Strider Duerinckx
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Christine Frewin, C/- Keiley Hunter

By email: keiley@keileyhunter.com.au

Date: 16 June 2021

Project Ref: 2021-161-02

Re: Land Capability Assessment for 14-22 Smiths Road, Emerald Beach

Dear Madam

Please find attached the Land Capability Assessment (LCA) for the proposed subdivision of 14-22 Smiths Road, Emerald Beach. The LCA has been undertaken in reference to:

- Coffs Harbour City Council (2015). *On-site Sewage Management Strategy*;
- DLG (1998). *Environment & Health Protection Guidelines: On-site Sewage Management for Single Households; and*
- Standards Australia / Standards New Zealand (2012). AS/NZS 1547:2012 *On-Site Domestic-wastewater Management.*

In summary, the proposed subdivision of the Site into two lots will formalise the existing two dwellings onto separate lots. A reserve EMA of 252m^2 has been calculated and located on Proposed Lot 1 and Lot 2.

Further details are provided in the attached report. If you have any questions, please contact me.

Regards,

Strider Duerinckx

1. SITE EVALUATORS			
Name:	Strider Duerinckx	Date of Inspection:	05 May 2021
Phone:	0402608396	**Council area:**	Coffs Harbour

2. ACCOMPANYING INFORMATION

FIGURES

Figure 1	Site Location
Figure 2	Proposed Development Layout
Figure 3	Existing Features
Figure 4	Recommended Effluent Management Areas
Figure 5	Minimum Lot Size Comparison

APPENDICES

Appendix A	Borehole Logs
Appendix B	Soil Chemistry
Appendix C	Water Balance

3. SITE INFORMATION

Address/locality of site: 14-22 Smiths Road. Emerald Beach

Owner/developer: Christine Frewin

Proposed Development:

Based on plans provided by Newnham Karl Weir & Partners (NKWP) (Figure 2), it is proposed to subdivide the 10,629m^2 Site into two lots (Figure 2). Proposed Lot 1 containing the existing dwelling in the northern portion would be 5,626m^2. Proposed Lot 2 would contain the remainder of the lot with the existing dwelling in the southern portion, 5003m^2 in area.

Size/shape/layout:

The property is situated in the R5 large lot residential zone on the northeastern side of Smiths Road. The southern corner of the block is approximately 200m north of the Smiths Road/Pacific highway interchange, and approximately 40m from a large manmade freshwater dam. The site sits on a slight ridge line, with a slope of approximately 7% downhill from west to east. The site has some large trees and areas of maintained lawns.

Existing On-site Sewage Management System:

An existing OSMS is present on Proposed Lot 1, consisting of a concrete septic tank and three absorption trenches. The trench locations were surveyed by existing Inspection Outlets (IOs) (Figure 3).

3. SITE INFORMATION

An existing OSMS is also present on Proposed Lot 2 (Figure 3). The OSMS consists of a concrete septic tank, and a single absorption trench. No information exists regarding the length of the absorption trench, however when inspected the system was not failing and the trench location is well away from any proposed lot boundaries.

Water supply:	Tank water.

Photograph 1: Proposed Lot 1 dwelling, and reserve Effluent Management Area (EMA) on LH side of the photo.

Photograph 2: Proposed Lot 2 dwelling, and reserve EMA on LH side of the photo.

4. SITE ASSESSMENT		Limitation		
		Minor	Moderate	Major
Climate: Sub-tropical to temperate climate Average maximum high temperature range <15°C? No.		Both lots		
Flood potential:				
Land application area above 1 in 20 year flood level?	Yes	Both lots		
Land application area above 1 in 100 year flood level?	Yes	Both lots		
Electrical components above 1 in 100 year flood level?	Yes	Both lots		
Exposure: The proposed EMAs will be located on a northeast facing slope cleared of trees.		Both lots		
Slope: Slopes of 6-8% to the east.		Both lots		
Landform: Lot 1 - The proposed EMA will be situated on a waxing divergent landform. Lot 2 - The proposed EMA will be situated on a waxing divergent landform.		Both lots		
Run-on and seepage: The proposed EMAs are in a mid-slope position. Catchment from road boundary. No seepage noted.		Both lots		
Erosion potential: There is minimal risk of erosion when soil is disturbed due to the slope and soils.		Both lots		
Site drainage: Lot 1 – Eastward drainage. The nearest drainage to the proposed EMA a large manmade dam approximately 40m downslope. Lot 2 – Eastward drainage. The nearest drainage to the proposed EMA is a large manmade dam approximately 75 downslope.		Both lots		
Fill: None noted in the EMA.		Both lots		
Surface rocks: None evident.		Both lots		
Groundwater: (NSW Office of Water Groundwater Bore Search)				Both lots

Horizontal distance to groundwater well used for domestic water supply: There is one registered domestic bore approximately 130m from the proposed EMAs. The bore (GW051796) I located over the ridgeline to the south. **Groundwater vulnerability?** The risk to groundwater is minor given the clay subsoil, expected fractured bedrock aquifer and buffer distance.			

5. SOIL ASSESSMENT	Limitation
Number of boreholes drilled: One borehole was drilled. See Appendix A and Figure 4.	
Depth to bedrock or hardpan (m): The borehole was extended to 1.2m depth without refusing.	Minor
Depth to high soil watertable (m): Permanent groundwater is expected at >10m depth based on position in the landscape.	Minor
Soil landscape unit: Ulong Soil Landscape is an erosional/residual soil landscape located on undulating rises and rolling low hills on Late Carboniferous-aged metasediments of the Coramba and Brooklana Beds. Soils are typically deep (>1m), moderately well-drained red and brown earth, with variability depending on landscape position. Limitations include high erodibility, localised sodicity and dispersibility, hardsetting with low subsoil permeability and strong acidity. **Soil Profile:** - Approximately 150mm of clay loam, dark brown, with some orange mottling and <10% coarse fragments, strong structure; overlying - Approximately 350mm of light clay, light brown and pale yellow, with some orange and grey mottling and <10% sub-angular gravel fragments, some charcoal fragments, strong structure; overlying - At least 700mm of light to medium clay, pale orange brown, with pale grey mottling and <10% sub-angular coarse fragments, moderate structure. Hydraulic loading rate Soil structure: Strong Soil texture: Light to medium clay 0.15-1.2m Permeability category: Category 5a Hydraulic loading recommended: 12mm/day secondary treated effluent.	

5. SOIL ASSESSMENT	Limitation
Reasons for the hydraulic loading recommendation: Good soil structure and light clay soil profile.	Moderate
Coarse fragments % (>2mm): <15% qtz	Minor
Soil chemical testing was undertaken of one sample from 0.4-0.6m depth in BH2 by EAL at Lismore, for their standard wastewater soil capability suite. The analytical report is included in Appendix B.	
pH: 4.65 pH Units. Strongly acidic soils.	Moderate
Electrical conductivity (dS/m): 0.432dS/cm.	Minor
Dispersiveness: Class 3/6 (Slake 3).	Major
Cation Exchange Capacity: 6.4 cmol+/kg	Minor
Exchangeable Sodium Percentage: 1.4 cmol+/kg	Minor
PSorp: 11,416 kg/ha	Minor

6. SYSTEM SELECTION

Consideration of connection to a centralised sewerage system: Unlikely due to rural location.

Type of treatment and land application system considered best suited to site:

Given the resultant lot size, in case of failure of the existing OSMS, future treatment to a secondary standard and subsurface application into an appropriately sized absorption bed field is considered a reasonable minimum combination.

7. WASTEWATER ENVELOPE SIZING

Expected wastewater quantity (litres/day):

4-bedroom dwelling modelled 4 x 1.5 x 150L/p/day = 720L/day

Hydraulic Balance:

Monthly nominated area water balance modelling undertaken. See Appendix C.

Data Parameter	Units	Value	Comments
Hydraulic load	L/day	720	
Precipitation	mm/month	Coffs Harbour	Median rainfall from BOM.

7. WASTEWATER ENVELOPE SIZING			
Pan Evaporation	mm/month	Coffs Harbour MO	Average evaporation from BOM.
Retained rainfall	unitless	0.95	Proportion of rainfall that remains onsite and infiltrates the soil
Crop Factor	unitless	0.6-0.8	Typical annual range expected in an open position with no shading.
Design Loading Rate (DLR)	mm/day	12	Based on strongly-structured light clay soil and absorption beds from AS/NZS 1547:2012.
Area required for hydraulic sizing	m^2	**70**	Equals 158m^2 bed field.
Area required for Nitrogen	m^2	**252**	Limiting
Area required for Phosphorus	m^2	**223**	

Effluent Management Area:

Based on water and nutrient balance modelling of a conservative 4 bedroom dwelling, a reserve EMA of 252m^2 is required to allow for hydraulic and nutrient loading.

This footprint has been allowed as a reserve area on Proposed Lot 1 and Lot 2 in case of failure of the existing OSMS (Figure 4).

8. MINIMUM LOT SIZE ANALYSIS

A minimum lot size analysis and modelling were completed to determine the maximum lot density suitable for subdivision on the Site. When considering the suitability for a lot to sustainably manage wastewater on-site, we typically refer to 'available effluent management area'. This broadly refers to available areas (i.e. not built out or used for a conflicting purpose) where OSMS will not be unduly constrained by site and soil characteristics. Available area on a developed a lot is determined by the following factors:

- total building area (including dwellings, sheds, pools etc.) which includes a defined building envelope but may extend beyond with additional improvements to a property, such as driveways and paths (impervious areas), and gardens/vegetated areas unsuitable for effluent reuse;
- dams, intermittent and permanent watercourses running through lots;
- maintenance of appropriate buffer distances from property boundaries, buildings, driveways and paths, dams and watercourses;

8. MINIMUM LOT SIZE ANALYSIS

- flood prone land;
- excessive slope;
- excessively shallow soils;
- heavy (clay) soils with low permeability;
- excessively poor drainage, shallow groundwater and/or stormwater run-on; and
- excessive shading by vegetation.

The residual areas (areas not otherwise occupied by improvements, buffers, restrictions or conservation vegetation) were then calculated for the selected lots, and the available area compared to the wastewater envelope required.

MLS Buffers:

Buffer distances from EMAs are typically enforced to minimise risk to public health, maintain public amenity and protect sensitive environments. Generally, adopted environmental buffers for secondary treated effluent land applied into absorption trenches/ beds based on DLG (1998) are:

- 250m from domestic groundwater bores;
- 100m from permanent watercourses;
- 40m from intermittent watercourses and dams;
- 6m from downslope property boundaries and 3m from upslope property boundaries; and
- 6m from downslope buildings and 3m from upslope buildings.

In addition, developed areas such as inground water tanks and swimming pools were also buffered.

Secondary treatment was selected for modelling purposes. Primary treatment may be possible on a case by case for the proposed lots on No.9 and 189 Gaudrons Road subject to soil depth and buffer requirements for such OSMS.

MLS Comparative Lots Assessed:

Six nearby R5 zoned representative lots were selected that have already been subdivided (Figure 5). The lots ranged in size from 1,689-4,212m^2 area.

- 39-41 Gaudrons Road 4,005m^2
- 45 Gaudrons Road 4,001m^2
- 75 Gaudrons Road 4,212m^2
- 79 Gaudrons Road 1,689m^2
- 81 Gaudrons Road 1,788m^2
- 160 Gaudrons Road 2,830m^2

The properties typically included a dwelling, garage/shed, landscaped trees, shrubs and gardens, driveways, water tanks, and recreational space. This development style will be similar to that proposed for the Site and therefore minimum lot size and development potential should be consistent.

8. MINIMUM LOT SIZE ANALYSIS

MLS Assessed Available EMA:

The assessment of available effluent management areas for each of the assessed lots is presented below. As is evident, the variability of lot sizes, on-lot improvements and restrictions of developed lots makes selection of a "typical" lot difficult, however comparison of the site constraints indicates that minimum lot size is the most significant issue to address.

From the sample selection of lots investigated, three of the lots are significantly smaller than the nominated minimum 5,000m^2 lot size, being 1,689 1,788 and 2,830m^2. Of these only the 2,830m^2 property (No. 160) has available effluent management area. This is because the existing dwelling is located hard against the southern boundary with no associated sheds, garages, swimming pools etc. The other two small lots by nature of the lot size and buffer constraints to site features have in effect no available effluent management area and wastewater application is compromised;

The remaining three properties of 4,001-4,212m^2 have each about 1,800m^2 of available unconstrained area for effluent application. Allowing for additional developed footprint such as sheds and swimming pools that may not be present currently, and constraints such as buffers to gullies and protected forest vegetation, the minimum 504m^2 footprint required for a secondary treatment and land application OSMS (primary and reserve envelopes) would still be able to be met

As such, given the low slopes and limited site and soil constraints, a minimum 5,000m^2 lot sizing at 14-22 Smiths Road would be considered acceptable.

Id	Lot Area (m^2)	Developed Area (m^2)[1]	Total Restricted Area (m^2)[2]	Available Eff. Application Area (m^2)	Percent of Lot Available for Eff. Disp. (%)	>504m^2 Area Available for Secondary Treatment?
39-41	4,005	1,293	2,142	1,873	47	Yes
45	4,001	1,166	2,154	1,843	46	Yes
75	4,212	1,564	2,377	1,827	43	Yes
79	1,689	630	1,546	143	8	No
81	1,788	771	1,788	0	0	No
160	2,830	560	1,808	1,022	36	Yes

1. House, driveway, shed etc

2. Includes developed area, protected vegetation and buffers to waterways and boundaries

9. BUFFERS		
Buffer distances from EMA to:		**Meets Buffers**
Permanent waters	>100m	Yes
Other waters	40m	Yes
Domestic Groundwater Bore	250m	No, 130m
Boundary of premises	6/12m	Yes
Driveways	3/6m	Yes
Buildings	3/6m	Yes

Buffers:

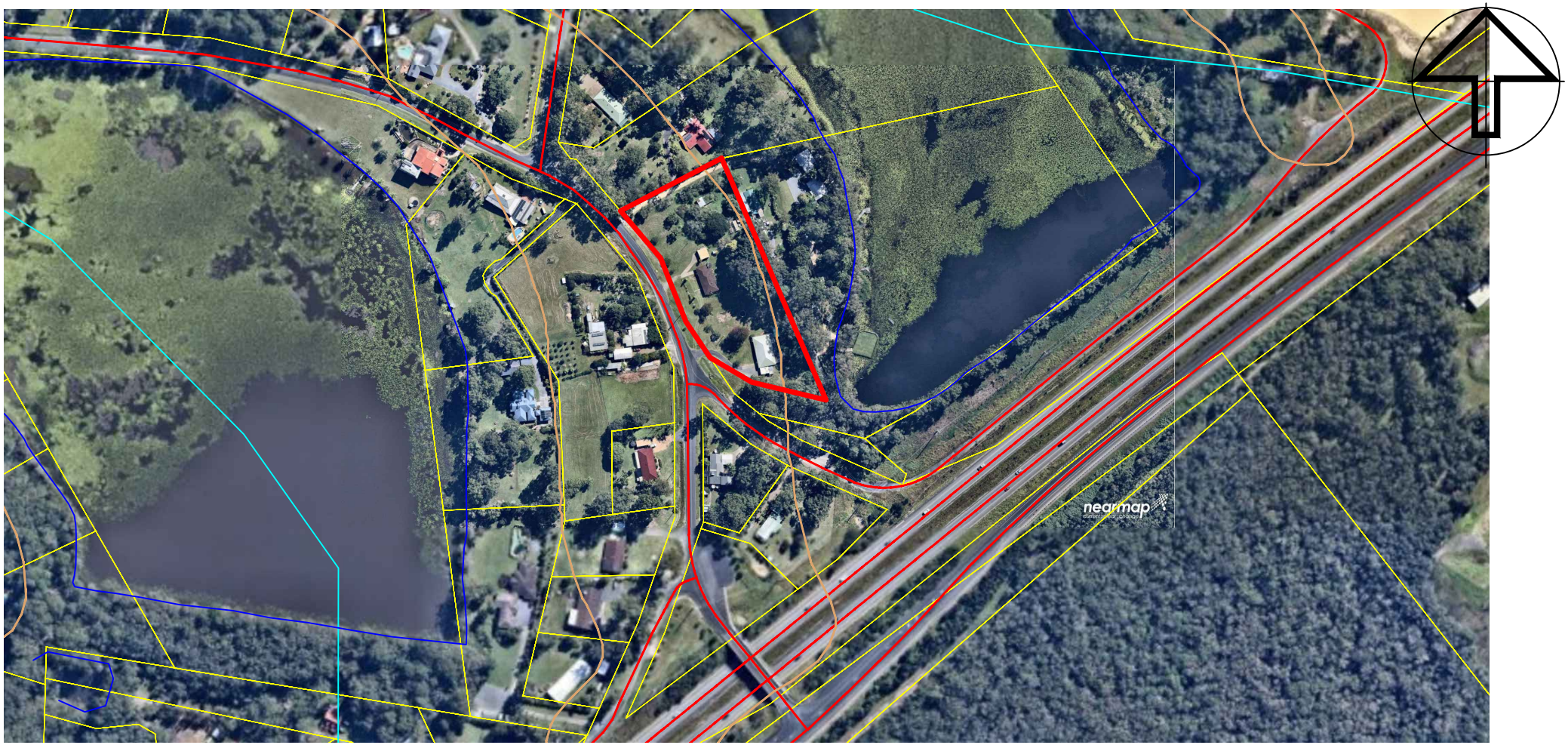
Buffers to all constraints are achievable for the existing OSMS except to licensed domestic groundwater bores. A buffer of 130m is available, but a 250m buffer is suggested by DLG (1998) Guidelines.

The OSMS are existing, and the bore is located over a topographical ridgeline, and as such the proposed subdivision does not increase the risk.

Appendix R of AS/NZS1547:2012 provides for risk assessable buffers to constraints including bores. A maximum buffer of 50m is allowed for high risk situations such as shallow sand extraction aquifers; unlike the existing conditions of a deep bedrock aquifer beneath clays.

As such the available 130m is considered acceptable.

FIGURES



0 80 120 160

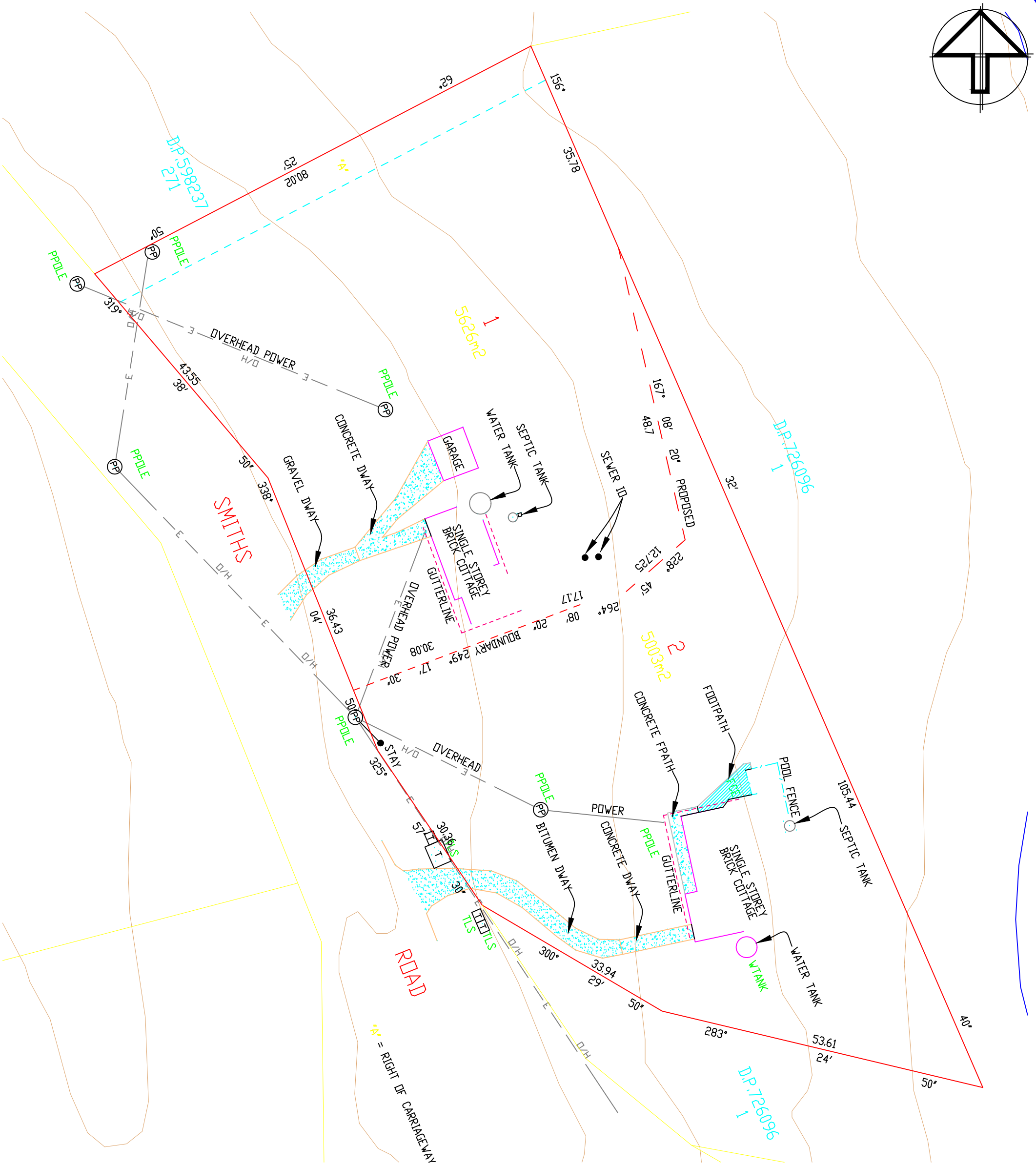
Horizontal Scale (metres) 1:4000

EARTH WATER CONSULTING

LEGEND

- Property Boundary
- Contour (10m)
- Drainage Alignment

TITLE: Site Location			PROJECT: LCA for 14-22 Smiths Road, Emerald beach		CLIENT: Christine Frewin
FIGURE: Figure 1					
SHEET: 1 OF 1	ISSUE: A	AUTHOR: SD	DATE: 24/5/21	SCALE: 1:4000	PROJECT: 2021-161



EARTH WATER CONSULTING

TITLE: Proposed Development Layout			FIGURE: Figure 2
			SHEET: 1 OF 1 / ISSUE: B
PROJECT: LCA for 14-22 Smiths Road, Emerald Beach			CLIENT: Christine Frewin
AUTHOR: SD	DATE: 16/6/21	SCALE: 1:600	PROJECT: 2021-161

EARTH WATER CONSULTING

TITLE: Existing Site Layout			FIGURE: Figure 3
			SHEET: 1 OF1 ISSUE: A
PROJECT: LCA for 14-22 Smiths Road, Emerald Beach			CLIENT: Christine Frewin
AUTHOR: SD	DATE: 24/5/21	SCALE: 1:600	PROJECT: 2021-161

EMA
252sqm

EMA
252sqm

~3
~15
~25
~6
~6
12
~13.2
~15.3

PP
E
D/H

0 10 20 30
Horizontal Scale (metres) 1:600

LEGEND

- Property Boundary
- Contour Line (2m)
- Drainage Alignment
- Driveway
- Existing Building
- Rainwater Tank
- Recommended Effluent Management Area

EARTH WATER CONSULTING

TITLE: Recommended Effluent management Areas			FIGURE: Figure 4
			SHEET: 1 OF1 ISSUE: B
PROJECT: LCA for 14-22 Smiths Road, Emerald Beach			CLIENT: Christine Frewin
AUTHOR: SD	DATE: 16/6/21	SCALE: 1:600	PROJECT: 2021-161

160 Gaudrons Road

MLS 75-81 Gaudrons Road

39-41 and 45 Gaudrons Road

EARTH WATER CONSULTING

0 20 30 40

Horizontal Scale (metres) 1:1000

LEGEND

- Property Boundary
- Adjacent Lot
- Drainage Alignment
- EMA Restricted Area
- EMA Available Area

TITLE: Minimum Lot Size Comparison			FIGURE: Figure 5
			SHEET: 1 OF1 ISSUE: A
PROJECT: LCA for 14-22 Smiths Road, Emerald Beach			CLIENT: Christine Frewin
AUTHOR: SD	DATE: 16/6/21	SCALE: 1:1000	PROJECT: 2021-161

APPENDIX A

Soil Borelog

Borehole No:	**BH1**
Logged by:	NS
Drilling date:	5/05/2021
Drilling method:	Hand auger
Borehole location:	Figure 2
Borehole coords:	0516023, 6662069

Project ref:	2021-161
Client:	Christine Frewin
Address:	22 Smiths Drive

PROFILE DESCRIPTION

Depth (m)	Sampling depth/name	Graphic Log	Horizon	Texture	Structure	Colour	Mottles	Coarse Fragments	Moisture Condition	Comments
0.1			A1	Clay Loam	Strong	Dark brown	Orange	<10%	SM	Topsoil
0.2			B1	Light Clay	Strong	Light brown pale yellow	Grey orange	<10%	SM	Residual
0.3	BH1_ 0.2-0.4									
0.4										
0.5										
0.6	BH1_ 0.5-0.7		B2	Light Clay to Medium Clay	Strong	Light brown pale yellow becoming orange	Nil Pink	<5%	SM	Residual
0.7										
0.8										
0.9										
1.0										
1.1										
1.2										
1.3					Borehole terminated at 1.2m					
1.4										
1.5										

Moisture condition

D	Dry	M	Moist	W	Wet / saturated
SM	Slightly moist	VM	Very moist		

APPENDIX B

WASTEWATER DISPOSAL SOIL ASSESSMENT

1 sample supplied by Earth Water Consulting Pty Ltd on the 30th April, 2021 - Lab Job No. K6423
Analysis requested by Strider Duerinckx. - **Your Project: BH2**
PO BOX 50 BELLINGEN NSW 2454

	SAMPLE 1 BH2 0.3-0.5m
Job No.	*K6423/1*
Description	Medium Clay
Moisture Content (% moisture)	16.7
Emerson Aggregate Stability Test (SAR 5 Solution) note 12	*3/6, Slake 3 see note 12
Soil pH (1:5 $CaCl_2$)	4.65
Soil Conductivity (1:5 water dS/m)	0.050
Soil Conductivity (as EC_e dS/m) note 10	0.432
Native NaOH Phosphorus (mg/kg P)	40.62
Residual phosphorus remaining in solution from the initial phosphate phosphorus	
Initial Phosphorus concentration (ppm P)	**30.00**
72 hour - 3 Day (ppm P)	14.10
120 hour - 5 Day (ppm P)	11.73
168 hour - 7 Day (ppm P)	12.09
Equilibrium Phosphorus (ppm P)	9.97
EXCHANGEABLE CATIONS	
Calcium (cmol+/kg)	2.36
Magnesium (cmol+/kg)	2.30
Potassium (cmol+/kg)	0.17
Sodium (cmol+/kg)	0.09
Aluminium (cmol+/kg)	0.77
Hydrogen (cmol+/kg)	0.67
ECEC (effective cation exchange capacity)(cmol+/kg)	6.4
Exchangeable Calcium %	37.1
Exchangeable Magnesium %	36.2
Exchangeable Potassium %	2.7
Exchangeable Sodium % (ESP)	1.4
Exchangeable Aluminium %	12.1
Exchangeable Hydrogen %	10.5
Calcium/ Magnesium Ratio	1.02

Notes:

1: ECEC = Effective Cation Exchange Capacity = sum of the exchangeable Mg, Ca, Na, K, H and Al

2: Exchangeable bases determined using standard Ammonium Acetate extract (Method 15D3) with no pretreatment for soluble salts. When Conductivity ≥0.25 dS/m soluble salts are removed (Method 15E2).

3. ppm = mg/kg dried soil

4. Insitu P determined using 0.1M NaOH and shaking for 24 hrs before determining phosphate

5. Soils were crushed using a ceramic grinding head and mill; five 1g subsamples of each soil were used to which 40ml of 0.1M NaCl with Xppm phosphorus was added to each. The samples were shaken on an orbital shaker

6. Exchangeable sodium percentage (ESP) is calculated as sodium (cmol+/kg) divided by ECEC

7. All results as dry weight DW - soils were dried at 60C for 48hrs prior to crushing and analysis.

8. Phosphorus Capacity method from Ryden and Pratt, 1980.

9. Aluminium detection limit is 0.05 cmol+/kg; Hydrogen detection limit is 0.1 cmol+/kg. However for calculation purposes a value of 0 is used.

10. For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm; EC_e conversions: sand loam 14, loam 9.5; clay loam 8.6; heavy clay 5.8

11. 1 cmol+/kg = 1 meq/100g

12. Emerson Aggregate Stability Test (EAST) for Wastewater applications (see Sheet 3 - Patterson, 2015), MEAT Class 1: Slaking, complete dispersion; Class 2: Slaking, some dispersion; Class 3-6: Slaking 1 slight to 3 complete, No dispersion; Class 7: No slaking, yes swelling; Class 8: No slaking, no swelling.

13. Analysis conducted between sample arrival date and reporting date.

14. .. Denotes not requested.

15. This report is not to be reproduced except in full.

16. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).

NATA
WORLD RECOGNISED ACCREDITATION
Accreditation No. 14960
Accredited for compliance with ISO/IEC 17025 - Testing

Checked:.....

PHOSPHORUS SORPTION TRIAL

1 sample supplied by Earth Water Consulting Pty Ltd on the 30th April, 2021 - Lab Job No. K6423

Analysis requested by Strider Duerinckx. - Your Project: BH2

Calculations for Equilibrium Absorption Maximum for Soil provided

I.D.	JOB NO.	Equilibrium P mg P/L (in solution)	Added P mg P/L	P Sorb at Equil. mg P/kg	Native P mg P/kg	Equilibrium P Sorption Level µg P/g soil	Divide Ø (from Table)	Equilibrium Absorption Maximum (B) µg P/g soil
BH2 0.3-0.5m	**K6423/1**	10.0	30	801	41	842	0.77	**1,094**

Calculations for phosphorus sorption capacity

	JOB NO.	Equilibrium Absorption Maximum (B) µg P/g soil	multiply by theta of wastewater to be applied (=X)	minus the native P (=Y)	**kg P sorption / hectare (to a depth of 15cm)** (1.95 is a correction factor for density, etc)	**kg P sorption / hectare (to a depth of 100cm)** (1.95 is a correction factor for density, etc)
BH2 0.3-0.5m	*K6423/1*	1094	(=B x theta)	(=X -native P)	(=Y x 1.95)	(=Y x 1.95 x 100/15)

EXAMPLE 1 - Calculations for phosphorus sorption capacity using a wastewater phosphorus of 15mg/L P

	JOB NO.	Equilibrium Absorption Maximum (B) µg P/g soil	multiply by theta of wastewater to be applied (ie. 0.84)	minus the native P (=Y)	**kg P sorption / hectare (to a depth of 15cm)** (1.95 is a correction factor for density, etc)	**kg P sorption / hectare (to a depth of 100cm)** (1.95 is a correction factor for density, etc)
BH2 0.3-0.5m	*K6423/1*	1094	919	878	**1,712**	**11,416**

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

Checked:.....

APPENDIX C

Nominated Area Water Balance & Storage Calculations

Site Address: **14-22 Smiths Road, Emerald Beach**

Proj Ref: 2021-161

Notes:

Flow Allowance		120	l/p/d
No. of Persons		4	p
Occupancy		1.5	p/room
Design Wastewater Flow	Q	720	L/day
Daily DLR		12.0	mm/day
Crop Factor	C	0.6-0.8	unitless
Retained Rainfall Coefficient	RRc	0.95	untiless
Void Space Ratio	V	0.3	unitless
Nominated Land Application Area	N	70	sqm
Trench/Bed wetted thickness	Ww	0.1	m
Rainfall Data	Coffs Harbour Rainfall Data (monthly median)		
Evaporation Data	Coffs Harbour Evap Data (monthly average)		

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D	\	days	31	28	31	30	31	30	31	31	30	31	30	31	**365**
Median Rainfall	R	\	mm/month	151.2	179	205.1	135.9	117.4	90	54.3	40.7	35.4	74.7	130.4	114.1	1612.2
Average Evaporation	E	\	mm/month	192.2	156.8	148.8	117	86.8	69	77.5	105.4	135	161.2	171	192.2	**0**
Crop Factor	C			0.80	0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.70	0.70	0.80	0.80	
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	154	125	119	82	61	41	47	63	95	113	137	154	**1189.94**
Percolation	B	DLRxD	mm/month	372.0	336	372.0	360.0	372.0	360.0	372.0	372.0	360.0	372.0	360.0	372.0	**4380.0**
Outputs		ET+B	mm/month	525.8	461.44	491.0	441.9	432.8	401.4	418.5	435.2	454.5	484.8	496.8	525.8	**5569.9**
INPUTS																
Retained Rainfall	RR	R*RRc	mm/month	143.64	170.05	194.845	129.105	111.53	85.5	51.585	38.665	33.63	70.965	123.88	108.395	**1261.79**
Effluent Irrigation	W	(QxD)/L	mm/month	318.9	288.0	318.9	308.6	318.9	308.6	318.9	318.9	308.6	318.9	308.6	318.9	**3754.3**
Inputs		RR+W	mm/month	462.5	458.1	513.7	437.7	430.4	394.1	370.4	357.5	342.2	389.8	432.5	427.3	**5016.1**
STORAGE CALCULATION																
Storage remaining from previous month			mm/month		0.0	0.0	75.5	61.5	53.6	29.1	0.0	0.0	0.0	0.0	0.0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-210.9	-11.3	75.5	-14.1	-7.9	-24.4	-160.2	-259.1	-374.3	-316.7	-214.5	-328.4	**-401.4**
Cumulative Storage	M		mm	0.0	0.0	75.5	61.5	53.6	29.1	0.0	0.0	0.0	0.0	0.0	0.0	**219.7**
Maximum Bed Storage Depth for Area	BS		mm	**75.54**	Is the calculated storage acceptable?			Yes, storage is conservative								

Nominated trench width	0.9	
Total length based on nominated width	77.8	
No. of beds	4	
Individual bed lengths	19.4	
Individual Bed footprints	17.5	
Spacing between beds	1.5	
Width of bed area	8.1	
Total bed area	158	
Nutrient uptake zone	284	2m buffer nutrient uptake allowance

Nutrient Balance

Proj Ref: 2021-161

Site Address: 14-22 Smiths Road, Emerald Beach

Notes:

INPUT DATA

Hydraulic Load		720	L/Day	
Effluent N Concentration		30	mg/L	
% Lost to Soil Processes		0.2	Decimal	
Total N Loss to Soil		4320	mg/day	
Effluent P Concentration		12	mg/L	
Design Life of System		50	yrs	
Crop N Uptake	250	kg/ha/yr =	68	$mg/m^2/day$
Crop P Uptake	25	kg/ha/yr =	7	$mg/m^2/day$
P-sorption analytical result in soil		11416	kg/ha	
% of Predicted P-sorp		0.75	Decimal	

Nitrogen Balance

Nitrogen uptake ability in vegetation	68	$mg/m^2/day$
Nitrgen loading in wastewater	17280	mg/day
Area required for nitrogen	**252**	m^2

Phosphorus Balance

P adsorbed	0.8562	kg/m^2
P uptake	0.125	kg/m^2
P generated	219	kg
Area required for Phosphorus	**223**	m^2