Onsite Sewage Management Guidelines

2023

BYRON SHIRE COUNCIL

Acknowledgement of Country

Byron Shire Council recognises the traditional owners of this land the Bundjalung of Byron Bay, Arakwal People, the Widjabal People, the Midjungbal People and the wider Bundjalung Nation.

The Council recognises that the most enduring and relevant legacy that Indigenous offer is their understanding of the significance of land and the local and deep commitment to place.

This document respects and embraces this approach and acknowledges that our country and resources are precious and must be looked after for future generations.

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1. Introduction

Byron Shire Council's On-Site Sewage Management Guidelines (the 'Guidelines') have been developed primarily for domestic dwellings and domestic-grade wastewater. The Guidelines originated out of recommendations from *Environment & Health Protection Guidelines On-site Sewage Management for Single Households (Department of Local Government, 1998)*.

On-Site Sewage Management (OSSM) systems treat wastewater generated from premises located in non-sewered regions and apply the effluent to the land. Typical OSSM systems include septic tanks, aerated wastewater treatment systems, composting toilets, reed beds, and biological filters. The treated wastewater (effluent) is applied to the land according to the site constraints using various land application methods, for example evapotranspiration beds, Wisconsin sand mounds and subsurface irrigation systems.

These Guidelines do not apply to premises in a sewered area.

These Guidelines provide essential information for designers, installers, homeowners and the community about how Council approves, manages and monitors OSSM systems. The Guidelines detail the information that must be included with an application to install, construct, alter or operate an OSSM system. The Guidelines will focus on providing designers and installers with local requirements and clarifications.

The long-term viability and satisfactory performance of each OSSM system is fundamental in minimising any potential adverse impacts to public health and our precious local environment. Council is committed to continually improve the management of OSSM systems. Accordingly, these Guidelines will be reviewed every five years.

Relationship with other guidelines

The requirements in these Guidelines take precedence over requirements in AS/NZS 1547:2012 and the Environment & Health Protection Guidelines On-site Sewage Management for Single Households.

Byron Shire – Local Context

Byron Shire is the traditional home of the people from the Bundjalung nation.

The areas beaches, hinterland and villages together with the waterways, natural habitats, farming landscape and cultural and heritage values, help to define the place and its communities.

About 93% of the shire is zoned rural or environmental protection. There are about 4,000 OSSM systems in the shire with a high proportion likely to be due for repair or replacement and many installed without contemporary approval processes.

These Guidelines will assist in protecting and caring for the land and communities.

Brief History of Byron Shire Council's OSSM Program

Prior to the mid 1990's most OSSM systems in the LGA were septic tank and trench systems and often with trench sizes smaller than current standards.

Standards for designing and installing OSSM systems were improved in the mid 1990's after the development of the 1*994 Australian Standard for 'Disposal systems for effluent from domestic premises' (AS 1547-1994)*.

In 1998 the NSW Government produced the *Environment & Health Protection Guidelines - On-site Sewage Management for Single Households* (often referred to as the 'Silver Bullet'). This document was produced to provide a consistent and comprehensive state-wide approach to on-site sewage management for domestic households.

Following recommendations in the 'Silver Bullet', Byron Shire Council developed an *On-site Sewage Management Strategy in 2001* and *Design Guidelines in 2004*.

The Australian Standards for on-site sewage management (AS 1547) have also undergone several revisions with the latest version released in 2012.

Council has implemented several catchment-based studies that have helped guide and refine on-site sewage management for the LGA, these include:

- 1999 assessment for Federal Village
- 2011 Laverty's Gap Drinking Water Catchment risk assessments
- 2017 Upper Coopers Creek Drinking Water Catchment risk assessments
- 2018 Ewingsdale risk assessments.

Primary Performance Objectives for OSSM

To protect public health, the environment and community amenity, Section 44 (1) of the Local Government Act regulations require that OSSM systems shall be designed and managed to:

- prevent the spread of disease by micro-organisms
- prevent contamination of waterways and groundwater
- prevent the spread of foul odours
- prevent the degradation of soil and vegetation
- discourage insects and vermin
- avoid people coming into contact with untreated sewage or effluent in their ordinary activities around a property
- avoid adverse impacts on the amenity of the premises and surrounding lands
- to achieve sustainable use of resources (including minimizing energy inputs and reusing nutrients, organic matter, and water where appropriate)

2. Roles and Responsibilities

Council is the regulator for the installation and operation of OSSM systems. Council's OSSM policies have been developed so that Council can work with property owners and residents with a mutual obligation to sustainably manage OSSM systems.

Local Government

The role of Local Government is to:

a) determine applications for the installation, construction or alteration of OSSM systems and connected drains. This includes evaluating the option of connecting to reticulated sewerage to ensure the best practicable option is adopted

b) require owners to enter into a servicing or monitoring agreement as appropriate for the ongoing operation of a OSSM system

c) maintain records of OSSM systems

d) conduct monitoring and education programs for OSSM systems

e) provide reports to relevant drinking water catchment authorities regarding the status of OSSM systems or relevant new proposals within drinking water catchments.

As part of the service fee on rates notice Council can provide independent advice on designs prior to application when requested by the property owner.

The homeowner will need to consult with a OSSM designer regarding options for OSSM on their property.

It is not Council's role to design or recommend an OSSM system.

Council cannot approve the installation of certain types of OSSM systems unless they are accredited by NSW Health.

Under the provisions of Clauses 40 and 41, Local Government (General) Regulation 2021, a local council must not approve of the installation of certain OSSM systems unless they have been accredited by the NSW Ministry of Health.

Exemptions may be applied for, refer to NSW Health Advisory Note 1

Compliance and Enforcement

Council may issue notices or orders requiring a person:

- to comply with an approval to install or operate
- to repair, upgrade or replace an OSSM system
- to take action to maintain premises with an OSSM system in a healthy condition.

Notices and Orders may be given to the owner or occupier of the premises or to the person responsible for the OSSM system.

Notices or orders can be issued under the Local Government Act, Environmental Planning and Assessment Act or the Protection of the Environment Operations Act.

Please refer to Council's Enforcement Policy for information on how we will manage enforcement action.

Persons or organisations undertaking plumbing and drainage work, including septic system installation or alterations, without necessary approvals can also face enforcement action under the Plumbing and Drainage Act.

Homeowners and Occupiers

Property owners should fully inform themselves about the OSSM system on their property and its operation and maintenance.

A copy of the OSSM approval details and the operation and maintenance manual shall be made available to the owner and resident by:

- the OSSM Installation Contractor for a new or upgraded OSSM system
- Pre-purchase inspection from Council or a nominated licensed plumber
- Accessing Council Information
- Council inspection programs.

Purchasers of properties with an existing OSSM system must also lodge an Application for an Approval to Operate with Council.

The property owner shall maintain the OSSM system in accordance with the relevant legislation, operation manuals and Council's Approval to Operate documentation.

Servicing of OSSM with electrical components must be conducted by a Byron Shire Council authorised service agent (refer to Council's website for authorised service agents).

Property owners should also ensure that OSSM approval details and the operation and maintenance manual are retained on the property and are readily accessible to each occupier.

Property owners should ensure that tenants have information that enables them to use the system safely.

If an OSSM system is defective and cannot be corrected by proper operation and maintenance, the homeowners or tenants should report this to Council to discuss possible system replacement.

NSW Health

NSW Health administers the certification of accreditation of sewage management facilities (SMF's) and vessels in accordance with Clause 41 of the Local Government (General) Regulation 2021. A certificate of accreditation may include specific requirements for the installation, operation and maintenance of the accredited OSSM system.

Accreditation of SMF's applies to facilities that normally service domestic premises with less than 10 people and flows less than 2,000 litres per day, such as the following:

- wet composting systems
- waterless composting systems
- greywater treatment systems
- septic tanks
- aerated wastewater treatment systems, sand filter and textile filter systems
- holding tanks and collection wells
- pumping systems designed to macerate and discharge to a sewerage system.

Council will only approve OSSM systems that have a certificate of accreditation with NSW Health, excluding reed bed systems.

Further information about OSSM systems and accreditation can be sourced from NSW Health webpage for *On-site single domestic wastewater management*.

Water Supply Authorities

Rous County Council and Byron Shire Council are regional water supply authorities, supplying drinking water to either other local government areas in the Northern Rivers and the Byron Shire.

Water supply authorities have a responsibility to promote measures that protect water quality within the drinking water catchments including minimising the risk of OSSM systems contaminating drinking water.

Rous County Council has developed guidelines for OSSM systems within their drinking water catchments that also form the drinking water catchment for Mullumbimby.

OSSM systems operating in a Rous County Council drinking water catchment area are subject to Rous County Council's On-site Wastewater Management Guidelines via a memorandum of understanding with Byron Shire Council.

Those guidelines should be considered in proposals to help determine an appropriate system in the Mullumbimby drinking water catchment and all other areas of the Byron Shire.

OSSM Designer

The key role of an OSSM designer is to:

- perform site and soil assessments in accordance with *AS/NZS 1547 On-site domestic wastewater management*, and these guidelines
- prepare and certify OSSM Design Reports
- be familiar with current OSSM legislation and regulation, these guidelines, and relevant Australian Standards
- prepare a draft OSSM Operation and Maintenance Manual

OSSM Installation Contractor

OSSM installation contractors must:

- be a licensed plumber and electrician where relevant
- not make alterations or installations without council approval
- consult and liaise with the designer during installation and construction phase to ensure design integrity and certify that the installation has been installed in accordance with the approved design report
- Arrange authority to work and inspections with Council certifiers
- Compile the final Operation and Maintenance Manual based on the draft manual prepared in the OSSM Design Report and any adjustments or details arising from the installation
- Provide a copy of the Operation and Maintenance Manual and OSSM approval details to the owner and resident following installation or upgrading of an OSSM system
- Provide Council with copies of the sewer service and work as executed diagrams. Penalties can be imposed for not providing information when required.

It is also recommended that OSSM installation contractors attend an appropriate accredited training program for installing OSSM systems.

OSSM Service Agent

There are certain OSSM systems that require servicing by a Council authorised service agent. Servicing is to be conducted at regular intervals in accordance with their NSW Health Accreditation and/or the OSSM Approval to Operate conditions or the manufacturers recommendations.

All service agents conducting inspections and/or performing maintenance work on OSSM systems must be suitably qualified persons and have appropriate training. Service agents are to provide advice and education to owners and property occupiers of OSSM systems regarding their system operation and maintenance requirements.

Servicing frequency and maintenance shall be undertaken by service agents in accordance with the requirements outlined in the NSW Health Certificate of Accreditation for the OSSM system or at a minimum quarterly frequency for any electrified systems if not specified in the Certificate of Accreditation.

All servicing and service report format must be consistent with the *NSW Health Advisory Note 5 Servicing of Single Domestic Secondary Treatment Sewage Management Facilities (SMF) February 2018*.

Service agents are to produce an inspection report for each service undertaken. This report is to certify compliance with operating requirements, specify repairs undertaken and results of on-site tests. The service agent is to provide a copy of the report to the owner and a copy for themselves.

A copy of each service report must be forward to council within two weeks of the service being conducted.

If a service agent observes that an OSSM system failure has been caused by improper use of the system, the service agent is to consult with the owner / 'operator' to ensure preventative actions are undertaken. If the problem continues, then the matter is to be reported to Council for appropriate action.

Where there is an identified pollution incident, (for example, effluent discharge to a location other than that approved), the service agent is required to notify Council.

Any of the above is to be recorded in the maintenance report. The maintenance report should also indicate if identified problems have been fixed.

Real estate agents and property transfer agents

Council recommends that estate agents and property transfer agents handling the sale, purchase, or letting of properties and facilities serviced by an OSSM system should ensure that:

- they are aware of the type and location of the OSSM system for each property and facility. Information can be obtained via the process at this link: Access to information - Byron Shire Council (nsw.gov.au)
- they arrange for an operation, maintenance, and performance monitoring check prior to finalising a sale, and either:
    - organise for completion of any maintenance and remedial actions identified by the check including a maintenance certificate provided to the purchaser

  - or adequately inform the purchaser of the required maintenance and remedial actions identified by the check

- prospective purchasers and occupiers are made aware of the details of the OSSM system, including operation and maintenance requirements. That information is only available via the accessing council information process
- each purchaser and occupier are supplied with a copy of the current OSSM approval details and the operation and maintenance manual
- purchasers and occupiers certify in writing that they have received information on the working details of the system and are aware of its type, maintenance requirements, and location, and any consent, approval or permit requirements (where applicable)
- purchasers lodge an Application for an Approval to Operate with Council for existing OSSM systems on the property within three months after property transfer
- prospective purchasers of land in a new subdivision development requiring an OSSM system are aware of the requirements of this guideline.

3. Applications and Approval Processes

Under Section 68 of the Local Government Act 1993, Council approval is required for the installation, construction or alteration of an OSSM system including the drains connected to the system. Failure to obtain an approval or to comply with the conditions of an approval is an offence, which may result in fines being issued and/or legal action

Approvals required from Council

There are two separate applications for OSSM approval:

1 **An approval to install or alter** an OSSM system (often known as a 'Section 68 application'); and
2 **An approval to operate** (ATO) an OSSM system.

The approval to install, construct or alter an OSSM system (a 'Section 68 application') is required for all circumstances regardless of whether an OSSM Design Report is required. This application is to be submitted to Council with payment of appropriate fees prior to any work commencing.

For new or altered OSSM systems, the Approval to Operate (ATO) for an OSSM system will be issued to the owner of a property when a final inspection has been undertaken and when all certification documentation (inspection reports, sewerage service diagrams, work-as-executed diagrams etc) has been received by Council.

For a property that has an existing OSSM system and is sold, the new property owner must lodge an ATO application with Council within two months of property transfer to enable continued operation of the system without approval until the application is finally determined (s47(2) of the Local Government (General) Regulation 2021)

It is an offence under the Local Government Act (Section 626) to:

- *undertake work to install/construct or alter an OSSM system without a Council issued Approval to Install, Construct or Alter an On-Site Sewage Management System.*
- *to operate an OSSM system without a current Approval to Operate issued by Council.*

An administration fee is to be paid to Council for the processing and issuing of the OSSM Approval to Operate certificate (see Council fees and charges).

What is an Approval to Operate?

Section 68A of the Local Government Act provides a definition

An Approval to Operate (ATO) is mandatory for all owners of OSSM systems. The ATO explains the obligations of the owner of an OSSM system with the intent to improve awareness of environmental and public health risks, as well as maintenance and operating requirements for the OSSM system.

An ATO applies to all systems. It is issued to the property owner and does not ‘attach’ to the property (like a driver’s licence is attached to a person, not the car). An ATO applies to the role of managing sewage on-site. It is not an approval of the OSSM facilities.

Owners require approval to install or operate for each OSSM system.

An Approval to Operate will specify if the OSSM system or components of the system requires an authorised OSSM servicing agent, and the frequency of regular maintenance by the servicing agent.

Approvals to Install

New Dwellings and Developments

An OSSM Design Report is required for all new dwellings proposing to use an OSSM system. This also applies to other developments that generate wastewater.

A Section 68(c) application for approval to install, construct or alter an OSSM system is to be submitted to Council with the OSSM Design Report with payment of appropriate fees prior to any work commencing i.e. prior to gaining a plumbing permit.

If an applicant is unsure of Council requirements when lodging a development application, a request should be made for a pre-lodgement meeting with Council.

An application must be made for each OSSM system being proposed.

Council will assess the application only after the report is deemed satisfactory and all fees have been paid. Council may then inspect the property and if a satisfactory assessment is made, we will issue an approval to install.
To facilitate quick assessment designers should format applications consistent with the Appendix D: Decision Ready Applications

Before commissioning the new OSSM system or moving into the new home, the property owner or installer must arrange a series of inspections by Council to check that the OSSM system has been installed correctly. Council will then issue an Approval to Operate.

Designers must consider other existing OSSM systems on the property and consider their condition in their design or potential augmentation to incorporate the new development.

Alterations and Additions to Developments or Change of Building Use

For developments/dwellings with an existing OSSM system a Section 68 application for approval to install, construct or alter an OSSM system is required for any of the following instances:

- the alteration / addition or change of use results in an additional load on the existing OSSM system
- the alteration / addition or change of use involves connection of new drains to the existing OSSM system (even if it does not impose any additional load on the system)
- the alteration / addition or change of use involves a modification to / replacement of the existing OSSM system (even if it does not impose any additional load on the system).

If the alteration / addition or change of use does not involve any of the above, then a Section 68 application is not required. However, a service report less than 12 months old may be required by Council to indicate the existing OSSM system is operating satisfactorily.

An **OSSM Design Report is required** as part of the Section 68 application **EXCEPT** for instances where the alteration / addition or change of use:

- does not impose any additional load on the system, or
- does not involve any modification / replacement of the existing OSSM system, **AND**
- where council has records that describe the current installation.

Subdivision / Boundary Adjustment / Rezoning Applications

For development applications (DA's) involving the subdivision of land into multiple parcels, an OSSM Design Report or land capability assessment must be prepared and accompany the DA.

The OSSM Design Report will address the requirements in this guideline in detail to justify that an OSSM system that meets these guidelines can be installed on the new parcel/s of land.

The size and location of the subdivision will determine the extent of content to be included in the OSSM Design Report. For large subdivisions (for example, subdividing into greater than five parcels of land) and where the soil assessment characteristics are confirmed the OSSM designer may only need to justify that an OSSM system can be installed on the most limiting parcels within the subdivision. This would mean a site and soil assessment and land application area calculation, based on a standard four-bedroom dwelling, is only carried out on the most limiting parcel/s, and not on every parcel of land. The most limiting size of the land application area would be indicatively placed onto a site plan for all parcels of land within the subdivision justifying that an OSSM system can be installed in accordance with this guideline and Council's OSSM Strategy and if applicable, Rous County Council On-Site Wastewater Management Guidelines.

Proposals for subdivisions must also consider minimum lot sizes in Byron Shire Council LEP Part 4.

Community Title, Multiple Occupancies and Dual Occupancies

Where Community Title, Multiple Occupancies and Dual Occupancies are approved considerations needs to be given to appropriate waste water management that is consistent with these guidelines.

At the development proposal stage a development application for a Community Title, Multiple Occupancies and Dual Occupancies must demonstrate that the allotment is capable of accommodating waste water loads generated by the maximum number of dwelling permissible on the development

Refer to the section on subdivisions above and Byron shire Councils Development control Plan (DCP) Chapter D2 Residential Accommodation and Ancillary Development in Rural Zones & Chapter B3 Services.

When using Byron Shire Councils model to calculate the size of a land application area the following allowances must be made:

a. **For Multiple Occupancies:** the total area of the allotment must be divided by the number of approved dwelling sites, plus one for a community facility.
b. **For Community Titles:** the area of each allotment plus a portion of the community land equivalent to the size of the community land divided by the approved number of allotments, plus one for a community facility.
c. **Where a Byron shire Council LEP or DCP permits secondary dwellings or dual occupancies:** the area of each allotment plus a portion of the community land equivalent to the size of the community land divided by the approved number of allotments plus one for a community facility divided by two.

Worked examples

An approved rural community title subdivision:

- *of 30 hectares includes 10 two hectare dwelling allotments and one community facility building that has toilets and sinks. The residual community land is therefore 10 hectares.*
- *if dual occupancies or secondary dwellings are permitted, then the area used in the model would be equivalent to: 2ha + (10ha /11 sites) / 2 = 2.45ha would be used in the model.*

An approved multiple occupancy:

- *of 60 hectares includes 10 dwelling sites and one community facility that has toilets and sinks.*

- *if dual occupancies or secondary dwellings are permitted, then the area used in the model would be equivalent to: (60ha /11 sites) / 2 = 2.7ha would be used in the model.*

Council will not approve the installation of OSSM on community land except for approved community facilities.

4. OSSM Design Reports

Any new OSSM system or an alteration to an existing OSSM system requires preparation of an OSSM Design Report. The OSSM Design Report is to be prepared by suitably qualified persons and lodged with Council together with an application form and payment of an application fee.

Site Inspection

A site inspection must be undertaken by the designer as part of the process of preparing an OSSM Design Report. Site inspections may also be conducted by authorised council staff.

Key Components of Report

The following is a list of the necessary & compulsory components of an OSSM Design Report required for decision ready applications:

1. **Executive summary** – a statement whether the proposal meets Council's guidelines if not, what other mitigation strategies have been included to address any shortfalls, the key constraints and mitigation measures and the proposed OSSM system.
2. **Introduction** –property location and reason for lodgement of application and any relationship to development approvals at the property
3. **Summary of proposed works** – nominate wastewater volumes, type of OSSM system and calculated land application area size.
4. **Desktop Study** – identifying key features and considerations – refer to following sections. This includes constraints such as flooding (1 in 100 year).
5. **Site and Soil Evaluation** –site and soil features and constraints
6. **Setback Distances** – compliance with recommended setback distances
7. **Wastewater Loadings-** a printout of Byron shire council onsite sewage management system model.
8. **Treatment and Land Application System** – details of the proposed OSSM system including a certificate for the NSW accreditation of the treatment units and cross sections and plans of the land application method.
   Sub-surface irrigation systems must be designed by a qualified irrigation designer.
9. **Site Plan** – must include a map / diagram of the whole property and another that zooms into the location of proposed system and key features including existing OSSM systems. The site plans must label all buildings (their uses) and their waste water management system where applicable.
10. **Floor Plans** – for all buildings proposed to be connected to OSSM system

11. **Operation and Maintenance Manual** – prepare a draft operation and maintenance information for the owner / occupier.

The desktop study does not negate performing site and soil evaluations, which are needed to cross-check and confirm the desktop study information and fill any data-gaps, but assists in the preliminary assessment of the property for environmental conditions and OSSM suitability

Desktop Study

As a minimum the following desktop study elements are to be researched and included in the OSSM Design Report.

Drinking Water Catchment Areas

The OSSM Design Report needs to identify if a property is located within any drinking water catchment area as identified in the Drinking Water Catchment Map contained in Byron LEP 2014 (the Drinking Water Catchment Map is also available on Council's online mapping).

Council will determine if the application needs to be referred to Rous County Council for assessment based on the "Suitability" assessment for the system according to the Rous County Council On-site Wastewater Management Guidelines.

Priority Oyster Aquaculture Areas

Identify if a property is located within a Priority Oyster Aquaculture Area (POAA) zone of influence. If the property is located within 100m of the riverbank or tributary and within 10km upstream or downstream (measured along the river) to the nearest POAA then the OSSM installation is within the zone of influence (NSW DPI, 2017).

Refer to the DPI *Fisheries NSW Spatial Data Portal* for mapping of Priority Oyster Aquaculture Areas.

If the property is located within a Priority Oyster Aquaculture Area zone of influence the design of the treatment and land application system shall consider the following measures which have been sourced from the Healthy Estuaries for Healthy Oysters – Guidelines (NSW DPI, 2017:7):

- secondary treatment with disinfection
- sub-surface dispersal of effluent
- located on hill crests or convex slopes
- be greater than 100 metres from waterways
- have a minimum depth of 600 millimetres to the water table

- have high sun and wind exposure
- be located to not be affected by flooding, surface wetness or erosion.

Soil Landscape Maps

Identify the soil landscape for the location of the OSSM system. Soil landscape mapping and information is available online using the NSW Government eSPADE information system.

eSPADE – soil map and information

Soil information is available on the internet via the eSPADE Google Maps-based information system. This website provides mapping and access to soil land information, including soil profiles, downloadable reports, and maps of profile points classified using a number of different soil attributes.

www.environment.nsw.gov.au/topics/land-and-soil/information/espade

This information is for input to the OSSM Design Model and to assist in determining potential limitations to the OSSM system.

Groundwater Bores

Identify the location and details of groundwater bores within 250 metres downstream (or cross-gradient) and 50 metres upstream of the proposed OSSM system.

The WaterNSW website provides groundwater bore data and maps to check the location and details of the nearest licensed groundwater bores in proximity to the property.

https://realtimedata.waternsw.com.au/

Flood Level Requirements

The flooding potential of the property must be determined, regarding the installation of the OSSM system, especially for low-lying floodplain areas. The OSSM tank lid and electrics are to be above the 1 in 100-year flood level.

Site and Soil Evaluation

The site and soil evaluation will follow the procedures outlined in AS/NZS 1547:2012 *On-site domestic wastewater management*.

The OSSM Design Report will include:

- The date of the site inspection and name of the site/soil assessor
- Tabulated results of the site and soil evaluation

- A summary of the key site and soil constraints and measures to address any limiting factors.

A key component of the soil assessment is determining the Soil Category (soil texture and structure) to be assigned for design purposes. Soil category determination shall take into account the soil horizons within the depth range into which effluent is absorbed (see Section 5.2.3 in AS/NZS 1547:2012).

If the OSSM designer (soil evaluator) has doubt in determining the soil category, then it is recommended that a sample of soil is taken to a soil laboratory for analysis and classification.

Site and soil assessment references in AS/NZS 1547:2012:
Appendix B – Site-and-soil evaluation procedures
Appendix C – Site-and-soil evaluation for Planning, Rezoning and Subdivision of Land
Appendix D - Site-and-soil evaluation for individual lots
Appendix E - Site-and-soil properties
Appendix F – Dispersive soil and sodality

Acid Sulfate Soils

The OSSM Design Report should determine if the property is within an acid sulfate soil (ASS) zone. ASS mapping and information is available online using either the NSW Government's eSPADE information system or SEED maps (Sharing and Enabling Environmental Data).

If the property is within an ASS zone, provide the following information:

- probability of ASS occurrence and likely depth to ASS based on the mapping
- if the proposed OSSM works will penetrate the ASS layers or result in the lowering of the water table to within these layers
- extent of proposed works, for example excavation depth, volume of excavation, duration that excavation hole will be exposed, management of soil stockpile and if any soil is to be transported off-site
- if ASS materials are likely to be disturbed, laboratory analysis should be undertaken to determine whether ASS are present or absent, to delineate the lateral and vertical extent, and to quantify the quantities requiring management if disturbed
- if the potential impacts are considered significant provide a management plan within the OSSM Design Report detailing the acid sulfate soil monitoring method and testing procedure (for example field pH tests and soil laboratory analysis), preventive actions,

containment of soil stockpiles, transportation method and amelioration application rates (for example, lime).

For further guidance refer to the *Acid Sulfate Soils Assessment Guidelines* and the *National acid sulfate soils sampling and identification methods manual* (see References section).

Setback Distances

The OSSM designer is to refer to AS/NZS 1547 – Appendix R, Table R1 - Guidelines for Horizontal and Vertical Setback Distances, reproduced in appendix E.

There are two acceptable methods to comply with horizontal and vertical setback distances from OSSM systems and effluent land application areas to site features:

1. Adopt the maximum setback distances in AS/NZS 1547 Table R1 where the site/system features are on the high end of the constraint scale. If the site assessment and OSSM Design Report adopts and confirms compliance with the maximum setback distances (or greater) then no additional information is required.
2. If the design does not comply with the above separation distances, then use the sliding scale method of AS/NZS 1547 – Appendix R – to support the nominated setback distance from a site feature to the land application area.
3. If setback distances to property boundaries or water courses cannot be achieved, then effluent must be disinfected.
4. Local, state or federal government guidelines, for example NSW Water, Rous County Council may require different setback distances and in those cases the greater distance should be applied.

Distance from a watercourse
The critical distance is that distance between the edge of the land application area and a watercourse. The buffer distance is that distance between the land application area edge and the edge of the water.

Viral Die-Off Method when Setback Distances to Groundwater Bores Cannot be Achieved

The OSSM Design Report is to include viral die-off calculations to support any reduced separation distance to a groundwater bore. Refer to Appendix A for an example of how to use the viral die-off calculations.

Systems in a Rous County Council Drinking Water Catchment Area

If a property is located within the Rous County Council Catchment Area for the Wilsons River Source, then the report needs to determine the suitability of the proposed OSSM system based on the criteria listed in the Rous County Council On-site Wastewater Management Guidelines.

Wastewater Loadings

The OSSM Design Report will include the following information and relevant assumptions:

- Number of habitable rooms and equivalent persons (EP)
- Wastewater flow allowances per person
- Total daily wastewater volume loadings on the OSSM system. This is to consider all sources of wastewater on the property.

Further information is provided in this guideline in the 'Sizing of Treatment Components' section.

Treatment and Land Application System

The OSSM Design Report will include the following information:

- Summary of the proposed OSSM treatment and land application system
- Summary of any key design assumptions or criteria and how the proposed OSSM system addresses any site or soil limitations. Refer to further information below regarding systems in a Drinking Water Catchment Area or a Priority Oyster Aquaculture Areas zone of influence
- Calculations of the sizing and layout of the land application system – a copy of the calculations from the OSSM Design Model (the "Design Model" worksheet as a minimum) or other method is to be included in the appendices of the report
- Any other key information for the OSSM system components such as the size of a septic tank or reed bed system, the inclusion of septic tank outlet filters, if a specific AWTS or other proprietary system is proposed including the NSW Health Certificate of Accreditation
- Technical drawings that may be based on example standard design drawings on Council's *On-site sewage* webpage

5. Attachments / Appendices

Property and Site Plans

The OSSM Design Report will include site plans to scale which show:

a. north arrow

b. whole of property boundaries

c. the location and uses of existing and proposed buildings and associated development on the property and neighbouring properties where they may be impacted

d. key site features (for example, contours, watercourses, groundwater bore locations, soil landscape boundaries, buildings)

e. any key setback distances

f. the location and general arrangement of the proposed OSSM treatment system and effluent land application area

g. the location of any and all existing OSSM systems

h. High value vegetation as defined by the following environmental layers in Council's online mapping: "Areas of High Environmental Value" and "Big Scrub Rainforest Remnants"

i. Easements and infrastructure

j. a reserve land application area

The OSSM Design Report is to consider and reference any applicable building envelop and environmental zones, within the OSSM Report and on the site plan, when determining the location of OSSM systems and effluent land application areas.

Operation and Maintenance Manual

The OSSM Design Report will include an appended draft *Operation and Maintenance Manual*.

The draft Manual will form the basis of the final Operation and Maintenance Manual that will be provided to the owner by the OSSM Installation Contractor.

The content of the draft Manual in the OSSM Design Report will include:

- Fact sheets from Council's On-site sewage webpage that area relevant to the proposed OSSM system
- The NSW Health Certificate of Accreditation if a specific OSSM proprietary system is proposed
- Other general maintenance requirements relating to the OSSM system that would not generally be undertaken by a OSSM Service Agent.

Further details of the content of the final O&M Manual that is to be completed by the OSSM Installation Contractor is contained in the chapter: *Operation and Maintenance of OSSM Systems*.

Owners Acknowledgement

The OSSM Design Report will include an *Owners Acknowledgement Statement* (signed by the owner) confirming that they are aware of the type of system being nominated in the report, that a variety of treatment options have been discussed, and of the operating and maintenance schedule required to be carried out for the nominated system.

Easements, Infrastructure, Contaminated Land

Plans should also consider and illustrate the locations of easements, right of ways and other infrastructure owned by a third party but not necessarily protected by an easement.

For example, many power lines, water supply pipelines, telecommunications and stormwater infrastructure may not be protected by easement but are protected by other legislation permitting access for maintenance or replacement that may result in damage to an OSSM system component or may be damaged by an OSSM system installation

As part of every application the location of the OSSM system must consider easements, infrastructure and contaminated land matters and consult industry guides, legalisation or council for guidance. Written permission where required, must be attached, where written permission is not required a written explanation must be provided.

Example industry guides include but are not limited to:

- Easements (essentialenergy.com.au)
- Rous County Council FAQs (nsw.gov.au)
- Building in the Vicinity of Underground Infrastructure Policy - Byron Shire Council (nsw.gov.au)
- Guideline for the Management of Activities within Electricity Easements and Close to Electricity Infrastructure (nsw.gov.au)
- Before You Dig Home | Before You Dig Australia (BYDA)

If any component of the OSSM system is impacted by the owner's infrastructure, for example pipes passing under internal roads or driveways, then plans should be included to illustrate how that installation should occur.

Any proposal that may impact on the stability of developments for example buildings, pools, sheds, water tanks retaining walls should be accompanied by an engineering report as an appendix.

Any proposal on land that is potentially contaminated should consult with Byron Shire Council's environmental health team and contaminated land register and or include details in the proposal as to how that risk is to be managed.

Proposals on property owned by more than one person, for example multiple occupancies and community land, require written permission from all owners, a body corporate or authorised person or director in the case of corporations, with written proof of their authority.

6. Choosing a Treatment System

This chapter provides an overview of standard treatment systems to assist in selecting the most suitable system that will satisfy the needs of the development and homeowner and the site constraints.

There are many different systems which treat and dispose of domestic wastewater, the more typical ones are described below.

The choice of a system may be partly dictated by the constraints of a site. An OSSM Designer would be the best to consult regarding choosing an appropriate OSSM system and understanding the maintenance and operation requirements.

Council will only approve OSSM systems that have a certificate of accreditation with NSW Health, excluding reed bed systems.

Composting Toilets

A Waterless Composting Toilet (WCT) collects toilet waste (normally called ‘blackwater’ for standard toilet systems) but not greywater (from the bathroom, laundry and kitchen). This reduces the solids, nitrogen and pathogens going to the septic tank.

A greywater system, usually a septic tank, is also required with a WCT, so that the greywater from the bathroom, laundry and kitchen can be collected and treated, prior to land application.

WCT’s are dry systems. They use no water, but instead sawdust or a similar material is used to help breakdown the waste solids into a ‘compost like’ material.

Wet compost toilets are special types of compost toilets that do use water and can also be used to breakdown kitchen vegetable scraps, paper and some garden waste. Other, more advanced wet composting systems might actively use ‘worms’ to breakdown solids.

Composting toilets require electricity to drive a small air circulation fan.

WCT’s require routine removal of the ‘composted’ waste with care taken to avoid contacting the waste material.

Composting toilets are usually located on an external wall of a building, and with a large storage area below the floor level, for collection / storage of the waste and carrying out maintenance.

Domestic Greywater Treatment Systems

‘Greywater’ is all household wastewater excluding toilet wastes, (from the bathroom, laundry and kitchen) and are often used on association with waterless compost toilets

Greywater generally contains lower nutrients but can still contain significant levels of pathogens. NSW Health requires that greywater be disposed of below ground level unless it has been adequately disinfected.

Greywater must be collected in an in-ground septic tank for primary treatment before land application. Further treatment may be necessary depending on the buffers to sensitive receptors.

The minimum allowable size for a greywater dispersal bed must be calculated based on the nutrient uptake and hydraulic capacity of the land application system, but in no cases shall it be smaller than 10 m^2 per person. This minimum figure is based on hydraulic dispersion capabilities of most soils and would only be considered appropriate for at least secondary treated greywater.

Primary Treatment Systems

Primary treatment refers to the removal of solids and organic matter through settling and sedimentation.

Primary treatment lowers suspended solids and biochemical oxygen demand (organic matter) in the effluent but does not significantly reduce nutrient levels.

The effectiveness of primary treatment depends on the length of time the sewage is in the tank which is a function of the size of the tank and the volume of water used in the house.

Byron Shire Council can approve primary treatment systems, refer to the Rous County Council On-Site Wastewater Management Guidelines for guidance on situations where primary treatment systems may be approved.

Septic Tanks

Septic tanks provide primary treatment through settlement plus anaerobic digestion of organic solids by microbes.

A septic tank is a simple but robust system for primary treatment. The size of the tank depends on the potential wastewater volume and accounts for the volume of wastewater to be detained over a number of days, plus an allowance for accumulation of sludge at the bottom of the tank and accumulation of a thick scum layer at the top of the tank (a scum layer is required for a ‘healthy’ septic tank).

Pathogens in the wastewater are NOT reduced in the septic tank.

Septic tanks should be pumped out at least every 3-5 years to remove accumulated solids Frequency of pump outs depends on how many people are using the system and how big the septic tank is. Septic tanks do not require electricity to operate.

Septic Tank Effluent Filters

An effluent filter is a coarse screen filter that fits into the outlet of a primary treatment tank. Effluent filters reduce *Total Suspended Solids* (TSS) carry over and thereby extend the operational life of land application components. Effluent filters are recommended on the outlets of both septic and greywater tanks. It is critical that homeowners are aware of the frequency and mode of cleaning septic tank filters.

Secondary Treatment Systems

Secondary treatment refers to a higher level of treatment compared to primary treatment systems – particularly in regard to the reduction of nutrient levels and pathogens. Secondary treatment often uses some form of aeration, settlement and clarification. The most common form of secondary OSSM treatment systems are aerated wastewater treatment systems but secondary treatment systems can comprise a septic tank with an additional downstream treatment unit such as a reed bed.

Byron Shire Council will only approve secondary treatment, where required, prior to land application.

By improving the quality of effluent, the size of the land application area can be reduced. It is also considered an added measure when confronted with site constraints i.e. poor soils and reduced distances to watercourses etc.

AWTS – Aerated Wastewater Treatment System

AWTS settle solids, reduce nitrogen and are generally fitted with a disinfection chamber for reduction of pathogens. This is usually done with the addition of chlorine in the final treatment stage, although some AWTS use ultra-violet radiation.

AWTS's use oxygen from electrical/mechanical 'blowers' to provide aerobic biological treatment – which generally produces a higher quality effluent compared to anaerobic treatment in septic tanks. AWTS require significant electricity to operate the blowers and other pumping units.

As with septic tanks, solids must be removed every 3-5 years.

Reed Bed Systems

Reed beds provide secondary treatment following primary treatment using a septic tank.

A reed bed is typically a rectangular or round concrete or poly tank, filled with gravel and planted with water loving reeds or sedge type plants.

Effluent from the septic tank passes through the gravel and root zone of the reeds where it undergoes treatment via physical, chemical and biological processes. The reed bed is designed so that the water always remains below the gravel surface.

A reed bed must be sized to achieve a minimum 5–7-day residence time (the time that it takes for wastewater to travel through the gravel.

The reed bed residence time is determined by the water holding capacity of the reed bed, which is governed by the water depth, reed bed surface area and porosity of the gravel used.

Reed beds require maintenance to ensure the beds are not overly congested with vegetation

Disinfection

There are a number of options for disinfection for OSSM systems. Chlorination is commonly used with AWTS's. Some systems use bromine, UV light or ozone to disinfect.

For dripper-under-mulch or spray irrigation systems, the effluent must be disinfected after secondary treatment. Subsurface irrigation requires partial-secondary or secondary treatment but does not require disinfection. NSW Health regulations require that disinfection of AWTS effluent occurs in most cases, even for sub-surface applications.

Collection Wells and Pumping Systems

Collection wells and pumping systems for on-site sewage management are normally storage wells that collect sewage or effluent by gravity flow before pumping to a treatment device/treatment compartment or a land application system. The sizing of collection wells is addressed in the *Sizing of Treatment System and Disposal Area* chapter.

A wastewater collection well and pumping system is to comply with NSW Ministry of Health - Sewage Management Facility Vessel Accreditation Guideline. NSW Health provides a register of accredited pumping wells ("sewage ejection pump stations") and collection wells.

Commercial OSSM Treatment Systems

Commercial OSSM systems are classified by Council as non-residential OSSM systems with capacities above 10 EP but less than 2,500 EP. These systems typically service unsewered holiday accommodation premises, and other unsewered commercial premises such as restaurants, cafes, schools, and processing facilities.

If a commercial OSSM system is proposed, then the following assessment steps and information is to be included in the OSSM Approval to Install Application (OSSM Design Report).

1. **Conduct a desktop study**, refer to soil maps, drinking water catchment maps, Rous County Council On-Site Wastewater Management Guidelines, soil stability and climate data etc. Ensure documents are referenced if applicable
2. **Determine the influent quality:** The wastewater from some non-residential sources is of a different quality than 'domestic wastewater' served by standard OSSM systems and as such is important in designing a system appropriate for the quality of waste water generated.
3. **Determine the effluent quality** required to achieve development objectives (i.e. reuse or landscape subsurface irrigation). Effluent quality is to be based on several factors e.g. the intended end use of the effluent, method of applying the effluent to the land, is recycled water used for particular plumbing fixtures, site constraints, receiving environment, sensitive area (oyster aquaculture farming), drinking water catchment area, high groundwater table, soil types, slope, separation distance from registered groundwater bore location, drinking water supply source, buffers from site features etc.

State how you determined the level of effluent quality needed for the development and provide supporting information/documentation (for example, risk assessment method).

4. **Nominate the type of OSSM system** that can treat the maximum quantity and quality of wastewater generated and achieve the effluent standard required.

5. **Provide documentation** to support that the nominated OSSM system can treat the wastewater strength and volumes generated and achieve the effluent quality standard required, for example include any state government (or equivalent) certificate of accreditation, standards and/or water marks for manufactured components. Design certification is required from a Wastewater Consultant or registered Professional Engineer. The applicant/owner may be required to conduct an in-situ effluent quality validation and verification accreditation monitoring program (for example, refer to Part 7 of NSW Guidelines for Management of Private Recycled Water Schemes, for guidance on this process).

6. **Conduct an appropriate site and soil evaluation** on the property. The assessments are to be in accordance with AS/NZS 1547: On-site domestic wastewater management or other suitable equivalent technical standards.

7. **Calculate the size of the land application area** required. Include water and nutrient balance model/spreadsheet/calculations and select the most limiting sized area (for example, largest area). Detail how the effluent is to be applied evenly to the land. Provide irrigation design and pump calculations, details of flush points and nominate all effluent irrigation areas and reserve areas if applicable.
   Note: the Byron Shire Council model should not be used for commercial applications.

8. **Site plan to scale** indicating the location of all OSSM systems and land application areas and setback distances from site features.

9. **Include any other documentation**. For example, photos, reports, previous approvals, technical documents that will support your application.

10. **Operation and maintenance management plan** is to be developed. Provide an OSSM treatment train process flow chart and nominate all critical control points in the process that will need to be monitored. Include details on:

    a. What is to be monitored?

    b. How it is to be monitored?

    c. When is it to be monitored?

    d. Who is to monitor?

11. **Include education information that details how the OSSM system works**, what to do, what not to do and a training awareness program. Provide details of an education program that includes responsibilities for the owners, staff and general public. A maintenance plan is needed that will include information on trouble shooting what to do if

something goes wrong with the OSSM system, and emergency procedures and contacts etc.

12. **Detail how often the OSSM system will need to be serviced**, include a copy of the standard service report check list, state the qualifications of the service person and the time intervals to send service reports to Council. For Commercial scale systems quarterly sampling and reporting is required.

Council will perform a monitoring and auditing role to ensure that the OSSM system continues to operate satisfactorily. The audit interval is to be determined based on a risk assessment process. All servicing reports are to be kept on-site and copies provided to Council. Refer to Council's website for further information.

7. Choosing a Land Application System

Land application systems are to be selected to satisfy the needs of the homeowner, the development, and the site constraints. Standard design drawings are provided on Council's website as examples of how different systems can be installed. Designers and installers should consult this guideline and AS/NZS 1547:2012 for additional details.

Regarding protection of public health, land application systems generally reinforce the 'barrier system' approach with OSSM systems. The barrier system is used to humans and animals from the wastewater by containing it in pipes and tanks; and from the effluent by use of a soil barrier (for example, applying the effluent into the soil at an appropriate depth) and sometimes using exclusion zones on a property

Choosing an appropriate land application system is largely determined by the effluent quality (determined by the treatment system) plus site and soil characteristics of a site. Cost and maintenance requirements are also relevant in choosing the type of system.

The sizing of the land application system (for example, the number and size of evapotranspiration beds) is to be calculated using Council's OSSM Design Model (see next chapter).

'Reserve' areas, with equivalent characteristics to the land application system, shall be designated and set aside in all new applications. Refer to more information in the chapter 'Sizing of Treatment Components'.

Reuse of Effluent

Effluent (treated sewage) is not necessarily a waste product and the safe reuse of effluent should be considered in the design of any OSSM. Reusing treated sewage helps reduce our reliance on clean water supplies and can help 'drought proof' some gardens.

Examples of effluent reuse include irrigating landscaping and garden beds, planting non-intrusive vegetation downslope of evapotranspiration beds and irrigating pasture or wood lots.

Reusing treated sewage is not permitted on plants where the leaf or roots form part of the edible component.

Further guidelines are available via the NSW EPA *Environmental Guidelines: Use of Effluent by Irrigation*

To allow reuse it is necessary to provide a suitable level of treatment to sewage. This may allow a relaxing of the 'barrier system' approach to public health protection, for example by reducing disease causing micro-organisms in the effluent with improved treatment it is possible to relax requirements and allow the discharge of effluent at shallower soil depths where it can be used by the overlying vegetation / lawns.

The following reuse applications and associated treatment requirements are recommended by NSW Health Advisory Note 4 and adopted by Council:

For secondary treatment without disinfection:

- Sub-surface application at depths between 150mm to 300mm.
- Low Pressure Effluent Distribution (LPED) Irrigation and Shallow Sub-surface Drip Irrigation if installed in accordance with AS/NZS 1547:2012 – Appendix M;

For secondary treatment with disinfection, the same applications as above are permitted plus:

- Surface under mulch drip irrigation and spray irrigation with appropriate design and buffers.

- *The reuse of treated greywater inside the house for washing machine water or toilet flushing is not permitted by Council.*
- *Treated and disinfected sewage must not be used for drinking, ablution, car washing or topping up swimming pools.*

Greywater Diversion Devices

Greywater diversion devices are specialised plumbing fixtures with a manually activated switch that diverts untreated greywater by gravity or pump directly to a sub-surface irrigation system.

Greywater diversion devices are not accredited by NSW Health.

Council does not recommend the use of greywater diversion devices on a risk management basis. The benefits of reusing greywater in a high rainfall area are not considered sufficient to outweigh the risks associated with soil degradation, impacts to sensitive environments and public health risks.

Council may from time to time during droughts - for example permit temporary greywater diversion if considered safe by Council.

Absorption Trenches & Methods

The traditional absorption trench is a “disposal-only” system. Because there is little opportunity for reuse or treatment through plant uptake and because it is difficult to distribute effluent evenly in a way that does not pollute in the long-term, traditional trenches are discouraged in new OSSM installations. Systems which rely on soil absorption as the principal mechanism, for example absorption trenches, generally do not comply with the requirements of these Design Guidelines or the NSW EHP Guidelines 1998 (p119).

On some highly constrained lots where insufficient space is available for any other form of land application, absorption trenches may be the only viable option for effluent dispersal. In these cases, Byron Shire Council would generally expect that absorption trenches be preceded by at least secondary treatment, and that all necessary efforts would be made to

disperse effluent evenly over the entire length of the trenches, for example by pumping or intermittently dosing.

On highly permeable soils which are located a sufficient distance above the standing water table beneath, it may sometimes be acceptable to use a “discharge control trench”, in which the trench beneath the distribution pipe is deepened and filled with washed sand (refer AS/NZS1547:2012 for design details).

On other types of highly constrained site, for example where only very small land application area is available, it is sometimes appropriate to distribute effluent in “micro-trenches”. These micro-trenches comprise narrow, shallow, gravel-filled trenches in which sub-surface irrigation pipes are installed. The advantages of micro-trenches are that by shallowly laying them along the contour and pumping the effluent into them, they can distribute effluent reliably, evenly and intermittently. Assuming that stormwater is adequately diverted, micro-trenches provide a good opportunity for reuse by plants and only a low risk of effluent surcharging during wet periods.

Evapotranspiration (ETA) Beds and Trenches

Evapotranspiration (ETA) beds (and ETA trenches) use subsurface adsorption of effluent into the soil and subsequent evapotranspiration by plants.

ETA beds are wider and shallower than traditional absorption trenches, thereby providing a much greater opportunity for uptake by plants and reduced dependence on infiltration and soil assimilation capacities to treat the effluent.

Owners of ETA beds should maintain appropriate vegetation on the beds. Mowed grass is the preferred vegetation cover, although shrubs and trees can be planted suitable distances away from the edge of ETA beds.

Sub-Surface Irrigation Systems

Sub-surface drip irrigation (SDI), also commonly referred to as sub-surface irrigation (SSI), is a good means of distributing treated effluent because it can distribute small, measured doses to evenly spaced centres in relatively undisturbed soil. This ensures a very reliable distribution available for rapid root uptake and minimises the risk of the irrigation field becoming saturated during extended rainfall. Sub-surface irrigation is particularly appropriate where there are site or soil limitations or limitations, such as steep slopes, on heavy impermeable (often termed “puggy”) soils and can even be used with care on highly permeable sandy soils.

Sub-surface irrigation systems must be designed and installed by suitably qualified persons. A Certified Irrigation Designer must submit a Detailed Irrigation Plan for installation on slopes greater than 30% and for commercial uses.

Sub-surface irrigation systems must be flushed to remove sediment/slime at least once per year, and preferably quarterly, by a qualified professional as part of the maintenance requirements. Suitably located pressure-release valves and flush pits must be provided to allow this regular flushing maintenance without causing pollution.

There are a number of different types of proprietary SDI systems on the market. Council requires that all new installations use pressure-compensated emitters, and strongly prefers the use of non-drain varieties.

Surface Dripper-Under-Mulch Systems

Byron Shire includes productive farming area where effluent reuse can be particularly beneficial. The irrigation of effluent by above-ground drippers in plantations and ornamental garden beds may be appropriate in some applications.

Surface dripper-under-mulch options may be considered for domestic situations in Byron Shire. The thickness of mulch should be at least 150 mm. Higher maintenance and monitoring conditions will be required to ensure that the mulch remains in place over the drippers and that casual access by children, vehicles and livestock is restricted by a vegetative border, fence or similar device. Disinfection of effluent is required.

Where surface dripper-under-mulch is installed, the following signage requirements must be implemented to ensure that access to the land application area is restricted.

- install a minimum of one sign along the perimeter of the land application area with lettering visible from three (3) metres
- Sign is to contain words to the effect:

"Recycled wastewater below.

- *do not dig*
- *do not drink*
- *no vehicle entry*
- *no stock access"*

Wisconsin Sand Mound Systems

Raised effluent mound application systems, such as Wisconsin Mounds, are normally used on relatively flat slopes that have site or soil restrictions. The restrictions may be:

- Slowly permeable soils
- Permeable layer (300 mm to 600 mm) of soil overlying a limiting layer such as rock, hardpan; or
- Permeable soils with high water table within 300 mm to 600 mm of ground level.

The mound is constructed directly on to the natural ground surface, which is ploughed beforehand. Primary treated effluent is dose loaded into the mound with further treatment taking place in the sandfill of the mound. An area of aggregate is used to distribute primary

effluent on to the surface of the sand-fill media beneath. The effluent discharges from the sand-fill media directly into the underlying soil.

The sizing of mounds is addressed in the following chapter.

Dose loading of land application systems

Dose loading of treated effluent by LPED lines (low pressure effluent distribution lines), and automatic sequencing valves is recommended as providing for more effective control in achieving uniform and even distribution over a land application area. LPED avoids the spot loading inherent in perforated lines and provides more effective distribution of effluent along the full length of a trench or bed system. (AS/NZS 1547:2012, pp148).

Where pressure dose loading of effluent by siphon or pump is used for ETA beds, the designer shall determine trench or bed lengths and perforated pipe details appropriate to the system layout and the siphon or pump duties.

Automatic sequencing valves

A distribution valve which under each pumping cycle (or siphon dosing cycle) trips to a new outlet feeding an individual distribution line in a land application system, thus dosing each distribution line in sequence.

Pressure-dosed distribution systems ensure that effluent is applied at the design hydraulic loading rate (DLR) uniformly throughout the design area. When used in conjunction with automatic sequencing valves hydraulic design is simplified, and each element of the land application area receives its proportioned dose over a few minutes each day, enabling a rest period throughout the remainder of the 24-hour period.

Dosing Siphons

Dosing siphons are used extensively in the USA and are becoming more readily available from OSSM suppliers in Australia.

They change low or variable flows into regular doses and suit pressurising laterals and land application areas. They have no moving parts and need no electricity. They are typically used with sand filters or evapotranspiration beds.

Council will consider the application of dosing siphons on a case-by-case basis.

8. Sizing of OSSM Components

The required method for sizing OSSM components is Council's OSSM Design Model. Alternative methods such as in AS/NZS 1547:2012 will also be considered only when accompanied by a detailed explanation of why the BSC Model was not used. The sizing of treatment components is generally based on AS/NZS 1547:2012 and the use of NSW Health accredited treatment systems.

Calculating Wastewater Volumes and Equivalent Population (EP)

Residential Dwellings

The potential Equivalent Population (EP) loading for domestic properties is calculated based on the number of bedrooms. The following loadings are to be used:

- 2 EP loading for one-bedroom dwellings

2 EP for the first habitable room and 1.5EP per bedroom for each habitable room after that, for example for a 4-bedroom / habitable room house = (1 x 2EP) + (3 x 1.5 EP) = 6.5 EP.

If the dwelling floor plan nominates a study, office or rumpus room, then this room is to be included as a bedroom in the EP calculations as these types of rooms can easily be converted into an additional bedroom and therefore potentially increasing the wastewater volume and size of the OSSM system.

Refer to the **OSSM Design Model** available on Council's 'On-site sewage' website.

- flow allowances per person based on water supply ('town water supply' or roof water) and whether water saving fixtures are installed
- flow allowances for each source (toilet, bathroom, laundry and kitchen).

Non-Residential / Commercial Loadings

Flow allowances for non-residential developments such as motels, cafes, restaurants factories and community buildings are to be based on either measured water usage or values in *AS/NZS 1547:2012 On-site domestic wastewater management – Appendix H – Table H4 for domestic flows from non-residential premises,* Reproduced in appendix E.

Tourist cabins / accommodation are to be based on 2 EP per bedroom.

New commercial installations will require metering capable of daily logging of water consumption or effluent application.

Sizing of Treatment Components

Septic Tanks

Sizing of septic tanks is to be based on *AS/NZS 1547: On-site domestic wastewater management – Appendix J – Recommended Capacities for Septic Tanks.*

Reed Beds

Sizing of reed beds can be based on any of the three following methods:

1. Using Council's OSSM Design Model
2. Coarse sizing method – allowing 4m^2 (surface area) per person to achieve a residency time of seven days, for example for a five-person household: 4m^2 x 5 EP = 20m^2 reed bed surface area. This is based on a minimum reed bed water depth of 0.5m.
3. Calculation Formula to achieve a minimum residence time of five to seven days: Residence time (days) = Reed Bed Volume (litres) x Porosity (dimensionless – fraction or %) / Daily Wastewater Generation (litres).

AWTS

A domestic-sized AWTS must comply with and have obtained a Certificate of Accreditation issued by NSW Health and be in accordance with the NSW Health - Sewage Treatment Accreditation Guideline.

Waterless Composting Toilets

A Waterless Composting Toilet must comply with and have obtained a Certificate of Accreditation issued by the NSW Health and be in accordance with the NSW Ministry of Health – Waterless Composting Toilet Accreditation Guideline (NSW Ministry of Health, 2016).

A grey water management system must be associated with compost toilet installations.

Collection Well for Pumping

The collection well capacity is to be determined by the daily flow per person (DF) multiplied by the number of persons (N) to calculate one day's storage volume. Confirm and provide details if the wastewater is to be pumped to a land application area, reticulated sewerage system, if it's part of a common effluent drainage system and the number of pumps used.

For collection wells that have pump/s installed they must also be fitted with a non-return valve on the pump outlet pressure pipework.

Collection Well Capacities

	Single Pump	Dual Pump	Tanker Pump Out
Capacity calculation	DF x N x 2 (2 days of storage)	DF x N (1 day of storage)	DF x N x 7 (7 days of storage)
Minimum capacity	2050 litres	2050 litres	5250 litres

Sewage Ejection Pump Station

A sewage ejection pump station macerates and pumps sewage to a small diameter sewerage reticulated system. A sewage ejection pump station is to comply with the *NSW Ministry of Health - Sewage Management Facility Vessel Accreditation Guideline*.

The minimum capacity of the sewage ejection pump station is to equate to six hours of the average wastewater peak flow measured over an eight-hour period per day. A wastewater daily flow of 150 litres/ person/day is used in this calculation.

The sewage ejection pump station must be fitted with a non-return valve on the pump outlet pressure pipework and fitted with a high-level audio and visual alarm.

High Level Alarms

All OSSM installations that incorporate a pump must have a high-level alarm installed, for example audio and visual alarm positioned either on the top of OSSM tank or fastened against a permanent structure where it will be observed during normal daily trafficable flow paths.

Sizing of Land Application Area – Council's OSSM Design Model for households

A computer model in the form of an MS Excel spreadsheet is available from Council to calculate the area required for the land application area – the Byron OSSM Design Model. The OSSM Design Model is available for free download on Council's website.

The model's theory and operation are described in Appendix C- *Background Information to OSSM Design Model*. The designer remains responsible for adopting the sizing calculated by the Byron OSSM Design Model and needs to amend the design as necessary with consideration of any site-specific characteristics.

The percentage reduction of nutrients (nitrogen and phosphorous) must be certified in the certificate of accreditation for use in model calculations, otherwise the default values of 20% must be used.

How to Accommodate for Heavy Clays

The OSSM Design Model will not allow operation for Soil Category 6 (Medium to Heavy Clays, or dispersive or shrink-swell soils). To calculate the effluent dispersal area in this situation it will generally be necessary to provide secondary treatment of effluent and to ameliorate soil conditions if they are dispersive, then to apply the computer model as though the site had a weakly structured Light Clay soil with DLR value of 5mm/day.

Using the OSSM Design Model for Non-standard applications

The OSSM Design Model can be used for non-standard applications, for example a small number of eco-tourist cabins connected to a common OSSM system with enhanced nutrient removal. The model can be used for these types of application by utilising the 'Design Model' worksheet in the program.

In the 'Design Model' worksheet the following parameters can be adjusted for non-standard applications:

- Total daily flow
- The wastewater source (toilet, bathroom, laundry, kitchen)
- Nitrogen and phosphorus loadings
- Nitrogen reduction in the treatment process.

Any adjustments need to be detailed and justified in the OSSM Design Report.

Using AS/NZS 1547:2012 to Size Land Application Systems

Council will also accept the use of sizing methods described in AS/NZS 1547:2012 in instances where the design output from the OSSM Design Model is unable to be accommodated on a constrained site.

Wisconsin Sand Mound Systems

Sizing of Wisconsin Sand Mound Systems is to be based on guidance provided in Appendix N (Land Application Methods - Mounds) of AS/NZS 1547:2012.

Additional reference material can be sourced from Wisconsin Mound Soil Absorption System; Siting, Design and Construction Manual (Converse and Tyler, 2000).

Reserve Land application Area

A reserve land application area is an area set aside for future use as a land application area to replace or extend the original land application system. A reserve land application area

may be required in the future if the primary land application area fails over time due to, for example, reductions in permeability of the soil or the soil's capacity to absorb phosphorus becomes supersaturated.

Reserve areas, with equivalent characteristics to the land application system, shall be designated and set aside in all new applications. The reserve area shall be protected from any development that would prevent it being used in the future.

On sites with large areas and limited constraints, the size of the reserve area will be 100% of the design land application area.

Council will consider a reduction in the size of a reserve area based on allowances outlined in AS/NZS 1547:2012, for example the reserve area may be reduced:

- if an improved wastewater treatment and improved land application system is provided.
- if dose loading or alternating loading of the design land application areas are employed.
- or where a standard procedure for site evaluation (see Appendix D in AS/NZS 1547:2012) supports a reduction in area.

On small sites, it may not be possible to provide a reserve area. The designer, in consultation with Council, should assess the options available for the site and select an appropriate design that will provide security in case of unexpected failure. In the case of irrigation line or soil quality degradation in a shallow irrigation system, the lines may be easily replaced, or topsoil quality may be improved, or topsoil replaced, enabling continued use rather than full decommissioning of the primary irrigation area.

9. Installation or upgrade of OSSM Systems

The installer/plumber must obtain a plumbing permit from Council prior to installation. The installation is to be in strict accordance with the approved plans and conditions. It is the responsibility of the installer to book the necessary inspections with Council.

Plumbing Permit

Following Council approval to install, construct or alter an OSSM system, the installer/plumber must obtain a plumbing permit from Council prior to commencement of work on site.

There are some exceptions to the need for a plumbing permit such as connecting drains to an existing OSSM system that does not impose any additional load on the system. Installers are to refer to Council's Local Approvals Policy to check if exemptions apply and for any associated requirements.

Irrigation Installations

Installers of irrigation systems are required to have a current trade certificate in plumbing, drainage or related trade or discipline.

Variations to the Approval to Install

Council expects systems to be installed in strict accordance with the approved plans and conditions.

If it is necessary to substantially alter the design or configuration of the OSSM system, the following will need to be lodged with Council and approved before proceeding with the amended installation:

- a Section 4.55 Modification application for OSSM systems approved as part of a Development Application
- a Section 106 Modification (S106) for systems approved under s68 of Local Government Act application.

Where the necessary amendments are of a very small or insubstantial nature it is permissible to install the altered system only with acknowledgment in writing from council's certifiers or environmental health officers.

Works as Executed diagram

Works as Executed diagrams are required for all new OSSM systems and for modifications to existing OSSM systems.

The Works as Executed diagrams must clearly show the size of all OSSM components and their position relative to major features (for example house, driveway and/or waterways).

See also Plumbing inspection documents | NSW Fair Trading

Installation Inspections

It is the responsibility of the installer to book the necessary inspections with Council. The exact inspections required for the installation / upgrade will be specified in the Conditions imposed on the plumbing permit and Council's Conditions of Approval for the installation, construction or alteration of the OSSM system.

It is an Offence under the Local Government Act. not to comply with an Approval issued by Council.

It is offence under the Plumbing and Drainage Act to conduct plumbing and drainage works unless the responsible person has given the plumbing regulator a notice of work, and (b) the work carried out corresponds to the specifications in the notice of work.

It is a requirement that the installer contacts Council prior to backfilling any sub-surface installation so that the system can be inspected and tested.

Certification of key activities/requirements (for example application of lime to trenches) and Works as Executed diagrams shall be provided by the plumber/installer and submitted to Council prior to inspection. Final inspection will not be approved until such certification is submitted to Council.

Inspections of OSSM plumbing and drainage works can only be carried out by Council Officers. Private certifiers or designers do not have authority to inspect any aspect of OSSM installations or drainage.

A final certificate must be issued by council after the final inspection before commission and use of the OSSM system can occur.

It is offence under the Plumbing and Drainage Act not to provide certificates and plans to the regulator or owner.

Important Note: if an approval to install has nominated conditions for example fencing land application areas, signage, diversion swales, buffer plantings these must be completed at the final inspection.

Operation and Maintenance Manual

It is the responsibility of the installer to prepare a final Operation and Maintenance (O&M) Manual for the owner.

The O&M Manual based on:

- the draft O&M Manual appended to the OSSM Design Report
- the Council approved plans and condition of approval
- any NSW Health Certificate of Accreditation for the OSSM components
- any amendments to the design or configuration of the OSSM system from the installation works.

Further details of the content of an O&M Manual are provided in the following chapter.

10. Operation and Maintenance of OSSM Systems

It is the responsibility of the installer to prepare a final Operation and Maintenance Manual for the owner. Owners and residents are to regularly maintain their OSSM system, either through a self-maintenance program or by using a service agent.

Mutual Obligation

Council's OSSM policies, strategies and guidelines have been developed so that Council can work with property owners and residents to sustainably manage OSSM systems.

Part of this mutual obligation involves owners and residents to regularly maintain their OSSM system, either through a self-maintenance program or by using a service agent. Owners must also have a current Approval to Operate for their OSSM system.

Operation and Maintenance Manual

It is the responsibility of the installer to prepare a final Operation and Maintenance Manual for the owner.

The content of the Operation and Maintenance Manual will include:

a. Fact sheets from Council's On-site Sewage webpage that are relevant to the installed OSSM system.

b. Any relevant NSW Health Certificates of Accreditation for installed or upgraded on-site sewage management facilities

c. Copies of: Council-stamped design plans; Council's Conditions of Approval; details of any modifications to the approved design plans, and Works as Executed diagrams

d. Manufacturer information where key OSSM components, for example warranty and service life information

e. contact information of servicing agent if applicable.

Who is responsible for rental properties?

The property owner is the responsible OSSM system 'operator' - responsible for the system operation and maintenance.

Owners of rented properties should ensure that occupiers of the premises are aware of the requirements for safe operation and regular maintenance of the OSSM system.

Servicing agents for OSSM Systems

Property owners / OSSM system 'operators' must engage an authorised OSSM servicing agent for an OSSM system that includes any of the following systems:

- Aerated Wastewater Treatment Systems (AWTS's)
- any NSW Health accredited system (for example, sand filter systems)
- sub-surface drip irrigation systems
- surface irrigation systems.

Owners / OSSM system 'operators' can choose to engage servicing agents to manage any OSSM system, for example for general maintenance of standard septic tank systems or reed bed systems.

Servicing Frequency

Quarterly maintenance is the minimum frequency for any OSSM systems / components that require an authorised OSSM servicing agent.

If an OSSM system component has a NSW Health Certificate of Accreditation that requires a more frequent servicing frequency then this will govern the servicing frequency.

An Approval to Operate will specify if the OSSM system or components of the system require a an authorised OSSM servicing agent, and the frequency of regular maintenance by the servicing agent.

Maintenance Reports

Any servicing undertaken by an authorised OSSM servicing agent will be reported to Council and the owner / OSSM system 'operator'.

The reporting will be in a form similar to those provided in Appendix D (extract from *NSW Health Advisory Note 5 - Servicing of Single Domestic Secondary Treatment Sewage Management Facilities (SMF)*).

The report is to be submitted to Council and the owner / 'operator' within 7 days of servicing the system or component. The service agent is also required to maintain a copy for their records.

If a service agent observes that an OSSM system failure has been caused by improper use of the system, the service agent is to consult with the owner / 'operator' to ensure preventative actions are undertaken. If the problem continues, then the matter is to be reported to Council for appropriate action. When there is an identified pollution incident, (for example, effluent discharge), the service agent is required to notify Council. Any of the above is to be recorded in the maintenance report.

Council Inspections

Council may undertake OSSM inspections for a number of reasons:

- in association with development or section 68 applications

- a new owner has purchased the property
- as a check to ensure compliant operation of OSSM systems - particularly in sensitive areas
- if complaints have been made
- if service reports are overdue.

Inspection programs by Councils are required across NSW under the Local Government Act 1993. This requirement includes keeping a register of all OSSM systems

11. Acronyms

Acronym	Full description
ARI	Average recurrence interval
AS / NZS	Australian/New Zealand Standard™
ASS	Acid sulfate soils
ATO	Approval to Operate
AWTS	Aerated wastewater treatment system
BSC	Byron Shire Council
DA	Development Application
DF	Daily flow
DIR	Design irrigation rate
DLR	Design loading rate
DPI	NSW Department of Primary Industries
EHP	Environment & Health Protection (in reference to the Environment & Health Protection Guidelines (Department of Local Government, 1998)
EP	Equivalent population or Equivalent persons
ETA	Evapotranspiration absorption (beds)
LEP	Local Environmental Plan
LGA	Local government area
LPED	Low pressure effluent distribution
OSSM	On-site sewage management - used interchangeably with OSMS, SMF and septic system

OSMS	On-site sewage management system
POAA	Priority oyster aquaculture area
POEO Act	Protection of the Environment Operations Act
SDI	Sub-surface drip irrigation
SEED	Sharing and Enabling Environmental Data
SSI	Sub-surface irrigation
SSD	Sewerage Service Diagram
SMF	Sewage management facility
SSI	Sub-surface irrigation
SMF	Sewage management facility
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
UV	Ultraviolet
WCT	Waterless composting toilet

12. Glossary

Term	Description
Aerated Wastewater Treatment System (AWTS)	a wastewater treatment process typically involving settling of solids and flotation of scum; oxidation and consumption of organic matter through aeration; clarification – secondary settling of solids, and disinfection of wastewater before irrigation.
Aerobic	dissolved or free oxygen is present
Anaerobic	dissolved or free oxygen is not present
Blackwater	human excreta and water grossly contaminated with human excreta, for example toilet wastewater (human excreta entering waterless composting toilets is considered as 'blackwater')
Domestic wastewater	water arising from household activities, including wastewater from bathrooms, kitchens, toilets and laundries
Effluent	treated wastewater
Equivalent population or Equivalent persons (EP)	a measure typically used in the design of wastewater management systems which equates flows or pollutant strengths to what is typically generated by a person
Evapotranspiration	the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants
Greywater	domestic wastewater from sources other than toilets, including washing machines and dishwashers. Also generally excludes kitchen waste. Also sometimes termed 'sullage'.
Habitable Room	Byron Shire Council Water and Sewage Equivalent Tenancy policy definition: A "bedroom" is any habitable room that, in the opinion of Council, by its physical design, designated or capable of being used as a bedroom including separably accessible rooms designated a bedroom, study, studio, den, attic, media room, home office or the like other than a kitchen, WC, bathroom or laundry
Human excreta	human faeces and urine

Land application area	the area over which treated wastewater (effluent) is applied via land application system, also referred to as the disposal area.
On-site sewage management (OSSM)	treatment and application to land of all wastewater generated within a household, within the boundary of the premises. Also known as onsite sewage management systems (OSMS) sewage management facility (SMF) or septic system and includes greywater management and compost toilets.
Sewage	wastewater and human waste arising from domestic premises and may contain waste arising from toilets and similar fixtures, showers, baths, hand basins, clothes washing machines, laundry tubs, kitchen sinks and dishwashers. Sewage includes blackwater and greywater but not stormwater
Sewage management	any activity carried out for the purpose of holding or processing, or reusing or otherwise disposing of, sewage or by-products of sewage
Sewage management facility (SMF)	a human waste storage facility or a waste treatment device intended to process sewage (clause 3 Local Government (General) Regulation 2005). See also OSSM definition.
Silver Bullet	Colloquial term for the document: *Environment & Health Protection Guidelines, On-site Sewage Management for Single Households* (Department of Local Government, 1998)
Sludge	mainly organic semi-solid product produced by wastewater treatment processes
Wastewater	liquid waste generated by a domestic premises and includes sewage, greywater and blackwater
Waterless composting toilet	(humus closet, biological toilet) waterless system that uses the principle of composting to break down human excreta to a humus-type material. The liquid fraction is evaporated or directed to an appropriate land application system.
Wet composting toilet	treats all household wastewater and putrescible household organic solid wastes such as food waste. Uses the principle of aerobic composting to break down the solid waste; the liquid component is directed to a land application system after passing through the pile of solids

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14. Appendices

Appendix A - Viral Die-Off Method

The following is based on Cromer, W. C., Gardner, E. A. and Beavers, P. D. (2001) and has been adapted from the Ballina Shire Council OSSM Guidelines (2017).

Viral Die-Off Method - Key Points & Parameters:

- Viruses are smaller and more resistant to natural die-off than bacteria, so if viral numbers (in effluent/soil) are acceptably low, then it is considered that bacterial numbers are also low
- It is recommended to target the following viral reductions for different treatment systems:
    - Raw wastewater ..... 7 order of magnitude (M_t/M_o = 0.0000001)
    - Primary treatment (septics)..... 7 order of magnitude (M_t/M_o = 0.0000001)
    - Greywater..... 5 order of magnitude (M_t/M_o = 0.00001)
    - Secondary treated effluent..... 3 order of magnitude (M_t/M_o = 0.001)
- Be cautious using the calculations for very low permeability soils because the low permeability input sometimes produces very small setback distances
- For “effective porosity” of the soil, it is recommended to use a number between 20% (0.2) and 35% (0.35)
- Temperature of the wastewater in the soil: it is recommended to use 14°C.

Estimating a setback distance using the viral die-off method has three main steps:

1. Determine how much time is needed for viruses in the effluent to naturally die off to acceptably low levels (the recommended target viral reductions listed above). To estimate this time (t), use **Equation 1a** and **Equation 1b** overleaf
2. Determine how far the effluent has seeped laterally downgradient or cross gradient in the time period calculated in Step 1. To estimate this travel distance, use **Equation 2** overleaf.
3. Establish a setback distance by applying a safety factor of 2 to the estimated viral die-off distance from Step 2 (ie double the answer from **Equation 2**). This is due to the range of variable inputs into the viral die-off equation e different soil layers, porosity, soil permeability and groundwater gradient.

Equation 1a: $\frac{M_t}{M_0} = e^{-kt}$

where:

$\frac{M_t}{M_0}$	is the dimensionless ratio between the viral concentration in the groundwater at any time t (M_t) and the viral concentration in the wastewater at the time of its application to the subsurface (M_0). Use the recommended viral reductions listed above for this ratio
t	is the travel time (days) of the viruses in the groundwater (to be calculated using this equation)
k	is the first order rate coefficient for the die-off rate of the organism and is the temperature- dependent variable (°C). Calculate k using Equation 1b and the recommended wastewater temperature value of 14°C.

Equation 1b: $k = (\mathrm{T} - 8.5)/20$

where:

T	is the wastewater temperature in the soil (in °C) – use the recommended wastewater temperature value of 14°C

Equation 2: $d_g = \frac{t-(d_v \times \frac{P}{K})}{(\frac{P}{K} \times i)}$

where:

d_g	is the horizontal distance from effluent land application area to where virus die-off occurs (metres) (calculated by this equation)
t	is the travel time (days) of the viruses in the groundwater (calculated using **Equation 1a** and **1b**)
d_v	is the vertical distance to groundwater (metres) estimated from groundwater bore log data
P	Is the porosity soil expressed as a fraction for example, clay 04-0.7, silt 0.35 – 0.5, sand 0.25-0.5, gravel 0.20-0.4. **It is recommended to use a number between 0.2 and 0.35**
K	is the soil permeability (m/day). Use either a measured permeability or the indicative permeability values in Table L1 of AS/NZS1547:2012 for the identified subsoil type

i	is the groundwater gradient (fraction for example, 0.02 if slope of groundwater 1:50). Use an estimate based on the ground surface slope.

Example:

For a secondary treatment system with a subsoil land application system and the following site and soil characteristics

Step 1 - Determine travel time (t - days) required to achieve target viral reduction:

Equation 1b - determine value for (k) based on T = recommended wastewater temp. of 14°C

k = (T – 8.5) / 20

k = (14 – 8.5) / 20 = 0.275

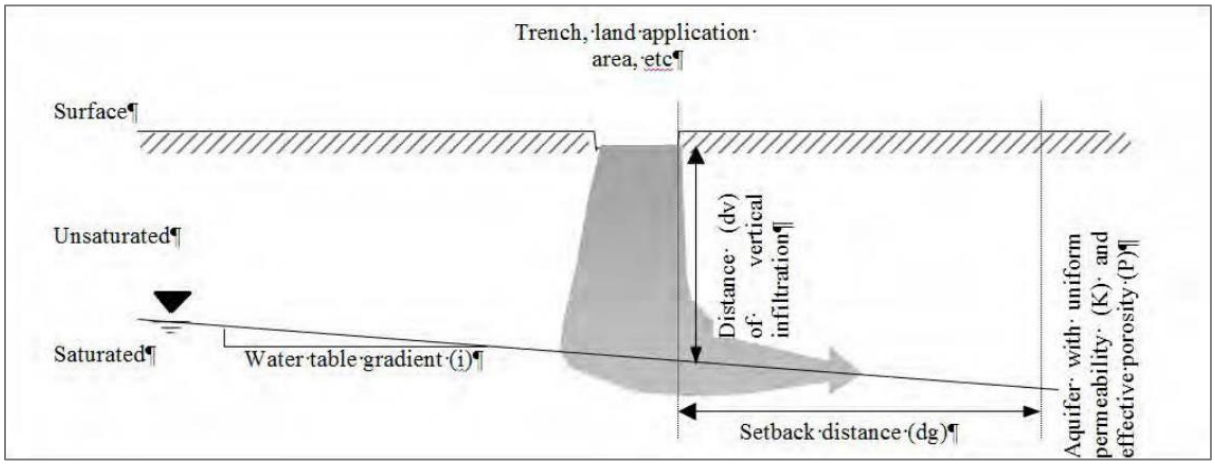
Equation 1a - determine travel time (t) in days

Mt/Mo = 0.001 – the target viral reduction for secondary treated effluent as per target values on first page of this Appendix

Rearranging Equation 1a gives

t = Ln (Mt / Mo) / -k

Therefore t = Ln (0.001) / -0.275 = **25.1 days**



Step 2 - Determine viral travel distance (metres) based on the travel time from Step 1:

Formula: $d_g = (t – d_v.P/K)/(P/K.i)$

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

d_v = vertical distance to groundwater (m) = 2.0 metres for this example

t = travel time (days) = 25.1 days from Step 1

P = porosity soil fraction = 0.35 for clay loam for this example

K = permeability (m/day) = 1.5 m/day from Table L1 of AS/NZS1547:2012 for clay loam for this example

i = groundwater gradient fraction = 0.02 for this example based on surface slope of 1:50)

Therefore, d_g = ((25.1 – 2 x (0.35/1.5)) / (0.35/(1.5 x 0.02)))

d_g = (24.633) / (11.667) = 2.11, say 2.1m

Step 3 – Apply Safety Factor of 2 to estimated viral travel distance from Step 2:

The minimum setback distance = 2 x d_g (twice the horizontal distance from effluent land application area to where virus die-off occurs)

Therefore, the minimum setback distance = 2 x 2.1m = **4.2 metres**

Appendix B - Background Information to OSSM Design Model

The Byron OSSM Design Model is an MS Excel spreadsheet computer model that was originally developed for Lismore City Council by Greg Alderson & Associates and has been reworked for Byron Shire Council by Antony McCardell and David Bonner.

The model calculates the minimum land application area required based on: Hydraulic loading; Total Phosphorous (TP) loading; and Total Nitrogen (TN) loading. The largest of these areas is selected as the minimum sustainable area for the application of effluent.

Hydraulic Calculations

The model performs a daily soil water moisture calculation to provide a baseline for the soil's capacity to absorb the next day's water input. The calculation is based on rainfall infiltration, hydraulic load from the household, evapotranspiration, and deep percolation (drainage).

Rainfall and Class A Pan Evaporation Data, for the 21yr period to 2003, was accessed from the Alstonville Agricultural Research Station, and is considered to be representative of rainfall patterns likely to occur in the Byron LGA region.

Soil texture and structure determine the permeability of the soil. Predicted soil percolation values were taken from AS/NZS 1547:2000 and applied in the model where soil type is identified and selected.

The required land application area, for the hydraulic load, is the land area (in m^2) which will accept the volume of applied effluent for 95% of the time (for example, the 95th percentile for the 21yr database). Of the 5% of days that fall outside the soil capacity to accept this volume of water, effluent-contaminated runoff might theoretically occur. It is assumed however that, during these unusually high rainfall periods when some “daylighting” of effluent might occur, almost all of the runoff would consist of rain water and that actual contamination would be so low and diluted that the overall effects would be negligible.

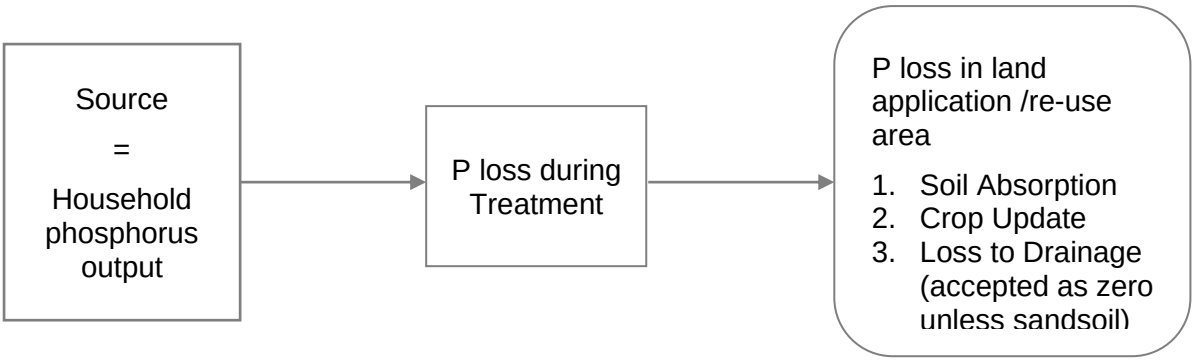
Phosphorus Calculations

The model calculates an annual total phosphorus budget based on TP input, soil adsorption potential, and crop uptake.

Default values for TP input and crop phosphorus uptake is 0.6kg/person/yr and 20/kg/ha/yr respectively.

The adsorptive capacity of the soil is considered to be finite and is based on predicted soil adsorption capacity for soil type (default values for known soil types are listed in the model). The soil adsorptive capacity is reduced by both depth (to rock or water-table) minus a default 0.5m water-table buffer.

The design life of the land application area is restricted to 50yrs in the case of the phosphorus calculation. The model considers the treatment/ land application process in a series of 'compartments' or sub-models, which can be described as:



Phosphorus balance sub-model within OSSM Design Model

The equation for the phosphorus application is:

$$\text{Area } (m^2) = (10{,}000 \times P_{load})/[(P_{sorp}\,(W-b))/T+P_{crop}] \quad \text{.....Eqn. 1}$$

Where:

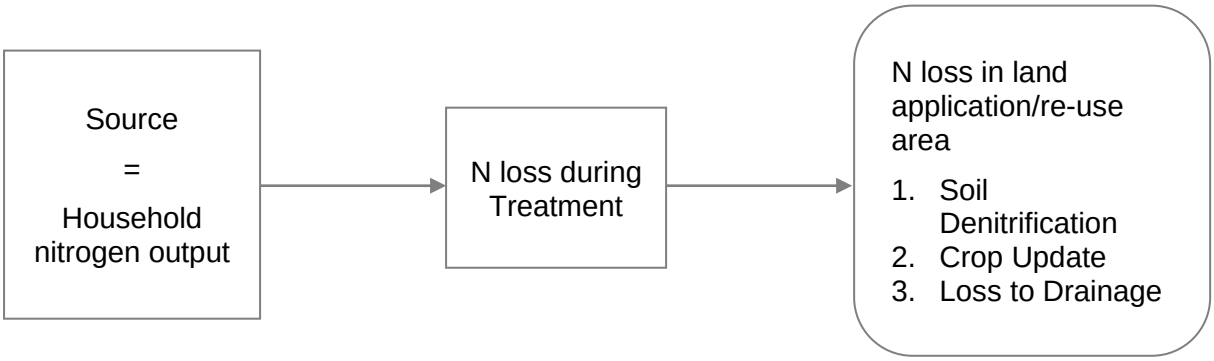
Area	- land application area required for soil/ plan P removal
10,000	- conversion factor from hectares to m^2
P_{load}	- dwelling P output less any removal during treatment (kg/yr)
P_{sorp}	- soil P adsorption capacity (kg/ha/m depth)
B	- buffer to water-table (default 0.5m)
T	- time to max soil adsorption limit (default 50 years)
P_{crop}	- annual crop P uptake capacity (kg/ha). Default in model is set at 10 kg/ha/year

Nitrogen Calculations

As with the phosphorus calculation the model calculates the land application area size for nitrogen based on an annual nitrogen budget for the site. Unlike the phosphorus cycle, the nitrogen cycle has an additional 'gas' phase that helps reduce the TN load applied to the land application area.

The model considers the treatment/ land application process in a series of 'compartments' or sub-models which can be described as:

Nitrogen balance sub-model within OSSM Design Model



Model assumptions for the nitrogen calculations are:

1. 20% of the TN arriving at the land application area will rapidly cycle through to the gaseous N phase and vent to the atmosphere,
2. The default value for TN production is 4.2kg/person/yr,
3. Plant N uptake is 200 kg/yr (unless otherwise justified).
   The equation for the phosphorus application is:

The basic model function for the nitrogen calcultion is described by the equation.

$$\text{Area (m2)} = ((N_{load} - N_{denit} / N_{crop}) \times 10{,}000 \quad \text{.....Eqn. 2}$$

Where:

Area - land application area required for soil/ plan N removal
10,000 - conversion factor from hectares to m^2
N_{treat} - dwelling N output less any removal during treatment (kg/yr)
N_{denit} - soil N denitrification capacity (default = 20% of TN after treatment)
N_{crop} - annual crop N uptake capacity (kg/ha).

It is acknowledged that using the above equation produces large, and therefore costly, land application areas. To reduce the requirement for these large areas Council accepts that domestic OSSM systems in rural areas of low development density present much lower risks to the broader environment because of the additional assimilative (effluent polishing) capacity of the lands surrounding the land application area. Consequently, the equation has been re-arranged to reflect a relaxation of minimum land application area sizes in low density, well-buffered developments, to include a nitrogen 'release to the environment factor'. This factor, currently set at a maximum of 10 kg TN/yr in the Byron OSSM Design Model, based conservatively on work done by Hornsby Shire Council (HSC, 1994), is calculated and applied according to block size.

The equation for the ‘nitrogen release factor’ is:

$$N_{lim} = N_{max}\,[1-\exp(-kB)] \quad \text{.....Eqn. 3}$$

Where:

N_{lim} - the allowable TN release/ export for the system (kg/yr)
N_{max} - the maximum annual allowable TN release per household (currently 10kg/yr)
k - curve to the line
B - block size

Equations 2 and 3 are re-arranged within the nitrogen sub-model to calculate land application thus;

$$\text{Area } (m^2) = (1- N_{lim/}\, N_{treat} - N_{denit)) \times ((N_{treat} - N_{denit/}\, N_{crop})) \times 10{,}000 \text{..... Eqn 4}$$

Nitrogen Calculation and Creek Buffer

Reductions from the recommended minimum buffer distances to waterways restricts the nitrogen calculation by reducing the allowable nitrogen 'release to the environment'. The nitrogen sub-model does this as a simple linear reduction, for example if the buffer distance between the proposed land application area is 50m (where the guidelines require 100m),

then the effective block size is reduced by 50%. Essentially, the model increases land application areas by reapportioning the entered block size value.

Appendix C – Example & Preferred Service Report

Local Council STS (DGTS) Service Report: (Version 5: August 2017)		
Owners name:	Local Council:	
Installation Address:		
System Brand & Model	☐ Domestic	☐ Commercial
Date of this service	Date of last service	Next service due
Has the STS/DGTS been serviced in accordance with the manufacturer / suppliers' requirements and sing the service sheet? ☐ Yes ☐ No - If 'No' why?		
STS/DGTS functioning correctly? ☐ Yes ☐ No - If 'No' why?		
According to sludge-judge or other methodology is de-sludging needed? ☐ Yes ☐ No If 'No' why?		
Offensive odours? ☐ Yes ☐ No - If 'Yes' why?		
Alarms tested and functional? ☐ Yes ☐ No - If not 'functional' what action is recommended?		
Final Effluent Quality Tested? ☐ Yes ☐ No Disinfected? ☐ Yes ☐ No Chlorine tablets remaining? ☐ Yes ☐ No Quality? ☐ Satisfactory ☐ Unsatisfactory On what evidence is this judgement made? If 'Unsatisfactory', what action was recommended?		
Land Application Area Surface ponding? ☐ Yes ☐ No Run off? ☐ Yes ☐ No Excess plant growth? ☐ Yes ☐ No Effluent leaving premises? ☐ Yes ☐ No High risk areas contaminated?* ☐ Yes ☐ No *Patio, play areas, BBQ, etc. Operating satisfactorily? ☐ Yes ☐ No If not 'Operating Satisfactorily', what action was recommended?		
Overall Condition of STS? ☐ Excellent ☐ Good ☐ Fair ☐ Poor Comments / Action Recommended / Repairs Needed / Repairs Performed Has the owner / occupier taken recommended actions? ☐ Yes ☐ No		
Service Agent	Contact Details	
Signature	Signature	

Extract from NSW Health (2018). *Advisory Note 5 – February 2018. Servicing of Single Domestic Secondary Treatment Sewage Management Facilities (SMF)*.

Appendix D - Preferred Format for Decision Ready Design Reports

Reports submitted in this format will permit quick assessments. A failure to include all the required information will require a revised version to be submitted within 21 days or the application will be refused.

a. **Cover pages:** address, lot and DP of the proposal, report number including version history, designer details and credentials / qualifications, contact details, date report completed. Site number for multiple occupancies.
b. **Signed statement from owner/s:** acknowledging that they have been made aware of the different design options suitable for their situation and the ongoing servicing and maintenance costs and obligations of the recommended / chosen system.
c. **Executive summary**: a summary that states if the proposal meets Byron Shire Council Guidelines and if not what why not and what additional mitigation strategies have been proposed.
d. **Introduction:** a brief description of the whole property including a whole of property plan as an appendix, details of development approvals and existing OSSM systems.
Note: the whole of property plan must show the existing buildings and their uses and existing OSSM systems, approved or otherwise.
e. **Site Description Detail**: all relevant details about the site (as subsections) including but not limited to the area of the relevant allotment/s, illustrated distances to sensitive receptors including groundwater, bores, surface water, intermittent waterways and drainage lines. Vegetation of the proposed LAA and buffers, slope of the allotment and proposed LAA, soils analysis, an aerial image map that zooms into the proposed development / installation as an appendix.
f. **Constraints Discussion:** a discussion of the constraints and how the design proposal overcomes them.
This section should also include discussion, where warranted, to incorporate other developments, existing or future, in the design. For example: dual occupancies, expanded dwelling modules, toilets, showers and sinks in sheds, studio connections, connecting existing old, delipidated or unapproved OSSM systems on the property.

g. **Staged Developments:** if new developments are proposed to be completed in stages this must be made clear at the application stage. Otherwise, a Section 4.55 Modification application for OSSM systems approved as part of a Development Application or a Section 106 Modification for systems approved under s68 of Local Government Act application will be required incurring further fees and slowing down the approval process.

h. **OSSM Design Details:** a brief description of the components selected for the OSSM system and why that system was chosen. Current certificates of accreditation are required as appendices. Details site plan to scale showing the location of all building to be connected, the location of all system components and cross sections of relevant components. Decommissioning details.
A complete legible copy of the completed Byron Shire Council model page.
NOTE: If variations to the defaults in the Byron Shire Council design model have

been used, they must be accounted for (discussed) here.

Appendices:

i. **Plans:** Whole of property plan, site plans, certificates of accreditation, proposed OSSM system plan and cross sections**,** building floor plans.
j. **Operation and Maintenance Plan:** what to do and not do to ensure the system is operating at its best and to maximise its life and should include details for owners to provide to tenants and what to do when alarms are activated.
k. **References and acknowledgements:** as required.

Appendix E – Tables Reproduced from AS/NZS 1547 On-site Domestic Waste Water

TABLE H4
TYPICAL DOMESTIC WASTEWATER DESIGN FLOW ALLOWANCES – DOMESTIC WASTEWATER FROM COMMERCIAL PREMISES – NEW ZEALAND

Source	Typical wastewater design flows (L/person/day)	
	On-site roof water tank supply	Reticulated community or a bore-water supply
Motels/hotels		
– guests, resident staff	220	
– non-resident staff	30	
– reception rooms	20 – 30	
– bar trade (per customer)	20	
– restaurant (per diner)	25 – 30	
Tearooms/lunch bars (per customer)		
– without restroom facilities	10	15
– with restroom facilities	15	25
Community halls		
– banqueting	20	30
– meetings	10	15
School (pupils plus staff)	15 – 30	
Rural factories, shopping centres	30	50
Camping grounds		
– fully serviced	100	130
– recreation areas	50	65

NOTE: These flows should be used for design purposes unless past experience demonstrates lower actual flows. Design flows should be based on the maximum figure in the range unless justification for lower values can be provided by way of actual water use data. Although guidance is provided for flow allowances for non-household activities, this Standard does not provide specific requirements for commercial loads, for example in commercial kitchens and laundries (see 1.9 definition of domestic wastewater).

TABLE R1
GUIDELINES FOR HORIZONTAL AND VERTICAL SETBACK DISTANCES
(to be used in conjunction with Table R2)

Site feature	**Setback distance range** (m) (See Note 1)	**Site constraint items of specific concern** (from Table R2) (see Note 1)
	Horizontal setback distance *(m)*	
Property boundary	1.5 – 50 (see Note 2)	A, D, J
Buildings/houses	2.0 – > 6 (see Note 3)	A, D, J
Surface water (see Note 4)	15 – 100	A, B, D, E, F, G, J
Bore, well (see Notes 5 and 6)	15 – 50	A, C, H, J
Recreational areas (Children's play areas, swimming pools and so on) (see Note 7)	3 – 15 (see Notes 8 and 9)	A, E, J
In-ground water tank	4 – 15 (see Note 10)	A, E, J
Retaining wall and Embankments, escarpments, cuttings (see Note 11)	3.0 m or 45° angle from toe of wall (whichever is greatest)	D, G, H
	Vertical setback distance *(m)*	
Groundwater (see Notes 5, 6, and 12)	0.6 – > 1.5	A, C, F, H, I, J
Hardpan or bedrock	0.5 – ≥ 1.5	A, C, J

NOTES:

1 The overall setback distance should be commensurate with the level of risk to public health and the environment. For example, the maximum setback distance should be adopted where site/system features are on the high end of the constraint scale. The setback distance should be based on an evaluation of the constraint items and corresponding sensitive features in Table R2 and how these interact to provide a pathway or barrier for wastewater movement.

2 Subject to local regulatory rules and design by a suitably qualified and experienced person, the separation of a drip line system from an upslope boundary, for slopes greater than 5%, may be reduced to 0.5 m.

Table R1 continued on next page ➤

TABLE R1
GUIDELINES FOR HORIZONTAL AND VERTICAL SETBACK DISTANCES
(to be used in conjunction with Table R2) (continued)

3	Setback distances of less than 3 m from houses are appropriate only where a drip irrigation land application system is being used with low design irrigation rates, where shallow subsurface systems are being used with equivalent low areal loading rates, where the risk of reducing the bearing capacity of the foundation or damaging the structure is low, or where an effective barrier (designed by a suitably qualified and experienced person) can be installed. This may require consent from the regulatory authority.
4	Setback distance from surface water is defined as the areal edge of the land application system to the edge of the water. Where land application areas are planned in a water supply catchment, advice on adequate buffer distances should be sought from the relevant water authority and a hydrogeologist. Surface water, in this case, refers to any fresh water or geothermal water in a river, lake, stream, or wetland that may be permanently or intermittently flowing. Surface water also includes water in the coastal marine area and water in man-made drains, channels, and dams unless these are to specifically divert surface water away from the land application area. Surface water excludes any water in a pipe or tank.
5	Highly permeable stony soils and gravel aquifers potentially allow microorganisms to be readily transported up to hundreds of metres down the gradient of an on-site system (see R3, Table 1 in Pang et al. 2005). Maximum setback distances are recommended where site constraints are identified at the high scale for items A, C, and H. For reading and guidance on setback distances in highly permeable soils and coarse-grained aquifers see R3. As microbial removal is not linear with distance, data extrapolation of experiments should not be relied upon unless the data has been verified in the field. Advice on adequate buffer distances should be sought from the relevant water authority and a hydrogeologist.
6	Setback distances from water supply bores should be reviewed on a case-by-case basis. Distances can depend on many factors including soil type, rainfall, depth and casing of bore, direction of groundwater flow, type of microorganisms, existing quality of receiving waters, and resource value of waters.
7	Where effluent is applied to the surface by covered drip or spray irrigation, the maximum value is recommended.
8	In the case of subsurface application of primary treated effluent by LPED irrigation, the upper value is recommended.
9	In the case of surface spray, the setback distances are based on a spray plume with a diameter not exceeding 2 m or a plume height not exceeding 0.5 m above finished surface level. The potential for aerosols being carried by the wind also needs to be taken into account.
10	It is recommended that land application of primary treated effluent be down gradient of in-ground water tanks.
11	When determining minimum distances from retaining walls, embankments, or cut slopes, the type of land application system, soil types, and soil layering should also be taken into account to avoid wastewater collecting in the subsoil drains or seepage through cuts and embankments. Where these situations occur setback clearances may need to be increased. In areas where slope stability is of concern, advice from a suitably qualified and experienced person may be required.
12	Groundwater setback distance (depth) assumes unsaturated flow and is defined as the vertical distance from the base of the land application systems to the highest seasonal water table level. To minimise potential for adverse impacts on groundwater quality, minimum setback distances should ensure unsaturated, aerobic conditions in the soil. These minimum depths will vary depending on the scale of site constraints identified in Table R2. Where groundwater setback is insufficient, the ground level can be raised by importing suitable topsoil and improving effluent treatment. The regulatory authority should make the final decision in this instance. (See also the guidance on soil depth and groundwater clearance in Tables K1 and K2.)

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FOR MORE INFORMATION

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