

Common Ground Property NSW P/L
C/- Precise Planning



Preliminary Wastewater Assessment:
Rezoning Application,
45 Noongah Street and 25 Gwynn
Hughes Street, Bargo, NSW

ENVIRONMENTAL



WATER



WASTEWATER



GEOTECHNICAL



CIVIL



PROJECT
MANAGEMENT



P1504816JR03V01
March 2017

Copyright Statement

Martens & Associates Pty Ltd (Publisher) is the owner of the copyright subsisting in this publication. Other than as permitted by the Copyright Act and as outlined in the Terms of Engagement, no part of this report may be reprinted or reproduced or used in any form, copied or transmitted, by any electronic, mechanical, or by other means, now known or hereafter invented (including microcopying, photocopying, recording, recording tape or through electronic information storage and retrieval systems or otherwise), without the prior written permission of Martens & Associates Pty Ltd. Legal action will be taken against any breach of its copyright. This report is available only as book form unless specifically distributed by Martens & Associates in electronic form. No part of it is authorised to be copied, sold, distributed or offered in any other form.

The document may only be used for the purposes for which it was commissioned. Unauthorised use of this document in any form whatsoever is prohibited. Martens & Associates Pty Ltd assumes no responsibility where the document is used for purposes other than those for which it was commissioned.

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is provide a water management assessment report in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and Common Ground Property NSW P/L C/- Precise Planning (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Martens & Associates Pty Ltd derived the data in this report primarily from a number of sources which may include for example site inspections, correspondence regarding the proposal, examination of records in the public domain, interviews with individuals with information about the site or the project, and field explorations conducted on the dates indicated. The passage of time, manifestation of latent conditions or impacts of future events may require further examination / exploration of the site and subsequent data analyses, together with a re-evaluation of the findings, observations and conclusions expressed in this report.


In preparing this report, Martens & Associates Pty Ltd may have relied upon and presumed accurate certain findings (or absence thereof) relative to the site. Except as otherwise stated in the report, Martens & Associates Pty Ltd has not attempted to verify the accuracy of completeness of any such information (including for example survey data supplied by others).

The findings, observations and conclusions expressed by Martens & Associates Pty Ltd in this report are not, and should not be considered an opinion concerning the completeness and accuracy of information supplied by others. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings and conclusions are based solely upon site conditions, information and drawings supplied by the Client *etc.* in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Martens & Associates Pty Ltd and the Client. Martens & Associates Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

© March 2017
Copyright Martens & Associates Pty Ltd
All Rights Reserved

Head Office
Suite 201, 20 George Street
Hornsby, NSW 2077, Australia
ACN 070 240 890 ABN 85 070 240 890
Phone: +61-2-9476-9999
Fax: +61-2-9476-8767
Email: mail@martens.com.au
Web: www.martens.com.au

Document and Distribution Status							
Author(s)		Reviewer(s)		Project Manager		Signature	
Robert Mehaffey		Jeff Fulton Andrew Norris		Jeff Fulton			
Revision No.	Description	Status	Release Date	Document Location			
				File Copy	Precise Planning		
1	Preliminary Wastewater Assessment	Final	08.03.17	1P, 1H, 1E	1P		

Distribution Types: F = Fax, H = Hard copy, P = PDF document, E = Other electronic format. Digits indicate number of document copies.

All enquiries regarding this project are to be directed to the Project Manager.



Contents

1 OVERVIEW.....	5
1.1 Background	5
1.2 Development Proposal	5
2 SITE DESCRIPTION	6
2.1 Summary	6
2.2 Sub-Surface Conditions	7
2.3 Climate Data	8
3 WASTEWATER ASSESSMENT	10
3.1 Individual System Wastewater Management	10
3.2 Soil Capability Assessment	10
3.3 Preliminary Land Capability Assessment for On-site Effluent Re-use	11
3.4 Hydraulic Load Estimations	14
3.5 Effluent Application Rates for Sub-Surface Irrigation	14
3.6 Soil, Water and Nutrient Modelling Summary	15
3.7 Buffer Setbacks for Effluent Reuse Area	16
3.8 Irrigation Requirements	16
3.9 Summary and Recommendations	17
4 REFERENCES	18
5 ATTACHMENT A – SITE PLANS.....	19
6 ATTACHMENT B – BOREHOLE LOGS.....	21
7 ATTACHMENT C – LAB RESULTS	31
8 ATTACHMENT D – NUTRIENT AND WATER BALANCE MODELS	34
9 ATTACHMENT E – NOTES ABOUT THIS REPORT	41

1 Overview

1.1 Background and Objectives

Martens & Associates (MA) has prepared this wastewater assessment to support a rezoning application for large lot residential subdivision at 45 Noongah St and 25 Gwynn Hughes St, Bargo, NSW ('the site'). This report provides an assessment of on-site wastewater management requirements and land capability.

The objectives of this report include:

- Assessment of the suitability of soil at the site to accommodate effluent irrigation.
- Identification of areas which are unsuitable for irrigation (including buffer setbacks).
- Identification of wastewater management systems most appropriate for the proposed development.
- Assessment of a preliminary design irrigation area for the proposed systems.

1.2 Development Proposal

We understand that the proposed development layout is conceptual only and for the purposes of rezoning application. The proposal seeks to rezone the site to allow residential subdivision with a minimum lot size of 4000m².

The assessment is prepared in accordance with the following guidelines:

- Australian/ New Zealand Standard 1547 (2012) - *On site Domestic Wastewater Management*
- Department of Local Government, NSW Environment Protection Authority, NSW Health Department, NSW Department of Land and Water Conservation and the NSW Department of Urban Affairs and Planning (1998) - *Environment and Health Protection Guidelines - On-site Sewage Management for Single Households*.
- Wollondilly Shire Council (2011) – *On-site Sewage Management System and Greywater Re-use Policy*

2 Site Description

2.1 Summary

A summarised site description is provided in Table 1. A site contour survey plan is provided in Attachment A.

Table 1: Site description summary.

Element	Description/Detail
Site Address	45 Noongah Street and 25 Gwynn Street, Bargo, NSW
Site Area	20.695 ha
Lot/DP	Lot 22 DP619150 and Lot 95 DP13116
Existing site development	Single storey dwelling and associated sheds in eastern portion of site have been removed.
Aspect	East
Typical slopes	<5 %
Existing vegetation	Trees and grasses.
Neighbouring environment	The site is surrounded by rural residential allotments to the north and east. Bushland to the west and south.
Local Government Area (LGA)	Wollondilly Shire Council
Easements	None based on review of survey and site investigation.
Drainage	Hornes Creek, which forms a major tributary of the Bargo River, bisects the site and flows in a generally northerly direction. An east west orientated drainage depression, located in the eastern portion of the site, flows into Hornes Creek.
Geology	The Wollongong Port Hacking 1:100,000 Geological Series Sheet (1985) describes the geology being at the boundary of Wianamatta Group and Hawkesbury Sandstone. Wianamatta Group consisting of laminate and dark-grey siltstone. Hawkesbury Sandstone consisting of medium to coarse-grained quartz sandstone, very minor shale and laminate lenses.

2.2 Sub-Surface Conditions

An initial scoping study was completed for the client on October 30, 2013 which involved the excavation of eight boreholes (BH101 – BH108) using a hydraulic auger to a maximum depth of 3.0m below ground level (mbgl). Borehole testing locations are shown on the site testing plan in Attachment A, detailed borehole logs are provided in Attachment B.

Borehole observations indicate the site is made up of two primary soil landscape units (LU), (Attachment A). The shale derived eastern portion (LU1) consisting of deeply weathered clays and the sandstone/siltstone derived western section (LU2) consisting of fine sandy clays over shallow rock (0.4 – 1.3 mbgl).

The natural soil and rock profile of LU1 is generally comprised of:

- Top soils (A horizon): Brown, weakly structured silty clay loam ranging between 0.0 – 0.6 mbgl.
- Sub-soil (B horizon): Brown, weakly structured sandy clay ranging from 0.6 – 0.8 mbgl overlying red/orange, weakly structured, light to medium clay ranging from 0.8 - 2.3 mbgl.
- Bedrock: Red - with grey mottles, extremely weathered, extremely weak shale ranging from 2.3 – 2.5 mbgl.

The natural soil and rock profile of LU2 is generally comprised of:

- Top soils (A horizon): Brown, poorly structured silty clay loam ranging between 0.0 – 0.2 mbgl.
- Sub-soil (B horizon): Brown, poorly structured sandy clay ranging from 0.2 – 1.3 mbgl, overlying bedrock.
- Bedrock: Orange/brown, extremely weathered, extremely weak sandstone/siltstone.

Soil characteristics are summarised in Tables 2 and 3 with detailed borehole logs in Attachment B.

Table 2: Summary of typical soil horizon characteristics for LU1.

Layer	Depth (m) ¹	Agricultural Classification	Soil Permeability Category ²
Silty clay loam	0.0 – 0.6	SiCL	4b
Sandy clay	0.6 – 0.8	SC	5b
Light medium clay	0.8 – 2.3	LMC	5b

Notes:

¹ Depth varies – indicative only.

² In accordance with Table 8 of NSW Department of Local Government *et al.* (NSW DLG, 1998).

Table 3: Summary of typical soil horizon characteristics for LU2.

Layer	Depth (m) ¹	Agricultural Classification	Soil Permeability Category ²
Silty clay loam	0.0 – 0.2	SiCL	4b
Sandy clay	0.2 – 1.3	SC	5b

Notes:

¹ Depth varies – indicative only.

² In accordance with Table 8 of NSW DLG (1998).

2.3 Climate Data

The nearest rainfall station with adequate data is at Buxton (Amaroo, rain station 068166, rainfall 1966 – present) and nearest station with evaporation records is Badgerys Creek (station 61351, 1967-1984 present). These stations are considered generally representative of the site. A comparison of median rainfall and evaporation is provided in Table 4.

Table 4: Comparison of rainfall and Class A Pan evaporation data for the site.

Month	Median Monthly Rainfall (mm)	Median Monthly Class A Pan Evaporation (mm)	Rainfall Surplus Rainfall – Evap. (mm)
January	81.30	177.10	-95.80
February	82.30	141.40	-59.10
March	64.40	137.40	-73.00
April	43.10	103.60	-60.50
May	34.20	65.70	-31.50
June	35.60	49.00	-13.40
July	22.20	56.80	-34.60
August	21.00	86.80	-65.80
September	38.80	116.20	-77.40
October	55.80	141.20	-85.40
November	59.50	152.00	-92.50
December	63.00	187.30	-124.30
Annual	602.20	1415.00	-813.30

The comparison shows a rainfall to evaporation deficit of -813.3 mm per year.

3 Wastewater Assessment

3.1 Individual System Wastewater Management

An individual onsite wastewater treatment system is recommended for each lot. The system should consist of a NSW Department of Health (DoH) approved aerated wastewater treatment system (AWTS) or equivalent. The system would likely consist of a single or dual tank treatment system for each dwelling and an irrigation system designed in accordance with AS/NZS 1547 (2012) *On-Site Domestic Wastewater Management* standard. For the purposes of the application, this assessment has evaluated wastewater irrigation areas for a 5 bedroom dwelling which will help guide subdivision design.

The AWTS should generally be located to allow gravity drainage of sewage to the AWTS within each site and would treat effluent to a secondary treatment standard as a minimum (see Table 5).

Table 5: Assumed secondary treatment standards.

Parameter	Secondary Standard
BOD ₅ (mg/L)	30
Suspended Solids (mg/L)	30
Faecal Coliforms (CFU/100mL)	30
Total Phosphorus (mg/L)	10
Total Nitrogen (mg/L)	25

3.2 Soil Capability Assessment

Four soil samples were tested for soil chemical properties, summarised in Table 6, with the laboratory report provided in Attachment C.

Table 6: Summary of soil assessment according to criteria specified in NSW Department of Local Government *et al.* (1998).

Parameter	Value	Limitations
pH (1:5)	4.5 – 4.7	Moderate
ECe (dS/m)	<0.1	Minor
CEC (cmol(+)/kg)	5.4 – 10.5	Moderate
P-sorption (mg P/kg soil)	567 ¹ – 662 ²	Moderate

Notes:

¹ Equal to P-sorption of 8,505 kg/ha for 1 m of soil with bulk density 1.5 T/m³ in LU2.

² Equal to P-sorption of 9,930 kg/ha for 1 m of soil with bulk density 1.5 T/m³ in LU1.

Moderate limitations posed by CEC and pH are not considered significant as site soils currently support excellent vegetation growth and wastewater irrigation is not expected to negatively impact these factors.

Limitation potential posed by P-Sorption and CEC is further assessed through nutrient budget analysis.

3.3 Preliminary Land Capability Assessment for On-site Effluent Re-use

Suitability for on-site effluent re-use in proposed irrigation areas is assessed according to Tables 4 and 6 of the NSW Department of Local Government *et al.* (NSW DLG, 1998) and summarised in Table 7.

Table 7: Site suitability for on-site effluent management systems, according to NSW Department of Local Government *et al.* (1998).

Feature	Details of Irrigation Areas	Limitation Rating
Flood potential ¹	All irrigation areas are above 1 in 20 year flood levels	Minor
Sun and wind exposure	High	Minor
Slope (%)	<5 %	Minor
Landform	Site is generally flat with portions of the site being <5 %	Minor
Erosion potential	None – low erosion potential	Minor
Site drainage	Hornes Creek bisects the site	Minor
Fill	No significant fill present on site	Minor
Rock outcrop	None observed during investigation	Minor
Geology	No major discontinuities	Minor
Depth to bedrock (m)	Generally >1.0 m in LU1	Minor
	Average of 0.8 m in LU2	Moderate
Depth to water table (m)	>1.0 m	Minor
Soil permeability Category	4b, 5b (both LUs)	Minor/Moderate
Coarse fragments (%)	Generally 0 – 20%	Minor

Land capability assessment reveals most site features represent a minor limitation to effluent disposal.

Moderate limitation posed by depth to bedrock in LU2 is addressed by generally low hydraulic loading rates is taken into account in nutrient balance calculations.

Moderate limitation posed by soil permeability category will be addressed in water and nutrient balance assessment (Section 3.6).

During site inspection, Hornes Creek was observed to be a series of disconnected ponds and is therefore an intermittent creek. According to NSW Department of Local Government *et al.* (1998) a 40 m buffer is

recommended to intermittent waterways. This buffer could possibly be reduced further by methods such as tertiary treatment of effluent.

3.4 Hydraulic Load Estimations

Design hydraulic load for the proposed development scenario is noted in Table 8 and has been calculated using allowances from Table H1 of AS/NZS 1547 (2012) and two persons for the first bedroom plus one for every other bedroom. We note that it is assumed the subdivision will be connected to main reticulated water supply.

These values are based on a conservative scenario of 5 bedrooms per dwelling. For each individual dwelling a site specific assessment is to be conducted to determine individual lot's wastewater needs.

Table 8: Design wastewater loads.

Bedrooms	Design Occupants	Recommended Wastewater Flow Allowance (L/p/d) ¹	Design Wastewater Load (L/p/d)
5	6	150	900

Notes:

¹ Based on reticulated water supply (Table H1, AS/NZS 1547, 2012).

3.5 Effluent Application Rates for Sub-Surface Irrigation

Soil properties and corresponding recommended design irrigation rates (DIRs) according to AS/NZS 1547 (2012) for LU1 and LU2 are given in Table 9 and 10 respectively. These are based on site investigations and assumptions of soil properties based on our experience in similar soil environments.

Table 9: DIR and soil properties for LU1.

Soil Category	Depth (m) ¹	Texture	Structure	Indicative Permeability (K _{sat}) (m/d)	Design Irrigation Rate (DIR) (mm/day)
Topsoil	0.0 – 0.6	SiCL	Weakly structured	0.12 – 0.5	3.5
Subsoil	0.6 – 2.3	SC/LMC	Weakly structured	<0.06	3
				Adopted design irrigation rate	3.5

Notes:

¹ Depth of soil horizons varies across the site.

Table 10: DIR and soil properties for LU2.

Soil Category	Depth (m) ¹	Texture	Structure	Indicative Permeability (K _{sat}) (m/d)	Design Irrigation Rate (DIR) (mm/day)
Topsoil	0.0 – 0.2	SiCL	Weakly structured	0.12 – 0.5	3.5
Subsoil	0.2 – 1.3	SC	Weakly structured	<0.06	3
				Adopted design irrigation rate	3.5

Notes:

¹ Depth of soil horizons varies across the site.

3.6 Soil, Water and Nutrient Modelling Summary

Details of the model outputs are summarised in Attachment D of this report. Sustainable irrigation areas for LU1 and LU2 are summarised in Tables 10 and 11 respectively.

Table 11: Modelling summary LU1: area required for sustainable irrigation.

Method	Area Required (m ²)
No of Bedrooms	5
Water Balance ¹	503
Nitrogen Uptake	411
Phosphorus Saturation	254
AS/NZS 1547: 2012 ²	257 (514 including reserve)
Adopted Design Area	514

Notes:

¹ Area where no wet weather storage is required.

² AS/NZS 1547 (2012) recommends that a reserve field of 100% of the primary field area be retained for use should it be required. Required area shown in parenthesis.

Table 12: Modelling summary LU2: area required for sustainable irrigation.

Method	Area Required (m ²)
No of Bedrooms	5
Water Balance ¹	503
Nitrogen Uptake	411
Phosphorus Saturation	331
AS/NZS 1547: 2012 ²	Surface irrigation: 257 (514 including reserve)
	Subsurface irrigation: 300 (600 including reserve)
Adopted Design Area	514 (Surface irrigation)
	600 (subsurface irrigation)

Notes:

¹ Area where no wet weather storage is required.

² AS/NZS 1547 (2012) recommends that a reserve field of 100% of the primary field area be retained for use should it be required. Required area shown in parenthesis.

3.7 Buffer Setbacks for Effluent Reuse Area

Irrigation field areas are located with buffers in accordance with DLG et al. (1998), with recommended buffers summarised in Table 12.

Table 13: Adopted buffer setbacks in accordance with AS/NZS 1547 (2012).

Site feature	Recommended setback range (m)
Drainage channels and farm dams	40
Site boundaries, and roads	3/6 ¹
Dwellings and buildings	3/6 ¹ or 15 ²

Notes:

¹ x/y buffer distance downslope/upslope of feature respectively.

² Buffer distance of 15m if a surface irrigation system is used.

These buffer setbacks shall be used for subdivision and future dwelling design purposes and have been included on the constraints plan in Attachment A.

3.8 Irrigation Requirements

Irrigation areas for individual systems are recommended to be either fenced surface spray or shallow subsurface irrigation systems with laterals installed parallel to site contours at 1 m intervals in accordance with AS/NZS 1547 (2012). Appropriate delivery mains with non-return

valves and flushing lines would need to be installed in the irrigation system.

If surface irrigation (spray) was preferred, irrigation areas would be required to be fenced and sign posted to restrict access. Scattered trees (that are to be retained) in irrigation areas should be managed by appropriate exclusion zones for buried pipework from the base of trunks. Establishment of tree protection zone (TPZ's) should be assured by an appropriately qualified arborist and implemented through a landscape management layout.

3.9 Summary and Recommendations

Assessment of on-site wastewater management assuming 5 bedroom dwellings has been conducted to determine site specific requirements and land capability constraints to then guide subdivision layout design.

An adapted design area of 514 - 600m² (depending on irrigation system and soil landscape) is required for each 5 bedroom dwelling for sustainable irrigation. Wastewater load and irrigation area may be amended for each dwelling in light of proposed dwelling size, design and number of bedrooms.

4 References

Australian / New Zealand Standard 1547 (2012), *On-site domestic wastewater management*

Australian Bureau of Statistics – *Census (2011) community profile for NSW*

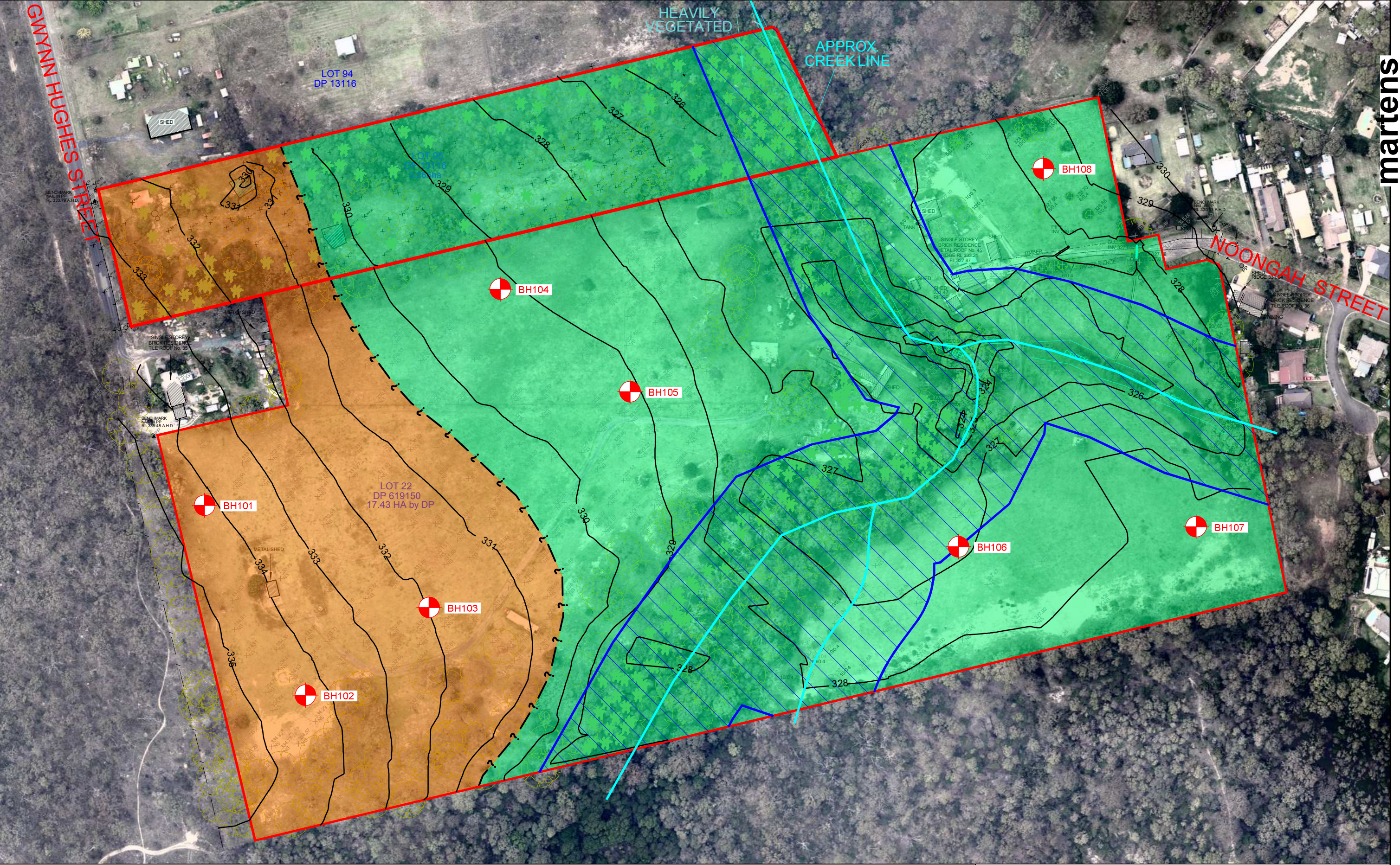
Department of Local Government, NSW Environment Protection Authority, NSW Health Department, NSW Department of Land and Water Conservation and the NSW Department of Urban Affairs and Planning (1998), *Environment and Health Protection Guidelines - On-site Sewage Management for Single Households*

NSW Department of Primary Industries, The Wollongong Port Hacking 1:100,000 Geological Series (1985)

Specialist Study Requirements – 45 Noongah Street and 25 Gwynn Hughes Street, Bargo.


Wollondilly Shire Council (2011) – *On-site Sewage Management System and Greywater Re-use Policy*


5 Attachment A – Site Plans





martens

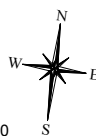

KEY:

 BOREHOLE LOCATION AND IDENTIFIER

 LANDSCAPE UNIT 1 (SHALE DERIVED)

 LANDSCAPE UNIT 2 (SANDSTONE DERIVED)

 40m INTERMITTENT WATERWAY AND DRAINAGE CHANNEL BUFFER

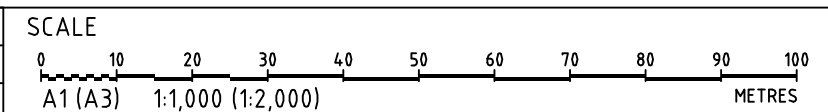

UNITS - METRES


Martens & Associates Pty Ltd ABN 85 070 240 890		Environment Water Wastewater Geotechnical Civil Management					
Drawn:	GMT	SITE PLAN 45 NOONGAH STREET, BARGO		Drawing No./ID:			
Approved:	JF			FIGURE 1			
Date:	7/8/2015						
Scale @A3:	1:2000	Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 Email: mail@martens.com.au Internet: http://www.martens.com.au			Project: P1504816	File: JD04V01	Revision: A

(C) Copyright Martens & Associates Pty Ltd
This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd



REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	FOR REZONING APPLICATION	7/03/2017	JCF	JCF	JSF	JSF



GRID
MGA

DATUM
m AHD

PROJECT MANAGER
JSF

CLIENT
PRECISE PLANNING

PROJECT NAME/PLANSET TITLE
REZONING APPLICATION

45 NOONGAH ST & 25 GWYNN HUGHES RD
BARGO, NSW

DISCLAIMER & COPYRIGHT
This plan must not be used for construction unless signed as approved by principal certifying authority.
All measurements in millimetres unless otherwise specified.
This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd.
(C) Copyright Martens & Associates Pty Ltd

Consulting Engineers
Environment
Water
Geotechnical
Civil

Suite 201 / 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE				
WASTEWATER CONSTRAINTS PLAN				
PROJECT NO.	PLANSET NO.	ISSUE NO.	DRAWING NO.	REVISION
P1504816	PS00	N/A	SK-A100	A

FILE C:\USERS\JFRECKER\WORK\LOCAL\TEMP\BRC\A100-1\DWG - PRINTED 07/03/2017 - USER JFRECKER

6 **Attachment B – Borehole Logs**

CLIENT	Precise Planning	COMMENCED	30.10.13	COMPLETED	30.10.13	REF BH101																																			
PROJECT	Wastewater Assessment	LOGGED	GMT	CHECKED	JF	Sheet 1 of 1																																			
SITE	45 Noongah St, Bargo, NSW	GEOLOGY	Sandstone	VEGETATION	Grass	PROJECT NO. P1303944																																			
EQUIPMENT	Mechanical Auger	EASTING	NA	RL SURFACE	NA																																				
EXCAVATION DIMENSIONS	Ø95mm X 2.9m depth	NORTHING	NA	ASPECT	East	SLOPE	<5%																																		
EXCAVATION DATA		MATERIAL DATA				SAMPLING & TESTING																																			
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	MATERIAL DESCRIPTION	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS																												
SOIL NAME, plasticity or particle characteristics, colour, secondary and minor components, moisture condition, consistency/relative density, ROCK NAME, grain size, texture/fabric, colour, strength, weathering.																																									
V	Nil	N	D	0.2			SL	SILTY CLAY LOAM - Brown, organics, trace sand (<5%), weakly structured. Grades to			B	0.1	3944/101/ 0.1																												
V	Nil	N	D	0.4			SC	SANDY CLAY - Brown, siltstone gravels (2-10mm, 20%), fine to medium grained.			B	0.3	3944/101/ 0.3																												
V	Nil	N	D	0.6			EW	EXTREMELY WEAK SANDSTONE - Orange brown, fine to medium grained, extremely weathered.			B	0.5	3944/101/ 0.5																												
TC	Nil	N	D	1.0			VW	VERY WEAK SANDSTONE - Orange brown, fine to medium grained, highly weathered.			B	1.2	3944/101/ 1.2																												
TC	Nil	N	D	2.0			VW-W	VERY WEAK TO WEAK SANDSTONE - White, fine to medium grained, moderately weathered.			B	2.1	3944/101/ 2.1																												
				3.0				Borehole terminated at 2.9m on very weak to weak sandstone.																																	
				4.0																																					
				4.5																																					
EQUIPMENT / METHOD N Natural exposure X Existing excavation BH Backhoe bucket HA Hand auger S Spade CC Concrete Corer V V-Bit TC Tungsten Carbide Bit PT Push tube														SUPPORT SH Shoring SC Shotcrete Nil No support				WATER N None observed X Not measured Water level Water outflow Water inflow		MOISTURE D Dry M Moist W Wet Wp Plastic limit Wl Liquid limit		PENETRATION L Low M Moderate H High R Refusal		CONSISTENCY VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard F Friable		DENSITY VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense		SAMPLING & TESTING A Auger sample B Bulk sample U Undisturbed sample D Disturbed sample M Moisture content Ux Tube sample (x mm)		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION N USCS Y Agricultural											
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																																									
martens (C) Copyright Martens & Associates Pty. Ltd . 2015														MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au														Engineering Log - Borehole													

Quality Sheet No. 4

CLIENT	Precise Planning	COMMENCED	30.10.13	COMPLETED	30.10.13	REF BH103																									
PROJECT	Wastewater Assessment	LOGGED	GMT	CHECKED	JF	Sheet 1 of 1																									
SITE	45 Noongah St, Bargo, NSW	GEOLOGY	Sandstone	VEGETATION	Grass	PROJECT NO. P1303944																									
EQUIPMENT	Mechanical Auger	EASTING	NA	RL SURFACE	NA																										
EXCAVATION DIMENSIONS	Ø95mm X 2.9m depth	NORTHING	NA	ASPECT	East	SLOPE	<5%																								
EXCAVATION DATA		MATERIAL DATA				SAMPLING & TESTING																									
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	MATERIAL DESCRIPTION	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS																		
SOIL NAME, plasticity or particle characteristics, colour, secondary and minor components, moisture condition, consistency/relative density, ROCK NAME, grain size, texture/fabric, colour, strength, weathering.																															
V	Nil	N	D	0.15			SCL	SILTY CLAY LOAM - Brown, organics, trace sand (<5%), weakly structured.			B	0.1	3944/103/ 0.1																		
V	Nil	N	D	0.9			SC	SANDY CLAY - Brown, siltstone gravels (2-10mm, 20%), fine to medium grained.			B	0.7	3944/103/ 0.7																		
V	Nil	N	D	1.4			EW	EXTREMELY WEAK SANDSTONE - Orange brown, fine to medium grained, extremely weathered.			B	1.3	3944/103/ 1.3																		
TC	Nil	N	D	1.8			VW-W	VERY WEAK TO WEAK SANDSTONE (With clay like properties) - Red to brown, fine to medium grained, extremely weathered.			B	1.8	3944/103/ 1.8																		
TC	Nil	N	D	2.9			VW-W	WEAK SANDSTONE - Light brown, fine to medium grained, slightly weathered.			B	2.3	3944/103/ 2.3																		
				3.0				Borehole terminated at 2.9m on very weak to weak sandstone.																							
EQUIPMENT / METHOD N Natural exposure X Existing excavation BH Backhoe bucket HA Hand auger S Spade CC Concrete Corer V V-Bit TC Tungsten Carbide Bit PT Push tube														SUPPORT SH Shoring SC Shotcrete RB Rock Bolts Nil No support				WATER N None observed X Not measured Water level Water outflow Water inflow		MOISTURE D Dry M Moist W Wet Wp Plastic limit Wl Liquid limit		PENETRATION L Low M Moderate H High R Refusal		CONSISTENCY VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard F Friable		DENSITY VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense		SAMPLING & TESTING A Auger sample B Bulk sample U Undisturbed sample D Disturbed sample M Moisture content Ux Tube sample (x mm)		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION N USCS Y Agricultural	
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																															
martens													MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au																		
Engineering Log - Borehole																															

CLIENT		Precise Planning		COMMENCED	30.10.13	COMPLETED	30.10.13	REF BH104	
PROJECT		Wastewater Assessment		LOGGED	BM	CHECKED	JF	Sheet 1 of 1	
SITE		45 Noongah St, Bargo, NSW		GEOLOGY	Shale	VEGETATION	Grass	PROJECT NO. P1303944	
EQUIPMENT		Mechanical Auger		EASTING	NA	RL SURFACE	NA		
EXCAVATION DIMENSIONS		Ø95mm X 2.5m depth		NORTHING	NA	ASPECT	East	SLOPE	<5%

EXCAVATION DATA				MATERIAL DATA				SAMPLING & TESTING					
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	MATERIAL DESCRIPTION	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS
V	Nil	N	D	0.15			SICL	SILTY CLAY LOAM - Brown, organics, trace sand (<5%), weakly structured.			B	0.1	3944/104/ 0.1
V	Nil	N	D	0.6			SC	SANDY CLAY - Light brown, with grey mottles, fine to medium grained sand, weakly structured.	S-F		B	0.25	3944/104/ 0.25
V	Nil	N	D	1.0			LC	LIGHT CLAY - Red, with minor grey mottles, weakly structured.	St		B	0.65	3944/104/ 0.65
V	Nil	N	D	2.0				Becoming stiff at 2.0m.			B	1.35	3944/104/ 1.35
V	Nil	N	D	2.2			EW	EXTREMELY WEAK SHALE - Red, with grey mottles, highly weathered.			B	2.0	3944/104/ 2.0
V	Nil	N	D	2.5				Borehole terminated at 2.5m on extremely weak shale.			B	2.5	3944/104/ 2.5
				3.0									
				4.0									
				4.5									

EQUIPMENT / METHOD	SUPPORT	WATER	MOISTURE	PENETRATION	CONSISTENCY	DENSITY	SAMPLING & TESTING	CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
N Natural exposure	SH Shoring	N None observed	D Dry	L Low	VS Very Soft	VL Very Loose	A Auger sample	pp Pocket penetrometer
X Existing excavation	SC Shotcrete	X Not measured	M Moist	M Moderate	S Soft	L Loose	B Bulk sample	S Standard penetration test
BH Backhoe bucket	RB Rock Bolts	Water level	W Wet	H High	F Firm	MD Medium Dense	U Undisturbed sample	VS Vane shear
HA Hand auger	Nil No support	Water outflow	Wp Plastic limit	R Refusal	St Stiff	D Dense	D Disturbed sample	DCP Dynamic cone penetrometer
S Spade		Water inflow	WL Liquid limit		VSt Very Stiff	VD Very Dense	M Moisture content	FD Field density
CC Concrete Corer					H Hard		Ux Tube sample (x mm)	WS Water sample
V V-Bit					F Friable			
TC Tungsten Carbide Bit								
PT Push tube								

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

(C) Copyright Martens & Associates Pty. Ltd . 2015

MARTENS & ASSOCIATES PTY LTD


Suite 201, 20 George St, Hornsby, NSW 2077 Australia


Phone: (02) 9476 9999 Fax: (02) 9476 8767

mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - Borehole

CLIENT	Precise Planning	COMMENCED	30.10.13	COMPLETED	30.10.13	REF BH105																																			
PROJECT	Wastewater Assessment	LOGGED	BM	CHECKED	JF	Sheet 1 of 1																																			
SITE	45 Noongah St, Bargo, NSW	GEOLOGY	Shale	VEGETATION	Grass	PROJECT NO. P1303944																																			
EQUIPMENT	Mechanical Auger	EASTING	NA	RL SURFACE	NA																																				
EXCAVATION DIMENSIONS	Ø95mm X 2.5m depth	NORTHING	NA	ASPECT	East	SLOPE	<5%																																		
EXCAVATION DATA		MATERIAL DATA				SAMPLING & TESTING																																			
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	MATERIAL DESCRIPTION	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS																												
SOIL NAME, plasticity or particle characteristics, colour, secondary and minor components, moisture condition, consistency/relative density, ROCK NAME, grain size, texture/fabric, colour, strength, weathering.																																									
V	Nil	N	D	0.6			SCL	SILTY CLAY LOAM - Brown, organics, trace sand (<5%), weakly structured.			B	0.1	3944/105/ 0.1																												
								Grades to			B	0.25	3944/105/ 0.25																												
											B	0.65	3944/105/ 0.65																												
V	Nil	N	D	1.0			SC	SANDY CLAY - Brown, siltstone gravels (2-10mm, 20%), fine to medium grained, weakly structured.	S		B	1.25	3944/105/ 1.25																												
				2.0				Becoming orange at 1.9m.	F-St		B	2.0	3944/105/ 2.0																												
				2.5							B	2.3	3944/105/ 2.3																												
				3.0				Borehole terminated at 2.5m on sandy clay.																																	
				4.0																																					
				4.5																																					
EQUIPMENT / METHOD N Natural exposure X Existing excavation BH Backhoe bucket HA Hand auger S Spade CC Concrete Corer V V-Bit TC Tungsten Carbide Bit PT Push tube														SUPPORT SH Shoring SC Shotcrete RB Rock Bolts Nil No support				WATER N None observed X Not measured Water level Water outflow Water inflow		MOISTURE D Dry M Moist W Wet Wp Plastic limit WI Liquid limit		PENETRATION L Low M Moderate H High R Refusal		CONSISTENCY VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard F Friable		DENSITY VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense		SAMPLING & TESTING A Auger sample B Bulk sample U Undisturbed sample D Disturbed sample M Moisture content Ux Tube sample (x mm)		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION N USCS Y Agricultural											
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																																									
martens (C) Copyright Martens & Associates Pty. Ltd . 2015														MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au														Engineering Log - Borehole													

CLIENT		Precise Planning		COMMENCED		30.10.13		COMPLETED		30.10.13		REF		BH107	
PROJECT		Wastewater Assessment		LOGGED		BM		CHECKED		JF		Sheet		1 of 1	
SITE		45 Noongah St, Bargo, NSW		GEOLOGY		Shale		VEGETATION		Grass		PROJECT NO.		P1303944	
EQUIPMENT		Mechanical Auger		EASTING		NA		RL SURFACE		NA					
EXCAVATION DIMENSIONS		Ø95mm X 2.5m depth		NORTHING		NA		ASPECT		East		SLOPE		<5%	
EXCAVATION DATA				MATERIAL DATA				SAMPLING & TESTING							
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	MATERIAL DESCRIPTION	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS		
V	Nil	N	D	0.1	[Pattern]	[Pattern]	SCL	SILTY CLAY LOAM - Brown, organics, trace sand (<5%), weakly structured.			B	0.1	3944/107/ 0.1		
				0.35								B	0.25	3944/107/ 0.25	
V	Nil	N	D	0.8	[Pattern]	[Pattern]	LC	SILTY CLAY - Brown/red, weakly structured.	S-F		B	0.65	3944/107/ 0.65		
				1.0											
V	Nil	N	D	2.0	[Pattern]	[Pattern]	MC	MEDIUM CLAY - Red, with orange mottles, weakly structured.	St		B	1.25	3944/107/ 1.25		
				2.1											
TC	Nil	N	D	2.3	[Pattern]	[Pattern]	EW	EXTREMELY WEATHERED SHALE - Orange, with red/white mottles.			B	2.3	3944/107/ 2.3		
				2.5											
				3.0				Borehole terminated at 2.5m on extremely weathered shale.							
				4.0											
				4.5											
EQUIPMENT / METHOD		SUPPORT	WATER	MOISTURE	PENETRATION	CONSISTENCY	DENSITY	SAMPLING & TESTING		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION					
N Natural exposure		SH Shoring	N None observed	D Dry	L Low	VS Very Soft	VL Very Loose	A Auger sample		pp Pocket penetrometer					
X Existing excavation		SC Shotcrete	X Not measured	M Moist	M Moderate	S Soft	L Loose	B Bulk sample		S Standard penetration test					
BH Backhoe bucket		RB Rock Bolts	Water level	W Wet	H High	F Firm	MD Medium Dense	U Undisturbed sample		VS Vane shear					
S Spade		Nil No support	Water outflow	Wp Plastic limit	R Refusal	St Stiff	D Dense	D Disturbed sample		DCP Dynamic cone penetrometer					
CC Concrete Corer			Water inflow	WI Liquid limit		VSt Very Stiff	VD Very Dense	M Moisture content		FD Field density					
V V-Bit						H Hard		Ux Tube sample (x mm)		WS Water sample					
TC Tungsten Carbide Bit						F Friable									
PT Push tube															
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS															
 (C) Copyright Martens & Associates Pty. Ltd . 2015		MARTENS & ASSOCIATES PTY LTD Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au						Engineering Log - Borehole							

CLIENT	Precise Planning	COMMENCED	30.10.13	COMPLETED	30.10.13	REF BH108							
PROJECT	Wastewater Assessment	LOGGED	BM	CHECKED	JF	Sheet 1 of 1							
SITE	45 Noongah St, Bargo, NSW	GEOLOGY	Shale	VEGETATION	Grass	PROJECT NO. P1303944							
EQUIPMENT	Mechanical Auger	EASTING	NA	RL SURFACE	NA								
EXCAVATION DIMENSIONS	Ø95mm X 2.5m depth	NORTHING	NA	ASPECT	East	SLOPE	<5%						
EXCAVATION DATA		MATERIAL DATA				SAMPLING & TESTING							
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	MATERIAL DESCRIPTION	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS
								SOIL NAME, plasticity or particle characteristics, colour, secondary and minor components, moisture condition, consistency/relative density, ROCK NAME, grain size, texture/fabric, colour, strength, weathering.					
V	Nil	N	D				SCL	SILTY CLAY LOAM - Brown, organics, trace sand (<5%), weakly structured.			B	0.1	3944/108/ 0.1
				0.5				Grades to			B	0.35	3944/108/ 0.35
V	Nil	N	D				LC	SILTY CLAY - Brown/red, weakly structured.	St		B	1.0	3944/108/ 1.0
				2.0							B	2.0	3944/108/ 2.0
V	Nil	N	D				MC	MEDIUM CLAY - Red, with orange mottles, weakly structured.	St		B	2.3	3944/108/ 2.3
				2.5				Borehole terminated at 2.5m in clay.					
				3.0									
				4.0									
				4.5									
EQUIPMENT / METHOD		SUPPORT	WATER	MOISTURE	PENETRATION	CONSISTENCY	DENSITY	SAMPLING & TESTING		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION			
N Natural exposure		SH Shoring	N None observed	D Dry	L Low	VS Very Soft	VL Very Loose	A Auger sample		pp Pocket penetrometer			
X Existing excavation		SC Shotcrete	X Not measured	M Moist	M Moderate	S Soft	L Loose	B Bulk sample		S Standard penetration test			
BH Backhoe bucket		RB Rock Bolts	Water level	W Wet	H High	F Firm	MD Medium Dense	U Undisturbed sample		VS Vane shear			
S Spade		Nil No support	Water outflow	Wp Plastic limit	R Refusal	St Stiff	D Dense	D Disturbed sample		DCP Dynamic cone penetrometer			
CC Concrete Corer			Water inflow	WI Liquid limit		VSt Very Stiff	VD Very Dense	M Moisture content		FD Field density			
V V-Bit						H Hard		Ux Tube sample (x mm)		WS Water sample			
TC Tungsten Carbide Bit						F Friable							
PT Push tube													
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS													
<div><div><div><div>Martens</div><div>(C) Copyright Martens & Associates Pty. Ltd . 2015</div></div></div><div><div>MARTENS & ASSOCIATES PTY LTD</div><div>Suite 201, 20 George St, Hornsby, NSW 2077 Australia</div><div>Phone: (02) 9476 9999 Fax: (02) 9476 8767</div><div>mail@martens.com.au WEB: http://www.martens.com.au</div></div><div><div>Engineering Log -</div><div>Borehole</div></div></div>													

7 Attachment C – Lab Results

SOIL TEST REPORT

Page 1 of 2

Scone Research Centre

REPORT NO: SCO13/308R1

REPORT TO: J Fulton
Martens & Associates Pty Ltd
6/37 Leighton Place
Hornsby NSW 2077

REPORT ON: Four soil samples
Job: P1303944

PRELIMINARY RESULTS
ISSUED: Not issued

REPORT STATUS: Final

DATE REPORTED: 20 November 2013

METHODS: Information on test procedures can be obtained from Scone
Research Centre

TESTING CARRIED OUT ON SAMPLE AS RECEIVED
THIS DOCUMENT MAY NOT BE REPRODUCED EXCEPT IN FULL



SR Young
(Laboratory Manager)

SOIL CONSERVATION SERVICE
Scone Research Centre

Page 2 of 2

Report No: SCO13/308R1
Client Reference: J Fulton
Martens & Associates Pty Ltd
6/37 Leighton Place
Hornsby NSW 2077

Lab No	Method	C1A/5	C2A/4	C2B/4	C5A/4 CEC & exchangeable cations (me/100g)							C8B/1		P9B/2	P18B/3 AWC (%)		
	Sample Id	EC (dS/m)	pH	pH (CaCl ₂)	CEC	Na	K	Ca	Mg	Al	ESP (%)	P sorp (mg/kg)	P sorp index	EAT	FC 0.1bar	WP 15bar	AWC
1	3944/103/0.1	0.02	5.8	4.6	6.1	0.1	0.3	3.5	1.6	0.8	2	334	2.6	3(1)	19	8	11
2	3944/103/0.7	0.01	6.1	4.7	6.0	0.2	0.1	1.2	2.9	0.5	3	625	4.1	5	19	10	9
3	3944/107/0.25	0.01	5.8	4.5	5.4	0.2	0.1	1.3	1.7	1.1	4	585	3.9	5	29	11	18
4	3944/107/0.65	0.02	6.0	4.5	10.5	0.6	0.2	0.8	5.9	1.2	6	777	5.3	5	27	17	10

AWC = moisture content (%) by weight



END OF TEST REPORT

8 Attachment D – Nutrient and Water Balance Models

Effluent Disposal Field - Annual Nutrient Balance Assessment

Method ST-14 Revised 20.3.2007



Suite 201, 20 George Street, Hornsby, NSW 2077, Ph: (02) 9476 999 Fax: (02) 9476 8767, mail@martens.com.au, www.martens.com.au

PROJECT DETAILS

Project	45 NOONGAH ST AND 25 GWYNN HUGHES ST, BARGO			Ref. No.	P1504816JS01V01
Author	GMT	Reviewed	JSF	Date Created	19/08/2015

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit
Treatment System	AWTS	-
Effluent flow rate	900	L/day - Based on 5 bedroom dwelling (west portion)
Effluent N	25.0	mg/L
Effluent P	10.0	mg/L
Design soil depth	0.85	m
Soil P-sorption	283.0	mg/kg
Plant N uptake	200.0	kg/ha/year
Plant P uptake	20.0	kg/ha/year

STEP 2 : ASSESSMENT

NITROGEN BUDGET FOR RE-USE FIELD

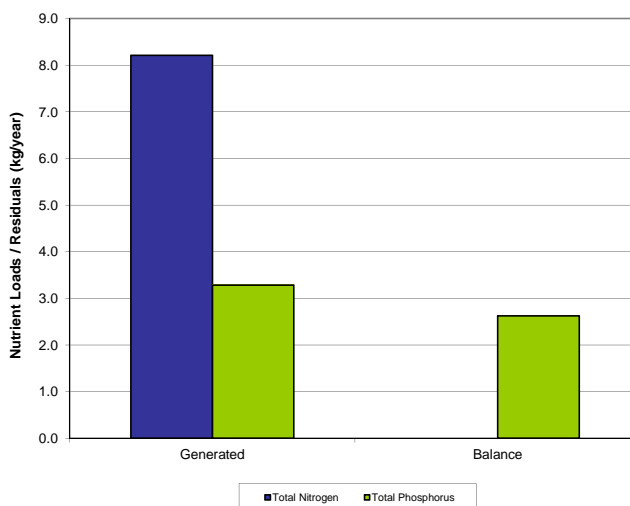
N generated	8.21	kg/year
N consumed	8.21	kg/year
N balance	0.00	kg/year
Min Area	411	m ²

PHOSPHORUS BUDGET FOR RE-USE FIELD

P generated	3.29	kg/year
P consumed	0.66	kg/year
P balance	2.62	kg/year
P sorption	131.2	kg P/design soil depth
Field life (for P)	50.0	Years
Min Area	331	m ²

MINIMUM NUTRIENT ASSIMILATION AREA

Minimum Area	411	m ²
--------------	-----	----------------



Effluent Disposal Field - Annual Nutrient Balance Assessment

Method ST-14 Revised 20.3.2007



Suite 201, 20 George Street, Hornsby, NSW 2077, Ph: (02) 9476 999 Fax: (02) 9476 8767, mail@martens.com.au, www.martens.com.au

PROJECT DETAILS

Project	45 NOONGAH ST AND 25 GWYNN HUGHES ST, BARGO			Ref. No.	P1504816JS01V01
Author	GMT	Reviewed	JSF	Date Created	19/08/2015

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit	
Treatment System	AWTS	-	
Effluent flow rate	900	L/day	- Based on 5 bedroom dwelling (east portion)
Effluent N	25.0	mg/L	
Effluent P	10.0	mg/L	
Design soil depth	1.00	m	
Soil P-sorption	331.0	mg/kg	
Plant N uptake	200.0	kg/ha/year	
Plant P uptake	20.0	kg/ha/year	

STEP 2 : ASSESSMENT

NITROGEN BUDGET FOR RE-USE FIELD

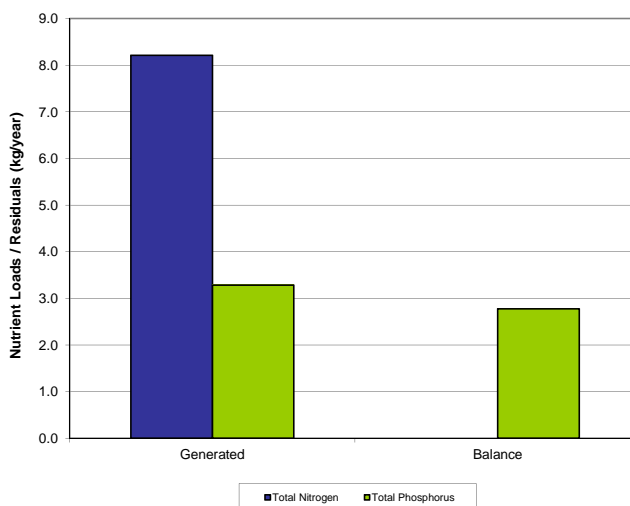
N generated	8.21	kg/year
N consumed	8.21	kg/year
N balance	0.00	kg/year
Min Area	411	m ²

PHOSPHORUS BUDGET FOR RE-USE FIELD

P generated	3.29	kg/year
P consumed	0.51	kg/year
P balance	2.78	kg/year
P sorption	138.8	kg P/design soil depth
Field life (for P)	50.0	Years
Min Area	254	m ²

MINIMUM NUTRIENT ASSIMILATION AREA

Minimum Area	411	m ²
--------------	-----	----------------



Effluent Disposal Field - Water Balance Assessment

Method ST-XX, Revised 11.8.2010



Suite 201, 20 George Street, Hornsby, NSW 2077, Ph: (02) 9476 999 Fax: (02) 9476 8767, mail@martens.com.au, www.martens.com.au

PROJECT DETAILS

Project	45 Noongah and 25 Gwynn Hughes Street, Bargo, NSW		
Author	RM	Reviewed	JF

Ref. No.	P1504816
Date Created	21.02.2017

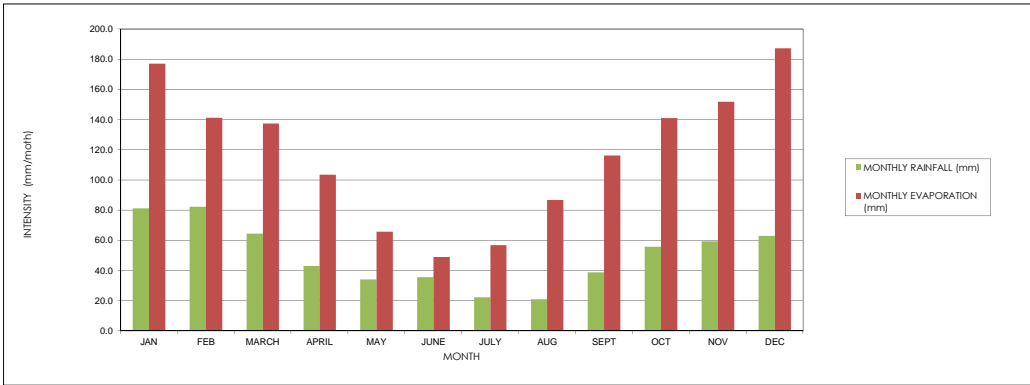
STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit	Notes		
Runoff Factor - RF	0.35	%		Design Irrigation Rate - DIR	3.5
Daily Effluent Load - DEL	900	L	- Based on 5 bedroom dwelling	Wet-Weather Storage (KL)	0.0
Effluent Disposal Area - A	503.0	m ²			
Design Percolation Rate (DPR)	1.5	mm/day			

STEP 2 : ENTER CLIMATE DATA

Source(s):	Evaporation data - Badgerys Creek McMasters Firestation (067068) 1967 - 1984
	Rainfall data - Buxton (Amaroo) NSW (068166) 1966 - 2013

MONTH	MONTHLY RAINFALL (mm)	MONTHLY EVAPORATION (mm)
	Enter Data	Enter Data
JAN	81.30	177.10
FEB	82.30	141.40
MARCH	64.40	137.40
APRIL	43.10	103.60
MAY	34.20	65.70
JUNE	35.60	49.00
JULY	22.20	56.80
AUG	21.00	86.80
SEPT	38.80	116.20
OCT	55.80	141.20
NOV	59.50	152.00
DEC	63.00	187.30



STEP 3 : ASSESSMENT

MONTH	NUMBER OF DAYS	MONTHLY RAINFALL (mm)	RETAINED RAINFALL	MONTHLY EVAPORATION	CROP FACTOR	EVAPO-TRANSPIRATION RATE	DESIGN PERCOLATION	AVAILABE IRRIGATION CAPACITY	EFFLUENT APPLIED	APPLICATION RATE	INCREASE IN PONDING DEPTH OF EFFLUENT	CUMULATIVE PONDING DEPTH OF EFFLUENT FROM PREVIOUS MONTH	DEPTH OF EFFLUENT	PONDING DEPTH OF EFFLUENT	WET-WEATHER STORAGE REQUIRED
-	(days)	(mm/month)	(mm/month)	(mm/month)	-	(mm/month)	(mm/day)	(mm/month)	(L/month)	(mm/month)	(mm)	(mm)	(mm/month)	(mm)	(KL)
-	DAY	R	RR = R x (1- RF)	E	CF	ETR = E x CF	DP = DPR x DAYS	AIC = ETR - RR +DP	EA = DEL x DAY	AR = EA / A	D = (AIC - AR)	CPD = PD from previous month	DE = D + CPD	PD	WWS
JAN	31	81.30	52.8	177.10	0.80	141.7	46.5	135.3	27900	55.5	-79.9	0.0	-79.9	0.0	0.0
FEB	28	82.30	53.5	141.40	0.80	113.1	42.0	101.6	25200	50.1	-51.5	0.0	-51.5	0.0	0.0
MARCH	31	64.40	41.9	137.40	0.80	109.9	46.5	114.6	27900	55.5	-59.1	0.0	-59.1	0.0	0.0
APRIL	30	43.10	28.0	103.60	0.80	82.9	45.0	99.9	27000	53.7	-46.2	0.0	-46.2	0.0	0.0
MAY	31	34.20	22.2	65.70	0.65	42.7	46.5	67.0	27900	55.5	-11.5	0.0	-11.5	0.0	0.0
JUNE	30	35.60	23.1	49.00	0.65	31.9	45.0	53.7	27000	53.7	0.0	0.0	0.0	0.0	0.0
JULY	31	22.20	14.4	56.80	0.65	36.9	46.5	69.0	27900	55.5	-13.5	0.0	-13.5	0.0	0.0
AUG	31	21.00	13.7	86.80	0.65	56.4	46.5	89.3	27900	55.5	-33.8	0.0	-33.8	0.0	0.0
SEPT	30	38.80	25.2	116.20	0.80	93.0	45.0	112.7	27000	53.7	-59.1	0.0	-59.1	0.0	0.0
OCT	31	55.80	36.3	141.20	0.80	113.0	46.5	123.2	27900	55.5	-67.7	0.0	-67.7	0.0	0.0
NOV	30	59.50	38.7	152.00	0.80	121.6	45.0	127.9	27000	53.7	-74.2	0.0	-74.2	0.0	0.0
DEC	31	63.00	41.0	187.30	0.80	149.8	46.5	155.4	27900	55.5	-99.9	0.0	-99.9	0.0	0.0