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NO PLAN 'B' – TREE IRRIGATION – RISKS

- **Native tree irrigation model sensitive to assumptions – high risk.**

  - Should any of these assumptions prove incorrect then the storage and land irrigation areas will be too small – anticipated level of nutrient leaching for the Inner Bays options could be as high as that of a dairy farm.

  - Council left with a costly system not performing to design, and is potentially exposed to enforcement action/reputational harm.

- **Water quality consenting risks under the LWRP**

  - Bundled activities require consent for **non-complying** activity (under regional plans);

  - **No discretion** to grant consent if any potential effects are more than minor and proposal is contrary to relevant plan objectives and policies.

  - S3 RMA definition of 'effect' includes any potential effect of low probability (loosely, as in plausibility)[1] which has a **high potential impact**.

  - Modelling risks identified by FOBP will have to be robustly assessed and accounted for in an effects assessment.

  - Sch 4, Cl 6 RMA – an assessment of the activity's effects on the environment **must** include:

    (d) if it is likely that the activity will result in any **significant adverse effect** on the environment, a description of any **possible alternative locations or methods for** undertaking the activity;

    (e) a description of the mitigation measures (**including safeguards and contingency plans** where relevant) to be undertaken to help prevent or reduce the actual or potential effect.

- **The Council has no safeguard or contingency plan if modelling risks (any one of them) are realised.**

- **Only high level planning/effects assessment undertaken thus far.**

  - Further due diligence of land based options (and all environmental effects) is required.

[1] *Shirley Primary School v Christchurch CC* [1999] NZRMA 66 (EnvC)

- **Effects to be considered through the LWRP 'policy' lens**

  - LWRP policies 4.13 and 4.14 – focus is on:

    - "reuse, recovers or recycles"; "minimise the volume or amount"; (Policy 4.13)

    - "not exceed the natural capacity of the soil to treat or remove the contaminant"; "not exceed available water storage capacity of the soil". (Policy 4.14)

  - Land based options involve disposal and not reuse; a need is being created (at significant cost) where that doesn't presently exist – pre-existing needs of the Akaroa community (for water) not met.

HARBOUR OUTFALL SHOULD NOT BE RULED OUT

- **Land based disposal previously rejected by the Council as feasible alternatives to harbour outfall**

  - The 2010 Harrison Grierson report recommended irrigation (of dry weather flows only) to the South of Akaroa, with a harbour outfall during winter.[2]

  - Irrigation then not considered feasible during wet weather events because:

    > Since the soil in the area is slow draining and the hydraulic capacity will be greatly reduced during wet weather events, the required irrigation area or storage volume would be very large and uneconomic.[3]

- **Council's consideration of alternatives rejected by Commissioner in 2015:**

  > … we can observe that within a radius of the WWTP the same as the length of the proposed outfall pipe (3.7 kilometres) there are over two thousand hectares of land. Until a wider investigation is undertaken it cannot be said that land disposal has been investigated and is not feasible or economic. Options might include buying a farm, installing a low density effluent disposal system over a large area, and re-selling the farm with appropriate easements and caveats.

- **Despite Commissioners' optimism, wider (extensive) investigations have resulted in the identification of few additional sites and none of the options are feasible, economic or produce sustainable outcome for the communities of interest.**

- **NZCPS Policy 23(2)**

  - States:

    > In managing the discharge of human sewage, do not allow:
    >
    > a) discharge of human sewage directly to water in the coastal environment **without treatment**; and

[2] This was subsequently ruled out after objection by Onuku/Ngai Tahu.

[3] para 234 Commissioners' Decision 2015, citing passage from the "Wastewater Options and Risk Analysis Report" February 2010, page 26

b) the discharge of treated human sewage to water in the coastal environment, unless:

i) there has been **adequate consideration of alternative methods, sites and route for undertaking the discharge**; and

ii) informed by an understanding of **tangata whenua values and the effects on them**.

(emphasis added)

- As to this policy:

> This is a clear direction that discharge of human waste into the CMA is appropriate only where there has been adequate consideration of alternatives, and by implication there are reasons for those alternatives being rejected. As discussed above under the heading of Consideration of Alternatives, we are not satisfied that the alternative of land disposal has been adequately assessed, so we consider the proposal is contrary to this policy.[4]

- That wider investigation has now been carried out; FOBP contends that the land disposal options considered are still not feasible or economic and ought to be rejected

- If FOBP recycle and reuse solution not possible due to (present) lack of a regulatory framework, a Harbour outfall option ought to be considered; either on a short term basis or as a longer term solution.

- A Harbour outfall is consentable as sustainable management under the RMA provided cultural concerns are addressed and the land-based options have been adequately investigated and reasonably discounted.

- In order to address cultural concerns, the treated effluent from the proposed WWTP must first pass through land in order to achieve consistency with relevant RMA instruments, including the NZCPS:

> If it then filters through to some sort of wetland draining into a watercourse and then to the harbour, the cultural concern would still be met.[5]

[4] para 257 Commissioners Decision 2015
[5] para 237 Commissioners' Decision 2015

MEMO

TO	FRIENDS OF BANKS PENINSULA INCORPORATED
FROM	TEKTUS CONSULTANTS LIMITED, JACK TURNER & EMILY AFOA
SUBJECT	AKAROA WASTEWATER • HEARING RESPONSE
DATE	15 October 2020

1 Introduction and Scope

1.1 This memo affirms our support of the Friends of Bank Peninsula (FOBP) submission, provides high-level comments regarding the government direction for water management, and responds directly to the query raised by the Hearing Panel.

2 Affirmation

2.1 Inflow and Infiltration (I&I)

a. We support the criticality of I&I improvements for any disposal solution.
b. The 60% current rate of I&I is high and a problem that arguably needs fixing now, independent of new treatment/disposal methods.
c. The baseline 20% target resulting from a partial fix is insufficient relative to WaterNZ guideline values[1].
d. Setting such a low benchmark for the I&I improvements and designing the treatment/disposal solution on that basis is a central shortcoming of the current proposal.
e. Climate change will further exacerbate the I&I problem.
f. Instead, we consider it more appropriate to target a best practice level of I&I and commit to implementing remedial network solutions to achieve that.

2.2 **We consider the 20% target I&I reduction (and resulting 55% I&I rate to the wastewater treatment plant) is an unreasonable baseline from which to approach the treatment discharge/disposal design on – as is currently the case.** Questions remain on the resilience of the existing network to future conditions, and combined with the evidential poor condition relative to significant I&I rates (particularly groundwater), alternative network solutions should be carefully considered at this point, rather than overdesigning the treatment/disposal system.

2.3 Staged Approach

a. **We support a staged approach to the disposal solution as proposed by FOBP, in that it provides further time to validate solutions used internationally and to allow legislation to enable it.**
b. FOBP proposed Stage 2 represents a significant improvement on the existing conditions and wastewater scenario in terms of water quality, connectivity with the land and Papatūānuku, and a volume loss from the purple pipe system. As above, Stage 2 provides a functional solution to allow opportunity to progress options for Stage 3, and for technology and legislation to catch up with many of the community's ultimate aspirations to use recycled wastewater.
c. Stage 3 represents a further improvement on the outcomes associated with Stage 2, with multiple reuse options via purple pipe, stream recharge (downstream of water takes), and/or Managed Aquifer Recharge (MAR). We are of the understanding that this solution can be completed under current legislation,

[1] WaterNZ guideline Infiltration & Inflow Control Manual, 2015 - https://www.waternz.org.nz/Folder?Action=View%20File&Folder_id=394&File=II%20Manual%20Volume%201.pdf

therefore Stage 3 provides the flexibility to be a long term and effective solution irrespective of legislative changes regarding recycled wastewater.

d. There remains opportunity with potentially substantial and broad-ranging benefits from MAR – subject to water quality control and collaboration to meet cultural objectives. Both Deep Bore Injection (DBI) and MAR have been discounted as discharge/disposal mechanisms in the Akaroa context. However, in our view, legitimate potential remains for further consideration of these options to resolve a future-resilient water management regime. There is real potential for DBI and/or MAR to provide cost-effective options to manage residual disposal needs while building up toward maximum re-use without direct discharge to surface-level water bodies.
e. We support the option of Reverse Osmosis (RO) as a feasible solution to minimise risk of cross-contamination of water supplies with either stream recharge or MAR options, potentially supported by disinfection (such as UV).
f. As of 2020, there remains a greater barrier to the implementation of Stage 4, particularly with a short residence time between the stream recharge and water take / recovery. Again, MAR would improve this with a greater residence time, in-line with overseas examples.
g. Stage 4 represents an aspirational and appropriate target given the risk to water supply in the face of climate change; and one which would be short-sighted to negate at this time.

3 State of the Industry

3.1 Water resources in Akaroa are limited, and peak summer demand is typically coincident with large numbers of seasonal visitors. As a result, water restrictions are relatively common – with Feb-Mar 2020[2] a more severe, and recent, example. *Climate change projections for the Canterbury Region* (NIWA, 2020)[3] identify a range of changing climate parameters, the combined effect of which, particularly for summer, is reduced surface and ground water quantity available for supply and an increase in seasonal demand. Furthermore, low lying infrastructure is at risk of inundation by rising sea level and groundwater levels – including storm surge, coastal inundation coastal and erosion (MfE, 2017)[4]. New Zealand's first national climate change risk assessment – the newly-released *National Climate Change Risk Assessment for New Zealand – Arotakenga Tūraru mō te Huringa Āhuarangi o Aotearoa* (MfE, 2020)[5] identifies: "Risk to potable water supplies (availability and quality) due to changes in rainfall, temperature, drought, extreme weather events and ongoing sea-level rise" as an extreme risk, and in New Zealand's top ten most significant climate change risks based on consequence and urgency.

3.2 The *Water Services Regulator Bill – Taumata Arowai*, enacted Aug-20, implements the Government's decision to create a new regulatory body to administer and enforce the new drinking water regulatory system, while contributing to improved environmental outcomes from wastewater and stormwater networks. A complementary Bill, the *Water Services Bill*, introduced Jul-20, is intended to give effect to Cabinet's decisions on reforming the drinking water regulatory framework, and Taumata Arowai's new wastewater and stormwater monitoring functions. The *Water Services Bill* comprises a significant part of the Government's response to the Havelock North Drinking Water Inquiry which found the contamination was a result of systemic failure across service provision, regulation, and source protection (noting all aspects of the system were implicated). With significant change in the Water Industry, this poses opportunity for considerable reform from continuing the

[2] https://newsline.ccc.govt.nz/news/story/level-4-water-restrictions-for-parts-of-banks-peninsula
[3] https://www.ecan.govt.nz/your-region/your-environment/climate-change/climate-change-in-canterbury/climate-change-projections-for-canterbury/
[4] https://www.mfe.govt.nz/sites/default/files/media/Climate Change/adapting-to-climate-change-stocktake-tag-report.pdf
[5] https://www.mfe.govt.nz/climate-change/assessing-climate-change-risk

status quo and is likely to bring comprehensive oversight and greater consistency, particularly in our collective transition to climate risk adaptation.

3.3 There is currently no regulatory framework for the reuse/recycling of treated wastewater in New Zealand. Careful consideration of all regulatory aspects including, for example, the Building Act, Health Act (drinking water supplies), and Resource Management Act, is required to ensure appropriate risk prevention mechanisms, monitoring and compliance programs, and/or verification systems are implemented to effectively manage public health risk. Given availability and quality of potable water supplies are identified as a national risk due to climate change, this is likely to be a task tackled by Taumata Arowai.

3.4 Australian Guidelines for Water Recycling[6] provide relevant guidance in response to increasing climate variability and population levels leading to serious water shortages across many areas of Australia. There, alternative sources of water are becoming more important as water restrictions become more widespread. Two areas are addressed – augmentation of drinking water supplies and managed aquifer recharge. Both methods are a form of indirect augmentation – similarly utilised in Singapore, the United Kingdom, and the United States of America – whereby highly treated recycled water is discharged into a receiving body such as a river, stream, reservoir or aquifer (through indirect injection or soil aquifer percolation), before re-treatment and subsequent supply as drinking water. This allows for additional time, additional treatment, and dilution. Detention time, the time between augmenting the water supply and extracting (blended/diluted) recycled water for reuse, is a key parameter enabling operators and regulators to assess recycled water treatment and recycled water quality and, where necessary, to intervene before water is supplied to consumers.

3.5 We understand from industry peers that Auckland's Watercare Services Limited is increasingly aware of the potential benefits of wastewater reuse:

a. Opportunities for wastewater reuse have always been considered. Strategically, the desire is to move towards reuse. The lack of legislation has definitely been a roadblock, but regardless, Watercare have investigated reuse and set strategic direction such that any actions taken today are compatible with enabling reuse.
b. Further, the current Central Interceptor (CI) project in Auckland is an example of the movement toward enabling reuse. Notes from a recent Watercare public board meeting (28 April 2020)[7] highlighted that:
    i. The **Māngere Recycled Water Plant (RWP)** was proposed to produce drinking water quality recycled water from the Māngere Wastewater Treatment Plant (WWTP) to replace the use of potable water supply, and has the additional benefit of being able to demonstrate the benefits of wastewater reuse and its potential applicability to Watercare integrating this into its water supply system.
    ii. **Effluent from Māngere WWTP will be treated via ultrafiltration, Reverse Osmosis, Hydrogen peroxide /Ultraviolet light disinfection and Chlorination**. The RWP has a capacity of 1MLD and will be used as construction water for the CI project whilst tunnelling operations are in place at Māngere.
    iii. The process flow for Māngere RWP has been selected by considering the experience of various operational recycled water schemes in Australia, U.S. EPA guidelines and WHO guidelines.

3.6 Overall, this is an ever evolving and exciting area with wide-reaching implications across our existing social fabric. **Opportunities for forward-thinking and future-proofed solutions are often inter- if not multi-generational, responding to the understanding and perspective of that time, and Akaroa's overall water management regime is now at that juncture.**

[6] https://www.waterquality.gov.au/guidelines/recycled-water

[7] https://wslpwstoreprd.blob.core.windows.net/kentico-media-libraries-prod/watercarepublicweb/media/watercare-media-library/board-meetings/board_meeting_board_papers_28_april_2020.pdf

4 Specific Query

4.1 The following query has been raised in response to the FOBP presentation of their submission to the Hearing Panel (note we have refined the wording as follows based on our understanding of the request):

Can you request an update from Tektus on the Ministry of Health (MOH) progress on regulation changes regarding reuse of treated wastewater?

4.2 In response, we note the following:

a. We understand the MOH has not yet evolved their position in respect of treated wastewater reuse beyond traditional '*collection and safe disposal of sewage effluent*'. However, its position in this area, including the relationship to drinking-water supplies, is specifically linked to the Three Waters review of 2019, which led to the Taumata Arowai – Water Services Regulator Act passed in July 2020.

b. Taumata Arowai will not become fully operational until enactment of the Water Services Bill, projected to occur in the second half of 2021. Until then, MOH will remain the regulator for drinking water safety. It is unlikely that the MOH will change course in the interim in respect of reuse, ahead of Taumata Arowai.

c. Based on the Taumata Arowai – Water Services Regulator Act (2020) itself, we note that the stated functions of the new national-level entity include:

> *Section 11 Functions of Taumata Arowai*
> *(a) provide national-level oversight, leadership, communication, and co-ordination in relation to—*
> *(i) drinking water safety and regulation, including the management of risks to sources of drinking water; and*
> *(ii) the environmental performance, management, and regulation of wastewater and stormwater networks; and*
> *(b) identify and monitor matters that affect the safety of drinking water, and the environmental performance of wastewater and stormwater networks, including current and emerging contaminants;*

d. It is likely that treated wastewater reuse will be a focus for Taumata Arowai once operational, particularly in the context of an increasingly uncertain and changing climate. Overseas experience suggests this form of water supply augmentation will become a reality here as well in time.

Yours sincerely,

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Date: 9 October 2020

To: Friends of Banks Peninsula

Duvauchelle Wastewater tree trial

Comments by freelance ecologist Geoff Walls, Taramoa Ltd, Christchurch
9 October 2020

I was asked to give an independent assessment of the wastewater tree trial for Friends of Banks Peninsula, as a matter of urgency. I visited the site on 8 October 2020 and my assessment follows. I am not expert in soil science or hydrology, but I have much experience in wetland ecology, wetland restoration, native plants, restoration planting and field assessment of the significance, condition and trend of native vegetation.

Experimental design
I was amazed by the design, which does not give any of the planted squares independence or sufficient size. Almost all squares are subject to edge effects (of four different aspects), crowding, shading and root competition from the adjacent squares. The very high planting density does not allow individual plants to exhibit their natural growth characteristics. The slope of the site probably means that all squares except the uppermost row are subject to the wastewater. So there are no true controls. The trial is therefore scientifically invalid and only able to be interpreted very crudely.

Choice of plants
The plants are a mix of wetland plants (harakeke/lowland flax and cabbage tree), terrestrial plants (totara, kanuka, akiraho, five-finger, tarata/lemonwood, whararikiki/coastal flax and kapuka/broadleaf) and those that can tolerate a broad spectrum of soil moisture (karamu, karamu-mingimingi hybrids, cabbage tree and manuka). That's more or less appropriate for the trial, which has an emphasis on trees, but their intense intermingling masks their observable response to the wastewater and their very different forms, habitat preferences and natural growth rates greatly compounds the dysfunction and confusion of the trial. Wastewater treatments on land in New Zealand and other countries are

usually in the form of constructed or natural wetlands with dense beds of reed-like plants (rushes, sedges, reeds, raupo, harakeke, toetoe and the like).

Condition of plants

At least half of the plants looked ill and unthrifty, regardless of plot setup. Manuka had mostly died, as had quite a lot of kanuka. Many of the kanuka, akiraho, tarata/lemonwood, kapuka/broadleaf and karamu looked poisoned, as though they had been sprayed with herbicide. The wastewater probably contains numerous chemicals toxic to native plants that are used in the home and by industries and get flushed into the sewerage system. So the apparent poisoning is not unexpected.

Much of the totara was suppressed by high densities of taller faster-growing plants, clearly struggling for light, space and normal soil nutrients. Where the competition was less and the soil not soggy with wastewater, totara looked healthy and vigorous.

Harakeke and cabbage trees were mostly thriving. That suggests that the trial site has become more wetland than terrestrial, and that the specialist wetland plants are better able to make use of the nutrients and moisture from the wastewater and less affected by the toxins.

The growth rates may have appeared spectacular then. Now they look at best normal for a damp fertile coastal site on Banks Peninsula, and at worst either grossly inflated or barely progressing.

Success or failure?

The trial was set up and planted in June 2015, so is just over five years in duration. The researchers' final report (June 2017) was only for the first two years, and the trial was deemed a success. Three years on, my assessment is that the trial demonstrates that the wastewater may have conferred initial benefits but that a mere three more years of wastewater delivery has seriously damaged the plants throughout the site.

The resulting vegetation from the outside and at the higher end looks pretty good. But inside it is far from well. Overall, the vegetation resulting from the trial neither normal restored terrestrial native forest nor normal native wetland vegetation. It is an ecological mess and ecologically sick. It smells bad, of death and decay, from too much toxic wastewater for too long. My judgement of the trial is that it is a failure. Not a complete failure, because important things have been made clear. But there are no grounds for promotion of the trial as a model of successful restoration of native vegetation using wastewater; quite the contrary.

Suggestions

If the local authority is determined to continue disposing of wastewater on Banks Peninsula land, it should consult the experts. There are numerous functional systems in New Zealand, both on private land and land manged by local authorities. There are professional companies who specialise in this field and there are clear guidelines available from the Ministry for the Environment.

If more trials are contemplated, it is recommended that they are properly designed constructed wetlands using wetland plants. Native plants that could be used include harakeke, cabbage tree, toetoe, mingimingi (*Coprosma propinqua*), kahikatea, swamp maire, pukatea, raupo and numerous sedges and rushes. The margins could be planted with kowhai, manuka, manatu/lowland ribbonwood and houhere (lacebarks). Otherwise, willows could be used. They are quick-growing and could be high-turnover. They would have to be well contained because of their rampant weed potential.

It might be worthwhile experimenting with plantations of our best native timber trees, such as totara, matai, silver pine, rimu, beeches, kowhai, rewarewa, puriri, tanekaha, Chatham Island akeake and manatu/lowland ribbonwood. They might respond positively to small infrequent applications of wastewater.

Duvauchelle Wastewater Tree Trial: Photos by Geoff Walls, 8 October 2020

From the outside the plants look quite good and the trial therefore a success.

However, all is not well within: karamu is grossly misshapen, pathologically too dense and slumping through weakness.

Broadleaf is deformed and dying, due to toxins, unhealthy soil and a regime of nutrients and soil moisture that it cannot handle.

Most of the original planted manuka has either died or is ailing, with such heavy loads of sooty mould that photosynthesis is almost impossible for them. None of the kanuka look very well, although more have survived so far. That harakeke and cabbage tree are in better condition indicates that the site has become a wetland due to the wastewater input.

Many of the trial kanuka have contorted branchlets and dysfunctional growing tips. This sort of thing happens with sublethal herbicide exposure, but in this situation the toxins are probably water-borne not air-borne.