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Attention: Darren de Klerk

Dear Darren

Otane WW Scheme Tipping Point Assessment - Treatment

A comparison of capital costs and present values of the two key options has identified that 'Transfer to and Treat at' Waipawa is the option preferred for long term management of wastewater from Otane. The following work describes the assessment and the outputs from it.

1 Introduction

As a result of having to address long term capability issues with its wastewater treatment plants (WWTPs) and address regional pressure and community aspirations to cease wastewater discharges to surface waters, Central Hawkes Bay District Council (CHBDC) has developed a conceptual scheme for, ultimately amalgamating wastewater treatment for the towns of Otane, Waipawa and Waipukurau and discharging the treated effluent to land via rapid infiltration or beneficial land application or various combinations of both methods. It is envisaged that wastewater treatment would be centralised at Waipawa, where there is land available and where there is access to nearby land which is suitable for rapid infiltration (RI) disposal.

The distances between the towns are significant, 9km from Otane WWTP to Waipawa WWTP and around 6.5km from Waipukurau WWTP to Waipawa WWTP. The costs of transfer infrastructure between the sites (pipes and pumps) are therefore also significant. CHBDC is in the process of installing a new potable water pipeline between Waipawa and Otane. This has presented an opportunity to install a considerable proportion of the Otane to Waipawa WW transfer pipe under the same contract (same alignment) at reasonably competitive rate. However, the check needs to be done that the whole of life cost of the transfer option does not exceed the equivalent cost to build a new WWTP at Otane and provide a local land disposal scheme. Further, a condition of consent (Condition 3) of the existing Otane WWTP discharge consent requires a major upgrade of the plant to be in place by March 2021.

This memorandum summarises the work done to make the necessary financial check as to whether the option to transfer Otane WW to Waipawa, and treating it there, is the appropriate one.

2 Prior Procurement Process

In 2018, CHBDC entered into a procurement process for a treatment plant upgrade for Otane WWTP. A new discharge consent was also obtained through to 2042. The primary focii of the new consent and upgrade were to address solids discharge (via a lamella clarifier), phosphorus (via chemical dosing) and e.coli (via solids removal and UV disinfection). The new consent is reasonably permissive in terms of ammonia and hence total nitrogen. However, it does impose an ammonia-N limit. The upgrades proposed, therefore, had no regard for nitrogen removal. Further, the upgrade and consent were both based on a continued, long term discharge to water. Thus, if the ammonia removal performance was to deteriorate significantly over the years (due to increased plant loading on the still used oxidation ponds), there would be no plant basis from which to mount an improvement programme if required.

The proposed and tendered upgrade of alum dosing, Lamella clarifier, filter and UV disinfection with Geobags for sludge dewatering would not be futured proofed against consent changes or community aspirational changes. That is, these are tertiary process which simply act by 'polishing' the basic secondary effluent produced by the treatment plant (which was proposed to remain as the oxidation pond system.

The tenders received ranged from $1.2 to $1.7M for the upgrades including civil, process, mechanical and electrical works. After evaluation, the low prices were corrected to approximately $1.5M. We note that the tenderer with the lowest submitted price (before price adjustments) was in liquidation (from 22 July 2018) during the tender evaluation process. This does not seem to have come out in the evaluation process.

Further, it has (since early 2017 in NZ) been becoming increasingly clear that Lamella clarifiers (both standard and ballasted) are an unreliable means of clarifying wastewater effluent. This appears (not yet confirmed) to be related to two factors which enhance each other. That is the wastewater solids (particularly algal solids), are almost entirely organic in nature and are neutrally, or even slightly positively buoyant. So, their natural tendency is not to settle rapidly as is required by a lamella. The addition of alum as a flocculant only partially overcomes this. Secondly biochemical reactions continue in and around the biological solids, causing gas bubbles to be released (these could be various combinations of O_2, CO_2, and CH_4). The gas bubbles adhere to the comparatively light weight flocs which then rise to the surface, further aided by the upward velocity of the flow through the lamella. Therefore, a lamella clarifier, as proposed, would likely not have been successful at removing the algal solids sufficiently to provide for TSS, and disinfection compliance. Similar cases are found locally with conventional Lamella clarifiers at Waipawa, Waipukurau, Pahiatua, Woodville and Taihape. Ballasted Lamella clarifiers at Ngaruawahia and Gore have also struggled for consistency of performance although these latter cases may also be partly due to the increased complexity of managing the operation.

3 Alternatives evaluated

Two basic schemes have been considered for the long term management of the Otane wastewater. Brief descriptions are provided in the following two sections. Various assumptions have been made in comparing the whole of life costs of the two schemes and these are also described below.

3.1 Transfer to and Treatment at Waipawa

Description

The first alternative for Otane wastewater is to pump all of the flow to Waipawa, treat it there and discharge the treated effluent (via either land disposal or land application) to land as part of an amalgamated northern CHBDC WW scheme. The reasons for considering an option such as this include:

- Because of 'scale', treatment plant build costs, on a per capita basis, are significantly lower for a larger facility i.e Waipawa plus Otane or Waipawa + Waipukurau + Otane.
- Operational resources are concentrated at one location, thereby reducing fixed costs and labour inputs. As these treatment plants transition away from simple oxidation ponds, either by addition of tertiary processes or by replacement with advance secondary systems, the operator input increases rapidly for tasks such as management of chemical systems, cleaning, instrument calibration, sludge management, sampling and reporting.
- The number of discharge consents to be obtained, managed and renewed is reduced. The costs of managing these consents is often independent of the scale of the activity.
- Discharge is more efficiently managed as of a combined irrigation or disposal system and, again, fixed costs are less for one scheme than two

Key components of the scheme option include:

- Existing pond treatment system decommissioned, but only after a new, combined WWTP is built at Waipawa. Ponds used (before and after) to buffer the high peak wet weather flows experienced at Otane.
- Pump station and pipeline to transfer raw sewage flows from Otane WWTP site to the Waipawa WWTP site for treatment
- Early development of a portion of the Walker Rd site for discharge (by Rapid Infiltration) of the Otane WWTP treated effluent prior to the new Waipawa WWTP being built
- Incremental capacity increase requirement to the future new combined WWTP at Waipawa.

Similar schemes to this include:

Town	Population	Receiving Plant	Distance	Status
Arrowtown	2446	Queenstown - Shotover	12km	Operational c15yrs
Jacks Point	1700	Queenstown - Shotover	11km	First stage in build. Later in planning
Luggate	400	Wanaka - Pure	6km	In detailed design
Hawea	2175	Wanaka - Pure	19km	Prelim Design
Omokoroa	3000	Tauranga - Chapel St	21km	Operational c10yrs
Otane	c800		9km	Concept

Assumptions made

- Option 1 is preferred. That is a single pump station, DN200, PN25 pipeline via the railway alignment
- Option described in a Beca letter, to CHBDC, entitled 'Otane to Waipawa Wastewater Rising Main Design – Pump Options Net Present Value Analysis', and dated 13 august 2019.
- Odour management will be required
- The existing Otane WWTP ponds will be decommissioned, sludge removed and reconfigured for wet weather flow buffering. This work is common to a scheme for a new treatment plant on site.
- An additional Capital cost will be incurred in providing for the additional 0.2MLD of treatment at Waipawa. Depending upon the accounting and assessment method used, the assigned cost could vary widely. A very conservative allowance of $1M has been provided as a most likely (based on a pro-rata of 0.2MLD/3.5MLD and $17.5M). However, it is normally a marginal cost that is used. It could be argued that in a 3.5MLD plant, CAPEX is $5M/MLD where-as in a 0.2MLD plant, it is approximately $10M/MLD. So, this number could be as low as $500k (or less) as a marginal cost.
- A proportional additional amount of Rapid Infiltration system will need to be provided for disposal of the additional 0.2MLD, treated through Waipawa WWTP.
- An inflow and infiltration reduction programme will be implemented at Otane to mitigate the present very high wet weather flow peaking experienced there.

3.2 Treatment at Otane

Description

The second alternative for Otane is to continue with standalone treatment at the existing Otane WWTP site.

Considering the progress of time and outcomes of the Reference Group engagement, it has been assumed that the such a scheme will require discharge of the treated effluent to land, even if not immediately. LEI have previously identified that there are unlikely to be opportunities for rapid infiltration disposal nearby to Otane. Therefore, a land irrigation scheme has been assumed. Further, in order to provide a plant that is more 'future proofed' from the perspective of effluent quality requirements being 'ratcheted up'. That is, a more compact, intensive biological treatment process that is capable of:

- fully nitrifying the effluent
- being adjusted to remove additional nitrate
- easily filtered
- producing high quality effluent for disinfection

A range of plant types could have been used but a low energy, rotating biological contactor, with an anaerobic pre-stage was used in this case. As with all cost rates, an allowance was also made for a higher cost option that will contribute to the size of the 95th percentile estimate value. A budget price was received from a supplier that was similar to those tenders received in 2018 but excluding peripheral civil works. Therefore, in the estimate, allowances have been made for those peripheral works. Recent budget estimates for other small, membrane based plants have been similar overall. (NB a second version of the estimate was produced, removing all the peripheral items, to mimic the scope of the 2018 tender. This reduced the overall cost estimate by $1.3M from that reported here).

The pond system would be re-purposed for wet weather flow balancing, as for the pumping option. A sludge removal (from the existing ponds) exercise would be required during the plant build process.

Assumptions made

- 75kVA HV power supply required to site
- Requires a small parcel of additional land adjacent Otane WWTP
- Decommissioning and sludge removal from existing ponds is a common task with the pumping option and has not been costed.
- Site will require access and circulation track development and security fencing.
- Raft style deep gravel foundation improvement has been assumed as site is low lying with high GWL and likely some soils that are poor structurally.
- Small, nitrifying package plant required at the site to treat 200m^3/d ADF (0.2MLD).
- Plant will require screening and disinfection. The disinfection could be provided by a UV irradiation system or via membranes used for the clarification step.
- There are no (pers comms Katie Beecroft, LEI) soils in the vicinity suitable for Rapid Infiltration disposal, therefore.
- Land will need to be purchased and a land application system, with storage, reticulated. This differs from the amalgamated, Waipawa based scheme because there is no RI option available locally and so the option of 'waiting' until synergies between an appropriate farming operation and discharge needs align, does not exist.
- Land purchase area 32ha (double the irrigable area required) price $40,000/ha (range $20k - $60k). The implication is $1.28M as part of the scheme cost summarised below.
- Land application area location 2km (range 1km – 5km)
- Treated effluent storage will be quired at the irrigation site. Most likely, 45 days (9ML), range 30 to 180 days and this depends on the actual soils that can be purchased.

3.3 OPEX

- As a general principal, OPEX which is common to both schemes has been omitted. This means that the NPVs are comparative in nature, rather than being absolute budgets. For example, for a given 0.2MLD, the cost of power to remove screenings, carbon, nitrogen and to disinfect is common to both schemes, as is the power to pump treated effluent away from the treatment plant. Similarly the cost of disposal of biosolids.
- It is reasonable to assume that there is no incremental operator input required for treating an additional 0.2MLD (Otane) in a WWTP with a combined throughput of 3.5MLD (all 3 towns). However, a standalone WWTP for Otane will have a significant OPEX labour input for grounds work, cleaning, calibration, preventative maintenance, sampling, testing, sludge management, consent management and general scheme management.
- Cost of power: $0.15/kW.hr
- Cost of MgOH for Odour suppression: $2/l
- Cost of Operator: $141,000 per FTE per annum grossed up for salary plus overheads.
- The assessed operator and staff input for the pipeline has been 0.2FTE, for the treatment plant 0.5FTE and for the Otane irrigation system, 0.25FTE.
- Biomass produced at both sites will ultimately need to be dewatered and either disposed of at a landfill or reused beneficially. These are regarded as common costs and have not been included.
- It is assumed that Otane will not have its own solids dewatering and loadout system and that sludge produced on site will be partially digested, will be thickened then tankered to Waipawa for dewatering and disposal. The cost per load for a sludge tanker (Septic tanker) has been assumed to be $300 per load. This amounts to approximately $11k/year.
- For maintenance and renewals, 5% (of Civil CAPEX) was allowed for civils, 5% for mechanical and electrical and 20% for instrumentation. This provided an aggregated maintenance and renewals allowance of 3% of total CAPEX per annum for the Otane WWTP. This allowance was also applied to the marginal cost of providing treatment at Waipawa, for the conveyance option.
- A 20% contingency allowance has been applied to calculated OPEX, maintenance and renewals amounts.

3.4 Net Present Value Assessment

- Cost of Capital: 4.5%pa
- Inflation allowance: 2% pa
- Evaluation period: 30 years

4 Results

The following table summarises the outcome of the CAPEX, OPEX and NPV comparisons:

Metric	Treat at Waipawa	Treat at Otane
CAPEX	$7.1M	$10.7M ($8 - $14M)
Annual OPEX & renewals	$0.22M	$0.52M
30 Yr NPV	$11.2M	$19.0M

Key differences between the two schemes are as follows:

Metric	Treat at Waipawa	Treat at Otane

CAPEX	Pipeline & pump Stn Marginal cost of 0.2MLD additional treatment Only small RI required for disposal	Stand-alone WWTP for 0.2MLD Land, storage & irrigation reticulation required for slow rate disposal
OPEX	Minimal additional operator input Low CAPEX for maintenance and depreciation	Considerable operator input Higher CAPEX to maintain and depreciate

Please note that the costs are not absolute and are not bankable. The analyses presented above use the 'Most Likely' cost outcomes from the cost estimating. However, there is never a single answer where cost estimates are concerned and there is always a range within which actual costs could fall.

A reduced version of the 'Treat at Otane' scheme was assessed for Capital cost. Instead, this assumed that the discharge would remain as is, into the farm drain at Drumpeel Rd, thence the Papanui Stream and ultimately the Tukituki River. The most likely cost of this is $6.4M (Likely range $5.3 - $8.0M), some 4.3M less than a land treatment option. This assessment used exactly the same treatment assumptions as the option above, including an ability to remove some nitrogen.

5 Summary and Recommendations

5.1 Summary

Two schemes have been assessed for future management of sewage treatment and discharge from Otane, in Central Hawkes Bay. These included 'standalone' treatment and disposal at Otane and conveyance to Waipawa for co-treatment and disposal with flows from Waipawa and Waipukurau.

Based on the three different financial metrics assessed, CAPEX, OPEX and NPV, the preferred scheme is to convey raw wastewater to Waipawa for treatment there in an upgraded or new facility. Wet weather flows would be buffered at Otane, in the decommissioned ponds. Because of the comparatively large transfer pipeline and small daily flow, septicity and odour will be an issue if left unmitigated.

Timing of implementation of the preferred scheme is not ideal, as follows and some mitigation measures will need to be put in place to allow various scheme components to be implemented and set to work:

- Construction of the rising main pipeline can commence immediately to make use of synergies with the current potable water pipeline construction,
- Pump station construction could follow shortly thereafter, allowing discharge from Otane WWTP, to the Farm drain and Papanui Stream to be ceased within the time frame remaining (31 March 2021) for implementation of Condition 3 of the current discharge consent, namely a fully operational upgrade,
- Completion of the conveyance system could be held until 31 March 2021 (18 months from now)
- However, the treated effluent would need to be transferred to Waipawa for temporary disposal there. The Waipawa consent does not provide for this,
- A (Waipawa discharge) consent change, of limited tenure, would therefore be required for the combined discharge to occur at Waipawa. Such a consent would also need to acknowledge, and provide for, a discharge to the Tukituki River system (via Waipawa River) that is a) to water and b) of a standard that is not as good as will ultimately be required. A financial provision has been made in the assessments for such a 'one off' consent application process,

- Land at Walker Rd has been purchased for the purpose of developing RI beds. Treated effluent conveyed across from Otane, could potentially be bypassed around Waipawa WWTP and sent directly (+ 3km) to Walker Rd. This would require obtaining a consent for discharge onto land at Walker Rd and it would require further capital expenditure for the pipe to Walker Rd and the RI beds themselves.
- Currently approved LTP funding provides for a WWTP upgrade at Otane and not for a conveyance system to Waipawa. Such a change would be material and significant in terms of the Local Government Act.

5.2 Recommendations

It is recommended the scheme is developed for conveyance of raw wastewater from Otane to Waipawa for treatment and disposal and reuse.

To take advantage of favourable contract rates and existing contract overhead costs, a significant proportion of the rising main for the conveyance system could be built now. Design for this has proceeded. The availability of the Walker Rd property provides a choice as to whether the Otane effluent is sent to discharge there (via RI) or with the Waipawa effluent into the Waipawa River. Either way, a consent will be required and, given the 18-month implementation constraint, work will need to be commenced on this promptly.

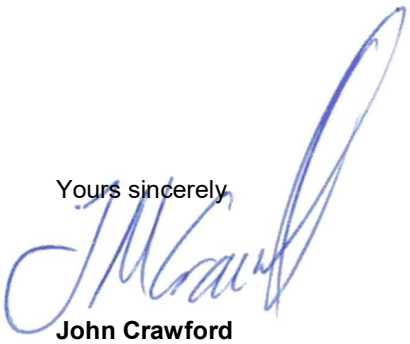
In the bigger picture, the 'major change' to the way Otane does treatment and disposal must be commissioned by the end of March 2021. Thus, because of the time taken to plan, consent, design and procure such infrastructure works, it is necessary to take the decision, in the very short term, as to which scheme Council wishes to implement.

There is consent risk associated with the timing of both schemes. It is likely that a major upgrade of the Otane WWTP could be progressed within the available, 18 month period. However, to do so would likely mean following a non-conventional procurement model which may 'challenge' Council's procurement rules. If the 'transfer and treat' (at Waipawa) option is selected, the consent requirements may be more challenging in the short term but more secure in the long term. The challenge in the short term being how and where the additional discharge will happen at Waipawa and what period of time can be negotiated for this to happen before a major upgrade or rebuild is required to be commissioned.

The benefits of taking a decision for an early start on a transfer pipeline include:

- Attractive contract price is available for laying, at least one third, of the transfer pipeline. More may be possible.
- A decision to proceed with a transfer option will essentially lock in a combined treatment option at Waipawa. This will have short term CAPEX benefits (A full formal rebuild of Otane WWTP will not be needed in the next 18 months), and capital deferral benefits as the long term strategy will not have the Waipawa upgrade happening until about year 5 or later.
- Such a decision will confirm that short term consent work is required at Waipawa. A team can then be assembled to strategize that and develop the necessary applications. Such consents could be:
    - based around an early implementation (opportunity for a full scale trial) of RI for Otane flows at Walker Rd, or
    - an amendment to the existing Waipawa consent to discharge to the Waipawa Rv above the Tukituki confluence. This option may be more challenging (for HBRC) since it is the Waipawa Consent that has been the subject of the recent HBRC legal action against CHBDC.

Yours sincerely



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