



On-site Wastewater & Liquid Trade Waste Management Assessment

Proposed Rural industry,
temporary dwellings and
existing dwelling at
Lot 2 DP 735538,
736 Federal Drive, Federal

For: Theme Rains
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**Greg Alderson
Associates**



Contact Information

43 Main Street,
Clunes NSW 2480

Telephone: 02 6629 1552

office@aldersonassociates.com.au
www.aldersonassociates.com.au

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1. INTRODUCTION

Greg Alderson and Associates have been commissioned by Theme Rains to provide an On-Site Wastewater & liquid trade waste Management Report for proposed and existing development at Lot 2 DP 735538, 736 Federal Drive, Federal. The On-Site Sewage Management System (OSMS) designed in this report is prepared for the following development:

- Wastewater & liquid trade waste generated from a proposed rural industry development which will manufacture skincare and aromatherapy products within proposed new sheds. Wastewater will be from staff amenities, cleaning and hose down of botanical extraction cylinders.
- An allowance is being made for two temporary one bedroom dwellings proposed to be put on the property under the *Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2021*.
- The existing 4-bedroom dwelling on the property.

The following report provides information for the site investigation and the proposed On-Site Sewage Management System (OSMS) that will treat all wastewater & liquid trade waste generated on the property.

Currently there is an existing OSMS servicing the existing dwelling. This OSMS consists of septic tank of approximately 2000L followed by an absorption field of unknown dimensions. The new proposed OSMS will provide the following improvements to on-site wastewater management at the site:

1. Secondary treatment will be provided instead of the existing primary treatment;
2. A significantly larger disposal area will be installed.

1.1 Proposed Upgraded OSMS

The following will be used for the design of the proposed OSMS:

- The design is for a total hydraulic loading of 1539 L/day.
- Primary treatment via a new 5000L NSW Ministry of Health Approved septic tank with effluent outlet filter fitted.
- Secondary treatment system, consisting of a proposed NSW Ministry of Health approved Ozzikleen RP10A **AWTS**.
- An **Evapotranspiration/ Absorption Bed (ETA)** Disposal Area, see attached plan.

2. Site Description

Staff of this office investigated the subject property and the proposed new OSMS location. An inspection of the existing OSMS was also made. The property is shown within its immediate locality on **Exhibit No. 1**.

2.1 Land Area

The total land area of the Lot is approximately 19690 m² in area. There is sufficient area available for wastewater treatment and disposal at the site including a full reserve area however setbacks to a permanent creek and intermittent drainage lines cannot be achieved if the most suitable disposal area is chosen.

2.2 Vegetation

The area proposed for wastewater disposal consists of slashed paddock.

2.3 Slope

Slopes across the property are generally steep as the property is located on a ridge. The gradient as measured in the proposed wastewater disposal area is 18%. Although this slope is greater than the recommended 15% maximum slope in Council's Strategy it is considered that an ETA bed can still be safely installed on this slope. Section 2.6 provides further information regarding the installation of ETA beds on the proposed steeper slope.

2.4 Soil

The soils of the site are dark reddish clay loams, being red krasnozems soils in accordance with the Great Soil Group classification. The site lies within the Rosebank Soil Landscape as located in the maps described in Morand (1994). The soil is deep, and is estimated to be greater than 2 m at this location. The following is a summary of the soil landscape description by Morand (1994).

Soil Landscape:	Rosebank Soil Landscape
Soils:	Moderately deep to deep (>100 cm), Krasnozems and brownish red well drained Krasnozems on slopes.
Geology:	Lamington volcanics: Lismore Basalts – Tertiary basalts, with bore and minor agglomerate
Limitations:	Very acid soils with high aluminium toxicity potential. Steep slopes and mass movement and localised rock outcrop.
Permeability:	moderate to high.

All of the limitations as outlined in Morand (1994) were not evident in the site assessment. The site is not subject to mass movement in the vicinity of the proposed

Table 2: Soil Assessment for Wastewater Disposal in accordance to EHPG (1998).

SOIL FEATURE	COMMENT	LIMITATION RATING		
		Minor	Moderate	Major
DEPTH OF SOIL	Soil depth is estimated to be greater than 2000mm in depth	✓		
DEPTH TO HIGH EPISODIC/ SEASONAL WATERTABLE	The water table was not intersected during borehole tests and no springs or other water discharges were observed. An allowance of 3.0 m to the water table was used in order to size the disposal area based of phosphorous movements	✓		
SOIL PERMEABILITY	The sites soils were clay loams which have an acceptable permeability.	✓		
COARSE FRAGMENTS	None observed in soil borehole	✓		
pH	Soil pH is generally acidic (4.5-5.5), and will require lime to be incorporated into the disposal area.	✓		
ELECTRICAL CONDUCTIVITY (dS/m)	Morand (1994) states that the Rosebank soil landscape has a very low electrical conductivity, there was no evidence of vegetation being affected by salt	✓		
PHOSPHOROUS SORPTION (kg/ha)	Morand (1994) states that the Rosebank soil landscape has a moderate to high phosphorous sorption rate of greater than 600mg/kg which is equivalent to greater than 10000kg/ha/year. 10000kg/ha/year was used for the design of the disposal area	✓		
MODIFIED EMERSON AGGREGATE TEST	Morand (1994) states that the Rosebank soil landscape has a low dispersive percentage, there were no signs of dispersiveness when soil at site was examined	✓		

Overall, the EHPG (1998) would class the soil as being a minor limitation for disposal of wastewater.

2.4.1 Improvements to Soil

Increased acidity affects cation exchange capacity and can lead to deficiencies in calcium and magnesium while mobilising aluminium, which is toxic to plant growth. Lime can be added to the soil profile when preparing the area for disposal to increase the pH to a range between 6.5 – 8.5, which will enable plants to take up nutrients, which will be within the wastewater.

Gypsum will be added to the soil during construction at the rate of 0.5 tonne/hectare to prevent the soil from degrading from sodium application, which is contained in the wastewater.

2.5 Environment and Health Risk Assessment

The following (Table 3) is an environment and health risk assessment in accordance with the policy for *Design Guidelines for On-Site Sewage Management Systems* Byron Shire Council (December, 2004).

Table 3: Environment and Health Risk Assessment for Proposed Disposal Area.

SITE FEATURE	LIMITATION		REASONING
	NONE	MAJOR	
FLOOD POTENTIAL	✓		The land of the proposed disposal areas is not subject to the 1:100 year flood height as depicted on Byron Shire Council GIS layers.
SOIL TYPE	✓		Light clay which has suitable permeability.
EXPOSURE	✓		Exposure to sun and wind is adequate.
SLOPE %		✓	Approximately 18%. Suitable with reduced width ETA beds.
LANDFORM	✓		Side slope of ridge.
EROSION POTENTIAL	✓		No signs of erosion present in disposal areas.
SUBSOIL DRAINAGE	✓		No visible signs of subsoil dampness in the proposed disposal area.
SURFACE DRAINAGE	✓		A catch drain is to be installed around the disposal area to divert rainwater
LAND FILLING	✓		No fill evident in the proposed disposal area
LAND AVAILABLE FOR APPLICATION AREA AND BUFFERS	✓		A minor intermittent drainage line is located approximately 22m across slope from the closest point to the proposed disposal area. Given the slope of the land wastewater will flow away from the drainage line
ROCKS AND ROCK OUTCROPS	✓		Rocks were observed across the property but not in the location of the proposed disposal area.
TREATMENT SYSTEM	✓		Secondary Treatment via AWTS.
BUFFERS	✓		Buffer to intermittent drainage retained at 40m due to wastewater in the disposal area flowing away from the drainage line

2.6 Site Constraints and Proposed Best Practice

Tables 2 & 3 presented site constraints that may occur following the BSC Design Guidelines for On-Site Sewage Management Policy (2004) and the Environment and Health Protection Guideline On-site Sewage Management for Single Households (1998). It can be seen that the slope the ETA beds are proposed to be constructed on slightly exceeds the maximum slope specified in Council's guidelines.

The slope of the site is limiting to the disposal of wastewater via ETA beds as 15% is the recommended maximum slope for their use. Generally, the entire site has slopes greater than 15%, hence special design requirements will be utilised for rendering ETA beds as suitable. This slope limitation can be overcome by installing narrower ETA beds as described in Section 4.3 of this report and the details in Exhibit No. 5 where cross

section details have been provided. As recommended, if the batter exceeds 1:1 it is recommended that a gravity wall is put in place as per the detail. If the batter is 1:1, partial protection as per the detail is to be provided. If the batter is less than 1:1, the batter can remain unprotected.

It is also noted that the proposed disposal area is within 40m is a very minor drainage line. Given the contour of the land, all wastewater will have travelled 40m before it intersects any drainage lines. Figure 2 shows the positioning of the proposed ETA beds in relation to the intermittent drainage line and the contour of the land. As the flow of wastewater is generally parallel to the drainage line the potential for nutrient and pathogen contamination to the water within the drainage line is limited.



Figure 2. Wastewater flow direction of ETA beds in regards to drainage line.

Based on the above review of site features it is considered that a 40m setback be incorporated into the OSMS sizing calculations.

3. Proposed On-site Wastewater Management System

It is proposed that an Aerated Wastewater Treatment System (AWTS) will be used for secondary treatment of all wastewater produced by the existing dwelling & proposed detached dwelling module. Prior to the AWTS, it is also proposed that a septic tank will be installed to reduce Biochemical Oxygen Demand (BOD) in the wastewater prior to it entering the AWTS for treatment. Disinfection of wastewater within the AWTS is also proposed. All treated wastewater after the AWTS will be pumped to evapotranspiration/absorption beds for disposal.

The layout of the treatment and disposal system is shown on **Exhibit No. 2 & 3**.

3.1 Predicted Hydraulic Loading

There are three proposed sources of wastewater to enter the OSMS. Each of these sources is described in the following sections, and when added together equates to a total hydraulic loading of 1539 L/day.

There are other uses of water in the production process. This includes the use of water in the distillation process (to produce steam), and for mixing with glycol to form coolant for the cooling of the still (coolant will be collected, contained and picked up by a waste collection provider). These other water uses will not create liquid trade waste that will be in high enough volumes for connection and management within the proposed OSMS.

2.6.1 Existing dwelling

The predicted hydraulic loads are based on the BSC Policy (December, 2004) using tank water supply with standard water saving devices (115L/person/day) and the use of flush toilets in the dwelling. Below is the predicted & possible hydraulic loading that the proposed OSMS is designed to manage:

4 existing bedrooms * 1.5 people * 115L = **690 L/day**.

2.6.2 Proposed temporary dwellings

An allowance is being made for two temporary one bedroom dwellings proposed to be put on the property under the Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2021. The predicted hydraulic loads are based on the BSC Policy (December, 2004) using tank water supply with standard water saving devices (115L/person/day) and the use of flush toilets in the dwellings. Below is the predicted & possible hydraulic loading that the proposed OSMS is designed to manage:

2 dwellings * one bedroom * 2 people * 115L = **460 L/day**.

2.6.3 Proposed Rural industry

From the proposed skincare and aromatherapy product manufacturing, there will be three wastewater sources:

1. Staff amenities
2. Cleaning of equipment in dishwasher
3. Hosing of botanical extraction cylinders

The owner has stated that up to 11 staff may work in the proposed industrial sheds. As the hydraulic loading is from staff amenities within a rural industrial building, hydraulic loading assigned for each staff member was guided by AS/NZS 1547:2012. Table H4 within AS/NZS 1547:2012 gives a 30L/day hydraulic loading for rural factory workers serviced by a roof water supply. This loading is considered suitable to apply to staff in this instance. Therefore, the total hydraulic loading is calculated as follows:

11 full time staff members * 30L/day = **330 L/day**

The owner has also stated that the only wastewater generated from the manufacturing process will be from the use of a commercial dishwasher. This dishwasher will be used a maximum of 3 times a day for cleaning equipment used in making product ingredients.

Commercial dishwashers are generally known to use low volumes of water per cycle. For examples, three different branded and manufactured dishwashers were investigated to determine water usage per cycle. These three dishwashers use the following volumes of water per cycle:

- Fagor Evo-concept = 2.4L
- Meiko Upster U500 = 3.0L
- Hobart Ecomaxplus = 2.3L

Based on the similar water usage across the three randomly chosen commercial dishwashers, a loading of 3.0L per cycle was chosen for calculating the wastewater usage as follows:

$$3 \text{ cycles/day} * 3.0\text{L/cycle} = \mathbf{9 \text{ L/day}}$$

The owner has stated that ethanol wipe down will occur for all surfaces in the rural industry shed, and therefore no additional wastewater will be generated from the washing down of equipment with water.

Although not planned to occur every day, an allowance is being made for the hosing out of 4 botanical extraction cylinders each week day. This involves a hot water hose out of the interiors of the cylinders used to contain the botanicals during the oil distillation process. This hose down is understood to be very brief, with each cylinder needing approximately 15 seconds to hose out.

A higher than expected tap flow rate of 40L/min or 0.66 L/sec is used for determining a flow rate (a garden tap on town water is around 35 L/min).

$$0.66 \text{ L} * 15 \text{ seconds} * 4 \text{ cylinders} = 40 \text{ L/day}$$

An allowance of **50L/day** will be made to provide a robust design.

3.2 Predicted Nutrient Loading

2.6.4 Total Nitrogen

There are five potential sources of nitrogen to enter the OSMS. These five sources are:

1. Proposed two temporary dwellings,
2. Existing dwelling,
3. Staff employed within the rural industry,
4. Commercial dishwasher waste water,
5. Botanical extraction cylinder washdown.

Table 4 presents the proposed Total Nitrogen (TN) loadings from each of these sources, which gives a combined TN loading of 67.7 kg/year.

Table 4. TN loading calculation.

	Number	people/brdm	No. bdrm	volume*	Total
Temp dwellings	2	2	1	4.2	16.8
Existing dwelling	1	1.5	4	4.2	25.2
Staff	11			2.2	24.2
Dishwasher (cycles)	1			1	1
Cylinder wash				0.5	0.5
TOTAL (kg/year)					67.7

*4.2 kg/person/year assigned for occupants of dwellings as per Council's OSMS design model.
 2.2 kg/person/year assigned for staff as this is 50% of total daily TN loading (from staff toilet use during working hours)
 A 1 kg TN allowance has been made in the dishwasher. Actual TN loading will be trace amounts & is anticipated to be less than 1 kg/year.

Cell D8 within Council's design model has been modified to include a total TN loading of 67.7 kg/year.

2.6.5 Total Phosphorus

There are Five potential sources of phosphorus to enter the OSMS. These five sources are:

1. Proposed two temporary dwellings,
2. Existing dwelling,
3. Staff employed within the rural industry,
4. Commercial dishwasher waste water,
5. Botanical extraction cylinder washdown.

Table 5 presents the proposed Total Phosphorus (TP) loadings from each of these sources, which gives a combined TP loading of 10.05 kg/year.

Table 5. TP loading calculation.

	Number	people/brdm	No. bdrm	volume	Total
Temp dwellings	2	2	1	0.6	2.4
Existing dwelling	1	1.5	4	0.6	3.6
Staff	11			0.3	3.3
Dishwasher (cycles)	1			0.5	0.5
Cylinder wash				0.25	0.25
TOTAL (kg/year)					10.05

*4.2 kg/person/year assigned for occupants of dwellings as per Council's OSMS design model.
 2.2 kg/person/year assigned for staff as this is 50% of total daily TN loading (from staff toilet use during working hours)
 A 1 kg TN allowance has been made in the dishwasher. Actual TN loading will be trace amounts & is anticipated to be less than 1 kg/year.

Cell D11 within Council's design model has been modified to include a total TP loading of 10.05 kg/year.

3.3 Disposal Area Required

This section investigates the disposal area required based on the predicted hydraulic and nutrient loadings from the existing & proposed development on the subject site, and environmental factors which influence the design. In order to ascertain the size of the disposal area, the model within the Byron Shire Council Design Guidelines for On-site Sewage Management for Single Households was used with the following modifications and parameters used to make it reflect the loadings proposed to be managed by the new OSMS.

- 1 person in Group 1 (doing this allows for hydraulic & nutrient inputs to be accurately modified to reflect the design loads);
- Land area of 19690m²;
- Buffer to intermittent waterway being 40m;
- Total daily flow (Cell B7) of 1539 L/day;
- N produced per capita (cell D8) 67.7 kg/year;
- P produced per person/year (Cell D11) 10.05 kg/year;
- AWTs treatment system;
- Red basaltic soils;
- Water table/bedrock depth 5m;
- Light clay strongly structured soils;
- Mounded bed for effective rainfall;
- ETA beds for land application type.

The disposal area required for the hydraulic and nutrient loadings is as follows:

Area Required for	Hydraulics:	161 m²
	Nitrogen:	0 m ²
	Phosphorus:	110 m ²

Therefore, the disposal area will be required to be 161 m² which equates to four ETA beds each 18.5m long x 1.5m wide. A copy of the design model calculations is attached as Appendix A.

3.4 Wet Weather Storage

It is proposed that wet weather storage will not be installed at this site, in accordance with BSC Policy (December, 2004). It is proposed that no wet weather storage is used based on the following:

- the disposal area is sized on the daily model where no cumulative storage is required;
- the size of the disposal area is conservative (i.e. higher absorption rates and lower hydraulic load application rates expected).

4. Details of On-site Sewage Management System

4.1 Trade Waste requirements

The trade waste generated from the rural industry is considered to be Concurrence Classification A liquid trade waste in accordance with the Department of Planning, Industry & Environment *Liquid Trade Waste Management Guidelines (2021)*. Table 11 within these guidelines lists the liquid trade waste activities that are included in Concurrence Classification A wastes. Within this table, Laboratory – pathology/analytical liquid waste is included, which correlates to the waste produced from the rural industry, as the dishwasher is to be used to wash equipment used in the quality analysis of produced skin care & aromatherapy products.

Pretreatment for Laboratory – pathology/analytical liquid waste is noted as being number 6 within Table 8 of the *Liquid Trade Waste Management Guidelines (2021)*, which is a 'Balancing, dilution, neutralizing pit/tank'. Note 3 from Table 11 also states:

"A balancing pit is only required if a general-purpose pit is not installed for other waste streams. If a general-purpose pit is installed, the laboratory waste can go through this pit."

Based on the above, a septic tank prior to the AWTS will function as the required 'Balancing, dilution, neutralizing pit/tank'.

4.2 Septic Tank

It is proposed that a 5000L septic tank will be installed to pre-treat all wastewater and liquid trade waste generated on the subject site. A minimum 4000L volume tank is required for flows of 1400-1600 L/day in accordance with table J1 of AS 1547-2012, however due to market availability it is proposed that a 5000L tank will be installed. Furthermore, an outlet filter is to be installed in the septic tank to further increase primary treatment.

4.3 AWTS

The base nutrient loadings are those from the BSC OSMS computer design model. It is proposed that an Ozzi Kleen RP10A+ AWTS system is used for providing secondary treatment for all existing and proposed development on the subject site. The Ozzi Kleen RP10A+ AWTS is stated to provide a nutrient removal of up to 87% for Total Nitrogen (TN) and 84% for Total Phosphorous (TP) on the NSW Ministry of Health Accreditation.

The approved TN of the Ozzi Kleen RP10A+ AWTS is used for sizing the disposal area. This was achieved by increasing the TN reduction in cell D9 to 87%. No TP reduction was included in the modelling of the disposal area.

A copy of the NSW Health Certificate of Accreditation is attached as Appendix B of this report.

A Davey D42 (or equivalent) submersible pump is to be fitted into the Ozzikleen RP10A+ AWTS to dose the ETA disposal beds. Details are shown in **Exhibit No. 2**. The AWTS is to be fitted with a high-water alarm.

4.4 Evapotranspiration/ Absorption Beds

The treated wastewater from the AWTS will be pumped to ETA beds for disposal. It is proposed to have **four** evapo-transpiration/absorption beds at **1.5 m** in width, **18.5 m** in length and **0.45 m** in depth. A four port K-rain indexing valve is to distribute the water between the ETA beds.

It is proposed that the disposal field will be located in an area that will be retained as mown grass. Also, due to the slope in the area the ETA beds are to be finished off with a mounded top to assist in shedding off rainwater.

4.3.2 Construction of ETA Beds

The ETA beds are to be constructed in accordance with AS1547:2012 with the construction described as follows:

- Construction of each bed will involve the excavation of the natural soil to a depth of 450mm (on lower slope). Soil will be scarified and sand placed on this interface for a covering of about 50mm thick. Aggregate of 6-25mm diameter is placed on this to a depth of 200mm;
- A single slotted distribution pipe (PVC not ag pipe) 100 mm in diameter is placed centrally on this bed;
- Topsoil consisting of sandy loam is to cover the aggregate to a depth of 200mm, and the final finish is a mound appearance however at this site due to the slope the finish will match the natural land surface;
- Geotextile fabric is to be placed between the aggregate and the topsoil;
- An inspection point of (being slotted and capped PVC pipe) will be installed in the bed;
- A small catch drain shall be installed upslope of the disposal area to redirect overland flow away from the disposal area.

Exhibit No. 3 shows a typical cross section of the disposal bed. The proposed layout is presented in **Exhibit No. 2**.

4.5 Decommissioning of Existing OSMS

The following measures are to be taken in decommissioning the existing OSMS:

1. Disconnect the septic tank from the dwelling,
2. Have the septic tank pumped out and de-sludged by a licensed septic tank pumping company,
3. Break in the lid of the septic tank and pierce the base of the tank,
4. Apply hydrated lime over the inside and lid of the septic tank,
5. Using an excavator, the septic tank is to have holes broken into its base and the walls are to be collapsed in on the base and then covered over with soil.

5. Maintenance Plans

The following is a maintenance check list for the OSMS for the dwelling which is to be undertaken by the client.

5.1 General

- Bleach, bleach-based products, whiteners, nappy soakers and spot removers shall not be disposed of into the on-site system. They shall be disposed of on a disused area of a garden, well away from the disposal area.
- Hygiene products, condoms, tampons, sanitary napkins, disposable nappies and cotton buds shall not be disposed of via the on-site disposal system. They should be disposed of into garbage bins in sealed plastic bags.
- Only the recommended amounts of disinfectants should be used. Biodegradable products for septic systems are recommended. Runoff diversion banks to be inspected annually and maintenance as required undertaken to ensure that surface runoff is diverted around each of the disposal areas.

5.2 Septic Tank & Effluent Filter

The septic tank should be regularly checked and is to be pumped every 3 to 5 years or as required, with wastes being removed by a licensed septic pumping company. The effluent filter should also be cleaned out at this time.

5.3 AWTS

Regular servicing and maintenance is required, commonly on a quarterly basis. The owner therefore must enter a service contract with a service agent. A copy of the service report is forwarded to Council within 14 days from the date of service. At each service, the treatment system and effluent disposal system should be checked, including:

- all pumps;
- the air blower, fan or air venturi;
- the alarm system;
- the operation of the sludge return system, where installed;
- pH from a sample taken from the irrigation chamber;
- check on sludge accumulation in the septic tank (primary treatment chamber) and the clarifier where appropriate;
- a thorough inspection & testing (if appropriate) of the effluent disposal field and all fixtures to ensure operation is in accordance with the approved design; and
- a sludge bulking test is required annually if activated sludge or contact aeration is used.

5.4 Disposal field

The disposal system is designed in a manner that will allow the system to be maintained and repaired quickly if part of the system happens to fail.

- Bleach, bleach-based products, whiteners, nappy soakers and spot removers shall not be disposed of into the on-site system. They shall be disposed of on a disused area of a garden, well away from the disposal area.
- Hygiene products, condoms, tampons, sanitary napkins, disposable nappies and cotton buds shall not be disposed of via the on-site disposal system. They should be disposed of into garbage bins in sealed plastic bags.
- Only the recommended amounts of disinfectants should be used. Biodegradable products for septic systems are recommended. Runoff diversion banks to be inspected annually and maintenance as required undertaken to ensure that surface runoff is diverted around each of the disposal areas;
- No vehicular, stock or regular pedestrian access should be made across the disposal field.
- Vegetation will be harvested frequently up to 2 times a year can be undertaken, this will encourage regrowth and in turn will increase uptake of nutrients and water;
- Plant clippings shall be removed from the site to decrease amount of nutrients returning to the wastewater system;
- Effluent from disposal system should not be discharged to the stormwater system or over the ground;
- The effluent distribution pipes are to be inspected for blockage etc. when the aggregate is cleaned and flush cleaned or replaced as required.

Some signs of the disposal system failure are listed below, if any of these occur contact the plumber who installed the system and arrange for immediate pump out of the septic tank to relieve the need for effluent disposal to the disposal area.

- Surface ponding and run-off of treated wastewater;
- degradation of soil structure - eg. sheet and rill erosion, surface crusts, or hard surfaces are evident;
- poor vegetation growth;
- unusual odours.

6. Conclusion

An OSMS has been designed for an existing dwelling, two proposed temporary dwelling and a proposed rural industry at Lot 2 DP 735538, 736 Federal Drive, Federal. It is determined that on-site wastewater management & liquid trade waste can be achieved at the subject site conforming to the environmental and health objectives of BSC Policy (December, 2004) & the Department of Planning, Industry & Environment *Liquid Trade Waste Management Guidelines (2021)* provided the following is undertaken:

- Decommission the existing septic tank and disconnect from the existing absorption trench;
- Provide a minimum 5000L **septic tank** volume for wastewater & liquid trade waste treatment, and install an **effluent filter**;
- Install a OzziKleen RP10A+ AWTS for treatment of all wastewater & liquid trade waste generated from the existing & proposed development;
- Wastewater will be pumped from the AWTS to **four** evapotranspiration/absorption beds each being **18.5 m x 1.5 m x 0.45 m** which will achieve the requirement for the hydraulic and nutrient loads;
- A maintenance program listed in Section 5.0 will be undertaken by the householder.

7. References

Australian Standard AS/NZ 1547 - 2012 *On-Site Domestic-Wastewater Management*.

Byron Shire Council (December, 2004). *Design Guidelines for On-site Sewage Management Systems*. Protecting the Environment and Health of Byron Shire. Technical Guidelines for System Designers.

Department of Planning, Industry & Environment (2021). *Liquid Trade Waste Management Guidelines*.

Environment Protection Authority, Dept. of Local Government, Department of Land & Water Conservation and NSW Department of Health (Feb 1998). *Environment and Health Protection Guidelines - On-Site Sewage Management Systems for Single Households*.

Morand, D.T. (1994). *Soil Landscapes of the Lismore-Ballina 1:100,000 Sheet Report*, Soil Conservation Service of NSW, Sydney.

End of Report

Appendices

Appendix A – On-site Wastewater Calculation Spreadsheet

Byron OSMS Design Model

Version: On-site Sewage Management System Design Model-Excel_version.xls

<input type="button" value="Set Defaults"/>		STEP 2 # persons (Grp 1) <input type="text" value="1"/> # persons (Grp 2) <input type="text" value="0"/>		STEP 3 Buffer to permanent water <input type="text" value="19690"/> Buffer to intermittent water <input type="text" value="40"/>		STEP 4 Block size (m ²) <input type="text" value="19690"/>		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 Grp1 <input checked="" type="checkbox"/> Toilet <input checked="" type="checkbox"/> Bathroom <input checked="" type="checkbox"/> Laundry Grp 2 <input checked="" type="checkbox"/> Toilet <input checked="" type="checkbox"/> Bathroom <input checked="" type="checkbox"/> Laundry	
STEP 1 bedrooms <input type="checkbox"/> persons <input type="checkbox"/>		Total Daily Flow (L/day) * <input type="text" value="1539"/>		Daily Effluent Flow per person (L/day) <input type="text" value="115"/>		% black to tot WW in a full system <input type="text" value="32%"/>		Wastewater stream <input checked="" type="checkbox"/> Kitchen <input checked="" type="checkbox"/> Kitchen		STEP 7 Treatment system Septic (primary treatment only) <input type="checkbox"/> [AWTS] <input type="checkbox"/> Septic + single pass sandfilter (SPF) <input type="checkbox"/> Septic + SPF, 25% septic return flow <input type="checkbox"/> Septic + recirculating sandfilter <input type="checkbox"/> Septic + reedbed <input type="checkbox"/>	
TN production per year (kg/year) <input type="text" value="67.70"/>		N prod. per capita (kg/person/yr) <input type="text" value="67.70"/>		% black to tot WW in a full system: TN <input type="text" value="70%"/>		N loss in disposal bed (% reduction) <input type="text" value="20%"/>		P soil sorption accord. soil type STEP 8 "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]		TN reduced by all N loss (kg/year) * <input type="text" value="7.04"/>	
N Plant Uptake rate (kg/ha/year) <input type="text" value="200"/>		P prod. per person per yr (kg/person/yr) <input type="text" value="10.05"/>		wastewater in a full system: TP <input type="text" value="40%"/>		Nitrogen Report N plant uptake (kg/yr) 3.21 Total N-load 7.04kg/yr N load exceedence 0.00 N load percolated (kg/yr) 3.83 N released (perc+exceed.) (kg/yr) 3.83 Enviro.N limit (kg/yr) 8.60		P uptake by plants (Hp) (kg/ha/yr) <input type="text" value="10"/>		P soil sorption (Ps) (kg/ha/m depth) <input type="text" value="10000"/>	
Water Table/ Bedrock Depth (m) STEP 10 <input type="text" value="5.00"/>		Buffer to Water Table (Bwt) (m) <input type="text" value="0.5"/>		Time for accumulation of P (years) <input type="text" value="50"/>		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)]		Final area (m ²) <input type="text" value="161"/>		Phosphorus area (m ²) <input type="text" value="110"/>	
Water balance area (m ²) <input type="text" value="161"/>		total ETA trench area <input type="text" value="111.06"/>		ETA trench length (m) <input type="text" value="18.51"/>		number of ETA beds <input type="text" value="4"/>		beds total plus separating spaces: X Y dimensions = 19.1m x 12.6m Area = 241 m ²		% Effective Rainfall STEP 11 Mounded bed <input type="checkbox"/> Level bed with grass <input type="checkbox"/>	
% Effective Rainfall <input type="text" value="65%"/>		Percolation (mm/d) <input type="text" value="12"/>		Avg depth of root zone (m) <input type="text" value="0.15"/>		Effective porosity of root zone <input type="text" value="0.37"/>		Avail. Water Capacity (AWC) of root zone <input type="text" value="0.15"/>		Soil texture in root zone Coarse Sand <input type="checkbox"/> Fine sand, Sandy loams <input type="checkbox"/> [Loams, Clay loams, Silt <input type="checkbox"/> Clay (light, med, heavy) <input type="checkbox"/>	
Avg depth bluemetal (etc) in trench below root zone (m) <input type="text" value="0.15"/>		Effective porosity of bluemetal in trench below root zone <input type="text" value="0.43"/>		Default AWC of bluemetal in trench below root zone <input type="text" value="0.00"/>		Trench under root zone <-		Land Application Type STEP 13 SSI <input type="text" value="1.50"/>		Lateral seepage width (m) <input type="text" value="0.300"/>	
Soil Moisture Holding Capacity: saturation & AWC (mm) <input type="text" value="117.23"/> <input type="text" value="29.43"/>		ETA trench width (m) <input type="text" value="1.50"/>		ETA trench separation <input type="text" value="2.00"/>		Permissible percentile exceedence <input type="text" value="5.00%"/>		Minimum effluent application (mm/day/m ²) 9.59		ETA bed separation <input type="text" value="1.40"/>	

**Appendix B -
NSW Ministry of Health Certificate of Accreditation
for the Ozzikleen RP10A+ AWTS**



Certificate of Accreditation

Sewage Management Facility

Aerated Wastewater Treatment System

This Certificate of Accreditation is issued by the Secretary of the NSW Ministry of Health pursuant to Clause 41(1) of the Local Government (General) Regulation 2005.

System: *Ozzi Kleen RP10A+ (Nutrient Reduction) AWTS*

Manufacturer: *Suncoast Waste Water Management*

Of: *59 Industrial Ave, Kunda Park, QLD, 4556*

The Ozzi Kleen RP10A+ (Nutrient Reduction) AWTS as described in Schedule 1, has been accredited as a sewage management facility for use in single domestic premises in NSW. This accreditation is subject to conditions of accreditation and permitted uses specified in Schedule 2.


*A/Director, Environmental Health
for Secretary (delegation PH335)*

Issued: *30 / 11 / 2021*

Certificate No: *AWTS014*

Expires: *30 June 2022*

Schedule 1: Specification

Ozzi Kleen RP10A+ Aerated Wastewater Treatment System

The Ozzi Kleen RP10A+ Aerated Wastewater Treatment System (AWTS) with nutrient reduction is designed to treat the wastewater from a residential dwelling occupied by a maximum of 10 persons. The Ozzi Kleen RP10A+ AWTS is contained in a vertically aligned cylindrical roto moulded polyethylene collection well with a design capacity of 4150 litres. The operational water level in the system is 1600 mm. The system consists of:

- a stilling well within the aeration/sedimentation chamber that prevents the incoming wastewater from disturbing the still water conditions required for settling and decanting.
- An aerated/sedimentation chamber with a capacity of 4150 litres where the treatment of the wastewater occurs through a programmable cycle of three intermittent phases.
 - An aeration phase when an aerobic environment is provided for micro-organisms. These conditions enable the micro-organisms to feed and grow on the organic waste and establish an “activated sludge”.
 - A settling phase when still conditions allow for settlement of the activated sludge to the bottom of the tank, leaving a layer of clear water at the top.
 - A decanting phase when still conditions are maintained but clear, treated water is drawn from near the surface of the tank for delivery to the chlorinator, basket strainer and chlorine contact tank.
- A combined 350 L chlorine contact chamber/irrigation pump chamber with a capacity of 300 litres for chlorine contact of the effluent. Flow to the chamber is from the main tank through a chlorinator and basket strainer.
- A 350 L waste sludge storage chamber that allows for settling and thickening of sludge for a period well in excess of 6 months before the need to pump out and dispose of the waste material.
- Air is supplied to the aeration chamber by a Rietschle Thomas LP-80HN air blower with an output of 77 litres / min. Air from the blower is also used to operate the decanter and to deliver waste sludge to the sludge storage chamber.
- An Ozzi Kleen submersible pump with level control and output of 100 litres / min @ 6 metres head supplies treated effluent for irrigation.
- An Alum dosing tank and unit is installed, and a modified PCL controller is installed to alter the operation of the RP10A+ AWTS.

Schedule 2: Conditions of Accreditation

1.0 General

- 1.1 Prior to installation the owner/occupier of the premises shall make an application, in accordance with Clause 26 of the *Local Government (General) Regulation 2005*, to the local authority for approval to install and operate the Ozzi Kleen RP10A+ AWTS as a Sewage Management Facility in accordance with Section 68, Part C of the *Local Government Act 1993*.
- 1.2 The local authority shall apply those Conditions of Accreditation, appropriate to the owner / occupier, to any approval to operate the Ozzi Kleen RP10A+ AWTS issued under Clause 45(4), *Local Government (General) Regulation 2005*.
- 1.3 In accordance with Clause 36 of the *Local Government (General) Regulation 2005*, the Ozzi Kleen RP10A+ AWTS shall have an expected service life of 5 years in the case of mechanical and electrical components and 15 years in the case of other components.
- 1.4 The owner / occupier shall ensure that the Ozzi Kleen RP10A+ AWTS is installed or constructed:

- in accordance with the accredited specifications of the type tested unit and in accordance with good trade practice, and
 - to allow ease of access for maintenance, and
 - regarding the health and safety of users, operators and persons maintaining the facility, and
 - must be installed or constructed to make appropriate provision for access to, and removal of, contents in a safe and sanitary manner, and
 - must, if it is intended to be a permanent fixture, be anchored to prevent movement.
- 1.5 The manufacturer / supplier shall ensure that the Ozzi Kleen RP10A+ AWTS is supplied, constructed, and installed in accordance with the design (including the disinfection unit) as submitted and accredited by the NSW Ministry of Health. The Ozzi Kleen RP10A+ AWTS shall not be modified or altered except that alternate individual mechanical and electrical components such as pumps, PLCs, etc, may be substituted provided that the component meets the accredited design specification.
- 1.6 Any permanent modification or variations to the accredited design of the Ozzi Kleen RP10A+ AWTS shall not be permitted.
- 1.7 Each Ozzi Kleen RP10A+ AWTS shall be permanently and legibly marked by the manufacturer in accordance with section 3 of AS1546.3:2017.
- 1.8 The manufacturer shall supply with each Ozzi Kleen RP10A+ AWTS an owner's manual, which sets out the care, operation, maintenance, and on-going management requirements of the system. The owner's manual prepared by the manufacturer shall specifically contain a plan for the on-going management of the Ozzi Kleen RP10A+ AWTS. The plan shall include details of:
- the treatment process,
 - procedures to be followed in the event of a system failure,
 - emergency contact numbers,
 - maintenance requirements,
 - inspection and sampling procedures to be followed as part of any on-going monitoring program developed by the local authority.
- 1.9 The manufacturer shall provide the following information to each local authority where it is intended to install an Ozzi Kleen RP10A+ AWTS in their area once Ministry Accreditation has been obtained:
- | | |
|-----------------------------------|---------------------------------------------------------------|
| • Statement of warranty | • Manufacturer's Service Report Form |
| • Statement of service life | • Engineering Drawings |
| • Quality Assurance Certification | • Specifications |
| • Installation Manual | • A4 Plans |
| • Service Manual | • Certificate of Accreditation documentation from NSW Health. |
| • Owner's Manual | |
- The manufacturer need not provide the above information to the local council where the information or document is contained on the manufacturer's web site.

2. Installation and Commissioning

- 2.1 The owner / occupier shall have the Ozzi Kleen RP10A+ AWTS inspected and checked by the manufacturer or the manufacturer's agent. The manufacturer or the agent is to certify that the system has been installed and commissioned in accordance with its design, conditions of accreditation and any additional requirements of the local authority.

- 2.2 The owner / occupier shall ensure that all electrical work is carried out on the Ozzi Kleen RP10A+ AWTS by a licensed electrician and in accordance with the relevant provisions of AS/NZS 3000.
- 2.3 The owner / occupier shall not commission the Ozzi Kleen RP10A+ AWTS unless the land application system has been completed.

3. Maintenance

- 3.1 The owner / occupier of the premises shall enter into a minimum 12-month contract or agreement with a service agent and ensure that the Ozzi Kleen RP10A+ AWTS is serviced:
- in accordance with the manufacturer's / supplier's service manual and using the manufacturer's / supplier's service sheet; and
 - by a service agent who
 - has completed a course on the servicing and maintenance of STS; and has some supervised servicing experience or extensive un-supervised experience.
 - is employed or authorised by the manufacturer / supplier of the Ozzi Kleen RP10+ AWTS.
 - uses replacement parts which meet the minimum specification of the Ozzi Kleen RP10A+ AWTS.
 - has advised of their name, contact details and credentials to the local authority.
 - submits a completed NSW Health "Local Council Service Report" (template attached) to the local authority immediately after every service.
 - shall report to the local authority any instances where the owner / occupier refuses to authorise repairs, replacement of parts or maintenance; and
 - does not perform electrical work or enter confined spaces unless trained and is suitably qualified to do so.
- 3.2 The owner/occupier shall not service the Ozzi Kleen RP10A+ AWTS unless they are an authorised agent of the manufacturer.
- 3.3 The Ozzi Kleen RP10A+ AWTS once installed and commissioned shall be serviced at three (3) monthly intervals.
- 3.4 The manufacturer / supplier of the Ozzi Kleen RP10A+ AWTS shall place on its web site a copy of the service manual, service sheet or form and specifications for the Ozzi Kleen RP10A+ AWTS to facilitate servicing, maintenance and repairs. Commercial-in-confidence documents may be provided directly to the service agent without uploading to the web site.
- 3.5 Each three-monthly service shall, as a minimum where provided, include a check on all mechanical, electrical and functioning parts of the system including:
- The chlorinator and replenishment of the disinfectant,
 - Pump and air blower,
 - The alarm system,
 - Slime growth on the filter media,
 - Operation of the sludge return system,
 - The effluent irrigation area,
 - On-site testing for free residual chlorine, pH and dissolved oxygen at the appropriate check points.

4. Verification

4.1 Effluent from the Ozzi Kleen RP10A+ AWTS taken in any random grab sample shall comply with the following standard:

- BOD⁵ less than 30 mg/L
- TSS less than 45 mg/L
- E. coli less than 100 cfu/100 ml
- Free residual chlorine greater than 0.2 and less than 2.0 mg/L

5. Permitted uses

5.1 The effluent is suitable for re-use for garden purposes by way of any of the forms of irrigation as described in AS/NZS 1547:2012:

- above ground spray irrigation; and/or
- surface drip irrigation covered by mulch; and/or
- sub-surface drip irrigation installed at around 100 mm depth; and or
- any form of sub-soil application.

Each of the forms of irrigation or application is subject to the approval of the local authority.

6. Reduction in Nutrient Levels

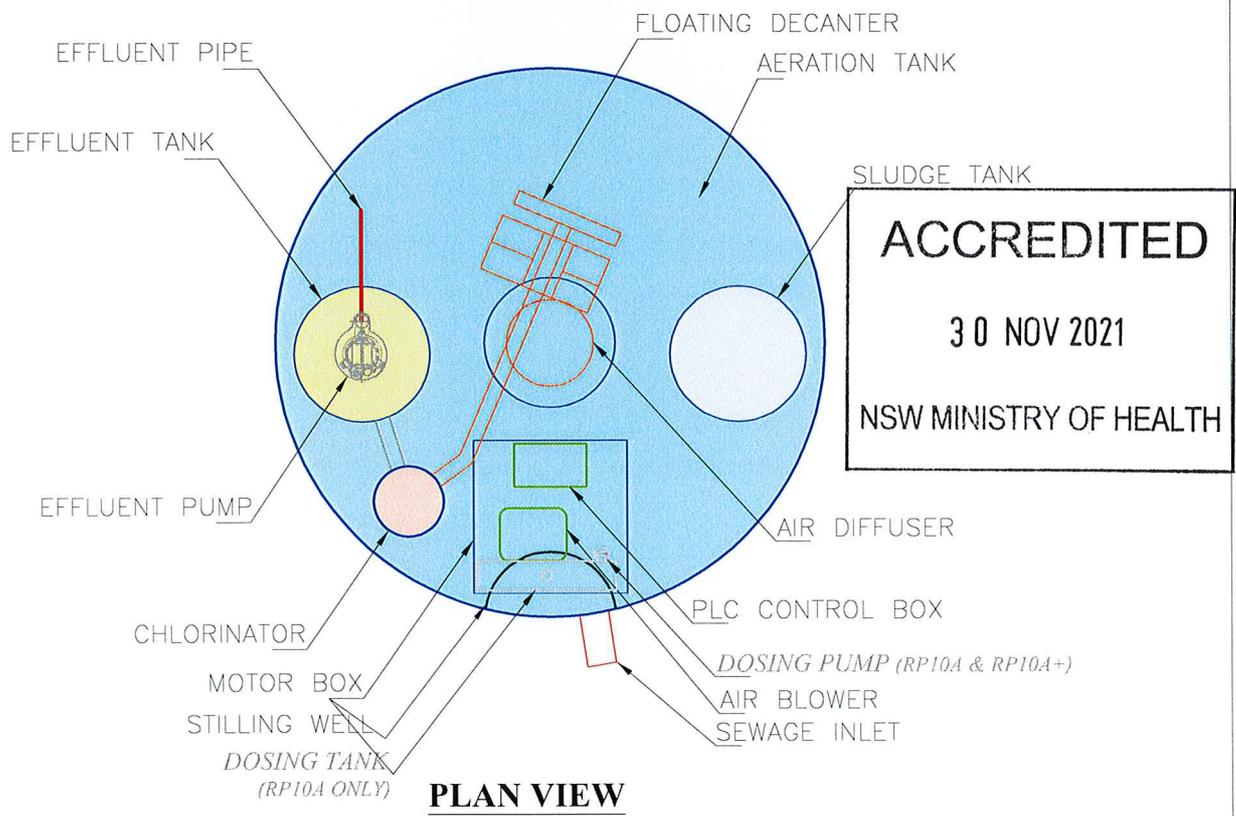
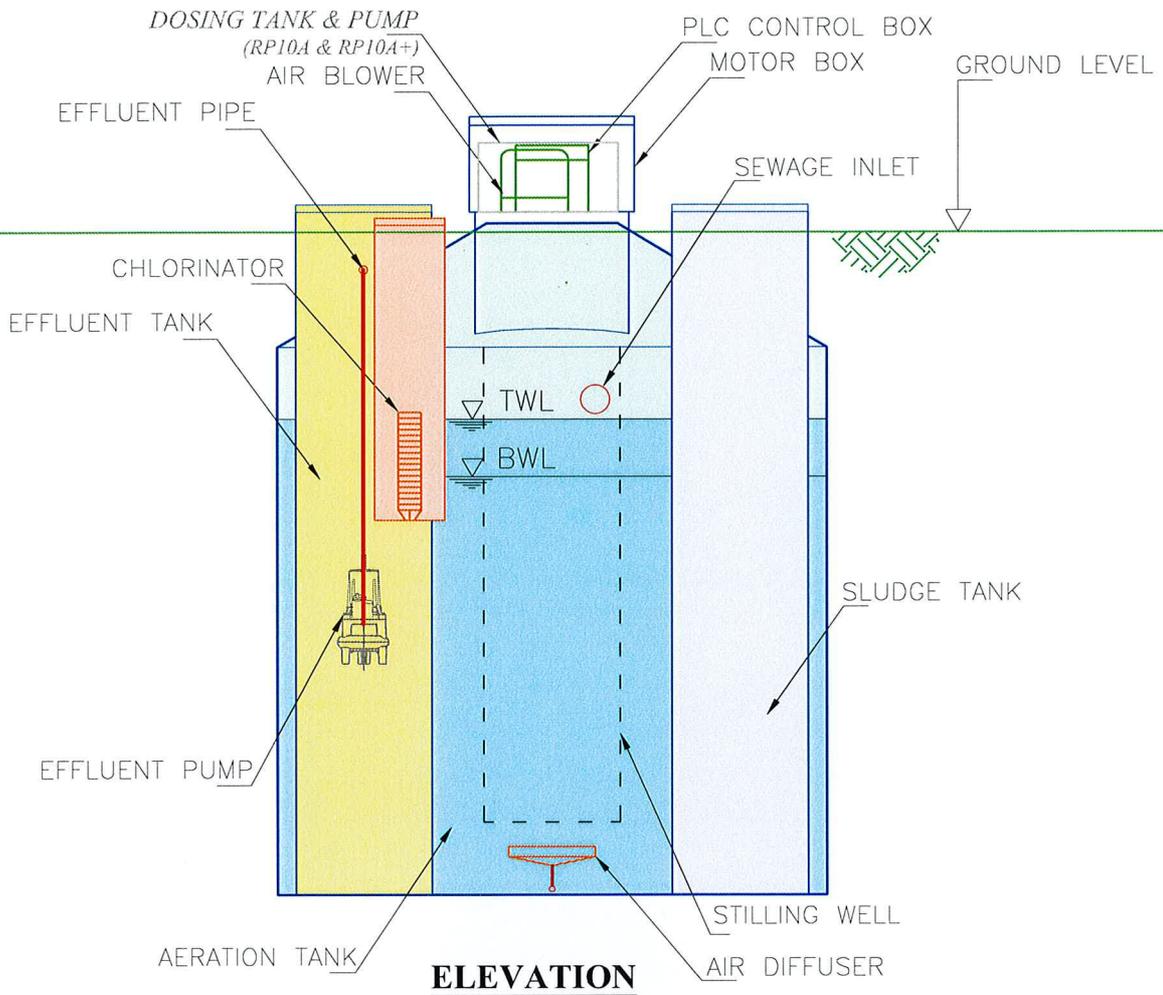
A separate testing program of the Ozzi Kleen RP10A+ AWTS for total Nitrogen (TN) and total Phosphorus (TP) reduction by the addition of an Alum dosing tank and a modified Programmable Logic Controller (PLC) was conducted over six weeks at three separate single domestic dwellings inhabited by 4 to 5 people. The testing methodology of AS/NZS1546.3:2008 was used. Testing was oversighted by a JAS-ANZ accredited product certification body.

Testing and analyses reported a TN reduction of up to 87% and a TP reduction of up to 84%.

Therefore, the local council shall ensure that the Ozzi Kleen RP10A+ is installed with an Alum dosing Unit and a modified PLC.

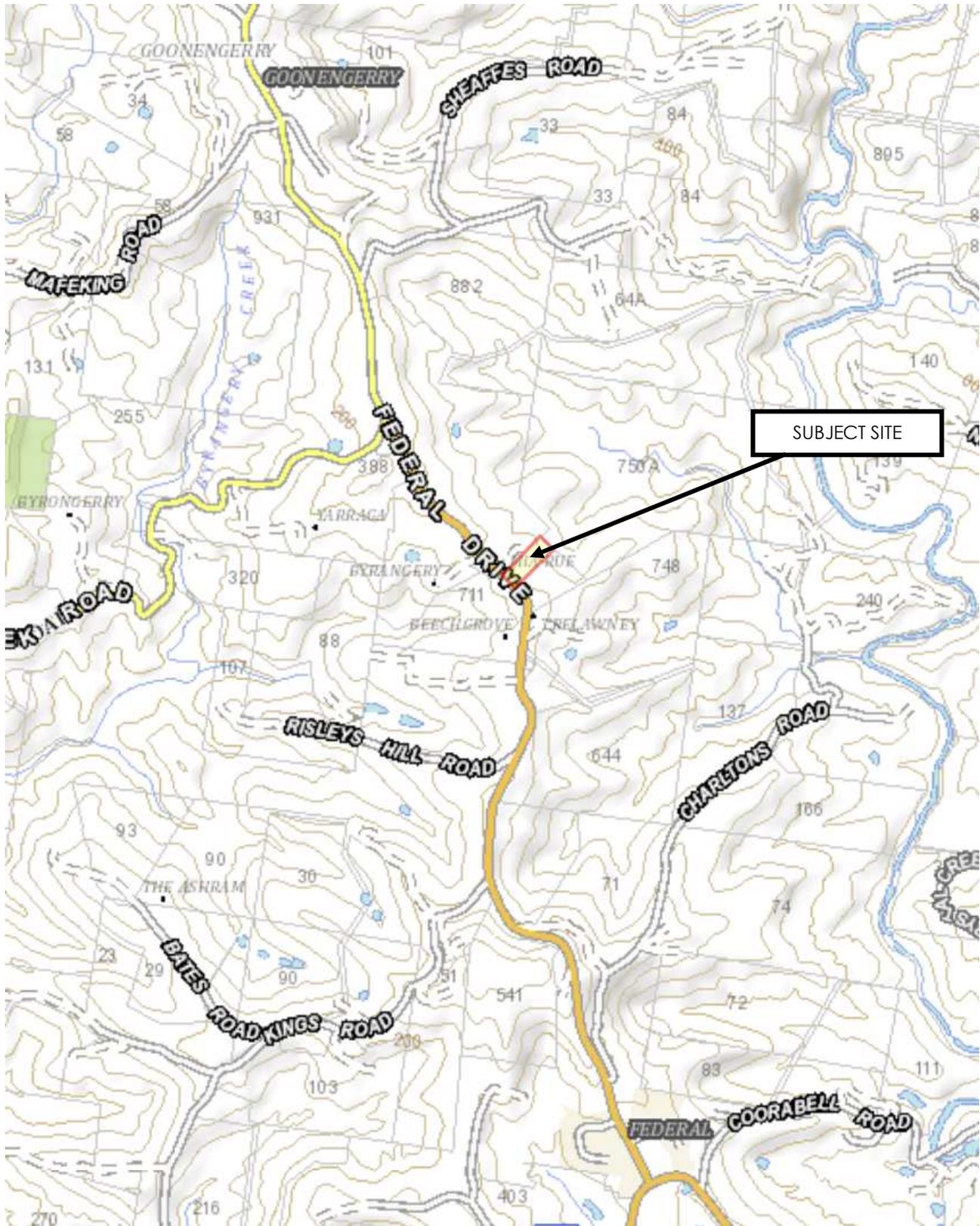
Local Council STS (DGTS) Service Report: February 2018		
Owner's Name:		Local Council:
Installation Address:		
System Brand & Model:	<input type="checkbox"/> Domestic	<input type="checkbox"/> Commercial
Date of this service: / /	Date of last Service: / /	Next service due: / /
Has the STS/DGTS been serviced in accordance with the manufacturer's / supplier's requirements and using the service sheet? <input type="checkbox"/> Yes <input type="checkbox"/> No If "No" why not?		
STS/DGTS functioning correctly? <input type="checkbox"/> Yes <input type="checkbox"/> No If "No" why not?		
According to sludge-judge or other methodology is de-sludging needed? <input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes" what action is recommended?		
Offensive odours? <input type="checkbox"/> Yes <input type="checkbox"/> No If "Yes" what action is recommended?		
Alarms tested and functional? <input type="checkbox"/> Yes <input type="checkbox"/> No If not "functional" what action is recommended?		
Final Effluent Quality Tested? <input type="checkbox"/> Yes <input type="checkbox"/> No Disinfected? <input type="checkbox"/> Yes <input type="checkbox"/> No Chlorine tablets remaining? <input type="checkbox"/> Yes <input type="checkbox"/> No Quality? <input type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory On what evidence is this judgement made? If "Unsatisfactory" what action was recommended?		
Land Application Area Surface ponding? <input type="checkbox"/> Yes <input type="checkbox"/> No Run off? <input type="checkbox"/> Yes <input type="checkbox"/> No Excess plant growth? <input type="checkbox"/> Yes <input type="checkbox"/> No Effluent leaving premises. <input type="checkbox"/> Yes <input type="checkbox"/> No High risk areas contaminated? * <input type="checkbox"/> Yes <input type="checkbox"/> No * Patio, play areas, BBQ, etc Operating satisfactorily? <input type="checkbox"/> Yes <input type="checkbox"/> No If "Not operating satisfactorily" what action was recommended?		
Overall Condition of STS? <input type="checkbox"/> Excellent <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor Comments / Action Recommended / Repairs Needed / Repairs Performed: Has the owner / occupier taken recommended actions? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Service Agent:		Contact Details:
Signature:		Date:

Source: Adapted from "Checklist 4.2: Operational AWTS inspection report for use by service providers and Council inspectors" in *Designing and Installing On-Site Wastewater Systems*, Sydney Catchment Authority, May 2012



ACCREDITED
 30 NOV 2021
 NSW MINISTRY OF HEALTH

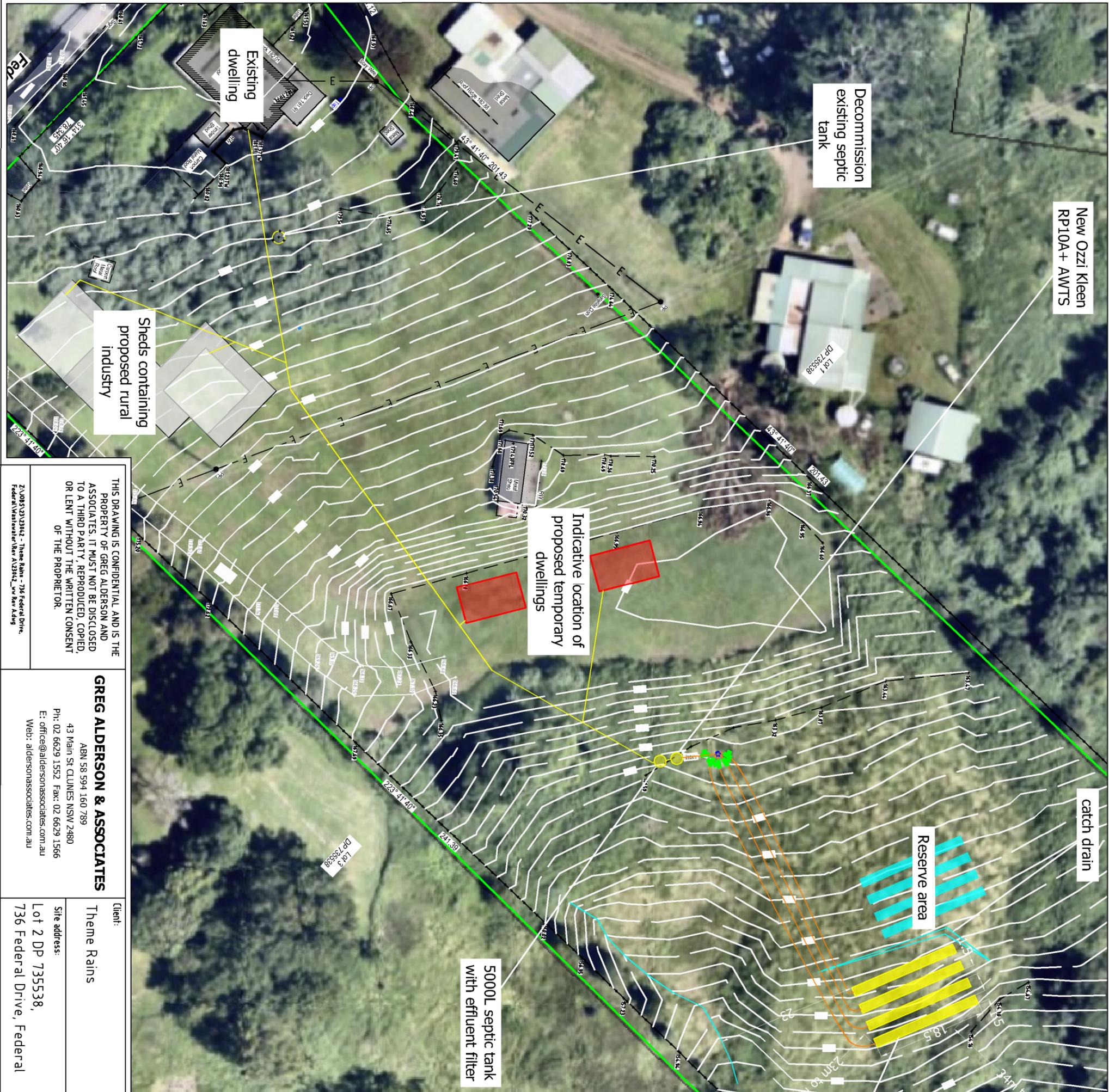
20/12/16	RP10A+ Notation	3	ARP	 59 INDUSTRIAL AVE KUNDA PARK QLD 4556 PH +61 7 5459 4900 FAX +61 7 5456 4677 www.ozzicleen.com	CLIENT	GENERAL	DESIGN	AP
02/09/13	AIR DIFFUSER LOCATION UPDATED	2	SB		PROJECT	Ozzi Kleen RP10 PACKAGE STP	CHKD	AP
28/08/08	GENERAL REVISION	1	DC		TITLE	SYSTEM DIAGRAM	DATE	02/09/13
DATE	DESCRIPTION	REV.	BY		Suncoast Waste Water Management	DWG NO.	GD-RP10-H10.B	SCALE



Source: NSW LPI Spatial Information Exchange (2021)
 Date 30/08/22
 Project No. 23042_ww.docx
 Scale: NTS

GREG ALDERSON AND ASSOCIATES
ABN 58 594 160 789
 43 Main Street, Clunes NSW 2480
 Phone: (02) 6629 1552
 Email: office@aldersonassociates.com.au

Exhibit No. 1.
SITE LOCATION
 Lot 2 DP 735538, 736 Federal Drive, Federal



New Ozzi Kleen
RP10A+ AWTS

Decommission
existing septic
tank

Existing
dwelling

Sheds containing
proposed rural
industry

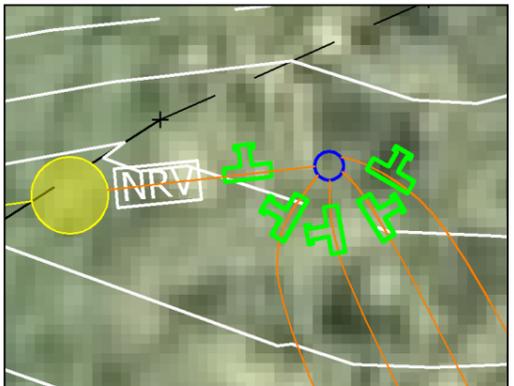
Indicative location of
proposed temporary
dwellings

catch drain

Reserve area

5000L septic tank
with effluent filter

Four ETA beds
each 18.5m L x
1.5m W x 0.45m D



KEY

- 32mm PN12.5 Polyethylene main line
- Non return valve
- K-rain indexing valve
- Combination vacuum/air relief valve

Wastewater Notes:

1. The system is designed to service the existing 4 bedroom dwelling, two single bedroom temporary dwellings and the proposed rural industry;
2. The existing septic tank is to be decommissioned as per the detail given in the accompanying report;
3. A Ozzi Kleen RP10A+ AWTS is required to be installed to provide secondary treatment of all wastewater & tradewaste generated from the existing & proposed development;
4. A Davey D42a/b submersible pump is to be fitted within the AWTS for pumping treated wastewater to the proposed new ETA bed disposal field. The delivery line is to be PE80 PN12.5 32mm OD;
5. A four port indexing valve is to distribute the wastewater between ETA beds;
6. Construct **four** evapotranspiration/absorption beds (ETA) for disposal of wastewater after the AWTS;
7. The ETA beds are to each be 18.5 m x 1.5 m x 0.45 m and installed in accordance with AS 1547-2012 and Exhibit No. 3;
8. All storm water and overland flow is to be diverted away from the proposed disposal area.

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2/ADBS/23/23/242 - Theme Rains - 736 Federal Drive, Federal Waterside NSW 23042, Mr Greg Alderson

GREG ALDERSON & ASSOCIATES

ABN 58 594 160 789
43 Main St CLUNES NSW 2480
Ph: 02 6629 1552 Fax: 02 6629 1566
E: office@aldersonassociates.com.au
Web: aldersonassociates.com.au

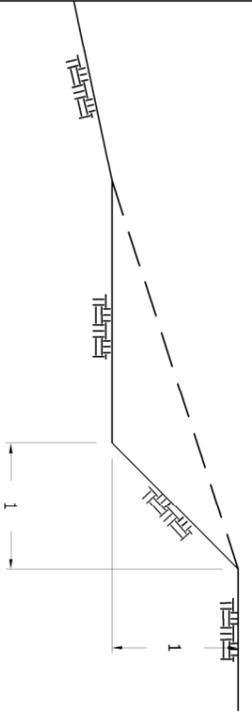
Client:

Theme Rains

Site address:
Lot 2 DP 735538,
736 Federal Drive, Federal

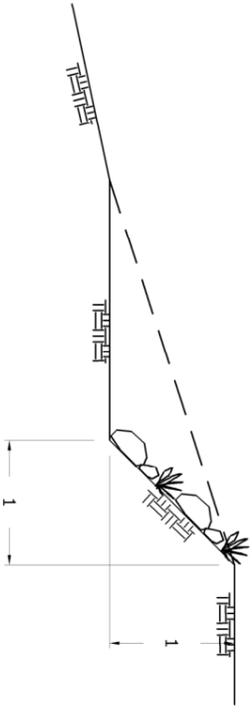
PROPOSED OSMS LOCATION

Drawn:	Source:	EXHIBIT NO.:	Date:
DB	Base image from Byron Shire Council mapping (12/22)	2	30/8/22
Scale:	Original Size:	Project:	Revision:
1:675	A3	PROPOSED RURAL INDUSTRY AND TEMPORARY DWELLINGS	A
Job Number:			
23042			



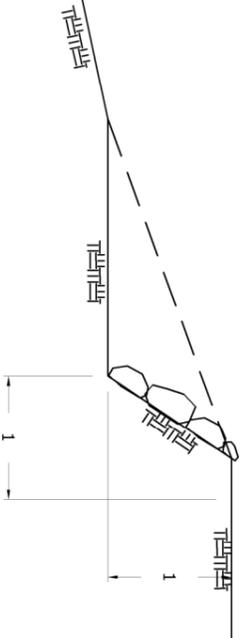
TYPICAL EMBANKMENT DETAIL:
Unprotected embankment, cut
N.T.S.

UNPROTECTED



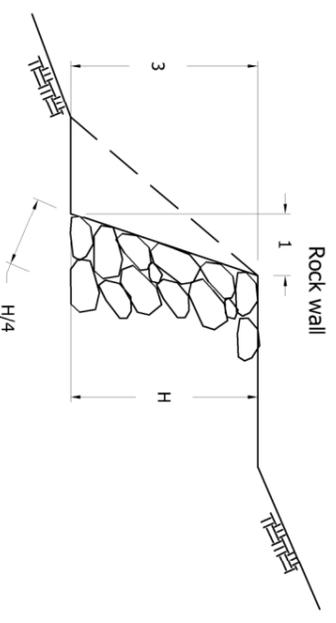
TYPICAL EMBANKMENT DETAIL:
Partially protected embankment, cut
N.T.S.

PARTIALLY PROTECTED



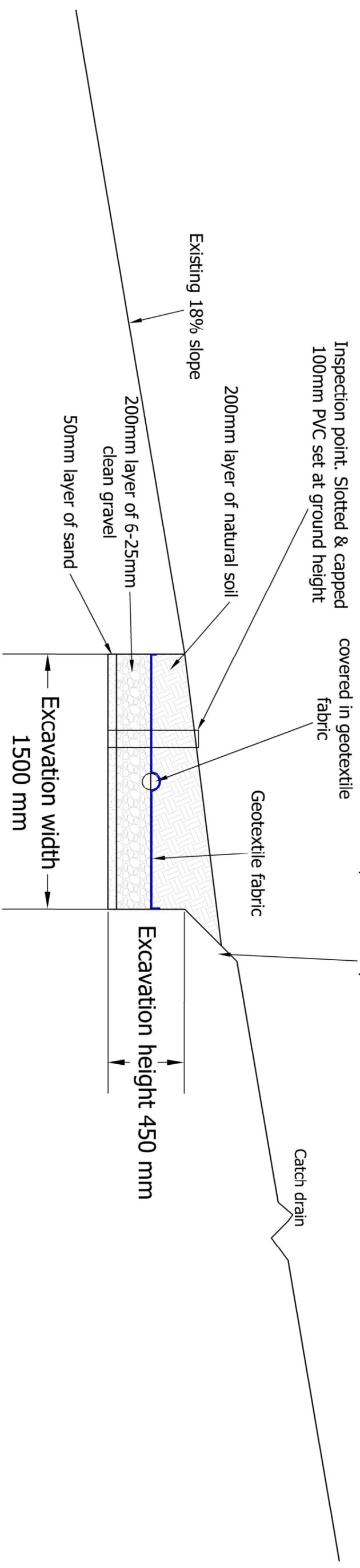
TYPICAL EMBANKMENT DETAIL:
Protected embankment, cut
N.T.S.

PROTECTED



TYPICAL EMBANKMENT DETAIL:
Gravity wall, cut
N.T.S.

GRAVITY WALL



If batter exceeds 1:1, a gravity wall as per detail above is required. If the batter is 1:1, partial protection as per the detail above is required. If batter is less than 1:1, it can be unprotected as per the detail above

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<p>Table 2\1085\13133042 - Theme Rains - 736 Federal Drive - 21x 5858</p>		<p>Drawn: DB Source: Greg Alderson & Associates</p>		<p>Scale: NTS Job Number: 23042</p>		<p>Original Size: A3</p>		<p>Project: PROPOSED RURAL INDUSTRY AND TEMPORARY DWELLINGS</p>	
								<p>Revision: -</p>	



Greg Alderson Associates

Greg Alderson and Associates

ABN 58 594 160 789

43 Main Street

Clunes NSW 2480

T +61 2 6629 1552

office@aldersonassociates.com.au



Civil Engineering

- Roads
- Driveways
- Stormwater
- Flooding
- Traffic
- Earthworks



Structural Engineering

- New Structures
- Additions and Alterations
- Foundations
- Wind Bracing & Tie Down
- Framing
- Retaining Walls
- House Plan Drafting
- BASIX Certificates



Environmental

- Contaminated Land
- Acoustics & Noise
- Wastewater
- Acid Sulfate Soil
- Water Quality
- Ecology