MEMO

TO	Whaitua Te Whanganui-a-Tara Committee and Expert Panel
FROM	James Blyth
DATE	14 October 2019
TOPIC	Summary of Septic Tanks and their potential impacts

1. Introduction

Septic tanks are on-site wastewater storage systems, common in rural and semi-urban communities where there is no wastewater network connections available to dwellings. Tanks are typically buried and collect a range of wastewater from household activities, including toilet waste. Solid waste typically remains in the tank, with overflows of water discharged through effluent fields that filter the water to remove nutrients and pathogens. There are a range of tank and effluent field designs, which can be dependent on the sites soil, topography, water table and climate.

A well designed and functioning (standard design) septic tank can anaerobically digest and store solid waste as sludge, and also aerobically breakdown and filter nutrients and pathogens through unsaturated soil within the effluent field (i.e. ammonia to nitrate). Unfortunately, septic tanks are often poorly maintained (not cleaned regularly enough) and many are in original condition from the point of installation. The effects of not removing solid waste can compound water quality issues as it leads to blockages of the effluent field (i.e. drain pipes), subsequently reducing aerobic treatment as the soil can remain saturated throughout the year.

Septic tank issues on water quality have been considered at the central government level, with a proposed National Environmental Standard for On-site Wastewater Discussion document developed (MFE 2008), but eventually withdrawn from circulation.

2. Responsibility of maintaining septic tanks

These wastewater devices are privately owned assets and are not dealt with by Wellington Water; meaning any failure of a septic tank and subsequent overflows to ground or surface water would be the responsibility of the owner and maybe regulated by district or regional councils.

MFE 2008 documents a review of all regional plans and bylaws relating to consent status and maintenance of septic tanks in New Zealand. The review found:

- Controls on septic tanks (i.e. installation and design) vary by region
- Some regional councils require resource consents, although the majority of councils treat them as a 'permitted' activity
- Councils often only become involved after serious problems occur
- 71 territorial authorities (TA's) and 3 regional councils (RC's) required no formal maintenance or inspection of septic tanks (unless they are consented); 9 RC's recommended regular maintenance and 2 RC's and 3 TA's had compulsory clean outs (but generally only applying to sensitive areas).

There is no straight forward cost recovery system in place for councils to inspect or monitor for septic tank impacts, hence most of New Zealand councils have little ongoing involvement post installation on new housing builds or replacements tanks. Environment Bay of Plenty (EBOP) has an on-site Effluent Treatment Regional Plan which monitors performance of septic tanks, and evolved from well documented impacts of these systems on rivers, lakes and estuaries in the region. This is currently going through a draft plan change with public consultation, to better capture impacts and effects these systems may have on the environment and drinking water quality (following the Havelock North contamination).

The former Waitakere City Council (WDC) had bylaws in place which required regular pump out and inspection of the on-site wastewater systems (undertaken by the council), with costs recovered through rating adjustments. The withdrawn NES was originally proposed as a means to implement a compulsory national standard, without requiring onerous efforts through regional and district council plan changes or bylaws.

3. Case Studies of septic tank states and impacts

A number of regional and district councils have undertaken investigations into the potential impacts septic tanks maybe having on water quality and human health risks within their respective communities. These are summarised below, with a failure of a septic tank system considered to be a situation where inadequately treated wastewater enters groundwater or surface water, leading to environmental or human health risks (MFE 2008).

- A survey of 3,251 systems in the Bay of Plenty found that 64% of the systems surveyed failed an inspection (Graham and Futter, 2002).
- A survey around Lake Rotorua found that 77% of septic tanks did not comply with the regional councils On-Site Effluent Treatment Plan. 90% of owners did not clean their septic tanks once per decade (10 years), which was attributed to a high nutrient load to Lake Rotorua, and high faecal contamination in springs and streams within the catchment (MFE 2008).
- Inspections in Clevedon Village, Manukau (Auckland) found 20% of on-site systems were subject to failure at the time of the survey, with an additional 10% likely to fail (Ormiston Associates Ltd, 2007).
- Investigations within the Otago Region found there may be up to 14,600 septic tanks with an estimated 15-50% of these in some stage of failure. 2500 (~17%) of these exceeded the threshold for nitrogen limits within protection zones (ORC 2015).
- Upper Hutt City Council investigated 48 properties in the Blue Mountains in September 1998 (GWRC 2000). Small section sizes limited effluent disposal areas and high winter water levels resulted in:
    - 23% of properties having overland effluent flow (above ground)
    - 16.7% of properties needed immediate sludge removal
    - 8.3% of properties had severely deficient tank sizes.
- GWRC environmental regulations database reported only 18 complaints relating to septic tanks (odour and overflows) from 2014 to 2019 (5 years).
    - The low complaints (~4 per year on average) are not likely due to ‘great condition’ septic tanks in the region, but reflective of the minimal amounts of human contact with these wastewater systems (from neighbours or members of the public), outside of the private owner. Most septic tanks are in rural or lifestyle block settings, with households distances great enough that odour and overflows would go unnoticed.

4. Typical water quality issues from septic tanks

Three main impacts from sewage are organic matter (solid waste), disease causing organisms (pathogens like bacteria, protozoa or viruses) and nitrogen compounds (ammonia in anaerobic systems, nitrate from aerobic systems). These can lead to odour issues, increased risk of disease in the community and environmental eutrophication. Even a functioning septic tank and overflow effluent field can still contain pathogen and nutrient enrichment risks, albeit significantly less than one in a poor or 'failed' state.

Concentration of nitrogen in septic tank effluent (overflow) water can be up to (and exceed) 40 mg/L (the nitrate-nitrogen national bottom line for rivers is 6.0 mg/L). While the concentration is high, the annual load is generally smaller (due to low volumes), with GWRC (2000) estimating a four person household would produce ~ 8.8 kg N $year^{-1}$. In essence, this could be considered a point source discharge as the leaching is occurring from a small localised effluent field that may be saturated with little attenuation, rather than distributed across a wider paddock (i.e. when considering dairy effluent irrigation or fertiliser spreading).

GWRC (2000) attributed similarities of an effluent field to a stock urine patch, where high nutrient loading can saturate the soil and result in large leaching at specific locations. Leaching rates of 8.8 kg N $year^{-1}$ are less than typical New Zealand sheep and beef farms, which can range from 10–30 kgN ha yr^{-1} depending on local conditions (Journeaux 2019). However, if there are multiple lifestyle blocks or small sections (i.e. five 2000 m^2 properties), nitrogen leaching rates per hectare from poorly maintained septic tanks could infact be higher than that contributed from agriculture.

Poorly treated overflow water can carry significant amounts of pathogens. When an individual is infected with a virus or bacteria (such as Campylobacter), they may excrete between 1,000,000 and 100,000,000 campylobacter per gram of faeces/day (with adult humans producing ~200 grams of faces per day). Subsequently, if this is not settled in the septic tank or anaerobically/aerobically digested through the effluent field and soil filtration, then it's likely to enter a receiving water body at some point, although the decay of these organisms over time and distance can be rapid (Leonard and Gilpin 2006).

An outbreak of Shigellosis occurred in Canterbury in 2004, were 13 cases were identified and linked to contamination of an institution's drinking water source by a break in the line for an on-site wastewater disposal system (Leonard and Gilpin 2006).

While not specifically covered in this document, there are a range of other chemicals which can be attributed to on-site wastewater systems, including soaps and drain cleaners and florescent whitening agents (from washing powders).

5. Assessment of Whaitua Te Whanganui-a-Tara

A localised assessment of the potential numbers and age of septic tanks in the Whaitua, by subcatchment has been detailed in the Nation (2019) report.

6. References

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Ministry for Environment (MFE). 2008. Proposed National Environmental Standard for On-site Wastewater Systems. Publication ME 890. Withdrawn.

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