Te Kauwhata WWTP

Peer Review Report

28 March 2017

Lakeside Developments 2017 Limited

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Executive Summary

Lakeside Developments 2017 Limited is submitting a Private Plan Change application to rezone a parcel of land adjacent to the village of Te Kauwhata. Upon a successful outcome, the opportunity exists to develop the land into a master-planned residential community to be known as “Lakeside”. Given the state and lack of capacity of the existing Te Kauwhata Wastewater Treatment Plant (WWTP), it is understood that any new developments in the area will need to be serviced by a dedicated and standalone WWTP. To this end, LDL is proposing an MBR based wastewater treatment solution that will service not only the new Lakeside development, but the existing Te Kauwhata township and any future developments within the township. It is proposed that once the MBR plant is established the existing WWTP will be decommissioned and removed.

Mena Water has provided a design proposal for a “package” MBR plant for the proposed development. In order to confirm if the proposed MBR solution is robust, Mott MacDonald (MM) has been asked to undertake a detailed peer review of the design.

The Peer Review has been based on key reference documents and email clarifications provided by Lakeside Developments 2017 Limited, as summarised in Section 2 of this report.

Section 3 reviews the Basis of Design for the proposed WWTP and discusses the key assumptions regarding wastewater flows and loads and treated effluent quality. A technical review of the proposed treatment plant and ancillary processes is presented as well as a review of the CAPEX and OPEX estimates provided by Mena Water and Candor[3].

Section 4 presents a high-level overview of the potential resource consenting requirements for the WWTP.

A number of issues, constraints and opportunities associated with the proposed solution have been presented throughout the report.

The overall concept of an MBR wastewater treatment plant as proposed, is appropriate for the proposed development, subject to the clarifications sought in this Peer Review. MBR plants produce a very high quality effluent and have a low footprint compared with more conventional technologies. Therefore, at this stage it is a conservative assumption to adopt a technology that achieves a high quality treated wastewater and is suitable for budgetary purposes.

A more thorough evaluation of Te Kauwhata’s current and future wastewater needs, including design population, flows and loads (including the actual measured flows and loads entering the existing Te Kauwhata WWTP) and treated effluent quality requirements will be required as part of the resource consenting process.

It is normal practice for the issues identified by this peer review to be answered as part of the resource consenting process and through the detailed design phase which will occur once the Private Plan Change application is approved.

Early consultation with Iwi groups and other stakeholders would help to identify an acceptable solution for an effluent discharge / re-use route. Discharge to land such as stormwater wetlands would likely improve the acceptability of the scheme over a direct discharge to water. The actual quality required would be subject to environmental studies to assess the impact of the discharge on the receiving environment.

The Capex estimate offered by Mena Water / Candor[3] appears to be appropriate and is within the tolerance of MM's cost estimate for a plant of this size. The Opex estimate requires further clarification but will be subject to assumed unit rates which would need to be confirmed with suppliers.

The following recommendations are made to Lakeside Developments 2017 Limited to progress this project and prior to making the final decision to proceed with the proposal.

- Confirm population, flows and loads, including obtaining actual influent flow and load data for the existing Te Kauwhata WWTP, including actual peak wet weather flows
- Confirm effluent disposal route (i.e. land irrigation, wetlands, lake discharge) in consultation (or obtain agreement in principle from) key stakeholder groups.
- Confirm sludge strategy (and sludge dry solids requirement)
- Develop preliminary design
- Undertake an assessment of environmental effects (AEE) and obtain regional council agreement for the preliminary design
- Prepare consent applications

It is recommended that Lakeside Developments 2017 Limited secure a Resource Consent for the wastewater treatment plant discharge before procurement of the treatment plant.

1 Introduction

Lakeside Developments 2017 Limited is submitting a Private Plan Change application to rezone a parcel of land adjacent to the village of Te Kauwhata. Upon a successful outcome, the opportunity exists to develop the land into a master-planned residential community to be known as “Lakeside”. Given the state and lack of capacity of the existing Te Kauwhata Wastewater Treatment Plant (WWTP), it is understood that any new developments in the area will need to be serviced by a dedicated and standalone WWTP. To this end, LDL is proposing an MBR based wastewater treatment solution that will service not only the new Lakeside development, but the existing Te Kauwhata township and any future developments within the township. It is proposed that once the MBR plant is established the existing WWTP will be decommissioned and removed.

Mena Water has provided a design proposal for a “package” MBR plant for the proposed development. In order to confirm if the proposed MBR solution and Candor[3]’s assessment is robust, Mott MacDonald (MM) has been asked to undertake a detailed peer review of the design, including:

- Review of available information and gap analysis.
- Review of design criteria and adequacy of the wastewater treatment system proposed to adequately treat wastewater from the proposed development and existing village.
- Review of technical issues associated with the treatment plant, other ancillary processes, such as chemical requirements, solids management, and discharge.
- Review of costs Capex and Opex where available.
- Review of issues, constraints and opportunities associated with the proposed solution.
- A high level planning assessment of the potential resource consenting requirements for the proposed WWTP.

Lakeside Developments 2017 Limited has confirmed that the wastewater treatment proposal is at a “high level” at this stage and this is reflected in the unrefined design assumptions with regard to populations and flows. The main aim of the “high level” design at this stage is to facilitate discussion with the Council and the Public with the aim of securing a Private Plan Change. No Resource Consent applications have yet been made. The fundamental question therefore is whether the proposed wastewater treatment solution will work and whether it is an appropriate solution with a reasonable level of certainty in gaining a successful resource consent outcome.

It is normal practice for the issues identified by this peer review to be answered as part of the resource consenting process and through the detailed design phase which will occur once the Private Plan Change application is approved.

In assessing the proposed wastewater treatment solution, MM has not considered other alternative treatment and disposal options such as transfer of wastewater flows by pipeline to other nearby towns.

2 Key Reference Documents

The following documents relating to the plant design and costing were provided by Lakeside Developments 2017 Limited to inform the peer review (electronic file names are shown):

- Wastewater Proposal - submitted to WDC.
- Mena Water Overview Email.
- Scope of Supply - 3000 CMD MBR STP.
- Te Kauwhata sewerage scheme_MBR plant.
- MBR Capex Cost Email.
- MBR Plant - Civil Works Costs.
- RB5665-17 - MBR Engineering Costings.

Lakeside Developments 2017 Limited has provided further clarifications from Mena Water and Candor[3] in the following emails.

- FE: Te Kauwhata MBR Proposal – Information Review from Simon Ash (4:19 pm, 21-02-17).
- FW: MBR plant OPEX from Simon Ash (10:14 am, 26-02-17).

3 Review of Basis of Design

3.1 Population

It is understood that the design population of 10,000 people has been derived based on a high level assessment of Te Kauwhata's wastewater treatment needs. This has been explained as follows:

Population Breakdown

- Current residential population in Te Kauwhata - 1,300 dwellings
- Lakeside development – 1,500 dwellings
- Future development in Te Kauwhata – c1,000 dwellings
- Total – 3,800 dwellings
- Number of people per dwelling of 2.5
- 9,500 people in total.

From a quick internet search the 2013 Census shows the residential population of Te Kauwhata to be 1,473 people, with 627 dwellings, rather than 1300 dwellings as assumed.

This might suggest that the design population may be an overestimate.

The average household size in Te Kauwhata from the 2013 Census is 2.5 people which agrees with the assumed value.

It is recommended that a more thorough evaluation of Te Kauwhata's current and future projected population be undertaken (including an assessment of any seasonal variance in population) so that wastewater flows and loads can be more accurately estimated. It is also recommended that ranges are used where assumptions are made to establish an envelope of potential influent flows to reflect the inherent level of uncertainty in both future connected population projections and assumed per capita wastewater flows and loads.

The timing of the future population projection should also be understood so that staging of infrastructure may be considered. This will depend on the agreed design horizon for the plant. For example, space could be left on site for addition of equipment later to accommodate future growth.

The population will increase gradually from the current population of Te Kauwhata to the ultimate population including the new developments. The design of the new wastewater treatment plant (WWTP) will need to consider this turn-down as it will be treating a much lower load initially. Mena Water has suggested compartmentalising the biological reactor and bringing these online as the demand requires, and we would agree with this approach. Turn-down capability of common equipment such as pumps and blowers should also be considered to ensure that the equipment can operate reasonably efficiently over the full expected range of required duties from start-up to ultimate connected capacity.

3.2 Estimated Flows

The average dry weather flow (ADWF) has been estimated based on 250 L/day/person, which is at the high end of the range cited in design literature in New Zealand (180 to 250 L/h/d)[1] and

[1] From NZS 4404:2010 Section 5.3.5.1

therefore should provide a conservative assumption for ADWF. There may be an opportunity to use a lower figure once the population and flows have been reviewed in more detail which could produce potential capex savings. The calculation of flows should consider other non-residential buildings such as schools, campsites, maraes, and commercial premises, as well as seasonal variations if relevant.

Note that there is likely to be a flow meter at the inlet to the existing WWTP which could provide some useful data on existing flow variations. It is recommended that this data is obtained and analysed to determine the current flows, including seasonal and wet weather variations from the existing Te Kauwhata village rather than making assumptions regarding this, when it is likely that actual data is available.

On the basis of an assumed 10,000 people the future ADWF has been calculated as 2,500 m^3/d. This is the average daily flow in dry weather and there will be diurnal peaks as well as wet weather peaks in flow and potentially seasonal variation. These will need to be catered for by the new WWTP. The maximum design flows will need to be determined by considering the range of existing flows from the existing Te Kauwhata village (which is assumed to be serviced by gravity sewer) with appropriate allowance for infiltration & inflow (I/I) and from the new developments. It is not known whether the new developments are to be serviced by a conventional gravity sewer, or low pressure sewer system.

If the new developments are to be serviced by a low pressure sewer system, then infiltration should be minor and peak variations will be mainly due to diurnal activity with potentially seasonal variation. If sewers are gravity then although infiltration may be low initially, there will be some and it will increase with time as the sewerage system ages. Also there is the possibility of inflow due to illegal connections being made over time.

In their email to Lakeside Developments 2017 Limited on the 21st February 2017, Mena Water said that the MBR plant has been designed for 3 times average daily flows, on the basis that 2/3 of the properties will be connecting to new wastewater infrastructure which should not have stormwater infiltration issues that existing systems can experience. This would imply a peak design flow of about 7,500 m^3/d (i.e. 3 times the stated ADWF of 2,500 m^3/d).

The population estimate assumes 3,250 people in Te Kauwhata village (note earlier comment regarding 2013 Census) and 6,250 people in the new developments. Using typical flow per person figures, the following flows have been estimated for comparison purposes:

- Average dry weather flow — 220 L/person/day
- Average dry weather flow — 2,090 m^3/d
- Dry weather diurnal PF — 2.5
- Peak dry weather flow — 5,225 m^3/d
- Peak wet weather flow PF — 2 x PDWF
- Peak wet weather flow — 10,450 m^3/d

If the new developments are to be serviced by a low pressure sewer system then the peak wet weather flow PF will be largely applicable to the existing Te Kauwhata population, in which case the PWWF may be reduced. On the assumption that there is a 1.2 x peaking factor to allow for I/I entering upstream of the pump vault on the low pressure sewer system, the PWWF could potentially be reduced as follows:

- Peak wet weather flow — 7,700 m^3/d

Therefore, the implied design peak flow of 7,500 m^3/d would seem reasonable (albeit this was derived using different assumptions). However, the assumed duration of this peak flow is important to the sizing of MBR plants as discussed later.

As flows are fundamental to the sizing of the WWTP and therefore the cost, it is important that these are properly defined and based on actual data where this is available rather than typical per capita projections and assumptions.

3.3 Estimated Influent Wastewater Loads

There is no information on the assumed design influent wastewater loads.

These should be estimated as part of the flow and load assessment. Again, there is likely to be some data on the influent concentrations and flows entering the existing WWTP that can be incorporated into the design basis for the new WWTP.

3.4 Review of Selected Treatment Option

3.4.1 Effluent Quality Assumptions

The Lakeside Wastewater Treatment Plant Briefing Paper presents the following typical treated effluent quality expected from the process:

- COD <15 mg/L
- BOD_5 <5 mg/L
- Suspended Solids <1 mg/L
- Total Nitrogen <5 mg/L
- Total Phosphorus <1 mg/L
- Turbidity <0.5 NTU
- Oil & Grease <1 mg/L
- Faecal Coliform 0 cfu/100mL

Based on the plant proposed we make the following comments regarding the expected effluent quality:

It is expected that the COD will be higher than this, perhaps 15 – 30 mg/L. This is normally determined by the soluble unbiodegradable COD which biological treatment and filtration processes are unable to remove.

It is expected that the final effluent Total Nitrogen (TN) concentration will be higher than the typical treated effluent quality TN quoted in the briefing paper for the process configuration proposed (i.e. MLE process without carbon dosing), perhaps <10 mg/L. A lower concentration could be achieved with alternative configurations such as a 4-stage Bardenpho process.

It is expected that the final effluent Total Phosphorus (TP) concentration will be higher than the typical treated effluent quality TP quoted in the briefing paper, closer to 5 mg/L. If phosphorus removal is required, this could be achieved using chemical precipitation with iron or aluminium salts, or alternatively through biological phosphorus removal with dedicated anaerobic zones. Neither are included in the process configuration proposed.

The actual quality required will be subject to environmental studies to assess the impact of the discharge on the receiving environment. This will need to be undertaken as part of the Resource Consenting process.

3.4.2 Wastewater Treatment Process

The level of detail provided for the proposed treatment option suggests a concept stage design. Comments are made in the following sub-sections regarding the individual unit processes.

The sensible point for tying into the existing township wastewater sewerage system would seem to be at the inlet to the existing WWTP or an existing terminal pumping station, where the existing flows converge.

As the existing sewer system is a gravity system, it will be necessary to either build the WWTP at a low point so that flows from the existing township can gravitate to the WWTP, or build a large terminal pumping station to intercept and deliver the flows to the new WWTP. If the later configuration is adopted then consideration should be given to locating emergency storage at this terminal pumping station so that storage is provided if the terminal pumps were to fail or lose power.

If the new development is to be serviced by a low pressure sewer system, consideration should be given to keeping this system segregated from the existing township gravity sewerage system. Any storm overflows from the existing township gravity system due to inflow and infiltration in the existing system would be dilute sewage and pose less of a risk to the environment in the event of a storm or emergency overflow.

3.4.2.1 Inlet Works

The inlet works consists of an automatically cleaned coarse screen, submersible pump lifting station, grit and grease removal, and automatically cleaned fine screen (3mm spiral screen).

In their email to Lakeside Developments 2017 Limited on the 21st February 2017, Mena Water say that the inlet works (screen & grit traps) will be sized for the maximum instantaneous flow arriving at the works, which MM agrees is appropriate. MM also agrees with the proposal to have two stages of screening (course and fine) upstream of MBR processes.

There is no information provided about the model of coarse and fine screens, or grease/grit removal equipment.

A screening aperture size of 3mm is currently proposed for fine screening upstream of the MBR process. For the MBR process (flat sheet membranes), a minimum screening aperture size of 2mm is typically required for the fine screens.

There should be no ability to bypass around either the coarse screen, the fine screen, or the grit removal plant. This will allow material into the plant which could damage the membranes. 100% standby units should be provided for each of these preliminary treatment stages.

A 5mm bypass screen is not sufficient. A 100% standby fine screen should be provided.

In our experience spiral sieve screens are an unsuitable means of pre-treatment for flat sheet MBR plants in New Zealand. Based on flat sheet MBR operational experience in New Zealand, these types of screens are not effective at removing hair and fibres in the quantities present in typical municipal wastewaters in New Zealand. The cleaning mechanism of these types of screens tends to extrude the captured material through the screen perforations by the cleaning action of the brushes. The poor hair and lint capture of these screens results in a build-up of this material in the membrane tanks where it agglomerates on appurtenances and underneath the membrane modules causing (sometimes severe) operational problems. In our opinion, for municipal flat sheet MBR installations in New Zealand the screen cleaning action should be in the reverse direction of the normal flow direction. It is also recommended that the flow undergoes a 90º change in direction as it passes through the screen apertures to maximise the capture of hairs and fibres that can otherwise streamline with the flow and pass directly through the perforations.

In our opinion it will be difficult to obtain a resource consent for the emergency overflows indicated on the layout drawing, including the inlet pumping station and inlet screen overflows. If the emergency overflows shown are not consented and an unconsented overflow does occur it would be necessary to demonstrate that sufficient practicable measures were put in place to prevent overflows from occurring, such as full critical equipment redundancy (standby equipment) and standby emergency power generation, to avoid prosecution.

3.4.2.2 Flow Balancing

A Buffer Tank is provided upstream of MBR to reduce membrane surface area required and hence the capital cost. Variations in incoming flow will be attenuated in the buffer tank and a more constant flow will be pumped to the biological reactor of the treatment plant.

The Buffer Tank has been sized at 600 m^3, based on 5 hours of ADWF. This is likely to be appropriate for a pressure sewer system where infiltration is minimal and diurnal variations dominate; however, it is unlikely to be suitable for an ageing gravity sewer system where wet weather inflow and infiltration can be significant resulting in sustained elevated inflows during and after wet weather periods. If the peak flow is taken to be 7,500 m^3/d and the membranes have a peak day throughput capacity of 3,000 m^3/d, then there is potentially 4,500 m^3/d of wet weather flow that cannot be treated and must be stored in the buffer tank. Ultimately the buffer tank sizing will depend on the duration of this peak wet weather flow (e.g. if sustained for a day then up to 4,500 m^3 buffer capacity will be required).

The buffer tank capacity and the flow capacity of the membranes must be sized such that during a prolonged storm event it will not be possible for the Buffer Tank to overflow, which would result in raw sewage discharging to the environment. It may be difficult to obtain resource consent for such an overflow. The optimum configuration can be determined once the design flows have been finalised, including interrogation of the flowmeter at the inlet to the existing WWTP. Some allowance for balancing could potentially also be built into the bioreactor tanks by allowing levels to vary.

3.4.2.3 Biological Treatment

The proposal is based on MBR. This will produce a very high quality effluent and has a low footprint compared with more conventional treatment technologies. Therefore, at this stage it is a conservative assumption both from a cost point of view and in terms of the effects on the environment.

There may be the opportunity to consider alternative processes that produce a lower effluent quality with a lower capital and operating cost. However, this must be considered as part of the assessment of effects on the environment which must be undertaken as part of the resource consent application.

One of the disadvantages of MBR technology is the very definite peak hydraulic throughput capacity of the membranes themselves. Hence this technology is less well suited to situations where peak flows are significantly greater than average flows. Alternative more conventional technologies are better able to cope with short term hydraulic peaks.

At this stage it is a conservative assumption to adopt MBR technology for the treatment plant concept.

Submersible Mixers for Aeration Tank

It is not understood why submersible mixers have been provided in the aeration tank (as shown in the Scope of Electromechanical Works). Will sufficient mixing not be provided by the diffused air aeration grid?

Dosing Pump for Disinfection & CIP

Typically citric acid (or another type of acid) is included for CIP cleaning of membranes to remove inorganic fouling, in addition to sodium hypochlorite which removes bio-fouling. Depending on the raw water chemistry this may be necessary to control inorganic fouling of the membranes.

There may also be a requirement for alkalinity correction (sodium hydroxide or similar) to maintain a suitable residual in the effluent (50 to 75 mg $CaCO_3$/L), depending on the alkalinity in the raw wastewater, as nitrification consumes 7.14g of alkalinity (as $CaCO_3$) and de-nitrification only returns half of this amount.

If phosphorus removal is found to be required, this could be achieved using chemical precipitation with iron or aluminium salts. This would require chemical storage and chemical dosing pumps. The effect on the biological process (additional sludge, alkalinity balance) would need to be considered. If phosphorus removal is necessary, careful consideration is required regarding the point of chemical addition, dose control and the chemical used as chemical phosphorus removal in MBR systems can lead to membrane fouling problems if these aspects are not carefully considered. Enhanced biological phosphorus removal with dedicated anaerobic zones is an alternative method to achieve phosphorus removal. The relative merits of each approach would need to be assessed if phosphorus removal is required.

Pump for Site Irrigation Network

Only one pump is provided (as shown in the Scope of Electromechanical Works). If this is the final effluent pump then there should be an installed standby.

3.4.2.4 Disinfection

It is understood that chlorination is being proposed for final effluent disinfection.

It is not apparent on the plant layout drawing where is it proposed to disinfect the treated effluent. If it is proposed to dose sodium hypochlorite for disinfection, it is not clear how it is proposed to achieve the required contact time for effective disinfection to occur prior to the release of treated effluent to the environment. If there is a continuous overflow from the TSE tank (presumably this stands for Treated Secondary Effluent) then this will not guarantee plug flow conditions. It will be necessary to provide a dedicated contact tank with the required minimum contact time of 30 minutes or more.

If chlorine gas is proposed to be used for chlorination for disinfection, the health and safety issues associated with this will require careful consideration.

Chlorine (whether as chlorine gas or sodium hypochlorite) can form carcinogenic by-products such as THM (trihalomethanes) and the chlorine residual itself is toxic to aquatic life. Residual chlorine will kill organisms in the water environment (including the stormwater wetland if used) and reduce biodiversity. Therefore, de-chlorination may be required prior to discharge, which will increase the cost. For this reason, there is a general trend towards more environmentally friendly disinfection options such as UV disinfection, which may be more appropriate in this case.

Furthermore, post MBR disinfection may not be required as the MBR membranes provide a physical barrier to bacteria, such as faecal coliforms and total coliforms. However, this will depend on the indicator organism selected for consent compliance. For some organisms, such as F-specific bacteriophage and viruses, a further disinfection process may be required downstream of the MBR.

A further advantage of further disinfection downstream of MBR (so called “double barrier protection”) is that it provides a safeguard in the event of loss of membrane integrity.

The above points should be considered further during the assessment of effects on the environment (AEE) and demonstration of best practicable option (BPO) which is required as part of the consenting process.

3.4.2.5 Sludge Processing

A monobelt has been proposed for dewatering the sludge.

The dry solids content of the dewatered sludge is not stated. Given that the sludge feed will be waste activated sludge from a MBR at approximately 1% dry solids it may be difficult to achieve a reliable “spadeable” solids cake with a one stage dewatering device, especially if a belt type device is used.

It is understood that the sludge disposal route has not been established. Landfill and compositing are possible outlets; however, it is important to understand the required sludge dry solids concentration necessary for the proposed means of transportation and end-use, and to check this is reliably achievable with the proposed dewatering equipment.

3.4.2.6 Odour

It is understood that the location of the WWTP has not been finalised. It is recommended that a suitable buffer distance be provided between the WWTP and residential housing to mitigate against risk of odour nuisance.

It is recommended that the inlet works, buffer tank, sludge storage and dewatering equipment be enclosed and ventilated to the odour control system; this would include: inlet pumping station, screening, grit removal, buffer tank, sludge storage chamber, dewatering container and dewatered sludge storage shed.

A carbon filter has been included in the proposed design for odour treatment.

Biofilters using bark media are a commonly employed in New Zealand for odour control due to their simplicity and low cost. We recommend that consideration be given to biofiltration for odour control as an alternative to the carbon filter proposed if the proposal is taken further.

3.4.2.7 Discharge

It is understood that the effluent disposal route (i.e. land irrigation, wetlands, lake discharge) is still to be confirmed. It is stated that both discharge to ground and discharge to an existing waterway will be investigated in further detail as part of the full disposal options assessment.

MM has the following comments:

A direct lake discharge may be difficult to consent due to Iwi cultural, stakeholder group and community concerns. Some form of land contact, such as rapid infiltration, sub-surface or surface irrigation or constructed wetland is normally preferred in New Zealand for cultural reasons.

The general area is low lying, can be wet for prolonged periods in winter and may have poor soil soakage characteristics. Therefore, the area required for land irrigation may be very large. There may be the potential to use some of the treated effluent to irrigate some of the open grassland areas, demonstrating beneficial re-use of the wastewater, which may assist with gaining community acceptance of the scheme. This would require chlorine disinfection (as is proposed), a storage pond and night time irrigation with appropriate signage to warn the public.

Discharge to stormwater wetlands is an appropriate option and may be more readily acceptable to Iwi and community groups compared to a direct discharge.

The storm wetlands will not provide any further improvement in the quality of MBR treated effluent. In fact, the bacteriological quality and suspended solids are likely to deteriorate through wetlands due to contamination by bird life and mixing with stormwater runoff. Therefore, it is important to consider where the consented discharge will be measured for compliance purposes. This should be at the outlet of the plant and not downstream of the wetland.

Early consultation with Iwi and other stakeholders is recommended to obtain agreement on the preferred effluent disposal / re-use route. Agreement on the effluent disposal / re-use route is fundamental to the successful acquisition of resource consent and therefore of the overall development proposal. This process can take a considerable amount of time and therefore this should be commenced as early as possible to avoid delays.

It would be worth considering retaining the existing wastewater discharge arrangement and applying for a variation to the existing consent. This may be easier to obtain consent for compared to an alternative discharge location. This would still allow the existing ponds to be decommissioned and replaced with MBR (at the same or an alternative location) provided the same discharge location is used.

3.4.2.8 Layout

The access road to the WWTP and the loop road inside it will need to be designed (grade, turning circles etc) in consideration of the types of vehicles that will use it. For example, if bulk storage of sodium hypochlorite is proposed then a B-Train type vehicle may be required to navigate through the site to deliver chemicals. This will need to be discussed with the chemical supplier once the chemical consumption, delivery volumes and delivery frequency are defined.

In general, it is preferable to locate the electrical room close to the main power consuming devices, which are likely to be the aeration blowers, in order to minimise the length of large cable runs. We note that the proposed electrical room location is some distance from the MBR containers housing the aeration blowers.

We also note on the plant layout drawing that the sludge dewatering container is a considerable distance from the dry sludge storage shed. It is unclear how dewatered sludge is transported from the Sludge Dewatering Container to the Dry Sludge Storage Shed.

3.4.2.9 Redundancy

In general, sufficient redundancy should be provided (e.g. duty/standby equipment) to maintain treatment in the event of failure of any single plant item.

It is likely there will be a requirement for a standby generator, particularly if power loss would result in imminent loss of containment and an emergency overflow of untreated or partially treated effluent to the environment.

3.4.3 Estimated Costs

Operating Cost

Mena Water's operating cost estimate based on 3 No. MR1000 plants operating at full capacity works out at about $550K/annum. The full cost will only be incurred once the plant reaches full capacity. As Mena Water has indicated, costs will be lower until the full design flows are realised.

It is not clear what the opex estimate includes and excludes. It would appear that the estimate includes the membrane modules themselves and cleaning chemicals. It is not clear if the estimate includes aeration of the main biological reactor. The full opex will include the power consumption associated with all motors and drives included in the Scope of Electromechanical Work, chemicals, consumables (replacement of membranes), sludge disposal costs, labour and maintenance.

Based on our internal cost database we estimate the operating cost of this size of plant to be around $400K; therefore, the Mena Water estimate seems reasonable and is within the range of tolerance of our database. This will depend in part on the assumed cost of electricity and chemicals, which should be confirmed to improve the accuracy of the estimate.

Capital Cost

Based on our internal cost database we estimate the capital cost of this size of plant to be around $10M; therefore, the Candor[3] / Mena Water estimate of $9,290,000 + GST seems reasonable and is within the range of tolerance of our database.

We note that the cost schedule includes an item "Disposal offsite of old sludge". It is not clear what this refers to. If it is an allowance to de-sludge the existing wastewater treatment ponds then there may be other costs associated with de-commissioning the ponds that have not been allowed for. An earlier estimate (Lakeside Wastewater Treatment Plant Briefing Paper) allowed $1M for "de-commissioning and removal of the ponds and creation of the reserve".

We note that the Capex estimate does not appear to include allowances for contingency, professional services, further investigations and consenting of the scheme. These costs can be considerable and it is assumed that Lakeside Developments 2017 Limited have made allowances for these costs elsewhere.

4 Resource Consenting Requirements

A high level planning assessment of the potential resource consenting requirements for the proposed WWTP is provided below.

4.1 Consent Requirements & Considerations

1. Discharge to land / water / air is likely to be a discretionary activity under the Regional Plan requiring resource consent(s) to authorise the activities.
2. Various consents under the District Plan are likely to be required.
3. Consent under the National Environment Standards (NES) for Managing Contaminants and Human Health is likely to be required.
4. Building consents are likely to be required.
5. Regional Plan Change 1 (PC1), new Waikato River acts and the Vision and Strategy are of importance and require reduction of nitrogen in discharges and other initiatives. We note that the Te Kauwhata area has been withdrawn from PC1 and may not be relevant at this point in time, but future reductions of nitrogen are highly likely to be required under a similar regional plan change to PC1 for the Te Kauwhata area.
6. If Lakeside Developments 2017 Limited intend to transfer the WWTP (including the land it's sited on) to the local authority, consideration might be given to designating the WWTP site at the outset as opposed to applying for a land use consent the site.
7. Consideration of the means of disposal or re-use of the treated effluent should be given at the outset of planning the development as obtaining resource consent to authorise it is a fundamental requirement to the development proceeding. Furthermore, the means of integration of the final effluent into the receiving environment may have an influence on the overall design of the development as it is likely to involve some form of integration into the overall land use, either by irrigation to open spaces or integration with the stormwater management of the development.

4.2 Technical Studies

Assessment of environmental effects will require a number of studies to be undertaken, such as:

1. Hydrology & Geohydrology e.g. determination of the existing environment and receptor of ultimate discharge via modelling etc.
2. Assessing the effects of the discharge on the receiving environment in terms of 'quality' on groundwater, surface water, land and soil.

5 Conclusion

The information provided for this review is at a concept design level. It is expected that the design will be developed further as the project information is refined. A more detailed Peer Review is recommended once the proposal has been further defined and developed.

It is normal practice for the issues identified by this peer review to be answered as part of the resource consenting process and through the detailed design phase which will occur once the Private Plan Change application is approved.

The overall concept of an MBR wastewater treatment plant as proposed, is appropriate for the proposed development, subject to the clarifications sought in this Peer Review. MBR plants produce a very high quality effluent and have a low footprint compared with more conventional technologies. Therefore, at this stage it is a conservative assumption to adopt a technology that achieves a high quality treated wastewater and is suitable for budgetary purposes.

Early consultation with Iwi groups and other stakeholders would help to identify an acceptable solution for an effluent discharge / re-use route. Discharge to land such as stormwater wetlands would likely improve the acceptability of the scheme over a direct discharge to water. The actual quality required would be subject to environmental studies to assess the impact of the discharge on the receiving environment.

The Resource Management Act 1991 requires that an Assessment of Effects on the Environment (AEE) is undertaken to support an application for resource consent. This includes demonstrating that the selected wastewater treatment solution is the Best Practicable Option (BPO) considering the sensitivity of the receiving environment to adverse effects, the current state of technology, and financial implications.

There may be the opportunity as part of the AEE process, to consider alternative processes that produce a lower effluent quality but with a lower capital and operating cost, depending on the effluent quality required.

It is understood that the design population of 10,000 people has been derived based on a high level assessment of Te Kauwhata's wastewater treatment needs. A more thorough evaluation of Te Kauwhata's current and future wastewater needs, including design population, flows and loads (including the actual measured flows and loads entering the existing Te Kauwhata WWTP) and treated effluent quality requirements will be required as part of the resource consenting process.

The Capex estimate offered by Mena Water / Candor[3] appears to be appropriate and is within the tolerance of MM's cost estimate for a plant of this size. The Opex estimate requires further clarification but will be subject to assumed unit rates which would need to be confirmed with suppliers.

The following recommendations are made to Lakeside Developments 2017 Limited to progress this project and prior to making the final decision to proceed with the proposal.

- Confirm population, flows and loads, including obtaining actual influent flow and load data for the existing Te Kauwhata WWTP, including actual peak wet weather flows.
- Confirm effluent disposal route (i.e. land irrigation, wetlands, lake discharge) in consultation (or obtain agreement in principle from) key stakeholder groups.

- Confirm sludge strategy (and sludge dry solids requirement).
- Develop preliminary design.
- Undertake an assessment of environmental effects (AEE) and obtain regional council agreement for the preliminary design.
- Prepare consent applications.

It is recommended that Lakeside Developments 2017 Limited secure a Resource Consent for the wastewater treatment plant discharge before procurement of the treatment plant.

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