ANNEXURE 4

Report on Effluent Disposal

prepared by

Cowman Stoddart Pty Ltd

Lot 3 DP 846470
48 Jervis Bay Road, Falls Creek

REPORT ON EFFLUENT DISPOSAL

PROPOSED COMMUNITY TITLE SUBDIVISION
TO CREATE
TWELVE (12) RESIDENTIAL LOTS
AND
ONE (1) COMMUNITY LOT

LOT 3 DP 846470
48 JERVIS BAY ROAD
FALLS CREEK

Prepared for

Mr. T. Pasialis

November 2017

Prepared by:

COWMAN STODDART PTY LTD

Town Planning, Agricultural & Environmental Consultants

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FALLS CREEK

EF390

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1.0 INTRODUCTION

The subject site is described as Lot 3 DP 846470 at 48 Jervis Bay Road, Falls Creek (see **Figures 1** and **2**). The property has an area of 25.21 ha and is owned by Mr T. Pasialis.

The site includes a dwelling house, shed and driveway and otherwise comprises cleared land with scattered mature trees in the eastern half of the site and forested land within the western and northern parts of the site.

A Development Application has been prepared seeking approval for subdivision of the site to create 12 residential allotments with a minimum area of 5635 m^2 and one Community Title Lot. Proposed Lot 9 includes the existing dwelling house.

Dwelling locations and design for the remaining 11 proposed residential Lots are not yet known. For the purposes of this report, on-site effluent disposal for a future four bedroom house on each of the vacant lots has been considered. A further report on effluent disposal should be prepared when a development application is lodged at Council with the building plans for each vacant residential Lot.

1.1 PURPOSE OF THIS REPORT

Our firm has been engaged by the landowner to undertake an effluent disposal assessment to support the Development Application for a proposed Community Title subdivision of the site.

This report addresses effluent disposal for the proposed subdivision. The site assessment and soil studies are limited to considerations of effluent disposal in terms of:

- *Chapter G8: Onsite Sewage Management* of Shoalhaven DCP 2014;
- the *Australian Standard AS/NZS 1547:2012*; and
- the Environment & Health Protection Guidelines, "*On-site Sewage Management for Single Households*" (known colloquially as "*the silver book*").

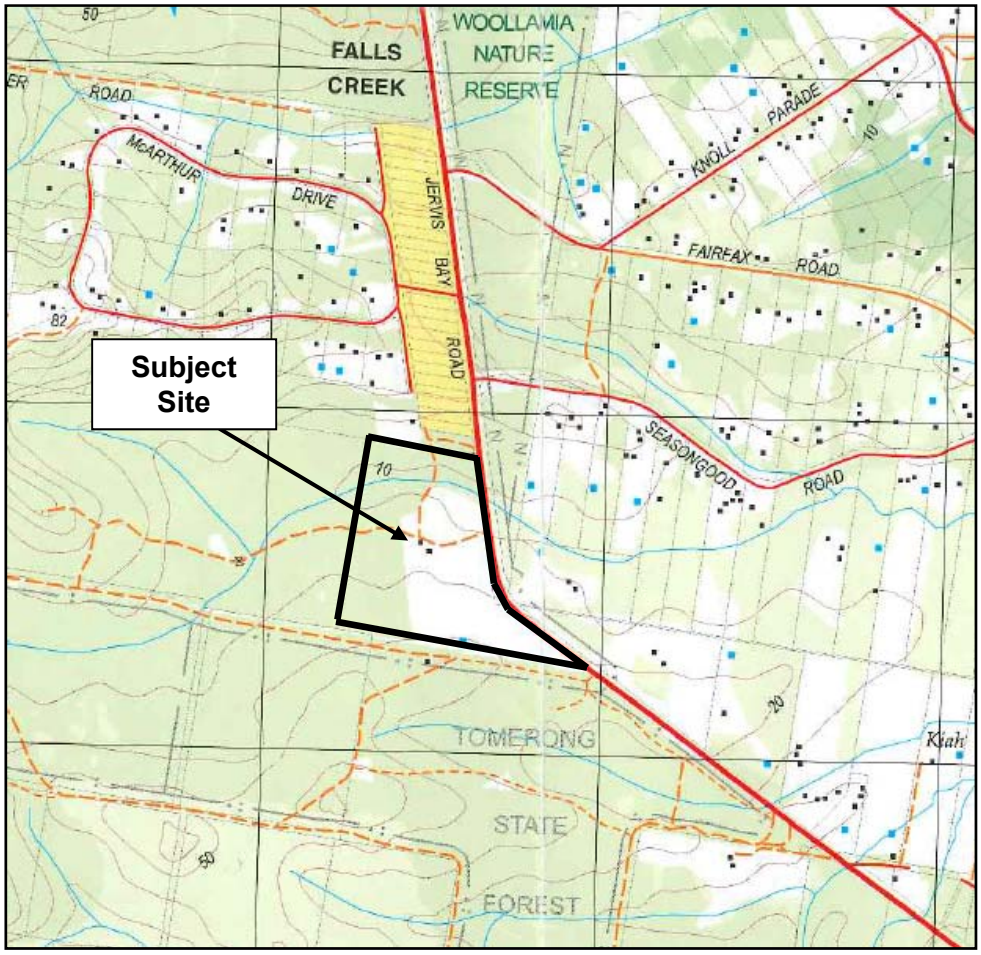


Figure 1: Site locality plan

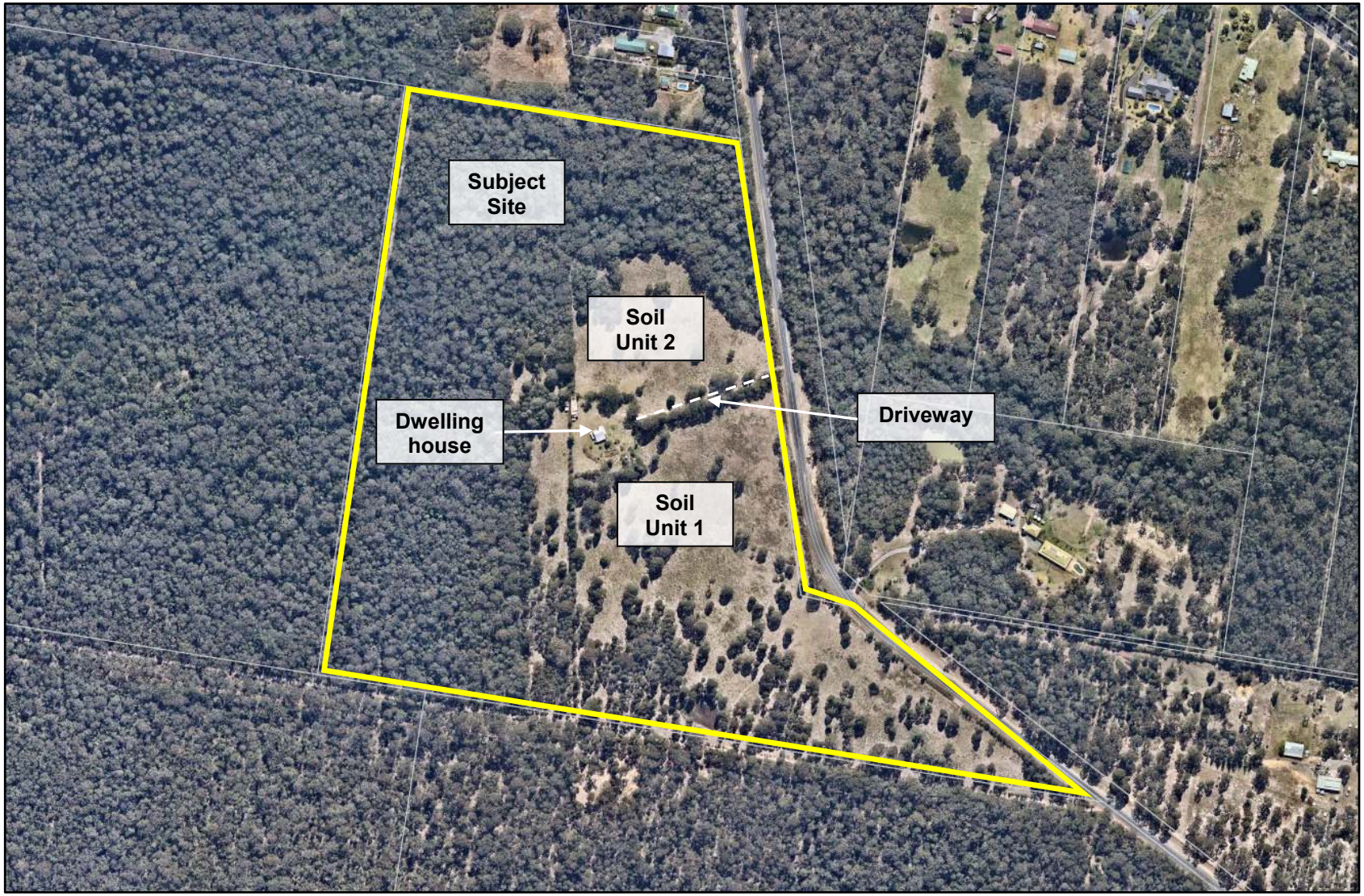


Figure 2: Aerial photo of site and surrounds.

2.0 SITE ASSESSMENT

2.1 SITE DESCRIPTION

The property is located in undulating terrain which has been partly cleared for rough grazing in the distant past. The land drains to an intermittent watercourse which flows through the site and is a tributary of Currambene Creek.

The property contains a three bedroom dwelling house, shed and driveway within an area of cleared land in the eastern part of the site (see **Figure 2** and **Plate 1**). The western and northern parts of the site comprise forested land.

The effluent disposal system serving the existing dwelling is a septic tank and trenches (see **Plates 2** to **3**) which appears to be operating satisfactorily.

2.2 TOPOGRAPHY

The terrain is a long gentle slope which extends from the southern boundary of the site to the watercourse. The slope of the cleared land varies across the site:

- cleared land south of the driveway has a slope of approximately 5 - 10 % (see **Plate 4**); and
- cleared land to the north of the driveway and south of the watercourse is flatter with a slope of approximately 5% (see **Plate 5**).

The land drains to the north east into an intermittent watercourse which flows to the east into Currambene Creek.

The site has good sun and wind exposure.

Plate 1: Existing dwelling house and septic tank.

Plate 2: Septic tank.

Plate 3: Septic tank and trenches.

Plate 4: View across site looking south, from driveway.

Plate 5: View of site looking north, from driveway towards intermittent watercourse.

2.3 BORES

The NSW Department of Primary Industries (DPI) water data website (http://allwaterdata.water.nsw.gov.au/water.stm) was accessed on 16th November 2017. A search of groundwater works within the vicinity of the site was undertaken from which it was determined that there are no groundwater works within 250 metres of the site.

2.4 FLOODING

The cleared land (where residential lots are proposed) is not subject to flooding.

2.5 SERVICES

Mains power is available at the site.

Reticulated water supply is not available at the site. The water main appears to terminate at the residential properties located to the north of the site. For the purposes of this report it is assumed that tank water will be collected for domestic use by potential future residents (also see Section 5.5).

Reticulated sewerage is not available at the site and for that reason effluent generated by any future residents will be required to be treated and disposed of on-site.

2.6 BUFFER DISTANCES

Minimum setbacks for on-site effluent disposal are summarised in **Table 1**. Refer Chapter G8 of Shoalhaven DCP 2014.

Table 1

Required Minimum Buffer Distances for On-site Systems

System	***Minimum Buffer Distances***
All land application systems	• 100 metres to permanent surface waters (eg. river, streams, lakes, etc). • 100 metres to any groundwater bores. • 40 metres to other waters (eg. farm dams, intermittent waterways; street drainage including gutters, swales and table drains and drainage channels, etc).
Surface spray irrigation *Secondary treated effluent with disinfection or higher* (Irrigation systems to conform to AS 1547)	• 6 metres if area up-gradient and 3 metres if area down-gradient of driveways and property boundaries. • 15 metres to dwellings. • 3 metres to paths and walkways. • 6 metres to swimming pools and buildings.
Sub-surface irrigation *Secondary treated effluent or higher*	• 6 metres if area up-gradient and 3 metres if area down-gradient of swimming pools, properties boundaries, driveways and buildings, including dwellings.

3.0 HYDRAULIC LOAD

A Development Application has been prepared seeking approval for a Community Title subdivision that will create 12 residential allotments with a minimum area of 5635 m^2 and one Community Title Lot. Proposed Lot 9 includes the existing dwelling house.

3.1 EXISTING DWELLING HOUSE

The effluent disposal system at the existing dwelling comprises a septic tank and trenches, which appears to be operating satisfactorily.

Wastewater generation from this dwelling has been estimated based on:

- an allowance of 120 litres wastewater/person/day;
- an occupancy of four people is assessed (ie. two occupants in the first bedroom and one occupant in each of the remaining bedrooms).

Based on the above, the total design hydraulic load for the existing dwelling house is **480 litres/day.**

3.2 FUTURE DWELLINGS

Dwelling locations and design for the Lots 2 to 8 and 10 to 13 are not yet known. However, for the purposes of this report, on-site effluent disposal for a future four bedroom house on each vacant lot has been considered.

Wastewater generation from each future dwelling has been estimated based on:

- an allowance of 120 litres wastewater/person/day;
- an occupancy of five people is assessed (ie. two occupants in the first bedroom and one occupant in each of the remaining bedrooms).

Based on the above, the total design hydraulic load for each future dwelling house is **600 litres/day.**

Note that a further report on effluent disposal should be prepared when a development application is lodged at Council with the building plans for each vacant Lot.

4.0 SOIL ASSESSMENT

Reference to the *1:250,000 Ulladulla Geological Series Sheet (S1 56-13)* indicates that the geology of the land is likely to be Wandrawandian Siltstone. The geology of the site has resulted in a duplex soil comprising a shallow sandy topsoil and medium clay subsoil (see below).

Based on the site's topography, soil samples were taken at two locations:

- Cleared land south of the driveway (Soil Unit 1 – See **Figure 2**); and
- Cleared land to the north of the driveway and south of the watercourse (Soil Unit 2 – see **Figure 2**).

Ground cover within the cleared parts of the site is natural pasture, predominantly carpet grass.

4.1 SOIL PROFILE

Soil Unit 1

A1 Horizon

Depth	:	0 – 10 cm
Colour	:	10 YR 4/3 Brown
Texture	:	Loam fine sandy
pH	:	6 (field measure)

A2 Horizon

Depth	:	10 - 20 cm
Colour	:	10 YR 4/6 Dark yellowish brown
Texture	:	Clay loam
pH	:	5.5 (field measure)

B Horizon

Depth	:	> 20 cm
Colour	:	7.5 YR 4/6 Strong brown
Texture	:	Medium clay

Soil Unit 2

A1 Horizon

Depth	:	0 – 8cm
Colour	:	10 YR 4/3 Brown
Texture	:	Fine sandy loam
pH	:	5.5 (field measure)

A2 Horizon

Depth	:	8 - 25 cm
Colour	:	10 YR 5/4 Yellowish brown
Texture	:	Loam fine sandy
pH	:	5 (field measure)

B Horizon

Depth	:	> 25 cm
Colour	:	10 YR 4/6 Dark yellowish brown with red mottling at approximately 80 cm
Texture	:	Medium clay

There was no gravel (laterite) present between the A1 and A2 horizon at the sample locations. The A2 horizon was not considered to be bleached at either location. The B horizon at the sample locations, showed no grey mottling, which would indicate poor drainage.

In summary, the soil assessment for Soil Unit 1 indicates a well-draining loam fine sandy topsoil with no bleached A2 horizon present and a medium clay subsoil.

The soil assessment for Soil Unit 2 indicates a well-draining fine sandy loam topsoil with no bleached A2 horizon present and a medium clay subsoil.

The soil depth at each location exceeds 50 cm, which satisfies the following Council requirement (ref Chapter G8 of the DCP):

> *"The minimum soil depth to bedrock (of low strength or harder) or other confining layer is 1.2m (for absorption trenches) or 0.5 m (for application of secondary quality effluent with disinfection and from the base of a mound system)."*

4.2 GROUNDWATER

No groundwater was encountered.

4.3 SOIL SURVEY

The soil type and geology is similar to that investigated for a residential subdivision at Worrigee Road, Worrigee (Lot 1 DP 624291). In October 2000, Cowman Stoddart Pty Ltd carried out an Effluent Disposal Report for this residential subdivision. The soil laboratory results from this study have been used to address the soil characteristics required by *Chapter G8 Onsite Sewage Management* of the Shoalhaven DCP 2014.

This information is described below:

Cation Exchange Capacity (CEC)

Cation Exchange Capacity is the capacity of the soil to hold and exchange cations. It is a major controlling agent of stability of soil structure and nutrient availability for plant growth. The laboratory analysis for a similar soil at Worrigee showed CEC as follows:

A1 horizon	3.7 m.e.%
A2 horizon	3.7 m.e.%
B horizon	23.1 m.e.%

CEC in Table 6 of "the silver book" is classified as a major limitation for effluent disposal if < 5 m.e.% for 0 – 40 cm in the soil profile. This is not the case as although it is low for the first 20 cm of the soil profile for Unit 1 and the first 25 cm of the soil profile for Soil Unit 2, it is 23.1 for the subsoil. In other words, the CEC of the subsoil compensates for the low CEC of the A1 and A2 horizon.

Phosphorus Sorption

P sorption capacity is the capacity of a soil to adsorb phosphorus and prevent it becoming a pollutant in watercourses. P sorption in Table 6 of "the silver book" is classified as a major limitation for effluent disposal if < 2000 kg/ha for 0 – 100 cm of the soil profile.

The laboratory analysis referred to above found the P sorption capacity of that soil to be as follows:

Table 2
P Sorption Laboratory Results for similar soil at Worrigee

Lab No.	*Horizon*	*P Sorption (mg/kg)*
1	A1	257
2	A2	209
3	B	740

Soil Unit 1

Based on the above laboratory results, P sorption on a proportional basis to a depth of 100 m is calculated for Soil Unit 1 as:

10 cm	@	257 mg/kg	=	2,570
10 cm	@	209 mg/kg	=	2,090
80 cm	@	740 mg/kg	=	59,200
		Total	=	63,860
			=	639 mg/kg

Based on a bulk density of 1.4 gm/cm^3, the P sorption capacity of Soil Unit 1 is 8,940 kg/ha. This is in the "minor limitation" range in Table 6 of "the silver book" and is satisfactory.

Soil Unit 2

Based on the above laboratory results, P sorption on a proportional basis to a depth of 100 m is calculated for Soil Unit 2 as:

8 cm	@	257 mg/kg	=	2,056
17 cm	@	209 mg/kg	=	3,553
75 cm	@	740 mg/kg	=	55,500
		Total	=	61,109
			=	611 mg/kg

Based on a bulk density of 1.4 gm/cm^3, the P sorption capacity of Soil Unit 2 is 8,555 kg/ha. This is in the "minor limitation" range in Table 6 of "the silver book" and is satisfactory.

Sodicity

Sodicity is the level of exchangeable sodium cations in the soil and relates to dispersion, surface crusting and soil erosion.

In the detailed laboratory analysis referred to above, the level of exchangeable cations in the soil were as follows:

Table 3

Sodicity results for similar soil at Worrigee

Lab No.	*Horizon*	*E.S.P*	*Rating*
1	A1	2.7%	Non-sodic
2	A2	4.3%	Non-sodic
3	B	5.2%	Marginally sodic

The implications of sodicity are:

– low hydraulic conductivity;

– hard, dense subsoil;

– high susceptibility to gully erosion and tunnel erosion.

Based on the above results, it is assumed that the subsoils at the project site are also marginally sodic. On this basis it is recommended that gypsum is applied to the effluent disposal areas (EDAs). The recommended gypsum application rate is 2 kg per 10 m^2 and

this should be mixed in with the topsoil. The application of gypsum will assist in the preservation of soil structure and the resulting infiltration of water through the soil.

pH

Field measurements of pH for the A1 and A2 horizons within each identified soil unit are summarised below.

Table 4

Field pH measurements

Horizon	*pH (field measure)*	*Rating*
Soil Unit 1		
A1	6	Moderately acid
A2	5.5	Moderately acid
Soil Unit 2		
A1	5.5	Moderately acid
A2	5	Very strongly acid

In the laboratory analysis referred to above, the soils were found to be strongly acidic.

On this basis, the application of lime is recommended. Agricultural lime should be incorporated into the soil during construction of the EDA at a rate of 2 kg/10 m^2. The application of lime will raise the soil pH.

Emerson Aggregate Test (EAT)

In the laboratory analysis of similar soils at Worrigee, the EAT analysis indicated that the soil structure was stable with negligible dispersion. This is a desirable feature.

Electrical Conductivity (EC)

In the laboratory analysis of similar soils at Worrigee, the soils were found to be non-saline.

Conclusion

None of the soil features are a major limitation for on-site effluent disposal.

The following soil amendments should be undertaken in order to optimise conditions for effluent disposal:

- Agricultural lime should be incorporated into the topsoil during construction of the EDA at a rate of 2 kg per 10 m^2.
- Gypsum should be applied to the EDA at a rate of 2 kg per 10 m^2 and this should be mixed in with the topsoil.

5.0 EFFLUENT DISPOSAL

5.1 EXISTING DWELLING HOUSE

The effluent disposal system at the existing dwelling house is a septic tank and trenches and appears to be operating satisfactorily. This is likely due to the current intermittent occupation of the house.

Given the soil conditions at the site (i.e. shallow topsoil and medium clay subsoil), the use of absorption trenches is not recommended, especially for permanent occupation of the house. As such, it is recommended that the current effluent disposal system should be upgraded if the dwelling house is to remain intact for future permanent occupation.

The estimated hydraulic load for the existing three bedroom dwelling is **480 ℓ/day** (see Section 3.0). Nutrient and water balance calculations for this hydraulic load are provided below.

Recommendations are provided in Section 5.4.

Should construction of a new house be proposed on Lot 9 and assuming the new dwelling comprises four bedrooms, then the calculations provided in Section 5.2 would be relevant.

5.1.1 Phosphorus Balance

A soil with a P sorption ability of at least 50 years is recommended for land application areas. Based on a total phosphorus (TP) concentration of 12 mg/ℓ in the wastewater and a critical loading rate of 3 mg/m^2/day, the required area of land can be calculated.

- Amount of P that can be adsorbed without leaching over 50 years.

  = 8940 x ⅓
  = 2980 kg/ha
  = 0.298 kg/m^2

- Amount of vegetation uptake over 50 years based on critical loading rate of 3 mg/m^2/day.

  P uptake = 3 x 365 x 50
  = 54,750 mg/m^2
  = 0.055 kg/m^2

- Amount of P generated over 50 years from the development.

  P generated = Total P x volume of wastewater
  = 12 x 480 litres/day x 365 days/year x 50 years

$$= 105 \times 10^6 \text{ mg}$$

$$= 105 \text{ kg}$$

- Irrigation area required.

$$= \frac{\text{P generated}}{\text{P adsorbed} + \text{P uptake}}$$

$$= \frac{105}{0.298 + 0.055}$$

$$= 298 \text{ m}^2$$

5.1.2 Nitrogen Balance

Based on a total nitrogen (TN) concentration of 20 mg/ℓ in the treated wastewater and a critical TN loading rate of 25 mg/m^2/day (nominal value), the area required for effluent disposal may be calculated as:

$$\text{Area required} = \frac{20 \times 480 \text{ litres/day}}{25}$$

$$= 384 \text{ m}^2$$

5.1.3 Water Balance

Climatic data used in the attached water balance are:

Median rainfall	:	HMAS Albatross
Pan evaporation	:	HMAS Albatross
Percolation rate	:	5 mm/week
Effluent generated	:	480 litres/day (see Section 3.0)

The water balance calculates that the area of land required for effluent disposal is 380 m^2 for the proposed development with no wet weather storage (see **Appendix A**).

5.1.4 Summary of Land Area Requirements

Hydraulic Balance	380 m^2
Phosphorus Balance	298 m^2
Nitrogen Balance	384 m^2

ie. an area of 390 m^2 should be used for effluent disposal. A reserve area of 380 m^2 should also be identified for expansion or contingencies.

5.2 FUTURE DWELLINGS

The estimated hydraulic load together with the soil conditions at the site indicate that the property is suitable for on-site effluent disposal provided:

- recommended soil amendments are implemented (see Section 4.3); and
- buffer distances are met (see Section 2.6).

The estimated hydraulic load for a future four bedroom dwelling on each proposed vacant lot is **600 ℓ/day** (see Section 3.0).

Nutrient and water balance calculations for this hydraulic load are provided below. The calculations apply to both soil units unless specified otherwise.

Recommendations are provided in Section 5.4.

5.2.1 Phosphorus Balance

Soil Unit 1

A soil with a P sorption ability of at least 50 years is recommended for land application areas. Based on a total phosphorus (TP) concentration of 12 mg/ℓ in the wastewater and a critical loading rate of 3 mg/m^2/day, the required area of land can be calculated.

- Amount of P that can be adsorbed without leaching over 50 years.

  = 8940 x ⅓
  = 2980 kg/ha
  = 0.298 kg/m^2

- Amount of vegetation uptake over 50 years based on critical loading rate of 3 mg/m^2/day.

  P uptake = 3 x 365 x 50
  = 54,750 mg/m^2
  = 0.055 kg/m^2

- Amount of P generated over 50 years from the development.

  P generated = Total P x volume of wastewater
  = 12 x 600 litres/day x 365 days/year x 50 years
  = 131 x 10^6 mg
  = 131 kg

- Irrigation area required.

$$= \frac{\text{P generated}}{\text{P adsorbed + P uptake}}$$

$$= \frac{131}{0.298 + 0.055}$$

$$= 373\ m^2$$

Soil Unit 2

A soil with a P sorption ability of at least 50 years is recommended for land application areas. Based on a total phosphorus (TP) concentration of 12 mg/ℓ in the wastewater and a critical loading rate of 3 mg/m^2/day, the required area of land can be calculated.

- Amount of P that can be adsorbed without leaching over 50 years.

$$= 8555 \times ⅓$$

$$= 2852\ kg/ha$$

$$= 0.285\ kg/m^2$$

- Amount of vegetation uptake over 50 years based on critical loading rate of 3 mg/m^2/day.

$$\text{P uptake} = 3 \times 365 \times 50$$

$$= 54{,}750\ mg/m^2$$

$$= 0.055\ kg/m^2$$

- Amount of P generated over 50 years from the development.

$$\text{P generated} = \text{Total P} \times \text{volume of wastewater}$$

$$= 12 \times 600\ \text{litres/day} \times 365\ \text{days/year} \times 50\ \text{years}$$

$$= 131 \times 10^6\ mg$$

$$= 131\ kg$$

- Irrigation area required.

$$= \frac{\text{P generated}}{\text{P adsorbed + P uptake}}$$

$$= \frac{131}{0.285 + 0.055}$$

$$= 385\ m^2$$

5.2.2 Nitrogen Balance

Based on a total nitrogen (TN) concentration of 20 mg/ℓ in the treated wastewater and a critical TN loading rate of 25 mg/m^2/day (nominal value), the area required for effluent disposal may be calculated as:

$$\text{Area required} = \frac{20 \times 600 \text{ litres/day}}{25}$$

$$= 480 \text{ m}^2$$

5.2.3 Water Balance

Climatic data used in the attached water balance are:

Median rainfall : HMAS Albatross

Pan evaporation : HMAS Albatross

Percolation rate : 5 mm/week

Effluent generated : 600 litres/day (see Section 3.0)

The water balance calculates that the area of land required for effluent disposal is 470 m^2 for the proposed development with no wet weather storage (see **Appendix B**).

5.2.4 Summary of Land Area Requirements

Soil Unit 1

Hydraulic Balance	470 m^2
Phosphorus Balance	373 m^2
Nitrogen Balance	480 m^2

ie. an area of 480 m^2 should be used for effluent disposal. A reserve area of 470 m^2 should also be identified for expansion or contingencies.

Soil Unit 2

Hydraulic Balance	470 m^2
Phosphorus Balance	385 m^2
Nitrogen Balance	480 m^2

ie. an area of 480 m^2 should be used for effluent disposal. A reserve area of 470 m^2 should also be identified for expansion or contingencies.

5.3 PROPOSED EFFLUENT DISPOSAL AREAS

At this stage of the proposed development, a specific EDA and reserve area have not been identified for each lot due to there being considerable scope for the positioning of

these areas (i.e. minimum lot size of 5635 m^2; required EDA of 480m^2; and required reserve area of 470m^2). However, a plan showing effluent disposal area (EDA) constraints and illustrative EDAs and reserve areas for the smaller/more constrained lots is provided in **Appendix C**.

A further report on effluent disposal should be prepared when a development application is lodged at Council with the building plans for each residential Lot. This report should include details of the EDA and reserve area location.

5.4 RECOMMENDATIONS

Recommended soil amendments for all proposed residential lots are as follows:

- Gypsum should be applied to the land application area at a rate of 2 kg per 10 m^2 and should be mixed in with the topsoil.
- Agricultural lime should be incorporated into the land application area at a rate of 2 kg per 10 m^2.

Additional recommendations are detailed below.

5.4.1 Existing Dwelling House (proposed Lot 9)

The current effluent disposal system should be upgraded if the existing three bedroom dwelling house is to remain intact for future permanent occupation. The hydraulic balance and nutrient balance calculations provided in Sections 5.1 would be relevant for an AWTS.

Secondary treated effluent from the AWTS may be disposed of by:

- Subsurface irrigation; or
- Surface spray irrigation.

A land application area of 390 m^2 and reserve area of 380 m^2 should be provided.

Alternatively, a septic tank and mound system is also a possibility where the EDA has a slope of <7%.

If reticulated water becomes available, then the EDA and reserve area will need to be increased accordingly (see below).

Should construction of a new house be proposed for Lot 9, then an effluent disposal report will need to be submitted to Council when a development application is lodged with the building plans. For a proposed four bedroom house, the relevant calculations provided in this report would be applicable.

5.4.2 Future Dwellings (proposed lots 2 to 8 and 10 to 13)

If a four bedroom house using tank water is proposed for each of the future vacant lots, then the hydraulic balance and nutrient balance calculations provided in Sections 5.2 would be relevant for an AWTS.

Secondary treated effluent from the AWTS may be disposed of by:

- Subsurface irrigation; or
- Surface spray irrigation.

A land application area of 480 m^2 and reserve area of 470 m^2 should be provided.

Alternatively, a septic tank and mound system is also a possibility where the EDA has a slope of <7%.

A further report should be prepared when a development application is lodged at Council with the building plans for each lot. The house design and exact location within each lot should only be finalised after consultation on the most appropriate effluent disposal system for the site. A revised nutrient balance and hydraulic balance may be required.

If reticulated water is available for future lots, then the EDAs and reserve areas will need to be increased accordingly (see below).

5.5 RETICULATED WATER

The calculations presented above are based on future dwellings using tank water for domestic purposes. There is a possibility that the subdivision may be connected to reticulated water given that a water main is located to the north of the site. Under the circumstances that reticulated water is connected to future proposed lots, the required effluent disposal areas will increase. For example, the N balance calculations (the limiting factor in determining EDAs above) will be as follows:

Existing dwelling house

$$\text{Area required} = \frac{20 \times 600 \text{ litres/day}}{25}$$

$$= 480 \text{ m}^2$$

Future dwellings

$$\text{Area required} = \frac{20 \times 750 \text{ litres/day}}{25}$$

$$= 600 \text{ m}^2$$

Given the area of the proposed lots (minimum area of 5635 m^2), it is considered that the EDA requirements for reticulated water use could be easily accommodated.

6.0 CONCLUSION

The subject site is described as Lot 3 DP 846470 at 48 Jervis Bay Road, Falls Creek. The site includes a three bedroom dwelling house, shed and driveway.

A Development Application has been prepared seeking approval for subdivision of the site to create 12 residential allotments with a minimum area of 5635 m^2 and one Community Title Lot. Proposed Lot 9 includes the existing dwelling house

The site assessment and soil studies indicate that the property is suitable for on-site effluent disposal provided that recommended soil amendments are implemented and buffer distances are met. Recommended soil amendments are as follows:

- Gypsum should be applied to the land application area at a rate of 2 kg per 10 m^2 and should be mixed in with the topsoil.
- Agricultural lime should be incorporated into the land application area at a rate of 2 kg per 10 m^2.

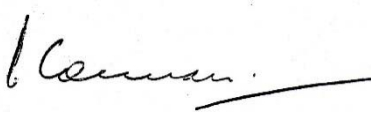
The recommended method of effluent disposal for each of the proposed lots is as follows:

- ***Proposed Lot 9 (existing dwelling house)*** – it is recommended that the existing effluent disposal system (septic tank and trenches) should be upgraded if the dwelling house is to remain intact for future permanent occupation. Effluent from the dwelling can be satisfactorily disposed of on-site via an AWTS and subsequent surface or subsurface irrigation on an area of 390 m^2 with a reserve area of 380 m^2. Alternatively a septic tank and mound system is a possibility where the EDA has a slope of < 7%.

  Should construction of a new house be proposed then an effluent disposal report will need to be submitted to Council when a development application is lodged with the building plans. For a proposed four bedroom house, the relevant calculations provided in this report would be applicable.

  Proposed Lots 2 to 8 and 10 to 13 – for each of these lots, effluent from a four bedroom dwelling can be satisfactorily disposed of on-site via an AWTS and subsequent surface or subsurface irrigation on an area of 480 m^2 with a reserve area of 470 m^2. Alternatively a septic tank and mound system is a possibility where the EDA has a slope of < 7%. A further report will need to be prepared when a development application is lodged at Council with the building plans for each vacant lot. A revised nutrient balance and hydraulic balance may be required.

If reticulated water becomes available, then the EDA and reserve area will need to be increased accordingly. Given the area of the proposed lots (minimum area of 5635 m^2), it is considered that the EDA requirements for reticulated water use could be easily accommodated.

Prepared by: Angela Jones (ENVIRONMENTAL CONSULTANT)	Reviewed by: Peter Cowman (ENVIRONMENTAL CONSULTANT)
	

APPENDIX A

Water Balance (Three bedroom House)

APPENDIX A

CALCULATION OF EVAPOTRANSPIRATION-ABSORPTION AREA SIZE BY WATER BUDGET AS OUTLINED IN AS1547

Project: Pasialis - Falls Creek - Existing Dwelling

Size of area each month

Pan Evaporation - Albatross **Rainfall - Albatross**

1 Month	2 Pan Evaporation E mm	3 Evapo-Transpiration ET ET=0.75E mm	4 Rainfall R mm	5 Retained Rainfall R1 R1=0.75R mm	6 LTAR per month mm	7 Disposal rate per month (3)-(5)+(6) mm	8 Effluent applied per month L	9 Size of Area (8)/(7) m^2
Jan	195.3	146.5	88.4	66.3	22.1	102.3	14,880	145.5
Feb	159.6	119.7	70.9	53.2	20	86.5	13,440	155.3
Mar	145.7	109.3	79.6	59.7	22.1	71.7	14,880	207.6
Apr	120	90.0	52.3	39.2	21.4	72.2	14,400	199.5
May	96.1	72.1	72.2	54.2	22.1	40.0	14,880	371.8
Jun	87	65.3	62.2	46.7	21.4	40.0	14,400	360.0
Jul	96.1	72.1	40.6	30.5	22.1	63.7	14,880	233.5
Aug	127.1	95.3	37.6	28.2	22.1	89.2	14,880	166.8
Sep	150	112.5	47.7	35.8	21.4	98.1	14,400	146.8
Oct	176.7	132.5	71.6	53.7	22.1	100.9	14,880	147.4
Nov	180	135.0	84.2	63.2	21.4	93.3	14,400	154.4
Dec	213.9	160.4	69.8	52.4	22.1	130.2	14,880	114.3

APPENDIX B

Water Balance (Four bedroom house)

APPENDIX B

CALCULATION OF EVAPOTRANSPIRATION-ABSORPTION AREA SIZE BY WATER BUDGET AS OUTLINED IN AS1547

Project: Pasialis - Falls Creek

Size of area each month

Pan Evaporation - Albatross **Rainfall - Albatross**

1 Month	2 Pan Evaporation E mm	3 Evapo-Transpiration ET ET=0.75E mm	4 Rainfall R mm	5 Retained Rainfall R1 R1=0.75R mm	6 LTAR per month mm	7 Disposal rate per month (3)-(5)+(6) mm	8 Effluent applied per month L	9 Size of Area (8)/(7) m^2
Jan	195.3	146.5	88.4	66.3	22.1	102.3	18,600	181.9
Feb	159.6	119.7	70.9	53.2	20	86.5	16,800	194.2
Mar	145.7	109.3	79.6	59.7	22.1	71.7	18,600	259.5
Apr	120	90.0	52.3	39.2	21.4	72.2	18,000	249.4
May	96.1	72.1	72.2	54.2	22.1	40.0	18,600	464.7
Jun	87	65.3	62.2	46.7	21.4	40.0	18,000	450.0
Jul	96.1	72.1	40.6	30.5	22.1	63.7	18,600	291.9
Aug	127.1	95.3	37.6	28.2	22.1	89.2	18,600	208.5
Sep	150	112.5	47.7	35.8	21.4	98.1	18,000	183.4
Oct	176.7	132.5	71.6	53.7	22.1	100.9	18,600	184.3
Nov	180	135.0	84.2	63.2	21.4	93.3	18,000	193.0
Dec	213.9	160.4	69.8	52.4	22.1	130.2	18,600	142.9

APPENDIX C

Effluent Disposal – Constraints Plan

APPENDIX C

APPENDIX C

= 40 m setback from intermittent watercourse

= 6m /3 m setback from downslope/upslope property boundary respectively

Illustrative footprint of combined EDA (390m²) and reserve area (380 m²) for existing three bedroom house on proposed Lot 9

Illustrative footprint of combined EDA (480m²) and reserve area (470 m²) for future four bedroom house on proposed Lots 5 and 6

Cowman Stoddart Pty Ltd
ABN 29 057 616 896

COWMAN STODDART PTY LTD

Town Planning, Agricultural and Environmental Consultants

Scale 1:3300 (Approx.)

Date: November 2017

Effluent Disposal – Constraints Plan

Proposed Community Title Subdivision

Lot 3 DP 846470

48 Jervis Bay Road, Falls Creek

Base plan: extract from subdivision plan prepared by Leslie & Thompson Surveyors (ref 12604-2)