1 Background

Westland District Council (WDC) has requested that Opus International Consultants (Opus) prepare a brief memorandum stating why a compact, high rate wastewater treatment process plant, located adjacent the Franz Josef village is currently preferred over continued use of an oxidation pond based system on the Waiho River alluvial fan. And to describe the likely characteristics of a compact WWTP at the site.

2 Scope of Report

This memorandum presents a number of reasons why oxidation pond systems are considered inappropriate for re-establishing a WWTP system for the town and why compact processes are likely to be appropriate and a number of the characteristics of the likely compact processes that are being considered.

3 Oxidation Pond Systems

3.1 Existing Site

The existing Franz Josef WWTP is a 2 cell oxidation pond system with no screening. Floating wetlands were at one time established on portions of both ponds. These had little impact in improving treatment results from the ponds. The wetlands had deteriorated to various extents over the past 2 to 3 years. The ponds discharged into an exfiltration gallery under the Waiho River. This was prone to blockage by River silt and required frequent clearing or repair. The pond discharge was periodically non-compliant for various reasons, frequently the operation (or not as the case may be) of the exfiltration gallery.

In June 2014, Opus prepared a risk assessment report for WDC which predicted that the Franz Josef WWTP would be inundated by the Waiho River within 5 years and that an alternative site would be required. At that time an available site, on higher ground, nearer to the less flood prone and less mobile Tatare River was considered for a new, compact WWTP with a land based disposal system.
In March 2016, over the Easter period, the Franz Josef WWTP was inundated by floodwaters from the Waiho River. Pond 1 was largely filled with Gravel. The Pond 2 embankment was fully breached in one corner. Since that time (now May 2016), the pond system has been partially reinstated so that some rudimentary treatment is provided before discharge to the Waiho River.

### 3.2 The Waiho Delta Area

The large scale geomorphological picture appears to be that the Waiho River is aggrading fast and that the area of its natural delta, particularly below the reasonably well protected highway area will be prone to ongoing meandering of the river bed and unpredictable pathways of higher flood flows.

Thus, establishment of another, pond based, treatment system somewhere on the delta is eventually likely to end in a similar outcome to that which has recently transpired. Unless the system is fully protected by a very robust stop banking system that actually prevents the river moving further north than its present course. WCRC would not fund such protection measures and the cost would have to be met by WDC as part of the pond system development cost. The stop banking could not simply be around the ponds but would have to be extended to be fully contiguous with the highway protection measures. The cost would be considerable.

There has been some discussion that the existing (to be abandoned) Scenic Circle Hotel site could be made available for establishment of a new, oxidation pond based, treatment system. That site is immediately Northwest of state highway 6 (SH6). As a new, pond based system would be significantly larger than the existing (under sized) system, a full revetment and armouring system some 700m long would be required, wrapping around the pond system and back to SH6. The likely cost of such revetment would be of the order of $2M based on the unit rate of previous such work in the area. WRC would not fund flood protection works. This would have to be fully funded by WDC.

Further, building at that location would put the ponds well within what would normally be considered an acceptable pond system buffer distance. As development to the East of SH6 progresses, this would likely result in odour issues being experienced as there is little that can be done to stop these on a large scale site once they become established. Please refer to section 3.3 below.

### 3.3 Buffer Zone

Without the benefit of a more specific risk assessment, the general wisdom around establishment of expansive, pond based treatment systems, where odour cannot be contained, is that a buffer zone of at least 300m should be established between the outer extremities of the pond system and the closest planned points of habitation.

Thus, the Easternmost extremities of a new pond system would have to be further down the same delta structure from the existing ponds (300m beyond the western edge of the Top-10 Holiday Park) (and hence exposed to the same risks), or further west, about where the 2014
assessment of a compact plant was made. It is unlikely that sufficient land would be available for a sufficiently sized, pond based treatment system at that location.

A suggestion has been received that the Scenic Circle Hotel site could be used as a new WW Pond based treatment site. It is possible that sufficient land could be found there. However, it is immediately adjacent the river, with its current problems and it is doubtful that an adequate buffer distance could be obtained to both existing and future development sites.

3.4 Tatare Catchment

As discussed in 3.3 above, there could be a potential pond system site north of the current extremities of the town development and south of the Tatare Rv. However, it is doubtful whether sufficient area would be available for ponds and establishment at that area would limit potential development in the vicinity.

Another option could be to establish a pond system north of the Tatare River some 2.5km from the proposed site.

Any option established in the Tatare catchment would require new discharge consents for discharge to the much smaller Tatare catchment. Any options to discharge to the Tatare River would likely incur several hundred thousand dollars in research and consenting costs. A range of potentially feasible discharge options would need to be identified, researched and costed. A full consent application package would need to be compiled, submitted and defended at Regional level and, potentially, in the Environment Court.

3.5 Consenting

The actual and likely effects of an ongoing effluent discharge from an oxidation pond system to the Waiho River bed are likely to be low.

On the basis of an email from the Regional Council, it is likely that a new oxidation pond system could be configured and consented to discharge into the Waiho system for a period of another 10 years. It would likely need to be fully lined (a cost of some $750,000 alone) and would need supplementary aeration (and associated power supply and electrical system) for peak period load management. It is unclear at this time if disinfection would be required. If it was, that would likely cost more than $1M as the effluent would need to be pre-conditioned to improve UV transmissivity. This is typically achieved using a Veolia Actiflo plant or similar and a typical cost for Actiflo (Doesn’t include the UV disinfection itself) is $1M.

However, following that, significant additional pressure would likely have to be applied, by the Regional Council, to adopt a higher level of treatment for the discharge. This would be, in our opinion, partly related to the current changes in management of fresh water quality in New Zealand, particularly for pristine waters and partly due to the scrutiny (with regard to environmental performance) that Franz Josef will increasingly attract as an international tourist destination.

Thus, within 10 years, it is likely that there will again be significant pressure applied to change the method of treatment again (as pond systems are not generally capable, especially
at low temperatures) of achieving modern levels of treatment, particularly with regard to nutrient removal.

Looking at four possible cost scenarios and using a 6% discount rate:
Compact plant cost, all up per estimates $6M to $10M
Pond system cost $4 to $5M, Transfer pumping $1M, Consents and Land cost $1M.

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<thead>
<tr>
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<th>High Cost Scenarios</th>
<th>Low Cost</th>
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<tbody>
<tr>
<td>Compact Plant now</td>
<td>$10M</td>
<td>$7M</td>
</tr>
<tr>
<td>Pond now</td>
<td>$7M</td>
<td>$6M</td>
</tr>
<tr>
<td>Compact future cost</td>
<td>(discounted value, Yr10) $5.4M</td>
<td>$3.9M</td>
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<tr>
<td>NPV of 2 plant scheme</td>
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The likely effect of adopting a ‘Pond now, Compact plant later’ scheme is a higher overall scheme capital cost on a net present value basis. The associated operating costs for a pond treatment system have not been calculated at this time.

4 Compact Systems

4.1 Benefits

- Small footprint
- Therefore, more easy to find a suitable site
- Shorter and less expensive sewer system
- Odour is easily managed
- Easily expandable
- Can be ‘tuned’ for different loads
- Ability to easily continue discharging into the Waiho River
- Capable of being configured for very high levels of treatment which improves overall environmental performance.
- And hence more readily ‘consentable’.
- This is also important in the context of the relationship between environmental performance of the District and its direct link to the Franz Josef and Westland economies.

4.2 Shortcomings

- Energy intensive
- Noise generated (but readily mitigated)
- Low hydraulic buffering capacity
- Less resilience to toxic shock from industrial trade waste
- Likely to be more expensive (CAPEX and OPEX) than equivalent pond systems.
- Produce excess biomass that must be dewatered and disposed of on an on-going basis.
4.3 Likely Characteristics at Franz Josef

- Footprint approximately 1,500 – 2,000m² for design population compared to approximately 50,000m² for equivalent pond system for same design population.
- Could be fully housed if necessary. Housing would hide individual process units but does present as a larger ‘bulk’ and does complicate maintenance access meaning that internal drainage is required.
- If un-housed, height approximately 6m including handrails above tanks
- If housed, building height approximately 8m to apex.
- Raw sewage lift pump station. A chamber of 2.3 to 3.0m diameter, built underground.
- Inlet would consist of septage receiver chamber, screens and grit removal, all covered with odour extraction.
- Probably a flow equalization tank to buffer peak diurnal and wet weather flows.
- Treatment based on biological oxidation and nitrification processes, sustained by oxygen supply.
- Steel process reactor tanks 4 to 5 m deep sitting on a concrete plant slab.
- Reactors will contain air diffusers over the floor area to release oxygen into the waste stream.
- Reactors could contain supplementary media either in fixed or free-floating form. These allow more treatment biomass to be ‘packed’ into a given volume and hence minimise the plant size.
- Reactor liquid and solids streams will be separated using gravity separation devices (clarifiers) or membrane tubes.
- Decision around these media and separation details cannot be released until a preferred proposer is nominated.
- Possibly tertiary filtration to improve effluent aesthetic quality.
- A formal disinfection process will be included. The existing pond system has no formal disinfection stage and it is difficult to properly disinfect pond effluent without using chlorine – which is a frowned up practice in NZ because of the carcinogenic by-products produced. The disinfection process will consist of either:
  - Exclusion of bacteria, protozoa and some viruses by very fine membrane separation, or
  - Irradiation of the pathogens by ultraviolet light, thereby disrupting the DNA/RNA of the organisms and preventing reproduction. This is the most common and widely accepted method of wastewater disinfection practiced in New Zealand.
- Electric air blowers, used to provide air and oxygen to the reactor tanks. These would be each provided with an acoustic shroud to reduce noise in the immediate vicinity of the machine. The blower system, in turn, would be fully housed to further reduce noise power levels.
- Sludge dewatering system consisting of
  - A tank for buffering and stabilising the sludge
  - A press or centrifuge machine for squeezing water out of the waste biosolids
- Bark Biofilter and or biological scrubber for destruction of odour compounds extracted from parts of the plant that have a potential to smell.
- High voltage (11kV) to provide power to the site and stepping down supply voltage from 11,000 to 415volts.
• Standby diesel generator to ensure that critical plant systems remain fully operational during any power outages.

5 Recommendation

Based on the research and costings undertaken to date, management of odour, management of odour and site availability, it is recommended that a compact, high rate wastewater treatment process plant is established to the East of State Highway 6 at Franz Josef to serve the projected peak period population. Visual buffering will be required as will specifically designed odour collection and destruction facilities. Site specific investigations and seismic design will be required (although these would inevitably be required for any plant configuration located at Franz Josef). The treatment plant should be configured with flexibility to allow further process modules and equipment to be added in future should capacity needs to be found to grow beyond expectations. We believe that this option will provide the best outcome in terms of future management of wastewater generated in the village.