

**BEFORE A HEARINGS PANEL OF THE GREATER WELLINGTON REGIONAL COUNCIL  
AND MASTERTON DISTRICT COUNCIL**

**[GWRC Ref: WAR 070077]**

**IN THE MATTER** of resource consent applications to Greater Wellington Regional Council pursuant to section 88 of the Resource Management Act 1991

**AND**

**IN THE MATTER** of a Notice of Requirement to Masterton District Council pursuant to section 168, 168A and 181 of the Resource Management Act 1991

**BY** Masterton District Council

**FOR** the proposed upgrade of the Masterton Wastewater Treatment Plant

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**SUPPLEMENTARY STATEMENT OF EVIDENCE OF HUMPHREY ARCHER  
ON BEHALF OF MASTERTON DISTRICT COUNCIL**

**RESPONSE TO OFFICERS' REPORT**

**Subject: Engineering Aspects Of Scheme Construction And Operation**

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## **1. OVERVIEW COMMENTS**

- 1.1** Before dealing with more detailed issues, I will firstly comment on the significant issues, which will have major impacts on the proposed scheme and particularly will have substantial cost impacts. The Officer's Report summarises the following concerns regarding the proposed land treatment system on pages 27 and 28.
- 1.2** *"There is high degree of uncertainty over the land irrigation operation and therefore the effects on the receiving environment given the uncertainty with the modeling, application rates, suitability of the soils, and the need for sound management.*
- 1.3** *Robust monitoring of the land application system is essential to assess the performance of the site and flag any issues that may arise which could limit the sustainability of the operation. It is also essential to ensure that the claimed predicted effects are not exceeded, of which there is some question about given the uncertainty of the modeling and proposed management which has been presented to date.*
- 1.4** *There is significant potential for greater than anticipated nutrient inputs into both the Makoura Stream and the Ruamahanga River via seepage through groundwater underneath the proposed land irrigation area and the base of the new oxidation ponds".*
- 1.5** I disagree that there is a high degree of uncertainty over the land irrigation operation. The evidence of Dr Green and Mr Borrie, will demonstrate that careful consideration was given to matching the application rates with the different soil types on the property. Conservative assumptions were adopted for the modelling of effects on groundwater by nutrient stripping from soil done by Dr Green, and also for the groundwater modelling done by Dr Proffitt to determine subsequent effects of groundwater on the receiving waters. I am confident that their presentations to this Hearing will eliminate the claimed uncertainties and demonstrate that nutrient inputs to Makoura Stream and Ruamahanga River will not be greater than predicted.
- 1.6** It is agreed that sound management of the scheme will be needed. The draft Operations and Management Plan (Attachment E to my evidence) contains all the relevant provisions that are included in the Plan prepared for the Taupo Land Treatment Scheme, which is widely regarded as a good example of effective utilisation of nutrients in the effluent for pasture growth and sale of baleage.
- 1.7** The uncertainties expressed in the technical report could have been resolved by discussions in a workshop format, which would have been more appropriate because of the multi disciplinary nature of the proposal. Six specialists were involved in

formulating the applicant's land treatment design and all are very experienced in their fields. Duffill Watts contacted two of the specialists by telephone, but the queries made by telephone do not reflect the statements made in the Duffill Watts report. Most of the uncertainties have arisen from misunderstandings which could have been corrected earlier in a workshop type format.

**1.8** On page 28 of the Officer's Report, it is stated:

*"The proposed minimum river flow to effluent dilution ratio of 30:1 will provide less dilution in the river at present and is insufficient to ensure that DRP receiving water quality guidelines will be met" and, "The proposed maximum instantaneous discharge rate of 1,200 L/s is significantly higher than the existing 700 L/s and will enable a greater contaminant load to be discharged to the river".*

**1.9** Proposed draft Condition 2(a) limits the maximum instantaneous discharge rate to 700 L/s. The draft conditions do not change the 30:1 dilution ratio directly, but would do so indirectly, via the proposed instream limit for DRP of 0.012 g/m<sup>3</sup> and the limit on maximum discharge rate to 700 L/s.

**1.10** Contaminant loads to the river will be significantly reduced by 34% on an annual basis and 53% reduction during summer. During freshes when there is a discharge, the loads will increase but the contaminants will not have effects on the river as explained by Dr Hickey and Dr Cooke.

**1.11** If the discharge rate is restricted to 700 L/s and/or greater than 30:1 dilution is required, the required storage volume in the ponds will need to be increased at significant cost. This assumes that MDC cannot provide additional land for irrigation of effluent. Further land treatment area would also come at a significant cost.

**1.12** We have commenced modelling of scenarios with the 700 L/s limit, or increased dilution ratios, but the results will not be available until the Hearing reconvenes on 9 March.

**1.13** As will be explained by others, the proposed instream DRP limit of 0.012 in draft condition 19(a) is not justified and nor are any other instream numerical limits justified. I would like to explain the consequences of such a limit for the treatment plant. To reduce the outputs of DRP from the plant, would require a nutrient stripping process to be installed as described in section 10.2 of the AEE, such as Dissolved Air Flootation (DAF) or Chemical Dosing and Clarification. Such processes would have significant capital costs (at least \$3 million). Operating costs for chemical purchase and sludge

disposal would be high and would be contrary to the sustainable, low operating cost scheme proposed in the application, which uses uptake by pasture and adsorption by soils, to reduce nutrient loads on the receiving waters.

**1.14** Similar to the land treatment scheme, there were five specialists engaged by the applicant to assess effects of the discharges on the receiving waters, and all are very experienced in their fields. WRC staff preparing the Technical Review, did not contact any of the five specialists, to clarify the rationale adopted by the applicant's specialists and also the impacts of the statements made in the Technical Review, particularly the cost impacts. Again, a workshop format would have been appropriate because of the numbers involved and interdependence between contaminant removal methods and effects.

**1.15** I will now address individual issues, starting first with those relating to the sludge landfill and land treatment scheme and then at the end, relating to receiving water aspects.

## **2. LONG TERM DISPOSAL OF SLUDGE TO LANDFILL IS CONSIDERED INAPPROPRIATE**

*(Officers' Report Section 12.4.2 and Duffill Watts (DW) Consideration S6)*

**2.1** The GWRC draft conditions would allow landfilling of existing sludge, but not on site landfilling of sludge from the future ponds. This approach is reasonable given the 30 year time delay and possible regulatory changes. Nevertheless, in my opinion, it is sound forward planning by MDC, to reserve space for a future sludge landfill. I do not agree with the suggestion in the Duffill Watts report that long term disposal of sludge to landfill is inappropriate, but I do agree that the acceptability of this option is better assessed for future pond sludge, at the time it is required.

**2.2** So that the overall context of biosolids beneficial reuse can be appreciated, I wish to provide the following commentary.

- 2.3** While beneficial reuse of biosolids from municipal wastewater treatment plants may be encouraged by some agencies, the reality in NZ is that the only significant reuse schemes are at:
- (a) New Plymouth – dried to a granule in a rotating drum dryer using natural gas and the granule is sold mainly to turf growing and golf courses as a soil supplement.
  - (b) Nelson Regional (Bells Island) – stabilised by autothermal aerobic digestion (55<sup>0</sup>C) and the liquid sludge is sprayed into a forest on Rabbit Island.
  - (c) Christchurch – anaerobically digested sludge is dewatered to 20% dry solids cake and is spread over the closed Burwood Landfill for restoration of the surface. This operation will soon cease once the restoration is complete. Christchurch City Council (CCC) now propose to thermally dry the digested sludge to a granule, which will be taken either to the Regional Landfill or to coal mines for site restoration. CCC did hold consents to spread dewatered digested sludge in forests to the south west of Christchurch but the forest owner decided to convert the forests to dairy farms and residential areas, which has prevented CCC from implementing the beneficial reuse scheme.
  - (d) Wellington – raw sludge co-composted with green waste at Living Earth plant which ceased operation at the end of 2008, mainly because of odour issues. Dewatered raw sludge is currently being co-disposed in the Carey's Valley Landfill.
- 2.4** Most NZ centres landfill sludge (or biosolids) either in municipal solid waste landfills or in “pond sludge only” landfills at Mangere, Blenheim and Christchurch, as described in my evidence in clause 6.16. It is also noted that dried biosolid granules from the Hutt WWTP are carted to the Silverstream Landfill and are not beneficially reused.
- 2.5** It can be seen from the above, that it has been difficult to establish beneficial reuse schemes in NZ.
- 2.6** Masterton pond sludge contains plastics and other debris because the wastewater inflow was not screened until the early 1990's. For reuse, the pond sludge would need to be screened which would add costs.
- 2.7** The proposed on-site landfilling of stabilised sludge from the existing ponds is the lowest cost option and is an appropriate solution for Masterton. The proposal conforms

to accepted and majority practice elsewhere in NZ. Therefore consents should be granted for land filling of sludge from the existing ponds, as recommended in the Officer's Report.

- 2.8** I disagree with the concerns expressed in the DW report, regarding effects from the drying and landfilling of pond sludge operations which I address in the following clauses.

**3. EFFECTS OF SLUDGE DRYING**

*(Officers' Report Section 12.4.3(c) (iii), last paragraph page 33 and DW Consideration S4)*

- 3.1** DW raise concerns regarding release of contaminants by leaching to groundwater during the drying operation. I disagree that there will be more potential for leaching of contaminants during drying, in comparison with sludge on the base of the pond under normal operation.
- 3.2** During anaerobic digestion of sludge at the base of the pond, sludge is periodically disturbed by belching of biogas. That disturbance over decades, would have allowed soluble contaminants to be released into the pond liquid, or to have been leached to underlying groundwater. In addition, metals form stable complex compounds with the organic and inorganic solids and are not leached from the sludge. It is noted that pond leakage has not caused significant contamination of groundwater or the river – refer to Section 8.3.5 of the AEE. Leakage from the ponds has been occurring for decades which would have created more potential for contaminant leaching, than the proposed 2 to 3 month drying period.
- 3.3** Thus I conclude that the sludge drying operation will not increase the potential for contamination of groundwater due to leaching and there is no need to include allowances for nutrient and pathogen leaching from sludge drying in the mass loads on the river, as suggested at the foot of page 33 of the Officer's Report.

#### **4. MANAGEMENT OF STORMWATER DURING SLUDGE DRYING AND MANAGEMENT OF THE SLUDGE LANDFILL**

*(Officers' Report Section 12.4.3(b) and DW Consideration S1 to S5)*

**4.1** The Officers Report (page 29) states:

*“There is limited detail in the AEE on the proposed sludge drying and landfill disposal operation. The applicant may wish to consider addressing the following at the hearing*

- *Leachate collection and discharge*
- *Management of stormwater during drying*
- *The landfill cap*
- *Management of the landfill”.*

**4.2** I have described the measures to be taken for stormwater and groundwater control during sludge drying in Clauses 6.9 and 6.11 of my evidence. The key point is that stormwater and groundwater will be discharged to Makoura Stream, only if the quality meets existing consent conditions for pond effluent discharge. Liquid sludge, and drainage water which doesn't comply with the existing consent, will be pumped to the new ponds.

**4.3** OR Section 12.4.7(ii) states that dewatering flows of 500 l/s discharged to Makoura Stream, will be a significant rate in comparison with the existing maximum rate of discharge from the ponds of 700 l/s and daily maximum total of 35,000 m<sup>3</sup>/day. The Officer's Report equates the permissible daily total of 35,000 m<sup>3</sup>/day to 233 l/s which is an error – The figure should be 405 l/s continuous for a 24 hour period.

**4.4** It is important to appreciate that the peak dewatering discharge of up to 500 l/s during river flood events will be mainly groundwater intercepted by the deep drains around the internal perimeter of the existing ponds. It is expected that the drainage water under river flood events will be very diluted and will have no effects on Makoura Stream, which is likely to be also flowing at increased rates at that time.

**4.5** It is recommended that the existing consent conditions for discharge to Makoura Stream, remain operative during the existing pond dewatering and sludge removal operation (both hydraulic and quality parameters). The extension of the interim consent for a further one year (or two at most), is considered reasonable in the context of the whole scheme development.

- 4.6** If all the drainage water during the sludge drying operation had to be pumped to the new ponds, the modelled storage requirements would be greatly exceeded and would likely result in more discharge to the river from the new ponds.
- 4.7** I have described the collection of leachate and management of the sludge landfill cap in Clauses 6.13 to 6.17 of my evidence. Based on experience of pond sludge landfills elsewhere in NZ, contaminants of concern in leachate are not expected, because the sludge is well stabilised by anaerobic digestion that has occurred on the pond base for decades.
- 4.8** In addition, differential settlement of the landfill is not expected to occur (as is common with municipal solid waste landfills) because of sludge uniformity and ability to compact the dried sludge during placement. Landfill gas management has not been required at the Blenheim, Christchurch and Waimate pond sludge landfills due to the well digested nature of pond sludge and will not be required at Masterton.

## **5. INTEGRITY OF SILTY CLAY POND LINER AND AVOIDANCE OF CRACKING**

*(Officers' Report Section 12.4.3(a) and DW Considerations P2 and P3)*

- 5.1** The Officers Report (page 29) states:

*“Maintenance of earthen pond liners can be difficult and exposure to low water levels can cause cracking. Any cracking will compromise the integrity of the liner and lead to leakage rates much higher than those predicted”*

- 5.2** A substantial number of test pits and boreholes have been formed on the site to log the soil properties at depth. There is enough silty clay on site to form the liner for the ponds and sludge landfill. The silty clay has been laboratory tested and it can be recompacted at optimum moisture content, to achieve the required low permeability.
- 5.3** It is agreed that cracking of the liner could occur if it was left exposed to the sun for a long period. The construction specification will require that as soon as each pond is completed, liquid from the existing ponds will be transferred to the new pond to prevent cracking of the liner.
- 5.4** There will be an operating range of 1.1 m in pond level to provide the required 275,000 m<sup>3</sup> of storage. The upper portion of the liner on the pond banks, could crack if exposed to the sun. Cracking will be prevented by shading of the liner by the 325 mm thick layer of rock placed on a geotextile layer, which is primarily for erosion protection.

The construction specification will require irrigation of the upper bank slopes, if there is a lack of rainfall after completion of a pond.

**5.5** In normal operation, the upper slope of the ponds will be wetted intermittently by high pond levels, wave splash, and by rainfall. The liner moisture content near the top of the slope, will be monitored during low rainfall periods and irrigation will be used if needed. This is unlikely to be required.

**5.6** Thus, I conclude that liner integrity can be managed during construction and operation.

## **6. DISCHARGES FROM WIPE OFF DRAINS TO GROUNDWATER**

*(Officers' Report Section 12-4-3 (c) (iii) and DW Consideration LA 11 and LA 12)*

**6.1** Neal Borrie will explain why the proposed application system will not result in 10% to 50% of applied pond effluent entering the wipe-off drain system, as claimed by DW. In brief, applications will be able to be controlled more accurately by the buried pipe and automated and manual valve system than conventional open head race distribution systems, which DW appear to have based their comments on.

**6.2** In addition to timer control of applications, sensors will be installed near the ends of border strip groups to automatically detect run off, then close the feed valve plus raise an alarm.

**6.3** It is intended that effluent will not enter the wipe-off drains under normal operation as stated in the last paragraph of page 102 of the AEE. I disagree with the DW statement *"the wipe-off drains and designated infiltration areas will be no more than a rapid infiltration system"*.

**6.4** The main purpose of the moderately permeable wipe-off drains and designated infiltration areas, will be to handle runoff due to rainfall, which will have low concentrations of contaminants (most likely less than runoff from a dairy cow grazing operation). If the infiltration areas were not provided, excessive quantities of rainfall runoff would be returned to the ponds, or discharged directly to Makoura Stream in high rainfall events.

**6.5** To summarise:

- (a) Pond effluent runoff to the wipe-off drains is not a design intention and will only occur due to an automatic control failure or incorrect settings;

- (b) Pond effluent will not be irrigated if significant rainfall is predicted or detected by an automatic rain gauge;
- (c) The moderately permeable wipe-off drains and designated infiltration areas are primarily intended for rainfall runoff from pasture and will handle up to a 2 year return period rainfall event;
- (d) During more intense rainfall events, runoff reaching the recycle pump station will be pumped into the ponds for 2 hours from the start of runoff occurring to handle the “first flush”. After 2 hours, the wipe-off drains will discharge stormwater to Makoura Stream which will be in flood at that time.

**6.6** To avoid pond effluent runoff to wipe-off drains, the operator will aim for the wetting front to reach approximately 90 percent of the border strip length. The consequences of pond effluent not reaching the lower 10 percent will not be significant, because rainfall runoff from the upper portion of each strip will irrigate the lower 10 percent. It should be noted that regular irrigation of the border strips will result in soil moisture contents being on average, higher than a dryland situation. Thus during significant rainfall events, more rainfall runoff will occur due to the soil reaching saturation in a shorter period of rainfall.

**6.7** Pond effluent application to approximately 90 percent of the border strip length was one of the reasons why nutrient leaching and groundwater flow modelling, used a 50 percent higher application rate than the proposed average. The 50 percent higher application rate was also adopted to account for variable soil and infiltration rates down the length of the border strip as discussed by Dr Green.

**6.8** The above summary clarifies the description given in parts of AEE section 6.4.5. I wish to reiterate that the primary objective is for pond effluent to receive polishing treatment by filtration through soil and for nutrient uptake by pasture. “Rapid infiltration” of pond effluent is not the objective of the proposal. The Council did undertake trials of rapid infiltration and rejected that option in 2004 – refer to Masterton Urban Area Sewerage Infrastructure Upgrade Project Issues and Options (Beca 2004d).

## **7. INTERCONNECTIONS BETWEEN WIPE-OFF DRAINS AND MAIN DRAINS/MAKOURA STREAM**

*(Officers' Report Section 12-4-3 (c) (ii) and DW Considerations LA13 and LA14)*

**7.1** DW make comments that more regularly spaced drains may be needed and that drainage water could flow into the wipe-off drains and be recycled to the ponds.

- 7.2** The land west of Makoura Stream slopes down in a south-westerly direction. The proposed deep drain at the western margin of the proposed border strips will be excavated down to the gravel layer (approx 1.5m to 2.0m deep). The drain will lower the groundwater levels in the underlying gravel layer thus allowing improved downwards drainage of the overlying soils into the gravel layer.
- 7.3** Modelling by PDP will be described by Graeme Proffitt, and that modelling demonstrated that mounding of groundwater can be reduced by the proposed drain. It will not be necessary to have more closely spaced drains.
- 7.4** In clause 8.13 of my evidence, I refer to Attachment D which shows the relative levels of the wipe-off drains (surface swales) and the deeper, new main drain and existing Makoura Stream. It will not be possible for drainage water to enter the wipe-off drain system because the latter will be at a higher level.

**8. LAND DISPOSAL OR LAND TREATMENT?**

*(Officers' Report Section 12.4.2 and DW Considerations LA1, LA2 and LA3)*

- 8.1** The OR states on page 27:

*"The application to discharge to land is land disposal, not a land treatment system".*

- 8.2** I disagree with this statement, which is based on the comments in the DW report from pages 10 to 13, most of which are based on misunderstandings, or inappropriate comparisons.
- 8.3** Industry standard practice is contained in the authoritative USEPA publication "Land Treatment of Municipal Wastewater Effluent - Process Design Manual September 2006". I have attached Chapter 1 of this manual because it provides definitions and a concise overview of the three main types of land treatment, along with helpful diagrams and expected percolate quality after each type of land treatment. It should be noted that the Manual uses the term "land treatment" even for very high rate Soil Aquifer Treatment (SAT) systems (also known as Rapid Infiltration).
- 8.4** My key points are that the Masterton proposal is:
- (a) Land treatment and will significantly reduce nutrient and bacterial contaminants, and

(b) Slow Rate (SR) land treatment (not rapid infiltration).

**8.5** The following table compares the Masterton Proposal with the design features of Slow Rate land treatment from Table 1-1 of attachment G (attachment A to F are included in my main evidence).

**8.6** The following table compares the Masterton Proposal with the design features of Slow Rate land treatment from Table 1-1 of attachment G (attachment A to F are included in my main evidence).

Feature/Location	Annual effluent loading rate m/yr	Typical effluent loading rate mm/week
USEPA Manual Slow Rate Irrigation design basis	0.5 - 6.0	19 - 65
Masterton	2.0	49 - 56 (summer) 38.5 (annual average)
Leeston	2.7	52 (annual average)
Taupo	1.6	31
Levin	4.7	90
Rotorua	4.2	80

**8.7** The above data was sourced from the USEPA Design Manual and sections 6.4.3 and 10.4.1 of the AEE. It can be clearly seen that Masterton complies with the Slow Rate irrigation category, as do the other NZ schemes on an annual basis. It appears that DW have misinterpreted the proposed Masterton effluent application rates set out in Table 23, page 99 of the AEE, in regard to two aspects when they stated in their Table A, Page 13, that the Masterton average weekly rate would be 100 mm/week.

(a) Taking the maximum rates used for modelling of nutrient leaching and groundwater effects (rather than the proposed average)

(b) Not subtracting rainfall which is included in the Table 23 rates.

**8.8** DW also did not correctly interpret the text below Table 23 of the AEE (page 99):

*“To retain an appropriate degree of conservation, the updated storage model was based on no irrigation to the clay rich soils occurring during winter (note the groundwater modelling conservatively uses the maximum irrigation rates to determine worse case effects on groundwater)”*

- 8.9** The misinterpretation of the above text, and other related text in the AEE, appears to have been the main reason for DW concluding that modelling may have underestimated effects on groundwater. The evidence of Dr Green and Dr Proffitt will explain the modelling and conservative inputs in greater detail.
- 8.10** I note that DW listed the USEPA Design Manual in their Section 9, References. However their assessment of the Masterton proposal has in places, not been in accordance with this industry standard reference book. I recommend the Hearing Panel considers the Masterton proposal in the context of the definitions used in that Manual and that the terminology used in the Manual be incorporated into the Decision e.g. Slow Rate Irrigation and Land Treatment (not Land Disposal).
- 8.11** DW comment on the use of the terms land disposal and land treatment in the AEE. All of the main references in the AEE, and key recent supporting documents, refer to Land Treatment. There were references to land disposal in earlier reports, but those should be seen in the context of distinguishing between volumes disposed to river or to land, which was the differentiator between scheme options considered earlier.

## **9. POTENTIAL FOR CLOGGING SOILS WITH ALGAE**

*(DW consideration LA 24)*

- 9.1** DW refer to section 6.7.9 of the AEE which considers the future potential to extract groundwater from the MDC site and distribute it to farmers. A benefit of using groundwater rather than pond effluent would be that *“there would be no algae in the groundwater, which could cause clogging of soils in hollows”*. DW go on to state *“this issue of soil pore blockage is not mentioned at all, in regard to the operation of the Homebush site”*.
- 9.2** The DW statement is not correct. Page 99, Section 6.4.3 of AEE states *“The re-grading of the land to consistent slopes (and elimination of hollows) is essential when applying treated effluent to land, because if the land is not re-graded, algae in the effluent will accumulate in hollows, clog the soil and exacerbate ponding in the hollows”* and further on AEE page 201, section 10.4.2, bullet 4 states *“for irrigation of pond effluent containing algae, the land should be re-graded to eliminate hollows where algae would accumulate and blind the surface (applies to spray systems as well as border strip)”*.
- 9.3** The above bullet point was a conclusion of the report “Masterton Land Treatment of Wastewater” Beca, May 2008, and there is discussion of this aspect in Section 4.2. It

follows that if the land has to be graded to avoid hollows, then border strip is the most suitable method of pond effluent application.

**9.4** An example of algae in pond effluent causing clogging in hollows on undulating ground was at Waikanae, which was one of the main reasons for decommissioning of the Waikanae pond and spray irrigation system, and piping of raw wastewater to Paraparaumu. John Harding will comment on this experience in his evidence.

**9.5** In comparison, there is a long history of pond effluent being applied to border strips at Templeton, Burnham and Leeston in Canterbury, (greater than 35 years) without algae clogging the soils. The Melbourne Werribee irrigation of pond effluent has been in operation for over 50 years and prior to that, raw sewage from the 1890's. This lack of clogging is because algae are well-distributed down the length of the graded border strip and biological activity incorporates the algae into the soil biomass.

**10. HIGHER E COLI CONCENTRATIONS TO BE DISCHARGED IN WINTER FROM THE NEW PONDS**

*(Officers' Report Section 12.4.2 and 12.4.4(c))*

**10.1** On page 28 of the OR this statement is made:

*“The proposed treatment upgrades are only predicted to improve wastewater quality by reducing bacteria levels during summer and may result in higher bacteria levels being discharged during winter”.*

**10.2** The existing ponds discharge has remarkably low E Coli concentrations from a three ponds-in-series system. The proposed new ponds will have six ponds-in-series with an optimum serpentine flow path pattern to reduce short circuiting. Thus E Coli concentrations should be lower than from the existing pond system. However, the predictions are based on the Marais empirical formula and from experience with other multiple ponds-in-series systems, E Coli results can vary with time for a given pond system and also between pond systems that have equivalent retention times and numbers of ponds-in-series. It must be remembered that ponds are natural processes and operator intervention cannot reduce E Coli concentrations (or any other parameter).

**10.3** Thus I consider that a conservative approach should be taken when setting consent concentration limits and recommend that the Table 54 (AEE) values for be used.

**10.4** It should also be noted that Table 54 (AEE) has compliance values slightly above the existing effluent quality values for most parameters. This was a precautionary approach to cater for the possibility that infiltration to the sewerage system is reduced by the proposed expenditure referred to in the evidence of David Hopman and Malcolm Franklin. The existing pond effluent has relatively low contaminant concentrations mainly because of dilution by infiltration into the sewerage system. If the infiltration is reduced, most contaminant concentrations in the pond effluent will increase. The exception would be E Coli, because longer retention times in the ponds would allow greater exposure to sunlight and predation, resulting in reduced E Coli concentrations.

**11. WRC PROPOSED EFFLUENT QUALITY LIMITS ARE TOO STRINGENT**

*(Officers' proposed condition 16)*

**11.1** The proposed condition 16, introduces more stringent numerical limits and a different statistical compliance basis, than that proposed by the applicant in AEE Table 54. Draft condition 16 was derived from Table 6 (page 31) of the "Technical Review of Discharges to Surface Water" and this statement preceding Table 6;

*"We recommend that the discharge standards be based on the median and 95<sup>th</sup> percentile values from recent (last five years) monitoring results .....(nominal increases can be built in, which would allow for any changes in wastewater quality that might result from reduced I and I)".*

**11.2** I agree with the officer's allowance of nominal increases to cater for the prospect of reduced Infiltration and Inflow (I and I) in future. However, I disagree with using just the last five year period of effluent quality results for parameters other than E Coli (which was significantly improved by the Interim Upgrading in 2003).

**11.3** AEE Table 54 was derived from AEE Table 25, which was based on the results of monitoring since 1994 (for all parameters except E Coli which was from 2003), with allowances for the prospect of reduced I and I and increased contaminant concentrations. The interim upgrading in 2003 would not have affected parameters other than the bacterial indicators.

**11.4** I strongly recommend that the longer data set from 1994 be used as the basis for future conditions, because that data set reflects a wider range of inflows and climatic conditions. It must be appreciated that oxidation ponds are natural treatment processes and there are few interventions that can be made by operators to improve final effluent quality.

- 11.5** If numerical limits are too stringent and numerical non-compliances occur, MDC would need to install expensive add-on treatment processes such as DAF or UV disinfection as described in AEE Section 10.2.
- 11.6** The numerical limits proposed in draft condition 16 are significantly more stringent than proposed by the Applicant in the AEE Table 54, which are the compliance limits that can be achieved.
- 11.7** As background information, the following table shows the comparison of effluent qualities, existing and proposed for Masterton, with the Blenheim STP which was upgraded in 2000 to a four ponds-in-series system with a 40 day retention time (significantly longer than 21 to 30 days at Masterton). Both pond systems experience similar climatic conditions and Blenheim also has significant infiltration in winter when groundwater levels rise (but not as much infiltration as Masterton).

**Comparisons of Proposed Consent Limits with Existing Oxidation Pond Effluent Qualities at Masterton and Blenheim**

<b>Parameter</b>	<b>Masterton Existing AEE Table 25</b>	<b>Masterton Proposed AEE 54</b>	<b>Draft Condition 16 Officers Report</b>	<b>Blenheim existing</b>
	<b>Geomean</b>	<b>Geomean</b>	<b>Median</b>	<b>Median</b>
BOD g/m <sup>3</sup>	17.7	21	15	28
Sol BOD g/m <sup>3</sup>	-	10	6.0	-
SS g/m <sup>3</sup>	22.5	32	20	48
Total N g/m <sup>3</sup>	10.1	13	14	19
Ammonia-N g/m <sup>3</sup>	0.7 (Summer) 3.0 (Winter)	2.0 6.0	2.0 6.2	9.5
Nitrate-N g/m <sup>3</sup>	-	1.0	10 (land only)	-
DRP g/m <sup>3</sup>	2.1	3.0	3.0	4.8
Total P g/m <sup>3</sup>	-	-	3.5	5.5
Faecal Coliform cfu/100ml	-	-	-	1,100
E Coli cfv/100ml	485 (Summer) 651 (Winter)	300 1000	300 1000	-

- 11.8** It is evident from the above table that existing Masterton effluent quality is very good in comparison to Blenheim and is likely to remain so when the new ponds are constructed. However, retention times at Masterton will increase over those for the existing ponds because of the increased storage at times and if infiltration into the sewerage system is decreased.
- 11.9** With longer retention, more algae could grow, as indicated by the higher SS value at Blenheim. The higher algae content increases the BOD value due to algae

decomposition during the 5 day test under dark conditions. The Officer's draft condition 16 has values for BOD and SS which are likely to result in non-compliance and which are unnecessarily stringent in relation to the Receiving Water Target analysis in AEE section 8.2.3.

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