

ON-SITE SEWAGE MANAGEMENT ASSESSMENT

PROPOSED REZONING & SUBDIVISION

March 2023

WRENN PTY LTD

Lot 16 DP 856265 225 Terranora Road Banora Point NSW

HMC2023.305.01

RE: Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW

HMC Environmental Consulting Pty Ltd is pleased to present our report for an On-site Sewage Management Design Report for the abovementioned site.

We trust this report meets with your requirements. If you require further information, please contact HMC Environmental Consulting directly on the numbers provided.

HMC Environmental Consulti	ng	PH:	0755368863
Suite 29, Level 2, 75-77 What	f Street	Email:	admin@hmcenvironment.com.au
PO Box 311		Web:	www.hmcenvironment.com.au
Tweed Heads NSW 2485		ABN:	60 108 085 614
Title:	On-site Sewage Manager	nent Ass	sessment
Job No:	2023.305.01		
Client:	Wrenn Pty Ltd		

Document Record:				
Version	Date	Prepared by	Checked by	Approved for issue by
Draft Issue A	28,03.2023	TR	HT	HT
Draft Issue B	5.04.2023	TR	HT	HT
Final Issue A	16.05.2023	КН		

Distribution List	Date	Version	Method of Transmission	Number of Copies
Planit Consulting	4.04.2023	Draft Issue A	Email	1 x pdf
Planit Consulting	5.04.2023	Draft Issue B	Email	1 x pdf
Planit Consulting	16.05.2023	Final Issue A	Email	1 x pdf

This report should be cited as '*HMC Environmental Consulting (2023). On-site Sewage Management Assessment, Proposed Rezoning & Subdivision, Lot 16 DP 856265, 225 Terranora Road, Banora Point, NSW. Report No. HMC2023.305.01.*'

COPYRIGHT

© HMC Environmental Consulting Pty Ltd, 2023

All intellectual property and copyright reserved.

Apart from any fair dealing for the purpose of private study, research, criticism, or review, as permitted under the Copyright Act, 1968, no part of this report may be reproduced, transmitted, stored in a retrieval system, or adapted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without written permission. Enquiries should be addressed to HMC Environmental Consulting Pty Ltd.



TABLE OF CONTENTS

1 INTRODUCTION & SUMMARY	4
2 PROJECT INFORMATION	5
3 SUMMARY OF RECOMMENDED ONSITE SEWAGE MANAGEMNT	5
4 SITE INFORMATION	6
4.1 Site Conditions	6
4.2 Setback Distance Risk Assessment	7
4.3 Site Compliance	7
5 EFFLUENT TREATMENT & LAND APPLICATION	8
5.1 Treatment Process	8
5.2 Land Application Method	8
6 LAND APPLICATION AREA SIZING AND DESIGN	9
6.1 Assessed Design Inputs	9
6.2 Summary of Modelling Calculations	9
7 DISCUSSION/REASON FOR APPROVAL	10
8 RECOMMENDATIONS	11
8.1 Site Plan & Detail	13
9 LIMITATIONS	15
10 REFERENCES	16
11 APPENDICES	16
APPENDIX 1 - SITE LOCATION	17
APPENDIX 2 - LAA DESIGN MODEL	20
APPENDIX 3 - NUTRIENT LOADING	22
APPENDIX 4 - SOIL INVESTIGATION	24
APPENDIX 5 - GEOTECHNICAL INVESTIGATIONS	27
APPENDIX 6 PHOTOGRAPHIC LOG	30

ABBREVIATIONS

AWTS	Aerated Wastewater Treatment System
BOD ₅	Biochemical oxygen demand over 5-day period
CFU	Colony forming unit.
DLR	Design loading rate
LAA	Land application area
LTAR	Long term acceptance rate (for effluent)
OSSM	On-site Sewage Management
SDI	Subsurface drip irrigation
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids



1 INTRODUCTION & SUMMARY

HMC Environmental Consulting Pty Ltd has been commissioned to prepare an on-site sewage management (OSSM) assessment for a proposed rezoning and subdivision located at Lot 16 DP 856265, 225 Terranora Road, Banora Point, NSW. It is proposed to rezone a portion of the property into R5 and subdivide to create three (3) residential lots and one (1) residual lot.

The planning proposal will result in the creation of four (4) lots with a minimum lot area of approximately 10,000m² in area, three of which are to be for future residential purposes. The fourth lot contains the residual area, primarily for conservation purposes.

The site and soil were assessed for on-site wastewater disposal limitations on each residential lot. Soil investigations were carried out comprising hand auger and/or mechanical excavations in 23 locations. Site walkovers were also carried out by experienced HMC staff on 4/10/2019, 19/11/2019 and 27/5/2021. The soil profile information and site constraints on each residential lot were used to determine the most suitable location and the area needed for disposal of treated sewage effluent.

The investigations recorded strongly structured sandy to silty clay soils with suitable drainage on gentle slopes within all of the nominated effluent land application areas. The investigations also recorded shallow rock at a depth of 400mm as a limiting layer in a few locations, and the presence of uncontrolled fill in the majority of the locations. Boulders and cobbles were encountered at depth. Areas with soil to at least 700mm depth in depth were considered suitable for effluent land application. To provide a vertical buffer of at least 1m to any limiting layer, this report recommends importing 300mm thick layer of loam/sandy loam topsoil to create raised irrigation areas of minimum 400m² within the nominated effluent land application areas on each lot.

To achieve best practice within the constraints of the uncontrolled fill, this report recommends effluent land application via shallow pressure compensating sub-surface drip irrigation installed via ripping to a depth of 100mm. The performance of the flexible dripperline is not impacted by sub-soil movement and is therefore suitable for the proposed raised irrigation beds overlying uncontrolled fill and any large boulders at depths. The pressure compensated emitters deliver the treated effluent directly to the rootzone of the nominated land application area in an efficient and uniform method.

Based on the relevant site information, this report specifies the type of sewage treatment process that is to be used and the resultant wastewater quality. Assuming a design occupancy for a household of five persons, this report specifies a 400m² area for secondary quality effluent with final disinfection. The method of land application is to be shallow sub-surface drip irrigation through pressure compensating dripperline at average 150mm depth below a turfed ground surface.

The native soil of the site may be suitable for fill material subject to compliance with texture classification. A reserve land application area of 200m² would remain unfilled and preserved for future use if the on-site sewage management system were extended or duplicated.

This report concludes that, based on the information presented, the subject site is suitable for the proposed development in relation to on-site sewage management.



2 PROJECT INFORMATION

Proposal	Proposed OSSM System Assessment – 3-Lot Subdivision & Residual Lot			
Lot numbers	Proposed Lot 1	Proposed Lot 2	Proposed Lot 4	Residual Lot
Property	Lot 16 DP 856265,	225 Terranora Road		
	Banora Point NSW			
Proposed Lot Size	10000m ²	10000m ²	21816m ²	58709m ²
	(1 ha)	(1 ha)	(2.18 ha)	(5.87 ha)
Council Area/Approvals:	Tweed Shire Counc	il		
	DA 0152/2001DA: The erection of a dwelling house. Submitted: 22/02/2001			
	DA K99/0355: Rural subdivision 2 lots. Submitted: 23/10/2000			
	<u>DA D96/0031</u> : Erect	ion of a shed, constru	uct a dam and plant fru	uit trees. Submitted:
	31/01/1996			
Design Daily Hydraulic	750L/day	750L/day	750L/day	No building
Load	5 persons design	5 persons design	5 persons design	envelope
	occupancy @	occupancy @	occupancy @	
	150L/p/day	150L/p/day	150L/p/day	
Water Saving Devices	Expected in new building			
Water Supply	Reticulated roof water supply			

3 SUMMARY OF RECOMMENDED ONSITE SEWAGE MANAGEMNT

Proposed Sewage Treatment and Land Application method for future lots:

- Install an NSW Health Accredited Aerated Wastewater Treatment System or Secondary Treatment System with final disinfection
- Effluent quality to achieve:

BOD5	≤10 mg/L	20 mg/L
TSS	≤10 mg/L	20 mg/L
E.coli*	≤10 cfu/100mL	30 cfu/100mL
FAC**	Minimum 0.5mg/L ***	
Turbidity****	N/A	10 NTU
* Where disinfection is required.		

** Where chlorine disinfection is used.

*** Minimum level, not 90% of samples.

****Where UV light is used for disinfection

- Within nominated land application areas install 400 linear metres of pressure compensated, non-drain dripperline laterals within a raised sub-surface irrigation bed of minimum height of 300mm and minimum area of 400m² with side flanks of 1:3 batter.
- Preserve additional 200m² reserve land application area for future use in the event of duplication or expansion of the on-site sewage management system.



4 SITE INFORMATION

Should conditions vary from those described below during any stage of installation, HMC is to be notified to ensure the recommendations of this report remain valid or alternative recommendations be made. The information relates to the general site but more specifically to the designated effluent land application areas (LAA) and available reserve effluent LAA.

4.1 SITE CONDITIONS

Inspected by	Helen Tunks, Mark Tunks & Taylah Richards
Date & Time of	Tuesday 19th November 2019.
	Thursday 27th May 2021
	See Appendix 1 for site location
Site Location	The development site is located on vacant land on a south-facing slope of a broad
	ridge. The residential areas are located on a large, generally level terrace created by
	former earthworks. Minimal topsoil remains with the residential area, and the trees
	have largely been cleared.
	Annual rainfall: 1555mm Tyalgum (1971 – 1984)
Climate	Annual evaporation: 1000-1200mm/year
	Warm, temperate. High volume, seasonal rainfall typical of region.
	Weather – Warm, dry during inspections.
\//eather	Surface water noted in depressions during inspection 27/5/2021.
Vedition	8mm rainfall 72 hours previous according to BOM Station 58056 (Tweed Heads
	Golf Club).
	Geotechnical Investigations – 14 test pits by mechanical excavation
Soil Investigations	HMC – 2019: 7 boreholes via hand auger
	HMC – 2021: 2 boreholes via hand auger
	Existing profile: Sandy Clay Loam topsoil overlying Sandy or Silty Clay with rock
	recorded as a limiting layer ranging from 400mm to more than 1m depth across the
	site. Cobbles and boulders encountered but did not exceed >20% soil volume and
	therefore not considered an absolute constraint.
	Uncontrolled fill with gravels encountered reflecting the soil disturbance on site.
	<u>Existing profile: Residual Lot (TP8, BH8, BH9)</u>
	The initial test pit encountered rock at 400mm depth at TP8. An additional
Soil Type & Category	investigation by HMC via hand auger confirmed soil depth to 700mm in two
	locations within the nominated LAA.
	Amended profile: Soil amendment via placement of a 300mm deep topsoil layer is
	recommended on all lots to achieve minimum 1000mm vertical buffer to a receiving
	layer of the native silty/sandy clay soil, rather than the underlying rock. It is
	recommended to place 300mm of pH neutral Loam/Sandy loam fill to form a raised
	irrigation area of 400m ² within the nominated LAAs.
	Soil Category 5 (Table 5.1 AS/NZS1547:2012)
	See Appendix 4 for soil investigation information.



Environmentally	The property is located along the Terranora broad ridgeline and extends southwards			
Sensitive Areas	down to the Tweed River. Remnant rainforest has been identified on the site.			
Reserve LAA	50% (200m ²) nominated as minimum reserve LAA per Lot for the purposes of			
	conservative design. Reserv	ve LAA may remain unfilled u	ntil an extension or	
	duplication of the effluent la	and application is required.		
Land Application Areas	Proposed Lot 1	Proposed Lot 2	Proposed Lot 3	
Terrain	Ridge – upper slope	Ridge – upper slope	Ridge – upper slope	
Slope & Drainage:	Gentle - moderate slope	Gentle - moderate slope	Gentle - moderate slope	
	grade 10-15%	grade 10-15%	grade 10-15%	
	Waxing divergent	Linear planar	Waxing divergent	
Aspect & Shading	Southern aspect	Eastern aspect	Southern aspect	
	Nil shading expected	Nil shading expected	Nil shading expected	
Ground	100% lawn grass cover to	100% lawn grass cover to	100% lawn grass cover to	
cover/vegetation	be established	be established	be established	

4.2 SETBACK DISTANCE RISK ASSESSMENT

The setback distances adopted for this upgrade are those recommended within the following:

- Environment & Health Protection Guidelines On-site Sewage Management for Single Households (DLG et al. 1998)
- Table R1 of AS/NZS1547: 2012
- Designing and Installing On-site Wastewater Systems (WaterNSW, 2019)

4.3 SITE COMPLIANCE

SITE CONSTRAINTS		Recommended	Complying?
Setback to Boundary 3m across slope		3m	YES
	6m downslope	6m	YES
Setback to	>100m to watercourse	>100m	YES
Watercourse			
Setback to Water Bore	>250m to nearest registered domestic	250m	YES
	groundwater bore		
Setback to Buildings &	>3m to buildings	>3m	YES
Site Features			
Reserve LAA	100% available		YES
Slope Gradient	5-10%	<20%	YES
Flood Liability	Nil flood inundation		YES
Water Supply	Not mapped		YES
Catchment			



5 EFFLUENT TREATMENT & LAND APPLICATION

5.1 TREATMENT PROCESS

The proposed sewage treatment recommended for all of the residential lots is secondary treatment + final disinfection via an Aerated Wastewater Treatment System (AWTS) NSW Health accreditation.

The AWTS provides initial settling, anerobic digestion, aerobic digestion and clarification/disinfection in a one or two tank system, depending on make and model.

The effluent quality expected to be achieved upon discharge is in compliance with NSW Health criteria for Advanced Secondary Effluent in accordance with NSW Health Accreditation Criteria (AS/NZ 1546.3: 2017) as follows:

Table 1 – Effluent Quality Criteria for All Lots – Advanced Secondary Treatment System

Parameter	Advanced secondary effluent			
	90% of Samples	Maximum		
BOD5	≤10 mg/L	20 mg/L		
TSS	≤10 mg/L	20 mg/L		
E.coli*	≤10 cfu/100mL	30 cfu/100mL		
Free Available Chlorine (FAC) **	Minimum 0.5mg/L ***			
Turbidity****	N/A	10 NTU		
* Where disinfection is required.				
** Where chlorine disinfection is used.				
*** Minimum level, not 90% of samples.				
****Where UV light is used for disinfection				

5.2 LAND APPLICATION METHOD

It is recommended that soil is imported to the nominated land application areas to provide a raised irrigation bed to support the installation of sub-surface dripperlines. The recommended subsurface drip line is to be pressurecompensated, non-drain and designed specifically for effluent irrigation. The drip irrigation field is to be installed with emitters and laterals at average 0.8 -1m spacing and buried 100 to 150 millimetres deep.

The finished surface of the raised irrigation area will be lawn grasses, with clumping grasses and scattered low stature shrubs also suitable subject to individual landscaping designs and care taken not to damage the dripperlines. Warning signage will be required in accordance with NSW Health accreditation criteria for the Aerated Wastewater Treatment System.



6 LAND APPLICATION AREA SIZING AND DESIGN

6.1 ASSESSED DESIGN INPUTS

Model Used: Draft Richmond Tweed On-Site Regional Strategy (Alderson, 1999). Daily Time Step			
Climate Data	Tyalgum (1971 – 1984). Mean annual rainfall 1555mm.		
Structure	Proposed Lots 1-3:		
	Assumed 3-bedroom dwelling		
Design Occupancy	5 persons		
Wastewater Design Flow	150L/p/day		
Allowance			
Wastewater Design	750L/day		
Hydraulic Load			
Nitrogen (TN)	3.8 kg/person/year (Whelan & Titammis,1982)		
TN System Nutrient	Secondary treatment ~55% reduction assumed in AWTS.		
Reduction	See Appendix 3.		
Vegetation Removal of TN	Conservative rate of 300 kg/ha/year. Note: Kikuyu up to 520kg/ha/year (NSW		
	Agriculture 1997)		
Phosphorus (TP)	0.6 kg/person/year (Geary & Gardner, 1996)		
Vegetation Removal of TP	20 kg/ha/year (Myers et al 1994)		
Phosphorus Adsorption ~10000 kg/ha/ based on field texture and work carried out by Morand,			
Maximum Design	3mm/day for Category 5 soils		
Irrigation Rate (DIR)	(Table 5.2, AS/NZS1547:2012)		
Proposed DIR	1.9mm/day		

6.2 SUMMARY OF MODELLING CALCULATIONS

To provide a realistic assessment of permeability, multiple tests are required. It is considered that the conservative loading rates based on soil texture (AS/NZS 1547:2012) are adequate for design inputs in this case for a domestic situation.

Analyte	Minimum Recomm Hydraulic Lo	ended Land Application Area (LAA) bading Rate (Q) = 750L/day			
	LAA Modelling Results	LAA Layout			
Hydraulic Load	400m ²				
Nitrogen (TN)	380m ²	400m ² subsurface drip irrigation under lawn.			
Phosphorus (TP)	58m²	200m ² reserve LAA has been nominated			
DLR	1.9mm/day				

The nutrient management area of 380m² will be achieved within the proposed LAA, which is limited by hydraulic loading.



7 DISCUSSION/REASON FOR APPROVAL

The site is located along a broad ridge with steep southward sloping land. The proposed residential lots are located on the elevated, generally level land presenting evidence of soil disturbance and loss from prior earthworks, and largely cleared of native vegetation.

To mitigate the constraints of surface rock, uncontrolled fill and large boulders expected at varying depths, the proposed solution is to construct raised subsurface irrigation beds 300mm above ground level.

The raised irrigation bed provides a minimum 1000mm vertical buffer to the restrictive rock layer within the nominated effluent land application areas. The water balance and nutrient modelling demonstrates that the recommended 400m² of raised irrigation bed area demonstrates that this soil depth is sufficient to provide nutrient adsorption and hydraulic uptake for the wastewater generated by future households.

Based on the information presented in this report, it is considered that the recommendations listed below are sufficient to attain an acceptable level of environmental impact from the design wastewater flow generated by the future dwellings on the proposed lots.



8 **RECOMMENDATIONS**

DESIGN HYDRAULIC LOADING

- Proposed Lots 1-3
- Reticulated water supply

- Assumed 3-bedroom dwelling5 persons occupancy
- RECOMMENDED ON-SITE SEWAGE MANAGEMENT SYSTEM

At development approval stage:

- Provide minimum 600m² effluent land application area (LAA) to be provided per dwelling site
- Construct a raised sub-surface irrigation bed of 400m² surface area per dwelling site. The sub-surface irrigation bed is to be raised to a total height of 300mm above the natural ground surface. Perimeter flanks are to be battered at maximum 1 (vertical): 3 (horizontal)
- Fill Material: Loam to Sandy Loam with minimal clay content, and neutral pH
- Soil preparation is essential prior to placement of fill. Vegetation is to be stripped and imported fill material worked/tilled into the native soil to a depth of 200mm as a transitional layer. Compaction should be minimised when installing the bed. The fill must be Loam to Sandy Loam with minimal clay content.
- Bed Surface: Grass (turf) must be established over the raised bed immediately after completing construction.
- An earth bank diversion bund/bank must be constructed upslope of the raised irrigation bed to divert surface water run-on.

At dwelling construction approval stage:

• Install an Advanced Secondary Treatment System (STS) including Aerated Wastewater Treatment System (AWTS) with NSW Health Accreditation to achieve the following effluent quality:

Parameter	Advanced secondary effluent							
	90% of Samples	Maximum						
BOD5	≤10 mg/L	20 mg/L						
TSS	≤10 mg/L	20 mg/L						
E.coli*	≤10 cfu/100mL	30 cfu/100mL						
Free Available Chlorine (FAC) **	Minimum 0.5mg/L ***							
Turbidity***	N/A	10 NTU						
* Where disinfection is required.								
** Where chlorine disinfection is used.								
*** Minimum level, not 90% of s	amples.							

- ****Where UV light is used for disinfection
- Install minimum 400m² shallow subsurface drip irrigation (SDI) with pressure compensated, nondrain, non-siphoning emitters. Dripperline laterals must be buried 100-150mm below the surface of the raised bed. Irrigation design to include hydraulic analysis, pump performance, and specifications for all components including dripperline, filters, air relief and check valves. A full hydraulic design is to be carried out as part of the installation approval at construction stage.
- Retain 200m² for reserve effluent land application area. Reserve LAA may be unfilled provided access
 remains available for future filling works and the design loading exceeds 750L/day



OPERATION & MAINTENANCE

- DO NOT ALLOW VEHICLES OR STOCK TO ENTER THE LAA.
- DO NOT DISPOSE OF DOWN THE DRAINS: Bleach, bleach-based products, whiteners, nappy soakers and spot removers. Dispose of in the garden in an unused location.
- DO NOT FLUSH DOWN THE SEPTIC SYSTEM: Hygiene products, condoms, tampons, sanitary napkins, disposable nappies and cotton buds.
- DO PRACTICE WATER CONSERVATION.
- DO USE only the recommended amounts of disinfectants and cleaners. Biodegradable products for septic systems are recommended.
- DO MOW & TOPDRESS the LAA regularly to ensure that rainfall is shed from the surface.
- Every 6-12 months: Remove biological effluent filter from within septic tank outlet and dislodge solids back into the main chamber of the septic tank or bury on site at a depth of <300mm. Wear gloves to avoid contact with effluent.
- Every 3-5 years: Engage a licensed liquid waste contractor to pump out septic tank to remove sludge and scum build up.



8.1 SITE PLAN & DETAIL

SEE FOLLOWING PAGES





Site Boundary
Proposed R5 Zone
Available Effluent Land Application Area (600m ²)
Nominated Development Envelope
 Contour lines - 1m intervals



HMC - 19.11.19 (Constrained by





TYPICAL SUB-SURFACE DRIP LAYOUT DETAIL

TYPICAL SUB-SURFACE DRIP ON RAISED IRRIGATION BED - SECTION DETAIL







TYPICAL SUB-SURFACE DRIP IRRIGATION ON RAISED BED

LAYOUT AND SECTION DRAING

COMPONENTS

- Aerated Wastewater Treatment System (AWTS)
- 400m² sub-surface drip irrigation

All drainage work is to be undertaken by a licensed Plumber/Drainer Plumber to check all levels on site and adjust layout where necessary

COUNCIL REQUIREMENTS:

- A Notice of Work for Plumbing and Drainage work is required to be submitted to council prior to any works beginning.
- Installation must comply with Council's OSSM approval document and conditions.
- The corresponding numbered Certificate of Compliance is to be submitted to council within 2 business days of the final inspection of works.

Q = 750L/day DIR = 1.8mm/day LAA = 400m² Deep Drainage Rate = 3mm/day

 Job:
 HMC2023.305.01

 DWG:
 HMCDWG2023.305

 Date:
 March 2023

 Revised:
 31/03/2023

 Drawn:
 KH

 Base:
 KH

Lot 16 DP856265 225 Terranora Road Banora Point NSW



HMC Environmental Consulting Pty Ltd Tweed Heads NSW 0755368863 www.hmcenvironment.com.au admin@hmcenvironment.com.au

9 LIMITATIONS

The information within this document is and shall remain the property of HMC Environmental Consulting Pty Ltd. This document was prepared for the sole use of client and the regulatory agencies that are directly involved in this project, the only intended beneficiaries of our work. No other party should rely on the information contained herein without the prior written consent of HMC Environmental Pty Ltd and client. The report and conclusions are based on the information obtained at the time of the assessment. Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary.

Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time, natural processes and the activities of man. Changes to the subsurface, site or adjacent site conditions may occur subsequent to the investigation described herein, through natural processes or through the intentional or accidental addition of imported material, and these conditions may change with space and time.

The findings of this report are based on the objectives and scope of work outlined within. HMC performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environment assessment profession. No warranties or guarantees, expressed or implied, are made. Subject to the scope of work, HMC's assessment is limited strictly to identifying typical environmental conditions associated with the subject property and does not include evaluation of any other issues. This report does not comment on any regulatory obligations based on the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of the work stated and does not relate to any other works undertaken for the Client. All conclusions regarding the property area are the professional opinions of the HMC personnel involved with the project, subject to the qualifications made above.

While normal assessments of data reliability have been made by HMC, HMC assume no responsibility or liability for errors in any data obtained from regulatory agencies, or information from sources outside HMC's control, or developments resulting from situations outside the scope of this project.



10 REFERENCES

- Alderson, G. & Associates Pty Ltd, Draft Richmond Tweed On-site Regional Wastewater and Sewage Management Strategy, 1999 (OSSM Design Model)
- Australian/New Zealand Standard AS 1547: 2012 *On-site domestic wastewater management*, February 2012
- eSPADE V2.0 NSW Office of Environment and Heritage
 <u>https://www.environment.nsw.gov.au/eSpade2WebApp</u>
- Geary, P. and Gardner, T. *On-site disposal of effluen*t. Innovative Approaches to the On-Site Management of Waste and Water: A one day conference, Southern Cross University, Lismore NSW, 1996.
- Lismore City Council, (2013)" Revised On-site Sewage and Wastewater Management Strategy," Lismore.
- Morand, D.T., Soil Landscapes of the Lismore-Ballina 1:100 000 Sheet, 1994
- NSW Department of Local Government, EPA (NSW), NSW Health, Land and Water Conservation and Department of Urban Affairs and Planning, *Environment & Health Protection Guidelines On-site Sewage Management for Single Household*", February 1998
- Sydney Catchment Authority, "Designing and Installing On-site Wastewater Systems. A Sydney Catchment Authority Current Recommended Practice", SCA, May 2012
- NSW Office of Water, "Commenced Water Sharing Plan for the Tweed River Area unregulated and alluvial water sources", October 2010
- Whelan, B.R. and Titammis, Z.V. Daily chemical variability of domestic septic tank effluent. *Water, Air and Soil Pollution* **17**, 131-139

11 APPENDICES

See following pages



APPENDIX 1 - SITE LOCATION

 ···
 ···
 ···
 ···
 ···

 ···
 ···
 ···
 ···
 ···
 ···

 ···
 ···
 ···
 ···
 ···
 ···

 ···
 ···
 ···
 ···
 ···
 ···

 ···
 ···
 ···
 ···
 ···
 ···

 ···
 ···
 ···
 ···
 ···
 ···

 ···
 ···
 ···
 ···
 ···
 ···

.

· · · · · ·

.



Figure 1: Site Location and Property Boundary as shown in Yellow (NSW SIX Maps)





Figure 2: Property Boundary (TSC GIS 2022).



APPENDIX 2 - LAA DESIGN MODEL

 Des
 <thDes</th>
 <thDes</th>
 <thDes</th>

 1
 1
 1
 1
 1

 2
 0
 0
 0
 0
 0
 0

 1
 0
 0
 0
 0
 0
 0
 0

 1
 0
 0
 0
 0
 0
 0
 0

 1
 0
 0
 0
 0
 0
 0
 0

 1
 0
 0
 0
 0
 0
 0
 0

a + a + a + a

.

 D
 O
 D
 O
 D
 O
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 <thD</th>
 <thD</th>
 <thD</th>
 <thD</th>

 M
 M
 M
 M
 M

 M
 M
 M
 M
 M
 M

 M
 M
 M
 M
 M
 M
 M

 M
 M
 M
 M
 M
 M
 M
 M

 M
 M
 M
 M
 M
 M
 M
 M

 M
 M
 M
 M
 M
 M
 M
 M

 M
 M
 M
 M
 M
 M
 M
 M

 M
 M
 M
 M
 M
 M
 M
 M

 M
 M
 M
 M
 M
 M
 M
 M

 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M
 M

Daily Effluent Disposal Model using Boughton Water Balance Model - Tyalgum										
Greg Alderson & Associates Pty Ltd (LCC, Part C, 2007)										
Period of Rainfall & Evaporation R	Period of Rainfall & Evaporation Record: 01/01/1971 - 31/12/1984									
Client:	Wrenn Pty Ltd									
Site:	225 Terranora Road, Ban	ora Point								
Number of Persons	5 equivalent p	persons								
Daily Flow =	750 L/day									
Nitrogen Volume per year	19.0 kg/year	3.80 kg N /p/year - See Table 7 & table 8								
Denitrification reduce to	11.40 kg/year	40.00 % reduction rate								
Plant Uptake rate (N) =	300 kg/ha/year	- See Table 6								
Phosphorus in Effluent (Ip) =	3 kg/year	0.6 kg P /person/year - see Table 11								
P Uptake by plants (Hp) =	20 kg/ha/year	- P which is taken up by vegetation, Table 9								
P sorption (Ps) =	10000 kg/ha/m de	pth - soil sorption capacity, Table 10								
Water Table Depth (Wtd) =	3 m - measu	red depth to the water table at the disposal site								
Buffer to W table (Bwt) =	0.5 m - adopted	d buffer to be set above water table								
Time for accumulation of P =	50.00 years									
Min. planted disposal area =	380 m ² (based on N loading)									
Min. planted disposal area =	58 m ² (based on P loading)									
Hydraulic Area	400 m ² (ignored if less than Min. planted disposal area)									
Crop factor =	1 See Table 3	3 and Section - B2.8								
% Effective Rainfall =	75% See Table 2	2								
Drainage below root zone/										
Percolation =	13 mm/day - L	.TAR								
% of storage depth at which										
percolation occurs =	50% See Section	т—В2.3								
Depth of topsoil/ De										
of trench =	0.45 m									
Available water/	0.179 Available w	vater from Table 1 (m/m)								
Soil Moisture Holding Capacity/										
Trench storage =	80.55 mm									
Permissible days overflow =	20 days/year									
Minimum effluent application =	1.88mm/day/m ²									
Max cum stor =	7.50 mm									
Required permissible storage =	0.00 m ³									
Max cum stor =	3.00 m ³									



APPENDIX 3 - NUTRIENT LOADING

 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N
 N

a + a + a + a

 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·
 ·

.

.

. \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet \bullet $\mathbf{x}_{i} \in \{\mathbf{x}_{i}, \mathbf{x}_{i}\}$ $\mathbf{x} = \mathbf{x} + \mathbf{x}$ $a \rightarrow a + a + a$

In consideration of nutrients such as nitrogen and phosphorus, a mass balance was used to estimate the application rate and long-term management of the on-site sewage management system based on effluent quality, wastewater volume and land application system, plant uptake, site and soil characteristics. In determination of LAA sizing regarding TN the following data was used.

Study	Mean Annual Loading
Witt et al. 1974	2.2 kg/person/year
Whelan & Titammis 1982	3.8kg/person/year
Sarac, K et al 2001	4.0kg/person/year
	(based on 6 dwellings within tank)
Davison et al., 2002	4.2 kg/person/year
	(based on two dwellings within tank)
Patterson, R.A 2004	4.38 kg/person/year
	(using mean of 85.8mg/L ⁻¹ at 140L/person/day)
Mean of listed studies	3.73kg/person/year
Realistic annual loading rate based on above listed studies	3.8 kg/person /year (as per Whelan & Titammis 1982)

Table 2: Nitrogen Production Data

The mean of the above studies provides a TN of approximately 3.7kg/person/year therefore the previously quoted figure of 3.8kg/person/year by Whelan & Titammis, 1982, is considered realistic for this domestic installation.



APPENDIX 4 - SOIL INVESTIGATION

. * * * * * *

.

 D
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 O
 <thO</th>
 <thO</th>
 <thO</th>
 <thO</th>

 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 D
 <thD</th>
 <thD</th>
 <thD</th>
 <thD</th>

.

NSW DLWC 1:100,000 Soil	Disputed Plains (dp) landscape:
Landscape Map (Morand, 1996)	Basalt derived valley in-fills and alluvial fans forming gently inclined
	slopes.
	Soils:
	Deep poorly drained Black Earths.
	Geology:
	Generally fine-grained sediments of the Lismore Basalts. Eluvial or
	outwash deposits at the toes of steep slopes or in the heads of gullies.

Soil Pr	ofile - HMC	C bore logs 19th No	ovember 2019	 Soil profile exposed 	d by hanc	d auger excava	ition
Bore hole No.	Depth (mm)	Field Texture Determination	Structure	Colour - Moist MUNSELL	рН	Coarse Fragments	Modified Emerson Aggregate Test
1	0-400	Sandy Clay Loam	Strong	Dark Yellowish Brown 10YR 3/4 Moist	4.5	Yes, fine gravels <20%	Class 3/6 Not limiting
2	0-400	Silty Loam	Strong	Dark Yellowish Brown 10YR 3/4 Moist	4.5	Yes, fine gravels <20%	Class 3/6 Not limiting
3	0-350	Clay Loam	Moderate	Dark Brown 7.5YR 3/4 Dry	5.0	Yes, fine gravels <20%	Class 8 No slaking Not limiting
4	0-750	Sandy Clay	Moderate	Dark Brown 7.5YR 3/4 Dry	5.5	Yes, fine gravels <20%	Class 3/6 Not limiting
	750-850	Sandy Clay Loam	Strong	Strong Brown 7.5YR 4/6 Dry	5.0	Yes, fine gravels <20%	Class 3/6 Not limiting
	850- 1000	Sandy Clay	Single grained	Yellowish Brown 10YR 5/4 Dry	6.5	Yes, fine gravels >20%	_
5	0-450	Sandy Clay	Weak	Dark Yellowish Brown 10YR 3/4 Dry	4.5	Nil	Class 3/6 Not limiting
	450-850	Sandy Clay Loam	Moderate	Dark Yellowish Brown 10YR ¾ Moist	4.5	Yes, fine gravels <20%	Class 3/6 Not limiting
6	0-200	Fine Sandy Clay Loam	Single grained	Dark Yellowish Brown 10YR 3/4 Dry	6.5	Yes, fine gravels <20%	Class 3/6 Not limiting
	200-350	Sandy Clay	Single grained	Black 2.5YR 2.5/1 Dry	9.0	Yes, fine gravels <20%	-
7	0-200	Sandy Clay	Strong	Dark Yellowish Brown 10YR 3/4 Dry	7.0	Yes, fine gravels <20%	Class 3/6 Not limiting



Soil Profile - HMC bore logs 27th May 2021 – Soil profile exposed by hand auger excavation											
Bore hole no.	Depth (mm)	Field Texture Determination	Structure	Colour - Moist MUNSELL	рН	Coarse Fragments	Modified Emerson Aggregate Test				
8	0-700	Sandy Clay	Moderate	Dark Brown 7.5YR 3/4 Dry	5.0	Yes, fine gravels <20%	Class 8 No slaking Not limiting				
9	0-700	Sandy Clay	Moderate	Dark Brown 7.5YR 3/4 Dry	5.0	Yes, fine gravels <20%	Class 8 No slaking Not limiting				
Modifi	ed Emersor	n Aggregate Test									

As described by Robert Patterson Lanfax Labs Technical Note T14-1 (November 2014)

"The modified Emerson test can be reported and interpreted, with respect to domestic wastewater application as:

Class 1 - Severe dispersion, maybe related to high sodicity which forces the clay particles apart in water. Amelioration with lime or gypsum may improve structural stability by increasing EC. Class 1 soils have a major limitation to wastewater application because of reduced permeability and potential to compact as the pores block.

Class 2 - Moderate dispersion, may be related to high sodicity. Amelioration may be effective by increasing EC. Without amelioration, this class has a major limitation to wastewater application as for class 1.

Classes 3-6 -Remoulding, and 1:5 soil:water suspension tests are irrelevant to wastewater assessment, but one can report the test results with degree of slaking as:

Slake 1 (slight), slake 2 (moderate) or slake 3 (completely slumped). Slake 1, 2, or 3 – no limitation to wastewater application, but may benefit from additional organic matter for surface irrigated soils.

Classes 7 and 8 - these soils are water stable but may swell (Class 7) or retain original size and shape (Class 8). Neither of these classes is a limitation to wastewater application."



INVESTIGATIONS

.

• • • • • •
• • • • • •
• • • • • •
• • • • • •
• • • • • •
• • • • • •

.

 \sim

APPENDIX 5 - GEOTECHNICAL

Geotechnical Investigation – Geotechnical Investigations Pty Ltd Report No. GI 3953-B 31 January 2019

Test Pit	Uncontrolled Fill Residual Soils		Rock	T.D.
No.	(m)	(m)	(m)	(m)
TP 1	0 - 1.8	1.8 – 2.3	NE	2.3
TP 2	0-1.3	NE	1.3 - 1.8	1.8(1)
TP 3	0-3.2	NE	3.2 - 3.4	3.4
TP 4	0-0.6	0.6 – 2.1	NE	2.1
TP 5	0-3.5	NE	NE	3.5
TP 6	0-2.1	NE	NE	2.1 ⁽¹⁾
TP 7	0-0.4	NE 0.4 – 0.6		0.6 ⁽¹⁾
TP 8	NE	0-0.4	0.4 -1.7	
TP 9	0-1.6	NE	1.6 - 1.7	1.7(1)
TP 10	0 – 0.7	0.7 – 0.9	0.9 - 1.1	1.1(1)
TP 11	NE	0 - 2.8	NE	2.8
TP 12	0-2.9	NE	NE	2.9
TP 13	0-2.1	2.1 – 2.8	NE	2.8
TP 14	NE	0-2.4	NE	2.4

Figure 3 Summary of Borelogs (Source: Geotechnical Investigations Report No. GI 953-b, January 2019, p3)

SEE FOLLOWING PAGES FOR BORELOGS



DRILLING



APPENDIX B

ENGINEERING LOGS – TEST PITS PROFILES TP 1 TO TP 14

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GPS:	S:	-28.23	5641		E:	153.532198
CL	IENT	WREN	N PTY LT	D									TEST F	PIT I.D	.: ТР	1
PF	ROJEC	T: LOT :	16 (No.2	25) TEI	RANOR	A ROA	D, BANG	ORA POINT					JOB N	o.: GI	3953-	
EC	DUIPN	/ENT TY	PE: 5.5	TONNE	КИВОТ	A		BUCKET S	BUCKET SIZE: 450mm				PAGE	: 1 of	1	
			6					I			≥ 0					
Method	Water	Depth (m)	iraphic Log				Mat	terial Description	Description Rel. Description Rel. Description			Test	Sample / Test		Struc	ture and additional observation
TB				(CH bou) Silty CL lders thr	AY: Hig	h plastic	ity, With gravel, t (w>w _p), Dark rα	With cobble.	s and d grey	F - St	P 110	P = - 130		FILL *PP's comp mate natur *Bou dia.	difficult to lete due to coarse rials and friable re of clay lders up to 0.6m
		2.0_ 		(CH cob) Silty CL bles thro	AY: Hig oughou	h plastic t, Moist	iity, With gravel (w>w _p), Red/bro	and boulders own	, With	St				RESID	JUAL
		2.5_ - - 3.0_ - 3.5_ - 4.0_ - - 4.0_ - - 4.5_														
TF	2 1 TE	RMINA	TED AT	2.3m -	- LIMIT	OF IN	/ESTIG/	CONSISTENCY / I		PENETRAT		ROUG	H COBE	SAN	PLES / T	FSTS
METHOD WEATHERING AD Auger Drilling EW Extremely VS C Casing HW Highly S MS Mud Support DW Distinctly F NMLC Rock Coring MW Moderately St RR Rock Roller SW Slightly VSt TB Toothed Bucket F Fresh Hd TC Tri Cone VL VL WB Wash Bore L MD Water Level F Foresh Hd				Very Soft Soft Firm Stiff Very Stiff Hard Very Loose Loose Medium Dense	D D VD Fb ELw VLw Lw M H VH	N STRENGT Dense Very Dense Friable Extremely Very Low Low Medium High Very High	Low	U() D BS DCP SPT N VS A PP	Undi Distu Bulk Dyna Stan Num Vane Acid Pock	SAMI sturbed Irbed Sample amic Co dard Pe ber of Shear Sulfate et Pene	e e one Pen enetron blows f e Sampl etrome	n mm) netrometer neter Test for SPT / 300mm e ter (kPa)				
		Water Se	epage	Logge	ed By:	JDW		Date:	13/03/18	Check	ed By:			Dat	te:	

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GPS:	S:	-28.23	5315		E:	153.531518
CL	CLIENT: WRENN PTY LTD TEST PIT I.D.: TP 2										2					
PF	PROJECT: LOT 16 (No.225) TERRANORA ROAD, BANORA POINT JOB No.: GI 3953-a										-a					
-							,		6175 450							-
EC	JOIN		(PE: 5.5	TONNI	E KUBO I	A		BUCKET	SIZE: 450mm	1	1	-	PAGE	: 1 01	1	
Method	Water	Depth (m)	Graphic Log				Mat	erial Descriptio	n		Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Stru	cture and additional observation
ТВ		- - 0.5_ - - 1.0_ -		(CH We Dar) Silty CL athered k red/br	AY: Hig basalt l own an	h plastic boulders d grey	ity, With grave	el, With cobbles	s and ist (w>w _p),	F - St				FILL *PP' com mate	? s difficult to plete due to coarse erials
		1.5_		(HV higi	V) BASAL n plastici	T and l ty silty	ayers of clay: Red	(XW) BASALT r I, dark orange/	nixed with mea /brown and gre	dium to :y	VLw				RESI	DUAL
				(HV	V-MW) B	BASALT	Fine gra	ined, Grey, da	rk grey and red	l/brown	Lw					
TF							TION DUE TO	O VERY SLOW	/ PENETRA	TION						
AD	ז כ	vie i HOD Auger Di	rilling	EW W	EATHERIN Extren	vG nely	VS	Very Soft	DENSITY / ROC D	K STRENGTH Dense	I	U()	Undi	SAMI sturbe	PLES / ⁻ d (size	in mm)
c		Casing	2	НW	Highly		S	Soft	VD	Very Dense	9	D	Distu	urbed		-
M	S	Mud Sup	port	DW	Disting	ctly	F c+	Firm	Fb	Friable	0.00	BS	Bulk	Sample		a atramatar
	VILC	Rock Rol	'ing ler	SW	Mode Slightl	rately v	St VSt	Stiff Verv Stiff	ELW VI w	Extremely Very Low	LOW	DCP SPT	Dyna	amic Co dard Pi	one Pei enetro	netrometer meter Test
TB	5	Toothed	Bucket	F	Fresh	1	Hd	Hard	Lw	Low		N	Num	ber of	blows	for SPT / 300mm
ТС	2	Tri Cone	2				VL	Very Loose	М	Medium		VS	Vane	Shear		
w v	в •	Wash Bo WATER Water Le	evel				L MD	Loose Medium Dens	H Se VH	High Very High		A PP	Acid Pock	Sulfate et Pen	e Samp etrome	le eter (kPa)
	•	Water Se	eepage	Logg	ed By:	JDW		Date:	13/03/18	Check	ed By:	-		Dat	te:	

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

				GPS:	S: -28.23	5063	E: 153.530866				
CL	CLIENT: WRENN PTY LTD TEST PIT I.D.: TP 3										
PF	ROJEC	T: LOT 16 (No	JOB No.: G	JOB No.: GI 3953-a							
50				BUCKET SIZE: 450mm		DACE: 1 of	£ 1				
					<u>г г</u>	PAGE. 10					
Method	Water	Graphic Log Depth (m)	Material D	Description	Test Consistency / Rel. Density	DCP Blows / 100mm Sample /	Structure and additional observation				
ТВ			(CH) Silty CLAY: High plasticity, W boulders throughout, Wet to very and grey	ith gravel, With cobbles and / moist (w>w _p), Dark red/brown	F - St		FILL *PP's not possible with Cobbles throughout Trace of building Material and grease cartridge				
		-	(HW) BASALT and layers of (XW) I high plasticity silty clay: Red. dark	BASALT mixed with medium to corange/brown and grey	VLw		RESIDUAL				
T		3.5_ - - 4.0_ - 4.5_ -	T 3 4m - 11MIT OF PEACH	<u> </u>							
	· 3 E					C A & A					
METHOD WEATHERING CON AD Auger Drilling EW Extremely VS Ve C Casing HW Highly S So MS Mud Support DW Distinctly F Fir NMLC Rock Coring MW Moderately St Sti RR Rock Roller SW Slightly VSt Ve TB Toothed Bucket F Fresh Hd Ha TC Tri Cone VL Ve L Lo WATER Water Lord MD MD Mc				STENCY / DENSITY / ROCK STRENGTH Soft D Dense VD Very Dense Fb Friable ELW Extremely L Stiff VLw Very Low Loose M Medium e H High ium Dense VH Very High	U() D BS DCP SPT N VS A PP	SAM Undisturbe Disturbed Bulk Sampl Dynamic Cc Standard P Number of Vane Shear Acid Sulfate Pocket Pen	PLES / TESTS e (size in mm) e one Penetrometer enetrometer Test blows for SPT / 300mm c e Sample etrometer (kPa)				
	•	Water Seepage	Logged By: JDW Dat	te: 13/03/18 Check	ed By:	Dat	te:				

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GPS:	S:	-28.23	4886		E: 153.530287
CL	IENT:	WREN	N PTY LT	D									TEST I	PIT I.D	.: TP 4
PF	ROJEC	T: LOT	16 (No.2	25) TE	RRANOR	RA ROA	D. BANOF	RA POINT					JOB N	o.: GI	3953-a
-						- ^	, -		75 . 450mm				DACE	. 1 . 6	1
E	LOIN		PE: 5.5		EKUBUI	A		BUCKETS	ZE: 450mm			-	PAGE		1
Method	Water	Depth (m)	Graphic Log				Mate	rial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation
TB				(CH bou	l) Silty CL Ilders, M	AY: Hig loist (w	gh plasticit >w _p), Dark	y, With gravel, ' red/brown	With cobbles	s and	F				FILL *Boulders up to 0.6m dia.
		0.5_		(GP) GRAVE	L: With	clay and o	cobbles,			L				
				(CH bou	l) Silty CL Ilders, M	AY: Hig loist (w	gh plasticit >w₽), Dark	y, With gravel, k red/brown	With cobbles	s and		-			RESIDUAL ? POSSIBLE FILL *Boulders up to 1m dia.
		2.0_													
T	• 4 TE	RMINA	TED AT	2.1m -	- ???			ONICICTENCY / D		VCTRENCT				C ^ ^ ^	
AE C M RF TE TC W	S MLC B B	Auger Dr Casing Mud Sup Rock Cor Rock Rol Toothed Tri Cone Wash Bo WATER Water Le	illing port ing ler Bucket re evel	W EW HW DW MW SW F	EATHERIN Extren Highly Distinc Moder Slighth Fresh	vG nely ctly rately y	VS S F St VSt Hd VL L MD	Very Soft Soft Firm Stiff Very Stiff Hard Very Loose Loose Medium Dense	EINSTEY / ROC D VD Fb ELW VLW LW M H VH	N STRENGT Dense Very Dense Friable Extremely Very Low Low Medium High Very High	Low	U() D BS DCP SPT N VS A PP	Undi Distu Bulk Dyna Stan Num Vane Acid Pock	SAMI sturbed Irbed Sample amic Co dard Pe ber of Shear Sulfate et Pen	d (size in mm) e one Penetrometer enetrometer Test blows for SPT / 300mm e Sample etrometer (kPa)
1			-Page	LOGG	eu by:	JDAA		Date:	12/03/18	Cneck	eu By:			Dat	

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GPS:	S:	-28.23	4981		E:	153.531520
CL	IENT	WREN	N PTY LT	D									TEST I	PIT I.D).: TF	P 5
PR		T: 10T	16 (No.2	25) TEI	RRANOR	A ROA	D. BAN	ORA POINT					JOB N	o.: GI	3953	-a
-																-
EC	QUIPN		PE: 5.5	TONNE	E KUBOI	A		BUCKETS	SIZE: 450mr	n	1		PAGE	: 1 of	1	
Method	Water	Depth (m)	Graphic Log				Mat	terial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Stru	cture and additional observation
ТВ				(Mł We (Mł We) Silty CL Ilders, Ve H/CH) Cla t (w>w _p).	AY: Hig ery moi ayey SII , Dark g ayey SII bbish,	T/Silty C grey	CLAY: High plasti CLAY: High plasti CLAY: High plasti	city, Trace of	cobbles,	F - St	P 80	P = - 120 < 80		*PP' Mat crun	's difficult as erial was nbling
TF AC C MS NN RR TB TC	р 5 ТЕ Л ИLC	4.0_ 4.0_ 4.5_ RMINA WETHOD Auger Dr Casing Mud Sup Rock Cor Rock Roll Toothed Tri Conted Tri Conted Wash Bo	TED AT illing port ing ler Bucket re	3.5m - WI EW HW DW MW SW F	- LIMIT EATHERIN Extren Highly Distinc Moder Slightl Fresh	OF RE NG nely ctly rately y	ACH VS S F St VSt Hd VL L	CONSISTENCY / 1 Very Soft Soft Firm Stiff Very Stiff Hard Very Loose Loose	DENSITY / ROO D VD Fb ELw VLw Lw M H	CK STRENGTH Dense Very Dense Friable Extremely Very Low Low Medium High	1 e Low	U() D BS DCP SPT N VS A	Undi Distu Bulk Dyna Stan Num Vane Acid	SAMI sturbe stribed Sample mic Cc dard Pi ber of s Shear Sulfate	PLES / d (size e enetro blows ·	TESTS in mm) netrometer meter Test for SPT / 300mm ole
	V	WATER Water Le Water Se	evel epage	Logge	ed By:	JDW	MD	Medium Dense	VH 13/03/18	Very High Checl	ked By:	PP	Pock	et Pen	etrome	eter (kPa)

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GPS:	S:	-28.23	5479		E:	153.530789
CL	LIENT	: WREN	N PTY LT	D									TEST I	PIT I.D	.: тғ	° 6
							D. D. A.N.C							<u> </u>	2052	
PF	KOJEC		16 (NO.2	25) I EI	RANOF	(A ROA	D, BANC						JOR N	o.: GI	3953	-a
EC	QUIP	MENT TY	' PE: 5.5	TONNE	КИВОТ	ГA		BUCKET S	IZE: 450mn	n			PAGE	: 1 of	1	
Method	Water	Depth (m)	Graphic Log				Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Stru	cture and additional observation
П		-		(GP) GRAVE	L: Fine	to coarse	e gravel, Moist, I	Dark grey		L				FILL	
ľ		-														
		_		(GP) GRAVE	L: Fine	to coarse	e gravel, With sa	nd and clay		1				*Bo	ulders up to 0.8m
		0.5_		thro	oughout,	, With c	obbles a	nd boulders, Mo	oist, Dark gre	У					dia.	
		_														
		-														
		1.0_														
		-														
		_														
		1.5														
		_														
		_	·													
		20														
		2.0_														
		-														
		_														
		2.5_														
		_														
		-														
		3.0_														
		-														
		-														
		2 -														
		5.5_														
		-														
		_														
		4.0_														
		-														
		-														
		_														
+		4.5_		2.1	TERM			0 110 417 05								
1	roit		IEUAI	2.1m -	ATHER!	NG		CONSISTENCY / P		K STRENGTU			NUN	SUVI		TESTS
A)	Auger Dr	illing	EW	Extrer	nely	vs	Very Soft	D	Dense		U()	Undi	sturbe	d (size	in mm)
С		Casing	2	нw	Highly	/	s	Soft	VD	Very Dense	9	D	Distu	irbed		
M	S	Mud Sup	port	DW	Distin	ctly	F c+	Firm	Fb	Friable	0	BS	Bulk	Sample	e Dec D	natromator
	VILC	ROCK COR	ing ler	SW	iviode Slightl	ratery lv	VSt	Sun Verv Stiff	elw Vlw	Extremely I	LOW	SPT	Stan	dard Pe	one Pe enetro	metrometer meter Test
ТВ	3	Toothed	Bucket	F	Fresh	'	Hd	Hard	Lw	Low		N	Num	ber of	blows	for SPT / 300mm
ТС	2	Tri Cone					VL	Very Loose	М	Medium		VS	Vane	e Shear		
W	В	Wash Bo	re					Loose	H	High		A	Acid	Sulfate	e Samp	ile
.	•	WATER	wol .				MD	ivieaium Dense	VH	very High		^{PP}	Pock	et Pen	etrom	ater (KPa)
	•	Water Le	epage	Logge	ed Bv:	JDW	I	Date:	13/03/18	Check	ed By:			Dat	te:	

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GP	PS:	S:	-28.23	5950		E:	153.531665
CL	IENT	: WREN	N PTY LT	D										TEST I	PIT I.D	.: ТF	۶ <i>۲</i>
DE			16 (No 3	<u>эг\ тг</u>											a . CI	2052	
Pr	OJE	.1: 101	10 (110.2	25) I E	RRANUR		D, BANU							JOPIN	0. : G	5925	-d
EC	QUIPI	VIENT TY	PE: 5.5	TONN	Е КИВОТ	A		BUCKET S	IZE: 450mm	۱				PAGE	:1of	1	
Method	Water	Depth (m)	Graphic Log				Mate	erial Description				Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Stru	cture and additional observation
-		_		(CH) Silty CL	AY: Hig	h plastici	ty, Trace of grav	el, Moist (w	>w _p),		F-				FILL	
в		_		Dar	k red/br	own						St					
		-		(GP) Sandy (GRAVEI	L: Fine to	coarse gravel, N	loist, Grey								
		0.5		(ну	ν) βάδαι	T. Fine	grained	Dark grev					-			RESI	
		0.5_					granica,	Durkgrey									DOAL
İ																	
		_															
		1.0															
		1.0_															
		_															
		1.5_															
		-															
		_															
		2.0_															
		-															
		_															
		2.5_															
		-															
		-															
		_															
		3.0_															
		-															
		-															
		_															
		3.5_															
		-															
		-															
		-															
		4.0_															
		-															
		-															
		-															
		4.5_															
TF) 7 TE	RMINA	TED AT	0.6m -	- EXCAV	/ATOR	REFUSA	L									
		METHOD		W	EATHERIN	NG	0	CONSISTENCY / D	ENSITY / ROC	K STRE	NGTH				SAM	PLES /	TESTS
)	Auger D	rilling	ЕW н\//	Extren	nely ,	vs s	very Soft Soft	D VD	Dens	e Denso			Undi	sturbe irbed	d (size	ın mm)
M	s	Mud Sur	oport	DW	Distin	ctly	F	Firm	Fb	Friabl	le		BS	Bulk	Sample	e	
NN	ЛLC	Rock Cor	ing	MW	Mode	rately	St	Stiff	ELw	Extre	mely L	ow	DCP	Dyna	amic Co	one Pe	netrometer
RR	ł	Rock Rol	ler	SW	Slight	У	VSt	Very Stiff	VLw	Very	Low		SPT	Stan	dard Pe	enetro	meter Test
		Toothed	Bucket	F	Fresh		I Ha VI	Hard Very Loose	LW M	LOW Medi	um			Num	iper of Shear	SWOIG	TOF SP1 / 300mm
w	B	Wash Bo	ore					Loose	Н	High			A	Acid	Sulfate	e Samp	le
<u>ا</u>		WATER	-				MD	Medium Dense	VH	Very	High		PP	Pock	et Pen	etrome	eter (kPa)
'	•	Water Le	evel												-		
	•	Water Se	eepage	Logg	ed By:	JDW		Date:	13/03/18	0	Check	ed By:		Date:			

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GPS:	S:	28.235	130		E: 153.533190
CL	IENT.	: WREN	N PTY LT	D									TEST I	PIT I.D	0.: TP 8
			10 (No. 2	ас\ те											12052 h
PR	KOJE	. 1: LOT	16 (NO.2	25) I E	RRANUR	a Rua	D, BANC						JOR N	o.: G	3953-0
EC	QUIPI	MENT T	/PE: 5.5	TONN	Е КИВОТ	A		BUCKET SI	ZE: 450mm	1 x 2.1m			PAGE	: 1 of	1
Method	Water	Depth (m)	Graphic Log				Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation
		_		(CI)	Gravelly	CLAY:	Medium	plasticity, Dry, R	ed/brown						RESIDUAL
Β		_		(CI)	Sandy C	LAY: M	edium pl	asticity, With silt	, Trace of gr	avel, Dry	VSt				Organic material
		-		(w<	w _p), Red	l/browr	า				- Hd	P 300	P = - 450		throughout
		0.5_		(HV ora	V) BASAL nge/brov	.T: Fine wn and	grained, grev	Very fractured,	Dry, Dark red	d/brown,	Vlw V	1			
		_					81				Lw				
1		_													
		_													
		1.0_													
		_													
		_													
		-													
		-													
		1.5_													
		-													
		-													
		-													
		2.0													
			1												
		_													
		_													
		-													
		2.5_													
		-													
		-													
		-													
		3.0													
		_													
		_													
		_													
		-													
		3.5_													
		-													
		-													
		-													
		4.0_													
		_													
		-													
		4.5_		0 7	EVON		DEFINE				1				
	011			u./m-		AIUR	KEFUSA	CONSISTENCY / D			ц			C ^ ^ ^	
ΔΓ)	Auger D	rilling	EW.	Fxtren	nelv	VS	Very Soft		Dense	п	μn	Undi	3AIVII sturhe	d (size in mm)
c	-	Casing		HW	Highly	,	s	Soft	VD	Very Dens	e	D	Distu	urbed	- (
M	s	Mud Su	oport	DW	Disting	ctly	F	Firm	Fb	Friable		BS	Bulk	Sample	e
NN	VILC	Rock Co	ring	MW	Mode	rately	St	Stiff	ELw	Extremely	Low	DCP	Dyna	amic Co	one Penetrometer
RR	R	Rock Ro	ller	SW	Slightl	у	VSt	Very Stiff	VLw	Very Low		SPT	Stan	dard Po	enetrometer Test
TB	5	Toothed	Bucket	F	Fresh		Hd	Hard	Lw	Low		N	Num	ber of	blows for SPT / 300mm
	, D	Iri Cone	2					very Loose	M H	iviedium High		VS A	Vane	sulfat	Sample
vv	D		ле				MD	Medium Dense	VH	Very High		PP	Pock	et Pen	etrometer (kPa)
	•	Water I	evel						•••						
	•	Water S	eepage	Logg	ed Bv:	JDW	1	Date:	21/12/18	Chec	ked Bv:	JN	1	Dat	te: 31/01/19
1			-	- 00					,, _0					1	

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486 Ph: 0755 233 979 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

Γ										GPS:	S:	28.235	015°		E:	153.532526°
CL	IENT:	WREN	N PTY LT	D									TEST I	PIT I.D	.: ТР	9
PF		T: LOT	16 (No.2	25) TF	RRANOR		D. BANO	RA POINT					JOB N	o.: GI	3953-	b
																~
EC	QUIPN	/IENT TY	PE: 5.5	IONNI	E KUBOI	A		BUCKETS	IZE: 450mm	n X 2.8m		-	PAGE	: 1 of	1	
Method	Water	Depth (m)	Graphic Log				Mate	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Struc	ture and additional observation
ТВ				(SC) We) Clayey : t, Dark re	SAND: ed/bro	Fine to co wn and gr	arse sand, With ey	i gravel and b	oulders,					FILL	
		_														
		0.5_														
		-														
		-													Lorge	>1 Om houldors
		1.0_													Large	e >1.0m boulders
		-		(CI-	CH) Sand	dy CLAY	': Mediun	n to high plastic	ity, With grav	vel, Wet,	F	1				
		-		Dar	k orange	e/browi	n									
		1.5_														
		-		(HV	V) BASAL	.T: Fine	grained,	Very fractured,	Dry, Dark red	d/brown,	Lw	1			RESID	DUAL
		-		ora	nge/brov	wn and	grey				- M					
		-														
		2.0_														
		-														
		_														
		-														
		2.5_														
		_														
		-														
		3.0_														
		_														
		-														
		_														
		3.5_														
		-														
		_														
		4.0														
		-														
TF	9 TE	RMINA	TED AT	1.7m -	- EXCAV	ATOR	REFUSA	L ON ROCK								
ΔΓ	א כ	METHOD	rilling	W FW	EATHERII Extren	NG nelv		CONSISTENCY / D	ensity / Roc ח	K STRENGTH	ł		Undi	SAM	PLES / T d (size i	ESTS n mm)
C	-	Casing		HW	Highly	, ,	s	Soft	VD	Very Dense	e	D	Distu	irbed	- (51201	·····,
M	S	Mud Sup	oport	DW	Distin	ctly	F st	Firm Stiff	Fb	Friable	Low	BS	Bulk	Sample	e De Bor	etrometer
RR	VILC }	ROCK CON	ler	SW	Slight	y areiy	VSt	Very Stiff	VLw	Very Low	LOW	SPT	Stan	dard Pe	enetron	neter Test
ТВ	3	Toothed	Bucket	F	Fresh		Hd	Hard	Lw	Low		N	Num	ber of	blows f	or SPT / 300mm
TC	D	Tri Cone	e					Very Loose	М н	Medium High		VS ∆	Vane Acid	Sulfate	Samnl	٩
	ט	WATER	ne				MD	Medium Dense	VH	Very High		PP	Pock	et Pen	etrome	c ter (kPa)
	•	Water Le	evel					1								
		Water Se	eepage	Logg	ed By:	JDW		Date:	21/12/18	Check	ced By:	JM	/	Dat	te:	31/01/19

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GPS:	S:	28.235	214°		E: 153.53199	1°
CL	IENT:	WREN	N PTY LT	D									TEST I	PIT I.D	.: TP 10	
			4.6 (N) 2	0 F \ T F			D. D. A.N.C							0	2052	
PF	OJEC	. I: LOT	16 (NO.2	25) I EI	RRANOR	a Rua	D, BANC						JOR N	o.: GI	3953-р	
EC	QUIPN	ΙΕΝΤ ΤΥ	PE: 5.5	TONNE	Е КИВОТ	A		BUCKET SI	ZE: 450mm	n x 2.5m			PAGE	: 1 of	1	
Method	Water	Depth (m)	Graphic Log				Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and add observatior	ditional າ
ТВ		- - 0.5_ -		(CI- Dar	CH) Sanc k orange	iy CLAY /browi	′: Mediur า	n to high plastici	ty, With grav	vel, Wet,	F - St				FILL	
		-		(CI-	CH) Sand	ly CLAY	': Mediur	n to high plastici	ty, Trace of g	gravel,					RESIDUAL	
		1.0_		(HV	V) BASAL	T: Fine	grained,	Very fractured,	Dry, Dark gre	έγ	Lw - M					
	2 10 1		ATED A	1.1m	- FXCA	VATO	RRFFU	SAL ON ROCK								
	1	METHOD		W	EATHERIN	NG		CONSISTENCY / D	ENSITY / ROC	K STRENGTI	-			SAM	PLES / TESTS	
AC C M: NM RR TB TC W	S MLC S B B	Auger Di Casing Mud Sup Rock Cor Rock Rol Toothed Tri Cone Wash Bo WATER Water I	rilling oport ing ler Bucket ore evel	EW HW DW MW SW F	WEATHERING VS Extremely VS Highly S Obstinctly F V Moderately St Slightly VSt Fresh Hd VL L MD			Very Soft Soft Firm Stiff Very Stiff Hard Very Loose Loose Medium Dense	D VD Fb ELw VLw Lw M H VH	Dense Very Dense Friable Extremely Very Low Low Medium High Very High	e Low	U() D BS DCP SPT N VS A PP	Undi Distu Bulk Dyna Stan Num Vane Acid Pock	sturbe Irbed Sample amic Co dard Pe ber of Shear Sulfate et Pene	d (size in mm) e one Penetrometer enetrometer Test blows for SPT / 300i e Sample etrometer (kPa)	mm
	•	Water Se	eepage	Logge	ed By:	JDW	1	Date:	21/12/18	Checl	ked By:	, NI	/	Dat	e: 31/01	/19

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GPS:	S:	28.235	635°		E:	153.531748°
CL	IENT:	WREN	N PTY LT	D									TEST I	PIT I.D	.: TP	11
PF	ROJEC	T: LOT	16 (No.2	225) TER	RANOR	A ROA	D, BANO	RA POINT					JOB N	o.: GI	3953·	-b
FC	אסווור		/DE: 5 5			Δ		BUCKETS	17E • 450mm	v 3.0m			PAGE	• 1 of	1	
			1		RODOT	~		DOCKETS	EE . 450mm	1 X 3.011	1	1	TAGE		-	
Method	Water	Depth (m)	Graphic Log				Mate	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Stru	cture and additional observation
ТВ				(CH) Mois (CH) Mois	Silty CL st (w>w; Silty CL st (w>w;	AY: Hig b), Dark AY: Hig b), Dark	gh plasticii < red/brov gh plasticii < grey and	ty, With sand, T wn ty, With sand, T l red/brown	race of bould	lers,	VSt St - VSt	PP :	= 300		RESII Gras Trace mate	DUAL s roots at surface e of organic erial.
TF ALC C MI RR TB TC W	> 11 T >> S MLC	3.0_ 3.0_ - 3.5_ - 3.5_ - 4.0_ - 4.0_ - 4.0_ - 4.0_ - 5.5_ - - - 4.0_ - - - 4.0_ - - - - - - - - - - - - -	ATED A rilling poort ring ler Bucket pore	T 2.8m WE EW HW DW MW SW F	– HIT A ATHERIN Extren Highly Distinc Moder Slighth Fresh	BOUI IG nely ctly rately y	LDER AN VS S F St VSt Hd VL L MD	D REFUSED CONSISTENCY / D Very Soft Soft Firm Stiff Very Stiff Hard Very Loose Loose Medium Dense	ENSITY / ROC D VD Fb ELw VLw Lw M H VH	K STRENGTH Dense Very Dense Friable Extremely Very Low Low Medium High Very High	1 Low	U() D BS DCP SPT N VS A PP	Undi Distu Bulk Dyna Stan Num Vane Acid Pock	SAMI sturbe irbed Sample mic Ccc dard P ber of e Shear Sulfate et Peni	PLES / 7 d (size e enetroi blows - e Samp etrome	TESTS in mm) netrometer meter Test for SPT / 300mm le eter (kPa)
	•	Water Se	eepage	Logge	d By:	JDW	1	Date:	21/12/18	Check	ed By:	JN	/	Dat	te:	31/01/19

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486 Ph: 0755 233 979 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GPS:	S:	28.235	240°		E:	153.531027°
CL	IENT:	WREN	N PTY LT	D									TEST F	PIT I.D	.: ТР	12
PF	ROJEC	T: LOT	16 (No.2	25) TER	RANOR	A ROA	D. BANG	ORA POINT					JOB N	o.: GI	3953-	-b
-							,			1.0						
EC	JOINN	/IENT IN	TPE: 5.5		KUBOI	A		BUCKET SI	ZE: 400mm	i x 1.0m			PAGE	: 1 01	1	
Method	Water	Depth (m)	Graphic Log				Mat	terial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Struc	ture and additional observation
Π		-		(CI-C	CH) Sand	ly Silty	CLAY: M	edium to high pla	asticity, Dry (w <wp),< td=""><td></td><td></td><td></td><td></td><td>FILL</td><td></td></wp),<>					FILL	
				Red,	/brown											
		2.0_														
		-		Boul	lders and	d cobb	les (crusl	hed and angular)				7				
		-														
		_														
		2.5_														
		-														
		-														
		3.0														
		_														
		-														
		_														
		3.5_														
		-														
		-														
		4.0_														
		-														
Т	 Р <u>12</u> Т	4.5_ ERMIN	∣ ATED A1	2.9m	– Гіміт	OF F	ΧΟΑΛΤ		ΟΝΤΙΝΙΙΔΙ	CAVE IN	1					
H	N	NETHOD		WE	ATHERIN	IG		CONSISTENCY / D	ENSITY / ROC	K STRENGTH	1			SAM	PLES / T	ESTS
)	Auger D	rilling	EW HW/	Extrem	nely	VS S	Very Soft Soft	D	Dense	2	U()	Undi	sturbe	d (size i	in mm)
M	S	Mud Sup	oport	DW	Disting	tly	F	Firm	Fb	Friable	-	BS	Bulk	Sample	е	
NN	VILC	Rock Cor	ring	MW	Moder	rately	St	Stiff	ELw	Extremely	Low	DCP	Dyna	mic Co	one Per	etrometer
RR	2	Rock Rol	ler	SW	Slightly	y	VSt มห	Very Stiff	VLw	Very Low		SPT	Stan	dard Pe	enetror	neter Test
		Tri Cone	BUCKET	г	riesn		VL	Very Loose	M	Medium		VS	Vane	ber of Shear	UIUWS 1	01 381 / 300mm
w	В	Wash Bo	ore				L	Loose	Н	High		A	Acid	Sulfate	e Sampl	e
_		WATER					MD	Medium Dense	VH	Very High		PP	Pock	et Pen	etrome	ter (kPa)
	▼	Water Le	evel	1077-	d Dur			Data	21/12/10	Charl	(ad P		1	Det		21/01/10
1	-	water 3	chage	Logge	u by:	JDAA		Date:	ZT/TZ/T8	Cneck	eu By:	JV	1	Dat	le:	21/01/18

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486 Ph: 0755 233 979 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

CLUENT: WRENA PTY LTD TEST PTILLD: TP 33 PRDIECT: LDT 16 (No.225) TERRANDRA ROAD, BANDRA POINT JOB No.: G1 395-b EQUIPMENT TYPE: S.S TONNE KUBOTA BUCKET SIZE: 450mm x 3.5m PACE: 1 of 1 Verifying gift gift Maserial Description gift gift gift gift 0										GPS:	S:	28.235	237°		E:	153.530449°	
PROJECT: LOT 16 (No. 225) TERRANORA ROAD, BANDRA POINT JOB No.: G1 3953-b EQUIPMENT TYPE: 5.5 TONNE KUBOTA BUCKET SIZE: 450mm x 3.5m PAGE: 10.1 1 View 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 0 </td <td>CLIENT</td> <td>: WREN</td> <td>N PTY LT</td> <td>D</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>TEST I</td> <td>PIT I.D</td> <td>.: ТР</td> <td>13</td> <td></td>	CLIENT	: WREN	N PTY LT	D									TEST I	PIT I.D	.: ТР	13	
THELE THELE The Control of the Control			16 (No 2	25) TER										o · G	3053.	.h	
EQUIPMENT TYPE: 5.5 TONKE KUBOTA BUCKET SIZE: 4.50mm x 3.5m PAGE: 1.01 10 0 <td>PROJEC</td> <td></td> <td>10 (110.2</td> <td></td> <td>NANUN</td> <td></td> <td>D, BANO</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>JOBIN</td> <td>U.. GI</td> <td>3933-</td> <td>-0</td> <td></td>	PROJEC		10 (110.2		NANUN		D, BANO						JOBIN	U. . GI	3933-	-0	
Weiger Bill Open Signation Open Signation Open Signation Open Signation Structure and additionation observation 10	EQUIPN	MENT TY	PE: 5.5	TONNE	KUBOT	A		BUCKET S	ZE: 450mm	ו x 3.5m			PAGE	: 1 of	1		
B ICO Clayey GRAVE: Fine to coarse gravel, With sand, Cobbles L- 0.5 Image: Comparison of throughout, Moist, Grey/brown MD 0.5 Image: Comparison of throughout, Moist, Grey/brown MD 1.5 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 1.5 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 1.5 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 1.5 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 1.5 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 2.0 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 1.1 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 2.0 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 1.1 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 3.0 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 3.0 Image: Comparison of throughout, Dry, Grey Image: Comparison of throughout, Dry, Grey 1.1 Image: Comparison of throughout, Dry, Grey Image: Comparison of througho	Water	Depth (m)	Graphic Log				Mate	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Strue	cture and additio observation	nal
Image: State	TR	- - 0.5_ - - 1.0_		(GC) throu (GP) throu	Clayey ughout, Sandy (ughout,	GRAVE Moist, GRAVEI Dry, G	L: Fine to Grey/brc	coarse gravel, V own coarse gravel, V	With sand, Co Vith cobbles	obbles	L- MD				FILL		
Image: constraint of the second se		 1.5 2.0		(CI) S grav	Sandy Cl el, Mois Silty CLA	LAY: M t, Dark Y: Meo	edium pla red/brov dium plas	asticity, Fine to o vn and orange/b ticity, With sanc	coarse sand, brown I, Moist (w≈v	With w _p), Dark	St - VSt	_			RESII	DUAL	
3.0_ - -		- 2.5_ - -		red/	brown a	ind dar	k orange,	/brown									
TP 13 TERMINATED AT 2.8m – LIMIT OF INVESTIGATION METHOD WEATHERING CONSISTENCY / DENSITY / ROCK STRENGTH SAMPLES / TESTS AD Auger Drilling EW Extremely VS Very Soft D Dense U() Undisturbed (size in mm) C Casing HW Highly S Soft VD Very Dense D Disturbed MS Mud Support DW Distinctly F Firm Fb Friable BS Bulk Sample NMLC Rock Coring MW Moderately St Stiff ELw Extremely Low DCP Dynamic Cone Penetrometer RR Rock Roller SW Slightly VSt Very Stiff VLw Very Low SPT Standard Penetrometer Test TB Toothed Bucket F Fresh Hd Hard Lw Low N Number of blows for SPT / 300mm VL Very Loose M Medium VS Vane Shear L Loose H High A Acid Sulfate Sample PP Pocket Penetrometer (kPa)		3.0_ - - 3.5_ - 4.0_ - - 4.5_															
INE I HOD WEAT I HERING CONSISTENCY / DENSITY / ROCK STRENGTH SAMPLES / TESTS AD Auger Drilling EW Extremely VS Very Soft D Dense U() Undisturbed (size in mm) C Casing HW Highly S Soft VD Very Dense D Disturbed MS Mud Support DW Distinctly F Firm Fb Friable BS Bulk Sample NMLC Rock Coring MW Moderately St Stiff ELw Extremely Low DCP Dynamic Cone Penetrometer RR Rock Roller SW Slightly VSt Very Stiff VLw Very Low SPT Standard Penetrometer Test TB Toothed Bucket F Fresh Hd Hard Lw Low N Number of blows for SPT / 300mm VL Very Loose M Medium VS Vane Shear L Loose H High A Acid Sulfate Sample PP Pocket Penetrometer (kPa) Water Level Water Level <	TP 13 T	TERMIN	ATED A	2.8m			IVESTIG	ATION						<u> </u>	DI 52 (
	AD C MS NMLC RR TB TC WB	METHOD Auger Dr Casing Mud Sup Rock Cor Rock Rol Toothed Tri Cone Wash Bo WATER Water Le Water Se	rilling port ing ler Bucket re evel eepage	WE, EW HW DW MW SW F	ATHERIN Extren Highly Distinc Moder Slighth Fresh	IG nely ctly rately y	VS F St VSt Hd VL L MD	UNSISTENCY / D Very Soft Soft Firm Stiff Very Stiff Hard Very Loose Loose Medium Dense	ENSITY / ROC D VD Fb ELW VLW LW M H VH 21/12/18	K STRENGT Dense Very Dens Friable Extremely Very Low Low Medium High Very High	H /Low	U() D BS DCP SPT N VS A PP	Undi Distu Bulk Dyna Stan Num Vane Acid Pock	SAMI sturbed Irbed Sample amic Co dard Pe ber of Sulfate et Pene	PLES / 1 d (size e one Per enetror blows f e Samp etrome te:	IESTS in mm) netrometer neter Test for SPT / 300mm le ter (kPa) 31/01/10)

 Unit 3/42 Machinery Drive, Tweed Heads South
 NSW
 2486

 Ph: 0755 233 979
 Fax: 0755 233 981
 Fax: 0755 233 981

ENGINEERING LOG – TEST PIT PROFILE

										GPS:	S:	28.235	516°		E:	153.529928°
CL	IENT:	WRENN	PTY LT)									TEST I	PIT I.D	.: ТР	14
DE			(No 22											a · C	1 205 2	h
	OJEC	1: LUT 16	D (INO.22	.5) IEK	KANUK		D, BANU						JOPIN	0. : G	1 2922-	U
EC	QUIPN	ΙΕΝΤ ΤΥΡ	E: 5.5 T	ONNE	кивот	A		BUCKET	SIZE: 450mn	า			PAGE	: 1 of	1	
Method	Water	Depth (m)	Graphic Log				Mate	erial Description	n		Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Struc	ture and additional observation
ТВ				(CI) S bould	ilty CLA ders, M	Y: Meo oist (w	dium plas	ticity, Trace of k orange/brow	sand and cob n and red/bro	bles and wn					RESID	DUAL
		-														
		4.5_														
TP	9 14 T	ERMINA	TED AT	2.4m -	- LIMIT		IVESTIG	ATION								
	1	VETHOD		WE/		NG	() / (CONSISTENCY /	DENSITY / ROC	K STRENGTH	I			SAM	PLES / T	ESTS
)	Auger Drilli Casing	ing	EW HW	Extren Highly	nely	vs s	very Soft Soft	ט עע	Dense Very Dense	2		Undi Disti	isturbe irbed	a (size i	in mm)
M	S	Mud Suppo	ort	DW	Disting	ctly	F	Firm	Fb	Friable	-	BS	Bulk	Sample	e	
NN	- /ILC	Rock Corin	g	MW	Mode	rately	St	Stiff	ELw	Extremely	Low	DCP	Dyna	amic Co	one Pen	etrometer
RR		Rock Roller	r	SW	Slightl	y	VSt	Very Stiff	VLw	Very Low		SPT	Stan	dard P	enetron	neter Test
TB		Toothed Bu	ucket	F	Fresh		Hd	Hard	Lw	Low		N	Num	ber of	blows f	or SPT / 300mm
TC	D	Tri Cone						very Loose	М н	Medium High			Vane Acid	e Shear Sulfate	- Samnl	P
	в Г	WATER	:				MD	Medium Dens	e VH	Very High		PP	Pock	et Pen	etrome	ter (kPa)
	•	Water See	page	Logge	d By:	JDW		Date:	21/12/18	Check	ed By:		1	Dat	te:	31/01/19

PHOTOGRAPHIC LOG

APPENDIX 6

. * * * * * * * * * * * * * * * * * * * * * * * * *







