25/02/21

Clean Ocean Foundation would like to take this opportunity to respond to Wannon Water's supply of further information on their proposed modification to the Warrnambool treatment plant.

Due to the level of concern expressed about the shortfalls of this proposal from both the general community, recreational users of the area and experts in the field of environmental science, community health and engineering - we would have expected a reasonable amount of time been given for the community to respond to Wannon Water's.

From a societal point of view, the disruption of caused by COVID-19 on the ability of community groups and social networks has been well documented. We also have had a five-day Stage Four in Victorian lockdown to contend with.

From a scientific and engineering perspective, for an effective analysis of this second proposal, Clean Ocean Foundation relies heavily on pro bono input of experts. Many of which have other pressing commitments – not least of which are - their livelihoods.

All this we contrast with the proponent, with access to significant resources, enjoying the luxury of having "the clock stopped" for almost four months whilst they prepare their second attempt.

Another major concern we have is the undertaking to consider upgrading the plant to higher level in the future. Clean Ocean Foundation's experience with other underfunded water treatment authorities have led us to view such commitments with extreme suspicion. Too many times have such proposals been accepted only for us to later witness regulatory authorities granting extensions based on "operational or budgetary constraints" for us to graciously accept such assurances.

Once again, we would like to emphasise with a growing community awareness and support for action mitigating the risks of issues relating to outfalls including nutrient pollution, health of recreational users, emerging contaminants (including microplastics) there is simply no justification for water treatment plants in advanced economies such as Australia to justify sub-standard treatment (non-tertiary) based on financial constraints.

The question we continue to ask is: "If it's good enough for Melbourne (the Eastern Treatment Plant/Boags Rock) – why not Warrnambool?

Please find attached our technical analysis of the Wannon Water's response.

Regards,

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WARRNAMBOOL STP AUGMENTATION WORKS APPROVAL APPLICATION – ADDITIONAL REPORTS ISSUED FEBRUARY 2021

TECHNICAL SPECIALIST REVIEW COMMENTS, CLEAN OCEAN FOUNDATION, FEBRUARY 25, 2021

1. INTRODUCTION

In June 2020, concerned members of the Warrnambool community approached the Clean Ocean Foundation seeking support in understanding the Works Approval Application for augmentation of Warrnambool WRF. The Clean Ocean Foundation's drew on its network of technical specialists from the Australian water industry to review the application, and identified that the Works Approval Application posed substantial risks to human health, the environment, beneficial use of the receiving waters, and failed to meet the State Environment Protection Policy. Additionally, the industry specialists identified that the application failed to adequately consider widely used approaches and processes which would mitigate or eliminate these impacts, and/or improve the effectiveness and efficiency of the upgraded plant.

In February 2021, Wannon Water released two reports in response to two Notices to Supply Further Information issues by the EPA. The Clean Ocean Foundation's network of technical specialists has reviewed the additional information provided.

2. SUMMARY OF FINDINGS

Key findings of the Clean Ocean Foundation's network of technical specialists review of the additional information are outlined in the following sections, with additional information on the Human Health Risk Assessment issues provided in Section 8 (Appendix 1). The EPA is additionally referred to the technical specialists' comments on the original Works Approval Application (*Warrnambool STP Works Approval - COF - Technical Specialist Review Comments - June 30 2020*).

Overall, the Works Approval Application continues to be based on shoreline discharge of undisinfected and nutrient rich effluent to an area of very high environmental and recreational value within a major regional city. At a fundamental level, the Clean Ocean Foundation's technical specialists consider that the impacts of the current and proposed discharge are both unnecessary and unacceptable in terms of environmental, human health, and community amenity, and the application should be rejected in its current form.

3. RECREATIONAL ACTIVITY WITHIN MIXING ZONE

The application, including the human health, environmental, and hydrodynamic assessments provided in the additional reports, continue to rely on a 300m mixing zone. This compromises the applicability of the additional studies as:

1. Recreational activities including diving, snorkelling, rock pooling and collecting are known to be routinely and frequently occurring in the mixing zone at present (including within just a few metres of the shoreline discharge). This is commonly known by the community, and has been ongoing for decades. Wannon Water are aware of this, including through the extensive

videos and photos they have received from the public. The assertions in the application and additional reports that this usage is infrequent or atypical, or have been effectively controlled by the existing signage, are inaccurate.

2. These recreational activities will continue to occur in the mixing zone in the future. As explained in the previous submission, other water authorities have moved to upgrade their treatment standards and/or eliminate shoreline discharges based on the risk of people using the mixing zone for recreation being deemed unacceptable in terms of human health. The current Sydney Water project to close three outfalls at Vaucluse-Diamond Bay, totalling 4 ML/d of flow at a cost of $85m is a relevant example of this. Signage, fencing, security patrols, and video surveillance have not been considered sufficient to prevent ongoing recreational usage of mixing zones in other jurisdictions, and there is no reason to suggest that the measures proposed by Wannon Water (which is limited to signage) would be for Warrnambool.

3. The response of the Warrnambool community during the consultation period indicates that Wannon Water no longer has a social licence to make 600m of coastline within this major regional centre unable to be safely used for recreation. The community's expectation that one of the key stretches of coastline within their city limits is protected and safe for use is reasonable and justified.

The ongoing reliance of the Work Approval Application on a 300m mixing zone in an effort to make a shoreline discharge of an undisinfected and nutrient rich effluent stream compliant is not necessary with well-established and cost-effective sewage treatment processes, or consistent with community expectations.

4. HUMAN HEALTH RISK ASSESSMENT

The human health assessment has been based on a number of assumptions which are optimistic at best, and in some cases, not consistent with the technical information available. As a result, the assessment's outputs, as presented, cannot be considered as suitably conservative. The limited certainty around the Quantitative Microbial Risk Assessment (QMRA), and the need to validate or adjust assumptions is noted in the report (Report 1, page 4 of 167).

However, critically, even with the lack of conservatism in a number of the assumptions applied to the QMRA, the Disability Adjusted Life Years (DALYs) calculated for a person using the area recreationally ten times per year are:

- More than 50 times the industry benchmark of 10^{-6} DALYs per person per year (see Report 1, page 6) at Stingray Bay (outside the mixing zone) during normal plant operation, and more than 170 times the industry benchmark following a "dirty decant".
- More than 120 times the industry benchmark at Shelly Beach (outside the mixing zone) during normal plant operations, and approximately 400 times the industry benchmark following a "dirty decant".

- More than 880 times the industry benchmark at the mid-point of the mixing zone during normal plant operations, and more than 7000 times the industry benchmark following a "dirty decant".

The calculated health risks for those using the area recreationally would be even higher on adjustment of the key assumptions to better predict effluent pathogen levels, and much higher again for use of the area within 150m of the outfall (which occurs routinely).

Despite the potentially optimistic assumptions applied, the quantitative human health risk assessment provided by Wannon Water indicates that the Warrnambool STP effluent discharge presents an unacceptable risk to human health of recreational users of the area (and those they come into contact with) – both under the current flows, and the higher flows proposed in the Application.

5. NITROGEN AND PHOSPHORUS LIMITS

The mass load limits proposed by Wannon Water for Total Nitrogen and Total Phosphorus discharged from the STP (Report 2, Table 5, page 11) are consistent with median effluent concentrations of 16 mg/L of TN and 8 mg/L of TP at the ultimate design flow of 27.9 ML/d. However, the expert recommendation included in Report 1 (Report 1, pages 126-128 of 167) identifies that meeting the SEPP limits at the edge of the 300m mixing zone would require:

a. A 'maximum allowable' (not median) Total Nitrogen of 19.2-22.4 mg/L at the current dry weather flow of 14.8 ML/d (equivalent to a Total Nitrogen mass load **308 kg/d as a maximum** rather than the **450 kg/d as a median** proposed by Wannon Water), and,

b. A 'maximum allowable' (not median) Total Phosphorus of 12.0-12.3/L at the current dry weather flow of 14.8 ML/d (or a Total mass load **180 kg/d as a maximum** rather than the **225 kg/d as a median** proposed by Wannon Water).

Hence, the licence limits proposed by Wannon Water for nitrogen and phosphorus are inconsistent with the expert opinion from CEE on the discharge concentrations needed to meet the SEPP requirements – both in the mass of nutrient discharges proposed, and the statistical measure applied. (Note that the GHD hydrodynamic modelling, while detailed, has been based on median compliance, which is not consistent with the SEPP requirements.)

Additionally, the "existing licence" conditions listed in Report 2 (Table 5, page 11) omit the maximum limits for both Total Nitrogen and Total Phosphorus implemented from November 2019. Further, maximum nutrient limits are omitted from the "proposed limits" put forward for the revised discharge licence by Wannon Water in this table. The application of median mass load limits alone (as proposed by Wannon Water) would:

- Fail to regulate the nutrient discharges in line with the relevant SEPP requirements (which largely refer to 75th percentile concentrations);

- Permit Wannon Water to discharge an unlimited mass of Total and Nitrogen and Phosphorus for up to 182 days per year (or up to 339 days per year under a weekly sampling regime), and,
- Fail to achieve the environmental protection intended by the SEPP.

Under the information Wannon Water have provided, substantial reduction in the proposed mass loads limits for nitrogen and phosphorus is required to meet the SEPP requirements at the edge of the mixing zone, and additional concentration limits (e.g. 90th percentiles or maxima) will be required. Further, the analysis presented by Wannon Water indicates that the limits will need to be substantially lower again to protect the environment within the mixing zone in line with community expectations.

6. PROPOSED UPGRADE CONFIGURATION

Despite Wannon Water's acceptance that the upgraded plant will be required to achieve increased phosphorus and nitrogen removal, the treatment technology proposed for the upgrade is effectively unchanged from the original application. The existing and new IDEA-based secondary treatment processes are poorly suited for additional phosphorus and nitrogen removal. For example:

- Chemical phosphorus precipitation (using alum) is inefficient when undertaken in a single stage of treatment (as is proposed), and overall chemical consumption and sludge production could be substantially reduced by implementing filtration downstream of the secondary treatment process. The additional reports correctly identify that the extent of alum dosing proposed may reduce the value of the biosolids as a fertiliser.
- The IDEA process configuration proposed is unable to efficiently utilise dosed substrate for additional nitrogen removal (particularly compared to a continuous BNR processes with post-anoxic zones, or a dedicated tertiary MBBR process), or achieve biological phosphorus removal without substantial modifications to the configuration proposed.

By failing to reconsider the upgrade works design in light of the additional nutrient removal required, Wannon Water has not established the suitability of the proposed upgrade works to efficiently meet the treatment criteria. As an example, upgrade options which achieve high levels of nitrogen and phosphorus removal efficiently in the new process trains may efficiently deliver the overall nutrient removal requirements required with minimal modifications to the existing IDEA reactors.

The additional reports note the unique nature of the Warrnambool STP influent sewage stream and the challenges in treating it to higher levels. However, the reports also dismiss engagement with the key trade waste customers to resolve the issues in the sewage composition in the short term, and refer only to working with the trade waste customers following approval of the works and upgrade of the plant is completed. Effective pre-treatment of the trade waste streams would represent a major improvement in the nutrient removal issues at the STP, and potentially reduce or eliminate the associated capacity issues. As pre-treatment of concentrated streams is also intrinsically more cost effective than treatment of a mixed and diluted stream with domestic sewage, this represents a cost imposition on Wannon Water's customers.

7. ADDITIONAL MONITORING PROPOSALS

The additional reports seek to address some of the most significant issues raised through additional monitoring alone. Given that Wannon Water is not expected to be required to negotiate a revision to the licence or further performance improvements until sometime after 2040, the proposal to adopt additional monitoring (rather than resolving the performance issues raised) is unlikely to see the SEPP requirements or community expectations met for decades.

8. APPENDIX 1: DETAILED COMMENTS ON HUMAN HEALTH RISK ASSESSMENT

8.1 Issues in Key Assumptions

The report (**Report 1, Section 2.2, Page 4)** asserts that the assumptions applied to the Quantitative Microbial Risk Assessment are conservative. While the reviewers agree that the specific assumption that ingestion of 100ml of seawater per swimming event is likely conservative, many of the other key input assumptions are not. The key issues in the assumptions applied are tabulated below.

Reference	Report Text	Issue / Comment
Report 1, page 13 of 167	*"The exposure pathways by which human populations could potentially be exposed to pathogens sourced from STP effluent include primary contact recreation at a nearby beach, offshore diving and similar activities, and the consumption of fish and shell fish caught in the local area.*	This list of activities ignores the frequent contact occurring through recreational activities and food collection within the mixing zone.
Report 1, page 13 of 167	*"An examination of 'dirty decant' events has been included as a scenario within the overall assessment. The scenario has been incorporated into the assessment through removal of the pathogen LRVs from treatment processes that would be applicable under normal operation."*	Removal of the treatment process LRVs alone from the assessment during a dirty decant event may not be conservative. Adsorption of some virus (and potentially other pathogens) to the mixed liquor solids is known to be a key mechanism of pathogen removal in secondary treatment processes. As such, the mixed liquor discharged during a "dirty decant" may have a higher concentration of some pathogens than the influent sewage. This means that a dirty decant event may see a negative log removal value for some pathogens over the secondary treatment process
Report 1, page 13 of 167	*"In order to provide some context as to the relative risk of pathogen concentrations, the results of a brief literature search summarising Cryptosporidium concentrations in various recreational waters has been included."*	It is not clear why the QMRA has focussed on Cryptosporidium for reasons which remain unclear. C.perfringens may be a better surrogate protozoan pathogen. Enterococci is more commonly as the indicator of pathogens of sewage origin in a marine environment. However, from the perspective of QMRA, it is not clear why the specific

Reference	Report Text	Issue / Comment
		surrogate virus or bacterial pathogens have been adopted (and helminths not considered).
Report 1, page 14 of 167	*"Most of the waste streams within an abattoir would not contain animal faecal material, resulting in a dilution of pathogens sourced from streams that do."*	The same applies to domestic sewage, with the bulk of flows being generated from washing with minimal pathogen concentrations. As such, this is not a valid reason for dilution of expected pathogen levels from those expected in typical domesticl sewage. Wastewater from abattoirs includes manure, paunch contents, urine, and dirt (as well as blood). While monitoring has found low levels of Cryptosporidium in combined abattoir wastewater prior to treatment (<50 oocysts/100ml), average E.coli levels exceeded 200,000,000 cfu/100 ml with a maximum of 520,000,000 cfu/100 ml (see K. Pither, Viridis Consultants, Wastewater Recycling Risk Assessment, Meat and Livestock Australia Limited, June 2017 **P.PIP.0516 Final Report - MLA**).
Report 1, page 14 of 167	*"DAF has been demonstrated to remove 1.7-2.5 logs of protozoa in drinking water treatment (Edzwald et al, 2001), and with similar indicative removal rates to bacterial pathogens when included in multi-treatment barriers (such as AGWR 2020, Table 3.3). Pathogen concentrations in this trade waste inflow are expected to be at least 2 logs less than domestic sewage, and probably substantially less than this estimate."*	Claiming 2-log removal for DAF, without looking at any details of the DAF, is not a conservative approach. The extension of Cryptosporidium levels to cover all pathogens (particularly virus) is potentially not valid for this stream.

Reference	Report Text	Issue / Comment
Report 1, page 14 of 167	*"The concentrations of these pathogens from the abattoir inflows have been assumed to be zero for the purpose of this QMRA."*	It appears to have been assumed that there are no pathogens in the abattoir waste stream – without any meaningful assessment of the inputs (including manure and paunch wastes), or the actual performance of the DAF. Even with the 2-log removal assumed (which is not supported as a conservative assumption), the pathogen levels would not be zero.
Report 1, page 14 of 167	*"The Warrnambool dairy site does not host live animals, and receives bulk milk and water for processing. The transmission of Cryptosporidium via raw milk has been reported in the literature (such as Ursini et al, 2020), however the potential concentration of this pathogen in milk would be expected to be orders of magnitude less than in sewage. Additionally, the Warrnambool dairy trade waste inflows are processed through an anaerobic reactor and with induced air flotation (IAF), which is expected to have similar indicative pathogen removal rates as treatment using DAF. Pathogen concentrations in this trade waste inflow are expected to be at least 2 logs less than domestic sewage, and probably substantially less than this estimate. The concentrations of these pathogens from the dairy inflows have been assumed to be zero for the purpose of this QMRA."*	Assuming IAF has a similar performance to DAF is not valid (they do not generally have the same solids capture performance. This also ignores the pathogens which are not associated with solids. Again, the extension of discussions on Cryptosporidium prevalence to all other pathogens is not supported or considered to be conservative or valid. Again, the assumption that pathogen levels are two log less than domestic sewage (which is not supported by evidence or sound argument) does not correlate to assuming a zero pathogen count in this stream. A 2 log reduction is not a zero count (as pathogen concentrations for many organisms is >>100 cfu/100ml or pfu/100ml in domestic sewage.
Report 1, page 14 of 167	*"The Warrnambool saleyard inflows can be expected to contain protozoa and bacterial pathogens. The default concentrations of these pathogens in sewage have been used to estimate these inputs in the*	As the saleyard inputs will primarily be washdown from areas covered with manure, the pathogen concentrations may be much larger than in domestic sewage (which is a combination of some faecal material, but

Reference	Report Text	Issue / Comment
	QMRA."	dominated by flows from kitchens and washing activities). This is in line with the abattoir monitoring reported above which showed E.coli and faecal coliform levels exceeding 2 x 10^8 cfu/100ml as an average.
Report 1, page 14 of 167	*"This reduced proportion of domestic inflows in 2040 leads to an estimated virus concentration in the STP inflow of 1.041 x 0.45 = 0.48 x the default virus concentration in sewage. Similarly, bacteria and protozoa* *concentrations are also estimated as 1.041 x 0.46 = 0.48 x their default sewage concentrations."*	Due to these issues listed above, the reduction in pathogen levels assumed to be in the sewage stream due to the trade waste loads is not supportable or conservative. Indeed, the reverse assumption was applied to the Outfall mixing zone assessment (Appendix 14.11 in the original application (see page 11 of 319)).
Report 1, page 15 of 167	*The STP includes secondary treatment, which provides a reduction of pathogen concentrations. From AGWR (2020), the removal of 0.5 LRV for protozoa and 1 LRV for bacteria and viruses is described as* *the default estimate for this treatment type.*	0.5 log is applied as the default removal of all pathogens in secondary treatment in the 2006 AGWR, which remains the applicable standard. The 2020 guidelines are not yet accepted or issued for use Hence, a conservative approach would continue to apply 0.5 log removal for all pathogens.
Report 1, page 15 of 167	*"The STP has infrequently experienced 'dirty decant' events, where the treatment processes have been incompletely effective. It is assumed that this has resulted in the discharge of effluent containing greater* *pathogen concentrations. The effects of dirty decant events have been examined as separate scenarios in this QMRA, with the expected LRV from treatment process reduced to zero."*	These events have not been infrequent in recent years. Further, as pathogens tend to be associated with suspended solids, dirty decant events may actually discharge higher concentrations of some pathogens than present in domestic sewage.

Reference	Report Text	Issue / Comment
Report 1, page 16 of 167	*Assume 5th percentile dilution from the annual dilution estimate to represent "low" wave conditions.*	The days in which the area undergoes the greatest usage from rock poolers, snorkelers and divers are much lower than the 5th percentile. The annual minimum day or minimum 2 days each year would be much more reflective of the actual conditions when highest usage is occurring by divers (i.e. the 0.27-0.54th percentile) in combination with the minimum dispersion.
Report 1, page 16 of 167	*"In summary, Table 2 includes indicator concentration data from sites 300 m and 130-140 m from the discharge point. Most of the sampling data is from the 300 m sites, and log reductions of >3 log for enterococci are calculated for those sites. As described in Section 2.4, a distance of 150 m from the discharge point has been used to estimate dilution in the mixing zone, so the monitoring data from points 130 m and 140 m from the discharge point have also been considered, as more representative of dilution at that distance. From these monitoring data, log reductions of >3 log for enterococci were estimated at the shorter distance."*	The log reductions of Enterococci estimated in the mixing zone ignore the issues with the validity of such monitoring (due to lack of spatial consistency in mixing), and the prevailing wave heights during monitoring being in excess of those present when the area is being used by the public for snorkelling and diving.

Based on the issues in a number of the key assumptions, the specific surrogate organisms considered, the basis applied to the QMRA (and Human Health Risk Assessment) has not been demonstrated to be conservative.

8.2 Issues in the reported results

The report provides the following datum for comparison of the DALYs estimated by the QMRA: "As a comparative risk expressed in DALYs, the health based target for drinking water favoured by WSAA is a risk of 10^{-6} DALYs per person per annum." (Report 1, page 13 of 167).

Despite concerns over the lack of conservatism of a number of the key input assumptions to the assessment (see above), the calculated Disability Adjusted Life Years (DALYs) are much higher than this standard for any users of the area. The DALY values estimated under the QMRA are compared

to the "WSAA health-based target" in the table below for low wave height (95th percentile), the 2040 design flow (27.9 ML/d), and daily flow.

Location	Treatment	Surrogate Organism	DALY relative to WSAA health-based target for drinking water	
			For a person using the area recreationally once per year	For a person using the area recreationally 10 times per year
Stingray Bay (outside mixing zone)	Standard	Cryptosporidium	**5.62 times > target**	**56.2 times > target**
		Norovirus	52.6% of target	**5.26 times > target**
		Campylobacter	96.8% of target	**9.68 times > target**
	Dirty Decant	Cryptosporidium	**17.8 times > target**	**178 times > target**
		Norovirus	**5.26 times > target**	**52.6 times > target**
		Campylobacter	**9.68 times > target**	**96.8 times > target**
Shelly Beach (outside mixing zone)	Standard	Cryptosporidium	**12.5 times > target**	**125 times > target**
		Norovirus	**1.17 times > target**	**11.7 times > target**
		Campylobacter	**2.15 times > target**	**21.5 times > target**
	Dirty Decant	Cryptosporidium	**39.5 times > target**	**395 times > target**
		Norovirus	**11.7 times > target**	**117 times > target**
		Campylobacter	**21.5 times > target**	**215 times > target**
150m from outfall	Standard	Cryptosporidium	**88.2 times > target**	**882 times > target**
		Norovirus	**71.6 times > target**	**716 times > target**
		Campylobacter	**44.7 times > target**	**447 times > target**
	Dirty Decant	Cryptosporidium	**279 times > target**	**2790 times > target**
		Norovirus	**716 times > target**	**7160 times > target**
		Campylobacter	**447 times > target**	**4470 times > target**

As summarised in the table, the Disability Adjusted Life Years for a recreational user of the area ten times per year exceed the acceptable impact for water supply risks adopted by WSAA:

- By a factor of up to 56 times at Stingray Bay (outside the mixing zone) when the treatment plant is performing normally, and by a factor of up to 178 following a dirty decant;
- By a factor of up to 125 times at Shelly Beach (outside the mixing zone) when the treatment plant is performing normally, and by a factor of up to 395 following a dirty decant, and,
- By a factor of up to 882 times at the mid-point of the mixing zone when the treatment plant is performing normally, and by a factor of up to 7160 following a dirty decant.

The health risks for those using the area within 150m of the outfall (which is common) would be even higher.

Hence, the QMRA indicates that recreational use of the areas outside the mixing zone represents risks to the health of individuals (and those they might infect) more than one hundred times greater than would generally be tolerated in an Australian water supply. The risks to recreational users of the area inside the mixing zone are over 800 times greater than the risks considered suitable for an Australian water supply, and many thousands of times greater following a dirty decant.

In short, despite the potentially optimistic assumptions applied, the quantitative human health risk assessment indicates that the Warrnambool STP effluent discharge presents an unacceptable risk to human health of recreational users of the area (and those they come into contact with) – both under the current flows, and those proposed in the Works Approval.

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