

Memorandum

To Tabitha Manderson

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From Anne-Maree Jolly

Office Palmerston North Office

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Subject Woodville land application of waste water

Background

Tararua District Council are in the process of renewing the Woodville Wastewater Treatment Plant consent. One scenario for treatment that has been suggested is the application of wastewater to land. With constraints on landuse within the Tararua District how feasible is this option. Key consideration needs to be given to the potential losses of nitrogen and phosphorus from the land application system.

This memorandum outlines the key assumptions and inputs that were used in the modelling exercise, the area of land assumed to be used for the hypothetical irrigation was based on the Water Balance exercise undertaken by Sheryl Paine.

The Woodville community does fall within a Horizons Regional Council priority catchment for intensive farming. However, under the One Plan definition of intensive does not include the proposed landuse system of an irrigated cut and carry system with no stock present. However, this automatically does not make land application of wastewater the best option. It only means an Intensive Landuse Consent is not required. Even though the system is not classified as intensive under the One Plan, this does not mean the environmental effect is considered to the minor or less than minor.

Two key drivers for nutrient lost from any system are climate and soil type. The greater the rainfall (in consideration with irrigation) and the more freely drained a soil is, the greater the risk of nitrogen lost from a system is. Woodville has an average annual rainfall of 1,250 mm while the soils range from being well to poorly drained (Table 1). This automatically results in higher nitrogen leaching losses compared to other regions within the Horizons Regional Council boundaries.

Measuring nitrogen leaching losses is a difficult and costly process. Therefore, the farm system nutrient model Overseer is often used to predict nitrogen and other nutrient losses from the root zone of farming systems. This model has not been developed to measure nitrogen losses from land application of wastewater specifically, however, these scenarios can still be modelled by someone suitably qualified.

The addition of wastewater into an Overseer nutrient budget is through the application of irrigation and increasing the nutrient content of the irrigation. This most accurately represents the application of wastewater to land within Overseer however it does not consider the makeup of the nutrients and how quickly nutrients transform from their organic to inorganic status.

Table 1: Soils of the Woodville region

Soil Order	Drainage	Parent material	Key features
Gley	Poor	Sedimentary	Drainage required for intensive use Summer safe Winter and spring waterlogging
Recent	Imperfect	Recent	Low P retention Good fertility Weakly developed soils
Brown	Well	Recent	Moderate to high P retention Summer and winter safe*
Allophanic	Well	Volcanic	High to very high P retention Stable topsoil#

*Rarely effected by summer drought not becomes waterlogged in winter

#minimal pugging or compaction by stock and machinery

Modelling Woodville wastewater land application in Overseer

Four scenarios to determine the potential nitrogen and phosphorus loss to water from land application of wastewater from the Woodville wastewater treatment plant have been modelled in Overseer. The parcel of land in which wastewater was applied to, is a hypothetical land parcel which has been split 50:50 between two different soil types. All other features within an Overseer file were treated the same.

Overseer Assumptions:

- Based off an average year knowing that all systems have seasonally variation which input an annual fertiliser applications and total amount of dry matter produced and therefore nitrogen added and removed from the system varies.
- Block sizes based off Water Balance Woodville WWTP dated February 2018. Summer only irrigation 189 ha and all year 122 ha.
- Nutrient concentrations for the wastewater were based off the flow and effluent load assessment dated June 2018.
- Soil type used, Kairanga and Manawatu, were two common soil types for the region
- Gley soil - Kairanga does not have artificial drainage
- Cut and carry system without stock used to avoid intensive land use definition under the One Plan
- Basic fertiliser requirements for maintenance used
- The use for irrigation pods were the chosen irrigation method
- Nitrogen fertiliser applied to enhance pasture growth during growing season
- Four cuts of silage to be taken each year in Overseer
- Soil information has been entered as soil series. This is not the preferred option of S-map data however this information is not available currently within the Woodville region. The effect of not using S-map data for the soil moisture information is not considered.

Scheduling wastewater irrigation

Unlike a typical irrigated farming system where irrigation can be turned on and off as required. For a wastewater land application system where there is no storage of wastewater, irrigation has to occur daily to dispose of the wastewater.

In addition, total amount of wastewater to dispose of is key driver to the application depth. Without storage, Woodville is required to dispose of approximately 565,000 m³ of wastewater each year. To achieve this an application depth of 5 mm every four days is required. If conditions are not suitable for irrigation, irrigation still must be applied to dispose of the wastewater.

On the other hand, if you only wish to apply irrigation for four months of the year. Using an application depth of 5 mm every two days, only approximately 576,000 m³ wastewater will be able to be disposed of over this time.

System	N mg/l in irrigation water	Waste N kg/ha loading	N kg/ha loss	P kg/ha loss	Water applied m ³	Scheduling
Woodville - before treatment 120 days	8.8	28	6	1.3	576,000	5 mm every two days 305 mm/yr
Woodville - before treatment all year	8.8	43	9	1.4	565,000	5 mm every four days 463 mm/yr
Woodville - after treatment 120 days	7.1	23	6	1.2	576,000	5 mm every two days 305 mm/yr
Woodville - after treatment all year	7.1	34	7	1.3	565,000	5 mm every four days 463 mm/yr

Overseer Version 6.3.0