S1	0.5-1	13/12	Soil	X	X	X	X											
2	S2	1.5-2	13/12	Soil	X	X	X	X											

Relinquished by (Company): Soilsrock Engineering	**Received by (Company):** EES	*Lab Use Only*	
Print Name: HENRY CHIU	**Print Name:** MT	**Job number:** 182561	**Cooling:** Ice / Ice pack / None
Date & Time: 21/12/2017	**Date & Time:** 21/12/17 11:25	**Temperature:** 20.2	**Security seal:** Intact / Broken / None
Signature:	**Signature:**	**TAT Req - SAME day / 1 / 2 / 3 / 4 / STD**	

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	SOILSROCK ENGINEERING PTY LTD
Attention	Jorge Cabaco

Sample Login Details

Your reference	Heathcote Sutherland
Envirolab Reference	182561
Date Sample Received	21/12/2017
Date Instructions Received	21/12/2017
Date Results Expected to be Reported	04/01/2018

Sample Condition

Samples received in appropriate condition for analysis	YES
No. of Samples Provided	2 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	24.2
Cooling Method	None
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	pH1:5 soil:water	Chloride, Cl1:5 soil:water	Sulphate, SO41:5 soil:water	Resistivity in soil*
S1-0.5-1	✓	✓	✓	✓
S2-1.5-2	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 182561

Client Details

Client	SOILSROCK ENGINEERING PTY LTD
Attention	Jorge Cabaco
Address	5/110 Oaks Avenue, Dee Why, NSW, 2099

Sample Details

Your Reference	**Heathcote Sutherland**
Number of Samples	2 Soil
Date samples received	21/12/2017
Date completed instructions received	21/12/2017

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

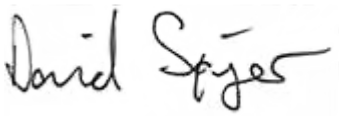
Date results requested by	04/01/2018
Date of Issue	03/01/2018

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Nick Sarlamis, Inorganics Supervisor

Authorised By



David Springer, General Manager

Misc Inorg - Soil			
Our Reference		182561-1	182561-2
Your Reference	UNITS	S1	S2
Depth		0.5-1	1.5-2
Date Sampled		15/12/2017	15/12/2017
Type of sample		Soil	Soil
Date prepared	-	22/12/2017	22/12/2017
Date analysed	-	22/12/2017	22/12/2017
pH 1:5 soil:water	pH Units	6.7	4.7
Chloride, Cl 1:5 soil:water	mg/kg	160	80
Sulphate, SO4 1:5 soil:water	mg/kg	330	<10
Resistivity in soil*	ohm m	34	200

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons. Resistivity is calculated from Conductivity.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Alternatively determined by colourimetry/turbidity using Discrete Analyer.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			22/12/2017	[NT]	[NT]	[NT]	[NT]	22/12/2017	[NT]
Date analysed	-			22/12/2017	[NT]	[NT]	[NT]	[NT]	22/12/2017	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	88	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	112	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

APPENDIX G

Laboratory Test Results for Atterberg Limit Tests

Sydney Laboratory
Unit 5/43 Herbert St
Artarmon NSW 2064
email: artarmon@ghd.com.au
web: www.ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax:(02) 9462 4710

Aggregate/Soil Test Report

Report No: SYD1703031
Issue No: 1
This report replaces all previous issues of report no 'SYD1703031'.

Client:
Soilsrock Engineering Pty Ltd
5/110 Oaks Ave
Dee Why NSW 2099

Project: 2125759

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 16/01/2018

Sample Details

GHD Sample No	SYD17-0601-01
Date Sampled	20/12/2017
Sampled By	Sampled By Client
Location	1 - 21 Dyllwnnia Grove, Heathcote NSW
BH / TP No.	BH7
Depth (m)	1.0 - 1.5
Soil Description	CLAY

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	Not Tested	
Mould Length (mm)		0	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	78	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	26	
Plasticity Index (%)	AS 1289.3.3.1	52	
Date Tested		15/01/2018	

Comments

N/A

Sydney Laboratory
Unit 5/43 Herbert St
Artarmon NSW 2064
email: artarmon@ghd.com.au
web: www.ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax:(02) 9462 4710

Aggregate/Soil Test Report

Report No: SYD1703032
Issue No: 1
This report replaces all previous issues of report no 'SYD1703032'.

Client:
Soilsrock Engineering Pty Ltd
5/110 Oaks Ave
Dee Why NSW 2099

Project: 2125759

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 16/01/2018

Sample Details

GHD Sample No	SYD17-0601-02
Date Sampled	20/12/2017
Sampled By	Sampled By Client
Location	1 - 21 Dyllwnnia Grove, Heathcote NSW
BH / TP No.	BH10
Depth (m)	1.0 - 1.5
Soil Description	CLAY

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	Not Tested	
Mould Length (mm)		0	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	80	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	23	
Plasticity Index (%)	AS 1289.3.3.1	57	
Date Tested		15/01/2018	

Comments

N/A

APPENDIX H

Site Photographs

CLIENT:	FUZORTINN PTY LTD	**PAGE:**	1 of 1
PROJECT:	HEATHCOTE HALL - DETAILED GEOTECHNICAL SITE INVESTIGATION	**DATE RECORD:**	15/12/2017
LOCATION:	1 - 21 DILLWYNNIA GROVE, HEATHCOTE NSW 2233	**LOG GED BY:**	H.C
DATE:	5/01/2018	**CHECKED BY:**	J.C
PROJECT NO.:	SRE/275/HC/17		

SITE PHOTOGRAPHS

Photo 1 - North West view of the site - corner of Dylwynnia grove with Tecoma Street.

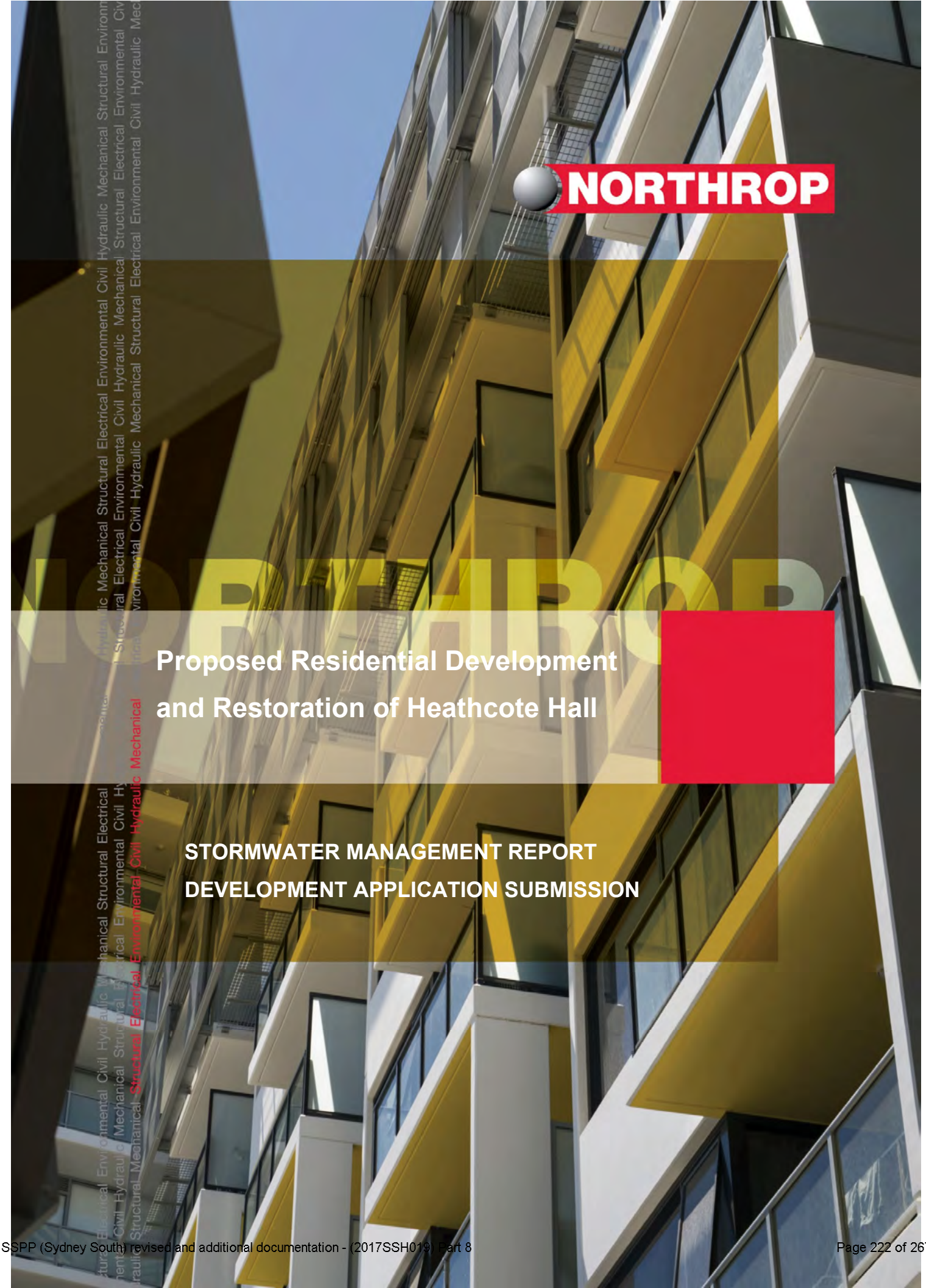
Photo 2 - North view to Borehole BH10 location - area of the proposed apartment building construction.

Photo 3 - North view to Borehole BH07 location - area of proposed townhouses construction located at west of the site.

Photo 4 - South view to the Borehole BH12 location - area of the proposed townhouses construction located a East of the site.

Photo 5 - South view to site boundary adjacent to Dillwynnia Grove, a small hill slopes down from site to road.

Photo 6 - North view to borehole location BH9.



Proposed Residential Development and Restoration of Heathcote Hall

STORMWATER MANAGEMENT REPORT
DEVELOPMENT APPLICATION SUBMISSION

Prepared for Fuzortinn Pty Ltd

16th of Feb 2018

Reference: S151903-CR01-D

Disclaimer

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151903 – Heathcote Hall Stormwater Management Report

Rev	Description	Prepared by	Issue Date
A	Draft – Issued for Review	RM	07.04.2017
B	Final – Issued for Development Application	RM	12.04.2017
C	Final – Issued for Development Application	DBA	07.12.2017
D	Final – Issued for Development Application	GC	16.02.2018

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1. Introduction

Northrop Consulting Engineers (Northrop) have been engaged by Fuzortinn Pty Ltd to prepare civil engineering and stormwater documentation to support a Development Application (DA) submission to Sutherland Shire Council (Council) for the proposed development at 1-21 Dillwynnia Grove, Heathcote. The proposed development will involve the construction of townhouses and apartments, a basement car park and associated infrastructure and service works as well as the restoration of Heathcote Hall and its surrounding gardens.

This report outlines the stormwater management strategy for runoff from the proposed development and has been developed in accordance with Sutherland Shire Council's 2015 Development Control Plan, Chapter 38 Stormwater and Groundwater Management.

This report should be read in conjunction with Northrop's Civil DA drawing set dated the 16th of February 2017.

Existing Site Description

The address of the subject site is 1-21 Dillwynnia Grove, Heathcote, Lot 1 and Lot 2 in DP 725184. The site is wholly located within the Sutherland Shire Council Local Government Area (LGA). **Figure 1** below shows the location and extents of the site.

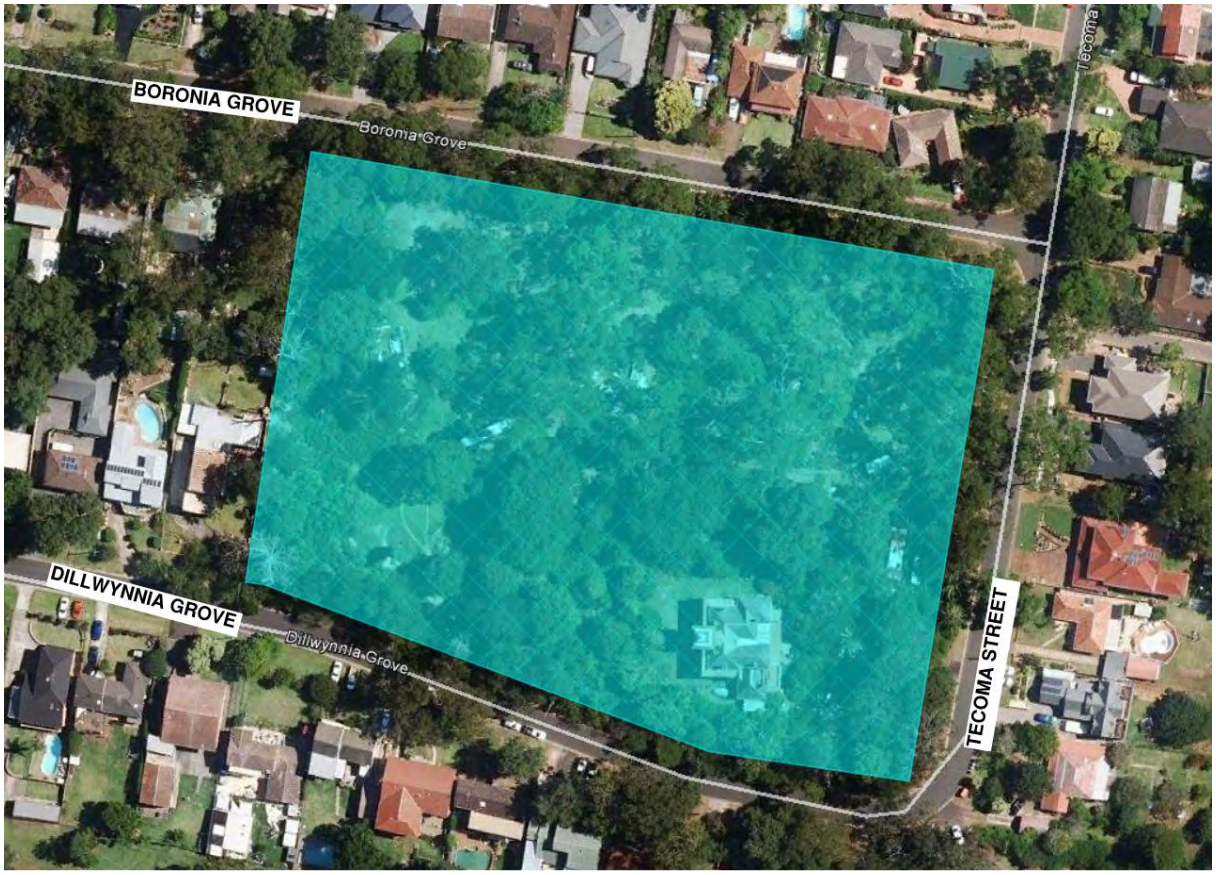


Figure 1 – Site location and extents.

The site is generally rectangular in shape and covers an area of approximately 17,470 m^2. The site is enclosed by Boronia Grove, Tecoma Street and Dillwynnia Grove on its Northern, Eastern and Southern Boundaries respectively. The site is bounded to the west by existing houses.

Proposed Development

The proposed development will involve clearing and excavation in the northern and western portions of the site. The demolition works will be followed by the construction of two levels of basement car parking and residential dwellings above. Please refer to the architectural drawings prepared by Ink Architects Pty Ltd for more details.

The heritage building and surrounding grounds are to be restored to their original condition, please refer to the landscape architectural plans and heritage consultant report for details.

2. Concept Stormwater Management Plan

This section of the report will outline the stormwater management strategy for the proposed development. The strategy has been developed in accordance with Chapter 38 of the 2015 Sutherland Council Development Control Plan: Stormwater and Groundwater management, Sutherland Shire Specification Stormwater management 2009, and Office of environment and heritage "guidelines for developments adjoining land managed by the Office of Environment and heritage" 2013.

The two main objectives are to:

- Capture and manage stormwater runoff generated from the proposed development and to safely discharge the stormwater to ensure that the peak site discharge (PSD) under proposed conditions does not exceed flows generated under pre-developed conditions.
- Appropriately manage gross pollutants and nutrient discharge from the site to minimise the impact on ecological heath of receiving waterways. This will be achieved by reducing pollutant loads by the percentages specified by Sutherland Shire Council.

Stormwater Quantity Management

The proposed development will utilise three On Site Detention (OSD) tanks to attenuate the peak stormwater discharge from the site. These tanks will be located in the North East and South West corners of the site. The DRAINS software package has been used to model and size the hydraulic behavior of these tanks.

Through discussion with council it has been determined that the heritage site has no requirement for OSD and that post developed flows are to match pre developed flows. As such we have allowed to pick up any overland surface flows that would cause a nuisance to the remaining site in swales located at the perimeter of the heritage zone, and then discharge these independently of the OSD system.

The model has been prepared to assess the 50%, 10%, 5% and 1% Annual Exceedance Probability (AEP) rainfall events (2, 10, 20 and 100 year ARI).

The DRAINS model has been built to assess both the predevelopment conditions as well as the post development conditions with OSD tanks.

The modelling input parameters adopted for the pre-developed model are as described:

- ILSAX Hydrologic routing method
- Soil Type 3
- Antecedent Moisture Conditions 3
- Paved Area Depression Storage 1 mm
- Supplementary Area Depression Storage 3 mm
- Grassed Area Depression Storage 5 mm.

- Roughness Factor 0.04 Pervious, 0.013 Impervious
- IFD Data obtained from the Bureau of Meteorology for Heathcote

The existing site comprises of three catchments, the extent and location of these catchments is shown below in **Figure 3**. The proposed post development catchments are shown in **Figure 4,** details of the proposed catchments and their areas can be found in the Northrop DA drawing package on sheet C04.91 and C04.92.

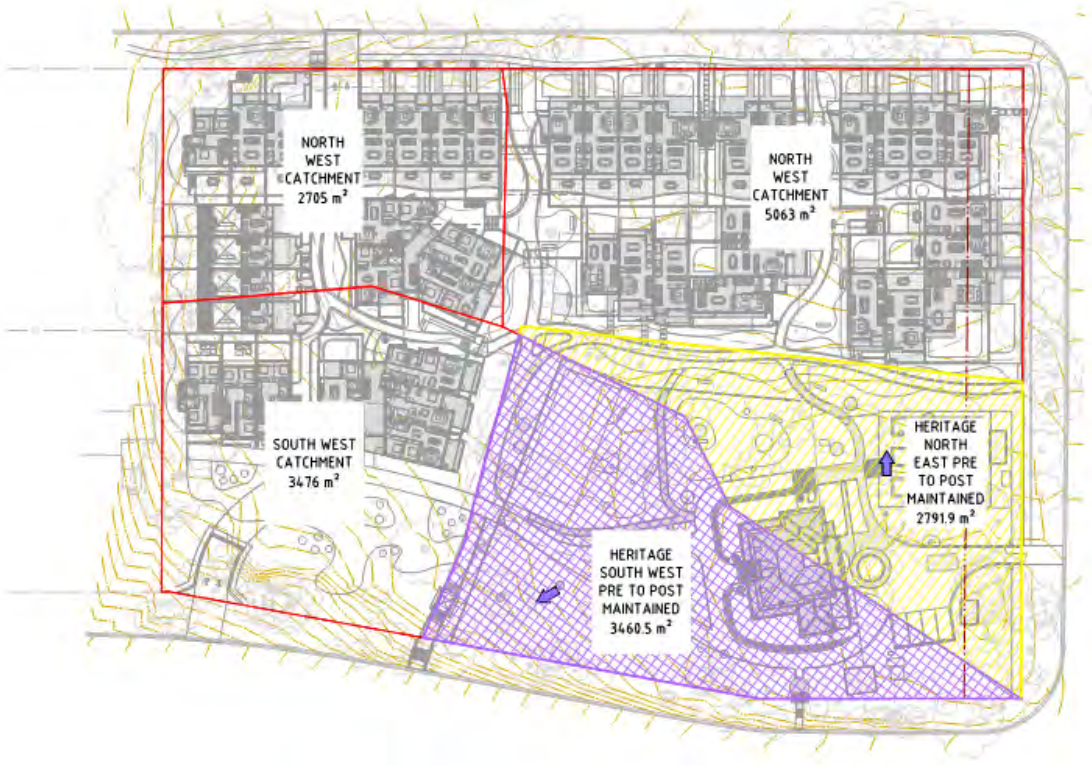


Figure 3 - Extent and location of the pre-developed site catchments.

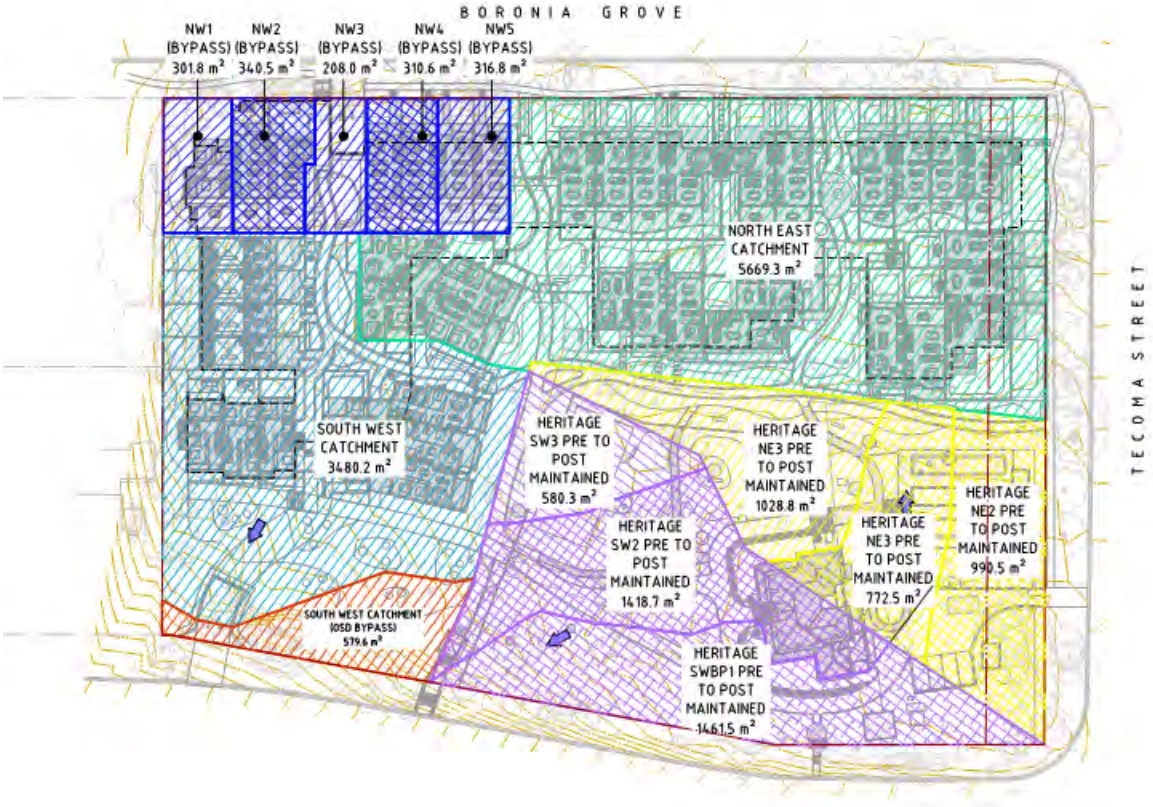


Figure 4 – The extent and location of the post-developed site catchments.

The catchment shown above in **Figure 4** labelled “Heritage Restoration zone” has been excluded from DRAINS and MUSIC modelling. This is due to the need to restore the area to its original conditions. Hence, it is not reasonably possible to pick up this catchment without new stormwater infrastructure such as pits and swales being constructed in this zone which would impact the heritage value of the site. Where reasonably possible the runoff from the heritage zone has been accounted for in the catchment plans for stormwater modelling to ensure no flows impact on the new works.

For the North west catchment there is currently no stormwater infrastructure within Baronia grove and as a result the catchments has been broken up to provide multiple discharge point through the use of RHS to roll kerb. Each connection has been provided with a minimum spacing of 15m and maximum flow of 15 L/s in the 10% AEP event

The Results of the DRAINS model are presented below in **Table 1.**

Table 1 – Hydrologic/Hydraulic Modelling Results for the site.

		PEAK SITE DISCHARGE (m3/s)							
		50% AEP-2 year		10% AEP -10 year		5% AEP- 20 year		1% AEP - 100 year	
CATCHMENT	POINT OF DISCHAGRE	PRE DEVELOPMENT	POST DEVELOPMENT	PRE DEVELOPMENT	POST DEVELOPMENT	PRE DEVELOPMENT	POST DEVELOPMENT	PRE DEVELOPMENT	POST DEVELOPMENT
NORTH WEST	TO GUTTER	0.076	0.047	0.119	0.068	0.140	0.079	0.173	0.095
NORTH EAST	TO EXISTING STORMWATER NETWORK	0.065	0.060	0.139	0.132	0.178	0.153	0.258	0.257
SOUTH WEST	TO EXISTING STORMWATER NETWORK	0.197	0.177	0.307	0.269	0.360	0.332	0.445	0.415

The results of **Table 1** above show that the post developed site discharge in each of the three catchments can be reduced to equal or less than the pre developed conditions for all stormw events. This has been achieved by using OSD tanks (2x total) located at the North East and South West discharge points to attenuate flows being discharged and maximizing the pervious area across the site.

For details of the of the size and location of the proposed OSD tanks refer to the Northrop Civil DA drawing package, in particular sheets:

• Stormwater Management Plan, C4.01

• OSD Detail Sheets, C4.61-C4.82

Stormwater Quality Management

Construction phase

During the bulk earthworks and construction of the proposed development, sediment and erosion control facilities will be designed and constructed/installed in accordance with Council's specification and with the requirements of the publication "Managing Urban Stormwater – Soils and Construction" (Also commonly known as the 'Blue Book').

A sediment and erosion control plan has been prepared and is illustrated in the civil DA drawings (Refer to sheet C2.01). This plan illustrates the strategies proposed to prevent excessive pollutant loads being exported from the site in runoff during constructions.

The plan incorporates the use of diversion bunds with hay bale water filters, sediment fences and sandbags, and temporary sediment basins.

MUSIC Modelling

The MUSIC software package (version 6.3.0) was used to model the quality of the stormwater discharged from the site, and to develop and size a stormwater treatment train for the proposed development. The model has been developed to conform to the requirements described in the *NSW Music Modelling Guidelines (2015)*.

As previously discussed the area of the Heritage Restoration Zone that cannot be collected by reasonable means or alterations to the heritage plans has been excluded. The proposed plan captures and treats as much of the runoff from the Heritage Zone as can reasonably expected to be collected and treated within the developable area.

The proposed treatment train consists of:

• 55m Vegetated Swale.

• 9 x Enviropod Pit Inserts.

• 3 x 690mm PSorb Stormwater 360 Stormfilter Cartridges.

• 5kL Rainwater Tank.

The results from the MUSIC model of the developed site with the proposed stormwater conditions with the described treatment devices are presented below in **Table 2**

Table 2 – MUSIC Modelling Results of the Heathcote Hall Area under Proposed Conditions with Treatment

Pollutants	% Reduction Target	% Reduction
Gross Pollutants (GP)	NA	99.4
Total Suspended Solids (TSS)	80	86.3
Total Phosphorous (TP)	40	63.7
Total Nitrogen (TN)	40	40

A screen shot of the MUSIC model and the results for the proposed developments are shown below in **Figure 5.**

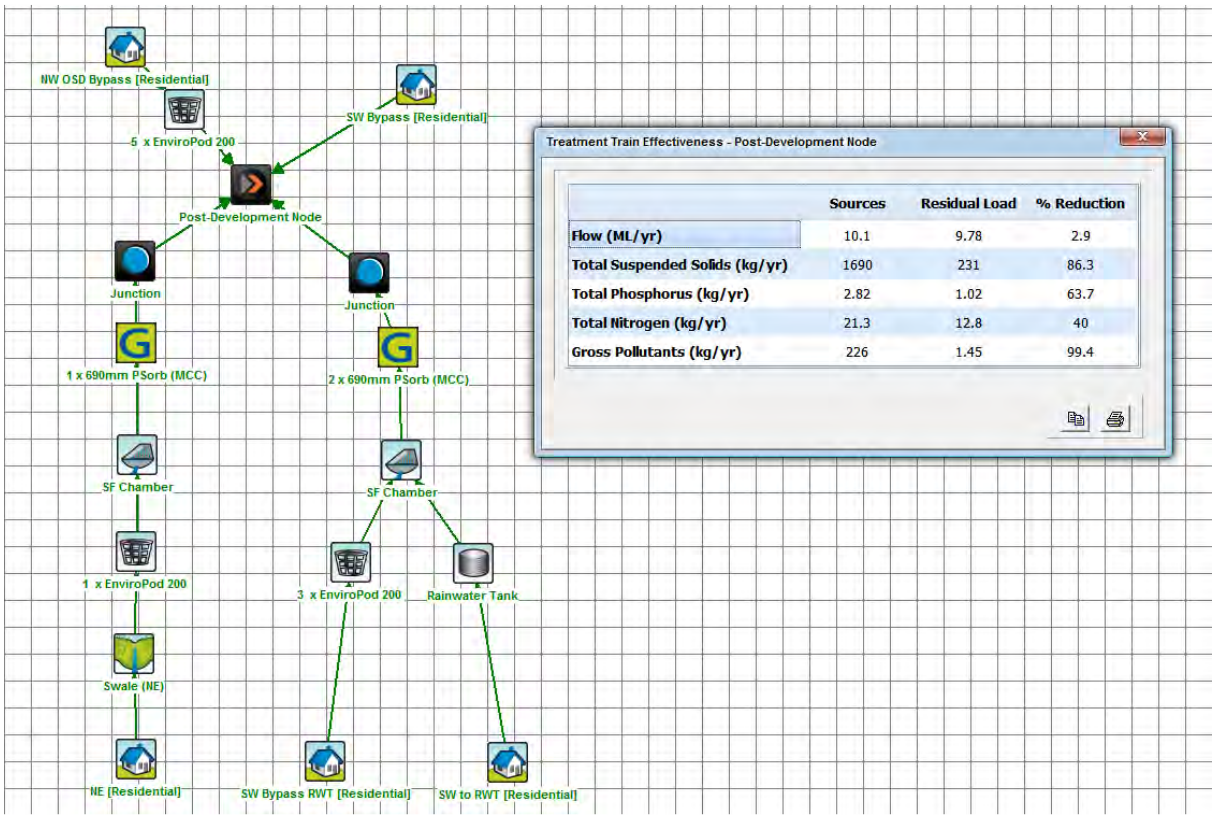


Figure 5 – Screenshot of Heathcote Hall Music model with results.

The results in **Table 2** reveal that the implementation of the proposed treatment train can effectively capture and remove a sufficient amount of pollutants from the site to achieve the targets as set by council.

Proposed Stormwater Treatment Train

In order to achieve the reduction targets specified, the following treatment devices are required as part of the treatment train:

- Trash Screens/Stormwater360 Enviropod 200 inserts

A total of 9 Stormfilter360 Enviropod inserts will be used as pre-treatment of stormwater runoff to capture litter and coarse sediment from site runoff.

- 690mm PSorb Stormwater 360 Stormfilter Cartridges.

3 cartridges will be used to purify stormwater runoff, 2 cartridges will be located within the north eastern OSD tank and 1 cartridge will be located within the south western OSD tank.

- Rainwater tank

A 5kL rainwater tank will be implemented to capture stormwater runoff generated off the roof of the buildings. The collected rainwater will be used for irrigation of the landscaped areas across the site. The rainwater tank structure will be incorporated as part of the south western OSD tank. Overflows from the rainwater tank would surface into the OSD and then discharge into Council's stormwater infrastructure.

Maintenance

Please refer to appendix A below for maintenance schedule

Conclusion

Northrop Consulting Engineers have been engaged by Fuzortinn Pty Ltd to prepare civil engineering and stormwater documentation in support of a Development Application submission to Sutherland Shire Council for the proposed development at 1-21 Dillwynnia Grove, Heathcote.

A stormwater management strategy has been developed in accordance with Chapter 38 of Council's DCP. The stormwater management strategy will include the implementation of on-site detention tanks, rainwater harvesting tanks, Enviropod pit inserts, grassed swales and landscaped areas.

Concept modelling on the effectiveness of the above stormwater treatment devices on the management of stormwater across the site has been undertaken using the DRAINS and MUSIC software packages. The modelling results have demonstrated that the above treatment devices are effective at reducing peak discharge rates and pollutant loads from the proposed site in accordance with Council's requirements.

Northrop are satisfied that stormwater runoff generated across the proposed development can be appropriately managed in accordance with Chapter 38 of the 2015 Sutherland Council Development Control Plan: Stormwater and Groundwater management, Sutherland Shire Specification Stormwater management 2009, and Office of environment and heritage "guidelines for developments adjoining land managed by the Office of Environment and heritage" 2013. The proposed stormwater management strategy can effectively manage stormwater runoff to ensure that under proposed conditions, the development will not result in an increase in pollutants or peak stormwater flows and will not result in any negative impacts to receiving water ways or downstream infrastructure.

3. Appendices

Appendix A- Maintenance schedule

STORMWATER DRAINAGE SYSTEM MONITORING AND MAINTENANCE SCHEDULE

GENERAL OPERATION

Site: 1-21 Dillwynnia Grove, Heathcote

Owner: _____

Commencement Date:_____

General Notes:

1- Maintenance is to be carried out with regard to relevant occupational health and safety guidelines and standards.

2- Initial monitoring and inspections of the stormwater system after commissioning are to be carried out every 3 months for the first year of operation with the amount and type of debris noted and recorded. This information shall be used to determine the modification of the frequency of inspections if required.

3- The frequency of inspections shown in the stormwater maintenance schedule are the maximum periods. Inspection frequencies may be reduced upon completion of the initial monitoring and inspection program as noted in note 2.

4- Blank copies of the maintenance schedule are to be made and filled out during each subsequent inspection with the details kept on site for future reference.

Designer Signature

Date 16.02.2018

HEATHCOTE HALL

Inspected by: .....
Date of Inspection: .....
Next Inspection: .....

Stormwater Maintenance Schedule

Prepared on 08.12.15

Items to be Inspected	Frequency	Performed by	Inspected		Maintenance Needed		Maintenance Procedure	Initial
			Yes	No	Yes	No		
General								
Stormwater surface inlet and junction pits	Four Monthly/ After Major Storm	Owner / Maintenance Contractor					Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris, litter and vegetation. (e.g. Vacum/eductor truck) Inspect and ensure grate is clear of sediment, debris, litter and vegetation. Ensure flush placement of grate on refitment	
General inspection of complete stormwater drainage system (that's visible)	Bi-annually	Owner / Maintenance Contractor					Inspect all drainage structures noting any dilapidation, carrry out required repairs.	
Rainwater Tanks								
First Flush Device	6 Monthly	Owner / Maintenance Contractor					Inspect first flush device to ensure correct operation. Remove accumulated litter & debris. If device is not functioning properly repair or replace.	
Internal Inspection	6 Monthly	Owner / Maintenance Contractor					Check for evidence of access by animals, birds or insects including the presence of mosquito larvae. If present, identify access point and close. If evidence of algal growth, find and close points of light entry.	
Tank and tank roof	6 Monthly	Owner / Maintenance Contractor					Check structural inegrity of tank including roof and access covers. Any dilapidation including holes or gaps are to be noted and repaired.	
On-Site Detention Tank / Discharge Control Pits								
Trash Screen	Six Monthly/ After Major Storm	Owner / Maintenance Contractor					Inspect trash screen to ensure correct operation. Remove accumulated litter & debris. If device is not functioning properly repair or replace.	
Orifice Plate	Six Monthly/ After Major Storm	Owner / Maintenance Contractor					Inspect orifice plate to ensure correct operation. Check orifice diameter size is correct and no damage is present to orifice edge. Check orifice plate is securely fastened to wall with no gaps present between plate and face of wall. If gaps are present fill with sealant or mortar to provide water tight seal.	
Weep Holes in base of sump	Six Monthly/ After Major Storm	Owner / Maintenance Contractor					Inspect weep holes in base of sump. Ensure weep holes are able to drain effectively and remove accumulated sediment and debris if present.	
Tank and tank roof	6 Monthly	Owner / Maintenance Contractor					Check structural inegrity of tank including roof and access covers. Any dilapidation including holes or gaps are to be noted and repaired.	
Primary Treatment								
Stormwater 360 Enviropod Pit Inserts (or equivalent)	Refer Manufacturers Manual	Maintenance / Specialised Contractor					Refer to manufacturers operation and maintenance manual.	
Secondary Treatment								
Stormwater 360 Stormfilter Cartridges (or equivalent)	Refer Manufacturers Manual	Maintenance / Specialised Contractor					Refer to manufacturers operation and maintenance manual.	

Appendix B- Drains Results

ILSAX CALCULATION SUMMARY SHEET

DRAINS results prepared from Version 2018.01

		Entire Catchment Area		
Soil Type	User to enter	Paved	0.786 ha	(22.5%}
		Supplementary	0 ha	(0%}
AMC	User to enter	Grassed	2.708 ha	(77.4%}
		Total Area	3.495 ha	

LOCATION AND LAND-USE | **TIME AND RUNOFF** | **INLET DESIGN** | **PIPE SYSTEM DESIGN** | **PIT RESULTS**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	31a	31b	32	33	34	35	36
Design AEP	Pit Name	Sub-Catchment Area (ha)	Land-Use	Percent-age	Constant Flow Time (minutes)	Kinematic Wave Formula Parameters Length (m)	Slope (%)	Friends Roughness n	Total Time tc (minutes)	Peak Sub-Catchment Flowrate (m^3/s) *worst storm	Origin of Approach Flows	Overflows Approaching Pit Flowrate (m^3/s)	Flow Width (m)	Depth x Velocity (m^2/s)	Inlet Family	Inlet Size	Total Approach Flow (m^3/s)	Overflow Leaving Pit Bypass Flow (m^3/s)	Flow Width (m)	Depth x Velocity (m^2/s)	Peak Flow in Pipe (m^3/s)	Reach Length (m)	Pipe Slope (m)	Pipe Diameter (mm)	U/S Pipe Invert Level (m)	D/S Pipe Invert Level (m)	U/S HGL in Pipe (m)	D/S HGL in Pipe (m)	Pipe Flow Velocity (m/s)	Pressure Change Coeff. Ku	QUDM Chart No. 2008 [2013]	QUDM Chart Ratios	Water Surface Elevation (m)	Surface Level (m)	Free-board (m)	Pit Name	Remarks
AR&R	**NE4**	0.1029	Paved	0	0	0	0	0	0	0.025					RSG	RSG 900x6	0.025	0	0	0	0.026	24.4	1	225	211.67	211.426	211.76	211.578	1.73	2.33	A1-4 [A2-3]7, Vo2/(2gD		211.82	212.5	0.68	**NE4**	
			Supp.	0	0	0	0	0																													
			Grassed	100	5	30	2.1	0.2	18.96																												
AR&R	**NE4**	0.1029	Paved	<------	-------	as above	-------	------>	0	0.043							0.043	0.001	0.4	0	0.039						212.506	212.42	0.97	2.33	A1-4 [A2-3]7, Vo2/(2gD		212.56	212.5	0	**NE4**	
			Grassed						13.71																												
AR&R	**NE 3**	0.0773	Paved	0	0	0	0	0	0	0.016					RSG	RSG 900x6	0.016	0.003	1.74	0.01	0.036	18.21	1	225	211.4	211.218	211.494	211.372	2.3	1.17	A1-5 [A2-4], Qg/Qo=0.4		211.58	212.85	1.27	**NE 3**	
			Supp.	0	0	0	0	0																													
			Grassed	100	5	58	2.1	0.2	23.94																												
AR&R	**NE 3**	0.0773	Paved	<------	-------	as above	-------	------>	0	0.029							0.029	0.009	5.38	0.02	0.053						212.342	212.158	1.34	1.17	A1-5 [A2-4], Qg/Qo=0.4		212.42	212.85	0.43	**NE 3**	
			Grassed						21.05																												
AR&R	**NE 2**	0.099	Paved	0	0	0	0	0	0	0.021	NE 3	0.003	1.74	0.01	RSG	RSG 900x6	0.024	0	0	0	0.059	55.36	5.73	225	211.1	207.93	211.197	209.02	3.65	2.73	H-O'L	>=0.45, S/D	211.33	212.75	1.42	**NE 2**	
			Supp.	0	0	0	0	0																													
			Grassed	100	5	58	2.1	0.2	23.94																												
AR&R	**NE 2**	0.099	Paved	<------	-------	as above	-------	------>	0	0.037	NE 3	0.009	5.38	0.02			0.046	0	0	0	0.089						211.482	209.436	2.24	2.73	H-O'L	>=0.45, S/D	212.16	212.75	0.59	**NE 2**	
			Grassed						21.05																												
AR&R	**NE 1**		Paved								NE4	0	0	0	Sutherland	Sutherland	0	0	0	0	0.133	6.6	1	375	207.846	207.78	208.969	208.933	1.21	0.69	H-O'L	>=0.00, S/D	209.02	209.85	0.83	**NE 1**	
			Supp.								NE 2	0	0	0																						
			Grassed																																		
AR&R	**NE 1**		Paved	<------	-------	as above	-------	------>			NE4	0.001	0.4	0			0.001	0	0	0	0.258						209.243	209.103	2.34	0.69	H-O'L	>=0.00, S/D	209.44	209.85	0.41	**NE 1**	
			Grassed								NE 2	0	0	0																						
AR&R	**EX 1**		Paved								NE 1	0	0	0	NSW RTA	SA1	0	0	0	0	0.134	4	3	450	207.76	207.64	208.933	208.92	0.84	0	A1-5 [A2-4], Qg/Qo=0.4		208.93	209.13	0.2	**EX 1**	
			Supp.																																		
			Grassed																																		
AR&R	**EX 1**		Paved	<------	-------	as above	-------	------>			NE 1	0	0	0			0	0	0	0	0.258						209.103	209.07	1.62	0	A1-5 [A2-4], Qg/Qo=0.4		209.1	209.13	0.03	**EX 1**	
			Grassed																																		
AR&R	**SW3**	0.058	Paved	7	5				5	0.026					RSG	RSG 900x6	0.026	0	0	0	0.023	27.2	8.53	225	210.87	208.55	210.933	208.809	2.47	5.54	A1-4 [A2-3]0, Vo2/(2gD		211.05	211.7	0.65	**SW3**	
			Supp.	0	0																																
			Grassed	93	5				5																												
AR&R	**SW3**	0.058	Paved	<------	-------	as above	-------	------>	5	0.037							0.037	0	0	0	0.031						210.944	208.968	2.7	5.54	A1-4 [A2-3]0, Vo2/(2gD		211.12	211.7	0.58	**SW3**	
			Grassed						5																												
AR&R	**SW2**	0.1419	Paved	7	5				5	0.063	SW3	0	0	0	RSG	RSG 900x6	0.063	0	0	0	0.069	16.3	17.18	300	208.5	205.7	208.597	205.797	3.49	4.35	A1-4 [A2-3]0, Vo2/(2gD		208.81	209.45	0.64	**SW2**	
			Supp.	0	0																																
			Grassed	93	5				5																												
AR&R	**SW2**	0.1419	Paved	<------	-------	as above	-------	------>	5	0.091	SW3	0	0	0			0.091	0.004	0.36	0.03	0.09						208.611	205.816	3.76	4.35	A1-4 [A2-3]0, Vo2/(2gD		208.97	209.45	0.48	**SW2**	
			Grassed						5																												
AR&R	**SW1**		Paved								SW2	0	0	0	NSW Dept.	RM7	0				0.069	10.2	20.59	375	205.6	203.5	205.689	204.19	3.42	1.09	I [A2-20 & A	Qg/Qo=0.4	205.78	206.6	0.82	**SW1**	
			Supp.																																		
			Grassed																																		
AR&R	**SW1**		Paved	<------	-------	as above	-------	------>			SW2	0.004	0.36	0.03			0.004				0.093						205.704	204.34	3.73	1.09	I [A2-20 & A	Qg/Qo=0.4	205.82	206.6	0.78	**SW1**	
			Grassed																																		
AR&R	**SW4**	0.058	Paved	5	0	50	10	0.012	2.2	0.026					NSW Dept.	RM7	0.026	0.006	0.46	0.03	0.131	8.5	1	375	202.235	202.15	202.878	202.83	1.19	0.99	9 [A2-6 & A	Qg/Qo=0.1	202.95	205	2.05	**SW4**	
			Supp.	0	0	-1	-1	-1																													
			Grassed	95	0	50	10	0.02	2.98																												
AR&R	**SW4**	0.058	Paved	<------	-------	as above	-------	------>	1.86	0.037							0.037	0.012	0.65	0.05	0.204						203.094	202.98	1.85	0.99	9 [A2-6 & A	Qg/Qo=0.1	203.27	205	1.73	**SW4**	
			Grassed						2.52																												
AR&R	**OSD 2**	0.348	Paved	40	5				5	0.159							0.159																				**OSD 2**	
			Supp.	0	0																																
			Grassed	60	5				5																												
AR&R	**OSD 2**	0.348	Paved	<------	-------	as above	-------	------>	5	0.229							0.229																				**OSD 2**	
			Grassed						5																												
AR&R	**OSD 1**	0.5669	Paved	80	0	105	1	0.013	5.47	0.233							0.233																				**OSD 1**	
			Supp.	0	0	0	0	0																													
			Grassed	20	0	105	1	0.2	28.18																												
AR&R	**OSD 1**	0.5669	Paved	<------	-------	as above	-------	------>	3.63	0.336							0.336																				**OSD 1**	
			Grassed						18.7																												
AR&R	**flow Chamber 2**		Paved														0				0.121	1.5	1	375	202.3	202.285	202.956	202.949	1.09							**Overflow Chamber 2**	
			Supp.																																		
			Grassed																																		
AR&R	**flow Chamber 2**		Paved	<------	-------	as above	-------	------>									0				0.186						203.283	203.266	1.69							**Overflow Chamber 2**	
			Grassed																																		
AR&R	**flow Chamber 1**		Paved														0				0.075	4.3	1.16	300	207.9	207.85	209.044	209.02	1.06							**Overflow Chamber 1**	
			Supp.																																		
			Grassed																																		
AR&R	**flow Chamber 1**		Paved	<------	-------	as above	-------	------>									0				0.171						209.57	209.436	2.43							**Overflow Chamber 1**	
			Grassed																																		

NOTES

This sheet presents results from a pipe system model using ILSAX, the rational method, extended rational method (ERM), or initial loss - continuing loss (IL-CL) model implemented in the DRAINS program,(www.watercom.com.au) involving considerable calculations with multiple rainfall patterns, and complex hydraulic computations. Therefore, unlike older rational method calculation sheets, this sheet does not portray hand calculations.
It presents the key model inputs and outputs of interest to reviewers.

Depending on inputs, the table may show results for a minor storm, a major storm, or both.
There may be multiple rows for up to three overflow routes coming to a pit.
You can edit headings or delete columns or rows.

The contents of each column are discussed below:

Column 1: Design annual exceedance probability (AEP); values for minor storms, major storms or both may be displayed. Numerical values are not available for the rational method, but users can enter these.
Column 2: Pit Name from DRAINS (The connecting sub-catchment, downstream pipe and overflow route are assumed to have
similar names, so they do not need to be entered in the table.)
Column 3: Sub-Catchment Area (ha)
Column 4: Land-Use Type: paved, supplementary and grassed areas (in different rows) for ILSAX, impervious and pervious areas for the rational method and ERM, or equivalent impervious areas (EIAs) and remaining areas for the IL-CL model.
Column 5: Percentages of paved, supplementary and grassed areas for ILSAX, or impervious and pervious areas for the rational method and ERM, or equivalent impervious areas (EIAs) and remaining areas for the IL-CL model.
Column 6: Constant flow times for the paved, supplementary and grassed areas (minutes) for ILSAX, or impervious and impervious areas for the rational method and ERM, or equivalent impervious areas (EIAs) and remaining areas for the IL-CL model.
Column 7: Lengths of paved, supplementary and grassed area flow path segments (m) for ILSAX, or impervious and impervious areas for the rational method and ERM, or equivalent impervious areas (EIAs) and remaining areas for the IL-CL model.
Column 8: Slopes of paved, supplementary and grassed area flow path segments (%) for ILSAX, or impervious and impervious areas for the rational method and ERM, or equivalent impervious areas (EIAs) and remaining areas for the IL-CL model.
Column 9: Roughnesses of paved, supplementary and grassed area flow path segments (Manning's values) for ILSAX, or impervious and impervious areas for the rational method and ERM, or equivalent impervious areas (EIAs) and remaining areas for the IL-CL model.
Column 10: Total flow times for the paved, supplementary and grassed areas (minutes) for ILSAX, or impervious and pervious areas for the rational method and ERM, or equivalent impervious areas (EIAs) and remaining areas for the IL-CL model.
For the rational methoid, it is the total catchment time of concentration.
Column 11: Peak Sub-Catchment Flowrate (m^3/s). For the rational method, the output indicates whether this is a full catchment or partial area estimate.
Column 12: Origin of Overflows, the names of any pits or nodes from which overflows come to the pit.
Column 13: Peak Overflows from upstream pits or nodes(m3/s), which may include flows from the sub-catchment through which they flow.
- not outputted for the rational method.)
Column 14: Approach Flow Width (m) - not outputted for the rational method.
Column 15: Approach Flow Depth x Velocity (m^2/s) - not outputted for the rational method.
Column 16: Inlet Family, in the DRAINS classification.
Column 17: Inlet Size, in the DRAINS classification.
Column 18: Total Approach Flow (m^3/s), local sub-catchment runoff plus overflows directed to the pit.
Column 19: Bypass Flow (m^3/s), the overflow occurring because of lack of inlet capacity or overflowing of the pipe system
Column 20: Overflow Width (m) just downstream of the pit - not outputted for the rational method; inspect the DRAINS model for this information.
Column 21: Overflow Route Depth x Velocity (m^2/s) just downstream of the pit - not outputted for the rational method; inspect the DRAINS model for this information.
Column 21a: Baseflow or Direct Inflow Peak (m^3/s), if present in the model; otherwise this column does not appear.
Column 22: Flow in Pipe (m^3/s).
Column 23: Pipe Length (mm).
Column 24: Pipe Slope (%).
Column 25: Pipe Diameter (mm) or Box Dimensions (m).
Column 28: Upstream Pipe Hydraulic Grade Line Level (inside the pipe) (m AHD).
Column 29: Downstream Pipe Hydraulic Grade Line Level (m AHD).
Column 30: Pipe Flow Velocity (m/s), for full or part-full flow.
Column 31: Pit Pressure Change Coefficient, the Ku value applying to the main line through the pit.
Column 31a: Chart Structure Number. If the QUDM method for determining Ku is applied, the number of the Chart in QUDM (2008) that is used to determine pit pressure change K factors is displayed.
If this is given as 'H-O'L' the equations in a paper by Hare and O'Loughlin are used.
Column 31b: Ratios used to define a K value from the appropriate QUDM chart, if teh QUDM method is applied.
Column 32: Water Surface Elevation (m AHD).
Column 33: Surface or Kerb and Channel (Kerb and Gutter) Obvert Level (m AHD).
Column 34: Freeboard (m), the difference between the levels in the two previous columns.
Column 35: Pit Name (repeated).

WASTE MANAGEMENT PLAN

PREPARED FOR

Ink Architects

Residential Development

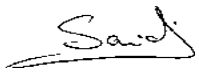
1-21 Dillwynnia Grove
Heathcote NSW

20/04/2017

EDDY SAIDI
Ph: 1800 025 073

REVISIONS

Revision	Date	Prepared by	Reviewed by	Approved by	Remarks
A	28/02/2017	A Armstrong	N Beattie	E Saidi	DRAFT
B	20/04/2017	A Armstrong	N Beattie	E Saidi	FINAL

Authorised By: 

Eddy Saidi

Date: 20/04/2017

DISTRIBUTION LIST

Recipient Name	Company	Revision
Gustavo Thiermann	Ink Architects	B

EXECUTIVE SUMMARY

This waste management plan covers the ongoing management of waste generated by the residential development located at 1-21 Dillwynnia Grove, Heathcote NSW.

Waste audit and management strategies are recommended for new developments to provide support for the building design and promote strong sustainability outcomes for the building. All recommended waste management plans will comply with council codes and any statutory requirements. The waste management plan has three key objectives:

i. ***Ensure waste is managed to reduce the amount of waste and recyclables to land fill*** by assisting residents to segregate appropriate materials that can be recycled; displaying signage to remind and encourage recycling practices; and through placement of recycling and waste bins in the retail precinct to reinforce these messages.

ii. ***Recover, reuse and recycle*** generated waste wherever possible.

iii. ***Compliance*** with all relevant codes and policies.

To assist in providing clean and well-segregated waste material, it is essential that this waste management plan is integral to the overall management of the building and clearly communicated to residents and tenants.

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GLOSSARY OF TERMS

TERM	DESCRIPTION
Chute	A ventilated, essentially vertical pipe passing from floor to floor of a building with openings as required to connect with hoppers and normally terminating at its lower end at the roof of the central waste room(s)
Collection Area/Point	The position or area where waste or recyclables are actually loaded onto the collection vehicle
Compactor	A Machine for compressing waste into disposable or reusable containers
Composter	A container/machine used for composting specific food scraps
Crate	A plastic box used for the collection of recyclable materials
Garbage	All domestic waste (Except recyclables and green waste)
Hopper	A fitting into which waste is placed and from which it passes into a chute or directly into a waste container. It consists of a fixed frame and hood unit (the frame) and a hinged or pivoted combined door and receiving unit
Recycling	Glass bottles and jars – PET, HDPE and PVC plastics; aluminium aerosol and steel cans; milk and juice cartons; soft drink, milk and shampoo containers; paper, cardboard, junk mail, newspapers and magazines
Green	Garden organics such as small branches, leaves and grass clippings, tree and shrub pruning, plants and flowers, and weeds
L	Litre(s)
Liquid Waste	Non-hazardous liquid waste generated by commercial premises that is supposed to be connected to sewer or collected for treatment and disposal by a liquid waste contractor (including grease trap waste)
Mobile Garbage Bin(s) (MGB)	A waste container generally constructed of plastic with wheels with a capacity in litres of 120, 240, 660, 1000 or 1100, 1500 or 2000

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INTRODUCTION

The following waste management plan pertains to the residential development located at 1-21 Dillwynnia Grove, Heathcote NSW. This waste management plan is an operational waste management plan and will address the phases of the completed development.

For the purpose of this report the proposed development will consist of:

- **36** x 3-bedroom townhouses segregated across 9 blocks (T1-T9);
- **21** residential units dispersed across 2 segregated apartment blocks (A & B); and
- 2 basement levels.

Table 1: *Apartment Unit Breakdown Matrix*

Building	# Units	% Mix
1 Bedroom	6	28.5714
2 Bedroom	15	71.4286
Total	**21**	

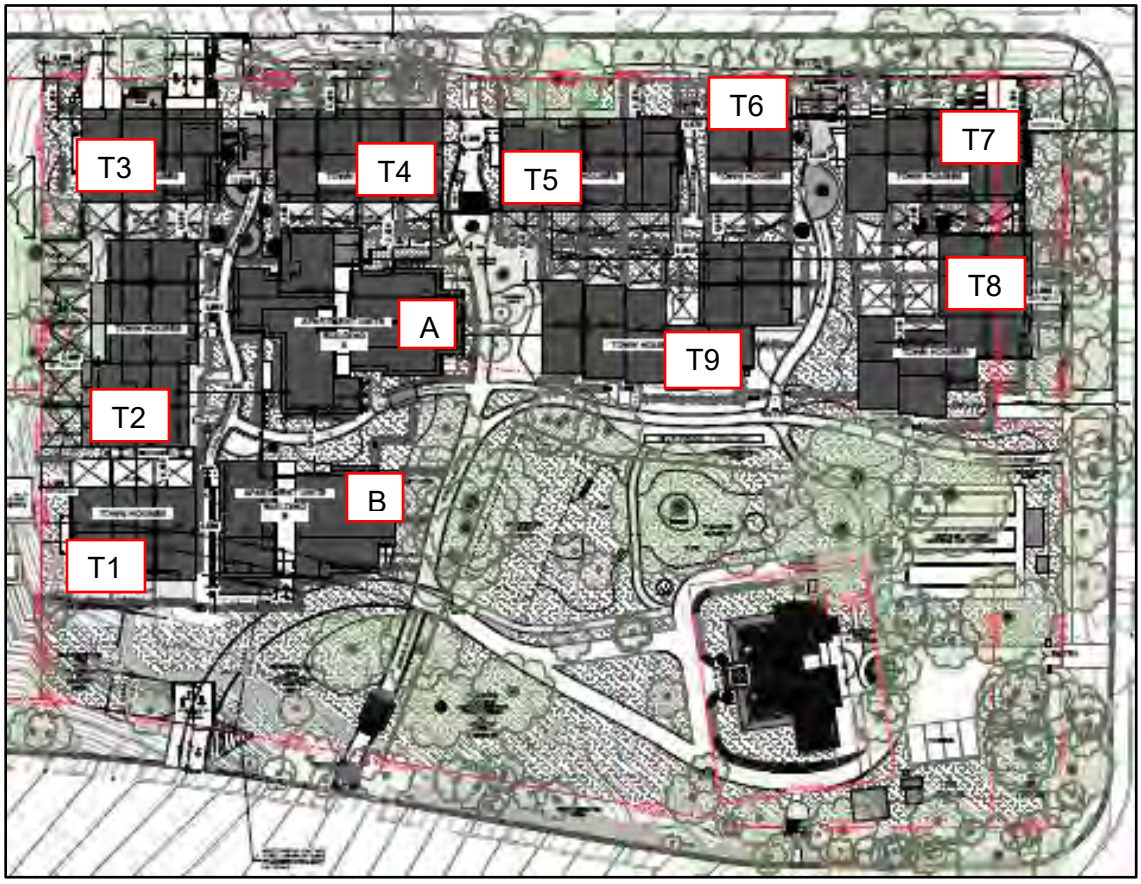


Figure 1: *Site Plan*

All figures and calculations are based on area schedules as advised by our client and shown on architectural drawings.

SUTHERLAND SHIRE COUNCIL

The assessment of waste volumes is an estimate only and will be influenced by the development's management and occupant's attitude to waste disposal and recycling.

The residential waste and recycling will be guided by the acceptance criteria of the Sutherland Shire Council and will be serviced by a private waste contractor.

All waste facilities and equipment are to be designed and constructed to be in compliance with the Sutherland Shire Council's *Development Control Plan 2006* and *Local Environmental Plan 2006,* Australian Standards and statutory requirements.

OBJECTIVES

- Prioritise waste minimisation measurements at the source by facilitating at the design, demolition and construction stage techniques that allow for the reuse, recycling and treatment of all forms of building waste;
- ensure development addresses waste reduction, reuse and recycling through the preparation of a waste management plan;
- encourage on-site waste management facilities that are integrated with the design of a development and enable source separation, reuse and recycling;
- enable collection service providers to efficiently collect waste and recyclables with minimum disruption and impact on the community; and
- promote the use of recyclable materials in the design, construction and operation of buildings and land use activities.

REQUIREMENTS

- A waste storage area is to be provided for all developments to store bin waste and recyclables.
- The location of waste and recycling facilities must not impact on car parking or landscaping requirements of the development.
- Developments must be designed so that bins do not need to be wheeled more than 75 metres. For housing for aged persons or persons with a disability (seniors housing), this distance should be limited to 50 metres. The bin-carting grade should be a maximum of 1:14.
- The location and design of the waste storage area must not detract from the amenity and character of the streetscape.
- Waste and recycling facilities must be designed to prevent litter and contamination of the stormwater drainage system.
- Bin storage and access requirements should take into consideration the future servicing requirements of the building.

GENERATED WASTE VOLUMES

The assessment of projected waste volumes is a calculated estimate only and will be influenced by the development's management and occupant's waste disposal and recycling practices.

CONSTRUCTION AND DEVELOPMENT WASTE

The head contractor will be responsible for removing all construction-related waste offsite in a manner that meets all authority requirements. Please refer to the separate waste management plan submitted for construction waste as part of the Development Application.

BUILDING MANAGER/WASTE CARETAKER

All waste equipment movements are to be managed by the building manager/cleaners at all times. No tenants or residents will be allowed to transport waste or recyclables from the waste room; tenants and residents will only transport their waste to the allocated bin room.

The building manager/cleaner duties include, but are not limited to, the following:

- organising, maintaining and cleaning the general and recycled waste holding areas (Frequency will depend on waste generation and will be determined based upon building operation);
- transporting of bins as required;
- organising both garbage and recycled waste pick-ups as required;
- cleaning and exchanging all bins;
- ensure site safety for residents, children, visitors, staff and contractors;
- abide by all relevant OH&S legislation, regulations, and guidelines;
- assess any manual handling risks and prepare a manual handling control plan for waste and bin transfers; and
- provide to staff/contractors equipment manuals, training, health and safety procedures, risk assessments, and PPE to control hazards associated with all waste management activities

NOTE: It is the responsibility of the building manager to monitor the number of bins required for the development. As waste volumes may change according to the development's management and occupants' attitudes to waste disposal and recycling, bin numbers and sizes may need to be altered to suit the building operation.

REPORTING

It is recommended that building management ensure that all waste service providers submit monthly reports on all equipment movements and weights of any waste and recycling products removed from the development. Regular reviews of servicing should take place to ensure operational and economic best practise and to assist with sustainability reporting.

EDUCATION

Building management is responsible for creating and managing the waste management education process.

Educational material encouraging correct separation of garbage and recycling items must be provided to each resident to ensure correct disposal of garbage and recycling. This should include the correct disposal process for bulky goods (old furniture, large discarded items, etc.) It is recommended that information is provided in multiple languages to support correct practises.

It is also recommended that the owners' corporation website contain information for residents to refer to regarding correct source separation. Information should include:

- recycling and garbage descriptions (Council provides comprehensive information);
- how to dispose of bulky goods and any other items that are not garbage or recycling;
- residents' obligations to WHS and building management; and

RESIDENTIAL WASTE PLAN

Sutherland Shire Council's *Development Control Plan* has been referenced to calculate the total number of bins required for the residential units. Please note that calculations are based on generic figures; waste generation rates may differ according to the residents' waste management practice.

Table 2: *Calculated Waste Generation*

Building/ Core	# Units	Generated Waste (L/week)	Waste	Generated Recycling (L/week)	Recycling
1 Bed Apartment	6	80	480	80	480
2 Bed Apartment	15	100	1500	100	1500
3 Bed Townhouse	36	120	4320	120	4320
TOTAL	**57**		**6300**		6300

BIN SUMMARY

The following assumptions have been taken into consideration:

- A minimum of 1 x 660L garbage MGB and 1 x 660L recycling MGB will be located in each separate waste room (4 in waste rooms in total) located on the basement level;
- residents are required to manually dispose of their garbage and recyclables directly within their corresponding waste room;
- garbage and recycling is collected twice weekly; and
- the number of bins have been rounded up for best operational outcome.

Using the assumptions stated, the required capacity and quantity of garbage and recycling bins have been calculated and tabulated respectively below:

Overall Bin Summary

Garbage: **6** x **660L** MGBs collected twice weekly
Recycling: **6** x **660L** MGBs collected twice weekly

Waste Room Bin Summary Breakdown

Waste Room 1:	T1, T2 & B	**2 x 660L** Garbage MGBs & **2 x 660L** Recycling MGBs
Waste Room 2:	T3, T4 & A	**2 x 660L** Garbage MGBs & **2 x 660L** Recycling MGBS
Waste Room 3:	T5 & T9	**1 x 660L** Garbage MGBs & **1 x 660L** Recycling MGBs
Waste Room 4:	T6, T7 & T8	**1 x 660L** Garbage MGBs & **1 x 660L** Recycling MGBs

Subject to the stakeholders preference/capability (and as built constraints), bin sizes and quantities may be changed. As waste volumes may change according to the development's type, bin numbers and collection frequencies may be altered to suit the building operation.

WASTE MANAGEMENT

Residents are required to manually dispose of their garbage and recyclables directly into the 660L MGBs provided within their corresponding waste room.

On collection days, the building caretaker will be responsible for transferring full 660L MGBs from each waste room to the central bin holding room for collection by a private waste contractor via a wheel-in/wheel-out arrangement from Boronia Grove.

WASTE HANDLING

Residents will be supplied with a collection area in each unit (generally in the kitchen, under bench or similar alternate area) to deposit garbage and collect recyclable material suitable for one days storage. All garbage should be bagged.

Recycling must not be bagged. It is recommended that residents use a crate or dedicated bin for collecting recyclables within the allocated residential space provided to ensure correct separation.

TEMPORARY STORAGE OF BULKY GOODS

A room or caged area should be allocated for the storage of discarded residential bulky items and should be incorporated with the waste and recycling bin store and collection room. The allocated space must be a minimum of $20m^2$. This area must be made available close to the collection area. It is envisaged that bulky goods will be managed by the appointed waste caretaker/s. Residents will be required to liaise with building management regarding all bulky goods movements.

It is recommended that donations to charitable organisations be encouraged. Clean, sound furniture and household goods etc. are highly sought after to provide for the disadvantaged. Donations will be arranged with the assistance of the building manager/caretaker.

OTHER WASTE STREAMS

Disposal or recycling of electronic, liquid waste and home detox (paint/chemicals etc.) will be organised with the assistance of the building caretaker. These items must not be placed in waste or recycling bins due to safety and environmental factors.

Residents should be directed to Council's comprehensive website for further information.

COMPOSTING

Consideration should be given for space for composting and worm farming to be made available for all residents in a communal facility or in small private courtyards (*see APPENDIX C.2 for Typical Worm Farm Specifications*). Residents may also choose to purchase and install apartment style compost bin where practical and self-manage these systems (*see APPENDIX C.3 and APPENDIX C.4 for Typical Compost Bins)*. Two systems have been included for consideration however there are a variety of compost systems available at hardware stores.

COMMON AREAS

The lobbies, retail amenities and circulation areas will be supplied with suitably branded waste and recycling bins, where considered appropriate. Building management will monitor use and ensure bins are exchanged and cleaned. These areas generate negligible waste however garbage and recycling receptacles should be placed in convenient locations.

Washroom facilities in retail and staff areas should be supplied with collection bins for paper towels (if used). Sanitary bins for female restroom facilities must also be arranged with an appropriate contractor.

Building management will monitor use and ensure waste bins are exchanged and cleaned.

GREEN WASTE

There will be green waste generated by the buildings landscaped areas. Any green waste will be collected and removed from site by the maintenance contractor during scheduled or arranged servicing of these areas.

WASTE ROOM AREAS

The areas allocated for the separate waste rooms, bin holding room and bulky goods storage are detailed in Table. 3 below. The areas provided are considered suitable for purpose.

Table 3: *Waste Room Areas - Apartments*

Location	Waste Room Type	Allocated Area
Basement	Waste Rooms	10-20m^2
Basement	Bin Holding Room	40 m^2
Basement	Bulky Goods Storage	20 m^2

COLLECTION OF WASTE

APARTMENTS

A private waste contractor will be engaged to service all garbage and recycling MGBs on a twice weekly basis.

On collection days, the building caretaker will transfer all bins from each waste room to the bin holding room for servicing via a wheel-in/wheel-out arrangement from Boronia Grove. Once serviced, the building caretaker will return all MGBs to the allocated waste rooms.

The collection areas will need to be reviewed by a traffic consultant to confirm that these (and other trucks if required) can adequately service the site by parking on Tecoma Street. The final number of truck movements will depend on management of waste contract; final configuration of waste and recycling arrangements therefore number of bin lifts and additional irregular truck movements for hard waste. This information and supporting drawings will be provided separate to this report.

GARBAGE ROOMS

CONSTRUCTION REQUIREMENTS

The garbage room will be required to contain the following facilities to minimise odours, deter vermin, protect surrounding areas, and make it a user-friendly and safe area:

- waste room floor to be sealed with a two pack epoxy;
- waste room walls and floor surface is flat and even;
- all corners coved and sealed 100mm up, this is to eliminate build-up of dirt;
- for residential: a hot and cold water facility with mixing facility and hose cock must be provided for washing the bins;
- for retail/commercial: a cold water facility with hose cock must be provided for washing the bins;
- any waste water discharge from bin washing must be drained to sewer in accordance with the relevant water board. (Sydney Water);
- tap height of 1.6m;
- storm water access preventatives (grate);
- all walls painted with light colour and washable paint;
- equipment electric outlets to be installed 1700mm above floor levels;
- the room must be mechanically ventilated;
- light switch installed at height of 1.6m;
- waste rooms must be well lit (sensor lighting recommended);
- optional automatic odour and pest control system installed to eliminate all pest types and assist with odour reduction – this process generally takes place at building handover – building management make the decision to install;
- all personnel doors are hinged and self-closing;
- waste collection area must hold all bins – bin movements should be with ease of access;
- conform to the Building Code of Australia, Australian Standards and local laws; and
- childproofing and public/operator safety shall be assessed and ensured

SIGNAGE

The building manager/caretaker is responsible for waste room signage including safety signage (*see APPENDIX B.2*). Appropriate signage must be prominently displayed on walls and above all bins, clearly stating what type of waste or recyclables is to be placed in the bin underneath.

VENTILATION

Waste and recycling rooms must have their own exhaust ventilation system either;

- Mechanically - exhausting at a rate of 5L/m² floor area, with a minimum rate of 100L/s minimum; or
- Naturally - permanent, unobstructed, and opening direct to the external air, not less than one-twentieth (1/20) of the floor area

Mechanical exhaust systems shall comply with AS1668 and not cause any inconvenience, noise or odour problem.

STORM WATER PREVENTION & LITTER REDUCTION

Building management shall be responsible for the following to minimise dispersion of site litter and prevent stormwater pollution to avoid impact to the environment and local amenity:

- promote adequate waste disposal into the bins;
- secure all bin rooms (whilst affording access to staff/contractors);
- prevent overfilling of bins, keep all bin lids closed and bungs leak-free;
- take action to prevent dumping or unauthorised use of waste areas; and
- ensure collection contractors clean-up any spillage that may occur when clearing bins

ADDITIONAL INFORMATION

Transfer of waste and all bin movements require minimal manual handling therefore the operator must assess manual handling risks and provide any relevant documentation to building management. If required, a bin-tug, trailer or tractor consultant should be contacted to provide equipment recommendations. Hitches may require installation to move multiple bins to the collection area. Council must be informed of any hitch attachments required to be installed on bins.

LIMITATIONS

The purpose of this report is to document a Waste Management Plan as part of a development application and is supplied with the following conditions:

- Drawings, estimates and information contained in this waste management plan have been prepared by analysing the information, plans and documents supplied by you and third parties including Council and government information. The assumptions based on the information contained in the WMP is outside the control of EFRS;
- the figures presented in the report are an estimate only – the actual amount of waste generated will be dependent on the occupancy rate of the building/s and waste generation intensity as well as the building managements approach to educating residents and tenants regarding waste management operations and responsibilities;
- the building manager will make adjustments as required based on actual waste volumes (if waste is greater than estimated) and increase the number of bins and collections accordingly;
- the report will not be used to determine or forecast operational costs or prepare any feasibility study or to document any safety or operational procedures;
- the report has been prepared with all due care however no assurance or representation is made that the WMP reflects the actual outcome and EFRS will not be liable to you for plans or outcomes that are not suitable for your purpose, whether as a result of incorrect or unsuitable information or otherwise;
- EFRS offer no warranty or representation of accuracy or reliability of the WMP unless specifically stated;
- any manual handling equipment recommended should be provided at the recommendation of the appropriate equipment provider who will assess the correct equipment for supply;
- Design of waste management chute equipment and systems must be approved by the supplier.

USEFUL CONTACTS

Elephants Foot Recycling Solutions does not warrant or make representation for goods or services provided by suppliers.

Sutherland Shire Council Customer Service
Phone: 02 9710 0333 Email: ssc@ssc.nsw.gov.au

SULO MGB (MGB, Public Place Bins, Tugs and Bin Hitches)
Phone: 1300 364 388

CLOSED LOOP (Organic Dehydrator)
Phone: 02 9339 9801

ELECTRODRIVE (Bin Mover)
Phone: 1800 333 002 Email: sales@electrodrive.com.au

RUD (Public Place Bins, Recycling Bins)
Phone: 07 3712 8000 Email: Info@rud.com.au

CAPITAL CITY WASTE SERVICES
Phone: 02 9359 9999

REMONDIS (Private Waste Services Provider)
Phone: 13 73 73

SITA ENVIRONMENTAL (Private Waste Services Provider)
Phone: 13 13 35

NATIONAL ASSOCIATION OF CHARITABLE RECYCLING ORGANISATIONS INC. (NACRO)
Phone: 03 9429 9884 Email: information@nacro.org.au

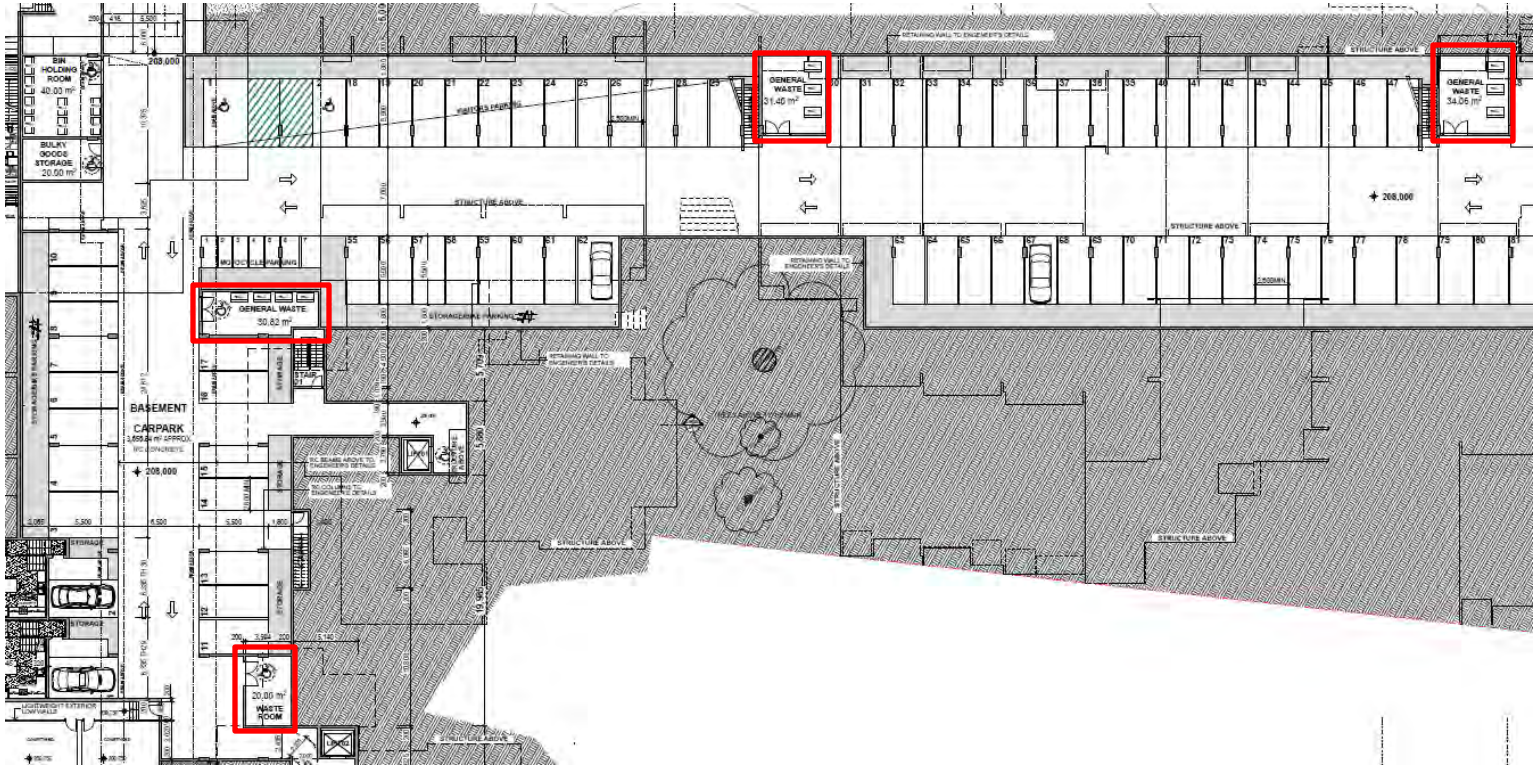
PURIFYING SOLUTIONS (Odour Control)
Phone: 1300 636 877 Email: sales@purifyingsolutions.com.au

Elephants Foot Recycling Solutions (Chutes, Compactors and eDiverter Systems)
44 – 46 Gibson Avenue
Padstow NSW 2211
Free call: 1800 025 073 Email: natalie@elephantsfoot.com.au

APPENDICES

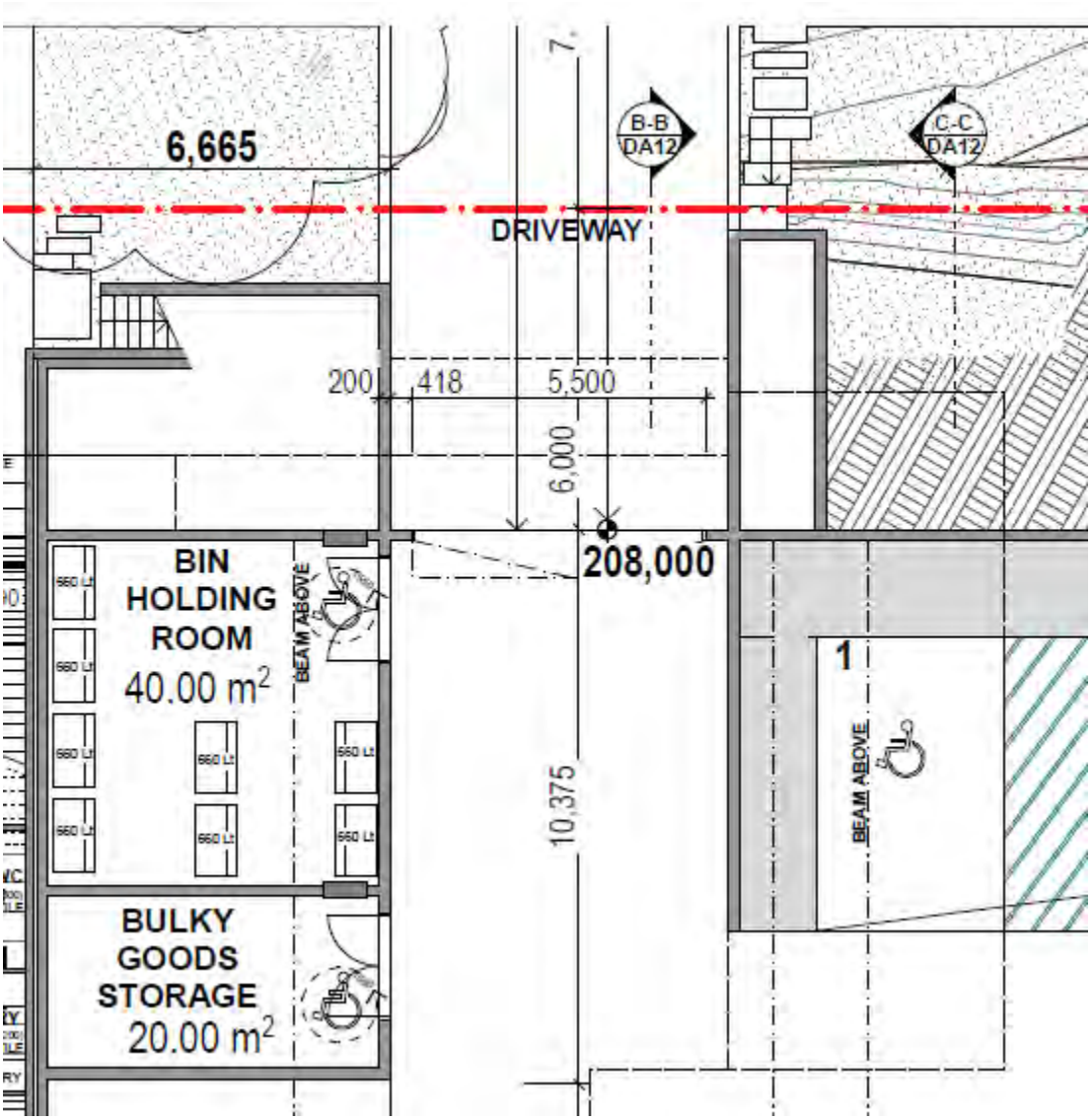
APPENDIX A DRAWING EXERPTS

APPENDIX A.1 ALLOCATED WASTE ROOMS



Excerpt: Ink Architects, DA06 18/04/2017 – Basement Floor Plan

APPENDIX A.2 BIN HOLDING ROOM & COLLECTION AREA



Excerpt: Ink Architects, DA06 18/04/2017 – Basement Floor Plan

APPENDIX B SUTHERLAND SHIRE EQUIPMENT SPECIFICATIONS

APPENDIX B.1 BIN DIMENSIONS AND SPECIFICATIONS

Mobile containers with a capacity from 500L to 1700L with four wheels

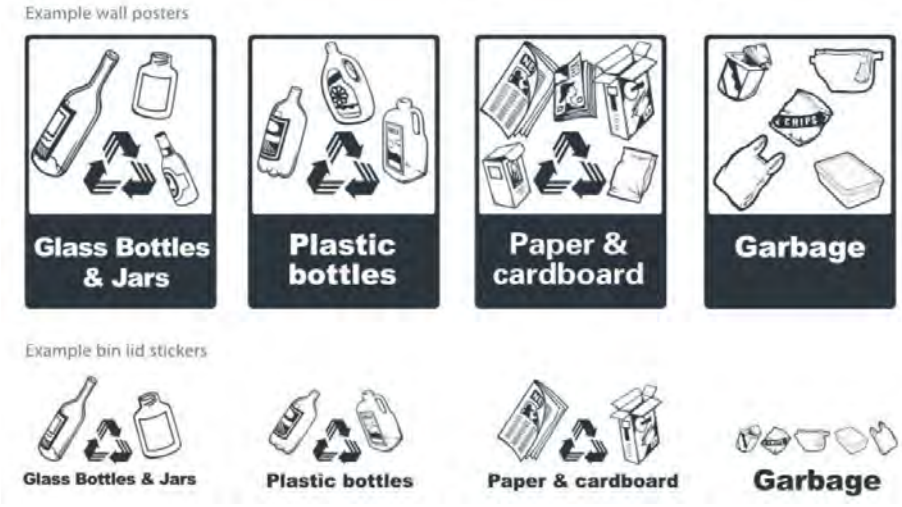
Dome or flat lid containers

Bin Type	660 Litre MGB	770 Litre MGB	1100 Litre MGB	1300 Litre MGB	1700 Litre MGB
Height	1250	1425	1470	1480	1470
Depth	850	1100	1245	1250	1250
Width	1370	1370	1370	1770	1770

APPENDIX B.2 SIGNAGE FOR WASTE & RECYCLING BINS

WASTE SIGNS

Signs for garbage, recycling and organics bins should comply with the standard signs promoted by the Department of Environment and Heritage.



SAFETY SIGNS

The design and use of safety signs for waste rooms and enclosures should comply with AS1319 Safety Signs for Occupational Environment. Safety signs should be used to regulate and control safety behaviour, warn of hazards and provide emergency information, including fire protection information. Below are some examples. Each development will need to decide which signs are relevant for its set of circumstances and service provided.

Source: Better Practice Guide to Waste Management in Multi-Unit Dwellings, 2008, DECC

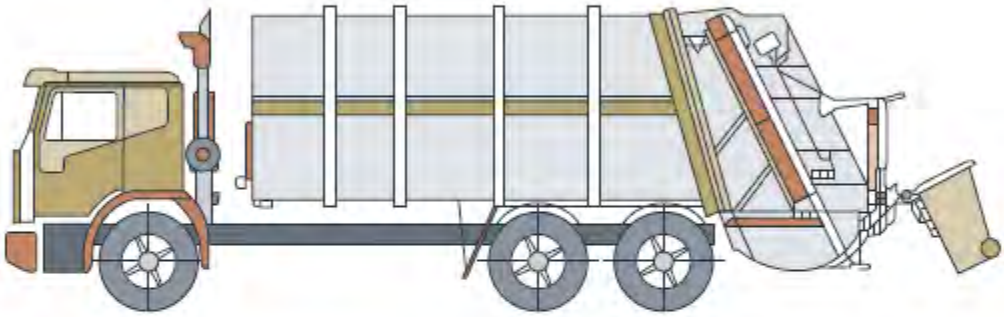
APPENDIX B.3 TYPICAL COLLECTION VEHICLE INFORMATION

Collection vehicles

Waste collection vehicles may be side loading, rear-end loading, front-end loading or crane trucks. The size of vehicle varies according to the collection service. Thus it is impossible to specify what constitutes the definitive garbage vehicle. Developers should consult the local council and/or relevant contractors regarding the type of vehicle used in that area.

The following characteristics represent the typical collection vehicle, however, these are only for guidance.

It may be possible to engage a collection service provider to use smaller collection vehicles to service developments with narrow roadways and laneways, or for on-site collections. However, as the availability of smaller vehicles to make services varies between councils and private contractors, wherever possible the development should be designed to accommodate vehicles of a similar size to that reported below.

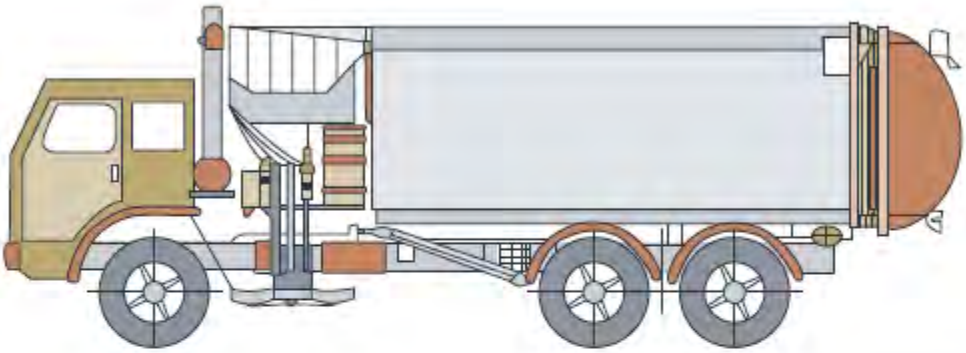


Rear loading collection vehicle

This is commonly used for domestic garbage and recycling collections from MUDs. It can be used to collect waste stored in MGBs or bulk bins, particularly where bins are not presented on the kerbside.

Rear loading collection vehicle	
Length overall	10.24m
Width overall	2.5m
Operational height	3.5m
Travel height	3.5m
Weight (vehicle only)	12.4 tonnes
Weight (payload)	9.5 tonnes
Turning circle	18.0m

Side-loading collection vehicle



Side-loading collection vehicle	
Length overall	9.64m
Front overhang	1.51m
Wheelbase	5.20m
Rear overhang	2.93m
Turning circle kerb to kerb	17.86m
Turning circle wall to wall	20.56m
Front of vehicle to collection arm	3.8m
Maximum reach of side arm	3.0m
Travel height	3.63m
Clearance height for loading	3.9m

This is the most commonly used vehicle for domestic garbage and recycling collections. It is only suitable for collecting MGBs up to 360 litres in size.

APPENDIX C WASTE MANAGEMENT EQUIPMENT SPECIFICATIONS

APPENDIX C.1 TYPICAL BIN MOVER

Typical applications:

- Move trolleys, waste bin trailers and 660litre/1100 litre bins up and down a ramp incline. Ideal for Apartment Buildings (to move waste bins located at a basement level to road level).
- Quiet, smooth operation with zero emissions and simple to use, no driver's licence required

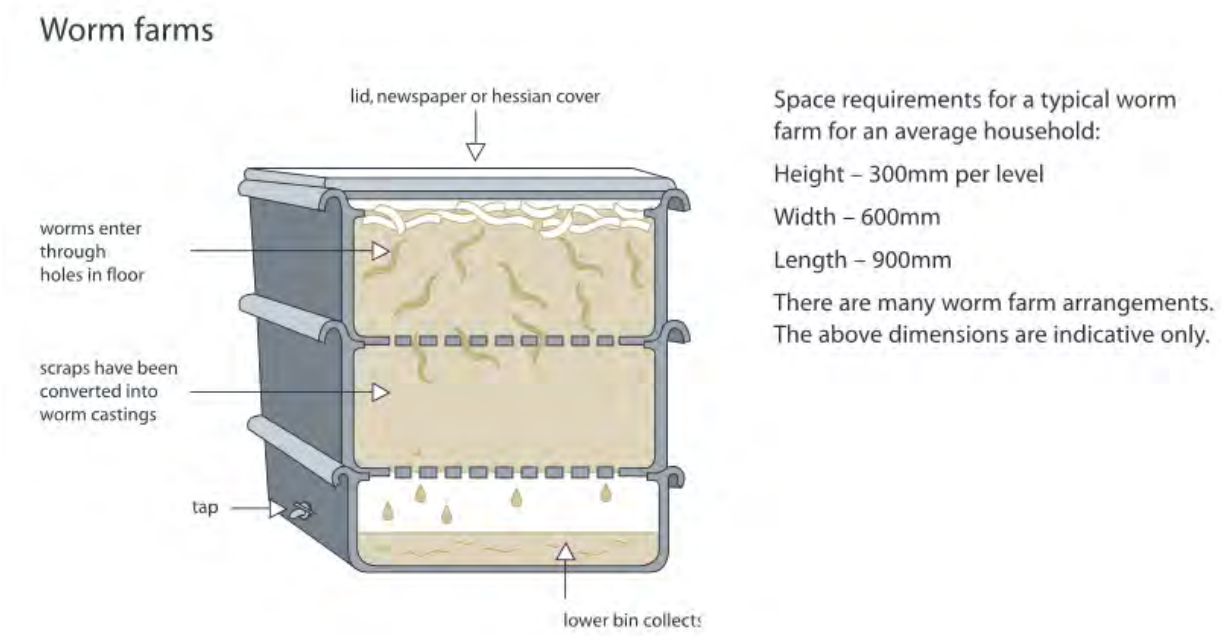
Features:

- Up to 1 Tonne on a ramp surface (depending on ballast and incline)
- Anti-rollback system on slopes
- Foot print: 1548L x 795W x 1104H (handle in the drive position)
- Pin Hitch is standard however alternate hitching options may be available to suit your specific application (e.g. tow ball)

Safety Features:

- Intuitive paddle lever control
- Stops and repels the unit if activated when reversing.
- Site assessment recommended to assess ramp incline steepness *(See Useful Contacts)*

APPENDIX C.2 TYPICAL WORM FARM SPECIFICATIONS



SOURCE: *Department of Environment and Climate Change NSW 2008, Better Practice Guide for Waste Management in Multi-Unit Dwellings*

APPENDIX C.3 TYPICAL APARTMENT STYLE COMPOST BINS

Apartment Style Compost bin – available from hardware stores

Suitable for:

- Vegetables
- Coffee grounds and filters
- Tea and tea bags
- Crushed eggshells (but not eggs)
- Nutshells
- Houseplants
- Leaves
- Cardboard rolls, cereal
- Boxes, brown paper bags
- Clean paper
- Shredded newspaper
- Fireplace ashes
- Wood chips, sawdust,
- Toothpicks, burnt matches
- Cotton and wool rags
- Dryer and vacuum cleaner lint
- Hair and fur
- Hay and straw

APPENDIX C.4 ELECTRIC ORGANIC COMPOST BIN

CLOSED LOOP
LOVE WHAT YOU DO
CLO'ey

Product Specifications

Decomposition Method	Fermentation by microorganisms
Decomposition Capacity	2 metric tonnes per year* (4 kg per day*)
Rating	220–240 V 50/60 Hz – 1.1 A
Decomposition Time	24 hrs
Operating Temperature	0C and 40C.**
Deodorisation Method	Nano-Filter system
Maximum Power	210 W
Power Usage	Average 1 kwh per day
Weight	21 kgs
External Dimensions	w 400 mm d 400 mm h 780 mm

* Food Waste Handling Capacity – based on an optimal operating environment.
** Ambient temperature range of area where unit may be installed.

SOURCE: *Closed Loop Domestic Composter – See Useful Contacts*

APPENDIX C.5 TYPICAL PUBLIC PLACE WASTE BINS

** Products and specifications may change according to manufacturer.*

SOURCE: *SULO Environmental Technology*