Mr Elias, Mr Maltese and Mr Petro

C/- AE Design Partnership

martens consulting engineers

Preliminary Onsite Wastewater Assessment:
Lot 2 Sec 4 DP2954
1111-1141 Elizabeth Drive, Cecil Park, NSW

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P1706121JR03V05
August 2020

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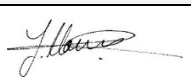
Mohammad Rahman	Andrew Norris Jeff Fulton	Terry Harvey	

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

CONTENTS

1 Overview

1.1 Background

Martens & Associates (MA) has prepared this preliminary onsite wastewater assessment to support a development application (DA) to Fairfield City Council (FCC) for a commercial subdivision at 1111-1141 Elizabeth Drive, Cecil Park, NSW ('the site'), being Lot 2, Sec 4, DP 2954. This report provides a preliminary assessment of on-site wastewater management requirements and land capability.

The most recent version of this report has been prepared due to changes to the subdivision layout which have been instigated as a result of Transport NSW's compulsory acquisition of a portion of the property for the proposed M12 Motorway.

1.2 Objectives

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.
- Preparation of a preliminary wastewater management solution for future lots.

1.3 Development Proposal

With reference to the development plans prepared by AE Design Partnership Pty Ltd (26 May, 2020), the proposed subdivision will include 11 commercial lots and associated internal access roads. Proposed scheme plan is provided in Attachment A.

It is understood that Lots 1-5 may potentially include short term accommodation developments in the future. The implications of this on wastewater management has been considered and discussed in Section 4.3.

1.4 Relevant Planning Controls and Design Principles

The assessment is prepared in accordance with the following guidelines and design principles:

- Department of Environment and Conservation (2004) *Environmental Guidelines – Use of Effluent by Irrigation*.
- 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.*
- Fairfield City 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.

Table 1: Site description summary.

Item	Description / Detail
Site address and Lot/DP	1111-1141 Elizabeth Drive, Cecil Park, NSW (Lot 2 Sec 4 DP 2954).
Approximate area[2]	7.38 ha (Project Surveyors, 2017)
Local Government Area (LGA)[1]	Fairfield City Council (FCC).
Current zoning and land use	The site is currently zoned as SEPP (Western Sydney Parklands) 2009. Residential accommodation is prohibited, certain commercial/educational buildings/activities are permitted and certain commercial activities requires consent.
Proposed land use	Commercial subdivision.
Site description	Rural residential lot with cleared pastoral land, dwelling and multiple sheds and stockpiles.
Surrounding land uses	Low density residential to the north, cleared pastoral land and tree cover to the east and south, new housing development being constructed to the west.
Topography	Located within slightly undulating terrain. Site elevation ranges from approximately 117 m AHD at street level on the south of the site to approximately 100 m AHD at the northern site boundary (Project Surveyors, 2017).
Expected geology	The Penrith *1:100,000 Geological Series Sheet 9030* (1991) describes site geology as Bringelly Shale consisting of shale, carbonaceous claystone, claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff. The NSW Environment and Heritage eSPADE website identifies the site as having soils of the Luddenham variety consisting of shallow dark podzolic soils or massive earthy clays on crests; moderately deep red podzoic soils on upper slopes; moderately deep yellow podzoic soils and praire soils on lower slopes and drainage lines.
Environmental receptors	Site drainage is via overland flow to a tributary of Ropes Creek along the north western site boundary. Ropes Creek is located approximately 3 km to the east of the site.

2.2 Sub-Surface Conditions

2.2.1 Soil and Rock Conditions

A geotechnical investigation was completed by Martens and Associates on 12 January, 2018 which involved the excavation of nine boreholes (BH101 – BH109) using a hydraulic auger to a maximum depth of 4.3 m below ground level (mbgl). Borehole testing locations are shown on the

site testing plan in Attachment A and detailed borehole logs are provided in Attachment B.

The natural soil and rock profile of is generally is agricultural soil classification forms and is comprised of:

- Unit A Topsoil - Silt Loam: Low liquid limit, light brown, weakly structured, trace clay and organic material ranging between 0.0 – 0.5 mBGL.
- Unit B Subsoil - Silty Clay: Medium plasticity, brown / red-brown, moderately structured with trace claystone gravels ranging from 0.0 – 1.6 mBGL.
- Unit C Bedrock - Shale: Brown, inferred very low strength, distinctly weathered, ranging from 0.7 - 2.3 mBGL.

Fill, comprising inferred firm silt loam / silty clay, was encountered in BH101 and BH102 up to approximately 0.7 mBGL and expected to be present in the southern portion. This fill is considered to be "uncontrolled" and has likely been placed for previous development and / or landscaping purposes and sourced from the site.

Table 2: Summary of soil depths.

Borehole Identification	Depth of Layer (mBGL)		
	Silt loam (Unit A)	Silty clay (Unit B)	Shale (Unit C)
BH101	0 – 0.5[3]	0.5 – 1.3[1]	1.3 – 3.3[2]
BH102	-	0.0 – 1.1[1, 3]	1.1 – 2.0[2]
BH103	0 – 0.3	0.3 – 1.0[1]	1.0 – 2.3[2]
BH104	0 – 0.3	0.3 – 0.8[1]	0.8 – 1.1[2]
BH105	0 – 0.3	0.3 – 0.7[1]	0.7 – 1.4[2]
BH106	0 – 0.3	0.3 – 1.0[1]	1.0 – 1.9[2]
BH107	0 – 0.3	0.3 – 0.9[1]	0.9 – 1.6[2]
BH108	0 – 0.5	0.5 - 4.3	-
BH109	0 – 0.1	0.1 – 1.6[1]	1.6 – 1.8[2]

Notes:
[1] V-bit refusal on inferred extremely weathered shale.
[2] TC refusal on inferred highly weathered shale.
[3] Fill material.

Encountered conditions are described in more detail in the borehole logs (Attachment B).

Table 3: Summary of typical soil horizon characteristics

Layer	Agricultural Classification	Soil Permeability Category [1]
Silty Loam	SiL	3a
Silty Clay	SiC	5b

Notes:
[1] In accordance with Table 8 of NSW Department of Local Government *et al*. (NSW DLG, 1998).

2.2.2 Hydrogeological Assessment

A review of the NSW Department of Primary Industries Water (DPIW) real time groundwater bore database revealed that there are no bores located within 500 m of the site.

Groundwater inflow was not encountered during drilling of BH101 to BH107 and BH109 to 3.3 mBGL.

Groundwater inflow was observed during drilling of BH108 at approximately 3.0 mBGL and excavation spoil below this depth, up to investigation termination depth of 4.30 mBGL (top of weathered rock), was encountered in a wet condition. Water is considered to be associated with the nearby drainage depression and small dam.

Should further information on permanent site groundwater levels be required, additional investigations would need to be carried out (i.e. installation of groundwater monitoring bores).

2.3 Climate Data

The nearest rainfall station with adequate data is at Horsley Park Equestrian Centre (Horsley Park, rain station 067119, rainfall 1997 – present) and nearest station with evaporation records is Badgerys Creek (station 067068, 1967-1984). 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	64.2	182.9	-118.7

Month	Median Monthly Rainfall (mm)	Median Monthly Class A Pan Evaporation (mm)	Rainfall Surplus Rainfall – Evap. (mm)
February	93.3	151.2	-57.9
March	57.3	136.4	-79.1
April	61.6	99	-37.4
May	27.7	65.1	-37.4
June	54.5	51	3.5
July	30.4	58.9	-28.5
August	26.7	89.9	-63.2
September	22.1	120	-97.9
October	48.4	142.6	-94.2
November	57.2	168	-110.8
December	61.4	201.5	-140.1
Annual	**604.8**	**1466.5**	**-861.7**

The comparison shows a rainfall to evaporation deficit of -861.7 mm per year.

3 Onsite Wastewater Assessment

This section of the report has been prepared to determine if an on-site system (i.e. on-site treatment & disposal) is possible for the development.

3.1 Individual Lot Wastewater Management Solution

A typical onsite wastewater treatment system for each lot would consist of a secondary sewage treatment system and an irrigation system designed in accordance with AS/NZS 1547 (2012) *On-site domestic wastewater management* standard.

The sewage treatment system should, where possible generally be located to allow gravity drainage of sewage and treat effluent to the standard shown in 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

3.2.1 Overview

Nine (9) boreholes were excavated on the site. The boreholes were located to characterise site soil characteristics. Attachment B provides full borehole log sheets. These showed a generally consistent soil profile across the site. All boreholes undertaken have also been logged in accordance with soil agricultural classification scheme for wastewater purposes.

3.2.2 Soil Permeability

Evaluation of soil permeability has been conducted using AS/NZS 1547 (2012) and the Department of Local Government *et al.* (1998) texture / structure analyses technique. Suitability of topsoil / subsoil for effluent irrigation is determined using this classification technique. Design

Irrigation Rates (DIR) are determined based on topsoil / subsoil texture and structure (Table 6).

Table 6: Design irrigation rates (AS/NZS 1547, 2012) and permeability classifications (DLG *et al*. 1998).

Soil Texture	Agricultural Classification	Design Irrigation Rate (mm/day)	DLG et al. (1998) Classification	Suitability Class
Silt Loam (Topsoil)	SiL	3.5	3a	Minor limitation
Silty Clay (Subsoil)	SiC	3.0	5b	Moderate limitation

With respect to permeability, the silty clay subsoil is a moderate limitation for sub-surface effluent irrigation/application. This limitation will be addressed in water and nutrient balance assessment (Section 3.6).

Design irrigation rate (DIR) is addressed by adopting AS/NZS1547/2012. Soils would be sufficiently permeable to assimilate applied wastewater without allowing excessive leaching to lower soil profiles or deep groundwater, thus maximising the potential for effluent evapo-transpiration and nutrient assimilation.

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]	Majority of the site is above the 1 in 20 year flood levels	Minor
Sun and wind exposure	High	Minor
Slope (%)[1]	< 10 %	Minor
Landform[1]	Convex and concave side slopes	Minor
Erosion potential[1]	No signs present	Minor
Site drainage[1]	Good	Minor
Fill	Fill present	Moderate

Feature	Details of Irrigation Areas	Limitation Rating
Rock outcrop	<10%	Minor
Geology	No major discontinuities	Minor
Depth to bedrock (m)	Generally >1.0 m	Minor
Depth to water table (m)	>1.0 m	Minor
Soil permeability category	3a, 5b	Minor/Moderate
Coarse fragments (%)	Generally 0 – 20%	Minor

Notes:
[1] These are major and moderate limitations associated with areas on the site impacted by flooding (i.e. within and adjacent to drainage channels along northwest and northeast boundaries). However as there is no proposed development within these areas they don't pose any limitation to effluent disposal.

The limitation posed by flooding potential has been assessed by GHD in the request for Secretary's Environmental Assessment Requirements (SEARs) for state significant development prepared by AE Design Partnership, November, 2017. AE stated that further investigations into flooding are to be conducted as part of the subsequent EIS process. It is anticipated that effluent disposal areas could be located outside of flood impacted areas.

Moderate limitation posed by fill material and soil permeability category shall be addressed in water and nutrient balance assessment (Section 3.6). Limitations posed by soil permeability have been discussed in Section 3.2.

Additionally, the fill material is consistent with natural site material and will not cause excessively slow drainage nor allow preferential or unacceptably rapid drainage.

3.4 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 8.

Table 8: Adopted buffer setbacks in accordance with DLG *et.al* (1998).

Site feature	Recommended setback range (m)
Drainage channels and farm dams	40
Site boundaries, and roads	3/61
Dwellings and buildings	3/61 or 152

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 to determine if there is sufficient space to safely dispose of effluent on each lot.

3.5 Equivalent Population (EP) and Effluent Area

When considering the overall sewage management solution assessment of sewage generation rates is essential. Table 9 provides initial guidance on likely sewage generation rates based on Table A1 of the Water Services Association of Australia Sewerage Code (2002) guidelines.

When calculating likely sewage generation rates in Litres per day for each commercial lot no detailed development plans were available. Therefore, it was assumed that 70% of the site would be hardstand (commercial building and car parking) with 30% of the site used as landscaped areas. Of the 70% of construction area it is further assumed that half of this area will include the commercial building itself and the remaining half will include car parking. Therefore, building size and EP calculations have been based on an area 35 % of the total proposed lot area.

Average dry weather flows into a sewer from domestic, commercial and industrial sources is defined as 150 L/d/EP (NSW Health, 2016).

Table 9: Design wastewater loads.

Intended Use	Classification [1]	Lot	Equivalent Population (EP) per hectare[1]	Lot Size (m^2) [2]	Building Footprint (BF)[3]	EP per BF[4]	Effluent Generated (Litres/day) [5]
Commercial	Local commercial	1	75	2,511	879	7	1,050
		2	75	2,511	879	7	1,050
		3	75	3,879	1358	11	1,650
		4	75	3,727	1304	10	1,500
		5	75	6,811	2384	18	2,700
		6	75	2,831	991	8	1,200
		7	75	2,087	730	6	900
		8	75	2,087	730	6	900
		9	75	2,087	730	6	900
		10	75	5,084	1779	14	2,100
		11	75	7,767	2718	21	3,150

Notes:
[1] Based on Water Services Association of Australia Sewerage Code (2002) guidelines.
[2] Subdivision layout – drawing number DA04 (25/7/18).
[3] 35 % of total site area.
[4] (BF/10,000) x 75
[5] BF x 150 L/d/EP

3.6 Effluent Application Rates for Irrigation

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

Table 10: DIR and soil properties for site soils.

Soil Category	Depth (m) [1]	Texture	Structure	Indicative Permeability (K_{sat}) (m/d)	Design Irrigation Rate (DIR) (mm/day)
Topsoil	0.0 – 0.3	SiL	Moderately Structured	1.5 – 3.0	3.5
Subsoil	0.3 – 1.4	SiC	Moderately Structured	0.06 – 0.12	3
			Adopted design irrigation rate		**3.0**

Notes:
[1] Depth of soil horizons varies across the site.

3.7 Soil, Water and Nutrient Modelling Summary

To refine the preliminary effluent application design developed using the soil hydraulics methodology of AS / NZS 1547 (2012) a water and nutrient budget has been prepared for the site. Modelling has been based on a nominal flowrate to provide irrigation rates for each method.

Water balance analysis was undertaken using local climate data and the monthly water balance modelling methodology adopted by DEC (2004) and DLG *et al.* (1998). This method allowed for assessment of a range of effluent application rates to determine the required wet-weather storage. Assessment was completed using a nominal 1000 Litres/day effluent flowrate to obtain required irrigation rates for two scenarios: no wet weather storage; and 7 days wet weather storage.

Analysis of nutrient assimilation and uptake by vegetation and soil (p-sorption) has been undertaken using a monthly nutrient balance. Sustainable irrigation rates obtained using water balance and nutrient assimilation rates are provided below in Table 11.

Table 11: A summary of DIR calculated based on soil hydraulics; nutrient; and water balance models.

Method	DIR rate(mm/day) [1]
Nitrogen balance	1.9
Phosphorus balance	2.8
Water balance - no storage [2]	1.4
Water balance - 7 days storage [3]	1.8
AS/NZS 15474 [4]	3.0

Notes:
1. Design based on a daily effluent load of 1,000L.
2. Design based on no wet weather storage.
3. Design based on 7 days wet weather storage.
4. Design Irrigation Rate (DIR) for clay loam subsoils (3.0 mm/day).

The minimum areas required for the management of effluent are provided in Table 12. Analysis of such areas conclude that water balance is the limiting factor for the design of effluent management solutions on the site.

Table 12: Modelling summary: area required for sustainable irrigation per litres / day.

Lot	Area Required (m^2) AS/NZS 1547: 2012	Area Required (m^2) Water Balance (no storage)	Area Required (m^2) Water Balance (7 days storage)	Area Required (m^2) Nitrogen Uptake	Area Required (m^2) Phosphorus Saturation	Adopted Design Area (m^2) with no wet weather storage
1	350	750	583	553	375	750
2	350	750	583	553	375	750
3	550	1,179	917	868	589	1,179
4	500	1,071	833	789	536	1,071
5	900	1,929	1,500	1,421	964	1,929
6	400	857	667	632	429	857
7	300	643	500	474	321	643

Lot	Area Required (m^2) AS/NZS 1547: 2012	Area Required (m^2) Water Balance (no storage)	Area Required (m^2) Water Balance (7 days storage)	Area Required (m^2) Nitrogen Uptake	Area Required (m^2) Phosphorus Saturation	Adopted Design Area (m^2) with no wet weather storage
8	300	643	500	474	321	643
9	300	643	500	474	321	643
10	700	1,500	1,167	1,105	750	1,500
11	1,050	2,250	1,750	1,658	1,125	2,250

3.8 Soil, Water and Nutrient Modelling Summary

The minimum area required for irrigation is dictated by water balance equates to approximately 31% of the lot area not inclusive of appropriate boundary and other setbacks and buffers. Given the expected development will have carparks and buildings covering approximately 70% of each lot, it is neither feasible no environmentally sustainable to dispose of effluents on these lots. Therefore a wastewater collection and pumpout system is recommended as the only viable option to manage wastewater generated from each lot of the proposed development.

4 Recommendations for On-site Wastewater Management

4.1 Recommended Management System

Findings of the onsite wastewater assessment concluded that, in absence of reticulated sewer services, a pumpout system is the most suitable compliant wastewater management solution to service the proposed commercial lots. The site capability assessment confirms that an onsite wastewater management and disposal system for the commercial lots would not be feasible, due to insufficient site area being available with respect to required buffers to disposal areas and intended lot usage.

Sydney Water is likely to provide reticulated sewer to the area within the next 2 to 4 years. Hence, it is expected that pumpout will only be required for a short period of time until a reticulated sewerage system connection becomes available. This is considered to be in accordance with Fairfield City Council (2018) policies and is also the most economically viable solution.

4.2 Correspondence with Fairfield City Council

Communications with Mr Sarid Dashti of Fairfield City Council (03/05/2018) confirmed that FCC assesses sites on an individual basis and will consider the use of pumpout where an onsite effluent management system will not be possible, as is the case on this site.

4.3 Minimum Onsite Wastewater Management Requirements

4.3.1 Developer Advice

The developer has advised that onsite wastewater treatment systems are not the preferred option for the subdivision given the expected timeframe for reticulated town sewer (as well as site constraints). Their preference, due to the nature of the proposed commercial development and intended lot use, is to provide an individual pumpout system for each lot.

4.3.2 Commercial Lots

All related wastewater (staff and visitor toilets, hand basins and staff kitchen facilities) are to be connected to the proposed onsite wastewater collection system.

A pumpout system is proposed for each commercial lot with the following components as a minimum:

- An appropriately sized commercial grease trap (where required for commercial outlets such as food or oil producing businesses).
- A septic tank located adjacent to the approved building. A summary of preliminary septic tank sizes are shown in Table 13.
- New effluent collection well with capacity shown in Table 13. This shall provide for approximately 7 days capacity.

Table 13: Design summary of septic tank and collection well sizes.

Lot	Lot Size (m^2)	Wastewater Generated (L / day)	Minimum Septic Tank Size (L) [1]	Minimum Collection Well Size (L) [2]
1	2,511	1,050	3,000	8,000
2	2,511	1,050	3,000	8,000
3	3,879	1,650	4,000	12,000
4	3,727	1,500	4,000	11,000
5	6,811	2,700	5,000	19,000
6	2,831	1,200	3,000	9,000
7	2,087	900	3,000	7,000
8	2,087	900	3,000	7,000
9	2,087	900	3,000	7,000
10	5,084	2,100	4,000	15,000
11	7,767	3,150	5,000	23,000

Notes:
[1] Septic tank size = 1550 (sludge allowance - NSW Health, 2016) + 1 days flow.
[2] Collection well size = 7 days capacity (NSW Health, 2016).

- New 50 mm Camlock fitting to allow pumpout tanker access. Camlock to be connected to the effluent collection well via a PVC or PE main. Where the connecting main is not covered by suitable 300 mm of soil, mechanical protection will need to be provided.

- Camlock to include marker post with reflector to prevent damage.

- Each collection well on each lot to be fitted with appropriate float switch, alarm and communications system to advise operator when system at 75% capacity.

4.4 Potential Short-Term Accommodation Use

Based on discussions with the Client, it is our understanding that Lots 1-5 have the potential to be used for short term accommodation. The scope of the accommodation has not been made available; however it is possible that the wastewater generated from such a development type may be greater than that indicated in Table 13.

Should greater generation rates be assessed at the DA stage for any development, regardless of whether they are short term accommodation uses of other commercial developments, then septic tank and collection well sizes as provided in Table 13 will need to be recalculated.

4.5 System Maintenance Requirements

General wastewater management system requirements for each lot are as follows:

- Collection wells are sized to require weekly pumpout by pumpout tanker. There are local pumpout contractors available to service the site on a regular basis.

- Septic tank well is to be regularly inspected and periodically (typically 5 – 10 years) pumped out to tanker to remove accumulated solids by pumpout tanker.

- All system pumps, alarms, floats and controls to be periodically maintained in conjunction with the septic tank and effluent collection well.

5 Conclusions and Additional Works

5.1 Additional Works at Detailed Design Stage

Additional works at detailed design include the following as a minimum:

- An wastewater management report will be required for each lot in conjunction with Development Applications to construct commercial buildings. Report shall provide details of the following:
    - Confirmation of building size and use to assess appropriate wastewater generation loads.
    - Treatment system specification, septic tank volume calculation, collection well sizing and required pumpout design (such as location of tanks, tanker stand and suction lines).

Prior to the installation of the sewage management system approval from Council is required under S68 of the Local Government Act. Further approval to operate is required prior to system commissioning.

5.2 General Conclusions

The wastewater management assessment shows that the site is capable of being used for proposed commercial subdivision, provided recommendations given in this report are adhered to in design and construction of the future onsite wastewater management systems.

6 References

1. http://www.bom.gov.au

2. Australian / New Zealand Standard 1547 (2012) – "On-site Domestic Wastewater Management".

3. Australian Bureau of Statistics – Census (2011) - "Community Profile for NSW".

4. Fairfield City Council (2002) – "On-site Sewage Management Strategy".

5. NSW Department of Environment and Conservation (2004) – "Environmental Guidelines – Use of Effluent by Irrigation".

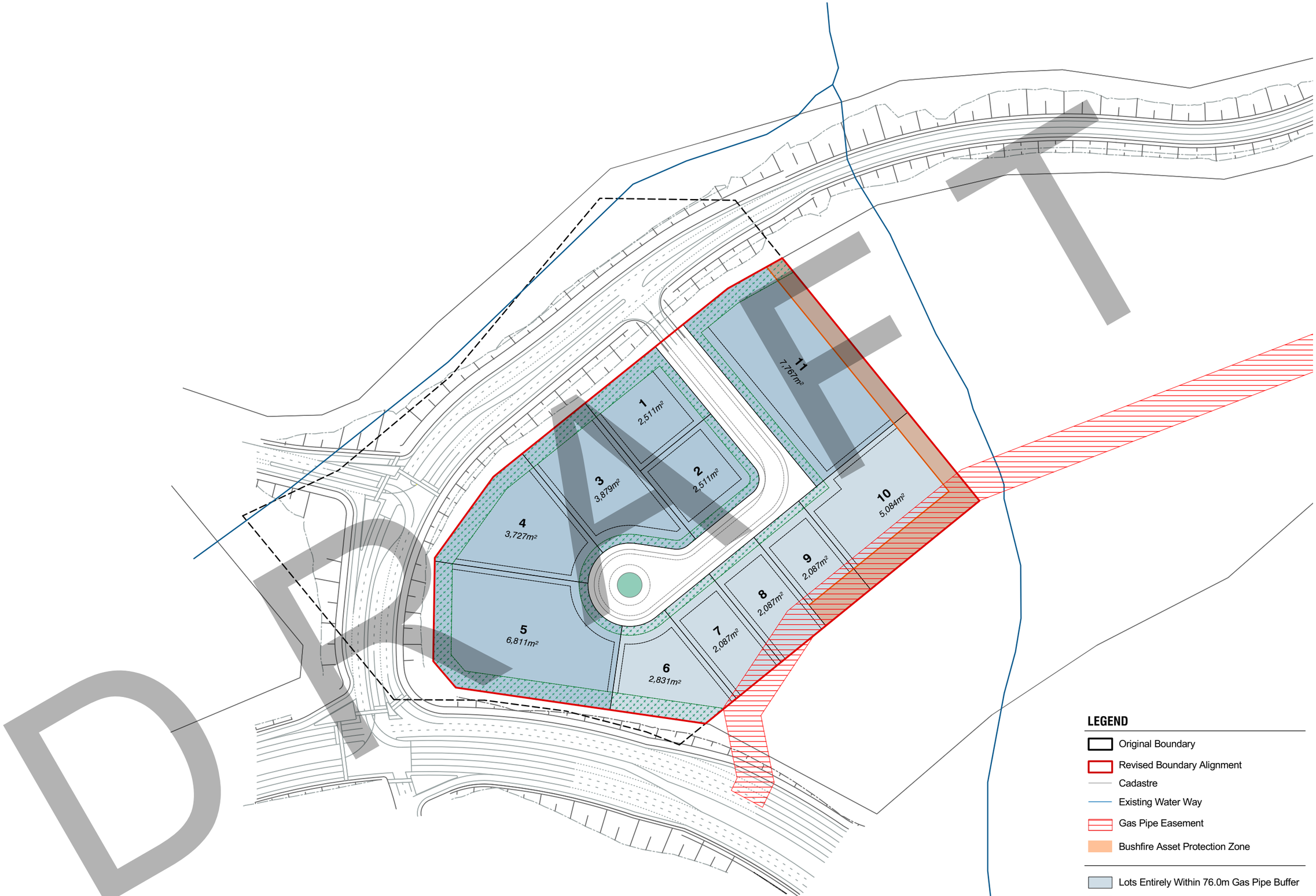
6. NSW Health (2016) – "Sewage Management Facility Vessel Accreditation Guideline (Septic Tanks, Collection Wells, Sewage Ejection Pump Stations, etc.).

7. 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".

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

9. Water Services Association of Australia (2002) – "Sewage Code of Australia Part 1: Planning and Design".

7 Attachment A – Site Plans



LEGEND

- Original Boundary
- Revised Boundary Alignment
- Cadastre
- Existing Water Way
- Gas Pipe Easement
- Bushfire Asset Protection Zone
- Lots Entirely Within 76.0m Gas Pipe Buffer
- Lots Outside 76.0m Gas Pipe Buffer
- Landscaping Setback
- Built Form Setback

PROJECT
1111-1141 ELIZABETH DRIVE,
CECIL PARK

1:2,000 @ A3

TITLE
REVISED CONCEPT

DRAWN	CHECKED	DATE	ISSUE
SB		26/05/2020	A

8 Attachment B – Borehole Logs

KEY

BOARHOLE LOCATIONS

APPROXIMATE SITE BOUNDARY

PRELIMINARY SITE INVESTIGATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	01/02/2018	GM/KW	MV	GT	AN

SCALE
0 7.5 15.0 22.5 30.0 37.5 45.0 52.5 60.0 67.5 75.0 METRES
A1 (A3) 1:750 (1:1,500)

GRID	DATUM	PROJECT MANAGER
		GT

CLIENT
AE DESIGN PARTNERSHIP

PROJECT NAME/PLANSET TITLE
PROPOSED COMMERCIAL SUBDIVISION

1111 - 114 ELIZABETH DRIVE
CECIL PARK , NSW

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
BOREHOLE LOCATIONS

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706121	PS01	R01	PS01-JZ01	A

DRAWING ID: P1706121-PS01-R01-JZ01

PRINTED ---- USER: JSUAREZ

A1 / A3 LANDSCAPE (A1LC_v02.0.01)

CLIENT	Mr Elias & Mr Maltese & Mr Petro.	COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH101**
PROJECT	Prelim. Salinity & Geotechnical Investigation	LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT	4WD ute-mounted drill rig	EASTING		RL SURFACE	114 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 3.30 m depth	NORTHING		ASPECT	NE	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Not Encountered	0	114.00				ML	FILL: Silt LOAM, low liquid limit, light brown, with fine grained gravels, inferred firm, moderate structure.		F	FILL
	M		0.5	*0.50* 113.50	P6121/101/0.5/S/1 D 0.50 m			CI	Silty CLAY, medium plasticity, brown and red-brown, some grey bands, inferred stiff to very stiff, moderate structure.	D	St - VSt	RESIDUAL SOIL
	H		1.0		P6121/101/1.0/S/1 D 1.00 m							
				1.30 112.70					CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 1.30: V-bit refusal.
AD/T	L		1.5		P6121/101/1.5/R/1 D 1.50 m							
			2.0		P6121/101/2.0/R/1 D 2.00 m							
	M		2.5		P6121/101/2.5/R/1 D 2.50 m							
				3.00								
	H		3.0	111.00 *3.30*	P6121/101/3.0/R/1 D 3.00 m				Inferred low strength.			
									Hole Terminated at 3.30 m			3.30: TC-bit refusal on inferred low to medium strength claystone.
			3.5									
			4.0									
			4.5									

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

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH102**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	113.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 2.00 m depth	NORTHING		ASPECT	N	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0.5	113.50	P6121/102/0.1/S/1 D 0.10 m			CL-CI	FILL: Silty CLAY, low to medium plasticity, light brown, grey and red-brown, with fine to medium grained gravels, inferred firm, moderate structure.	D	F	FILL
					P6121/102/0.5/S/1 D 0.50 m							
				0.70								
	M		1.0	112.80	P6121/102/1.0/S/1 D 1.00 m			CI	Silty CLAY, medium plasticity, red-brown, with grey bands, trace claystone gravels, inferred stiff to very stiff, moderate structure.		St - VSt	RESIDUAL SOIL
				1.10								
AD/T	L		1.5	112.40	P6121/102/1.5/R/1 D 1.50 m				CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 1.10: V-bit refusal.
				1.80								
	H		2.0	111.70					Inferred low strength.			
				2.00					Hole Terminated at 2.00 m			2.00: TC-bit refusal on inferred low to medium strength claystone.
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH103**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	107 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 2.30 m depth	NORTHING		ASPECT	NE	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	107.00				ML	TOPSOIL: Silt LOAM, low liquid limit, light brown, with clay, inferred firm, moderate structure.		F	TOPSOIL
				0.30								
				106.70				CI	Silty CLAY, medium plasticity, red-brown, with brown and grey bands, trace claystone gravels, inferred stiff to very stiff, moderate structure.			RESIDUAL SOIL
	M		0.5		P6121/103/0.5/S/1 D 0.50 m					D	St - VSt	
					P6121/103/0.9/S/1 D 0.90 m							
			1.0	*1.00*								
AD/T	L			106.00					CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 1.00: V-bit refusal.
			1.5		P6121/103/1.5/R/1 D 1.50 m							
				1.70								
				105.30					Inferred low strength.			
	H		2.0		P6121/103/2.0/R/1 D 2.00 m							
				2.30								
									Hole Terminated at 2.30 m			2.30: TC-bit refusal on inferred low to medium strength claystone.
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH104**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	110 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.10 m depth	NORTHING		ASPECT	NW	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	110.00	P6121/104/0.1/S/1 D 0.10 m			ML	TOPSOIL: Silt LOAM, low liquid limit, light brown, with clay, inferred firm, moderate structure.		F	TOPSOIL
				0.30								
	L-M		0.5	109.70	P6121/104/0.5/S/1 D 0.50 m			CI	Silty CLAY, medium plasticity, brown and red-brown, trace claystone gravels, inferred stiff to very stiff, moderate structure.	D	St - VSt	RESIDUAL SOIL
				0.80								
AD/T	M		1.0	109.20	P6121/104/1.0/R/1 D 1.00 m				CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 0.80: V-bit refusal.
				1.10					Hole Terminated at 1.10 m			1.10: TC-bit refusal on inferred low to medium strength claystone.
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH105**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	107 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.40 m depth	NORTHING		ASPECT	NW	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	107.00	P6121/105/0.1/S/1 D 0.10 m			ML	TOPSOIL: Silt LOAM, low liquid limit, light brown, with clay, inferred firm, moderate structure.		F	TOPSOIL
				0.30								
	L-M		0.5	106.70	P6121/105/0.5/S/1 D 0.50 m			CI	Silty CLAY, medium plasticity, brown and red-brown, trace claystone gravels, inferred stiff to very stiff, moderate structure.	D	St - VSt	RESIDUAL SOIL
	M-H			*0.70*								
AD/T	L		1.0	106.30	P6121/105/1.0/R/1 D 1.00 m				CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 0.70: V-bit refusal.
	M			*1.40*	P6121/105/1.3/R/1 D 1.30 m				Hole Terminated at 1.40 m			1.40: TC-bit refusal on inferred low to medium strength claystone.
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH106**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	107 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.90 m depth	NORTHING		ASPECT	NW	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	107.00	P6121/106/0.1/S/1 D 0.10 m			ML	TOPSOIL: Silt LOAM, low liquid limit, light brown, with clay, inferred firm, moderate structure.		F	TOPSOIL
				0.30								
				106.70				CI	Silty CLAY, medium plasticity, brown and red-brown, trace claystone gravels, inferred stiff to very stiff, moderate structure.			RESIDUAL SOIL
	L-M		0.5		P6121/106/0.5/S/1 D 0.50 m					D	St - VSt	
				1.00								
AD/T	M		1.0	106.00	P6121/106/1.0/S/1 D 1.00 m				CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 1.00: V-bit refusal.
			1.5		P6121/106/1.5/R/1 D 1.50 m							
				1.90								
			2.0						Hole Terminated at 1.90 m			1.90: TC-bit refusal on inferred low to medium strength claystone.
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH107**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	104 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.60 m depth	NORTHING		ASPECT	NE	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	104.00	P6121/107/0.1/S/1 D 0.10 m			ML	TOPSOIL: Silt LOAM, low liquid limit, light brown, with clay, inferred firm, moderate structure.		F	TOPSOIL
				0.30 103.70								
	L-M		0.5		P6121/107/0.5/S/1 D 0.50 m			CI	Silty CLAY, medium plasticity, brown and red-brown, trace claystone gravels, inferred stiff to very stiff, moderate structure.	D	St - VSt	RESIDUAL SOIL
				0.90 103.10								
AD/T	M		1.0		P6121/107/1.0/R/1 D 1.00 m				CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 0.90: V-bit refusal.
			1.5	*1.60*	P6121/107/1.5/R/1 D 1.50 m				Hole Terminated at 1.60 m			1.60: TC-bit refusal on inferred low to medium strength claystone.
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH108**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	105.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.30 m depth	NORTHING		ASPECT	NW	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V			0	105.50	P6121/108/0.1/S/1 0.10 m			ML	TOPSOIL: Silt LOAM, low liquid limit,brown, with clay, organic material, inferred firm, moderate structure.		S - F	TOPSOIL
				0.50								
	L		0.5	105.00	P6121/108/0.5/S/1 0.50 m			CL-CI	Silty CLAY, low to medium plasticity, dark brown, with red bands, inferred firm to stiff, moderate structure.	D / M		RESIDUAL SOIL
			1.0		P6121/108/1.0/S/1 1.00 m						F - St	
				1.50								
			1.5	104.00	P6121/108/1.5/S/1 1.50 m			CI-CH	Medium CLAY, medium to high plasticity, brown and red-brown, with fine grained claystone gravels, inferred stiff, moderate structure.			
			2.0		P6121/108/2.0/S/1 2.00 m					M		
			2.5		P6121/108/2.5/S/1 2.50 m							
	L-M	Water inflow.	3.0								St	
			3.5							W		
			4.0									
				4.30					Hole Terminated at 4.30 m			4.30: V-bit refusal on inferred very low strength claystone.
			4.5									

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

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH109**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	100.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.80 m depth	NORTHING		ASPECT	NW	SLOPE <10%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	100.50 *0.10*				CL-CI	TOPSOIL: Silty CLAY, low to medium plasticity, brown and grey, inferred soft to firm, moderate structure.	D	S - F	TOPSOIL
				100.40	P6121/109/0.1/S/1 0.10 m			CI	Silty CLAY, medium plasticity, brown and red-brown, trace claystone gravels, inferred firm to stiff, moderate structure.			RESIDUAL SOIL
	L-M		0.5		P6121/109/0.5/S/1 0.50 m						F - St	
				1.00								
			1.0	99.50 *1.10*	P6121/109/1.0/S/1 1.00 m			CI	Medium CLAY, medium plasticity, red-brown with grey bands, with fine grained claystone gravels, inferred stiff to very stiff, moderate structure.		St - VSt	
	M		1.5		P6121/109/1.5/S/1 1.50 m							
				1.60								
AD/T				98.90					CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 1.60: V-bit refusal.
				1.80								
									Hole Terminated at 1.80 m			1.80: TC-bit refusal on inferred low to medium strength claystone.
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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

Engineering Log - BOREHOLE

9 Attachment C - Water Balance Results

Effluent Disposal Field - Water Balance Assessment

PROJECT DETAILS

Proposed Lot 1					
Project	Lot 2 Sec 4 DP2954 1111-1141 Elizabeth Drive, Cecil Park, NSW			Ref. No.	P1706121
Author	MR	Reviewed	JF	Date Created	3/07/2020

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit	Notes
Runoff Factor - RF	0.35	%	
Daily Effluent Load - DEL	1000	L	
Effluent Disposal Area - A	739.2	m^2	
Design Percolation Rate (DPR)	1.429	mm/day	

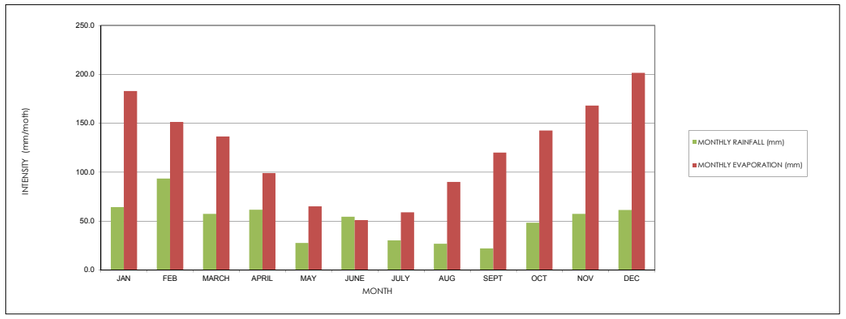
Design Irrigation Rate - DIR	1.4	mm/day
Wet-Weather Storage (KL)	0.0	kL

STEP 2 : ENTER CLIMATE DATA

Source(s): Evaporation data - Badgerys Creek McMasters Firestation (067068) 1967 - 1984

Rainfall data - Horsley Park Equestrian Centre (067119) 1997 – 2018

MONTH	MONTHLY RAINFALL (mm) Enter Data	MONTHLY EVAPORATION (mm) Enter Data
JAN	64.20	182.90
FEB	93.30	151.20
MARCH	57.30	136.40
APRIL	61.60	99.00
MAY	27.70	65.10
JUNE	54.50	51.00
JULY	30.40	58.90
AUG	26.70	89.90
SEPT	22.10	120.00
OCT	48.40	142.60
NOV	57.20	168.00
DEC	61.40	201.50



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	64.20	41.7	182.90	0.80	146.3	44.3	148.9	31000	41.9	-106.9	0.0	-106.9	**0.0**	**0.0**
FEB	28	93.30	60.6	151.20	0.80	121.0	40.0	100.3	28000	37.9	-62.4	0.0	-62.4	**0.0**	**0.0**
MARCH	31	57.30	37.2	136.40	0.80	109.1	44.3	116.2	31000	41.9	-74.2	0.0	-74.2	**0.0**	**0.0**
APRIL	30	61.60	40.0	99.00	0.80	79.2	42.9	82.0	30000	40.6	-41.4	0.0	-41.4	**0.0**	**0.0**
MAY	31	27.70	18.0	65.10	0.65	42.3	44.3	68.6	31000	41.9	-26.7	0.0	-26.7	**0.0**	**0.0**
JUNE	30	54.50	35.4	51.00	0.65	33.2	42.9	40.6	30000	40.6	0.0	0.0	0.0	**0.0**	**0.0**
JULY	31	30.40	19.8	58.90	0.65	38.3	44.3	62.8	31000	41.9	-20.9	0.0	-20.9	**0.0**	**0.0**
AUG	31	26.70	17.4	89.90	0.65	58.4	44.3	85.4	31000	41.9	-43.4	0.0	-43.4	**0.0**	**0.0**
SEPT	30	22.10	14.4	120.00	0.80	96.0	42.9	124.5	30000	40.6	-83.9	0.0	-83.9	**0.0**	**0.0**
OCT	31	48.40	31.5	142.60	0.80	114.1	44.3	126.9	31000	41.9	-85.0	0.0	-85.0	**0.0**	**0.0**
NOV	30	57.20	37.2	168.00	0.80	134.4	42.9	140.1	30000	40.6	-99.5	0.0	-99.5	**0.0**	**0.0**
DEC	31	61.40	39.9	201.50	0.80	161.2	44.3	165.6	31000	41.9	-123.6	0.0	-123.6	**0.0**	**0.0**

Effluent Disposal Field - Water Balance Assessment

PROJECT DETAILS

Proposed Lot 1					
Project	Lot 2 Sec 4 DP2954 1111-1141 Elizabeth Drive, Cecil Park, NSW			Ref. No.	P1706121
Author	MR	Reviewed	JF	Date Created	25/06/2020

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit	Notes
Runoff Factor - RF	0.35	%	
Daily Effluent Load - DEL	1000	L	
Effluent Disposal Area - A	566.8	m^2	
Design Percolation Rate (DPR)	1.4	mm/day	

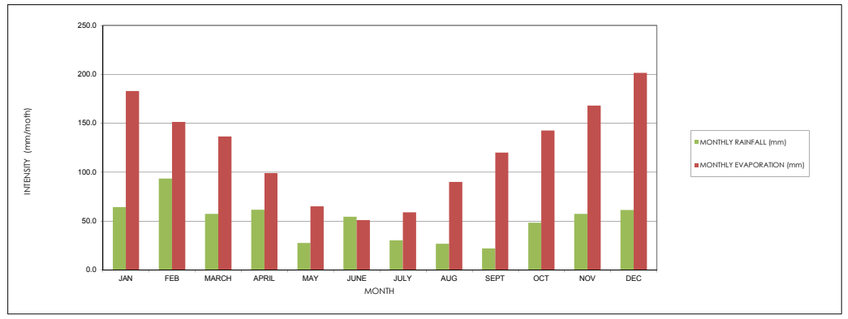
Design Irrigation Rate - DIR	1.8	mm/day
Wet-Weather Storage (KL)	7.0	kL

STEP 2 : ENTER CLIMATE DATA

Source(s): Evaporation data - Badgerys Creek McMasters Firestation (067068) 1967 - 1984

Rainfall data - Horsley Park Equestrian Centre (067119) 1997 – 2018

	MONTHLY RAINFALL (mm)	MONTHLY EVAPORATION (mm)
MONTH	Enter Data	Enter Data
JAN	64.20	182.90
FEB	93.30	151.20
MARCH	57.30	136.40
APRIL	61.60	99.00
MAY	27.70	65.10
JUNE	54.50	51.00
JULY	30.40	58.90
AUG	26.70	89.90
SEPT	22.10	120.00
OCT	48.40	142.60
NOV	57.20	168.00
DEC	61.40	201.50



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)	(L)
-	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	64.20	41.7	182.90	0.80	146.3	44.3	148.9	31000	54.7	-94.2	0.0	-94.2	**0.0**	**0.0**
FEB	28	93.30	60.6	151.20	0.80	121.0	40.0	100.3	28000	49.4	-50.9	0.0	-50.9	**0.0**	**0.0**
MARCH	31	57.30	37.2	136.40	0.80	109.1	44.3	116.2	31000	54.7	-61.5	0.0	-61.5	**0.0**	**0.0**
APRIL	30	61.60	40.0	99.00	0.80	79.2	42.9	82.0	30000	52.9	-29.1	0.0	-29.1	**0.0**	**0.0**
MAY	31	27.70	18.0	65.10	0.65	42.3	44.3	68.6	31000	54.7	-13.9	0.0	-13.9	**0.0**	**0.0**
JUNE	30	54.50	35.4	51.00	0.65	33.2	42.9	40.6	30000	52.9	12.4	0.0	12.4	**12.4**	**7000.0**
JULY	31	30.40	19.8	58.90	0.65	38.3	44.3	62.8	31000	54.7	-8.1	12.4	4.2	**4.2**	**2401.9**
AUG	31	26.70	17.4	89.90	0.65	58.4	44.3	85.4	31000	54.7	-30.7	4.2	-26.4	**0.0**	**0.0**
SEPT	30	22.10	14.4	120.00	0.80	96.0	42.9	124.5	30000	52.9	-71.6	0.0	-71.6	**0.0**	**0.0**
OCT	31	48.40	31.5	142.60	0.80	114.1	44.3	126.9	31000	54.7	-72.2	0.0	-72.2	**0.0**	**0.0**
NOV	30	57.20	37.2	168.00	0.80	134.4	42.9	140.1	30000	52.9	-87.1	0.0	-87.1	**0.0**	**0.0**
DEC	31	61.40	39.9	201.50	0.80	161.2	44.3	165.6	31000	54.7	-110.9	0.0	-110.9	**0.0**	**0.0**

10 Attachment D - Nutrient Balance

Effluent Disposal Field - Annual Nutrient Balance Assessment

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PROJECT DETAILS

Proposed Lot 1

Project	Lot 2 Sec 4 DP2954 1111-1141 Elizabeth Drive, Cecil Park, NSW			Ref. No.	P1706121JS01V02
Author	MR	Reviewed	JF	Date Created	1/07/2020

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit
Treatment System	AWTS	-
Effluent flow rate	1000	L/day
Effluent N	30.0	mg/L
Effluent P	10.0	mg/L
Design soil depth	0.70	m
Soil P-sorption	350.0	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	10.95	kg/year
N consumed	10.95	kg/year
N balance	0.00	kg/year
Min Area	548	m^2
DIR(mm/day)	1.9	mm/day

PHOSPHORUS BUDGET FOR RE-USE FIELD		
P generated	3.65	kg/year
P consumed	0.72	kg/year
P balance	2.93	kg/year
P sorption	146.3	kg P/design soil depth
Field life (for P)	50.0	Years
Min Area	362	m^2
DIR(mm/day)	2.8	mm/day

MINIMUM NUTRIENT ASSIMILATION AREA		
Minimum Area	**548**	m^2