REPLY STATEMENT OF DR BECKY MACDONALD IN RELATION TO APPLICATION FOR RESOURCE CONSENT

1. I confirm that I am a Principal Wastewater Engineer at Jacobs New Zealand Ltd, an engineering and environmental consultancy firm. This statement is produced in addition to my statement of evidence tabled at the hearing of this matter in Taipa on 24-26 June 2019. The purpose of this evidence is to address matters arising during the hearing for the purposes of the applicant's right of reply.

Taipa WWTP Process Description.

2. Evidence presented during the hearing did not accurately convey the current operation of the Taipa WWTP. Specifically, the presentation of Andreas Kurmann's submission by Wayne Parsonson was particularly erroneous. The process described in the evidence presented in my statement of evidence was accepted as correct by FNDC and NRC.

3. In summary:
   The Plant is a pond-based system. Initially wastewater flows into the Plant through a new rotary screen to remove large solids with screenings stored in an open topped skip. Initially screened wastewater flows into three basins that are nominally 4.0 meters deep and an approximate volume of 6,070 cubic meters. These basins were originally designed with two surface aerators each, however, over time the operation has changed. Currently Basin 1 has two 7.5 kW, sub surface, directional (impellor style) aerators and is fully mixed. Basin 2 has no aeration and solids build up in the base over time. Basin 3 contains one 7.5 kW sub surface, directional (impellor style) aerator. Basin 3 discharges into the oxidation pond, which is nominally 1.6 meters deep and has a surface area of approximately 11,300 square meters. The oxidation pond is not mixed or aerated. At the outlet of the oxidation pond, wastewater is pumped through two 30 kW pumps (operating in duty / standby arrangement) along a single pressure pipeline to the wetlands, located approximately 1km away. There are four constructed wetlands operating in series, with a total surface area of approximately 8850 square meters and a sub-surface connection between each wetland. These wetlands are nominally 0.5 meters deep and are planted with native wetland plants. Wetland 4 discharges into a local creek (drain) which eventually joins the Parapara Stream.

Current Plant Performance:

4. The quality of the treated wastewater from the Taipa WWTP measured at the outlet from the wetlands is as follows:

Parameter (a)	Average	95%ile
pH	7.5	8.2
Dissolved Oxygen (g/m³)	9.6	18.2
Ammoniacal Nitrogen(g/m³)	22.6	31.6
Total Solids(g/m³)	32.3	57.2
BOD(g/m³)	14.7	27.9
Pathogens (Fecal coliforms) (CFU/100ml) (b)	1125	3860
Temperature	19.2	23.9

(a) Based on resource consent monitoring data from Jan 2017 through to June 2019 (inclusive), comprising 20 samples.

(b) Includes FC contribution from wetland birds and animals. Quantification of the contribution of each pathogen source (e.g. avian, human,) is required to understand the disinfection performance of the Taipa WWTP

It is important to note that treatment and disposal are intrinsically linked, with the disposal pathway informing the level of treatment required. For example, land disposal can tolerate higher concentration of nitrogen compounds, including ammoniacal nitrogen. Thus, a short treatment upgrade of the existing plant should keep in mind the possibility of disposal land.

Future Treatment Improvements Scope of Work

5. Site specific factors (e.g. power supply, ground conditions, etc) can have a significant effect on the cost to construct and operate wastewater treatment plants. At this stage there is insufficient data to generate costs with a sufficient degree confidence for the Plant.

6. FNDC have not yet selected their preferred option to improve treatment in the short term. The preferred option could impact significantly on the capital and operating costs. Once a preferred option is identified, it is recommended that conceptual design be undertaken to provide robust scope and cost estimate for the project. FNDC will then be in a position to make informed decisions on their LTP financial commitments.

7. For context, upgrading to SBR would be expected to include the following scope:
    - Reinstatement of previous pipelines to allow parallel operation of the lagoons
    - Construction of a concrete scour protection pad on the base of each aerated lagoon
    - Relocation of one aerator from lagoon 1 to lagoon 2, so that all three ponds have 1 aerator each. Moorings and power supply are already present.
    - Additional aeration may be required, but the design work would need to be carried out to assess this
    - Installation of flow splitter (most likely automated valves or gates) to allow the untreated wastewater flow to be directed to each lagoon individually
    - Installation of a PLC and associated instrumentation/controls to allow remote activation of each aerator and flow splitter
    - Installation of a baffle curtain to reduce short circuiting in the oxidation pond, specifically from the outlets of basins 1 and 2.

Response to Andreas Kurmann's response to Minute #2

8. In Andreas's response to Item (i) he proposed modifying the operation of the existing plant to optimise treatment, including nitrogen treatment. As I stated during the hearing, I agree that operation of the existing plant could be altered to improve treatment.

9. The current operation of the plant, with Lagoon 2 operating without mixing or aeration, will likely be contributing to the ammoniacal nitrogen in the Taipa WWTP treated wastewater. This is due to three factors promoting ammonification reactions, 1) the warm wastewater temperature in summer, 2) the anaerobic condition of Lagoon 2, and 3) the high BOD loading of lagoon 2.

    As discussed during the hearing, I expect such improvements to the existing operation of the Taipa WWTP to include:

    - Construction of a concrete scour protection pad on the base of each aerated lagoon.
    - Relocation of one aerator from Lagoon 1 to Lagoon 2, so that all three ponds have 1 aerator each. Moorings and power supply are already present.
    - Additional aeration may be required, but the design work would need to be carried out to assess this.

- Installation of a baffle curtain to reduce short circuiting in the oxidation pond, specifically from the outlets of basins 1 and 2.

EC Unit Installation cope

10. In my opinion the scope of works described in Mr Kurmann's reply for the construction and installation of an EC unit is incomplete. I have developed an indicative scope using the same approach as for the SBR option above (so direct comparison can be made) as follows:

- Construction of a foundation pad for the EC unit, included bunding to contain spills.
- Bunded/contained clean down pad, for the removal and replacement of EC plates.
- Deposal of used EC pads, including transport to landfill.
- Construction of a sludge load facility out for the EC unit.
- Construction and installation, including containment, of a sludge dewatering facility (such as centrifuging).
- Construction of sludge storage facility for the EC unit.
- Provision for the cartage and ongoing disposal of sludge produced by the EC unit.
- Site access improvements to provide access for the increased truck movements.
- Odour management for the stored sludge, particularly if the EC is positioned after Lagoon 1, as the sludge will have a high biological activity.
- Installation of a PLC and associated instrumentation/controls to allow remote operation of the EC unit.
- Purchase and installation of solar panels to provide power for the EC unit.
- Purchase and preparation of land for solar panels (likely to be a similar footprint as the existing oxidation pond.
- Connection of the solar panels to the EC unit.
- Provision of a battery bank for power storage during darkness and cloudy days.

EC Unit Performance

11. The context of the samples taken from the "Taipa settlement pond" stated to in item (i) and the Taipa "waste water plant" stated in (j) is unknown. It is not known if these samples were taken at the same location or the methodology used to take the samples. Wastewater composition varies throughout the treatment process and composition of stored wastewater can vary due to the microbial action inherently present. There is no information

about how the wastewater samples were stored or the duration they were stored for between the time of sampling and processing through the lab scale plant. It is likely that the pond will have significantly different characteristics/composition to the actual wastewater sample tested. Thus, it is considered not appropriate to use this data set to predict the performance of EC at the Taipa WWTP.

Response to clarifications on Andreas Kurmann's response to Minute #2

12. The New Zealand guidelines (Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas, updated 2003) refer to E. coli and enterococci, not faecal coliforms as stated by Mr Kurmann. Furthermore, this document provides risk-based approach for freshwater quality that does not rely solely guideline values. The approach generates a "grade" for the suitability for recreation at a specific location.

Dated 15 July 2019

Dr Becky MacDonald

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