Feasibility Assessment for Wastewater Management

For Proposed Development at: Lot 2 DP 1233492, Lot 1 DP 239858 Peelwood Road, Laggan

Prepared by:

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Date of Assessment: 9/08/2021

Signed: 

Andrew Macloed
Director
SEEC

Document Certification

This report has been developed based on agreed requirements as understood by SEEC at the time of investigation. It applies only to a specific task on the nominated lands. Other interpretations must not be made, including changes in scale or application to other projects. The contents of this report are based on a professional appraisal of the conditions that existed at the time of our investigation. Where subsurface investigations have been done the results are only applicable to the specific sampling or testing locations and only to the depth(s) investigated. Because of natural geological variability, and/or because of possible anthropogenic influences, the subsurface conditions reported can change abruptly. Such changes can also occur after the site investigation. The accuracy of the conditions provided in this report is limited by these possible variations and influences and/or is limited by budget constraints imposed by others and/or by adequate accessibility.

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Document Issue Table

Version	Date	Author	Reviewed	Notes
Draft A	19/05/2020	CB	AM & LO	
01	22/07/2020	CB	Client	
02	28/07/2021	CB	Client	
03 Final	09/08/2021	CB	Client	

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1 INTRODUCTION

Strategic Environmental and Engineering Consulting have been commissioned by Laterals Planning, on behalf of the property owner, to provide this Wastewater Site Assessment at Lot 2 DP 1233492 and Lot 1 DP 239858 Peelwood Road, Laggan (Figure 1). It will accompany a rezoning application. The purpose of this report is to demonstrate that an Effluent Management Area (EMA) can feasibly be sited on any newly-created rural/residential lot. It does not provide details of a specific system to be used on a lot and must not be used by the purchasers of any proposed lot.

This study includes:

- Undertaking a site inspection and soil survey to assess the suitability of each proposed allotment for onsite effluent disposal;
- Assessment of soil texture, depth, pH, electrical conductivity, dispersion potential, and phosphorous sorption;
- Discussion of suitable methods for treatment and land application of effluent;
- Hydraulic and nutrient modeling to determine the necessary size of effluent management areas;
- Preparation of a site plan showing suitable effluent management areas;
- A discussion of any special management initiatives; and,
- Preparation of this written report for submission to Council.

The site and soil investigation is undertaken in accordance with:

- AS/NZS 1547: 2012 On-site Domestic Wastewater Management (Standards Australia / Standards New Zealand, 2012).
- Environment and Health Protection Guidelines: Onsite Sewage Management for Single Households (Department of Local Government, 1998).

Figure 1: Existing Lot 2 DP 1233492, and Lot 1 DP 239858

2 ASSUMPTIONS

It is assumed that the new lots would be rural residential developments and could potentially include:

- New rural home (assumed five-bedrooms) and access;
- Workshops, garages, etc.

This report is a conceptual Wastewater Assessment to show that any new lot could feasibly manage treated wastewater. However, future owners would require a site specific Wastewater Site Assessment for their individual lot, considering their proposed development and their preferences. This report must not be relied upon for the design or installation of a wastewater system on any of the proposed lots.

3 SITE ASSESSMENT

3.1 Introduction

A site assessment was undertaken by Ciaran Bromhead of SEEC on the 17th October 2019. The assessment was undertaken following Table 4 in the Environment and Health Protection Guidelines: Onsite Sewage Management for Single Households (Department of Local Government, 1998), which describes a rating system for onsite effluent management constraints. Several possible site constraints are considered including, but not limited to:

- Proximity to permanent and intermittent watercourses;
- Landform, site gradient and drainage characteristics;
- Aspect and exposure;
- Extent of surface rock and outcrop;
- Climate of the area;
- Existing vegetation; and
- Available land area.

The following sections provide a brief commentary on the levels of constraint for onsite effluent disposal across this site. The "Limitations" are defined in DLG (1998).

3.2 Location and General Site Conditions

Lot 2 DP 1233492 is a 26 ha (approx.) rural lot located on the western side of Peelwood Road, Laggan. Lot 1 DP 1253980 are located on the south-eastern extent of Lot 2 DP 1233492. The property is bound by similar rural properties to the north, east and west and by Laggan village to the south. The existing topography consists of long foot slopes and undulating low rises. The northern portion of the site consists of stepper slopes grades at approx. 20% to the south-east towards an intermittent watercourse. There is a drainage depression that runs through the southern central portion of the site. This depression intersects two dams which have been filled in. During development of the proposed subdivision this depression will be diverted.

3.3 Climate

Laggan experiences a temperate climate, with warm summers and cool winters. According to the Australian Bureau of Meteorology, nearby Crookwell Post Office (Site No. 070025) receives 859.6 mm of annual average rainfall per year and nearby Goulburn Tafe (Site No. 070263) experiences 1,262.6 mm of evaporation. Rainfall is slightly heavier during winter then evenly distributed across the rest of the year, while evaporation is significantly greater in summer (Figure 2) (*Moderate Limitation*).

Table 1: Average monthly rainfall and evaporation (Crookwell and Goulburn)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rain (mm)	69.7	54.5	57.9	57.8	65.6	88.9	83.9	88.8	74.9	76.3	65.9	67.4	859.6
Evap (mm)	195.3	145.6	124	75	49.6	33	37.2	58.9	84	120.9	150	189.1	1262.6

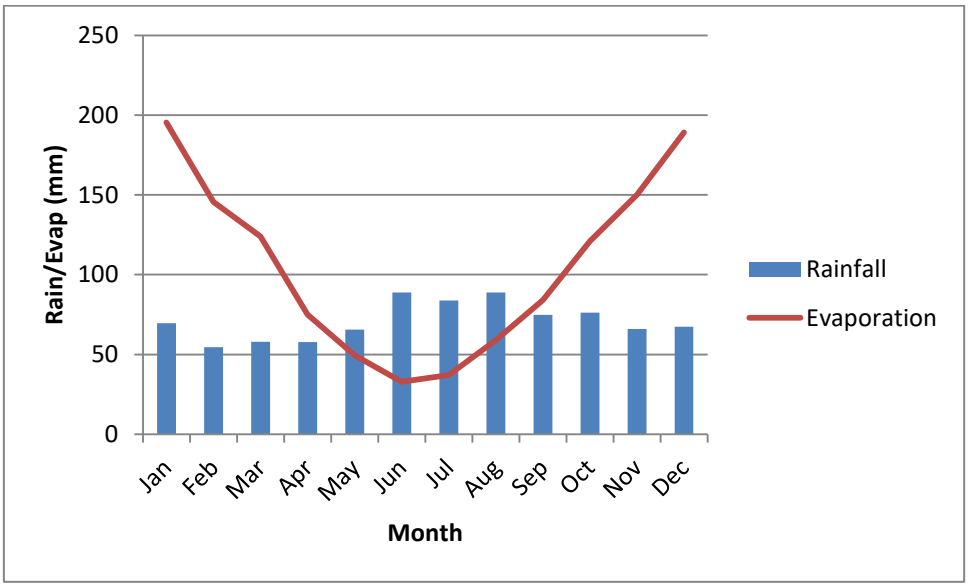

Figure 2: Graph showing Rainfall and Evaporation

3.4 Flood Potential

There are several existing drainage depressions running though the site. Flood mapping completed by SEEC has found that the site is at risk of flooding (see SEEC report 19000339-FS-01. Any effluent disposal below the 1:100 ARI flood level must be treated to a minimum standard of secondary-treatment and disposed of by subsurface irrigation only. All electrical components of the Aerated Wastewater Treatment Systems (AWTSs) installed onsite must be located above the 1:100 ARI Flood Level (*Moderate Limitation)*.

3.5 Exposure

Land identified as potentially suited to on-site effluent management on this site is well exposed to sun and wind (*Minor Limitation*).

3.6 Slope

The site has varying topography of slopes between 7 and 20%. Where slopes are between 10-20% all effluent management must be via subsurface irrigation and the Design Irrigation Rate (DIR) must be decreased by 20% (*Moderate Limitation*).

3.7 Stormwater Run-on

Some of the land identified as potentially suited to on-site effluent management might be subject to some degree of run-on. An upslope drain/berm could be required on some lots (*Minor Limitation*).

3.8 Proximity to Watercourses and Dams

According to NSW Spatial Services there are several drainage depressions and an intermittent watercourse flowing through this site, from the west to the east. During the site inspection the intermittent watercourse was dry. There were signs of erosion towards the eastern extent of the intermittent watercourse. A 40m buffer has been applied to all drainage depressions, proposed overland drainage swales and the intermittent watercourse. (*Moderate Limitation*).

3.9 Surface Rock

No surface rocks were identified during our site investigation (*Minor Limitation*).

3.10 Groundwater Seepage

Several areas of moisture tolerant vegetation were observed in proximity to the intermittent watercourse during our inspection. Subsurface soil conditions in this area showed signs of mottling in the moist subsoil. These areas have been avoided for the purposes of effluent management (*Moderate Limitation*).

3.11 Groundwater

Upper Lachlan Shire Council requires that no onsite effluent disposal occur within 250 m of bores used for potable water supply. According to WaterNSW's online ground water map there are no bores used for potable water supply within a 250 m radius of the proposed EMAs (*Minor Limitation).*

3.12 Erosion Potential

There were some signs of localised erosion, although soil erosion is not expected to be a significant problem on this generally well-vegetated site (*Minor Limitation*).

3.13 Fill

No fill was encountered during our investigation (*Minor Limitation*).

3.14 Vegetation

The site is well vegetated with a good covering of improved pasture. This vegetation provides good opportunity for the retention of water and nutrients resulting from onsite effluent disposal (*Minor Limitation*).

3.15 Land Availability

All lands suitable for effluent management must be given a 40 m buffer to dams, drainage depressions and the proposed overland drainage swale located downslope of the proposed EMAs (*Minor Limitation*). If stormwater improvement devices are constructed on any proposed lots the EMA must be given the maximum available setback from them (*Moderate Limitation)*.

Future owners would need to be considerate of their available (and required) EMAs when planning potential developments. As previously mentioned, this is a conceptual Wastewater Assessment and future owners would require a site specific Wastewater Site Assessment to suit their individual development and preferences.

4 Soils and Geology

4.1 Soil Landscape Mapping

Soil Landscape mapping by eSPADE (2019) identifies the site is on the *Blakney Creek Soil Landscape* (Figure 3).

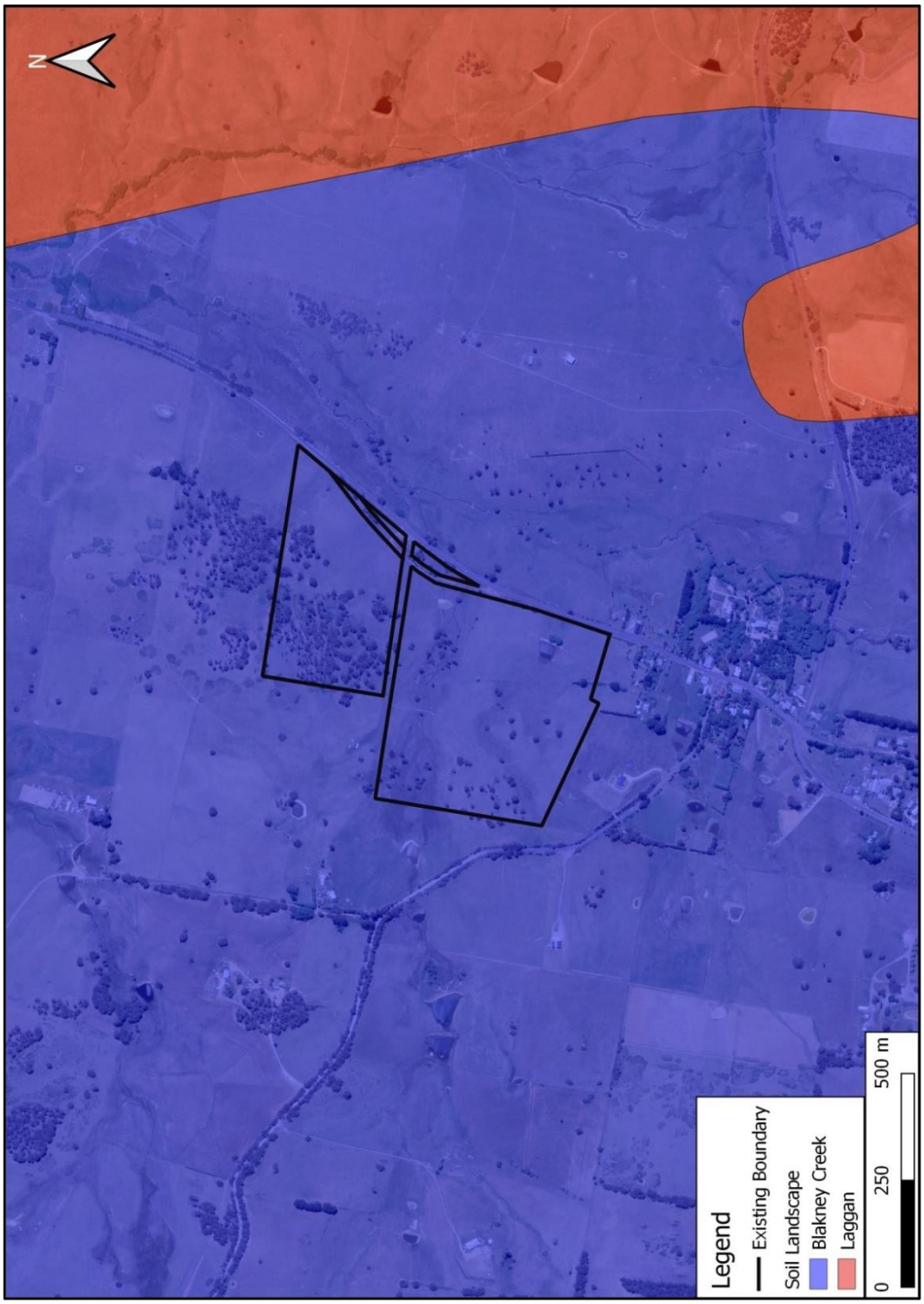

Figure 3: Soil Landscapes and boundary of Lots 2 DP 1233492.

4.2 Site Specific

Eleven bores were excavated by SEEC staff while on site. The soil profiles for each were similar consisting of:

Bore 1

0-250 mm	Weak greyish brown fine sandy clay loam topsoil. 30-35 mm ribbon.
250-650 mm	Well-structured orange brown, sandy clay loam. 40 mm ribbon.
650-1,200+ mm	Well-structured orange brown, clay loam. 40-45 mm ribbon.

Bore 2

0-250 mm	Weak greyish brown fine sandy clay loam topsoil. 30-35 mm ribbon.
250-650 mm	Well-structured orange brown, sandy clay loam. 40 mm ribbon.
	Refusal on rock fragments.

Bore 3

0-200 mm	Weak greyish brown fine sandy clay loam topsoil. 30-35 mm ribbon.
200-800 mm	Well-structured orange brown, sandy clay loam. 40 mm ribbon.
	Refusal on rock fragments.

Bore 4

0-200 mm	Weak greyish brown fine sandy clay loam topsoil. 30-35 mm ribbon.
200-850 mm	Well-structured reddish brown, clay loam. 40-45 mm ribbon.
850-1,200+	Weak reddish brown, clay loam. 20% quartz fragments

Bore 5

0-150 mm	Dark brown sandy clay loam topsoil. 25-30 mm ribbon.
150-300	Waterlogged gleyed sandy clay loam. 30 mm ribbon.
300-1,100	Mottled reddish brown clay loam. 50 mm ribbon.

Bore 6

0-400 mm	Well-structured reddish brown sandy clay loam topsoil. 40 mm ribbon.
400-1,200+ mm	Well-structured reddish brown, clay loam. 40-45 mm ribbon.

Bore 7

0-400 mm	Well-structured reddish brown sandy clay loam topsoil. 40 mm ribbon.
400-600 mm	Well-structured reddish brown clay loam to light clay 50 mm ribbon.

600-750	Weak flaky sandy clay. 20% rock fragments.

Bore 8

0-200 mm	Weak greyish brown fine sandy clay loam topsoil. 30-35 mm ribbon.
200-600 mm	Well-structured reddish brown, clay loam. 40-45 mm ribbon.
600-1,200+ mm	Moderately-structured light brown light clay. 55 mm ribbon. 10% rock fragments.

Bore 9

0-50 mm	Massive grey sandy loam topsoil.
50-400 mm	Massive greyish brown sandy clay loam.
400-600	Massive yellowish brown light clay. 15% rock fragments.

Bore 10

0-50 mm	Massive grey sandy loam topsoil.
50-400 mm	Massive greyish brown sandy clay loam.
400-600	Massive yellowish brown light clay. 15% rock fragments.

Bore 11

0-200 mm	Well-structured reddish brown sandy clay loam topsoil. 40 mm ribbon.
200-1,200+ mm	Well-structured reddish brown, clay loam. 40-45 mm ribbon.

4.3 Soils Summary

The bores and soil testing showed the soils at this site:

- Are moderately deep (800-1,200+ mm) with the exception of boreholes 2, 9 and 10 (600-800 mm) (*Minor – Moderate Limitation*).
- Moderately to well drained: bores generally revealed fine sandy clay loam topsoil over clay loam to light clay subsoils (*Moderate Limitation*).
- Are non-acidic: subsoil is pH 6.1 (*Minor Limitation*);
- Are unlikely to be dispersive. Laboratory results found an Emerson Aggregate Test (EAT) class 5 (Appendix 2) (*Minor Limitation*).
- Have a good ability to sorb phosphorous. P sorb = 660 (Appendix 2) (*Minor Limitation*).

5 Wastewater Management

5.1 Design Wastewater Load

The Design Wastewater Load is calculated assuming a five-bedroom dwelling (Upper Lachlan Shire Council, 2008) on each proposed lot with access to a tank water supply (120 L/person/day). This equates to 1,200 L/day wastewater generated for each proposed lot based on a maximum occupancy of 10 persons.

5.2 Feasibility to Install A Wastewater System

Due to the well-structured Category 4 soils found across much of the site, it is recommended that wastewater be disposed via irrigation methods. Wastewater can only be irrigated after secondary treatment and disinfection in an AWTS or similar. As such, the following recommendations are based on the assumption that each proposed lot will install a secondary treatment system such as an AWTS.

Depending on the final size and location of any development, irrigation could be either surface or subsurface. The required area of each EMA is calculated by undertaking a hydraulic balance and a nutrient balance. A Design Irrigation Rate (DIR) of 3.5 mm/day (well-structured category 4 soil) is used. This equates to an Effluent Application Area (EAA) of approximately 343 m^2. However, nutrient modelling requires a minimum total EMA of 615 m^2 (Appendix 1). Therefore, the total EMA would be 615 m^2 comprising of:

- 343 m^2 of irrigation (the EAA) built to the requirements of AS/NZS1547:2012 and
- 272 m^2 of Nutrient Uptake Area (NUA) immediately downslope of the irrigation area and left undeveloped.

Once installed vegetation over the EMAs must be managed as either fully managed lawn (clippings removed) or improved pasture to maximise nutrient uptake.

On Lots located below the 1:100 ARI Flood Level, subsurface irrigation must be adopted. The required area of EMA is calculated by undertaking a hydraulic balance and a nutrient balance. A DIR of 3.5 mm/day (well-structured category 4 soil) is used. This equates to an EAA of approximately 343 m^2. However, nutrient modelling requires a minimum total EMA of 615 m^2 (Appendix 1). Therefore, the total EMA would be 615 m^2 comprising of:

- 343 m^2 of subsurface irrigation built to the requirements of AS/NZS1547:2012 and
- 272 m^2 of NUA immediately downslope of the irrigation area and left undeveloped.

Once installed vegetation over the EMAs must be managed as either fully managed lawn (clippings removed) or improved pasture to maximise nutrient uptake

On Lots where slopes are above 10% subsurface irrigation must be adopted. The required area of EMA is calculated by undertaking a hydraulic balance and a nutrient balance. A DIR of 2.8 mm/day (well-structured category 4 soil on slopes between 10-20%) is used.

This equates to an EAA of approximately 429 m². However, nutrient modelling requires a minimum total EMA of 615 m² (Appendix 1). Therefore, the total EMA would be 615 m² comprising of:

- 429 m² of subsurface irrigation built to the requirements of AS/NZS1547:2012 and
- 186 m² of NUA immediately downslope of the irrigation area and left undeveloped.

Once installed vegetation over the EMAs must be managed as either fully managed lawn (clippings removed) or improved pasture to maximise nutrient uptake.

5.3 General Requirements for Effluent Management Areas

5.3.1 Vegetative Cover

An EMA must be well vegetated before it is commissioned to prevent runoff and possible erosion. Vegetation is required to promote nutrient uptake. Grass is generally the most suitable form of vegetation and, at the time of inspection, the site had a good covering of improved pasture grasses suitable for effluent management. Given the nature of nearby similar rural properties in Laggan Village all proposed RU4 - W are expected to have fully managed lawns.

5.3.2 Protection from Stock and Vehicles

Future owners should identify their EMA and ensure it is protected from stock and/or vehicle access (fence it off if need be).

5.3.3 Buffers

Buffers are required to effluent management areas from lot boundaries and the built environment. They vary depending on the relative position of the effluent management area to a given feature (Table 2):

Table 2: Buffer distances (Upper Lachlan Shire Council '*Onsite sewage Management Strategy, 2008*'.

	Secondary-treated surface irrigation	Secondary-treated subsurface irrigation or subsoil disposal
Property boundary, driveways, walkways and paths	• 6 m up-gradient and 3 m down-gradient of driveways and property boundaries • 3 m to walkways and paths	• 6 m up-gradient and 3 m down-gradient
Dwellings and swimming pools	• 15 m to dwellings • 6m to swimming pools	
Permanent and intermittent watercourses	• 100 m from permanent surface waters (e.g. rivers, streams, lakes etc.) • 40 m to other watercourses (e.g. farm dams, intermittent watercourses and drainage channels).	
Bore or well used for domestic consumption	250 m	

5.3.4 Future Management

Council will require AWTSs be inspected every three months by a qualified person and the results of that inspection sent to council. It would also be the responsibility of new owners to maintain their effluent disposal areas by ensuring effluent is distributed evenly over the entire effluent management area and it is regularly mown.

6 Summary and Conclusion

The purpose of this report is to assess the feasibility to manage wastewater on any Lot, thereby demonstrating that an onsite wastewater management system could theoretically be sited on any lot. This report does not provide details of a specific system to be used on a lot and must not be used by the purchasers of any of the proposed lots.

We have determined that EMA can be created on this site but with a number of caveats and conditions as detailed in this report and summarised below.

- Any Lot located below the 1:100yr ARI Flood Level, must utilise subsurface irrigation after secondary treatment in an AWTS, or similar.

- Surfaces which slope at 10% or more must utilise subsurface irrigation after secondary treatment in an AWTS, or similar.

Given the conceptual nature of this assessment, it is expected that future proponents would require a *site specific* Wastewater Site Assessment to suit their individual development and preferences. Site-specific assessments must be considerate of the mitigation measures contained herein. As noted previously, this report assesses the theoretical feasibility to establish an EMA on any lot and must not be relied upon by future purchasers of any lot.

7 References

Department of Local Government (1998). Environment and Health Protection Guidelines: *Onsite Sewage Management for Single Household.*

DLWC/SCA (2002). Soil Landscapes of The Sydney Catchment Authority's Hydrological Catchments. NSW Department of Land and Water Conservation and Sydney Catchment

eSPADE (2020). NSW Office of Environment and Heritage.

Standards Australia / Standards New Zealand (2012). AS/NZS 1547:2012 *On-site Domestic Wastewater Management*.

WaterNSW (2015). *Neutral or Beneficial Effect on Water Quality Assessment Guideline.*

WaterNSW (2018). *Developments in the Sydney Drinking Water Catchment – Water Quality Information Requirements.*

WaterNSW (2019). *Designing and Installing On-Site Wastewater Systems. A WaterNSW Current Recommended Practice.*

8 Appendices

(See over page)

8.1 Appendix 1 – Nutrient Balance

Wastewater Volume		1200	(L/day)	
Vegetation in EMA	Improved Pasture			
Nitrogen Balances				
A = (C x Q) / Lx				
Where:				
A = Land Area (m2)				
C = Concentration of Nutrient =		30	mg/L	
Q = Wastewater Flow =		1200	L/day	
Lx = Critical Loading Rate =		76	($mg/m^2/day$)	
A =		474	m^2	
Phosphorus Balances				
Step 1: P Sorption Calculation			Basalt soils?	
Psorb (topsoil)	clay loam	300	mg/kg	from SCA (2012)
Psorb (subsoil)	clay loam	660	mg/kg	from lab results
Bulk Density (topsoil)	clay loam	1500	kg/m3	from SCA (2012)
Thickness (topsoil)		200	mm	
Coarse Frags (topsoil)		0	%	
Bulk Density (subsoil)	clay loam	1500	kg/m3	from SCA (2012)
Thickness (subsoil)		800	mm	
Coarse Frags (subsoil)		0	%	
Calculated Psorb (topsoil)		900	kg/ha	
Calculated Psorb (subsoil)		7920	kg/ha	
Assumed P-sorb		3087	kg/ha	(insitu P-sorb is 35% calculated P-sorb)

Step 2: Determine the required area to sorb phorphorus (50 year design life) :

P absorbed =	8820	x 0.35	
=	3087	kg/ha	
=	0.3087	kg/m2	
P uptake =	6.5	$mg/m^2/day$	

Determine the amount of phosphorus generated over that time:

Concentration of phosphorus =		12	mg/L
Phosphorus generated = Concentration x volume of wastewater =		262.8	kg

Area Required:

P generated / (P sorbed + P uptake) =	615	m^2 of	Improved Pasture

8.2 Appendix 2 – Laboratory Results

Department of Primary Industries

Report No. **WN191144**

Biosecurity Laboratory Operations
Environmental Laboratory
1243 Bruxner Highway, WOLLONGBAR NSW 2477
Phone: 02 6626 1103 Email: wollongbar.csu@dpi.nsw.gov.au

Kim Passfield
SEEC Pty Ltd
PO Box 1098
BOWRAL NSW 2576

Soil Analysis Report

1 sample(s) of soil received on 28/10/19. Tested as per the following methods.
Testing commenced 28/10/19

Method	Method Description
S202	Soil Electrical Conductivity
S201	Soil pH in 1:5 water or 1:5 $CaCl_2$ suspension
SP901	Soil colour and texture **
SP903	Determination of the Emerson Class Number of Soil **
S259	Determination of Soil Phosphorus Sorption**
S273	Gillman & Sumpter Exchangeable Cations

** Where shown, indicates NATA accreditation does not cover the performance of this service.

Results relate only to the items tested.
Notes:

- When required, samples air dried at 40°C as per Soil Chemical Methods - Australasia (Rayment and Lyons 2011).
- Results are expressed on an air-dry weight basis unless otherwise stated.
- Physical soil testing results are calculated on 105°C dry weight.
- This report should not be reproduced except in full.
- Samples will be retained for one calendar month from the date of the final report. Samples will then be discarded.
- Clients wishing to recover their samples must contact the laboratory within this period. This laboratory will return residual samples at client expense.

Date of issue 6/11/19

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ASPAC

Approved for Release by:
Michael Rowe
Technical Officer

DPI Environmental Laboratory Page 1 of 2

Laboratory No. Client's ID	Units	Limit of Reporting	1 19000339 laggan-seec
Soil Analysis			
Electrical Conductivity	dS/m	0.0010	0.007
pH (Water)	pH units	0.04	6.1
pH ($CaCl_2$)	pH units	0.04	4.4
Texture			Sandy clay loam
Emerson aggregate test			Class 5
P Sorption	mg/kg	25	660
Exchangeable Cations			
Aluminium	cmol(+)/kg	0.10	0.99
Calcium	cmol(+)/kg	0.030	1.5
Potassium	cmol(+)/kg	0.010	0.30
Magnesium	cmol(+)/kg	0.0070	1.9
Sodium	cmol(+)/kg	0.030	0.094
CEC (effective)	cmol(+)/kg	0.20	4.8
Calcium/Magnesium			0.80
Percent Aluminium Saturation	% of ECEC		21
Exchangeable Calcium	% of ECEC		32
Exchangeable Potassium	% of ECEC		6.2
Exchangeable Magnesium	% of ECEC		40
Exchangeable Sodium Percentage	% of ECEC		2.0