ENVIRONMENTAL CONSULTING Pty Ltd

ONSITE SEWAGE MANAGEMENT ASSESSMENT

Voluntary Upgrade of Existing OSMS

April 2024

Prepared for: Eddie Lloyd

Lot 6 DP 264057
175 Moffatts Road
Billinudgel

HMC Ref: 2024.734

RE: Lot 6 DP 264057, 175 Moffatts Road, Billinudgel

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

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

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TITLE:	Onsite Sewage Management Assessment
PREPARED FOR:	Eddie Lloyd
HMC JOB NUMBER:	2024.734

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E. Lloyd	30.04.2024	Draft Issue A	For review
E. Lloyd	6.05.2024	Final Issue A	For lodgement

This report should be cited as '*HMC Environmental Consulting (2024). On-site Sewage Management Assessment, Voluntary Upgrade of Existing OSMS, Lot 6 DP 264057, 175 Moffatts Road, Billinudgel, NSW. Report No. HMC2024.734.'*

TABLE OF CONTENTS

LIST OF TABLES

ABBREVIATIONS

AWTS	Aerated Wastewater Treatment System
BEDS	Effluent Disposal Beds- will be used in reference to the construction of shallow sub surface effluent disposal trenches that utilise the principles of evaporation, transpiration and absorption. The method of construction for the Effluent Disposal Bed referred to in this report is in accordance with a "Conventional Bed" provided in Figure L5 of AS/NZS 1547: 2012.
BOD_5	Biochemical oxygen demand over 5 day period
CFU	Colony forming unit
DIR	Design irrigation rate
DLR	Design loading rate
LAA	Land application area
LTAR	Long term acceptance rate
OSMS	On-Site Sewage Management System
SDI	Sub-surface drip irrigation
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids

1. INTRODUCTION AND SUMMARY

HMC Environmental Consulting Pty Ltd has been commissioned to prepare an on-site sewage management assessment for the voluntary upgrade of existing system, to support a new pool and cabana located at Lot 6 DP 264057, 175 Moffatts Road, Billinudgel, within the Byron Shire Council.

A site inspection was carried out on 17/04/2024 by Helen Tunks of HMC. During the site inspection the site and soil characteristics were assessed in terms of wastewater treatment and disposal, along with the design and condition of the existing OSMS. The property is constrained by steep to moderate slopes, low soil permeability and reduced buffer distances to watercourses.

The existing OSMS comprises a 2050L concrete septic tank, 50L pumpwell with effluent disposal through an absorption trench, ~17m in length. This report recommends decommissioning the existing primary treatment system and absorption trench in accordance with NSW Health guidelines.

It is proposed to install an Aerated Wastewater Treatment System (AWTS) for secondary treatment and disinfection of effluent. The proposed AWTS must have NSW Health accreditation for total nitrogen (TN) reduction of minimum 54%. It is recommended to install 400m^2 of shallow ripped subsurface drip irrigation (SDI) under lawn for effluent disposal. The proposed effluent land application area (EAA) will require landform shaping to ensure a maximum 25% slope gradient.

100% reserve LAA remains available on the site for replacement SDI within the proposed EAA, as the soils would remain suitable to be reused following decommissioning of the sub-surface dripper lines.

2. PROJECT INFORMATION

Table 1 - Project Information

Proposal	Proposed OSSM System Assessment
Property	Lot 6 DP 264057 175 Moffatts Road Billinudgel
Property Area	4.37 Ha
Council Area/Approvals:	Byron Shire Council
Design Daily Hydraulic Load	690L/day Existing 3-bedroom dwelling and shed with amenities Assumed 6 persons design occupancy @ 115L/p/day
Water Saving Devices	Yes, assumed in existing dwelling
Water Supply	Non-reticulated roof catchment
Existing OSSM System Design & Function	~2050L concrete septic tank & 50L pumpwell + macerator pump Absorption trench ~17m long

3. SUMMARY OF RECOMMENDED SEWAGE WORKS

Table 2 - OSSM Proposal

Proposed On-Site Sewage Management System
● Decommission existing septic tank in accordance with NSW Health Advisory Note 3 (See Appendix 9) ● Install an aerated wastewater treatment system with NSW Health Accreditation for nutrient reduction of minimum 54% TN. Suitable treatment systems include; -Taylex ABSNR 1350 (STS-AWTS067) -OzziKleen RP10A+ (STS-AWTS061) -FujiClean ACE 1200 Advanced (STS-AWTS042) ● Connect all sanitary drainage to new AWTS (Gravity 100mm DWV sewer pipe buried min 150mm depth/min 300mm depth in trafficable areas) Land Application Area: ● Install 400m^2 of shallow ripped pressure-compensated subsurface drip irrigation (SDI) under lawn Recommended dripper line is Netafim Unibioline CNL 16mm @ average 100mm depth and 1m spacing. No tech filter is required with the Unibioline CNLXR (herbicide impregnated) dripline ● Soil preparation required prior to installation of dripperline: Re-forming of slope to achieve a maximum 25% slope gradient Seed lawn grass immediately over SDI area ● Construct an upslope surface water diversion bund & intercept drain to divert surface water run-on away from proposed EAA

Table 3 - Variation to Byron Shire Council OSSM Design Model/Strategy

OSSM Design Model/Strategy Default	Change Displayed on Design Model/ Specification	Justification
● Total nitrogen reduction 20% standard for AWTS	● 54% assumed	● TN reduction due to proposed AWTS with NSW Health Accredited Nutrient Reduction -Taylex ABSNR 1350 (STS-AWTS067) **54%** -OzziKleen RP10A+ (STS-AWTS061) **82%** -FujiClean ACE 1200 Advanced (STS-AWTS042) **79%**
● 40m to intermittent watercourse	● 15m	● Downslope mapped drainage line is a stream order 1 intermittent watercourse which discharges into Marshalls Nature Reserve approximately 3.6km downstream of the property boundaries. ● A viral die-off calculation was performed to calculate the minimum required horizontal setback distance from the proposed EAA to the nearest watercourse. The conservative estimate of pathogen die-off from the proposed EAA has been calculated to be 1.5m using viral die-off calculations (Cromer, Gardner, & Beavers) as detailed in Appendix 8. A safety factor of 2 has been applied within the die-off model, to be conservative, increasing the calculated pathogen die-off to approximately 3m.

4. LAND CAPABILITY – SITE & SOIL ASSESSMENT

4.1. SITE CONDITIONS

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

Table 4 - Site Conditions

Inspected by	Helen Tunks
Date & Time of Inspection	17/04/2024 See Appendix 1 for site location, Appendix 7 for photos.
Weather	Weather: Fine, warm, nil rainfall during site inspection. BOM Stn 58040 Mullumbimby (Fairview Farm). Nil rainfall recorded the week preceding site inspection. ~328mm rainfall recorded the month preceding site inspection
Soil Type & Category	Soil Category 5 (AS/NZS1547:2012) BH1& 2 – within proposed LAA See Appendix 3 for soil investigation information.
Climate	Warm-temperate and high volume, seasonal rainfall typical of region.
Terrain	Ridge
Slope & Drainage:	~25% maximum slope to be achieved by land forming Waning divergent
Aspect & Shading	Northern aspect Minimal shading expected
Ground cover/vegetation	Existing vegetation (full cover), 100% grass cover to be achieved, existing 100% grass cover
Site Constraints	Imperfectly drained soil High volume seasonal rainfall Setback to intermittent watercourse
Reserve LAA	100% available

4.2. SITE COMPLIANCE

Table 5 - Site Constraints

Site Constraints		Recommended	Complying?
Setback to Boundary	18m across slope	50m	NO
Setback to Watercourse	15m downslope	100m	NO
Setback to Water Bore	100m upslope	50m	YES
Setback to Buildings	12m upslope	6m	YES
In-ground Rainwater Tanks & Services	>15m	15m	YES
Flood Liability	Nil flood inundation within proposed LAA		YES

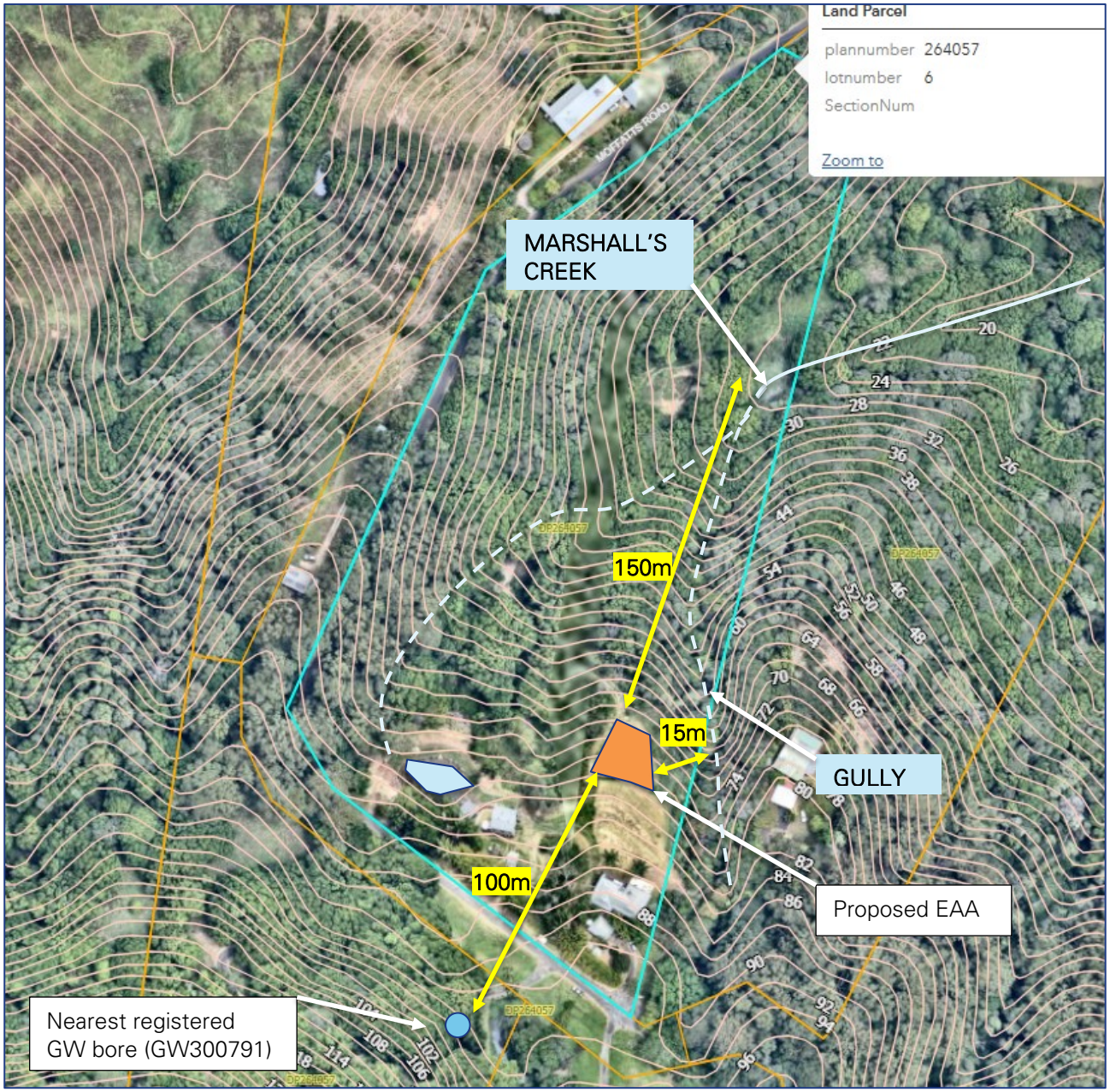

Figure 1: Site Features & Setback Distances to LAAs, indicative only (Source: Byron Shire Council Mapping, 2024).

4.3. SETBACK DISTANCE RISK ASSESSMENT

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

- Table R1, AS/NZS1547: 2012
- Byron Shire Council – "Design Guidelines for On-site Sewage Management for Single Households" (BSC,2023)

The following site features do not comply with the recommended setback distances from land application areas (LAAs) as mentioned in the above guidelines.

- Property boundary
- Surface water

A setback distance risk assessment of the site constraints, based on Table R1 of Australian and New Zealand Standard (AS/NZS1547:2012), was carried out and is detailed in Appendix 5. The risk assessment conclusions are presented in Table 6 below.

Table 6 - Risk Assessment Results for Site Constraints

Site Constraint	Setback Distance/Criteria Achieved	Average Risk Assessment Result (Appendix 5)	Mitigations
Property boundary	18m across slope	LOW	• >50m to downslope property boundary • Secondary treated and disinfected effluent • Low DIR achieved of 1.7mm/day • Pressure compensated disposal within dripper lines under lawn grass
Surface waters	~15m to downslope intermittent watercourse	LOW / MEDIUM	• Proposed AWTS with minimum TN reduction of 54%, provides a significant reduction in risk to public health and the environment compared to the existing primary treatment system • Shallow disposal within shaped EAA, maximum 25% slope gradient • 100% grass cover to be achieved • North facing and generally grassed, enhancing sun and wind exposure, increasing evapotranspiration.
CONCLUSION	AVERAGE RISK = LOW		Mitigations considered satisfactory given the constraints of the existing lot and the significant improvement in effluent treatment and distribution achieved with the proposed replacement system.

5. SEWAGE TREATMENT SYSTEM

The site constraints for effluent disposal require effluent to be treated to a minimum secondary quality with final disinfection to minimise risk to the environment. The existing septic tank of 3000L does not provide adequate sewage treatment.

This level of treatment enables the effluent to be distributed to the shallow topsoil zone via pressure compensated drip irrigation line under a lawn grass surface. The pressure compensating nature of the emitters within the dripperline allows for the drip irrigation line to be installed on sloping land and still achieve uniform and controlled distribution of effluent.

Appendix 4 provides the NSW Health guidelines for effluent quality suitable for shallow sub-surface drip irrigation. An Aerated Wastewater Treatment System (AWTS) with NSW Health accreditation would be a suitable system to provide this level of effluent treatment. Typical AWTS systems available locally can treat wastewater flows between 1200- 3000L per day.

6. LAND APPLICATION AREA SIZING AND DESIGN

6.1. ASSESSED DESIGN INPUTS

Table 7 - Design Model

Model Used: Byron OSSM Design Model (On-site Sewage Management System Design Model Excel version 3.xls)	
Climate Data	Alstonville Rainfall & Evaporation Record: 1/7/1980 – 30/6/2001
Structure	Existing 3-bedroom dwelling and shed with amenities
Design Occupancy	6 persons assumed
Wastewater Design Flow Allowance	115L/p/day
Wastewater Design Hydraulic Load	690L/day
TN System Nutrient Reduction	Secondary treatment ~54% reduction assumed in proposed AWTS
Phosphorus Adsorption	~8000 kg/ha/ based on field texture and work carried out by Morand, 1996
Maximum Design Irrigation Rate (DLR)	3mm/day based on soil category 5 (Table 5.2, AS/NZS1547:2012)
Proposed DIR	2.25mm/day
Comments	DIR reduced to 1.7mm/day due to oversizing of proposed EAA

6.2. SUMMARY OF MODELLING CALCULATIONS

Table 8 - Modelling Calculations Summary

Analyte	Minimum Recommended Effluent Application Area (EAA) Hydraulic Loading Rate (Q) = 690L/day	
	LAA Modelling Results	Proposed LAA Layout
Hydraulic Load	244m^2	400m^2 shallow ripped subsurface drip irrigation. 100% grass cover to be achieved. Landform modification to ensure maximum 25% slope gradient.
Nitrogen (TN)	307m^2	
Phosphorus (TP)	88m^2	
DIR	2.25mm/day	

To provide a realistic assessment of permeability multiple tests are required. It is considered that the conservative loading rates based on soil texture (AS/NZS 1547:2012) are adequate for design inputs in this case for a domestic situation. The nutrient management area of 307m^2 will be contained within the proposed EAA.

7. DISCUSSION/REASON FOR APPROVAL

The proposed OSSM system upgrade reduces the risk to public health and the environment by disposing of secondary treated and disinfected effluent under lawn grass. It is acknowledged that the slope is steep, therefore landform shaping is required to ensure a maximum 25% slope gradient is achieved. In addition, it is recommended to install an upslope surface water diversion bund and intercept drain to divert surface water run-on away from proposed EAA.

A monthly water balance is provided within this report to demonstrate that the hydraulic loading and retained rainfall can be contained within the topsoil layer of the proposed EAA with an irrigation rate of 3.8mm/day.

Overall, the proposed system is a conservative design, maximises the advantages of the existing topsoil and achieves an average low risk of encroaching towards property boundaries and watercourses.

8. RECOMMENDATIONS

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

Table 9 - Recommendations

DESIGN HYDRAULIC LOADING

- 690L/day
- Non-reticulated roof catchment
- 3-bedroom dwelling
- 6 persons occupancy assumed

RECOMMENDED ON-SITE SEWAGE MANAGEMENT SYSTEM

Refer to Site Plan & Detail Construction Design on following pages

- Decommission existing septic tank in accordance with NSW Health Advisory Note 3 (See Appendix 9)
- Install an aerated wastewater treatment system with NSW Health Accreditation for nutrient reduction of minimum 54% TN. Suitable treatment systems include;
  -Taylex ABSNR 1350 (STS-AWTS067)
  -OzziKleen RP10A+ (STS-AWTS061)
  -FujiClean ACE 1200 Advanced (STS-AWTS042)
- Connect all sanitary drainage to new AWTS (Gravity 100mm DWV sewer pipe buried min 150mm depth/min 300mm depth in trafficable areas)

Land Application Area:

- Install 400m^2 of shallow ripped pressure-compensated subsurface drip irrigation (SDI) under lawn Recommended dripper line is Netafim Unibioline CNL 16mm @ average 100mm depth and 1m spacing. No tech filter is required with the Unibioline CNLXR (herbicide impregnated) dripline
- Soil preparation required prior to installation of dripperline:
  Re-forming of slope to achieve a maximum 25% slope gradient
  Seed lawn grass immediately over SDI area
- Construct an upslope surface water diversion bund & intercept drain to divert surface water run-on away from proposed EAA

OPERATION & MAINTENANCE

GENERAL MAINTENANCE ACTIONS

- A contract with an authorised AWTS service agent for quarterly service inspections is to be current and remain current always during the operation of the system.
- The occupants are to practice water conservation and follow the chemical usage recommendations provided by the AWTS Manufacturer to maximise performance and longevity of the on-site sewage management system
- DO NOT ALLOW VEHICLES OR STOCK INCLUDING SLASHERS/TRACTORS TO ENTER THE EFFLUENT LAND APPLICATION AREA
- DO NOT DISPOSE OF DOWN THE DRAINS: Bleach, bleach-based products, whiteners, nappy soakers, and spot removers. Dispose of in the garden in an unused location
- DO NOT FLUSH DOWN THE SEPTIC SYSTEM: Hygiene products, condoms, tampons, sanitary napkins, disposable nappies, and cotton buds

- DO PRACTICE WATER CONSERVATION
- DO USE only the recommended amounts of disinfectants and cleaners. Biodegradable products for septic systems are recommended
- DO MOW the EAA to ensure that rainfall is shed from the surface

8.1. SITE PLAN & SECTION DETAIL

ONSITE SEWAGE MANAGEMENT DESIGN
EFFLUENT APPLICATION AREA (LAA)

SHEET 1 - PLAN

EXISTING SEPTIC TANK & PUMPWELL TO BE DECOMMISSIONED IN ACCORDANCE WITH NSW HEALTH ADVISORY NOTE: 3

COMPONENTS

- Aerated Wastewater Treatment System
- 500m² sub-surface drip irrigation
- Lilac PE pipe (buried)
- 100mm DWV PVC pipe (buried)
- check valves
- flush valves
- air valves
- stock/vehicle barriers

LOCATIONS ARE GENERAL ONLY AND ARE TO BE CONFIRMED ONSITE

Job:	HMC2024.734
DWG:	HMC2024.734
Date:	April 2024
Version:	B - 29.04.2024
Drawn:	KH
Base:	Nearmap 2024
Council:	Byron Shire Council

Lot 6 DP 264057
175 Moffatts Road
Billinudgel NSW 2483

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Intermittent watercourse

Proposed Effluent Application Area
500m² sub-surface drip irrigation under grass
Reshaping of slope required to ~25% prior to dripperline installation

Intermittent watercourse

O/H Power Lines

Proposed pumped effluent line - Lilac PE pipe buried min 150mm depth

Proposed AWTS (General location)

Proposed upslope surface water diversion bund & intercept drain

Existing absorption trench ~17m to be decommissioned

Existing 2050L concrete septic tank to be decommissioned

Existing gravity sewer line (general location)

Proposed pool and pool house

Existing 50L pumpwell + macerator pump to be decommissioned

Proposed new gravity sewer line (all sanitary drainage from dwelling & studio) - General location only

Existing shed with amenities

Dam

Dam

BH1

BH2

~25%

~25%

~25%

~15%

~15m

Existing 3-B/R dwelling

EXIST DWELLING

EXIST GARAGE

WATER TANKS

MOFFATTS ROAD

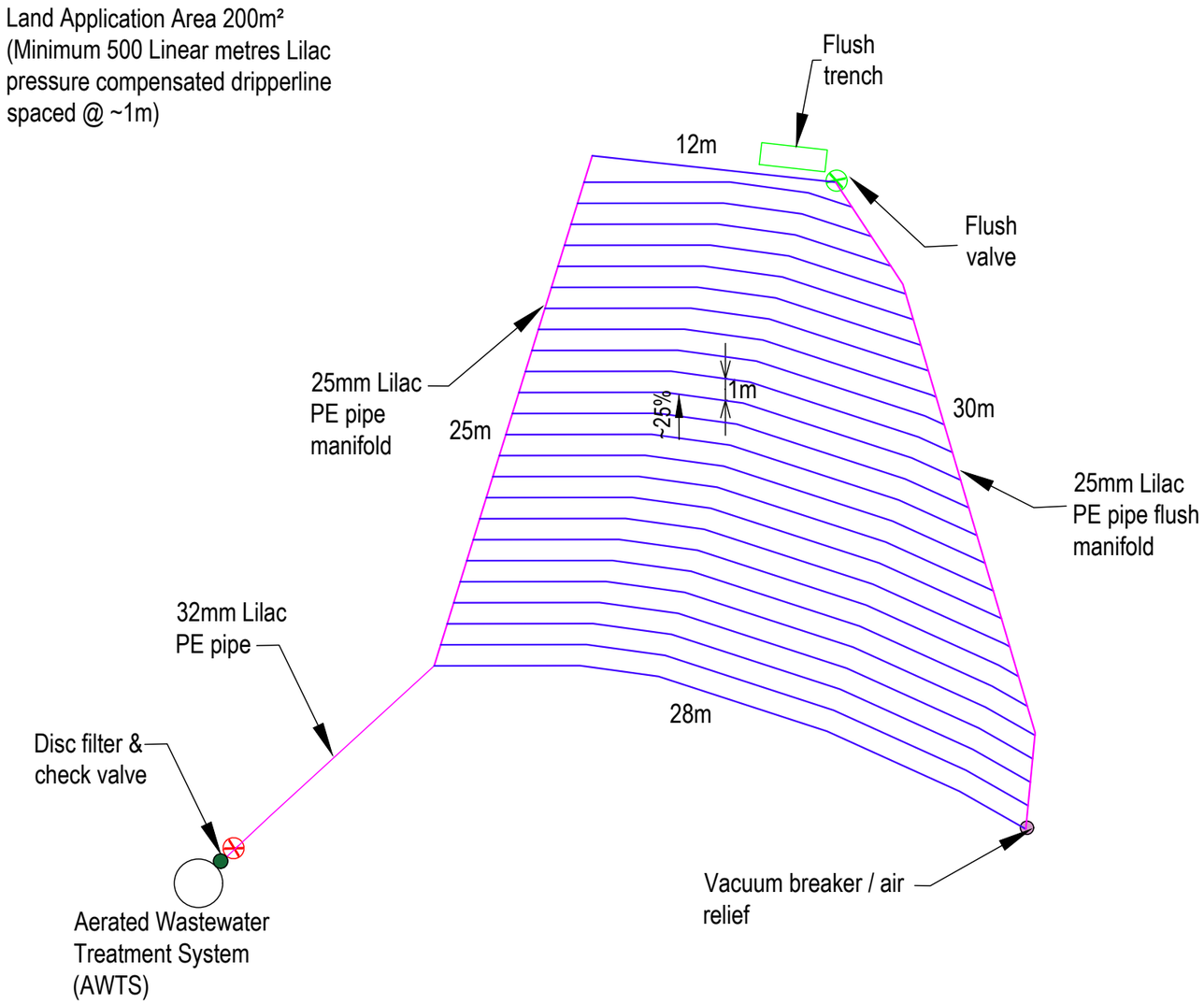
W

N

Scale: @ A3

0 10 20m

TYPICAL SUB-SURFACE DRIP LAYOUT - SCHEMATIC - NOT TO SCALE



SUB-SURFACE DRIP IRRIGATION MINIMUM COMPONENTS AND DESIGN REQUIREMENTS

1. Pressure compensating Unibioline CNLXR lilac dripperline or similar to be installed at approx 100mm depth and approximately 1m lateral spacing.
2. The effluent distribution pipe from the tank to the irrigation area should be buried a minimum 150mm depth or a minimum of 300mm depth in trafficable areas (or within trafficable conduit).
3. The presence of buried pipes shall be indicated using underground marking tape or be indicated by signage - 'Sewage effluent pipework installed below, Do not dig"
4. Vacuum release valves to be installed at highest point in the pipeline.
5. Non return valves to be installed.
6. Flush valves to be installed at the end of each subsurface zone to allow periodic flushing of the irrigation lines.

TYPICAL INSTALLATION NOTES

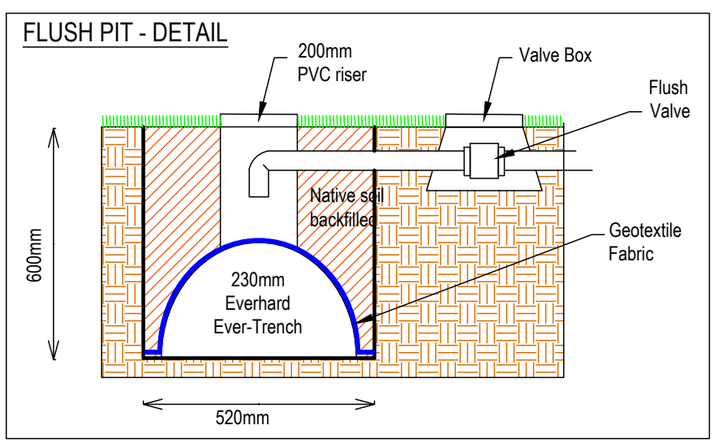
a. Sub-surface pipes as per manufacturers specifications, all pipework and fitting should comply with the Australian Standard 2698 "Plastic Pipes and Fittings for Irrigation and Rural Application". Effluent grade pipe work must be used.
b. The commissioning of the piped dispersal system should include a test run/check for leaks and poorly distributed areas.
c. Shrubs to be planted no closer than 1m from the irrigation pipes. Small trees should be no closer than 5m and large trees should be at least 20m from the irrigation system.
d. Existing septic tank to be decommissioned in accordance with NSW Health Advisory Note 3.

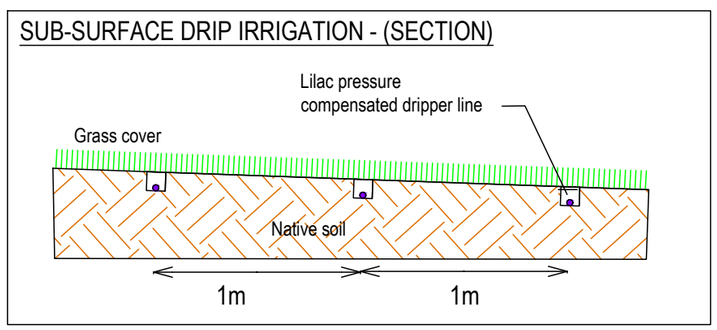
MAINTENANCE AND MANAGEMENT

- If effluent ponds on the surface or soils become soggy, seek advice from Council or a plumber immediately
- The irrigation area must be maintained in such a manner as to prevent any run-off of effluent to adjoining allotments, public places and watercourses.
- The system operator should maintain the irrigation area regularly to ensure adequate cover of the pipe work, elimination of weeds, maintenance and regular mowing.

LICENSING, NOTIFICATION & INSPECTION

- Plumbing and drainage works must be performed by trades persons licensed by NSW Dept of Fair Trading. A notice of work is required to be submitted to Council minimum of 2 days prior to work. Council inspection is required prior to backfilling and at completion. Plumber is to provide a Certificate of Compliance and Drainage Diagram to Council at completion of works.





KEY

- Tech Filter
- Disc Filter
- Air Release/vacuum breaker
- Flush Valve
- Check valve
- 100mm DWV Pipe (sewer grade)
- 32mm Lilac PE Pipe
- 25mm Lilac PE Pipe
- Lilac pressure compensated dripperline

NOTE: Tech filter not required when installing Uniobioline CNLXR

ONSITE SEWAGE MANAGEMENT DESIGN
EFFLUENT APPLICATION AREA (LAA)

SHEET 2 - DETAIL

EXISTING SEPTIC TANK & PUMPWELL TO BE DECOMMISSIONED IN ACCORDANCE WITH NSW HEALTH ADVISORY NOTE: 3

COMPONENTS

- Aerated Wastewater Treatment System
- 500m² sub-surface drip irrigation
- Lilac PE pipe (buried)
- 100mm DWV PVC pipe (buried)
- check valves
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- air valves
- stock/vehicle barriers

LOCATIONS ARE GENERAL ONLY AND ARE TO BE CONFIRMED ONSITE

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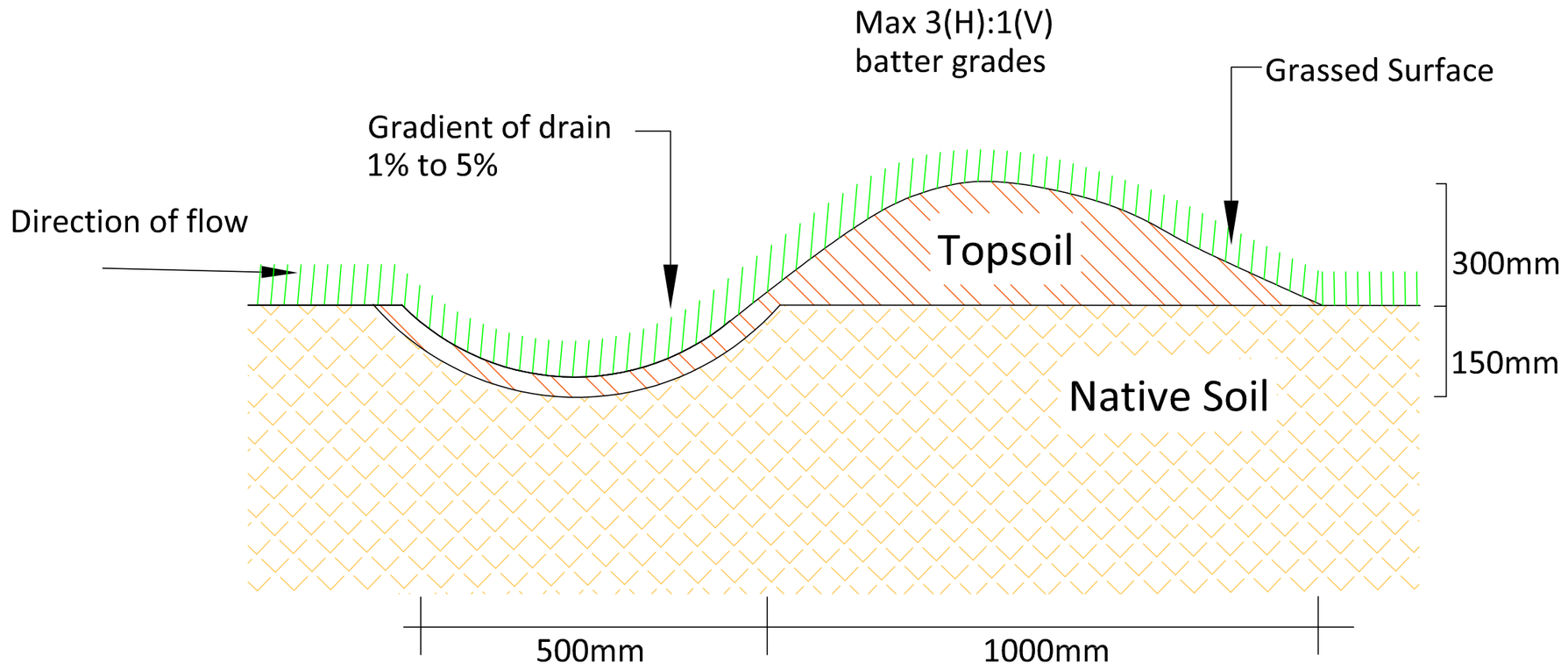
CROSS SECTION: DIVERSION BUND



Source: Sydney Catchment Authority, 2013: Standard Drawing 8A

UPSLOPE/DOWNSLOPE DIVERSION BUND

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Date: April 2020
Revision Date:

9. LIMITATIONS

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

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

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

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

10. REFERENCES

- Australian/New Zealand Standard AS 1547: 2012 - *On-site domestic wastewater management*, February 2012
- Byron OSSM Design Model (On-site Sewage Management System Design Model Excel version 3.xls)
- Byron Shire Council – "On-Site Sewage Management Design Guidelines" (BSC,2023)
- Morand, D.T., *Soil Landscapes of the Lismore-Ballina 1:100 000 Sheet*, 1994
- Morand D.T., (1996). *Soil Landscapes of the Murwillumbah - Tweed 1:100 000 Sheet Report, Soil Conservation Service of NSW, Sydney.*
- Myers, Brian J. (1992). Effluent loading rates for irrigated plantations - a water balance model. Australian Forestry. 55, 39-47.
- NSW Office of Water, "Commenced Water Sharing Plan for the Tweed River Area unregulated and alluvial water sources", October 2010
- Whelan, B.R. and Titammis, Z.V. Daily chemical variability of domestic septic tank effluent. *Water, Air and Soil Pollution* ***17***, 131-139

11. APPENDICES

See following pages

APPENDIX 1 SITE LOCATION

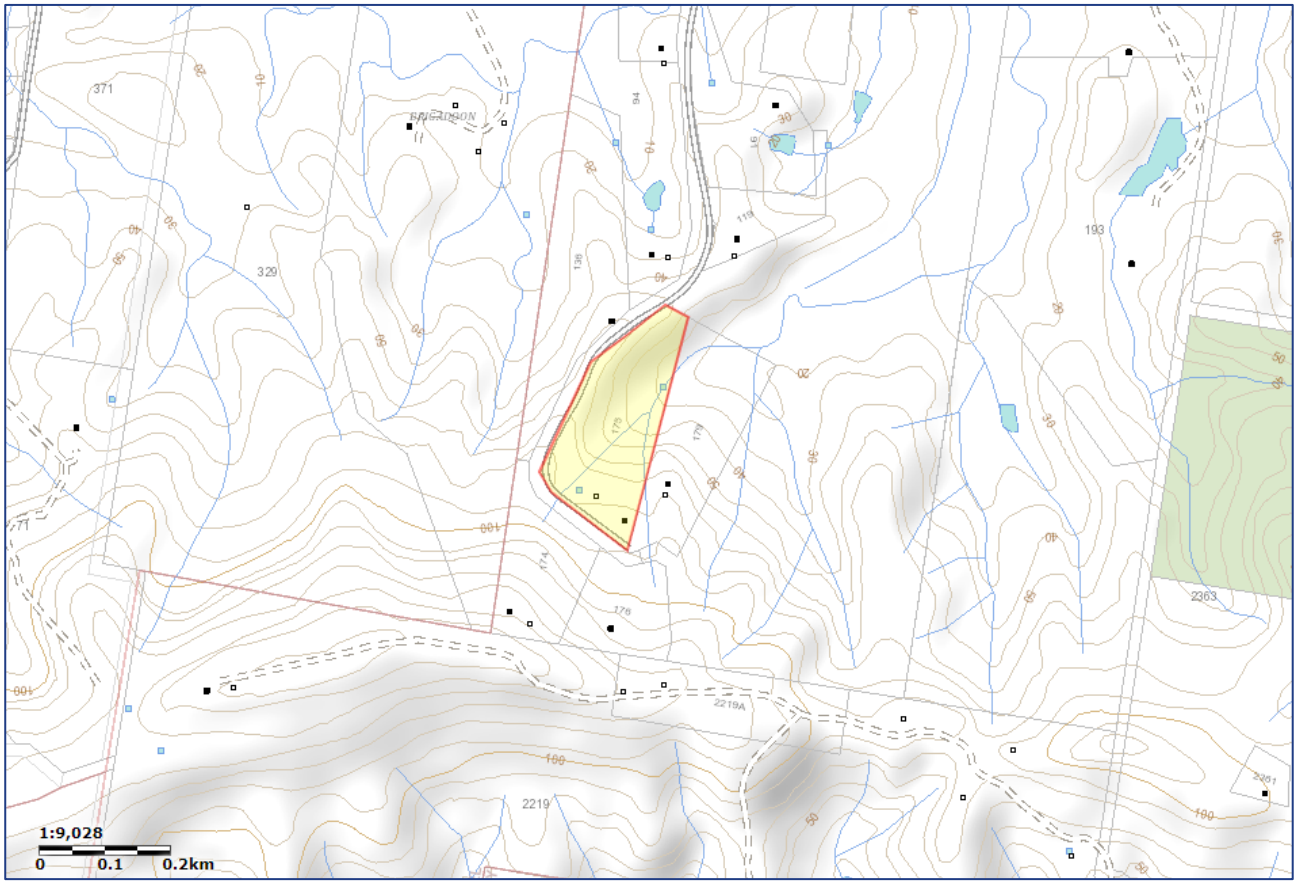


Figure 2 - Site Location (Source: NSW Spatial Viewer, Six Maps)

Figure 3 - Site Boundary (Source: Nearmap 2024)

APPENDIX 2 OSSM DESIGN MODEL & MONTHLY WATER BALANCE

Byron OSMS Design Model *Version:* e201821531-byron-osms-design-model-final-version-for-distribution-with-design-guidelines-491834 (1).xlsm ***Period of Rainfall & Evaporation Record: 01/07/1980 - 30/06/2001***

Set Defaults

STEP 1: bedrooms / persons

# bedrooms (Grp 1) (STEP 2)	4	STEP 3: Buffer to permanent water / Buffer to intermittant water		**Block size (m2)** (STEP 4)	10000
# bedrooms (Grp 2)	0				15

STEP 5 – Daily effluent flow accord. water supply type

- Reticulated supply (bore,spring,creek) 180L/p.d
- Reticulated + std. water saving devices 145L/p.d
- Roof water harvesting 140L/p.d
- Roof water harvesting + std. water sav. 115L/p.d

STEP 6 – Wastewater stream

Grp1	Grp 2
☑ Toilet	☐ Toilet
☑ Bathroom	☐ Bathroom
☑ Laundry	☐ Laundry
☑ Kitchen	☐ Kitchen

Total Daily Flow (L/day) *	690	Daily Effluent Flow per person (L/day)	115	% black to tot WW in a full system	32%
TN production per year (kg/year)	25.20	N prod. per capita (kg/person/yr)	4.20	% black to tot WW in a full system: TN	70%
TN reduced by all N loss (kg/year) *	9.27	N loss in treatment system (% reduction)	54%	N loss in disposal bed (% reduction)	20%
N Plant Uptake rate (kg/ha/year)	200				
Phosphorus in effluent (Ip) (kg/yr) *	3.60	P prod. per person per yr (kg/person/yr)	0.60	wastewater in a full system: TP	40%

STEP 7 – Treatment system

- Septic (primary teatment only)
- AWTS
- Septic + single pass sandfilter (SPF)
- Septic + SPF, 25% septic return flow
- Septic + recirculating sandfilter
- Septic + reedbed

STEP 8 – P soil sorption accord. soil type

- "Alluvial"Soils 1 (dp,mu,my,te) 10,000 kg/ha/m
- "Alluvial"Soils 2 (cr) 2,000 kg/ha/m
- Red Basaltic Soils (bg,ca,co,el,ew,mb,ro,wo) 10,000 kg/ha/m
- Duplex Soils (ba, bi,bu,mi, ni) 8,000 kg/ha/m
- Podzol Soils (ab,bo,br,eb,fh,ki,ku,og,po,ty,wy) 1,000 kg/ha/m

		Nitrogen Report		
P uptake by plants (Hp) (kg/ha/yr)	10	N plant uptake (kg/yr)	6.15	Total N-load 9.27kg/yr
P soil sorption (Ps) (kg/ha/m depth)	8000	N load exceedence	0.00	
Water Table/ Bedrock Depth (m) (STEP 10)	3.00	N load percolated (kg/yr)	3.13	
Buffer to Water Table (Bwt) (m)	0.5	N released (perc+exceed.) (kg/yr)	3.13	
Time for accumulation of P(years)	50	Enviro.N limit (kg/yr)	3.13	
Final area (m²)	**307**	Nitrogen area (m²)	**307**	
Phosphorus area (m²)	**88**	Hydraulic area (m2)	**244**	
Water balance area (m²)	307			
☑ Specific Crop Coeff.(grass=1.00)	1.00			
% Effective Rainfall	65%			
Percolation (mm/d)	4			

STEP 9 – Soil texture & structure beneath system

- Gravels,Sands Ksat >3.0m/d
- Sandy loams - weakly structured Ksat >3.0m/d
- Sandy loams - massive Ksat 1.4 - 3.0m/d
- Loams - high/moderate structured Ksat 1.5 - 3.0m/d
- Loams - weakly structured or massive Ksat 0.5 - 1.5m/d
- Clay loams - high/mod structured Ksat 0.5 - 1.5m/d
- Clay loams - weakly structured Ksat 0.12 - 0.5m/d
- Clay loams - massive structured Ksat 0.06 - 0.12m/d
- Light clays - strongly structured Ksat 0.12 - 0.5m/d
- Light clays - moderately structured Ksat 0.06 - 0.12m/d
- Light clays - weak. structured or massive Ksat <0.06m/d
- Med. to heavy clays - strong. struct. Ksat 0.06-0.5m/d
- Med. to heavy clays - mod. structured Ksat <0.06m/d
- Med. to hvy clays - weak. struct. or massive Ksat<0.06m/d
- DISPERSIVE soil (Modified Emerson Aggregate test)

STEP 11 – % Effective Rainfall

- Mounded bed
- Level bed with grass

STEP 12 – Soil texture in root zone

- Coarse Sand
- Fine sand, Sandy loams
- Loams,Clay loams,Silt
- Clay (light,med,heavy)

Avg depth of root zone (m)	0.30	Effective porosity of root zone	0.34	Avail.Water Capacity (AWC) of root zone	0.13
Avg depth bluemetal (etc) in trench below root zone (m)	0.00		0.00		0.00
Soil Moisture Holding Capacity: saturation & AWC (mm)	102.00	39.00			
Permissible percentile exceedence	5.00%	SSI laterals pipe separation (m)	0.60		
Minimum effluent application (mm/day/m²)	2.25				
Exceedence (L)	0.00000				

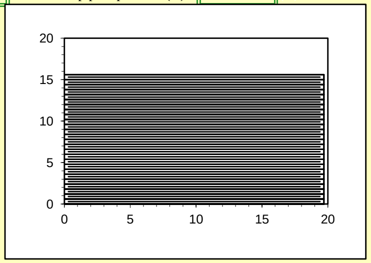
STEP 13 – Land Application Type

- SSI
- ETA

STEP 14: Calculate (or Cntl- q)

STEP 15: 2.00

26



LAND APPLICATION AREA (LAA)

Client: Eddie Lloyd
Location: 175 moffatts Rd, BILLINUDGEL
File No. 2024.734
Water Supply: Non-reticulated
Water Saving: AAA

Rainfall (mm)

Mullumbiimby (Fairview Farm): BOM Station No. 58040 (1961-1990)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	204.7	244.2	251.1	174.6	166.7	131.9	96.2	72.3	61.7	106.9	120.4	154.4

TABLE A1: SIZE OF AREA PER MONTH

(1) Month	Days in Month (n)	(2) Pan Evapoaration E (evap maps) mm	(3) Evapo-transpiration ET (ET = 0.75E) mm	(4) Rainfall R Mean mm	(5) Retained rainfall RR (Rr = 0.75R) mm	(6) Design Loading Rate (DLR) per month mm	(7) Disposal rate per month (3) - (5) + (6) mm	(8) Treated Effluent applied per month L	(9) Size of area (8)/(7) m2	No of days Per Month	Daily effluent	DLR/DIR
Jan.	31	177	132.5	204.7	153.5	118	96.8	21390	221.0	31	690	3.8
Feb.	28	140	105.0	244.2	183.2	106	28.3	19320	683.9	28	690	3.8
Mar.	31	133	100.0	251.1	188.3	118	29.5	21390	726.3	31	690	3.8
Apr.	30	105	78.8	174.6	131.0	114	61.8	20700	335.0	30	690	3.8
May	31	84	62.8	166.7	125.0	118	55.6	21390	385.1	31	690	3.8
Jun.	30	72	54.0	131.9	98.9	114	69.1	20700	299.7	30	690	3.8
Jul.	31	84	62.8	96.2	72.2	118	108.4	21390	197.3	31	690	3.8
Aug.	31	109	81.4	72.3	54.2	118	145.0	21390	147.6	31	690	3.8
Sept.	30	132	99.0	61.7	46.3	114	166.7	20700	124.2	30	690	3.8
Oct.	31	155	116.3	106.9	80.2	118	153.9	21390	139.0	31	690	3.8
Nov.	30	162	121.5	120.4	90.3	114	145.2	20700	142.6	30	690	3.8
Dec.	31	183	137.2	154.4	115.8	118	139.2	21390	153.7	31	690	3.8
								AVERAGE:	**296.3**	TOTAL	8280	

TABLE A2: DEPTH OF STORED EFFLUENT

(1) Month		(2) First trial area LAA m2	(3) Application rate (8)/(2) mm	(4) Diposal rate /month (7) mm	(5) Nett Application rate (3) - (4) mm	(6) Increase in depth of stored effluen (5)/n mm	Depth of effluent for month (X - 1) mm	(7) Increase in depth of effluent + (6) mm	(8) Computed depth of effluent = month (X) mm
Jan.		400.0	53.5	96.8	-43	-242.0	0	-242.0	0.0
Feb.			48.3	28.3	20.1	112.0	0	112.0	112.0
Mar.			53.5	29.5	24.0	134.2	112	134.2	246.2
Apr.			51.8	61.8	-10.1	-56.1	246.2	-56.1	190.1
May			53.5	55.6	-2.1	-11.6	190.1	-11.6	178.5
Jun.			51.8	69.1	-17.3	-96.8	178.5	-96.8	81.7
Jul.			53.5	108.4	-55.0	-307.0	81.7	-307.0	0.0
Aug.			53.5	145.0	-91.5	-511.0	0.0	-511.0	0.0
Sept.			51.8	166.7	-115.0	-642.3	0.0	-642.3	0.0
Oct.			53.5	153.9	-100.4	-560.9	0.0	-560.9	0.0
Nov.			51.8	145.2	-93.5	-522.1	0.0	-522.1	0.0
Dec.			53.5	139.2	-85.7	-478.8	0.0	-478.8	0.0
								MAX:	**246**

Porosity (n)	gravel	0.300	
	Clay	0.200	
	Clay	**0.179**	
	Clay Loam	0.185	
	Tunnel Trench	0.60	
Depth	Trench	450.0	mm
Topsoil	**Irrigation**	**250.0**	mm

APPENDIX 3 SOIL INVESTIGATION

Table 10 - Soil Investigation

NSW DLWC 1:100,000 Soil Landscape Map (Morand, 1996)	**Burringbar (bu) landscape:** High rolling to steep hills on metamorphics of the Neranleigh-Fernvale Group. **Soils:** Shallow to moderately deep, moderately well-drained stony Grey Earths on crests and some slopes; deep, moderately well-drained Red Podzolic Soils on slopes of deeply weathered siltstone/mudstone/shale; shallow, poorly drained Yellow Podzolic Soils on slops of quartzite/phylitte; deep, moderately well-drained Red Earths on foot slopes/lower slopes; imperfectly drained stony Yellow Podzolic Soils on old coastline. **Geology:** Jurassic Neranleigh-Fernvale Group. Predominantly phyllitic siltstones and shales, slaty in part. Quartzites and siliceous sandstones and siltstones are also present. Greywacke and argillite may occur in places. Variant a – Steep to very steep slopes.

Soil Profile via hand auger within proposed LAA See following page for soil profile information.
Modified Emerson Aggregate Test
As described by Robert Patterson Lanfax Labs Technical Note T14-1 (November 2014) *"The modified Emerson test can be reported and interpreted, with respect to domestic wastewater application as:* ***Class 1 -*** *Severe dispersion, maybe related to high sodicity which forces the clay particles apart in water. Amelioration with lime or gypsum may improve structural stability by increasing EC. Class 1 soils have a major limitation to wastewater application because of reduced permeability and potential to compact as the pores block.* ***Class 2 -*** *Moderate dispersion, may be related to high sodicity. Amelioration may be effective by increasing EC. Without amelioration, this class has a major limitation to wastewater application as for class 1.* ***Classes 3-6 -****Remoulding, and 1:5 soil:water suspension tests are irrelevant to wastewater assessment, but one can report the test results with degree of slaking as:* *Slake 1 (slight), slake 2 (moderate) or slake 3 (completely slumped). Slake 1, 2, or 3 – no limitation to wastewater application, but may benefit from additional organic matter for surface irrigated soils.* ***Classes 7 and 8 -*** *these soils are water stable but may swell (Class 7) or retain original size and shape (Class 8). Neither of these classes is a limitation to wastewater application."*

Soil Investigation record sheet	Address: 175 Moffatts Road Billinudgel	Date: 30/04/2024
Soil Profile with hand auger within Proposed LAA		

BH1	Depth	0-300	300-1000		
	Structure	Strong	Weak		
	Moisture	Moist	Moist		
	Coarse Fragments	Fine gravel, Very few (<2%)	Fine gravel, Common (10-20%)		
	pH	6.0	6.0		
	Colour	7.5YR 2.5/2 very dark brown	10YR 4/2 Dark greyish brown		
	Soil Category	Light Clay, Category 5	LightClay, Category 5		
	Modified Emerson Aggregate Test	Class 8 - No swelling	Class 8 - No swelling		
	Ribbon Test				

BH2	Depth	0-300	300-1000		
	Structure	Strong	Strong		
	Moisture	Dry	Moist		
	Coarse Fragments	Fine gravel, Medium gravel, Common (10-20%)	Fine gravel, Very few (<2%)		
	pH	5.0	4.5		
	Colour	7.5YR 5/6 strong Brown	10YR 4/6 Dark Yellowish Brown		
	Soil Category	Light Clay, Category 5	Light Clay, Category 5		
	Modified Emerson Aggregate Test	Class 3-6 - No dispersion	Class 3-6 - No dispersion		
	Ribbon Test				

APPENDIX 4 EFFLUENT TREATMENT

The method of land application chosen to suit the dwelling size and site will determine the treated effluent quality target criteria. The proposed secondary effluent treatment with disinfection is suitable for shallow sub-surface drip irrigation.

Table 11 - Recommended Final Use of Treated Effluent based on Treatment

Treatment	Standard	Recommended Final Use / Application
Primary Treatment (sewage or greywater) e.g., septic tank, greywater tank, wet composting closet	Solids separation and digestion- no effluent standard	Sub-soil at greater than 300mm depth below finished ground level e.g., absorption trenches, mounds, and evaporation-transpiration beds.
Secondary Treatment without Disinfection	• BOD < 20 mg/L • TSS < 30 mg/L • Service person performs compliance inspection and reports condition of land application system. • Local council develops risk	• Sub-soil > 300mm depth • Sub-surface (300 mm to 150 mm) • LPED • Shallow Sub-surface Drip Irrigation
Secondary Treatment with Disinfection	• BOD < 20 mg/L • TSS < 30 mg/L • E. coli <30 cfu/100mL	• Sub-soil > 300mm depth • Sub-surface (300 mm to 150 mm) • * LPED • Shallow sub-surface drip irrigation • Surface and spray irrigation (100 mm to above GL)
Advanced Secondary Treatment without Disinfection	• BOD < 10 mg/L • TSS < 10 mg/L • Service person performs compliance inspection and reports condition of land application system. • Local council develops risk	• Sub-soil > 300mm depth • Sub-surface (300 mm to ground level (no spray) • * LPED • ** Shallow Sub-surface drip irrigation
Advanced Secondary Treatment with Disinfection	• BOD < 10 mg/L • TSS < 10 mg/L • E. coli <10 cfu / 100mL	• Sub-soil > 300mm depth • Sub-surface (300 mm to 150 mm) • * LPED • ** Shallow sub-surface drip irrigation • Surface and spray irrigation (100 mm to above GL) • Greywater may be used for toilet flushing and washing machines

From NSW Health AdNote 4 (4 January 2017)
**Low Pressure Effluent Distribution (LPED) Irrigation Lines if installed in accordance with AS/NZS 1547:2012 On-site domestic wastewater management; Appendix M*
***Shallow sub-surface drip irrigation if installed in accordance with AS/NZS 1547:2012 On-site domestic wastewater management; Appendix M*

APPENDIX 5 SETBACK DISTANCE RISK ASSESSMENT

Table 12 - Site Features Not Achieving Maximum Setback Distances

Site Feature	Horizontal Setback Distance Range	Site Constraint Items
Property boundary	1.5-50m	A D J
Surface waters	15-100m	A B D E F G J

Table 13 - Site Constraint Risk Assessment

Item	Site/system feature	Constraint Scale Factors Lower ◄——► Higher		Risk Level of Constraint
A	Microbial quality of effluent [3]	Secondary treatment	Primary treatment	Low-Secondary treatment in AWTS
B	Surface water	Category 1-3 soils >100m setback Low rainfall Low resource value	Category 4-6 soils <50m to surface water High rainfall High resource value	High - Category 5 soils High-15m to watercourse Medium resource value Average: Medium
D	Slope	0-10% (subsurface effluent application)	>30% subsurface effluent application	High – steep slopes
E	Position of land application area in landscape	Downgradient of surface water, boundary	Upgradient of surface water, boundary	High – downslope to watercourse
F	Drainage	Category 1 and 2 soils, gently sloping	Category 6 soils, seepage, low lying area	Medium – Category 5 soils
G	Flood potential	Above 1 in 20-year flood contour	Below 1 in 20-year flood contour	Low – nil flood inundation within proposed LAA
J	Application method	Drip irrigation or subsurface application of effluent.	Surface/above ground application of effluent.	Low-subsurface application under lawn
AVERAGE RISK LEVEL				
Property boundary				LOW
Surface waters				LOW/ MEDIUM

APPENDIX 6 SETBACK GUIDELINES

Table 14 - Setback Guidelines (Table R1)

Table R1 – AS/NZS 1547:2012 Guidelines for Horizontal and Vertical Setback Distances (to be used in conjunction with Table R2)		
Site Feature	**Setback Distance range (m)**	**Site constraint items of specific concern (from table R2)**
	Horizontal Setback Distance (m)	
Property Boundary	1.5-50	A, D, J
Buildings/houses	2.0->6	A, D, J
Surface Water	15-100	A, B, D, E, F, G, J
Bore, Well	15-50	A, C, H, J
Recreational areas (Children's play areas, swimming pools and so on)	3-15	A, E, J
In-Ground water tank	4-15	A, E, J
Retaining wall and Embankments, escarpments, cuttings	3.0m or 45o angle from toe of wall (whichever is greatest)	D, G, H
	Vertical Setback Distance (m)	
Groundwater	15-50	A, C, F, H, I, J
Hardpan or bedrock	0.5->1.5	A, C, J

Notes:
The overall setback distance should be commensurate with the level of risk to public health and the environment. For example, the maximum setback distance should be adopted where site/system features are on the high end of the constrain scale. The setback distance should be based on an evaluation of the constraint items and corresponding sensitive features in Table R2 and how these interact to provide a pathway or barrier for wastewater movement.
Subject to local regulatory rules and design by a suitably qualified and experienced person, the separation of a drip line system from an upslope boundary, for slopes greater than 5%, may be reduced to 0.5m.
Setback distances of less than 3m from houses are appropriate only where a drip irrigation land application system is being used with low design irrigation rates, where shallow subsurface systems are being used with equivalent low areal loading rates, where the risk of reducing the bearing capacity of the foundation or damaging the structure is low, or where tan effective barrier (designed by a suitably qualified and experienced person) can be installed. This may require consent from the regulatory authority.
Setback distance from surface water is defined as the areal edge of the land application system to the edge of the water. Where land application areas are planned in a water supply catchment, advice on adequate buffer distances should be sought from the relevant water authority and hydrogeologist.
Surface water, in this case, refers to any fresh water or geothermal water in a river, lake, stream, or wetland that may be permanently or intermittently flowing. Surface water also includes water in the coastal marine area and water in man-made drains, channels, and dams unless these are to specifically divert surface water away from the land application area. Surface water excludes any water in a pipe or tank.
Highly permeable stony soils and gravel aquifers potentially allow microorganisms to be readily transported up to hundreds of metres down the gradient of an on-site system (see R3, Table 1 in Pang et al. 2005). Maximum setback distances are recommended where site constraints are identified at the high scale for items A, C and H. For reading and guidance on setback distances in highly permeable soils and coarse-grained aquifers see R2. As microbial removal is not linear with distance, data extrapolation of experiments should not be relied upon unless the data has been verified in the field. Advice on adequate buffer distances should be sought from the relevant water authority and a hydrogeologist.

Setback distances from water supply bores should be reviewed on a case-by-case basis. Distances can depend on many factors including soil type, rainfall, depth and casing of bore, direction of groundwater flow, type of microorganisms, existing quality of receiving waters, and resource value of waters.
Where effluent is applied to the surface by covered drip or spray irrigation, the maximum value is recommended.
In the case of subsurface application of primary treated effluent by LPED irrigation, the upper value is recommended.
In the case of surface spray, the setback distances are based on a spray plume with a diameter not exceeding 2m or a plume height not exceeding 0.5m above finished surface level. The potential for aerosols being carried by the wind also needs to be taken into account.
It is recommended that land application of primary treated effluent be down gradient of in-ground water tanks.
When determining minimum distances from retaining walls, embankments, or cut slopes, the type of land application system, soil types, and soil layering should also be taken into account to avoid wastewater collecting in the subsoil drains or seepage through cuts and embankments. Where these situations occur setback clearances may need to be increased. In areas where slope stability is of concern, advice from a suitably qualified and experienced person may be required.
Groundwater setback distance (depth) assumes unsaturated flow and is defined as the vertical distance from the base of the land application systems to the highest seasonal water table level. To minimise potential for adverse impacts on groundwater quality, minimum setback distances should ensure unsaturated, aerobic conditions in the soil. These minimum depths will vary depending on the scale of the site constraints identified in Table R2. Where groundwater setback is insufficient, the ground level can be raised by importing suitable topsoil and improving effluent treatment. The regulatory authority should make the final decision in this instance. (See also the guidance on soil depth and groundwater clearance in Tables K1 and K2.

Table 15 - Setback Guidelines (Table R2)

Table R2 - AS/NZS 1547:2012 Site Constraint Scale for Development of Setback Distances (used as a guide in determining appropriate setback distances from ranges given in Table R1)				
Item	Site/system feature	Constraint Scale Lower ⟷ Higher		Sensitive features
A	Microbial quality of effluent 3	Effluent quality consistently producing ≤106 cfu/100mL E.coli (for example, primary treated effluent)	Effluent quality consistently producing ≥106 cfu/100mL E.coli (for example, primary treated effluent)	Groundwater and surface pollution hazard, public health hazard
B	Surface water 4	Category 1 to 3 soils 5 no surface water down gradient within > 100m, low rainfall area	Category 4 to 6 soils, permanent surface water <50m down gradient, high rainfall area, high resource/environmental value6	Surface water pollution hazard for low permeable soils, low lying or poorly draining areas
C	Groundwater	Category 5 & 6 soils, low resource/environmental value	Category 1 and 2 soils, gravel aquifers, high resource/environmental value	Groundwater pollution hazard
D	Slope	0-6% (surface effluent application)	>10% (surface effluent application), >30%	Off-site export of effluent erosion

			subsurface effluent application	
E	Position of land application area in landscape 6	Downgradient of surface water, property boundary, recreational area	Upgradient of surface water, property boundary, recreational area	Surface water pollution hazard, off-site export of effluent
F	Drainage	Category 1 and 2 soils, gently sloping area	Category 6 soils, sites with visible seepage, moisture tolerant vegetation, low lying area	Groundwater pollution hazard
G	Flood potential	Above 1 in 20-year flood contour	Below 1 in 20-year flood contour	Off-site export of effluent, system failure, mechanical faults
H	Geology and Soils	Category 3 and 4 soils, low porous regolith, deep, uniform soils	Category 1 and 6 soils, fractured rock, gravel aquifers, high porous regolith	Groundwater pollution hazard for porous regolith and permeable soils
I	Landform	Hill crests, convex side slopes and plains	Drainage plains and incise channels	Groundwater pollution hazard, resurfacing hazard
J	Application method	Drip irrigation or subsurface application of effluent	Surface/above ground application of effluent	Off-site export of effluent, surface water pollution

NOTES:
Scale shows the level of constraint to sitting on an on-site system due to the constraints identified by SSE evaluator or regulatory authority. See Figures R1 and R2 for examples of on-site system design boundaries and possible site constraints.
Examples of typical siting constraint factors that may be identified either by SSE evaluator or regulatory authority. Site constraints are not limited to this table. Other site constraints may be identified and taken into consideration when determining setback distances.
The level of microbial removal for any on-site treatment system needs to be determined and it should be assumed that unless disinfection is reliably used then the microbial concentrations will be similar to primary treatment. Low risk microbial quality value is based on the values given in ARC (2004), ANZECC and ARMCANZ (2000), and EPA Victoria (Guidelines for environmental management: Use of reclaimed water 2003)
Surface water, in this case, refers to any fresh water or geothermal water in a river, lake, stream, or wetland that may be permanently or intermittently flowing. Surface water also includes water in the coastal marine area and water in man-made drains, channels, and dams unless these are to specifically divert surface water away from the land application area. Surface water excludes any water in a pipe or tank.
The soil categories 1 to 6 are described in Table 5.1 Surface water or groundwater that has high resource value may include potable (human or animal) water supplies, bores, wells, and water used for recreational purposes. Surface water or groundwater of high environmental value include undisturbed or slightly disturbed aquatic ecosystems as described in ANZECC and ARMCANZ (2000).
The regulatory authority may reduce or increase setback distance at their discretion based on the distances of the land application up or downgradient of sensitive receptors.

APPENDIX 7 PHOTOGRAPHIC LOG

Photo No. 1	Date 17/04/2024
Description: View west and across slope overlooking proposed EAA, as staked onsite.	

Photo No. 2	Date 17/04/2024
Description: View south and upslope overlooking proposed EAA, as staked onsite.	

Photo No. 3	Date 17/04/2024
Description: View north and downslope overlooking proposed EAA, as staked onsite.	

APPENDIX 8 VIRAL DIE-OFF MODELLING

Estimation of Pathogen Die-Off from Land Appplication Areas page 1

Based on a paper by W C Cromer, E A Gardner & P D Beavers, "An Improved Viral Die-Off Method For Estimating Setback Distances"

Step A - Equation 1: Determine days required for viral reduction

Formula: **Mt / Mo = e-kt**

Mt / Mo = is the dimensionless ratio of viral concentration in the groundwater t (Mt) and the viral concentration in the wastewater (Mo)

t = is the travel time (days) of the viruses in the groundwater

k = is the first order rate coefficient for the die-off rate of the organism and is the temperature- dependent variable (°C).

For treated effluent from a secondary treatment on-site system, Mt/Mo should be 0.001 (3 orders of magnitude reduction)
For primary treated effluent from a septic tank, Mt/Mo should be 0.0000001 (7 orders of magnitude reduction)
For raw wastewater, Mt/Mo should be 0.0000001 (7 orders of magnitude reduction)
For greywater, Mt/Mo should be 0.00001 (5 orders of magnitude reduction)

Input:	0.001	Mt / Mo (dimensionless ratio of viral concentration)
	14	T (groundwater temp °C)

Calculate k (14 – 8.5) / 20

k = **0.275**

Calcultae t Ln (Mt / Mo) / -k

Ln (0.0000001) / -0.275

t = **25.1**

An Improved Viral Die-Off Method For Estimating Setback Distances (W C Cromer, E A Gardner & P D Beavers)

Step B - Equation 2: Correcting Travel Time for Vertical Infiltration

The time required for groundwater (containing viruses) to move a given distance in saturated material:

Formula: **dg** = **(t - dv .P/K)/(P/K.i)**

dg = horizontal distance from effluent land application area to where virus die-off occurs (m)

dv = vertical distance to groundwater (m)

t = travel time (days)

P = porosity soil (fraction eg 0.3) - clay 40-70%, silt 35-50%, sand 25-50%, gravel 25-40%

K = permeability (m/day)

i = groundwater gradient (fraction eg 0.02 if slope of groundwater 1:50).

Input:	1	dv (vertical distance to the water table in metres)
	0.4	P1 (effective porosity of the soil - refer to "porosity" worksheet)
	0.4	P2 (effective porosity of the aquifer/soil of watertable
	0.5	K1 (saturated hydraulic conductivity in metres/day)
	0.5	K2 (saturated hydraulic conductivity in metres/day)
	0.05	i (groundwater gradient - the steeper, the more conservative the answer)

Calculate dg (t - dv .P/K)/(P/K.i)

dg = **1.52** metres

dg + safety factor (*2) = **3.0** metres

APPENDIX 9 DECOMMISSIONING SEPTIC TANKS

Advisory Note 3 — Revised January 2017

Destruction, Removal or Reuse of Septic Tanks, Collection Wells, Aerated Wastewater Treatment Systems (AWTS) and other Sewage Management Facilities (SMF)

This advisory note has been developed to assist local councils when dealing with applications to reuse septic tanks, collection wells and or aerated wastewater treatment systems (AWTS). It should be read in conjunction with the Local Government (General) Regulation 2005.

UNDER NO CIRCUMSTANCES ARE SEPTIC TANKS, COLLECTION WELLS, AWTS, ETC TO BE REUSED AS VESSELS FOR HOLDING WATER FOR DRINKING PURPOSES, OR FOR ANY INTERNAL HOUSEHOLD DOMESTIC PURPOSE.

Existing septic tanks, collection wells and AWTS become redundant where reticulated sewerage progresses through an area and premises connect. Questions are asked periodically by the public about the fate of the redundant SMF. These onsite SMF may be demolished or potentially reused onsite as a storm water storage vessel. There is also potential for these systems to be sold second hand and reinstalled. The existing septic tank, where suitable, potentially may also be used when the premises is upgraded to an AWTS installation.

Where it is feasible to reuse a septic tank, collection well, or AWTS there are several precautions that need to be observed to ensure that public health risk is minimised. The reuse and/or removal of a septic tank, collection well or AWTS shall only be carried out after the premises are connected to sewer or to an alternative form of SMF.

During times of water restrictions the water supply authority should be contacted to determine if it is a permissible use of water to hose out a SMF prior to its reuse or relocation.

This guideline considers the following circumstances.

1. Septic Tanks / Collection Wells
1.1 Demolition
1.2 Reuse for Stormwater Storage
1.3 Upgrade to AWTS
1.4 Removed and Relocated

2. AWTS
2.1 Demolition
2.2 Used as Domestic Greywater Treatment System
2.3 Removed and Relocated

If reuse of a different type of SMF is under consideration then the intent of these guidelines should be met.

1. Septic Tank / Collection Well:

1.1 Demolition On-Site

1.1.1 The contents of the septic tank / collection well are to be removed by a method acceptable to the local council, either by tanker removal to an appropriate authorised site or pumped into the existing disposal trench if of sufficient capacity and which then should be sealed. The contents of a septic tank or collection well must not be broadcast or discharged above ground.

1.1.2 The sides, lid, baffle or partition (if fitted) and square junctions of the tank should be hosed down as the waste is being removed.

1.1.3 The tank is to be treated by liberally broadcasting “Builders' (hydrated) Lime” over the exposed surfaces. It is advisable to wear personal protective equipment.

1.1.4 Several holes should be punched or drilled into the base of the tank. The lid and those parts of the walls baffle and square junctions above the ground should be demolished and collapsed into the tank and the tank filled with clean soil or rubble and topped with clean soil. This should be performed to ensure that voids cannot develop which would allow collapse and injury in the future.

1.2 Reused On Site as a Storm Water Storage and Irrigation Tank

1.2.1 The water from such a stormwater or irrigation tank may be used for garden purposes but not for topping up swimming pools. Nor should the water be used for internal household purposes such

as for toilet flushing, or in laundry tubs, washing machines, bathrooms or kitchen.

1.2.2 For reuse on site as a non-domestic water containing vessel the contents are to be removed either to a site acceptable to the local council or pumped into the existing disposal trench if of sufficient capacity which then should be sealed. The contents of a septic tank or collection well must not be broadcast or discharged above ground.

1.2.3 The sides, lid, baffle or partition (if fitted) and square junctions of the tank should be hosed down as the waste is being removed.

1.2.4 The tank should be filled with fresh water and disinfected to a minimum level of 5 mg/L of free residual chlorine with a half hour contact time. The chlorine should be allowed to dissipate naturally at least overnight and not be neutralised.

1.2.5 The inlet(s) and outlet(s) of the vessel should be sealed. Pumps and other accessories may then be installed and connected to an irrigation system. The tank is to be mosquito proofed and fitted with a strainer or first flush device to prevent the introduction of coarse particles and materials.

1.2.6 The tank is to be labelled as containing water unfit for human consumption.

1.2.7 Pipes, fittings or fixtures in accordance with the water supply authority requirements may only be used. No cross connection is to be made with any potable water supply, nor should the vessel be likely to contaminate any potable water supply. Backflow prevention devices may need to be installed in accordance with the water supply authority directions.

1.2.8 Any overflow is to be directed to the storm water discharge or as specified by the local council.

1.3 Upgrading to AWTS

An existing septic tank may be used in conjunction with an AWTS on the same site provided:

1.3.1 The existing septic tank is of at least the same size and capacity of the septic tank of the accredited AWTS and the existing septic tank is not to be relocated elsewhere on the same site;

1.3.2 The contents of the septic tank are to be removed either to a site acceptable to the local council or pumped into the existing disposal trench if of sufficient capacity which then should be sealed. The contents of a septic tank or collection well must not be broadcast or discharged above ground.

1.3.3 The septic tank when inspected by a competent person such as the installer of the AWTS or a plumber / drainer is found to be in a suitable condition and in conformity with AS/NZS 1546.1:2008.

1.3.4 Written approval under section 68 of the Local Government Act from the local council to alter the SMF must be obtained prior to the upgrade and the approval to operate must be reassessed.

1.4 Removed and Relocated

1.4.1 Septic tanks and collection wells may only be removed, relocated and reused as such where the septic tank or collection well is subject to a current "Certificate of Accreditation" issued by the NSW Ministry of Health.

1.4.2 The contents of the septic tank and/or collection well are to be removed either to a site acceptable to the local authority or pumped into the existing disposal trench if of sufficient capacity which then should be sealed. The contents of a septic tank or collection well must not be broadcast or discharged above ground.

1.4.3 The sides, lid, baffle or partition (if fitted) and square junctions of the tank should be hosed down as the waste is being removed.

1.4.4 The inlets and outlets should be plugged and the tank should then be filled with clean water and disinfected to a minimum level of 5 mg/L of free residual chlorine, with a minimum one half hour contact time. The lid should be exposed to the chlorine solution. The chlorine should be allowed to dissipate naturally at least overnight and not be neutralised.

1.4.5 The contents of the tank and/or well may be then emptied as stated above in 1d.2 and the trench should be sealed. The septic tank and/or collection well may be removed if the structural integrity of the tank and/or well can be maintained.

1.4.6 Approval of the local council under section 68 of the Local Government Act is to be obtained before the vessel(s) is reinstalled.

2. AWTS

2.1 Demolition On-Site

2.1.1 The waste contents of the AWTS are to be removed by a method acceptable to the local council, either by tanker removal to an appropriate site or pumped into a disposal trench (if one exists) and sealed. The liquid content of the AWTS is not to

be irrigated using the land application system and is not to be discharged to the environment.

2.1.2 The sides, lid, baffles or partitions, components and square junctions of the AWTS should be hosed down as the waste is being removed.

2.1.3 The pumps, blowers and internal components of the AWTS may be either collapsed into the AWTS or selectively removed by the owner/occupier, an AWTS manufacturer or service agent for proper disposal to landfill. The owner/occupier, manufacturer or service agent must remove such parts in a manner which will not contaminate the environment or compromise the health and safety of themselves or others. Un-retrieved components must be left in the AWTS.

2.1.4 The AWTS and remaining components are to be disinfected by broadcasting "Builders' (hydrated) Lime" over the exposed surfaces. It is advisable to wear personal protective equipment.

2.1.5 Several holes should be punched or drilled into the base of the tank. The lid and those parts of the walls, baffle and square junctions above the ground should be demolished and also collapsed into the tank and the tank filled with clean soil or rubble and topped with clean soil.

2.1.6 All irrigation lines and spray head, sprinklers, drippers and the like are to be flushed with potable water for 5 minutes. If the irrigation lines are to be connected to the reticulated water supply the installation shall comply with the water supply authority requirements and a backflow prevention device installed.

2.2 Used as a Domestic Greywater Treatment System (DGTS)

The AWTS may be used as a domestic greywater treatment system provided:

2.2.1 The premises is connected to the sewer and the proposal is acceptable to the local council under its wastewater management strategy or policy;

2.2.2 The AWTS is subject to a current "Certificate of Accreditation" issued by the NSW Ministry of Health;

2.2.3 Only greywater is discharged to the AWTS, ie blackwater from any toilet, bidette or bidet is not connected;

2.2.4 Excess treated greywater or untreated greywater is discharged to the sewer when the land application system is overloaded;

2.2.5 The land application system has been reassessed by the owner/occupier to the local council's satisfaction as being suitable for the land application system management of treated greywater;

2.2.6 Prior approval is obtained from the local council to alter and to operate the AWTS as an DGTS; and

2.2.7 The maintenance of the AWTS is carried out by a service contractor suitable to the local council.

***NOTE**: It is not necessary to pump out or recommission the AWTS unless maintenance such as desludging is required.*

2.3 Removed and Relocated

2.3.1 AWTS may only be reused where the AWTS is subject to a current "Certificate of Accreditation" by the NSW Ministry of Health.

2.3.2 The removal and relocation of an AWTS shall be performed by an AWTS manufacturer, installer or service agent familiar with the AWTS brand.

2.3.3 The waste contents of the AWTS are to be removed by a method acceptable to the local council, either by tanker removal to an approved site or pumped to a disposal trench if of sufficient capacity which then should be sealed. The contents of a septic tank or collection well must not be broadcast or discharged above ground.

2.3.4 The sides, lid, baffles or partitions, components and square junctions of the AWTS should be hosed down as the waste is being removed.

2.3.5 The tank should then be filled with clean water and disinfected to a minimum level of 5 mg/L of free residual chlorine, with a minimum one half hour contact time.

2.3.6 All irrigation lines and spray head, sprinklers, drippers and the like are to be flushed with potable water for 5 minutes. If the irrigation lines are to be connected to the reticulated water supply the installation shall comply with the water supply authority requirements and a backflow prevention device installed.

2.3.7 The tank may then be emptied and removed. Tanks of reinforced concrete may only be removed

where the structural integrity of the tank can be maintained.

2.3.8 The pumps, blowers and internal components of the AWTS must be removed by an AWTS manufacturer or service agent for use only as spare parts. The manufacturer or service agent must remove such parts in a manner which will not contaminate the environment or compromise the occupational health and safety of themselves or others.

2.3.9 All mechanical and electrical items such as pumps and blowers must be renewed (not reconditioned), and covered by warranty. Valve diffusers and media may be reused and are to be cleaned and serviced.

2.3.10 Maintenance of the re-installed AWTS must be carried out by service contractor to the satisfaction of the local council.

2.3.11 Installation approval of the local council is to be obtained before the AWTS is reinstalled.