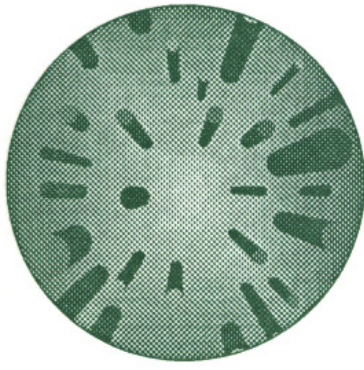




BLUE MOUNTAINS
Geological and
Environmental
Services Pty. Ltd.

ACN 069 994 056

20 Fifth Avenue, Katoomba 2780

Phone (02) 4782 5981

Fax (02) 4782 5074

REPORT ON

**INVESTIGATION AND ASSESSMENT FOR THE SITING
OF A PROPOSED EFFLUENT MANAGEMENT AT LOT
242 DP 12749, No. 17 THOMPSON STREET, SCOTLAND
ISLAND**

PREPARED FOR: MR. J. McHUGH

SUBMITTED TO: NORTHERN BEACHES COUNCIL

REF. No. 230202

FEBRUARY 2023

CONTENTS

1.	INTRODUCTION	1
2.	PROPOSED EFFLUENT MANAGEMENT SYSTEM AND DESIGN WASTEWATER VOLUME	1
3.	SITE DESCRIPTION	5
4.	FIELDWORK METHODS	6
5.	GROUND SURVEY AND PHYSICAL CONSTRAINTS	6
6.	SUBSURFACE PROFILE	7
7.	DESIGN LOADING RATE AND TRENCH DIMENSIONS	9
	7.1 Preparation and Management of the Land Application Area	11
8.	INSTALLATION, OPERATION AND MAINTENANCE	14
9.	CONCLUSION	15
	REFERENCES	17

APPENDIX 1: SODIUM ADSORPTION RATIO VALUES FOR A VARIETY
OF LAUNDRY DETERGENTS AND SOIL CLASSIFICATIONS.

TABLE 1: EXPECTED QUALITY OF WASTEWATER AFTER TREATMENT
IN AN AERATED SYSTEM.

FIGURE 1: PLAN SHOWING THE PROPOSED DWELLING AND
COMPONENTS OF THE EFFLUENT MANAGEMENT SYSTEM
AT LOT 242 DP 12749, No. 17 THOMPSON STREET, SCOTLAND
ISLAND.

COPYRIGHT

The contents, structure, original data, findings and conclusions of this report remain the intellectual property of Blue Mountains Geological and Environmental Services Pty Ltd and must not be reproduced in part or full without the formal permission of the Author. Permission to use the report for the specific purpose intended in Section 1 is granted to the Client identified in that section on condition of full payment being received for the services involved in the preparation of the report. Furthermore, the report should not be used by persons other than the Client or for other purposes than that identified in Section 1.

1. INTRODUCTION

This report outlines the results of an investigation and assessment for the siting of a proposed effluent management at Lot 242 DP 12749, No. 17 Thompson Street, Scotland Island. The investigation was performed at the request of Mr. McHugh. The report will be submitted to Northern Beaches Council.

The unsewered property comprises a vacant parcel of land having an area of approximately 1500m² which is situated on the eastern side of Scotland Island. Reference to the accompanying plan, Figure 1, shows that the proposed development comprises the construction of a dwelling and the siting of an associated effluent management system.

As a function of the constrained nature of the unsewered property, in conjunction with the area taken up by the proposed dwelling and associated features, a 'best-fit' solution is applied to on-site effluent management and where possible, appropriate guidelines and standards are adhered to – i.e. 'best practicable option' from AS/NZS 1547 (2012). The best-fit solution is based on minimising water usage and effluent generation from the dwelling, providing disinfected secondary treated wastewater and applying this in an efficient manner and appropriate location over the largest total available areas. Furthermore, a best practicable outcome is defined in AS/NZS 1547 (2012) as being the option for wastewater servicing, treatment and land application that best meets public health, environmental and economic objectives. Reliance on Council is also required to accept the best practicable outcome and variations to guidelines and standards to achieve a result for on-site effluent management which allows the development potential of the land to be realised.

2. PROPOSED EFFLUENT MANAGEMENT SYSTEM AND DESIGN WASTEWATER VOLUME

As confirmed with Mr. McHugh, the proposed effluent management scheme for the dwelling comprises the following components (Figure 1):

1. An aerated wastewater treatment system (AWTS) comprising a single pre-cast polyethylene processing tank. It is understood that the Eco-septic Eco Pro model will be utilised.

2. Two absorption trenches for the land application of secondary treated wastewater.

The nominated location of the proposed AWTS, as determined with Mr. McHugh and pending exact final confirmation, is shown in Figure 1. Manufacturers specifications, NSW Health Accreditation and any other relevant details in relation to the AWTS will be provided by the supplier for submission to Council in addition to this report.

This report is submitted to Council as part of the approval process for the proposed dwelling and associated effluent management system. Blue Mountains Geological and Environmental Services is not responsible or liable for the installation, operation, maintenance and on-going performance of both the proposed AWTS and area to be utilised for land application. An appropriately qualified and experienced person should install both the AWTS and absorption trenching.

The main environmental concern with the AWTS in general is considered to be the levels of nitrates, phosphates and faecal coliforms generated, particularly if prescribed treatment levels are not achieved. Reference to the Guidelines in Department of Local Government et. al. (1998) shows the expected quality of wastewater after treatment in an AWTS, which is given in Table 1. Design figures may not be indicative of long-term operational characteristics, and an AWTS must be well maintained and operated to achieve this quality on a continuous basis. Note that the aerated systems currently on the market and accredited by the NSW Health Department provide a better wastewater quality with nitrogen (**N**) and phosphorus (**P**) concentrations typically not exceeding 15 - 20mg/litre and 10 - 12mg/litre respectively.

Aerated systems rely on biological activity for proper system operation. Changes to the effluent loadings, in the form of either a significant increase or decrease, may result in poor system performance. It is suggested that an AWTS must be operated continuously and the power must not be turned off, as intermittent use may require servicing of the system at each start up.

TABLE 1: EXPECTED QUALITY OF WASTEWATER AFTER TREATMENT IN AN AERATED SYSTEM

PARAMETER	CONCENTRATION	FAILURE INDICATOR
BIOCHEMICAL OXYGEN DEMAND	< 20mg/L	>50mg/L
SUSPENDED SOLIDS	< 30mg/L	>50mg/L
TOTAL N	25 - 50mg/L*	not applicable
TOTAL P	10 - 15mg/L*	not applicable
FAECAL COLIFORMS NON-DISINFECTED EFFLUENT	up to 10 ⁴ cfu/100mL	not applicable
FAECAL COLIFORMS DISINFECTED EFFLUENT	< 30cfu/100mL	>100cfu/100mL
DISSOLVED OXYGEN	>2mg/L	<2mg/L

* Improved treatment levels with currently accredited systems.

It would be prudent, as with on-site or reticulated sewer, to implement a water usage minimisation scheme in the dwelling to extend the effective life span and performance of the effluent management system as a whole. The requirement for minimising water usage and effluent generation is considered to be more pronounced at Scotland Island due to the typically small size of the residential unsewered properties and setting within Pittwater. Whilst the AWTS provides for re-use of all effluent generated by application to the land, reducing the loads to be treated and discharged will significantly decrease the potential for adverse environmental impacts. As confirmed with Mr. McHugh, the dwelling will be fitted with a set of highly rated water limiting devices/appliances including two low-flow showerheads, two low litreage dual flush toilets, aerator taps and a front loading washing machine that are required in new dwellings as part of the BASIX scheme in Local Government.

It is suggested to utilise 'environmentally friendly' cleaning, washing and detergent products in the dwelling to reduce the levels of P, as well as sodium, discharged into the proposed AWTS

and absorption trenches. Furthermore, reducing the amounts of such products used would also be beneficial to the environment. Reference to the Figure in Appendix 1 shows the sodium contents in grams/wash for a variety of laundry detergents used in both front and top-loading washing machines (from Dr. R. Patterson, Lanfax Labs). It is recommended to utilise laundry detergents with the lowest sodium content as practical. Cross-matching low sodium products with low P ones would also be beneficial.

In addition to the details above, it is important to ensure that chemical cleaning and detergent products are compatible for use with an on-site effluent treatment system. Such products can kill off bacteria in a treatment device, which results in ineffective treatment (particularly with respect to faecal coliforms). Use of harsh bleaches and disinfectants should be avoided, but only used sparingly if necessary. Alkalinity and P contents in cleaning products can also have an influence on performance and the treatment levels achieved. However, with low P products, a relatively higher alkalinity is required in order to get an appropriate level of cleaning, which can adversely impact upon a treatment system.

Further to discussions with Mr. McHugh, the following details are provided in relation to wastewater generation at the subject site:

- There is a tank water supply.
- The proposed dwelling comprises three bedrooms.
- The proposed dwelling will be occupied by three persons on a full-time basis.

As distinct to the lesser number of occupants, design effluent volume and trench length calculations are based on the maximum potential occupancy level of the dwelling on a full-time basis which is dependent on the number of bedrooms. Reference to Table J1 in AS/NZS 1547 (2012) shows that a three bedroom dwelling has a population equivalent of 1 - 5 persons. For use in this assessment, the maximum potential occupancy level of the proposed dwelling is set at five persons. This represents an ample allowance for two persons/bedroom in two of the bedrooms and one person in the remaining bedroom.

Reference to Table H1 in AS/NZS 1547 (2012) shows that the typical domestic wastewater design flow allowance for dwellings with a tank water supply is 120 litres/person/day.

Based on the details above, the maximum design effluent volume from the proposed dwelling is:

- 5 persons x 120L/person/day = 600L/day.

It is imperative to ensure that appropriate water-conservation practices are carried out in the dwelling so the maximum design effluent volume above is not exceeded – i.e. ideally kept as low as possible. However, for the three persons who will reside in the dwelling, the design output of effluent is 360 litres/day, or 60% of the maximum.

3. **SITE DESCRIPTION**

The property comprises an irregular-shaped parcel of land that has a frontage of 18.275m onto Thompson Street and extends downslope in an east-northeasterly direction for distances ranging from 40.19 - 70.89m to the frontage with Florence Terrace at 41.66m in length. The location of the proposed dwelling and associated features are shown in Figure 1.

The proposed land application area (**LAA**) as a whole for secondary treated effluent is positioned off the downslope eastern alignment of the dwelling and comprises absorption trenches 1 and 2, each at 16.6m in length, 1.1m in width and suggested depth of 0.6m (Figure 1). Both trenches are spaced 2.5m apart and maintain the following set-back distances:

- 10.4m north-northeast of the closest point of the proposed dwelling (trench 1).
- 7.5m north-northeast of the closest point of the proposed deck (trench 1).
- 3 - 5.6m from the downslope eastern boundary (trench 2). Plus a further 5.8 - 6m beyond the eastern boundary to the alignment of Florence Terrace proper.
- 6.4m from the southern boundary, which is in an upslope position (trench 1).
- 6.9m from the northern boundary, where the terrain does not fall towards it (trench 2).

The terrain across the LAA as a whole has a typical grade of 1 in 3.5 - 9 in a north-northeasterly direction based on the contours at 1m intervals in Figure 1. There are no trees across or between proposed absorption trenches 1 and 2 and the vegetation comprises weeds that will be carefully cleared. This area is relatively well-elevated and affords exposure to the easterly to northerly aspect and prevailing winds.

The components of the proposed LAA are positioned at typical elevations between 28 - 30m. The nearest 'water feature' in the relevant flow path of the closest absorption trench 2 is the mean high water mark at Pittwater at a distance of approximately 103m in a north-northeasterly direction. Note that this distance in plan view is considerably increased along the ground surface.

Climatic conditions at the site are generally temperate throughout the year. The average annual rainfall is approximately 1225mm, whilst the annual evaporation is about 1790mm which exceeds rainfall in all months except May and June.

4. FIELDWORK METHODS

The initial phase of the fieldwork comprised a site inspection and ground survey on 8/2/23 aimed at delineating the area available for the siting of absorption trenching with respect to the location of the proposed dwelling, associated features and the geomorphological characteristics of the land.

Further to the ground survey, three 100mm diameter hand-auger holes were bored to maximum depths of 1.2m across the site of proposed LAA as a whole. The auger holes were used to determine the physical characteristics of the subsurface strata and provide a representative description of it.

To assess soil permeability, results of the auger holes are related to the textural/structural classification in Table E1 in AS/NZS 1547 (2012) which enables determination of the soil category and corresponding indicative permeability value. An indicative permeability value can be converted to a design loading rate (**DLR**) from Table L1 in AS/NZS 1547 (2012) for use in trench length calculations.

5. GROUND SURVEY AND PHYSICAL CONSTRAINTS

The location of proposed absorption trenches 1 and 2 have been carefully delineated on the property with Mr. McHugh. Results from the ground survey indicate that the main physical constraints to on-site effluent management comprise the steep nature of the terrain and

occurrence of some significant trees to remain and allowance for clearance from both the structural root zones and tree protection zones. Further to the physical constraints, the land available for effluent disposal is further limited by the area covered by the proposed dwelling and associated features including the existing access track off Thompson Street, as well as set-back distances from these and property boundaries.

The physical constraints and associated considerations substantially limit the area available for the application of treated wastewater. Therefore, it is only the terrain off the downslope eastern side of the dwelling that is considered for effluent disposal.

As part of the best-fit solution, the aim is to utilise the full lengths and widths delineated for absorption trenches 1 and 2 as detailed in Section 3 and shown in Figure 1. Furthermore, the reduced buffer distances from the downslope eastern boundary only relative to those outlined in Table 5 of the guidelines in Department of Local Government et. al. (1998) are required to provide appropriate clearance from relevant significant trees to remain. However, there are additional distances of 5.8 - 6m between the eastern boundary and alignment of Florence Terrace. In addition, the distance from the closest absorption trench 1 to both the dwelling and deck off its eastern alignment is greater than the minimum requirements in the 1998 guidelines, but is controlled by providing clearance from tree 129 (i.e. T129 shown in Figure 1). Therefore, it is not possible to position trenches 1 and 2 further upslope and away from Florence Terrace with allowance for the trench widths at 1.1m and spacing of 2.5m – i.e. maximum possible width and spacing.

The components of the proposed LAA are relatively well-elevated and afford exposure to the easterly to northerly aspect and prevailing winds, which in conjunction with the uptake by the vegetation cover to be established and managed (see Section 7.1), will enhance the benefits of evapotranspiration and concurrently reduce the absorption loads of treated effluent on the subsurface strata.

6. SUBSURFACE PROFILE

Reference to the Sydney 1:100,000 scale Soil Landscape map indicates that the proposed LAA and property as a whole is underlain by the colluvial ‘Watagan’ group which occurs on rolling to

very steep hills on fine-grained Narrabeen Group sediments (mainly interbedded laminite and shale with quartz to lithic quartz sandstone).

The soils of the Watagan group comprise shallow to deep (30 - 200cm), Lithosols/Siliceous Sands and Yellow Podzolic Soils on sandstones; moderately deep (100 - 200cm) Brown Podzolic Soils, Red Podzolic Soils and Gleyed Podzolic Soils on shales (Chapman and Murphy, 1989).

The Watagan group is limited by mass movement hazard, steep slopes, severe soil erosion hazard, very strong acidity, low fertility, high aluminium toxicity and occasional rock outcrop (Chapman and Murphy, 1989).

The subsurface profiles observed in the auger holes at the site of proposed trenches 1 and 2 have a 'duplex' structure as there is a well-defined textural and permeability contrast between the A and B soil horizons. With reference to Table E4 in AS/NZS 1547 (2012), it is considered that the A1 and A2 horizon soils have a single grained structure whilst the B soil horizon has a strong structure.

The soils are described in accordance with the classification schemes in Australian Soil and Land Survey: Field Handbook (1990) and Table E1 in AS/NZS 1547, 2012 (Appendix 1). The typical subsurface profile observed in the auger holes in the area containing proposed absorption trenches 1 and 2 is detailed below.

(i) LOAMY SAND (TOPSOIL) – A1 Horizon

- observed from the surface to a depth ranging from 0.25 - 0.3m.
- comprises dark grey-brown, fine to medium grained loamy sand with few weathered sandstone and ironstone fragments (i.e. 2 - 10% coarse fragments from Table E2 in AS/NZS 1547, 2012).
- soil category 2 for sandy loams from Table E1 in AS/NZS 1547 (2012).

(ii) SAND – A2 Horizon

- observed from 0.25 - 0.3m to a depth ranging from 0.45 - 0.5m.
- comprises brown to dark-brown, fine to medium grained slightly clayey sand with few weathered sandstone and ironstone fragments (i.e. 2 - 10% coarse fragments).
- soil category 1 for gravels and sands.

(iii) LIGHT CLAY – B Horizon

- observed from 0.45 - 0.5m to a depth of 1.2m.
- comprises firm to stiff, brown to orange-brown and lesser red-brown light clay with few weathered sandstone and ironstone fragments (i.e. 2 - 10% coarse fragments). Below 0.8m, have some light-grey colouring and more red-brown.
- soil category 5 for light clays.

7. **DESIGN LOADING RATE AND TRENCH DIMENSIONS**

As detailed in Section 3, the components of the proposed LAA as a whole comprise absorption trenches 1 and 2, each at 16.6m in length, 1.1m in width and suggested depth of 0.6m. As part of the best-fit solution and as detailed in Section 5, the aim is to utilise the maximum available trench lengths delineated at a total of 33.2m.

Based on the findings in Section 6, with absorption trenching at a suggested depth of 0.6m it is considered that the A2 horizon sand and B horizon light clay will control the absorption and assimilation of treated effluent. Therefore, the average DLR values for these soil types will be applied to trench length calculations.

Reference to Table L1 in AS/NZS 1547 (2012) shows that the following DLR values for secondary treated effluent apply to absorption trench calculations:

- Sand in soil category 1 – DLR = 50mm/day (which is the same for the overlying loamy sand).
- Light clay in soil category 5 – DLR = 12mm/day for a strong structure.

The average of the DIR values above is 31mm/day which will be applied to this assessment.

In this Section, the design volumes of secondary treated effluent that can be applied to proposed absorption trenches 1 and 2 will be assessed. The total of these will be related to the maximum design effluent volume of 600 litres/day from the proposed dwelling.

From Section L4.2 in AS/NZS 1547 (2012), the equation below is used to calculate the required length of trench:

$$L = Q / (\text{DLR} \times W), \text{ where}$$

- L = trench length in metres.
 Q = design daily effluent flow.
 DLR = Design Loading Rate in mm/day.
 W = width in metres.

The DLR is defined as the long term acceptance rate, reduced by a factor of safety, expressed in L/m²/day or mm/day as applied to the horizontal design area of a land application system. Note that the DLR value is used to determine the length of trench based on the bottom area only as the effect of the sidewalls have already been included (in the DLR value). Whilst no allowance is made for absorption through the sidewalls of trenching, it is still likely to be an effective addition to the wetted area.

The trench length equation is modified below to assess the design volume of secondary treated effluent that can be applied to the components of the proposed LAA:

$$\begin{aligned} Q &= L(\text{DLR} \times W) \\ &= 33.2\text{m}(31\text{mm/day} \times 1.1\text{m}) \\ &= 1132\text{L/day.} \end{aligned}$$

Based on the equation above, the components of the proposed LAA can cater for the maximum design effluent volume from the dwelling at 600 litres/day. With regards to proportioning treated effluent and pending final confirmation from the system installer, with two trenches at identical dimensions it is suggested that a rota-valve (or auto-sequencing valve) with two outlets is installed in association with the proposed AWTS – i.e. one pump cycle to trench 1 and the next cycle to trench 2.

In summary,

- * PROPOSED LAA = absorption trenches 1 and 2, each at 16.6m in length, 1.1m in width and suggested depth of 0.6m which are spaced 2.5m apart.

7.1 Preparation and Management of the Land Application Area

Proper preparation and installation are important factors which significantly affect the ability of a LAA to contain and assimilate treated wastewater. It would be prudent to install standpipes in the absorption trenches so the condition and liquid level can be readily observed and monitored. Reference to Gardner et. al. (1997) indicates that loading rate should be balanced by allowable sinks. Allowable sinks for N are denitrification/volatilisation (typically 15 - 20% loss) and plant uptake, which depends on the plant yield and N concentration in the vegetation. Provided the vegetation in an effluent disposal area is harvested and removed on a regular basis (years for trees, months for grasses/pasture), it will provide a sustainable and recurrent sink for N.

Allowable sinks for P are plant uptake (generally 8 - 10 times less than N uptake) and the storage capacity of the soil (may account for up to 30% of the N loading). Reference to Gardner et. al., (1997) indicates that for sandy soils, the P front moves downwards at a rate of about 20 years/metre of soil depth for a P concentration of about 10mg/litre of effluent. The many adsorption sites for P in soils and aquifers suggest that adverse groundwater consequences of P leaching are likely to be the exception rather than the rule.

Appropriate preparation of the proposed absorption trenches is required whilst excavating in order to achieve level bases across the contour of the land. This will assist with evenly applying treated wastewater across the full length and width of the trenches.

When the trenches are being excavated, it is suggested to carefully strip and stockpile the loamy sand topsoil in the A1 horizon for re-use at the surface once prepared. If required, the A2 horizon sand can also be re-used in the trenches. However, light clay subsoil in the B horizon should not be re-used in the absorption trenches or placed in the general area containing them.

To raise the pH of the expected very strongly acidic soils and address the high potential aluminium toxicity as noted for the Watagan group in Section 6, sodium content in the treated

effluent and potential for dispersion, it is suggested to apply agricultural lime and gypsum across the components of the LAA. Lime and gypsum can be applied at suggested rates of approximately $0.3 - 0.4\text{kg/m}^2$ (i.e. $3 - 4\text{kg/m}^3$) and 0.1kg/m^2 respectively (i.e. 1kg/m^3) in the trenches proper and surrounding parts (particularly downslope sides). The addition of lime and gypsum will also enhance plant growth, the uptake of nutrients and assist to maintain the soil structure in the medium to longer term periods. It is understood that liquefied versions of lime and gypsum are also available.

Lime and gypsum can be purchased from selected plant nurseries and landscape/rural supply stores and it is suggested to reapply the additives and carefully incorporate into the top 50mm of soil as required every three to five years for example. Note that it would be prudent to contact the NSW Agriculture Department to assess any advice they can provide regarding soil additives, application methods and rates.

Research by the NSW Agriculture Department shows that to help with the spreading of soil additives such as lime and gypsum across areas of pasture and increase their positive attributes, the 'Long Worm' (deep burrowing), 'Turgid Worm' (topsoil burrowing) and 'Trap Worm' (middle layers) can be introduced. These worms can be provided in the LAA as a whole to ensure that lime and gypsum will be transferred to the subsoil to effectively raise soil pH and address the sodium content in the treated effluent. The addition of worms will also improve overall soil condition and drainage.

In the event of weed proliferation due to the discharge of treated effluent, it is suggested that adequate eradication measures are implemented to prevent their possible spread beyond the margins of absorption trenches 1 and 2. Furthermore, ensure that the removal of existing weeds prior to establishment of the LAA as a whole does not result in the loss of topsoil depth or adverse disturbance to the soil coverage.

With regards to a vegetation cover in and adjacent to proposed absorption trenches 1 and 2, discussions with Mr. McHugh indicate that turf grass will be laid immediately after their installation – i.e. on and between them and the disturbed margins adjacent to them and ideally all the way to the downslope eastern boundary to provide a well-vegetated buffer zone. Up to approximately 30 - 50mm of permeable sand-based 'turf underlay' soil can also be provided

to assist with the establishment of the grass. Turf grass will provide an immediate coverage after installation to address the potential for soil erosion/disturbance and also enhance the uptake of secondary treated effluent by evapotranspiration.

Once established, grass in and adjacent to the LAA must be properly managed by being mown regularly with the cuttings harvested and removed to avoid the recycling of nutrients back to the soil. It is suggested that grass is not cut to a level that is too low as this will limit the depth and density of root growth.

Note that evapotranspiration, which will be enhanced at the subject site as a function of the overall temperate climate and uptake by the grass cover, will provide a concurrent reduction in the hydraulic loading rate and volumes of treated effluent permeating to the subsoil.

Any upslope runoff must be directed away from the proposed trenches so the soils ideally have to cater for only direct rainfall and treated wastewater. This can be achieved with a contour bank or dish-drain in the land immediately above the absorption trenches. However, anomalous levels of runoff is not expected, so the need for an upslope diversion device is unlikely to be required in the first instance but can be installed if ever required in the future. Nonetheless, mounded surfaces can be provided at approximately 100mm high over proposed absorption trenches 1 and 2 to allow for any settlement and further assist with the containment/assimilation of treated wastewater and divert any localised runoff. This can be achieved by replacing the majority of the soil excavated from the trenches with care taken to avoid overcompaction. The mounds can also extend upslope of the trenches for a distance of about 1m.

It is imperative to ensure that construction works do not adversely impact on the areas delineated for the land application of treated effluent such as topsoil compaction, the stripping of topsoil and the placement of building materials for example – i.e. maintain existing soil depth and condition and can partition these areas from construction works if required.

Stormwater provisions associated with the dwelling and tank water supply must not be directed towards the components of the LAA and adjacent parts, so there are no adverse impact upon the proper functioning of the absorption trenches.

8. INSTALLATION, OPERATION AND MAINTENANCE

For the effluent management system to work well, the supplier, installer, service agent, residents and owners must be committed to its management, whilst the AWTS must be serviced on a quarterly basis. Quarterly services as part of maintenance agreements normally involve inspection of the mechanical, electrical and functioning parts of the system to ensure they are operating properly, replacement of chlorine tablets for disinfection and a check of the components of the LAA. A properly operated and maintained system should meet the expected parameters for wastewater quality (see Table 1, Section 2).

Newly installed systems often require a lead-in time before satisfactory performance is achieved. This time can often be reduced by promoting establishment of the bacteria in the treatment system. The effectiveness of the system will, in part, depend on how it is used and maintained. A guide to good maintenance procedures, from Department of Local Government (1998), is listed below:

DO

- have the system inspected and serviced four times per year by an approved contractor.
- have the system service include assessment of sludge and scum levels and the performance of the components of the LAA.
- have the AWTS desludged at least every three years.
- have the disinfection chamber inspected and tested quarterly to ensure correct disinfection levels.
- have the grease trap, if installed, cleaned out as required on a regular basis.
- keep a record of pumping, inspections and other maintenance.
- learn the location and layout of the treatment system and components of the LAA.
- use biodegradable liquid detergents such as concentrates with low sodium and P levels (see Appendix 1).
- conserve water – deliberate attention to this issue is imperative due to the constrained nature of the unsewered property, the limited nature of the tank water supply and to also provide a way to enhance the performance/life span of the AWTS and ensure that the components of the LAA do not become hydraulically overloaded.

DON'T

- put bleaches, disinfectants, whiteners, nappy soakers and spot removers in large quantities into the AWTS via sinks, toilets or washing machines.
- allow any foreign material such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- use more than the recommended amounts of detergents.
- put fats and oils down the drain and keep food waste out of the system – this is considered to be particularly important because food scraps can result in a higher than acceptable biochemical oxygen demand level and excess oils/fats can overload or hinder the performance of any type of effluent treatment system. Use of a strainer in the kitchen sink is required and removing excess food waste/oils from plates with paper towelling before washing would reduce the input of fats and organic material into the AWTS (used paper towels can be composted).
- switch off the power to the AWTS, even when the dwelling is unoccupied.

9. CONCLUSION

- (i) An investigation and assessment has been undertaken for the siting of a proposed effluent management at Lot 242 DP 12749, No. 17 Thompson Street, Scotland Island. The unsewered property comprises a vacant parcel of land having an area of approximately 1500m².
- (ii) The proposed development comprises the construction of a three bedroom dwelling and the siting of an associated effluent management system. The dwelling will be utilised on a full-time basis by three persons. A best-fit solution has been applied to on-site effluent management.
- (iii) The proposed effluent management scheme for the dwelling comprises an AWTS and two absorption trenches for land application.
- (iv) The maximum design effluent volume from the proposed dwelling with allowance for five occupants and tank water supply is 600 litres/day.

- (v) As part of the best-fit solution, the proposed LAA as a whole off the downslope eastern side of the dwelling comprises absorption trenches 1 and 2, each at 16.6m in length, 1.1m in width and suggested depth of 0.6m which are spaced 2.5m apart. Guidelines in relation to preparation and management of the AWTS and components of the LAA should also be followed.

GRANT AUSTIN

Engineering Geologist

Member Australian Institute of Geoscientists

Affiliate Institution of Engineers Australia

REFERENCES

Chapman, G.A. and Murphy, C.L. (1989): Soil Landscapes of the Sydney 1:100,000 Sheet. Map and Report. Department of Conservation and Land Management, Sydney.

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

Gardner, T., Geary, P. and Gordon, I. (1997): Ecological Sustainability and On-Site Effluent Treatment Systems. Australian Journal of Environmental Management – Volume 4, Number 2 pp 34 - 156.

McDonald, R.C., Isbell, R.F., Spreight, J.G., Walker, J. and Hopkins, M.S. (1990): Australian Soil and Land Survey: Field Handbook. Second Edition. Inkata Press, Melbourne.

Standards Australia & New Zealand (2012): Australian/New Zealand Standard 1547 – On site domestic wastewater management.

APPENDIX 1

SODIUM CONTENTS FOR A VARIETY OF LAUNDRY DETERGENTS AND SOIL CLASSIFICATIONS

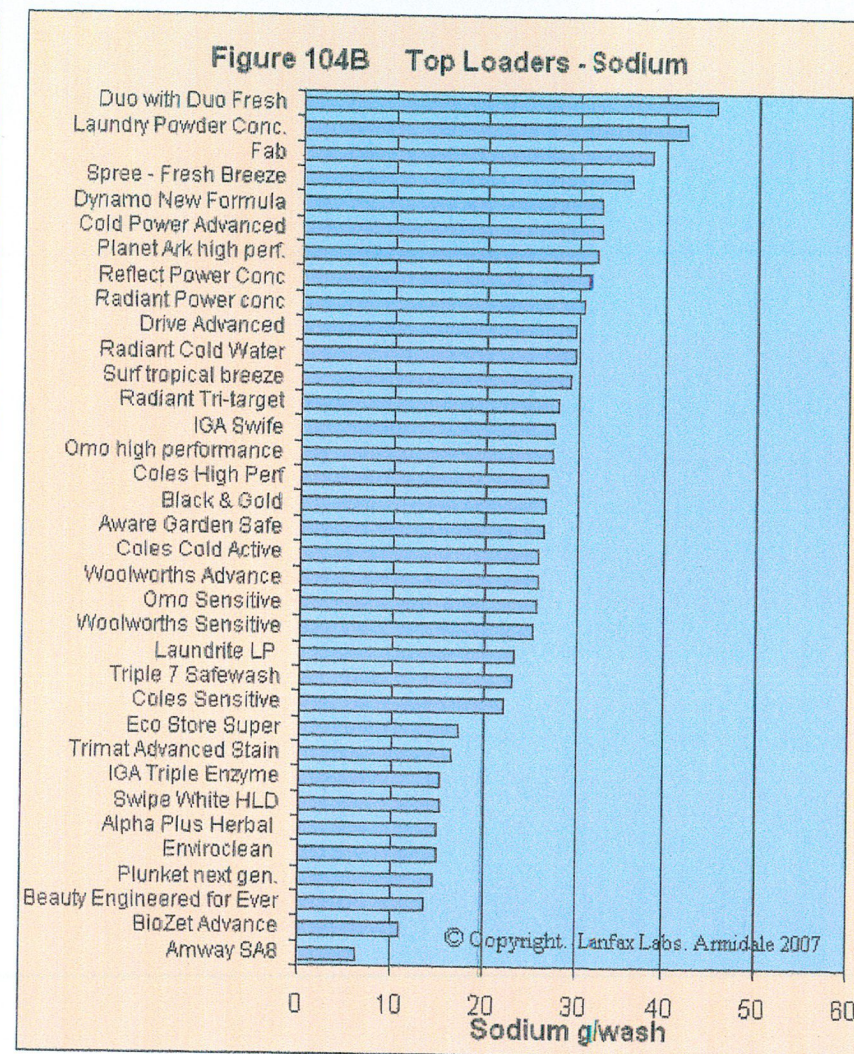
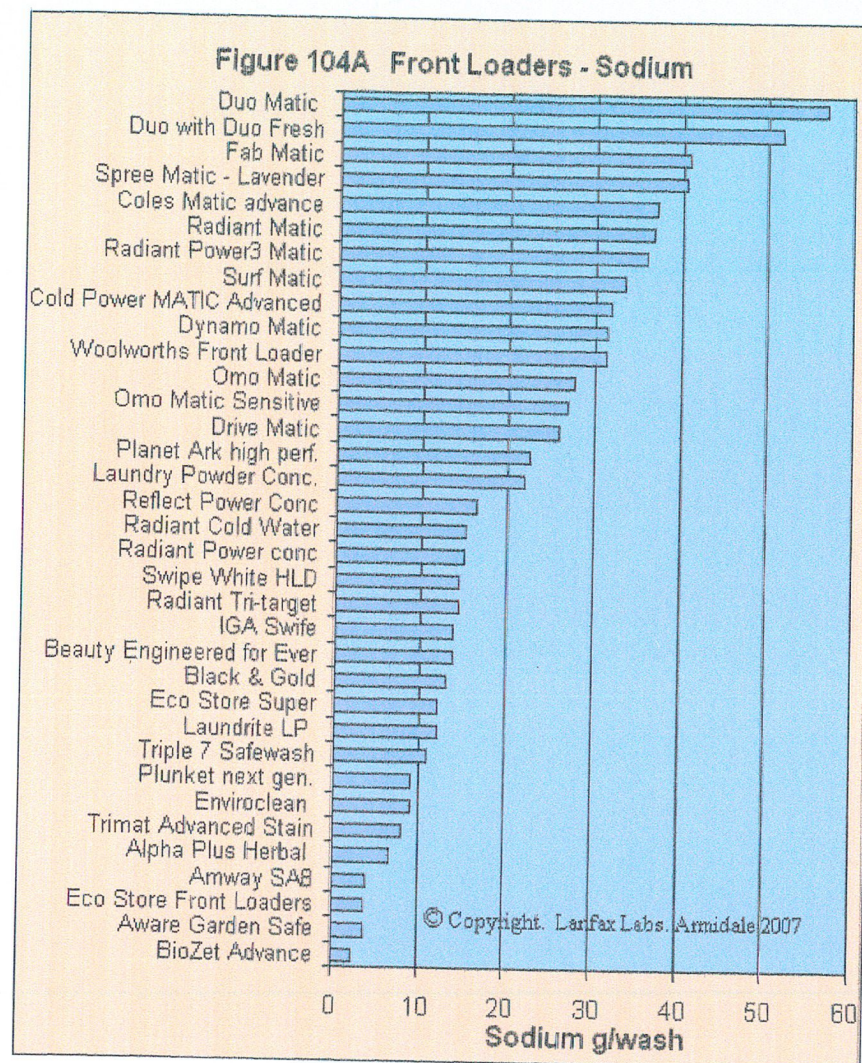


TABLE E1
ASSESSMENT OF SOIL TEXTURES

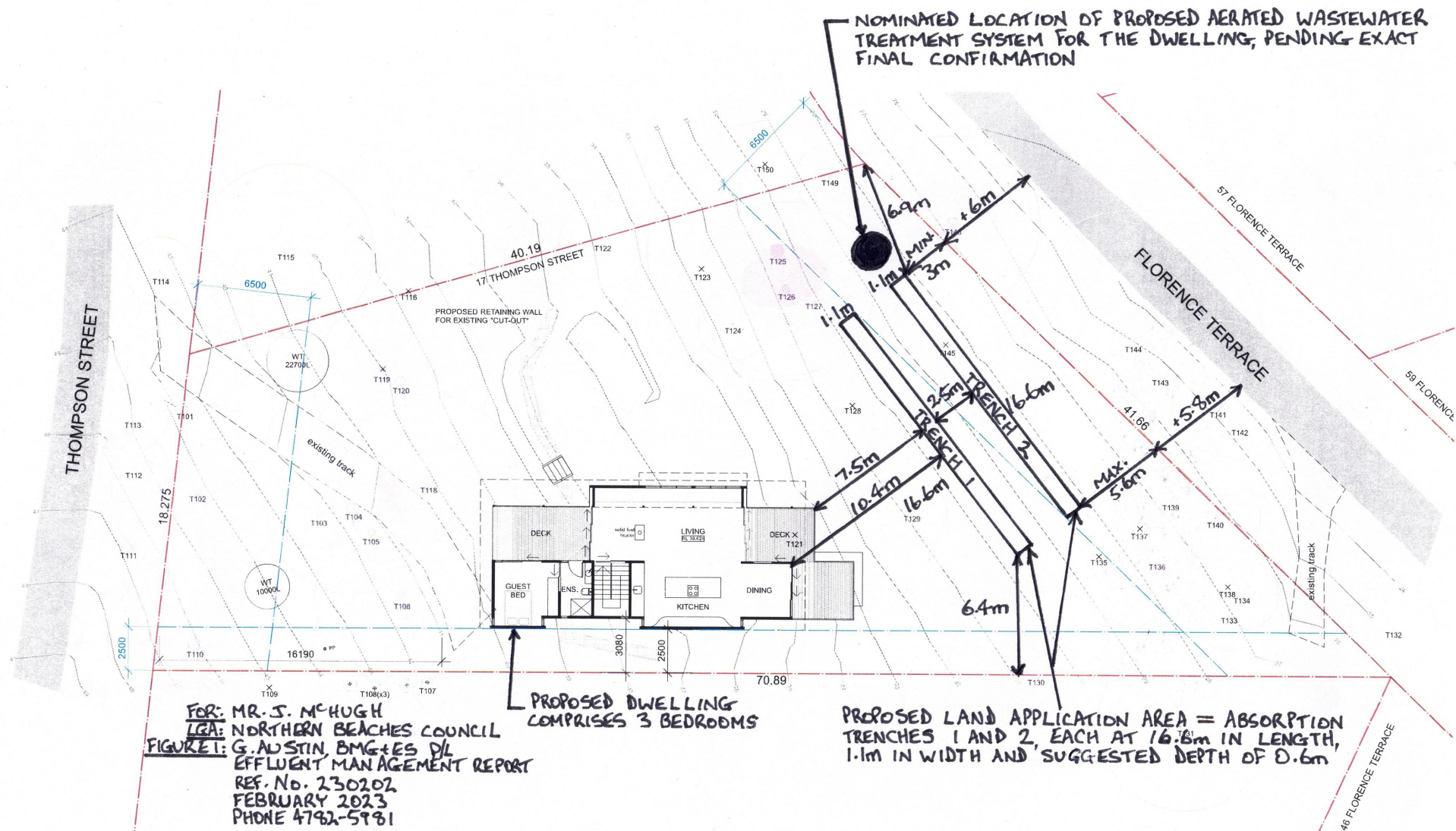
Soil category	Classification	Properties	Typical clay content% (see Note)
1	Sand	Very little to no coherence; cannot be moulded; single grains stick to fingers	Less than 5
2	Loamy sand	Slight coherence; forms a fragile cast that just bears handling; gives a very short (5 mm) ribbon that breaks easily; discolours the fingers	5 – 10
	Sandy loam	Forms a cast but will not roll into a coherent ball; individual sand grains can be seen and felt; gives a ribbon 15 – 25 mm long	10 – 20
3	Fine sandy loam	As for sandy loams, except that individual sand grains are not visible, although they can be heard and felt; gives a ribbon 15 – 25 mm long	10 – 20
	Loam	As for sandy loams but cast feels spongy, with no obvious sandiness or silkiness; may feel greasy if much organic matter is present; forms a thick ribbon about 25 mm long	10 – 25
	Silty loam	As for loams but not spongy; very smooth and silky; will form a very thin ribbon 25 mm long and dries out rapidly	10 – 25
4	Sandy clay loam	Can be rolled into a ball in which sand grains can be felt; forms a ribbon 25 – 40 mm long	20 – 30
	Fine sandy clay	As for sandy clay loam, except that individual sand grains are not visible although they can be heard and felt; forms a ribbon 40 – 50 mm long	20 – 30
	Clay loam	Can be rolled into a ball with a rather spongy feel; slightly plastic; smooth to manipulate; will form a ribbon 40 – 50 mm long	25 – 35
	Silty clay loam	As for clay loams but not spongy; very smooth and silky; will form a ribbon about 40 – 50 mm long; dries out rapidly	25 – 35
5	Sandy clay	Forms a plastic ball in which sand grains can be seen, felt or heard; forms a ribbon 50 – 75 mm long	35 – 45
	Light clay	Smooth plastic ball that can be rolled into a rod; slight resistance to shearing between thumb and forefinger; forms a ribbon 50 – 75 mm long	35 – 40
	Silty clay	As for light clay but very smooth and silky; will form a ribbon about 50 – 75 mm long but very fragmentary; dries out rapidly	40 – 50
6	Medium clay	Smooth plastic ball, handles like plasticine and can be moulded into rods without fracture; some resistance to ribboning, forms a ribbon 75 mm or more long	40 – 55
	Heavy clay	Smooth plastic ball that handles like stiff plasticine; can be moulded into rods without fracture; firm resistance to ribboning; forms a ribbon 75 mm or more in length	50 or more
NOTE: The typical clay content figures are included for information only.			

SOIL CLASSIFICATION

<i>Field Texture Grade</i>		<i>Behaviour of moist bolus</i>	<i>Approximate clay content (%)</i>
S	<i>Sand</i>	coherence nil to very slight; cannot be moulded; sand grains of medium size; single sand grains adhere to fingers.	commonly less than 5%
LS	<i>Loamy sand</i>	slight coherence; sand grains of medium size; can be sheared between thumbs and forefinger to give minimal ribbon of about 5mm.	about 5%
CS	<i>Clayey sand</i>	slight coherence; sand grains of medium size; sticky when wet; many sand grains stick to fingers; will form minimal ribbon of 5-15mm; discolours fingers with clay stain.	5%-10%
SL	<i>Sandy loam</i>	bolus coherent but very sandy to touch; will form ribbon of 15-25mm; dominant sand grains are of medium size and are readily visible.	10%-20%
L	<i>Loam</i>	bolus coherent and rather spongy; smooth feel when manipulated but with no obvious sandiness or 'silkeness'; may be somewhat greasy to the touch if much organic matter is present; will form ribbon of about 25mm.	about 25%
ZL	<i>Silty Loam</i>	coherent bolus; very smooth to often silky when manipulated; will form ribbon of about 25mm.	about 25% and with silt 25% or more
SCL	<i>Sandy clay loam</i>	strongly coherent bolus; sandy to touch; medium size sand grains visible in finer matrix; will form ribbon of 25-40mm.	20%-30%
CL	<i>Clay loam</i>	coherent plastic bolus; smooth to manipulate; will form ribbon of 40-50mm.	30%-35%
CLS	<i>Clay loam, sandy</i>	coherent plastic bolus; medium size sand grains visible in finer matrix; will form ribbon of 40-50mm.	30%-35%
ZCL	<i>Silty clay loam</i>	coherent plastic bolus; plastic and often silky to the touch; will form ribbon of 40-50mm.	30%-35% and with silt 25% or more
LC	<i>Light clay</i>	plastic bolus; smooth to touch; slight resistance to shearing between thumb and forefinger; will form ribbon of 50-75mm.	35-40%
LMC	<i>Light medium clay</i>	plastic bolus; smooth to touch; slight to moderate resistance to ribboning shear; will form ribbon of about 75mm.	40%-45%
MC	<i>Medium clay</i>	smooth plastic bolus; handles like plasticine and can be modelled into rods without fracture; has moderate resistance to ribboning shear; will form ribbon of 75mm or more.	45%-55%
MHC	<i>Medium heavy clay</i>	smooth plastic bolus; handles like plasticine; can be modelled into rods without fracture; has moderate to firm resistance to ribboning shear; will form ribbon of 75mm or more.	50% or more
HC	<i>Heavy clay</i>	smooth plastic bolus; handles like stiff plasticine; can be modelled into rods without fracture; has firm resistance to ribboning shear; will form ribbon of 75mm or more.	50% or more

From: Australian Soil and Land Survey: Field Handbook 1990

FIGURE 1: PLAN SHOWING THE PROPOSED DWELLING AND COMPONENTS OF THE EFFLUENT MANAGEMENT SYSTEM AT LOT 242
DP 12749, NO. 17 THOMPSON STREET, SCOTLAND ISLAND



DESIGN by WAVES JAMES T MCHUGH PO Box 293 Church Point NSW 2106 M 0439404650 E McHughdesign@outlook.com	REVISION DA 05.02.22 Issue for DA DA.1 03.05.22 Remove Studio. w-water size B 02.02.23 Issue for wastewater mod.	REVISION	PROJECT ADDRESS 17 THOMPSON ST SCOTLAND ISLAND 2105	DRAWING TITLE UPPER FLOOR PLAN	CONTRACTORS NOTE Do not scale from drawing, use measured dimensions. This Contract shall include all typical dimensions on site before construction of work. To be read in conjunction with all other Contractor's drawings. This Drawing is to be modified consistently with any amendments. Copyright on this drawing retained by the Designer. Prior to any earth works, Contractor is to contact any authorities necessary regarding but not limited to REAL SERVICE YOU USE	2001	SCALE: 1:200 @ A3	DRAWN BY: JMc	THIS ISSUE: 02.02.23	FIRST ISSUE: 02.08.21	REVISED NO: 10	REVISIONS: B
	FOR CC	CLIENT MADDY										
	NOT FOR CONSTRUCTION											