28 March 2019

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Our ref: 3137090-67756
Your ref:

Dear Chris

Drouin WWTP works approval support
Responses to EPA Request For Additional Information

We offer the following responses to the EPA's request for additional information.

EPA Referral Response Comments

Referral comments response

1. *Please provide responses to the issues raised in the referral comments provided by Melbourne Water, included as Appendix A.*

See GHD responses to Melbourne Water comments below.

Surface water discharge

5. *Please provide further consideration of the impacts to the beneficial uses of the waterway, including the value of the waterway, for determining the proportionality of the cost, risk to, and value of the receiving environment.*

The aquatic ecosystem of the receiving environment of Shillinglaw Creek (see Figure 1) has been monitored by Gippsland Water following Rapid Bioassessment protocols in accordance with previous SEPP (Waters of Victoria) requirements (which are also consistent with current SEPP(Waters) protocols). This monitoring was undertaken primarily to assess the potential impacts of the existing DAFF plant, which does not necessarily reflect the expected conditions under the proposed MBR plant. However, it does provide a useful series of aquatic ecosystem condition assessments in Shillinglaw Creek and King Parrot Creek. Additionally, fish surveys have been undertaken by Gippsland Water. The summary of ecological values in the receiving waters provided below are based on these monitoring (Table 1).

Shillinglaw Creek upstream of the Drouin WWTP discharge is a small stream, with low baseflow, and patchy instream, emergent and submerged vegetation. Anecdotal evidence suggest that the reaches of

Shillinglaw Creek upstream of Drouin WWTP are seasonal, although there has been water present during all biological monitoring events. Downstream of the discharge point, Shillinglaw Creek is a perennially flowing waterway, largely due to the Drouin WWTP effluent discharge. However the average stream channel width and depth is similar upstream and downstream of the discharge point, suggesting the creek channel is a drainage line dug into the natural drainage line. The riparian zone is managed by numerous private landholders, with stock access to the waterway apparent along much of the waterway, although some reaches contain revegetation protected by stock exclusion fencing. Occasional instream weed removal and channel clearing by local landholders impacts the available instream habitat quality.

Macroinvertebrate monitoring indicates that the aquatic ecosystem of Shillinglaw Creek and King Parrot Creek is generally degraded, with biological indices (SIGNAL, Number of Families, AUSRIVAS, number of Key Families) consistently failing to meet relevant SEPP objectives (under previous SEPP (Waters of Victoria). Across multiple years monitoring, there is little indication that the discharge is causing any degradation to the aquatic ecosystem condition, as indicated by comparison of the biological indices. Multivariate statistical analyses of macroinvertebrate community data has shown some differences in community composition attributable to the discharge, that are consistent with differences in aquatic habitat quality resulting from greater stream flow.

Further downstream, at the confluence with King Parrot Creek, macroinvertebrate monitoring also fails to meet SEPP objectives. There is little indication that the aquatic ecosystem of King Parrot creek is further impacted by the input of Shillinglaw Creek.

Shillinglaw Creek and King Parrot Creek support native fish, including Short-finned Eel, Tupong, common galaxias, Southern Pygmy perch, and there are records of the EPBC listed Eastern Dwarf Galaxias. The provision of perennial flow from the effluent discharge enhances the availability of habitat for fish in Shillinglaw Creek, which might otherwise diminish during low flow periods.

Overall, macroinvertebrate monitoring indicates that the aquatic ecosystems in the receiving environment are typical of modified and degraded waterway conditions. This assertion is supported broad and diffuse landuse impacts associated with agricultural practices, channel and riparian zone modification in the catchment. However these habitats provide habitat suitable for supporting native fish. The perennial flowing stream within Shillinglaw supports considerable instream vegetation, that does provide habitat for fish, and also provides ecosystem services, protecting bank stability and likely providing in channel nutrient processing.

Shillinglaw Creek upstream of discharge

Drouin discharge drain

Shillinglaw Creek downstream of discharge

Figure 1 – Photos of Shillinglaw Creek

Table 1 – Summary of all biological studies undertaken for Drouin WWTP – overview of conclusions from each report

Year	Survey type	Comments
2006	Macroinvertebrates	Analysis of the macroinvertebrate communities suggested that the installation of the DAFF has improved significantly river health of both Shillinglaw and King Parrot Creeks,
2009	Macroinvertebrates	There was no significant difference in the macroinvertebrate community composition between the upstream and downstream (of the Drouin WWTP discharge point) macroinvertebrate communities for either Shillinglaw or King Parrot Creek
2010	Macroinvertebrates	There was no difference in either the number of macroinvertebrate families or the number of individuals between the sites upstream and downstream of the Drouin WWTP discharge point in Shillinglaw Creek, indicating that the discharge was having no long-term impact on the biota.

Year	Survey type	Comments
2010	Fish	Drouin WWTP discharge into Shillinglaw Creeks was unlikely to be having an impact on fish populations. An EPBC listed species was found Galaxiella pusilla (Eastern Dwarf Galaxias) in King Parrot Creek upstream and downstream of the confluence of Shillinglaw Creek.
2012	Fish	There were no significant differences in the fish communities upstream and downstream of the discharge point.
	Macrophytes	There were significant differences in macrophytes upstream and downstream of the discharge point in Shillinglaw Creek, but not in King Parrot Creek. Periphyton was significantly higher in King Parrot Creek downstream of the confluence with Shillinglaw C compared to upstream.
2014	Macro-invertebrates	The results showed that whilst Shillinglaw Creek is in a degraded state both upstream and downstream of the discharge point results suggest macroinvertebrate communities within Shillinglaw Creek are not noticeably being detrimentally affected by Drouin WWTP discharge.
2016	Macro-invertebrates	Whilst Shillinglaw Creek and its aquatic environment is in a degraded state (due to factors including recent vegetation removal and land use), there were no observable negative impacts to the creek's macroinvertebrate community attributable to the Drouin WWTP discharge.

The results of the risk evaluation of existing Drouin WWTP discharges are presented in "Drouin WWTP Discharge ERA (Project Report)", completed in November 2017 (updated April 2018). Risk results presented in this report cover the identified beneficial uses of aesthetic enjoyment (encompassing amenity, community connection and recreation), native species / dwarf galaxias (encompassing aquatic ecosystems and species) and agriculture / irrigation / stock watering (see Tables 27, 28 and 29 of the Drouin WWTP Discharge ERA report).

For each of the beneficial uses identified in Shillinglaw and King Parrot Creeks the majority of risks from the existing discharge were determined to be low, with the exception of some medium risks. All identified medium risks were located in Shillinglaw Creek, not reaching as far as King Parrot Creek (Table 2). Risks associated with the proposed MBR plant are presented in Table 3. The spatial extent of these risks will change depending on winter or summer discharge scenario and these are essentially described by the mixing zones of total N and total P.

Table 2 – Medium risk impacts from existing discharge

Beneficial Use	Stressor	Location
Aesthetic Enjoyment	Nutrients: Total Nitrogen / Total Phosphorus	Shillinglaw Creek 10m d/s of discharge point to confluence with King Parrot Creek
Native Species / Dwarf Galaxias	Nutrients: Total Nitrogen / Total Phosphorus	Shillinglaw Creek 10m d/s of discharge point to confluence with King Parrot Creek
	Ammonia: (toxicant)	Shillinglaw Creek 10m d/s of discharge point to confluence with King Parrot Creek
Agriculture / Irrigation / Stock Watering	Total Phosphorus	Shillinglaw Creek 10m d/s of discharge point to confluence with King Parrot Creek

Table 3 – Medium risk impacts from proposed MBR discharge

Beneficial Use	Stressor	Location
Aesthetic Enjoyment	Nutrients: Total Nitrogen / Total Phosphorus	Shillinglaw Creek 10m d/s of discharge point to confluence with King Parrot Creek
Native Species / Dwarf Galaxias	Nutrients: Total Nitrogen / Total Phosphorus	Shillinglaw Creek 10m d/s of discharge point to confluence with King Parrot Creek
Agriculture / Irrigation / Stock Watering	Total Phosphorus	Shillinglaw Creek 10m d/s of discharge point to confluence with King Parrot Creek

Gippsland Water's proposed MBR plant provides opportunity for considerable improvements to the level of treatment, and hence quality of effluent discharged to the environment. However, with the greater volume of influent expected from an increasing population in Drouin, the volume of effluent discharged to Shillinglaw Creek is forecast to double (4.2 ML/day for future discharge scenarios compared to current median winter discharge of 2.1 ML/day). As a result of these two key changes in the discharge to the environment, the impacts from the proposed MBR plant were re-assessed through recalculation of the extent of water quality impacts. Following EPA guidance, a conservative assessment of the mixing zone distance was undertaken for the low streamflow scenario likely to result in greatest risk to beneficial uses. The results indicated similar risk impacts as those of the existing discharge. However, under different scenarios, the spatial extent of the risk differed, indicated by different mixing zone lengths for each of the discharge scenarios. Mixing zone distances are outlined in response to comment 7 below.

6. *Please provide details of a discharge strategy for managing and minimising the risks to beneficial uses from ammonia, nitrogen, and phosphorous, including but not necessarily limited to, details of discharge seasonality and discharge dilution ratios.*

One key strategy for minimising risks is reduce discharges during summer low flow periods and to discharge more during winter high flow periods. Under existing discharge conditions, mixing zones are small in winter, typically due to dilution available within Shillinglaw Creek. As there is no streamflow gauging in Shillinglaw Creek, the streamflow in Shillinglaw Creek was estimated using the catchment size ratio of Shillinglaw Creek at Drouin WWTP and the Gauging station at King Parrot Creek (Drouin WWTP – MBR Discharge Assessment July 2018). The estimated median streamflow in Shillinglaw Ck before Drouin WWTP discharge is 0.236 ML/day in summer and 1.74 ML/day in winter. To accurately determine discharge ratios, Gipplsand Water are installing a permanent streamflow gauging station within Shillinglaw Creek. This will improve confidence in Gippsland Water future discharge assessments and to help gauge discharge ratios.

The risks associated with ammonia toxicity are set out in detail in in section 8.3.7.2 of ANZECC (2000). Temperature and pH have an effect on ammonia toxicity - a decrease in pH and temperature results in a lower risk from ammonia. Previously, GHD assessed ammonia from the Drouin WWTP discharge using the ANZECC guideline of 0.9 mg/L (which is the guideline value at pH of 8 and for any temperature). Whilst ANZECC (2000) provides different ammonia trigger values for a range of pH values, there is no table for trigger values corresponding with temperature. The ANZECC (2000) ammonia tables are essentially derived from the United States Environmental Protection Agency and summarised in the report Update of Ammonia Water Quality Criteria for Ammonia (USEPA 1998).

Whilst ANZECC (2000) is about to be re-published during 2019 (and potentially will provide updated values for ammonia toxicity), it is worth noting that the USEPA updated their ammonia research within the document: Water Quality Criteria Aquatic Life Ambient Water Quality Criteria For Ammonia – Freshwater (USEPA 2013). This publication provides similar (although lower values) for ammonia toxicity (as both acute and chronic values) compared to ANZECC (2000). However, Table 6 within the USEPA 2013 document shows the changes in 'trigger value' for both temperature and pH for chronic data.

Since completing the analyses presented in the Drouin WWTP – MBR discharge assessment report, additional work examining the ammonia risk with more detailed consideration of pH and temperature data is presented below.

Ammonia, temperature and pH values in summer and winter for Shillinglaw Creek, the existing DAFF discharge and Lagoon 3 are presented in Table 4. As expected, temperatures are colder in winter compared to summer. Table 5 provides updated discharge data for the MBR plant (provided recently, and after the original GHD report was produced) – of note is the pH of discharge at 7.1 (for both summer and winter) and the ammonia at 0.15 mg/L for summer and 0.6 mg/L for winter.

Table 4 – Overview of key parameters of Shillinglaw Ck (upstream) and existing DAFF / Lagoon 3 (median values for summer and winter)

Parameter	Unit	Shillinglaw Ck Upstream		Existing DAFF discharge		Lagoon 3	
		Summer	Winter	Summer	Winter	Summer	Winter
Ammonia-N	mg/L	0.017	0.039	0.5	1.2	4.9	8.4
Total N	mg/L	0.65	2.85	7.1	11	-	-
Total P	mg/L	0.41	0.61	0.025	0.025	-	-
pH	pH units	6.9	7	6.6	6.6	8.6	7.7
Temperature	°C	17.9	8.7	19.3	9.6	21.6	10.1

Table 5 – MBR Plant updated average discharge quality parameter concentrations (updated date provided by KBR on 21 March 2019)

Parameter	Unit	Summer	Winter
Ammonia-N	mg/L	0.15	0.6
NO_x-N	mg/L	4.2	2.8
Total N	mg/L	5.8	4.6
Total P	mg/L	0.1	0.1

Total Suspended Solids	mg/L	<5	<5
pH	pH units	7.1	7.1
COD	mg/L	31	21

Ammonia trigger values at relevant pH and temperature values are presented in Table 6. A comparison of the ammonia trigger value for ANZECC (2000) and USEPA (2013) at pH 8 and 20 °C shows that ANZECC (2000) is higher at 0.9 mg/L compared to USEPA (2013) value of 0.78 mg/L. As such, the USEPA (2013) values may be considered conservative for Australian conditions.

Table 6 – Derived ammonia trigger values using USEPA (2013) taking into account temperature and pH

Temperature	pH	Ammonia Trigger Value	Note
°C	pH units	mg/L	
20	8	0.9	ANZECC (2000) ammonia toxicity trigger value which is based on USEPA (1998)
20	8	0.78	USEPA (2013)
19.3	7.1	1.9	MBR Summer discharge (temperature based on current DAFF discharge temperature)
9.6	7.1	3.7	MBR Winter discharge (temperature based on current DAFF discharge temperature)

Results in Table 6 show that the ammonia trigger value during summer is 1.9 mg/L and during winter is 3.7 mg/L. These values are before any mixing would occur with Shillinglaw Creek water, which would provide additional dilution. The trigger values of 1.9 mg/L in summer and 3.7 mg/L in winter are higher than the expected MBR ammonia discharge values for ammonia of 0.15 mg/L in summer and 0.6 mg/L in winter.

During winter total N and total P concentrations within Shillinglaw Creek upstream of the discharge point are higher than in the summer period. This may be due to higher rainfall and runoff during wetter months that carry nutrients from urban runoff (and agriculture) into the creek. These higher background concentrations during winter mean that there is less of a difference between Drouin WWTP discharge and Shillinglaw Creek, leading to less impact of the discharge. However, increased streamflow during winter is the main factor that would reduce the effect of the discharge – the increased streamflow in winter provides more dilution than during lower summer flows.

Therefore, there is a reduced risk from ammonia during cooler conditions and as such winter time is preferred for MBR discharge to Shillinglaw Creek. Winter discharges will also reduce total N and total P concentrations as a result of higher dilution available within the creek.

7. *Please provide an analysis of options to improve the quality of the discharge to reduce ammonia, nitrogen and phosphorus concentrations and the mixing zone impact*

Reduction in ammonia, nitrogen and phosphorus concentrations in the receiving waters may be undertaken by managing the timing of discharge to occur during higher streamflow periods – i.e. to obtain a higher dilution factor (as discussed above).

Additional analysis shows that the ammonia toxicity of proposed MBR discharge will not be an issue during winter or summer given the expected pH in discharge of 7.1 and lower temperatures in winter.

The SEPP (WoV) guidelines published in 2003 were used in the original analyses and these have since been updated to SEPP (Waters) published in October 2018. This has resulted in an increase in the guideline values for both total N and total P for Shillinglaw Creek and King Parrot Creek. For total P the increase was from 0.045 mg/L to 0.055 mg/L (as 75th percentile) and for total N the increase is from 0.6 mg/L to 1.1 mg/L (as 75th percentile).

These increases in SEPP guideline values mean that mixing zones will be shorter compared to the original analysis and may be eliminated entirely under some discharge scenarios.

It should also be noted Shillinglaw Creek upstream of the discharge point and King Parrot Creek upstream of the confluence of Shillinglaw Creek have total N and total P values exceeding the 2018 SEPP guidelines – i.e. there are additional sources of nutrients entering the catchment leading to non-compliance with SEPP even before WWTP discharge enters the waterway.

Mixing zone estimates under low flow and median flow conditions are presented below for four separate scenarios: existing treatment during summer and winter, and proposed MBR treatment during summer and winter. Under current discharge volumes and SEPP (Waters) guidelines, the modelling indicates that the proposed MBR treatment will reduce total mixing zone distance.

Uncertainty in the mixing modelling resulting from assumptions used in catchment runoff streamflow modelling and limitations in historical water quality data limit the confidence in the current mixing zone estimates. Based on preliminary results of recent mixing zone water sampling and mapping undertaken by Gippsland Water to validate the mixing zone modelling, the modelled mixing zone appears to be a very conservative estimate (Draft Report: Drouin WWTP Discharge Mixing Zone Mapping July 2018). Furthermore, there appear to be multiple sources of nutrients from sites on Shillinglaw Creek downstream of the Drouin WWTP discharge.

To improve the model validation, Gippsland Water will implement water quality monitoring undertaken across the modelled mixing zone and with sufficient temporal replication will provide additional data will help refining the mixing zone model.

Mixing zone estimates under 2030 population scenarios involve discharge volumes predicted to be 4.2 ML/day which is double current volumes. Although the proposed MBR treatment will provide the same level of treatment under these values, greater flows generally result in longer mixing zones. For example, the modelled mixing zone for winter and summer in 2030, are 3.0 km and 10.5 km respectively. Gippsland Water acknowledge the limitations of the mixing zone model provides low confidence in these 2030 forecasts, for the reasons outlined previously. In the short term, the model provides a useful comparison of the relative impact of the proposed MBR treatment on reducing mixing zone from current treatment, albeit likely a conservative estimate. However, the prediction of future mixing zone will be improved by Gippsland Water's current work to improve the robustness of the modelling, including:

- Seasonal upstream and downstream water quality sampling for all parameters of interest (two events have already been undertaken)
- Re-establishing the weir and gauging station on Shillinglaw Creek to accurately measure streamflows (Works on Waterways permit application currently with MW)

- Investigating options for ecological improvements in the discharge drain and Shillinglaw Creek to drive nutrient uptake (primarily phosphorus, ammonium and nitrate) (early conceptual planning for this is currently underway)
- Supporting third-party reuse / extraction of the recycled water, which will assist to reduce discharge volumes, and decrease mixing zone during periods of greatest water resource demand, typically summer. This timing provides the greatest potential for mixing zone reduction.

Southern Rural Water recently granted an increase to an existing Take and Use licence less than 1500 m downstream of the Drouin WWTP. Conditions of this new licence are specifically tied to, and volumetrically reliant, on continuing discharges from the Drouin plant. The new licence allows the water user to:

1. extract up to 50% of the volume discharged by Gippsland Water;

2. to a daily maximum volume of 0.5 ML and an annual volume of 150 ML; and

3. water must only be taken from the waterway when Gippsland Water is discharging.

This type of arrangement represents a new opportunity for treated wastewater to be reused by industry and agricultural landholders downstream of the Drouin WWTP plant. With increasing volumes of treated wastewater becoming available as Drouin's population grows, there will be further opportunities for Southern Rural Water to negotiate increases to existing licences, or establish new licences, based on this same philosophy of using excess water discharged to the waterway for productive uses. Third Party reuse schemes provide considerable opportunity for Gippsland Water to provide water resource security to industry partners, and improve environmental outcomes by reducing the proportion of discharge in the stream, thereby reducing the mixing zone. Future opportunities to supply third party reuse directly from the the WTTP, rather than indirectly via the Shillinglaw Creek would further improve mixing zone reduction.

Current discharge plans do not rely on the further expansion of Gippsland Water’s effluent irrigation to minimise discharges to the environment. However, government policy in Water for Victoria and Gippsland Water's own environmental policies dictate the continual increased use of treated wastewater for agricultural, horticultural, recreation and environmental benefits. As such, opportunities to divert this resource from discharge to the waterway will continue to be investigated to increase beneficial reuse of treated wastewater.

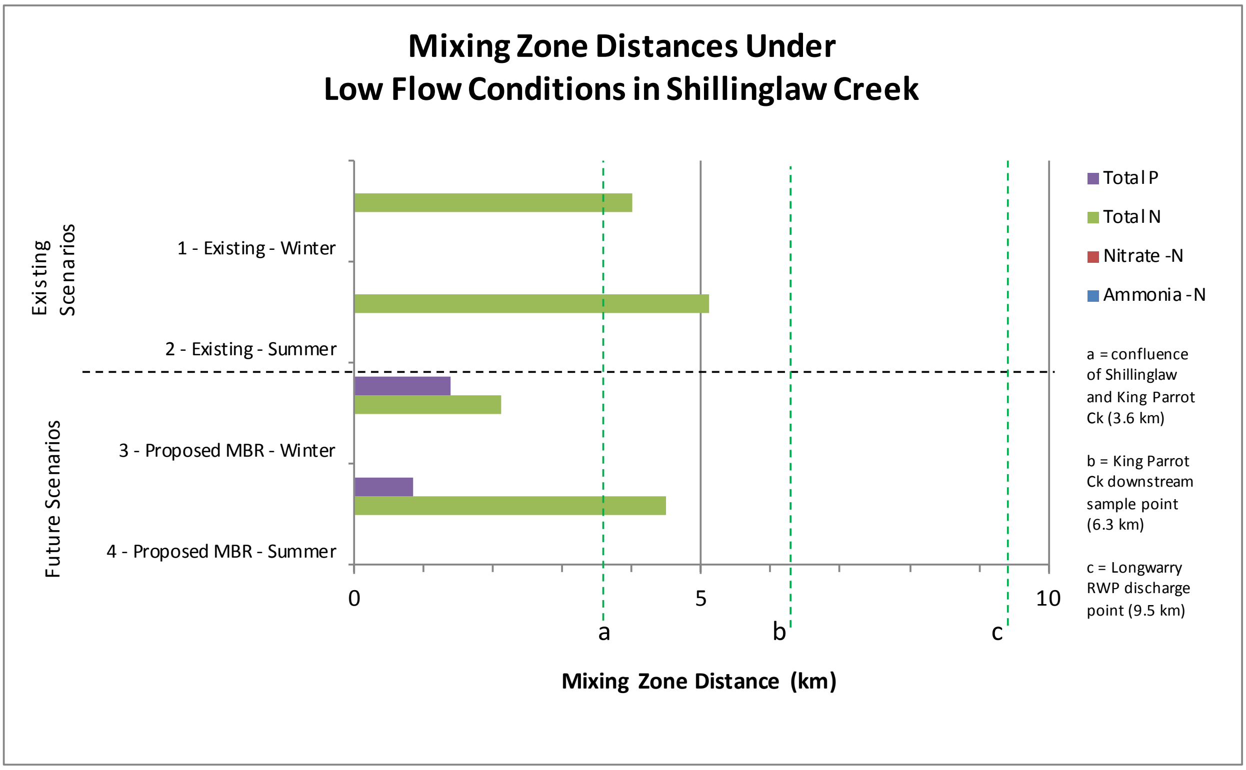

Figure 2 – Mixing zone distances under low flow conditions in Shillinglaw Ck

Table 7 – Estimated mixing zone distances for each scenarios a defined low streamflow in Shillinglaw Creek

Scenario	Mixing zone (km)			
	Ammonia -N	Nitrate -N	Total N	Total P
1 - Existing - winter	0	0	4	0
2 - Existing – summer	0	0	5.1	0
3 – Proposed MBR - winter	0	0	2.1	1.4
4 – Proposed MBR - summer	0	0	4.5	0.8

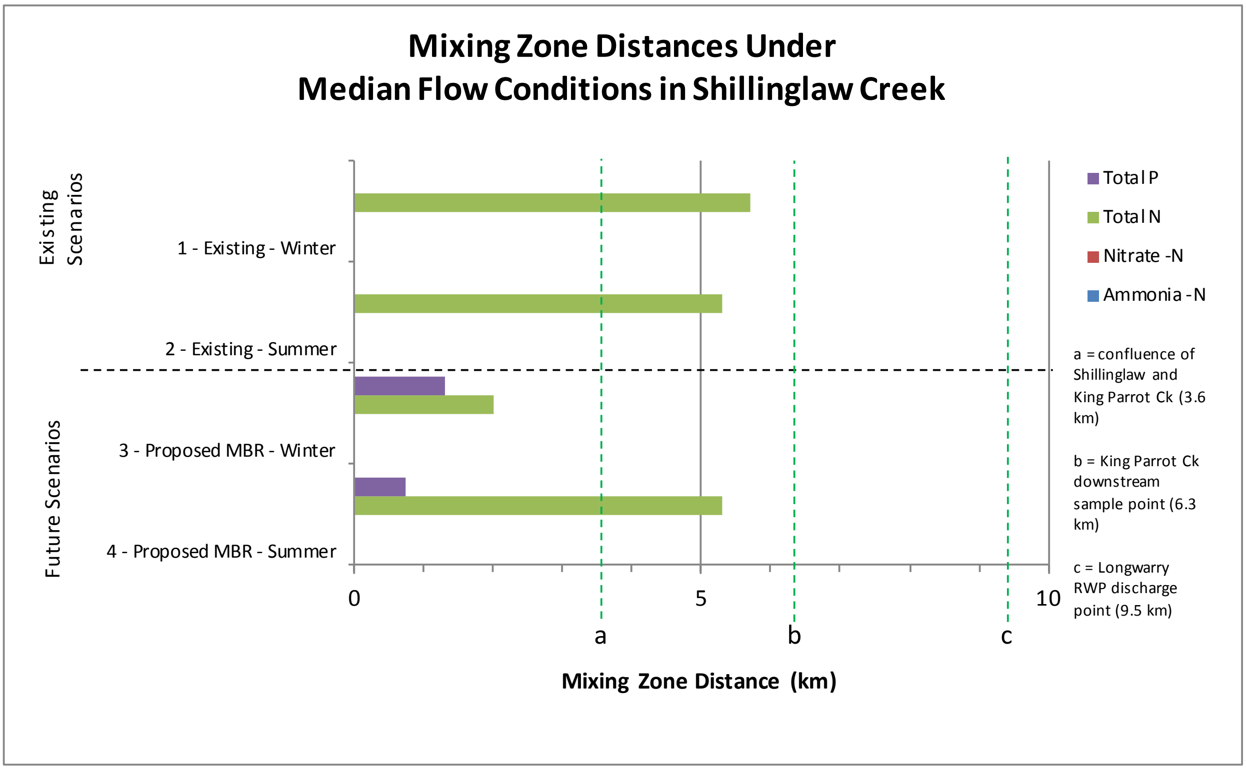

Figure 3 – Mixing zone distances under median flow conditions in Shilliglaw Ck

Table 8 – Estimated mixing zone distances for each scenarios a defined low streamflow in Shillinglaw Creek

Scenario	Mixing zone (km)			
	Ammonia -N	Nitrate -N	Total N	Total P
1 - Existing - winter	0	0	5.7	0
2 - Existing – summer	0	0	5.3	0
3 – Proposed MBR - winter	0	0	2	1.3
4 – Proposed MBR - summer	0	0	5.3	0.7

Appendix A Melbourne Water Referral Response Comments

1. *It would have been helpful if Melbourne Water was included in the project's stakeholder and community engagement plan, and particularly the ERA, as a referral authority for the waterway in which the treatment plant discharges. We prefer to constructively participate in projects rather than only get involved once the work has been done.*

2. *The ERA should be updated with the most recent SEPP and Melbourne Water Healthy Waterways Strategy documents. The dates on documents indicate that they were submitted after both of these new guidance docs had been released.*

The original work undertaken in September 2017 and July 2018 was prior to the updated SEPP (Waters) which was actioned on 19 October 2018. These reports also did not take into account Melbourne Water's Healthy Waterway strategy for the same reason. Updates taking into account these new guidelines / strategies are presented above in this letter.

Additional work has been undertaken to assess the risk of discharge to the Melbourne Water Health Waterway Strategy Key Values (listed below in Table 9).

Table 9 - Melbourne Water HWS Key Values (10 – 50 Year Targets) for King Parrot and Musk Creek Subcatchments

Key Values	Current State	Current Trajectory	Target Trajectory
Birds	n/a	Low	Low
Fish	Low	Moderate	High
Frogs	Very low	Moderate	Moderate
Macroinvertebrate	Moderate	Very Low	High
Platypus	Low	Very Low	Low
Vegetation	Low	Very Low	Moderate
Amenity	High	High	Very High
Community Connection	High	High	Very High
Recreation	High	Moderate	High

3. *As noted by a number of the reports there is very limited data on metals (N=1) and contaminants other than nutrients and E coli in Shillinglaw Creek. This does not provide a lot of confidence in the assessment. It would be good to assess the MBR capabilities with regard to treatment.*

No work has been done on estimating the metals concentration in the effluent from the MBR. However it is not expected to significantly reduce the metal concentration of the influent sewage, so it would be reasonable to assume that the metals concentration of the MBR effluent will be similar to that of the influent sewage.

The lack of heavy industry within Drouin (to be confirmed by Gippsland Water's tradewaste overview for Drouin) may not pose much risk from heavy metals in the raw sewage entering the plant. Gippsland Water suggest that the water quality sampling regime be reviewed to include metals to obtain WWTP discharge and background levels in Shillinglaw and King Parrot Creeks.

There is no data on other contaminants.

4. *The proposed mixing zones are extensive. Furthermore, it is suggested that "compliance of future Drouin WWTP discharges into Shillinglaw and King Parrot Creeks may be best managed by applying a revised mixing zone into the licence. A drawing of the proposed mixing zone will be negotiated with the EPA following commissioning of the MBR." The extent of the mixing zone should be understood, including forecast discharge growth into the future, and agreed as part of the Works Approval process.*

The mixing zone has been re-assessed with updated values for ammonia toxicity, total N and total P under 2030 population scenario. The mixing zone for ammonia is now considered to be essentially non-existent - previous calculations were too conservative. Total N and total P mixing zones are reduced from the previous reports as SEPP guideline concentrations have increased compared to the previous SEPP. A discharge regime during winter will be also reduce the mixing zones as higher dilution will be available. A mixing zones overview is presented above.

Gippsland Water are currently in the process of installing a gauging station to accurate measure streamflow. More recent work based on over 30 in-stream sample locations along the length of Shillinglaw Creek in winter 2018 has provided some additional data to validate the mixing zone length. Work to characterise the current and future potential mixing zone is still ongoing.

5. *The ERA for the proposed works (attachment 9) fails to consider the risks to an ephemeral creek posed by changes to hydrology resulting from the higher discharge. It should also consider the risks to beneficial uses vs. just changes to mixing zone.*

There was no risk assessment of the changes in hydrology to Shillinglaw / King Parrot Creeks due to Drouin WWTP discharges. However, the risks associated with changes to hydrology is the contribution of additional flow from the discharge during summer and winter baseflows. This additional flow would provide higher flow compared to a natural streamflow conditions. It is unlikely the WWTP discharge would alter other environmental flow requirements such as summer or winter freshes or bank full flows.

The exisiting EPA licenced Drouin WWTP discharge provides permanent flow in Shillinglaw Creek, which would otherwise be an ephemeral or seasonally flowing waterway. The change of treatment proposed by Gippsland Water will not alter the hydrology of Shillinglaw Creek from current conditions. Therefore, there is no hydrological risk to the values or beneficial uses resulting from the proposed MBR plant.

Under increased population in Drouin, the volume of wastewater needing treatment will increase. This increase will provide greater discharge volumes, but the permanency of discharge will remain. .There may also be some benefits associated with the additional baseflows, including provision of habitat. This increase in flow will not result in changes to other environmental flow features, and will not result in changes to connectivity that result in risks to ecological values.

The consequences (and potential benefits) to beneficial uses within Shillinglaw and King Parrot Creeks would require additional time and effort to quantify accurately which is outside the scope of this response.

6. *The upstream monitoring site for Shillinglaw Creek is very close to the discharge point. It would be good to confirm that 'upstream' water quality reflects the waterway without STP impact, i.e. without groundwater influence or backwatering.*

There were three upstream water quality sites available, and these can be examined individually as required. We have assumed that upstream concentrations were representative of Shillinglaw Creek before any influence of the Drouin WWTP. It is acknowledged that some backwatering may occur during periods of low or no background flow. However, although the upstream sites may not have visible flow, the channel does hold remnant pools of water beyond the extent of backwatering, which may have local groundwater sources.

An updated water quality sampling program will be able to address this for future sampling, and revision of mixing zone model based on this data will be improved with the assessment of background conditions.

7. *Re: Attachment 9 Table 9 – It is unclear why upstream concentrations would change with scenario.*

There is a wrong title on the table. The table shows the expected future concentrations of the MBR plant for key parameters under three discharge scenarios, rather than the upstream concentrations.

Table 1 Expected future concentrations of the MBR plant under discharge scenarios

	Units	2031 Summer	2030 Winter (no lagoons, 2 BNR trains)	2019 Winter (no lagoons, 1 BNR train)
Ammonia -N	mg/L	0.1	1.2	1.1
Nitrate –N	mg/L	1.5	~3	~3
Total Nitrogen	mg/L	3.1	5.2	4.7
Total Phosphorus	mg/L	0.2	0.1	0.3
BOD	mg/L	<2	<2	<2
COD	mg/L	<40	<40	<40

Suspended Solids	mg/L	<5	<5	<5

These details can be updated with the following

Table 10: Predicted MBR effluent quality

Parameter	**Summer**		**Winter**	
	Range	**Average**	**Range**	**Average**
Ammonia	0.08–0.22	0.15	0.07–2.35	0.6
Oxidised nitrogen	1.3–8.0	4.2	0.3–6.0	2.8
Total nitrogen	2.9–10.0	5.8	1.5–9.5	4.6
Total P	0.01–0.40	0.1	0.06–0.34	0.1
TSS	<5	<5	<5	<5
pH	7.0–7.1	7.1	7.0–7.2	7.1
BOD	<5	<5	<5	<5
COD	30–32	31	19–22	21

8. *The increases of in P discharge with the proposed MBR are of concern (4-6 times SEPP) especially given the risk of P contamination associated with run off from land disposal (RMCG report, attachment 20).*

Updated values for the MBR plant provided by KBR show lower total P values compared to previous values (see Table 10) In addition, the available dilution during winter or higher streamflow periods will reduce the risk of total P concentrations in the discharge in Shillinglaw Creek. It should also be noted that SEPP 2018 guideline values for total P have increased compared to SEPP 2003 (see Table 11).

Table 11 – Changes to SEPP guideline values from 2003 to 2018

Parameter	unit	SEPP (WoV) – 2003 guideline		SEPP (Waters) – 2018 guideline	
Total N	mg/L	0.6	75^{th} Percentile	1.1	75^{th} Percentile
Total P	mg/L	0.05	75^{th} Percentile	0.055	75^{th} Percentile

9. *Several listed species have been caught in fish surveys. Melbourne Water could get some specific internal advice on the potential for impacts to fish for both the existing and future discharges. The specific values in this catchment also need further consideration in conjunction with the 2018 Heathy Waterways Strategy.*

Listed fish species have been considered in the ERA. Within Shillinglaw and King Parrot Creeks, Dwarf Galaxias have been observed, and these waterways contain suitable habitat. Historical records of Australian Grayling exist from further downstream in the catchment, where the waterway has been heavily modified to form drainage channels near the confluence with Yallock Creek, however the waterways impacted by water quality mixing zone from Drouin WWTP is not likely to provide important habitat for this species. Other non-listed native fish species are also recorded from Shillinglaw and King Parrot Creek in the range of the mixing zone include Shortfinned eels, Southern pygmy perch, Tupong, Common galaxias. Additional native fish have been recorded from the wider catchment including Spotted Galaxias, Climbing Galaxias, River Blackfish and Small Mouthed Hardyhead.

The additional flows provided by the Drouin WWTP discharge is considered like to enhance aquatic habitat availability for fish in Shillinglaw Creek, through the provision of relatively secure environmental flows.

Ammonia toxicity trigger values at relevant pH and temperature values calculated from best available environmental standards (USEPA 2013) are presented in Table 5. Results in Table 5 show that the ammonia trigger value during summer is 1.9 mg/L and during winter is 3.7 mg/L. These values are before any mixing would occur with Shillinglaw Creek water, which would provide additional dilution. The expected MBR ammonia discharge values for ammonia of 0.15 mg/L in summer and 0.6 mg/L in winter are an order of magnitude lower than the ammonia toxicity trigger values. Therefore, there is a reduced risk from ammonia from MBR discharge to Shillinglaw Creek, which indicates a low risk of toxicity impacts on native fish.

The requirements of the 2018 Healthy Waterways Strategy had not been included in the existing ERA report (the initial report was completed in November 2017). A winter discharge regime should reduce risks associated with listed fish species including Dwarf Galaxias. The receiving waterways have been surveyed for fish in 2010 and 2012 with results indicating no significant differences upstream and downstream of the discharge point.

A high level risk assessment of values with rationale is provided below.

Table 2 High Level Risk Assessment of Receiving Waterway Values

Value	Risk Rationale	Score
Birds	Direct impacts to bird species are highly unlikely. Bird habitat in the mixing will have insignificant change and food sources are unlikely to be altered. Additionally, the mixing zone does not extend to Westernport and wader-bird habitat.	Low
Fish – Dwarf Galaxia	This small fish species is typically found in well vegetated slow moving waterways, or temporary habitats including wetlands. This species spawns in late winter to spring. The change in hydrology poses the greatest risk to this listed species. However, the current discharge already	Low

	alters the natural flow regime and maintains this flow throughout the year. Instream habitat may increase due to higher nutrient loads which would be favourable to Dwarf Galaxia habitat preferences.	
Fish – Australian Grayling	Australian Grayling *Prototroctes maraena* is a small to medium size diadromous fish species. The freshwater habitat preferences for this species include cool waters with gravel substrates. This species undertake spawning migrations in lower reaches of rivers between February and May triggered by a drop in water temperature and increase in flows. Changes in hydrology and temperature poses the greatest risk to this listed species. However, there is poor habitat quality for this species in the receiving waterways and it is unlikely to be present. In addition, the existing discharge already alters the natural flow regime and temperature.	Low
Fish – Native Species	Native fish species surveyed in the local catchment include Short Finned Eel -*Anguilla australis*, Common Jollytail - *Galaxias maculatus*, Pygmy Perch - *Nannoperca australis* and Tupong - *Pseudaphritis urvilli*. The existing discharge conditions may already be impact these species, through habitat alteration (vegetation and flow) and it is unlikely that these will be negatively exacerbated by the proposed changes.	Low
Frogs	The receiving waterway provides suitable habitat for frog species. In the region, the listed species Growling Grass Frog, *Litoria raniformis* is known to occur, with records of its presence much further downstream. This species requires still or slow moving water with vegetation and breeds in spring through to late summer. Increases in nutrients downstream of the discharge point may increase macrophytes and algae, this may increase habitat availability for frogs but excessive growth particularly algal or cyanobacteria blooms could be detrimental. The changes in water quality such as electrical conductivity between upstream and downstream are unlikely to impact the Growling Grass Frog due to similar conditions experience under the current discharge.	Medium
Macroinvertebrates	The receiving waterways have been assessed to be modified and experiencing stressors from the rural landscape. Monitoring of the existing discharge indicates	Low

	no detectable negative change between upstream and downstream. Due to the existing condition of the waterway it is not anticipated that the increased discharge will impact macroinvertebrate communities.	
Platypus	The instream habitat and riparian vegetation of the receiving waterway make it unlikely that platypus are currently present. Therefore, risk to platypus are negligible.	Low
Vegetation - riparian	The riparian vegetation of the receiving waterway is minimal, with the stream flowing through farmland. The riparian zone consists of exotic grasses with minimal shading to the stream. An increase in nutrients loads may potentially influence growth of exotic weed species but this is unlikely to be significant or different from the current discharge influence.	Low
Vegetation - instream	The receiving waterway is heavily vegetated with aquatic plants and choked with reeds in some patches. Increased nutrient loads may potentially increase plant growth. Macrophytes provide habitat for aquatic species and can help filter stream loads and contaminants. However, dense growth of aquatic plants such as reeds species *Phragmities* sp. and *Typha* sp. can be viewed as unfavourable for stream hydrology and create homogenous habitat by out competing other species.	Low
Amenity	Amenity to the receiving waterway is unlikely to change from the current discharge amenity impacts.	Low
Community Connection	The receiving waterway largely flows through private farm land with minimal broader community connection. It is unlikely that community connection will change from the current discharge impacts.	Low
Recreation	The receiving waterway largely flows through private farm land with limited access for recreational activities. The discharge may contribute to an increase in a cyanobacteria bloom which would impact contact activities. However, it is unlikely that recreation will change from the current discharge impacts due to the limited access.	Low

Table 3 Likelihood risk criteria

Likelihood of impact		
	Level	**Frequency**
A	**Certain**	Almost certain environmental impacts
B	**Likely**	Environmental impacts likely to occur
C	**Possible**	Possible environmental impacts
D	**Unlikely**	Environmental impacts unlikely to occur
E	**Rare**	Environmental impacts would rarely occur

Table 4 Consequence risk criteria

Consequence		
	Level	**Consequence**
5	**Catastrophic**	Known to cause cumulative environmental change, including loss of flora and fauna species or no longer desirable for human activities
4	**Major**	May cause cumulative environmental change widespread restriction of activities
3	**Moderate**	Detectable change in habitat and/or communities or localised restriction of activities
2	**Minor**	Low level detectable change in habitat and/or communities or minimal localised restriction of activities
1	**Insignificant**	Alteration to habitat or communities within natural variability

Table 5 Risk matrix

Likelihood	A	M	H	VH	VH	VH
	B	M	H	H	VH	VH
	C	L	M	H	VH	VH
	D	L	L	M	H	VH
	E	L	L	M	H	H
		1	2	3	4	5
		Consequence				

VH	Very High Risk

Additional Comments and Information as a response to the Gippsland Water / EPA meeting on 18th March 2019.

- Nutrient loads were identified as a key issue for EPA-

The expected treatment achievable by the proposed MBR plant are provided in the previous sections of this letter. These are based on concentrations in the discharge.

The treatment performance of the proposed MBR plant will reduce the mixing zone compared to current treatment. With increases in discharge volumes, the total nutrient load discharged will increase, which would extend the mixing zone without further measures. In addition to the proposed MBR treatment, Gippsland Water's is committed to ongoing mixing zone reduction through various measures, including waterway offsets, third party reuse and irrigation reuse options. Although the load from the increasing Drouin community will increase total incoming load, the MBR plant provides industry best practice for treatment to minimise the environmental impact.

- Note what discharge strategies can be used to reduce risk, explore timing of discharge ratios.

Discharge strategies (i.e. to discharge during higher streamflow cooler months of winter) have been discussed earlier in this letter.

There is no ability to control the timing of plant discharge other than to irrigate the treated wastewater as the MBR plant cannot be turned on and off rapidly.

- Note if better than licence limits can be achieved with MBR plant.

KBR has provided updated discharge quality ranges. For ammonia, discharge values are lower than the ANZECC limits.

- Ammonia toxicity is of concern.

Updated analysis of ammonia shows that it is unlikely to be above toxic levels within the MBR discharge, particularly within the winter periods.

- Provide information about RBA monitoring as EPA typically place more emphasis on this than water quality.

A summary of all the biological studies undertaken for Drouin is presented below in Table 6. This table is taken from "Drouin WWTP Discharge ERA (Project Report)" and the conclusions reached in that report states:

> *Results are relatively consistent over the years of sampling in that Shillinglaw Creek is somewhat degraded upstream and downstream of the discharge point and the Drouin WWTP discharge*

does not have much, if any, effect on macroinvertebrate communities. There is a similar outcome from the fish surveys in that Drouin WWTP discharge seems to have had little effect on fish diversity and numbers. The macrophyte study did note changes downstream of the discharge point in Shillinglaw Creek. However, one key result is that there was increased periphyton biomass and chlorophyll a in King Parrot Creek downstream of the confluence with Shillinglaw showing that nutrients from Drouin WWTP are probably contributing to these increases.

As such the RBA and fish sampling has shown a low risk in the past to environmental values of Shillinglaw and King Parrot Creeks, with the exception of perhaps increased eutrophication and biomass under certain conditions.

- Metals in discharge – provide a profile of the risk

MBR treatment is not expected to be effective for removing metals from the influent. Therefore it would be reasonable to assume that the metals concentration of the MBR effluent will be similar to that of the influent sewage. The inclusion of metals in a future water quality monitoring will be undertaken. Metals are likely to be a lower risk of toxicity in the discharge given the lack of heavy industry in Drouin. A review of the metals data after a number of samples have been taken may provide confidence to EPA that this risk is being managed. Additional actions can occur should a metals risk be identified.

- Recommend a monitoring program (long term)

Gippsland Water commits to a long term water quality monitoring program which can be used to test the assumptions of the risk assessment. Rapid Bioassessment will be conducted to test for any ecological impacts of the discharge, as an indicator of general aquatic ecosystem condition.

- Provide an approach to improving mixing zone over time, reasons why or why not this is not possible, but using monitoring of RBA to show risk is managed.

Gippsland Water is committed to protecting beneficial uses of the receiving waters, through working with Melbourne Water to deliver improved waterway condition through waterway offsets within the King Parrot Creek catchment.

Recent mixing zone mapping highlighted several sources of water quality impacts from agricultural land downstream of Drouin WWTP. Figure 4 provides an example for nitrate concentrations, that decline downstream of the Drouin WWTP discharge, but also increase to greater concentrations approximately 1.5km further downstream. Opportunities exist for Gippsland Water to help manage these sources, resulting in a net benefit to the waterway conditions. The protection of instream vegetation downstream of the discharge location is one measure that will enhance ecosystem services that provide benefits to downstream ecosystem condition. There are opportunities to enhance aquatic habitat and protect riparian condition, which are expected to improve ecological values and ecosystem condition.

Furthermore, with urban growth in Drouin forecast to continue, there are future opportunities to contribute to stormwater management, including constructed wetlands. Melbourne Water have identified the likely threats to King Parrot Creek from urban stormwater, and have developed 10 year performance objectives for waterways in the Westernport region (Healthy waterway Strategy, 2018). There are opportunities for Gippsland Water to develop waterway offsets that support Melbourne Water's performance objectives for urban stormwater in King Parrot Creek catchment.

"Progressively implement stormwater harvesting, focusing on Casey Clyde Growth Area and outer lying towns (for example, Drouin). Once this catchment has reached its anticipated long-term urban footprint based on the current urban growth boundary, this will require around 11.8 GL/year of stormwater harvested and 4.4 GL/year infiltrated."

"Prevent decline in stormwater condition by treating any new development (e.g. Drouin) so directly connected imperviousness (DCI) remains below 0.5% along King Parrot Creek and tributaries. For every hectare of new impervious area, this requires harvesting about 5.7 ML/y and infiltrating 2.1 ML/y. This is about 2.0 GL/y and 0.8 GL/y for full urban development."

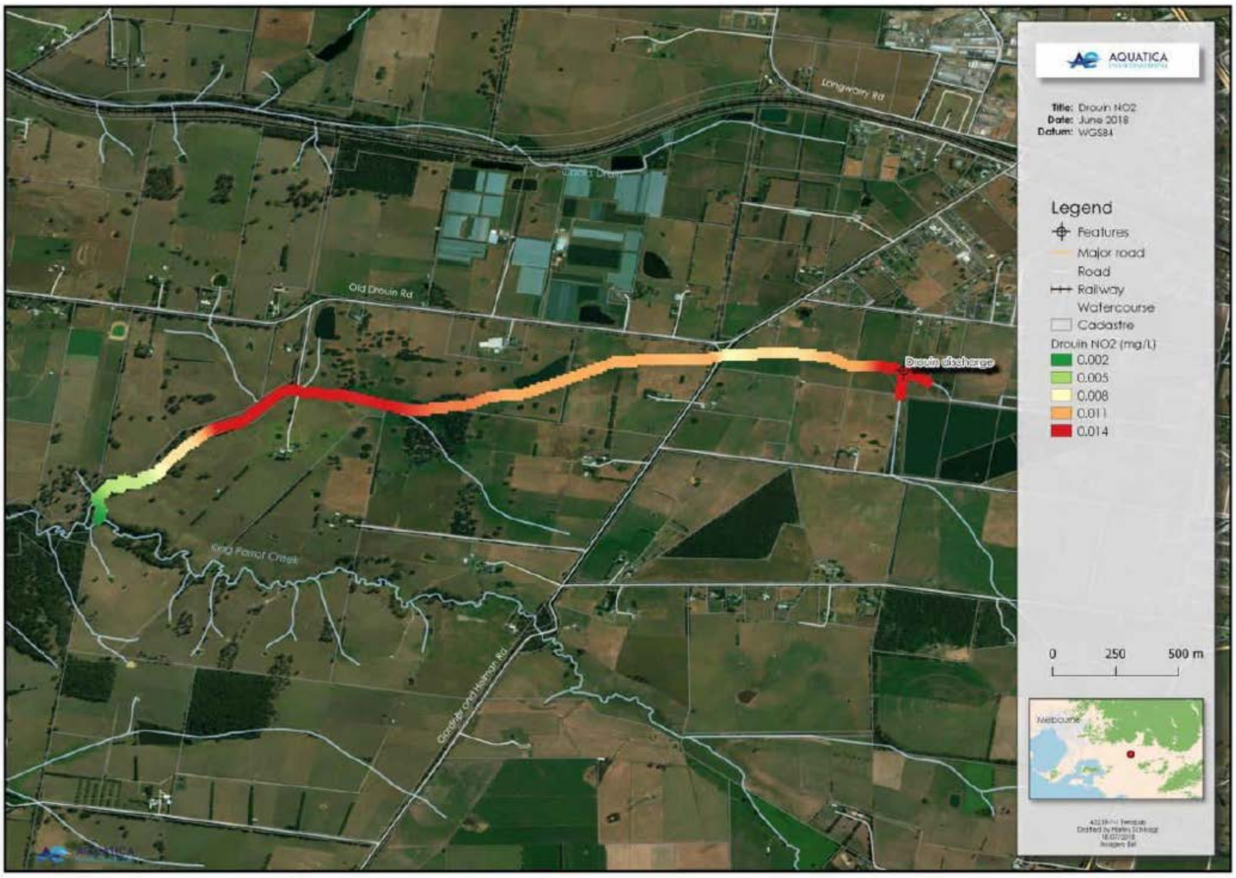

Figure 4 - Mixing Zone map, showing sampled water quality (Nitrate–N) in Shillinglaw Creek.

The mixing zone may be improved over time should better technology become available and it is cost effective to implement. It is noted that the proposed MBR plant technology is considered industry best practice standard. Gippsland Water are committed to continue monitoring of the receiving waters using water quality testing of stream waters to confirm the mixing zone extent and RBA methods to assess aquatic ecosystem condition.

Sincerely
GHD

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