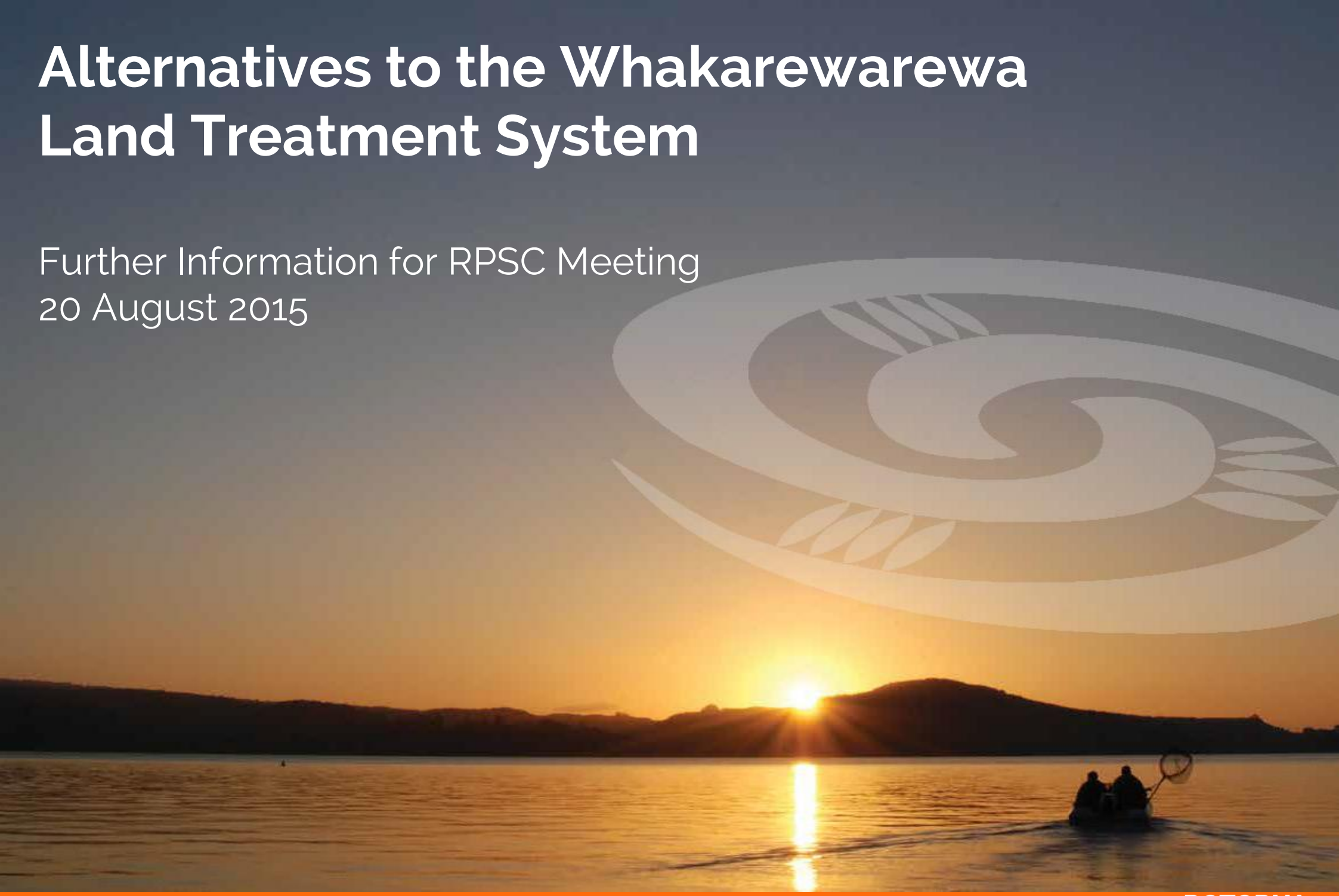
Alternatives to the Whakarewarewa Land Treatment System

Further Information for RPSC Meeting
20 August 2015



ROTORUA
LAKES COUNCIL

Micro-pollutants

Centre for Integrated Biowaste Research

'Organic Materials Guidelines – Organic Contaminants Review

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August 2014

ROTORUA LAKES COUNCIL

CIBR Review - Conclusions

It is not feasible to characterise and regulate all organic compounds when considering land application of organic wastes. Furthermore, even if all compounds were measured, there is still limited knowledge to suitably assess the risks of EOCs on the receiving ecosystems and human health (Tremblay et al. 2013).

Based on local and international literature, EOCs classes should include:

- endocrine disruptors (e.g. nonylphenols and steroid hormones),
- flame retardants (e.g. HBCD and selected PDBEs),
- antimicrobial agents (e.g. triclosan and ciprofloxacin)
- pharmaceuticals (e.g. carbamazepine , diclofenac);
- persistent herbicides (e.g. clopyralid);
- cleaning agent (LAS);

Cawthron Report EDC's, June 2013

CAWTHRON INSTITUTE

REPORT NO. 2363

ANALYSIS OF HORMONAL ACTIVITY AND SELECTED ENDOCRINE DISRUPTING CHEMICALS IN ROTORUA DISTRICT COUNCIL SEWAGE TREATMENT PLANT WASTEWATER AND STREAM WATER SAMPLES

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- Endocrine Disrupting Chemicals: at certain doses can interfere with hormone system in mammals
- In the environment may be related to reproductive and infertility problems
- There are many international and some NZ studies on removal of EDC's and micro-pollutants in wastewater treatment processes.
- NZ studies show secondary treatment plants remove up to 99% of estrogenic and androgenic products from the wastewater.
- RDC contracted Cawthron to determine levels in RDCs treated wastewater

Cawthron Report Conclusions

IF treated wastewater was to enter Puarenga Stream or Lake Rotorua:

- EDC concentrations would be **below the PNEC** (Europeans Union's 'Predicted No Effect Concentration's) for aquatic organisms.
- Overall conclusion - the **risk** of RDC treated wastewater causing endocrine disruption within potential receiving waters is **negligible**.

Moving Forward?

- Add a Consent conditions requiring monitoring on a 5-yearly basis?
- Include monitoring of recommended micro-pollutants based on the most up-to-date CIBR and Cawthron recommendations?
- Set trigger levels for action?

Post-meeting note – discussion followed and the suggestion was to do a suite of tests in year 1 (following the upgrade) as an initial baseline level for the process, and then 5-yearly after that. Trigger levels would also be reviewed and updated appropriately, and would initiate a cascade of actions including further testing, identify source, including add-on treatments if/when required

Public Health

Pathogens

What are pathogens?

Pathogens are microscopic organisms that cause disease in humans and animals. There are many different kinds. Some of the more widely known are Campylobacter, Salmonella, Giardia, Cryptosporidium, and viruses that cause diarrhoea and cold and flu-like symptoms. These pathogens are present in faeces and may enter our waterways through untreated sewage discharges, and from leaky sewerage pipes, septic tanks, stormwater and rural run-off.

- Pathogens are present in the environment.
- Levels are higher during rainfall events when run-off into surface water occurs
- Toi Te Ora states “As a public health precaution, it is routinely recommended that people avoid swimming in rivers, streams and harbour areas for 48 hours after heavy rainfall events”.

E. Coli – Indicator of Pathogens

What are councils doing?

Councils around the country monitor water quality to minimise the risk to public health. They do this by measuring the number of enterococci (indicator bacteria) in our water. They do not measure pathogens directly because the science to do this cost effectively and reliably isn't yet available.

What are indicator bacteria?

In the case of the recreational water-quality guidelines, the indicator bacteria are enterococci for marine waters and E. coli for freshwaters. These bacteria occur naturally in the gut of humans and animals, including mammals, birds, fish and reptiles. The indicator bacteria themselves do not pose a significant risk to human health. Rather, they indicate the presence of faecal material, which contains disease-causing pathogens. It is the number of enterococci or E. coli per 100 mL of water that is measured and on which the guideline levels are based.

Discharge Consents

‘Acceptable’ and unacceptable levels of risk are considered based on guidelines and the discharge environment

Treatment plants Consents can have conditions around:

- Achieving median (50%), 95%, maximum E coli levels in the discharge
- Specifying a UV dose that relates to above (Mangere, Whangarei)
- Specifying transmissivity levels (clarity of the water before UV treatment)
- Trigger levels on transmissivity, turbidity – eg above the levels the water is diverted for discharge to land, or stored and retreated later

NPS River Ecosystem Health Attributes

E Coli < 260
50%

E Coli 260-540

E Coli > 540

A	≤ 260	Annual median	People are exposed to a very low risk of infection (less than 0.1% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating).
		95th percentile	People are exposed to a low risk of infection (up to 1% risk) when undertaking activities likely to involve full immersion.
B	> 260 ≤ 540	Annual median	People are exposed to a low risk of infection (less than 1% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating).
		95th percentile	People are exposed to a moderate risk of infection (less than 5% risk) when undertaking activities likely to involve full immersion. 540 / 100 mL is the minimum acceptable state for activities likely to involve full immersion.
C	> 540 ≤ 1000	Annual median	People are exposed to a moderate risk of infection (less than 5% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating). People are exposed to a high risk of infection (greater than 5% risk) from contact with water during activities likely to involve immersion
National Bottom Line	1000	Annual median	
D	> 1000	Annual median	People are exposed to a high risk of infection (greater than 5% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating).

River Ecosystem Health
50% samples < 260 - Very low risk with occasional immersion & some ingestion
95% samples < 260 - Low risk with full immersion

Public Health Guidelines - Contact Risk

What does 'risk' mean?

The risk is of getting sick when swimming, surfing or otherwise being exposed to freshwater or seawater. The guidelines that New Zealand councils use are based on fixed levels of risk, which in turn are based on overseas guidelines (which have been confirmed by New Zealand studies). Overseas investigations have settled on a maximum acceptable level of risk for marine waters of 19 in every 1000 bathers contracting an illness. For freshwaters the accepted level of risk is 8 in every 1000 bathers contracting an illness.

E Coli < 260
(all samples)

E Coli 260-550
Investigate and locate

E Coli > 550
notify

Box 2: Surveillance, alert and action levels for freshwater

Acceptable/Green Mode: No single sample greater than 260 E. coli/100 mL.

- Continue routine (e.g. weekly) monitoring.

Alert/Amber Mode: Single sample greater than 260 E. coli/100 mL.

- Increase sampling to daily (initial samples will be used to confirm if a problem exists).
- Consult the CAC to assist in identifying possible location of sources of faecal contamination.
- Undertake a sanitary survey, and report on sources of contamination.

Action/Red Mode: Single sample greater than 550 E. coli/100 mL.

- Increase sampling to daily (initial samples will be used to confirm if a problem exists).
- Consult the CAC to assist in identifying possible location of sources of faecal contamination.
- Undertake a sanitary survey, and report on sources of contamination.
- Erect warning signs.
- Inform public through the media that a public health problem exists.

E. Coli in our environment

	Minimum Maximum	Median (50% level)	Action
Raw Sewage & septic tank effluent (approximate)	5,000,000 15,000,000	10,000,000	Non-contact Reticulate & treat
Current WWTP discharge to LTS (2009-2015)	200 65,000	1,600	Signs Non-contact
Waipa Stream M11 unirrigated	1 53	15	
Waipa Stream lower M5 below LTS and Mill, 2010-2014	19 260	80	Monitor
Puarenga Stream	9 870	77	Monitor
Lake Rotorua (Holdens Bay)	0.5 480	7	Monitor

Our discharge environment
50% samples < 80
100% samples < 260

E coli – Guidelines Summary

RPS River Ecosystem Health
50% samples < 260 - Very low risk with occasional immersion & some ingestion
95% samples < 260 - Low risk with full immersion

Public Health
100% samples < 260
Monitoring, action, notification

Current Streams discharge environment
(achieves public health guidelines for contact risk)
50% samples < 80
100% samples < 260

WWTP and Upgrades

Current Wastewater Treatment Process

- Main mechanism for pathogen kill is 3000-fold reduction in E coli through WWTP process
- Additional pathogen die-off in the natural environment after irrigation
- Additional pathogen die-off in the soil

WWTP and Upgrades

Upgrade Option – Sand filter

- Main mechanism for pathogen kill is 3000-fold reduction in E coli through WWTP process
- Sand filtration removes particulate material down to 3 mg/l suspended solids, which allows for very effective UV treatment (does not filter pathogens)
- Sandfilter struggles if solids entering are too high. It backwashes, adding extra load to the WWTP. Backwashing will continue to occur until after the solids entering the filter have reduced.
- An extended backwash/recovery period is likely to coincide with an extreme storm event adding to the risk of exceeding onsite storage capacity (storage allows for the water to be retreated). If storage is exceeded, filtration would be bypassed and UV effectiveness reduced.
- UV light treatment disinfects the water, providing an effective barrier against pathogens (unless the sand filter is bypassed during extreme flows).

WWTP and Upgrades

Upgrade – Membrane Filters

- Main mechanism for pathogen kill is 3000-fold reduction in E coli through WWTP process
- Membranes remove all particulate material, which allows for very effective and efficient UV treatment and in provides an additional physical barrier (prevents bacteria and all but the very small viruses passing through).
- UV light treatment disinfects the water providing an effective barrier against pathogens.

E coli after wastewater treatment

Current WWTP and LTS (post-LTS)

- 50% < 80 and 99% < 260
- Some risk of exceeding 260 associated with extreme wet weather events

Sand filtration / UV

- Single barrier to pathogens
- 50% < 80 and 99% <260, potentially similar to discharge environment
- Some risk of exceeding 260 associated with extreme wet weather events

Membrane filtration / UV

- Double barrier to pathogens
- 99% < 80 and 100% < 260, significantly lower than the discharge environment
- No samples exceeding 260

Comments:
MBR E coli median = 1 (limit of detection)
260 Could be a trigger level