



**COOTAMUNDRA-  
GUNDAGAI REGIONAL  
COUNCIL**

**Gundagai STP**

**Effluent Quality In 2020**

**May 2020 Report**

# Contents

<b>1.0</b>	<b>Introduction .....</b>	<b>2</b>
1.1	Background .....	2
1.2	Water Quality Monitoring.....	4
1.3	Contents of this Document .....	5
<b>2.0</b>	<b>2019 Water Quality.....</b>	<b>6</b>
2.1	Typical Performance of the Plant.....	6
<b>3.0</b>	<b>2020 Water Quality.....</b>	<b>8</b>
3.1	Overview Comments.....	8
3.2	Specific Comments on Water Quality at the Extraction Point.....	9
3.2.2	Notes from Table 3.....	10
3.3	Overview of 2020 Water Quality to Date .....	10
	Attachment No 1.....	14
	High January 2020 Reading.....	14
	Attachment No 2.....	18
	High March 2020 Readings .....	18
	<b>Attachment 3.....</b>	<b>20</b>
	<b>2019 Water Quality Data.....</b>	<b>20</b>
	<b>Attachment 4.....</b>	<b>27</b>
	<b>Effluent Quality Strategy during the Construction Period .....</b>	<b>27</b>
	<b>Attachment 5.....</b>	<b>35</b>
	<b>END USER AGREEMENT EXERTS .....</b>	<b>35</b>

## 1.0 Introduction

This document is a summary of the water quality being achieved from the Gundagai Sewerage Treatment Plant (STP) during 2020 with this version containing results up until the end of April of 2020. This report is now being posted on the Council Website and will be updated monthly depending when the water sample results are made available to Council. However, before dealing with those aspects there is a need to provide relevant background to this water quality report for those parties interested in reading this document for the first time now that it is being posted on the web site. Hopefully, this background will provide readers with sufficient background when they examine this document but if not please do not hesitate to contact Council's Manager Assets through the switchboard (1300 459 689).

### 1.1 Background

All the effluent produced by the township of Gundagai is processed through a treatment plant located in the middle of the town's golf course. The effluent once it is treated is passed into a fenced off storage on the golf course and from here it is extracted and used to irrigate the golf course and the sporting fields down on the river plain. That system has been in place for several decades now and has made it possible for the town to have these facilities. It also makes beneficial use of a product that is in scarce supply in Australia as well as keeping this nutrient rich water out of the Murrumbidgee River. Users of these facilities are not just protected by the treatment plant itself, but also by several on-site measures that include the following (and it should be stressed that this list is not exhaustive):

- Irrigation occurs during the evening when there is no one on the golf course or the sporting fields and must stop at least 4 hours before the course is used, this is referred to as the withholding period. It is there as it allows the ground to dry out before there is usage and hence less chance of any transference of bacteria or viruses. Similarly, there is a very significant die off rate of these elements and the protozoa should the plant itself not operate at the appropriate level.  
The 4 hours is in line with industry guidelines for reuse.
- The irrigation sequence is such that the first holes likely to be played are the areas first irrigated and the first stopped under the irrigation sequence to maximise the withholding period to more than 4 hours.
- The Golf Course and playing fields are not irrigated on Friday or Saturday evenings given the large-scale usage of these facilities on weekends and the relatively light usage through the week. This is part of a historical practice and is set out in a formal agreement that exists between Council and the Gundagai Districts Sports Club that is responsible for the Golf Club. A small segment of that document is included in this report as a guide to those reading this document for the first time. That end user agreement is currently being reviewed to accommodate the new plant now that that design is complete and to include new and emerging factors such as pandemics after what we have now experienced. Once it is completed and signed off the non-commercial elements will also be put on the Council web site.
- There are provisions in relation to irrigation on windy and wet days when spray or overflow from the course may be problems.

- There is to be no irrigation for a number of days after rainfall to ensure that the water quality of the effluent being reused has not been impacted by the rainfall with the plant modified in its current format to allow a new plant to be built on the same site.
- Fortnightly readings on water quality as well as experienced operators who would notice if there was any significant change in incoming water quality. Where a poor reading is found without a satisfactory reason then irrigation is suspended immediately until the water quality improves.
- A formal Trade Waste Policy covering all non-domestic properties. Council has observed that incoming wastewater quality does not significantly change unless something illegal is dumped into the system and if this were noticed again irrigation would be ceased immediately.
- If there ever was any health event with respect to the users of the course or the playing fields, then these facilities would be immediately closed, and the quality of the effluent investigated before any further irrigation occurs.
- Historically the cooler temperatures and low levels of evaporation sees no irrigation carried out from late April to early September. This ensures that users of these facilities are not walking in treated sewage that has not had an effective withholding period.

The existing treatment plant was constructed in 1923 and was upgraded in 1961 but is currently being replaced by a newer plant that will treat to a much higher standard than the old plant was able to. This is occurring in 2020 and will be finished in 2021 with the existing plant continuing during that period but in a modified format that requires this close observation of the performance of the plant. It has been noticed that in this format that water quality can diminish a little for a few days after a significant rainfall event and thus there are requirements not to irrigate the golf course or the sporting fields for a number of days afterwards.

The current reuse scheme was initially conceived in the 1980's as a way to beneficially reuse the effluent to give the town much improved sporting facilities as the costs of providing town water to irrigate and maintain these facilities would be cost prohibitive. The scheme was signed off by the Council and the NSW Government of the day and was the recipient of several industry prizes for this beneficial reuse of what would have otherwise deemed a waste stream.

The ongoing effluent reuse in Gundagai however needs to currently meet two overriding performance parameters these being:

- The volume irrigated in any one day is not to exceed 5 ML but as the irrigation system does not capacity to put this volume of the water on the ground in a day and as the normal inflow to the plant is around 0.45 ML/day this criterion is effectively mute.
- The faecal coliform count is to be below 1000 Coliform Faecal Units (cfu) for a defined volume. There can be some readings of other matter that shows up as faecal counts and thus there needs to be a full understanding of what is happening in the wider environment when any of this data is reviewed by Senior Council Officers.

These are not the only parameters monitored at present as can be seen from the detailed results but do form the basis of the existing reuse system. The new plant will however be monitored against a much larger suite of parameters. Most of those parameters have been monitored for some time now.

## 1.2 Water Quality Monitoring

Water quality samples are taken by independent body and passed through a NATA accredited laboratory and can take two to three weeks before all of the results are available for reporting hence the reporting of them is somewhat in arrears but Council does get advance faecal coliform data if there is a poor sample to allow it to act more quickly but these results can still takes around 1 week to obtain. If there has been an excursion beyond this 1000 cfu count the first steps for Council officers is to explore if there is some external factor that may have generated this high reading as there are a number of other elements such as algae that can masquerade as faecal coliforms. From a community safety perspective here these officers first need to explore if there is any irrigation occurring at time and stop it until more is known as well as determining exactly what risk is posed to the community, which necessitates reporting it immediately to the regulators.

For example the last element of the current treatment process is to subject the flows to UV radiation in what is referred to as a maturation pond but typically in the transition to winter the performance of these units can reduce for a period of time due to sudden arrival of cold weather and a lack of sunlight. However as this occurs over the cooler periods this is not a problem as there is no irrigation occurring and the water quality will have cleaned itself up before reuse is required. This is typical of this type of treatment process and not unique to Gundagai. Hence exceedance of the 1000 count is of no health consequence during this period providing there is no irrigation until the water quality has improved to below this level and that is the current practice.

The problem with water quality monitoring is that it provides historical data for the water authority to explore trends and correct these if so required but it is of no use in the day to day operation of the plant as it contains nothing but historic data with the plant performance probably having already altered by the time the results have been obtained. Thus, there are a number of onsite measures in place to protect the community if other elements of the plant have not performed as they should have.

The measures start with having a reliable and well proven technology in the treatment plant that is up to date with modern requirements and Council is investing a significant level of funds in replacing the existing 100 year old plant. They are followed by the need for a withholding period, and then other measures such as no irrigation for several days after a significant rainfall event, having provisions to prevent spray drift etc. All of these requirements are what forms a formal document between the Golf Club and Council referred to as the "End User Agreement" with significant punitive measures if these requirements are not meet but it should be stressed that there has been many years of good joint operation between these two bodies.

There are three sampling points the first being at the extraction point from the golf course storage and is representative of the water being applied to the golf course. Council is currently installing a chlorination dosing unit at this point to provide further protection and historically this has been used as the point to measure the 1000 cfu limit. The other points are at the entry to the golf course storage and at the maturation pond which have been more recent additions. These figures are useful in terms of the operation of the plant and also demonstrate the contribution that the golf course storage is making to the treatment plant during this period of modified operation. The detailed figures for 2020 to date are set out in Section 3 of this document along with appropriate comments on plant performance. The detailed figures for 2019 are contained in Attachment 3.

There are also some ground water probes that are monitored less frequently to determine if the treatment plant is seeping into any groundwater and impacting water quality as well as analysis of the course in general to see if there is any accumulation of salts or nutrients that may prove to be harmful in the longer term. These have indicated no such trends to date.

### 1.3 Contents of this Document

- **Attachments 1 and 2** contain an explanation of any deviation from the set limits for the operation of the plant in 2020 and what risk these may have posed to the community (if any risk existed) as well as indicating what can be done to prevent these excursions from occurring again.
- **Attachment 3** contains the detailed water quality reports for 2019 for those interested.
- **Attachment 4** contains the updated effluent quality strategy Council is operating to, as at the date of this report. This strategy remains fluid and is amended as more is learned in respect to the effluent water quality and the originally approved effluent reuse scheme as well as the final design. It seeks to set out why decisions were made and what were the targets for Council during this period. It is included in this document to provide the community of how Council is operating the existing plant whilst the new plant is being constructed.

These measures recognise the time that it can take to get the results of the water quality data generally makes it too late to act. Rather the strategy seeks to introduce automatic additional barriers that apply when events that the trend monitoring has indicated would normally impact the performance of the plant.

- **Attachment 5** contains relevant excerpts from the end user agreement currently being used by all parties that includes the measures specifically designed to address water quality during the construction period. This included a guide to show how the reuse scheme is being administered on a day by day basis.

## 2.0 2019 Water Quality

Water quality monitoring on a fortnightly basis was introduced in late 2018 after the plant had been modified to allow for the construction of a new plant to occur. This monitoring is very expensive in a small community but was considered essential for the construction period with a modified plant, but this preconstruction period became a little more drawn out than Council had originally anticipated. However, because of this extended monitoring period a considerable amount has been learned about the performance of the modified plant during 2019 and that has allowed the onsite precautionary procedures to be modified to better protect the community.

As indicated the modified plant has seen one of the maturation ponds removed to allow for the construction but the existing maturation pond has been modified to give it greater treatment capacity recognising that it has around 40 years of accumulated biosolids in the base of the pond. The remainder of the treatment plant has remained intact.

### 2.1 Typical Performance of the Plant

For most of the 2019 year the modified plant was quite capable of bringing in the effluent quality at levels below the 1000 cfu limit and did so noting that the golf course storage is provide great assistance in achieving these levels of water quality. However, there were brief periods when this is not the case, and these can be summarised into two categories based in the 2019 experience.

- Immediately after significant rainfall event where the maturation period is decreased by much increased inflow. This is overcome by not allowing irrigation of the facilities for several days after the rainfall event ceases allowing the ponds to settle down as they seemed to recover quickly. This requirement was added into the modified end user requirement and sees better conservation of the limited supply of effluent.

- The water quality exceeded the 1000 cfu limit in the sampling period 23/4 to 4/7 (when the water quality returned to levels well below the 1000 cfu requirement). There was no irrigation in this period and as such Council did not breach the requirement applicable to the plant in reusing this effluent.

This higher cfu count was the result of a particularly cold late April and May with a significant number of overcast days that did not allow the maturation pond to work. This transition from a particularly hot summer was sudden with no period for the plant to make any gradual changes. Traditionally maturation ponds struggle during this period when the much colder months arrive such as in Gundagai and it is probable that this sort of performance has been traditionally occurring since the ponds were installed in 1961. Unfortunately, under the previous sampling regime there is not significant data available to comment on this with any detail.

- During June, excess effluent filled the storage to maximum capacity and then overflowed the golf course storage into the unnamed creek that is isolated from the river system and was part of the drainage for the original township of Gundagai, before it was moved after the 1852 floods. This arrangement remains unchanged since the reuse scheme was originally approved and commenced operation several decades ago. This overflowing effluent was either evaporated or was taken up by the ground.
- At all other times in 2019 the water quality at the traditionally agreed monitoring point (extraction point) was below the 1000 cfu requirement and as such the water

quality appears to have been controlled by the alterations made to the construction strategy measures as well as the newly drawn up end user agreement.

- Council did have an independent expert analysis carried out to determine if its strategy still exposed it to a high risk and that consulting company confirmed that Council's directions were of a low risk and it would appear that the results of 2019 have confirmed this. Nevertheless, a chlorination facility to be added to the existing reuse effluent that company was then engaged to design the new chlorination arrangement and obtain quotes from reliable suppliers.
- In general, most of the numbers have been around the 100 cfu mark or lower but there have been to higher readings that have caused Council to monitor the plant more closely.

- The 24/10 figure of 606 cfu was found to be the result of a 20mm plus rainfall event the day before the sample was taken leading to some shortcutting of the modified maturation pond. However as results generally take more than two working weeks to get back, non-irrigation of the golf course for a number of days followed this rainfall event as part of the onsite measures to control water quality and protect those using the facilities. This was confirmed by the next reading (down to 101 cfu followed by 28 at the next reading) as well as the levels faecal coliforms in the maturation pond.

In addition, the standard procedure is to not irrigate the golf course and other facilities for at least two days before any sporting events are undertaken and as such gain the maximum benefits from a much elongated withholding period.

- On 19/12 there was another reading of 606 cfu was obtained but the levels of faecal coliforms in the maturation pond itself were quite low and as such this slightly elevated number was not necessarily an inflow of faecal matter.

It was also noted that that the golf course storage in particular had significant algal growth as a result of the golf course reducing irrigation and little effluent overflowing the maturation pond into the effluent into the golf course storage due to very significant evaporation losses in this period. This algal matter if decaying can give rise to elevated faecal coliform counts and this is supported by the rapidly rising suspended solids counts during December which would have been also impacted by the algal growth.

The golf course had already cut its irrigation amounts to save water and as a result the withholding periods were much longer at this time so there was additional safety particularly with the high temperatures assuring those golfer brave enough to venture onto the course that the course was already very dry.

In addition, it is normal practice not to water the golf course after Thursday night until Sunday night again maximising holding periods. Similar practices exist for the other sporting facilities



## 3.0 2020 Water Quality

### 3.1 Overview Comments

2020 has been a difficult year for the operation of the treatment plant with the drought of 2019 continuing into the start of the year only to be followed by exceedingly high levels of rainfall that has seen 25% (approximately 180 mm) of the annual rainfall for Gundagai falling in the two months from Mid-January to Mid-March. Significant rainfall has continued through April such that by the end of April some 245 mm or 38% of the average annual rainfall had fallen and temperatures had dropped considerably with a mean daily maximum temperature of only 21 °C in April unlike the January figure of 34.0 °C with very high evaporation.

However, prior to the rainfall the sky was blackened with considerable volumes of ash and smoke that impacted the operation of both the maturation pond and the golf course storage. It is this ash falling into the pond that is considered to have been responsible for the high reading of 7 January and the first of two excursions above the limit set for reuse in 2020 to date. The ash gives something of a false faecal coliform reading showing up as faecal matter in the sampling and thus there was no real threat from this event with the following water quality sample faecal count well back down below the limit after rain had cleared the skies and effectively brought the wildfires under control. For a more detailed explanation refer to Attachment 1

Compounding the above has been the extremely high temperatures experienced in the summer months that saw an extended period where there was an excessively long period when there was no overflow from the maturation pond to the golf course storage allowing the later to become drawn down until significant rainfall in early March saw a very large overflow into golf course storage over many days significant impacting water quality (refer attachment 2 for a more detailed explanation). However, with the plentiful rainfall that occurred at this time there was no need to irrigate the golf course and playing fields giving the ponds the time to re-established water quality before there was any need for irrigation. Indeed the only irrigation that has been required since the 3<sup>rd</sup> of March has been to irrigate the playing fields that were closed off to the community to draw down the golf course storage to allow some works at the new treatment plant to occur.

It will now be interesting to see if the ponds demonstrate the same winter onset lack of performance that that typically can reduce water quality with some de-stratification as occurred in 2019 see Attachment 3. The golf course pond has settled down in April with the pond

BOM forecasts as of the end of April are indicating that 2020 should be wetter than average in this region and as such it is anticipated that with the onset of winter this traditional period of no irrigation in the cooler months will again occur with probably no need to irrigate the golf course until September 2020. By this time the new chlorination unit on the irrigation system will be fully operational for the remaining period till the new plant comes online and there is no need for any of the maturation or storage ponds except for ornamental purposes.

This document is a record of water quality leading up to the construction of the new STP since it was modified. It is also to serve as a record of why things were done during this period, how effective any current measures have been and any emerging trends in respect to water quality that need to be considered moving forward. It will assist with further updating of the current end user agreement based upon actual Gundagai experience as opposed to more general industry experience.

## 3.2 Specific Comments on Water Quality at the Extraction Point

### 3.2.1 Notes from Table 1

- (1) In the period from Mid-December to Mid-January the air around Gundagai is full of smoke and ash and this was impacting the performance of the maturation ponds and in fact what is being measured here is not faecal coliforms but rather ash that would show up as faecal coliforms.
- (2) Similar comments apply here excepting that this reading was taken when much of this region was on fire. with wildfires doing damage in Tumut Batlow Adelong Refer attachment no 1 for a more detailed explanation
- (3) This low reading and the speed at which the plant came back into compliance further demonstrates that the 7/1 faecal count was indeed ash leading to false high readings. However water quality or more specifically this reading was impacted by the first significant rainfall for months, in the period 17 – 21 Jan, with the rain elevating the faecal count and bringing in the requirement not to irrigate for a number of days as per the end user agreement.
- (4) It is only in either very late February or early March where inflows into the maturation pond have reached the level where they are now starting to overflow the maturation pond. This has led to a stirring up of the sediment in the bottom of the drawn down golf course storage. In March despite a maximum of 42.3 the mean of the maximum temperatures has dropped to 26.7 reducing evaporation losses. In April, this figure was considerably lower with ongoing rainfall
- (5) There is significant rainfall between the 4<sup>th</sup> and the 8<sup>th</sup> of March with very large flows now occurring from the maturation ponds into the golf course storage as a result of these wet weather flows into the plant with the catchment having become wetted by rainfall in January and February. Rainfall is 72.1 mm for the month with most of that occurring in this 4<sup>th</sup> to 8<sup>th</sup> period. Refer Attachment 2 for more detailed comments on what has happened here but with no irrigation there is no concern over public health issues.
- (6) Similar comments apply as above and again reference should be made to Attachment no 2. This is the second failure in March to keep below 1000 cfu but this figure represents water quality in the golf course storage improving and potentially it may have complied if it had not been taken the day after rainfall.
- (7) Water quality continues to improve as the golf course storage pond continues to settle down from this sudden inflow that stirred up the sediment in the lower pond.

### 3.2.2 Notes from Table 2

- (1) The exceeding high faecal count here shows a reading that cannot be explained by just a change in plant performance and indicates that some external agent has played a role and the much reduced readings in the next month seem to confirm this. As set out in attachment 1 this external agent is thought to be the ash from the bushfires burning around the town.
- (2) These suspended solids readings corroborate that excessive increases in faecal counts has been because of significant rainfall occurring during March and April

- (3) These readings appear suspicious but do not warrant further detailed examination as they are not relevant to explaining any plant failures

### **3.2.2 Notes from Table 3**

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- (2) These suspended solids readings corroborate that excessive increases in faecal counts has been because of significant rainfall occurring during March and April

### **3.3 Overview of 2020 Water Quality to Date**

COVID -19 regulations have seen the number of day trippers stopping in the township and the tourism industry essentially totally implode reducing the actual daily inflow on the treatment plant particularly with the shut-down of several local businesses.

The figures contained in Table 1 demonstrates that there have been three occasions on which the faecal count has exceeded the 1000 cfu limit but none of these posed a health threat to anyone using the golf course or the other sporting facilities. Two water sample readings occurred when there was no irrigation occurring of either of these facilities and one was something of a false reading measuring a considerable amount of smoke and ash entering the ponds as the result of a fire season not like any before it.

Outside of these three readings the plant has operated within the designated limits but it has been struggle with the unique climatic or ambient conditions experienced during this year to date that make it something of a year like no other.

As indicated, with forecasts for a wetter than average year, it is not anticipated that irrigation will need to recommence before September this year but will then continue throughout the rest of this calendar year.

The main lessons to be learned from this is the sudden transition from one of the worst droughts on record to a very wet few months was the need to avoid such a sudden transfer of a large amount of effluent and this can be overcome by some preliminary slow pumping down of the maturation pond to minimise the suddenness of such a load however it is not anticipated that these circumstance are likely to replicate in 2021 and after that the ponds will no longer be required.

**Fortnightly Sampling of Treated Effluent Bidgee Banks Golf Course**  
**Table 1 Irrigation Extraction Point**

Parameters	Units	6/11	20/11	5/12	19/12	7/1	24/1	5/4	18/2	3/3	16/3	31/3	14/4	22/4		
Biochemical Oxygen Demand	mg/L	12	2	12	6	9	20	3	4	12	12	17	12	12		
Calcium (dissolved)	mg/L	26.2	28.4	21.2	15.7	15.9	18.0	16.5	17.8	16.0	17.2	17.6	20.5	17.8		
Faecal coliforms	cfu/100 mL	101	28	192	606 (1)	5050 (2)	550 (3)	140	10	505 (4)	2020 (5)	1410 (6)	800 (7)	210 (7)		
Conductivity	µS/cm	796	722	845	538	523	548	496	524	496	490	466	514	530		
Magnesium (dissolved)	mg/L	7.15	4.48	4.9	5.78	5.32	5.53	5.08	5.17	5.10	6.5	5.92	6.45	6.00		
Nitrogen, total	mg/L	37	31	24	13	7	6	4	4	8	11	8	14	13		
Nitrate/Nitrite as N	mg/L	0.1	2.1	4.3	7.7	4.4	1.5	<0.1	<0.1	4.3	6.6	3.85	10.0	8.6		
Oil & Grease	mg/L	6	3	1	2	2	4	1	1	2	6					
Phosphorus, Total	mg/L	9.38	12.7	12.9	0.36	8.06	11.3	5.0	4.68	3.74	3.13	4.53	2.73	2.24		
pH	pH units	7.5	7.8	7.9	7.8	7.2	7.1	6.7	7.2	7.3	7.6	7.3	7.4	7.8		
Sodium Adsorption Ratio	Ratio	3	4	3	3	4	4	4	4	3	3	3	3	3		
Sodium (dissolved)	mg/L	75.5	88,6	65.4	55.7	69.4	78.3	68.8	80.4	70.4	60.9	50.9	70.3	62.2		
Total Kjeldahl Nitrogen	mg/L	37	29	20	5	3	5	4	4	4	4	5	4	6		
Total Suspended Solids	mg/L	3	20	105	74	8	8	15	20	52	56	58	50	49		

**Fortnightly Sampling of Treated Effluent Bidgee Banks Golf Course  
Table 2 Storage Inlet**

Parameters	Units	6/11	20/11	5/12	19/12	7/1	24/1	5/2	18/2	3/3	16/3	31/3	14/4	22/4			
<b>BOD</b>	mg/L	12	5	14	9	31	26	14	28	44	27	46	29	32			
<b>Calcium (dissolved)</b>	mg/L	23	27.8	18.7	8.53	16	16.7	14.5	15.9	17.2	19.4	19.0	24.1	26.5			
<b>Faecal coliforms</b>	cfu/100 mL	178,000	1,620	3,160	4,340	122,000 (1)	50,200	27,000	33,300	33,000	28,300	48,500	280,000 (3)	20,000			
<b>Conductivity</b>	µS/cm	680	704	618	457	572	543	480	434	537	487	537	569	627			
<b>Magnesium (dissolved)</b>	mg/L	5.94	4.43	4.25	4.41	5.32	4.14	3.85	4.16	4.96	6.82	6.18	7.62	9.42			
<b>Nitrogen, total</b>	mg/L	35	30	22	16	17	15	27	21	23	20	24	21	24			
<b>Nitrate/Nitrite as N</b>	mg/L	1.9	2.2	4.1	4.1	4.2	4.0	7.6	7.4	11.0	9.3	6.9	12.0	8.7			
<b>Oil &amp; Grease</b>	mg/L	3	4	3	5	4.0	<1	2	2	2	3	4	3	1			
<b>Phosphorus, Total</b>	mg/L	10.2	13.5	13.8	9.49	8.88	30.0 (3)	4.87	4.85	6.36	4.03	4.79	3.3	3.48			
<b>pH</b>	pH units	7.8	8.4	8.2	8.4	8.0	7.6	6.7	9.4	8.7	7.5	9.1	8.7	8.1			
<b>Sodium Adsorption Ratio</b>	Ratio	3	4	3	5	4	4	4	4	4	3	3	3	4			
<b>3Sodium (dissolved)</b>	mg/L	71.5	88.4	62.3	68.9	70.3	67.7	61.7	67.8	65.8	61.3	54.8	77.2	82.7			
<b>Total Kjeldahl Nitrogen</b>	mg/L	33	28	18	12	13	13	19	14	12	11	17	14	15			
<b>Total Suspended Solids</b>	mg/L	19	23	48	93	74	47	164	39	63 (2)	134 (2)	13	11	58			

**Fortnightly Sampling of Treated Effluent Bidgee Banks Golf Course  
Table 3 Near Maturation Pond Outlet**

Parameters	Units	6/11	20/11	5/12	19/12	7/1	24/1	5/2	18/2	3/3	16/3	31/3	14/4	22/4			
Biochemical Oxygen Demand	mg/L	10	3	17	12	64	35	18	26	44	58	41	22	32			
Calcium (dissolved)	mg/L	21.3	26.0	15.6	7.9	16.0	16.4	14.1	14.0	17.1	19.3	18.9	24.6	21.2			
Faecal coliforms	cfu/100 mL	178,000	8,890	6,400	4,020	178,000 (1)	51,100	34,000	149,000	26,300	45,400	32,000	300,000	100,000			
Conductivity	µS/cm	671	657	565	447	615	540	503	444	539	536	525	584	675			
Magnesium (dissolved)	mg/L	5.4	3.9	3.27	4.05	5.06	4.12	3.85	4.0	4.98	6.86	6.11	7.92	7.62			
Nitrogen, total	mg/L	34	30	23	18	33	16	27	22	25	26	25	40	20			
Nitrate/Nitrite as N	mg/L	2.9	3.4	3.7	5.5	3.8	1.9	6.7	9.7	9.1	7.5	9.5	9.1	8.6			
Oil & Grease	mg/L	9	4	3	5	3	<1	5	6	6	6	6	5	<1			
Phosphorus, Total	mg/L	11.9	15.9	12.8	9.9	9.9	5.9	4.8	4.8	6.5	4.5	4.4	4.5	4.1			
pH	pH units	7.8	8	8.4	9.5	8.8	8.1	6.7	9.7	9.1	7.5	9.5	9.1	8.6			
Sodium Adsorption Ratio	Ratio	3	4	3	5	4	4	4	4	4	3	3	3	3			
Sodium (dissolved)	mg/L	69.5	83.5	58.1	67	69.8	67.8	62.6	67.7	65.9	59.1	53.3	76.9	65.3			
Total Kjeldahl Nitrogen	mg/L	31	27	17	13	29	14	20	15	12	16	18	16	20			
Total Suspended Solids	mg/L	27	41	52	102	132 (1)	48	16	80	68 (2)	119 (2)	118 (2)	102 (2)	71			

## Attachment No 1

### High January 2020 Reading

The 1000 cfu limit for faecal coliforms was exceeded on 7/1/2020 when a water quality sample was taken. The count on that day was 5050 cfu and was at odds with water quality being produced by the plant particularly in the six months prior. As there had been no rainfall for a significant period and there was no incidence that Council was aware of this reading required immediate investigation as its accuracy was suspicious. Due to the Christmas shut down these results were late to Council and the first step was to get some quick faecal results and these indicated that the plant was already back into the performance zone so there was no immediate concern over water quality.

The sudden increase from 4020 cfu on the last December reading in the maturation pond to 178,000 cfu on 7/1/2020 needed explanation as this sort of dramatic increase cannot be explained by plant performance alone and almost assuredly must be as a result of some outside agency. Similarly, the quick recovery which again is at odds for the expected performance of the maturation ponds only served to confirm this was the case. Council officers and their consultants were sure that this reading was the result of the ash and smoke in the air because of ambient conditions but when through a due diligence process that required exploring the following:

#### **1 Some foreign biological matter in the effluent that causes problems at the plant or some toxin.**

This could explain the sudden decline of the water quality but not so much the quick recovery of the performance of the plant certainly far more quickly than would be expected if some form of foreign substance in the incoming sewerage had led to problems with the plant. Supporting this is Gundagai is essentially a residential town in nature with only a few light commercial applications and as such there is no likely source of such a discharge and indeed operational history would support that such events are very rare.

Further supporting this is that the other water quality parameters did not appear to change significantly, and it would have been expected that some other foreign body would have altered some of these considerably.

***This was considered unlikely to have been the cause of the high count in this instance.***

#### **2 Short circuiting of the maturation pond leading to reduced effluent quality due to a lack of maturation time**

At Gundagai this only happens

- If there is significant rainfall in a short period that leads to an overflow at the flow diversion arrangement at the pumping tank. However, there was no rainfall in this period to cause such an overflow.
- Plant failure and there was no such event during this period.
- Operator failure and again as these are experienced operators this was not a factor during this period even with the Christmas period.

***Ruled out as a cause of the high count in this instance***

### 3 Sampling Error

Possible but the person taking the sampling is experienced at this practice and the fact that the faecal readings elsewhere are also high would tend to mitigate against this potential cause in this instance.

***Possible but considered unlikely in this instance to have been the cause of the high reading.***

### 4 Plant in current format unable to cope with the operation

This is the first reading to exceed the licence requirement where either rain induced short circuiting or the transition into winter were not the cause. Indeed in 2019 the transition into winter lead to higher readings but that was expected and dealt with by on-site procedures that prevented risk to the community. That occurrence however saw a much more gradual decline despite a very rapid transition temperature wise. In general, this reading is at odds with the plant's performance and needs understanding before reacting particularly as water quality has returned to suitable levels.

***Highly unlikely as this is first not obvious event of the plant exceeding the target figure***

### 5 Localised pollution incidents

In the case of ponds this localised pollution can take the form of birdlife (particularly ducks) or some local event such as disturbing the pond and stirring up biosolid material on the bottom of the pond. This sort of localised event could lead to a false high reading that was not fully indicative of water quality. However on the 7<sup>th</sup> of January there were high readings in both the maturation pond and the Golf Course Storage (at the inlet) and the operators and the sampler report no significant bird life during that week, or any activity near the pond.

Possibly floating sludge rafts may have been another source for such an incident but these would not have resolved themselves as quickly, but the operators confirmed that these were not the case.

***No evidence to support this factor as the potential cause of the high count.***

### 6 Algal Growth in Ponds

Decaying algae can often show up in faecal counts giving a false reading and there was evidence of algal growth particularly in the golf course storage at this time but to get to the number of the readings shown on January 7<sup>th</sup> would have required a massive full bloom and this did not occur. It is however thought that this may have contributed somewhat to the figures attained for 7/1/2020.

***Likely a minor contributing factor but unlikely to have been the major cause of the high count in this instance.***

### 7 Climatic Conditions

In this week temperatures where in the 30s and 40's peaking at 45.2° C just a couple of days before the sample was taken and the township was choked with smoke from nearby fires in Adelong, Tumut Batlow etc.

***Considered to be the most likely cause of the high count in this instance and pursued further below.***



**As indicated Council officers had observed that the last reading in December was a little higher than normal and somewhat expected the January readings to be a little higher than the normal performance but no to the levels actually attained in the January Sample.**

### **Review of Climatic Conditions**

Temperatures were exceedingly high during December and early January with some strong winds predominantly north westerly and as such the evaporation figures for Gundagai were extremely high, particularly in the two weeks before this water sample was taken. There was also no rainfall between this and the past reading. When coupled with the Christmas holidays (absenteeism from the town) it is unlikely that there was any effluent being transferred to the golf course storage from the maturation pond during this period. As such it would have been expected that this would have produced a better-quality effluent at the extraction point.

However, the town was blanketed in smoke and ash for several weeks prior to the water sample being taken, and this was particularly the case in the week leading up to the early January water quality sample. This lack of sunlight may have upset the performance of the maturation ponds a little, but it is thought not sufficient to generate this not sufficiently to explain this rapid a transition in faecal counts. Golf course staff indicated that the course was to some degree covered in a layer of ash from this smoke which was due to the close proximity of the bushfires, and the fact that the golf course is at the bottom of the Gundagai basin that would have trapped much of this polluted air.

The large surface areas of the maturation pond and the golf course storage would have received a significant amount of this ash and it is considered that the ash contributed to the elevated faecal coliform results. The sudden disappearance of the smoke and in particular the ash in the days that followed when rain fell also explains the rapid recovery of the same.

This conclusion is also supported by higher than average levels of suspended solids in the maturation ponds and at the inlet to the storage pond that tends to be where the prevailing wind blows towards would seem to further confirm this assertion these counts have been impacted by the ash entering the water.

### **Risk to Community**

This incident is considered to have had negligible impact on the community due to:

- The golf course was effectively shut due to the poor air quality in the region, with health department recommendations against exercise outside in such poor air quality.
- Irrigation was at this time was limited to tees and green due to the reducing volume of water available and as such the irrigation cycles finished much earlier increasing the withholding time. Indeed, with the high temperatures at that time any irrigated surfaces would have been bone dry by the time anyone would have played on the course. The dry straw-coloured fairways were witnessed at that time with the green reinstated only after the rainfall that occurred from the 17<sup>th</sup> of January till the 22<sup>nd</sup> rather than irrigation.
- It is unlikely that anyone would have played in the oppressive heat and conditions at that time even if the course had of been open. This is the general experience of the golf club as related by maintenance staff.
- The golf club's last irrigation is on Thursday evenings and then not again until Sunday night to protect players and conserve available water supplies. That is the current standard practice for the club.

- The other playing fields were being irrigated with town water not effluent as it was the wicket areas only that were being irrigated. Again, the outer elements of these fields were straw coloured. The rain and the commencement of irrigation from the effluent is what has allowed these to recover but there were concerns from sporting associations over just how hard the ovals had become because of this.

There was no standard on site control measures specifically implemented for this event in the end user agreement at that time as it was not thought of and indeed had not occurred in the history of the golf course. The chlorination facility being added to the exiting supply will address this matter for the future events if there are still high readings that are not faecal based. Nevertheless, one of the learning lessons is to revise the end user agreement to better cover events such as this if they should occur again but this should not prove to be a problem with the completion of the new plant.

In summary whilst the reading exceeded the set limit it was not in fact faecal coliforms and technically there was no breach of the EPA licence.

**Lessons Arising from this:**

This will not be an issue when the new treatment plant comes online but until then Council will insert into the Council operation manual for the Chlorinator a requirement to increase the chlorine dosage if a similar situation arises. Hopefully, there will never be another fire season like the last and it will take some time for the fuel loads to regenerate.

## Attachment No 2

### High March 2020 Readings

Water quality post 7/1/2020 settles down and remains well within the limits required until mid-March when two of the water qualities exceeded the 100 cfu limit those being On the 16/3 (2020 cfu) and 31/3 (1410) cfu. However, the readings were of no particular concern as the golf course has ceased irrigation as of March 3 and the sporting ovals were closed to the whole community. The water quality then settles back down during April.

To best understand what happen in March it is best to explore the full set of ambient conditions that were occurring at the time. Refer table below:

Month	Mean Max Temp (°C)	Max Temp (°C)	Rainfall (mm)
November 2019	27.1	39.5	38.2 (!)
December	33.1	41.4	11.4
January 2020	34.0	45.2	40.3 (2)
February	30.7	42.2	59.0 (3)
March	26.7	33.6	72.1 (3)
April	21.1	28.1	72.3
May (to 13 <sup>th</sup> )	17.0	22.3	20.3

**Notes:**

1. *Virtually all of the November rainfall occurs prior to the 5<sup>th</sup> of that month.*
2. *Virtually all of the rainfall in January occur between the 17<sup>th</sup> and the 21<sup>st</sup>*
3. *Virtually all of the February rainfall happens on the 10<sup>th</sup> and 11<sup>th</sup> with it dry until March*
4. *There is significant rainfall on the 4<sup>th</sup> of March through to the 6<sup>th</sup> of March.*

This period sees also saw

- The transition from one of the worst droughts on record, to a much wetter than average end of summer /autumn with some 38% of the average annual rainfall occurring between mid-January to end April.
- The worst bushfire season ever experienced
- COVID – 19 resulting in the loss of day trippers and effectively all the tourism the town has spent much time cultivating. This would have also decreased the inflow into the treatment plant.
- Construction of the new Sewage Treatment Plant commence.

This data would seem to indicate the following:

- That sometime in late November or early December evaporation losses in the maturation pond were sufficient to exceed inflow and the pond ceased to discharge into the golf course storage pond.
- That pond then began to drop in level as did the maturation pond.
- Both ponds continued to drop in level during January 2020 with the golf course storage dropping more quickly due to the irrigation occurring. However, the rainfall in January will have seen some restoration of levels in the maturation ponds but no back to discharge levels
- Some of the levels in the maturation pond are restored with possibly a small amount of flow was transferred to the golf course storage ponds in the rainfall in February before the maturation pond levels again started to decline marginally due to the high levels of evaporation.
- The significant rainfall in March saw the maturation pond filled to over its normal discharge point with flow continuing for a number of days down to the Golf course storage stirring up the bio-solid material at the bottom of that pond as the pond was drawn down somewhat due to the sheer volume of that inflow.

This hypothesis is supported by

- Operator observations in respect to pond levels and flows to the golf course storage.
- Other data in the tables such as the Suspended Solids in the golf course storage rising as this inflow has clearly stirred up some of the biosolid material in the base of this storage and it is taking some time to fully resettle due to the ongoing rain swollen inflow.
- High levels of suspend solids developing in the maturation ponds as significant inflow occurs due to large amounts of rainfall swelling the inflow.

The water quality sample of 31/3 shows the pond continuing to settle and potentially would have been under 1000 cfu had there not been significant rainfall the day before the sample was taken as it is clearly demonstrated that rainfall can impact the quality of the final effluent quality in the plants modified format. However, the golf course was not being irrigated at this time. The water sample on 17/4 was complying but was higher than expected due to large volumes of rainfall in the early parts of April. The sample taken on 21 /4 is much lower after a period of little rainfall occurring allowing the water quality to settle further confirming the above hypothesis

### **Lessons Learned**

This was potentially one of the longest periods of little or no inflow into the Golf Course storage and the new plant will have no such pondage hence this type of problem will not occur. Council should consider a small pump and commence discharging at a slow rate earlier to prevent this sudden impact loading as occurred in March this year. However, with 2020 predicted to be wetter than average it is doubted that this will happen and with the reductions in Carbon emissions at a worldwide level this year, then potentially next year will not be yet another record hot summer.

**2019 Water Quality Data**

## Fortnightly Sampling of Treated Effluent Bidgee Banks Golf Course (Irrigation Extraction)

Parameters	Units	3/12/18	14/12/18	14/1/19	31/1/19	13/2/19	28/2/19	14/3/19	28/3/19	11/4/19	23/4/19	9/5/19	23/5/19	6/6/19	
Biochemical Oxygen Demand	mg/L	101	25	8	15	23	9	14	59	9	8	14	16	10	
Calcium (dissolved)	mg/L	17.5	24.7	18.2	13.0	14.6	12.1	11.1	27.5	21.4	18.9	21.8	27.0	24.8	
Faecal coliforms	cfu/100 mL	S	6160 (1)	1	100	50	444	10	90	734	2600 (2)	6000 (2)	5600 (2)	6560 (2)	
Conductivity	µS/cm	2710	585	490	480	493	515	657	539	575	617	646	611	646	
Magnesium (dissolved)	mg/L	5.22	8.35	6.56	5.23	5.63	3.82	3.93	12.7	9.4	6.95	9.13	12.0	8.83	
Nitrogen, total	mg/L	243	32	10	11	12	11	14	15	23	21	24	23	23	
Nitrate/Nitrite as N	mg/L	<0.1	5.2	5.1	3.9	4.1	4.3	4.5	0.1	11.1	11.1	8.0	8.8	7.3	
Oil & Grease	mg/L	20	3	3	3	3	1	3	1	1	4	2	3	2	
Phosphorus, Total	mg/L	55.4	8.77	6.6	3.09	4.67	1.89	3.27	5.82	3.14	3.91	4.94	3.53	2.89	
pH	pH units	7.8	8.4	7.3	8.6	7.4	8.0	8.9	6.8	7.2	8.0	7.6	7.3	7.3	
Sodium Adsorption Ratio	Ratio	9	3	4	1	4	5	5	3	4	3	4	5	3	
Sodium (dissolved)	mg/L	17.1	66.1	70.1	56.4	69.8	76.4	79.4	72.2	83.0	65.9	96.7	123.0	74.2	
Total Kjeldahl Nitrogen	mg/L	243	27	5	7	8	7	9	15	12	10	16	14	15	
Total Suspended Solids	mg/L	126	73	15	49	74	79	142	28	33	70	54	35	18	

S -Reading suspicious

### Fortnightly Sampling of Treated Effluent Bidgee Banks Golf Course (Irrigation Extraction)

Parameters	Units	4/7/19	18/7	1/8	19/8	29/8	12/9	30/9	10/10	24/10	6/11	20/11	5/12	19/12
Biochemical Oxygen Demand	mg/L	6	6	8	9	10	10	11	8	8	12	2	12	6
Calcium (dissolved)	mg/L	21.2	23.3	21.8	26.7	22.6	15.6	21	12	38.4	26.2	28.4	21.2	15.7
Faecal coliforms	cfu/100 mL	300	50	1	83	20	37.0	119	64	606	101	28	192	606
Conductivity	µS/cm	689	722	775	796	810	836	774	798	815	796	722	845	538
Magnesium (dissolved)	mg/L	9.28	8.94	8.64	9.85	7.9	5.14	8.0	5.60	7.61	7.15	4.48	4.9	5.78
Nitrogen, total	mg/L	32	30	37	42	43	44	38	39	39	37	31	24	13
Nitrate/Nitrite as N	mg/L	5.9	2.8	40	52	5.6	5.0	0.6	3.7	1.6	0.1	2.1	4.3	7.7
Oil & Grease	mg/L	<2	1	2	3	<1	<1	7	1	2	6	3	1	2
Phosphorus, Total	mg/L	3.70	2.6	4.21	6.01	8.57	5.57	6.5	6.39	3.95	9.38	12.7	12.9	0.36
pH	pH units	7.6	7.9	7.7	7.7	7.8	7.8	7.8	7.7	7.8	7.5	7.8	7.9	7.8
Sodium Adsorption Ratio	Ratio	3	3	3	5	3	3	3	3	3	3	4	3	3
Sodium (dissolved)	mg/L	61.5	62	68.3	131	62.2	44.8	60.0	55	78.8	75.5	88,6	65.4	55.7
Total Kjeldahl Nitrogen	mg/L	26	27	33	37	37	39	37	37	37	37	29	20	5
Total Suspended Solids	mg/L	<2	13	<2	7	7.0	20	7	7	10	3	20	105	74

## Fortnightly Sampling of Treated Effluent Bidgee Banks Golf Course (Storage Inlet)

Parameters	Units	14/1/19	31/1/19	13/2/19	28/2/19	14/3	28/3	11/4	23/4	9/5	23/5	6/6	4/7	18/7	1/8	19/8
Biochemical Oxygen Demand	mg/L	28	21	29	34	38	29	30	31	19	31	24	12	9	12	11
Calcium (dissolved)	mg/L	18.3	15.4	17.5	14.0	12.1	19.2	23.2	20.9	21.9	28.6	23.0	22.1	24	21.5	26.1
Faecal coliforms	cfu/100 mL	2500	96700	3670	34400	22500	60000	36000	73000	160000	96000	193000	13,600	12,100	150	10000
Conductivity	µS/cm	504	544	194	546	508	548	600	661	664	712	671	764	807	809	842
Magnesium (dissolved)	mg/L	5.92	5.46	6.77	4.22	3.9	6.67	9.2	7.43	8.86	12.2	7.81	9.47	8.76	7.89	10.10
Nitrogen, total	mg/L	26	27	26	26	25	33	26	39	29	36	34	43	47	47	49
Nitrate/Nitrite as N	mg/L	6.6	7.0	8.1	8.3	8.1	9.6	16.7	14.7	8.6	9.7	8.2	6.6	7.7	9.4	8.8
Oil & Grease	mg/L	7	5	7	5	7	3	2	6	2	4	3	1	3	4	4
Phosphorus, Total	mg/L	6.71	7.05	6.69	5.67	6.17	5.62	4.45	7.45	6.26	5.56	4.54	6.76	5.71	6.6	6.00
pH	pH units	7.6	8.9	9.4	8.6	9.2	8.5	8.5	8.5	7.9	8.0	8.0	7.8	7.7	7.7	7.7
Sodium Adsorption Ratio	Ratio	3	1	4	4	4	3	4	3	4	5	3	3	3	3	5
3Sodium (dissolved)	mg/L	63.6	5.4	75.5	72.5	68	632	83.9	66.4	98.2	127	67	62.1	57.6	65.8	127
Total Kjeldahl Nitrogen	mg/L	19	20	18	18	17	23	11	24	20	26	26	36	39	38	40
Total Suspended Solids	mg/L	124	160	128	149	137	101	86	71	49	49	48	4	11	9	5



### Fortnightly Sampling of Treated Effluent Bidgee Banks Golf Course (Storage Inlet)

Parameters	Units	4/7	18/7	1/8	19/8	29/8	12/9	30/9	10/10	24/10	6/11	20/11	5/12	19/12		
Biochemical Oxygen Demand	mg/L	12	9	12	11	6	10	12	6	10	12	5	14	9		
Calcium (dissolved)	mg/L	22.1	24	21.5	26.1	23.4	13.7	19	11	27	23	27.8	18.7	8.53		
Faecal coliforms	cfu/100 mL	13,600	12,100	150	10,000	55	4,500	2,020	8,590	25,600	178,000	1,620	3,160	4,340		
Conductivity	µS/cm	764	807	809	842	837	816	795	816	795	680	704	618	457		
Magnesium (dissolved)	mg/L	9.47	8.76	7.89	10.10	8.29	4.18	4.4	4.6	6.67	5.94	4.43	4.25	4.41		
Nitrogen, total	mg/L	43	47	47	49	48	47	47	44	40	35	30	22	16		
Nitrate/Nitrite as N	mg/L	6.6	7.7	9.4	8.8	8.0	7.0	8.7	4.9	2.2	1.9	2.2	4.1	4.1		
Oil & Grease	mg/L	1	3	4	4	4	1	1	4	3	3	4	3	5		
Phosphorus, Total	mg/L	6.76	5.71	6.6	6.00	8.57	6.12	7.56	7.84	6.38	10.2	13.5	13.8	9.49		
pH	pH units	7.8	7.7	7.7	7.7	7.8	7.7	7.4	7.9	7.9	7.8	8.4	8.2	0.45		
Sodium Adsorption Ratio	Ratio	3	3	3	5	3	2	4	3	3	3	4	3	5		
3Sodium (dissolved)	mg/L	62.1	57.6	65.8	127	65.7	40.1	51	59	74.8	71.5	88.4	62.3	68.9		
Total Kjeldahl Nitrogen	mg/L	36	39	38	40	40	40	38	39	38	33	28	18	12		
Total Suspended Solids	mg/L	4	11	9	5	14	7	7	7	10	19	23	48	93		

## Fortnightly Sampling of Treated Effluent Bidgee Banks Golf Course (Maturation Pond Outlet)

Parameters	Units	13/2/19	28/2/19	14/3/19	28/3/19	11/4/19	23/4/19	9/5/19	23/5/19	6/6/19	4/7/19	18/7/19	1/8	19/8	Average
Biochemical Oxygen Demand	mg/L	21	18	29	29	20	18	13	21	26	11	10	10	10	
Calcium (dissolved)	mg/L	16.4	13.6	14.0	19.3	24.0	20.7	21.9	27.5	22.1	22.2	24	22.9	26.3	
Faecal coliforms	cfu/100mL	6560	40,000	15100	83300	41000	68000	187000	103000	212000	10800	37400	34	10,000	
Conductivity	µS/cm	546	561	497	544	609	659	696	731	688	780	780	786	818	
Magnesium (dissolved)	mg/L	6.4	4.41	4.0	6.63	9.46	7.06	8.96	11.8	7.29	9.55	9.14	8.1	10.10	
Nitrogen, total	mg/L	25	27	24	32	28	40	32	36	41	43	43	43	49	
Nitrate/Nitrite as N	mg/L	7.2	7.8	7.3	9.9	16.1	14.1	8.6	7.5	7.0	6.8	6.7	7.2	9.2	
Oil & Grease	mg/L	6	8	5	3	3	5	5	2	3	2	2	6	7	
Phosphorus, Total	mg/L	6.06	3.24	6.12	5.96	5.11	6.35	6.56	6.92	5.46	6.57	5.39	6.05	6.67	
pH	pH units	9.6	8.9	9.6	9.3	8.8	8.7	7.9	8.2	7.9	7.7	7.7	7.7	7.7	
Sodium Adsorption Ratio	Ratio	4	4	4	3	4	3	4	5	3	3	3	3	5	
Sodium (dissolved)	mg/L	71.3	72	67.3	62.6	87.9	66.1	98.3	121	63.1	62.8	60.6	66.7	125	
Total Kjeldahl Nitrogen	mg/L	18	18	17	22	12	26	23	28	33	36	36	36	40	
Total Suspended Solids	mg/L	152	150	128	90	94	70	43	39	52	2	11	6	6	

## Fortnightly Sampling of Treated Effluent Bidgee Banks Golf Course (Maturation Pond Outlet)

Parameters	Units	4/7/19	18/7/19	1/8	19/8	29/8	12/9	30/9	10/10	24/10	6/11	20/11	5/12	19/12	
Biochemical Oxygen Demand	mg/L	11	10	10	10	8	19	19	12	9	10	3	17	12	
Calcium (dissolved)	mg/L	22.2	24	22.9	26.3	22.5	13.0	19	11	27.3	21.3	26.0	15.6	7.9	
Faecal coliforms	cfu/100mL	10800	37400	34	10,000	100	7,200	2,020	44,000	90,000	178,000	8,890	6,400	4,020	
Conductivity	µS/cm	780	780	786	818	839	820	792	820	791	671	657	565	447	
Magnesium (dissolved)	mg/L	9.55	9.14	8.1	10.10	8.18	4.11	6.3	4.8	6.65	5.4	3.9	3.27	4.05	
Nitrogen, total	mg/L	43	43	43	49	46	49	48	43	41	34	30	23	18	
Nitrate/Nitrite as N	mg/L	6.8	6.7	7.2	9.2	7.4	8.4	9.1	2.2	2.8	2.9	3.4	3.7	5.5	
Oil & Grease	mg/L	2	2	6	7	<1	<1	5	<1	5	9	4	3	5	
Phosphorus, Total	mg/L	6.57	5.39	6.05	6.67	6.96	6.19	7.6	7.01	6.45	11.9	15.9	12.8	9.9	
pH	pH units	7.7	7.7	7.7	7.7	7.5	7.8	7.7	7.8	7.7	7.8	8	8.4	9.5	
Sodium Adsorption Ratio	Ratio	3	3	3	5	3	3	3	4	3	3	4	3	5	
Sodium (dissolved)	mg/L	62.8	60.6	66.7	125	63.4	42.3	51	62	76.3	69.5	83.5	58.1	67	
Total Kjeldahl Nitrogen	mg/L	36	36	36	40	39	41	39	41	38	31	27	17	13	
Total Suspended Solids	mg/L	2	11	6	6	5	28	11	14	19	27	41	52	102	

## Attachment 4

### Effluent Quality Strategy during the Construction Period

The current Gundagai STP represents 100-year-old technology that has had some upgrading in 1961 with the addition of the maturation ponds and the humus tank that made possible the relocation of the golf course to around the treatment plant. This allowed the effluent to be used to irrigate the golf course and the nearby playing fields, which at the time was considered better by all parties than discharging the effluent to the river system, despite the small size of the town.

It is however recognised that given the nature of that existing technology there is no way that the plant can meet modern day recycled water guideline requirements even if it was a much younger plant in good condition. The only way the plant can meet those standards is for it to be replaced with newer technology specifically designed to meet these targets.

The upgrading of the Gundagai STP is therefore in part about the need to produce a plant that meets those guidelines. Another part is about also of the plant being capable of discharging effluent to the river system if required, to give the overall operation greater flexibility. The remaining part of the need to upgrade the Gundagai plant is the progressive physical failure of parts of the plant that carries the spectre of a possible failure of these individual units and the need to enact the emergency plan developed for that eventuality, as part of these works. This has always been the urgent component of these works for Council given the race to replace the plant before its failure, as the case of failure is not a matter of “if” but rather “when”.

Two independent option studies have identified that the only real option for the construction of a new plant was on the existing site but as always the difficult in constructing a new treatment plant on an existing site is that the construction work will inevitably impact the existing plant. In the case of the Gundagai STP plant this impact has taken the form of the loss of one of the maturation ponds arms as the site of the new extended aeration plant and the new inlet works. As such there was the potential to impact effluent quality and thus one of the first steps required in any reconstruction of the treatment plant is the need for an effluent strategy to try and ensure that there is minimal degradation of the effluent quality. This also includes sufficient additional safety measures added to protect the golfers, greenkeepers staff and Council operators as well as the public, but in the case of the later their presence on the golf course is relatively rare.

#### **1 Background**

In implementing any form of water quality programme there is first a need to understand the potential constrictions on effluent quality imposed by the construction works at the site as well as the peculiarities applicable the site.

##### **1.1 Site and Project Constrictions**

- The first of the constrictions applying to building a project of this nature is normally cost, which in the case of the Gundagai STP has two sub components that are based on the simple recognition that the total replacement of the existing treatment plant alone has always been beyond Council’s capacity to fund. Added to this there are additional works that also need to be done to make the operation of the treatment plant more sustainable, particularly in floods.

Council developed a business case and has secured some funding assistance to build the new plant, replace the pumping stations and rising mains etc. However based upon its contractor's (NSW Public Works Advisory) estimates at this time it has been determined that even with this funding assistance along with Council's contribution there will only just be enough funds to cover the proposed scale of the works and possibly not all of the works. The Council contribution to this scheme is at the limit of what it can borrow given the small rate base served. Thus, this fund is all that there is to meet the works required

The sub elements of costs in this instance therefore are:

- Expenditure on any interim water quality works such as say the construction of a balance storage tank will take \$300,000 out of the pool of funds to cover the project. Thus, moneys expended on these interim safe guards will result in some of the proposed long term upgrade works not being able to be carried out with the new plant potentially not able to meet reuse or discharge requirements.
  - Some the funding assistance has time constraints attached to it and this project has been delayed and will exceed the time limits for the Commonwealth component. At this time Council is advised that there will be no Commonwealth funds available beyond 30 December 2019 and as the original scheme involved full Commonwealth funding some of the works are going to definitely fall out of the project, given the delays to date in moving this project forward. Clearly spending any money on interim works needs to have a substantive case to support it.
- The next constriction typical to these types of works is normally space available. The scale of the improvements possible for any interim water quality improvement would clash with space needed for the plant expansion. The bottom line is that there will be no space for say the balance storage tank example listed above. The existing site must be squeezed to the minimum size possible to allow the new works to occur and there is little other room available for additional works on that site.
  - A further constraint is given the nature and physical condition of the existing plant, would any interim works realistically achieve any significant improvement in effluent quality? For example, again with the balance storage tank example, this would assist with the overnight non inflow period when there is no new food coming into the plant. This should improve water quality, but that improvement would only achieve marginal gains that are arguably not worth the investment required.
  - The next factor may be the time involved to put these measures into place. Contractually it is not wise to enter a situation where one contractor is carrying these interim works whilst the new plant contractor is trying to undertake their works.

Carrying works of this nature will also interfere with the existing works and for a short time may result in effluent quality this is significantly worse than what is what is currently produced.

## **1.2 Particular Site Peculiarities that also need to be Factored In are:**

- The maturation ponds have accumulated 60 years of biosolid material and would thus have had reduced capacity to treat the effluent significantly even before any work commenced for the new plant. Indeed when the maturation arm for the new works was drained it was confirmed that there was only a small volume of water over the biosolids and observations made at the time of draining indicated that in the remaining arm that the conditions would not be much better.

It was not possible to drain one of the ponds at the STP without undertaking the works that Council has undertaken to prepare the site so that soil samples could be taken to allow a formal design for the new plant to proceed. That sampling program has identified the need for a raft of support piers to support the base structure for IDEA tank and the sludge lagoons.

Any cleaning of the ponds arrangements was not included in the O and M manual for the works when the ponds were constructed 60 years ago. It is also not possible to clean out the other pond at this time as that would effectively leave the plant with no maturation capacity and leave the site exposed as it takes months to dry out the pond. Bringing the other arm back into action requires a whole new outlet arrangement be constructed as well as wetting the existing arm meaning that it may not be sufficiently dry when the Contractor comes on site leading to prolongation claims. This does not include the need to have this pond re-cleaned for the Contractor.

Had Council known that the delays were going to be as expansive as time has proven, then this action may have been contemplated at that time but again it is a very costly exercise to drain these ponds for very little gain?

- The construction of formal chlorination equipment as identified by the DOI Water is unlikely in the first instance and it would also prove to be prohibitively costly in this interim period as it is based on effluent that has been cleaned sufficiently for it to work. This component will certainly be part of the final plant. Nevertheless, some more rudimentary chlorination during stress periods may prove to be of significant assistance.
- The reuse system has operated for 40 years without problems that are known to Council, the golf course management, and local medical personnel. In addition, no one is aware of young person's seeking to enter the storage to retrieve golf balls in the history of the course. This is because everyone is aware that the pond water is treated sewage effluent. Similarly, there has been no history of illness of the golfers that has been identified as may be expected if there were problems with the reuse scheme.

Given this history it is difficult to justify spending large amounts of money that threaten to undo the only real solution to the current water quality i.e. build a new plant. Risk management would seem to offer better alternatives given this trouble-free history.

- The golf course is located away from the township and popular areas and even if there was to be some spray drift with a lesser effluent quality it will not impact humans as the site has suitable withholding arrangements in place and this will not change. The normal operation is that by the time there is any potential for human contact the site is already dry unless there has been unexpected rainfall that morning after there has been irrigation. This withholding period is the highest level of protection currently employed leading to the highest levels of reduction in bacteria, viruses, etc.

- Wet weather producing excess flows in low irrigation problems could represent a problem with the reduced maturation capacity but the scheme when commissioned has the whole creek bed as part of the original scheme with the storage next to the STP simply created to provide sufficient depth for the reuse pumps to maintain prime.
- The winter periods may represent the time when the withholding period is most challenged, but any irrigation required in this period is smaller in nature and is able to occur much earlier with a longer withholding period. In general, there is minimal overall irrigation during these periods, and it is not required in most years and hence the creek has traditionally held the excess flows during this period.
- The site will hopefully soon have the capacity for raw water irrigation, and this will add some dilution during the summer months and not be used in the winter months. As soon as the raw water extraction licence modification is approved by the NSW Government then this can be added to the site.
- Golfers understand the course is irrigated by treated effluent and as a matter of course practice appropriate personal hygiene. A full upgrade to the golf course irrigation system is being compiled by the club with the "Toro" irrigation team.
- The golf course management and the Council have worked closely over the years to ensure that the reuse system has run appropriately.
- There has been regular monitoring for some time now and that has not revealed any accumulation of bacteria or nutrients on the golf course site. However, that monitoring has only been on a quarterly basis and whilst useful for trend analysis is only of limited value as a guide to the performance of the plant.

## **2 Goals in Terms of Effluent Reuse during the Interim Period before the New Plant is Constructed**

Given the above constraints particularly costs and the fact that there does not appear to have been any problems associated with the current arrangements then the most socially and long term environmentally responsible goals are:

- To endeavour to ensure that the water quality during the new works does not fall off too significantly from current levels.
- To ramp up risk management procedures.
- Monitor the effluent quality more closely and get a better understanding of exactly what is happening with the performance of the current treatment system including developing barriers that are automatically adopted to reduce risk based on pasted observed trends.

## **3 Initiatives to Attain these Effluent Goals**

The following initiatives are considered to be proportional to the needs of the course and the construction of the new plant as they appear to be delivering the above goals and do not represent unrealistic expenses that are detracting from the funding pool.

### **3.1 Specific Initiatives in respect to maintaining water quality are:**

In looking to maintain past standards of water quality as a minimum the question arises just what were those standards and based upon the past 20 years of records it would seem that the plant would operate between 0 and 1000 cfu (faecal coliforms) with some 4 excursions possibly as a result of a rainfall event. However, the difficulty is in trying to gain any real idea of performance based upon just quarterly water sampling that also has the following factors that need to be considered:

- The infrequent sampling assisted by human nature may have made it difficult to pick up on some of the rain impacted events as given this infrequent nature of sampling it is ideal to carry out the sampling on nicer days when there is a much reduced chance of impact from rainfall events.
- For reasons unknown the sampling was only carried out in April and then again in October each year missing the winter impacts that have recently been observed. In those days the operation of the treatment plant was carried out by other areas of Council other than the Engineering areas and as a result of this and some large scale turnover of staff, post amalgamation no one can give an explanation as to why sampling had this winter gap. Plants dependent on maturation ponds are clearly going to be impacted in the winter months and a falloff in faecal reduction is the general industry experience of these cooler months with the impact higher in the cooler zones.
- Sampling in the period December to February potentially saw little flow from the maturation ponds into the golf course storage as the evaporation from the 2 ponds would exceed daily inflow on many days and the golf course could and did suffer from this lack of flow. As the readings over this history have been taken from the extraction point from the golf course storage.

The loss of one of the maturation ponds would result in reduced detention time and reduced evaporation hence that will have an impact on plant performance particularly in high intensity rainfall events in comparison to when both maturation ponds were working well. However, from observations made during the pond draining Council is aware that both maturation ponds were operating in a less than optimal manner.

Typically, there is no or little irrigation during the period mid to late April to mid to late September due to the small evaporation occurring in this period and typically these are the months when there is more rainfall in this region. Based upon this information the following initiatives have or are being employed to maintain water quality:

– ***Initiative***

Given this clogged up state of the existing maturation ponds it was determined to add another zone on top of the remaining maturation pond of higher quality water that allowed more maturation to occur than was possible under the past regime where these ponds had high levels of biosolid retention.

***Results of the Initiative*** *Current increased monitoring shows that water quality being produced under normal conditions (as recorded by the independent laboratory carrying out the water quality sampling) as being of a similar level to that has been occurring over the last few years and potentially decade. This is attributed to the new layers and improved usage of the golf course storage. However, the weakness in this is during significant rainfall events, where there are reduced detention times. This is somewhat offset a little by operating at higher levels in the maturation pond Increases surface area and hence storage volume.*



- **Initiative**

Maturation performance drops off during the winter period it is proposed to use pool chlorination prior to the recommencement of any irrigation just to ensure those first few uses of the reuse effluent are safe until the performance of the maturation pond returns under warmer conditions.

**Current Status:** *Arrangements for this are in place.*
- **Initiative**

Carry out a series of trials with chlorination of the storage in the effluent pond to determine how to best achieve reduction in faecal coliforms in the golf course storage prior to any irrigation. Typically, this type of plant and particularly the maturation capacity drop if in winter (refer section B)

**Current Status:** *Trials ceased as water quality has cleared up so well that further trials meaningless*
- **Initiative**

Minimise the disturbance to the existing plant.

**Current Status:** *Done with site fenced off.*
- **Initiative**

Make use of the additional maturation and aeration offered by the golf course storage.

**Current Status:** *Existing aeration equipment has been brought back online in support of this storage area that will be reduced to nothing more than an ornamental pond after the new plant is constructed.*
- **Initiative**

Lodge an application to allow raw water to draw off at the golf course site to feed into the irrigation of the playing fields until the new plant was on line.

**Current Status:** *Application lodged still awaiting formal approval, but pump and equipment purchased and assembled such that this is ready to go when that approval is granted.*
- **Initiative**

Formalise current end user procedures into a new end user agreement that sets out the extra precautions needed in the construction period leading up to the construction of the new plant some of those key procedures are included in Part C

**Current Status:** *End user agreement compiled with just formal signing to occur. The golf club is using the document already.*
- **Initiative**

Ensure that any excessive flows in low irrigation periods are retained in the dry creek bed on the golf course which is isolated from the Murrumbidgee River.

**Current Status:** *Procedure already in place with this being the standard practice since the scheme was first established and there is sufficient capacity in the creek to accommodate this added flow.*

– **Initiative**

Put in place an emergency plan in place should there be a physical failure of the existing plant to overcome this short-term impact on the water quality.

**Current Status:** *Plan compiled and in place*

### 3.2 Specific initiatives in respect to risk management include:

The best form of protection given that the golf course only irrigates of an evening when there is no human contact possible is to ensure that either golfers do not enter the treatment plant and that they practise sensible hygiene. The criticality of the withholding period and the need to close the golf course on the holes when general maintenance requires daytime use of the reuse water are other manners in which to reduce the risk attached to the reuse of effluent.

It is noted that procedures here seem to be working with improved awareness of the fact the course is irrigated with effluent and that there seems to be no evidence of any health related issues arising after a long period of reuse. Nevertheless, specific initiatives in this area are:

– **Initiative**

Fencing of the current water storage with additional signs at the request of the EPA

**Current Status:** *Done*

– **Initiative**

Inclusion of new and additional signs on the course

**Current Status:** *Done*

– **Initiative**

Upgraded security fencing of the whole STP site

**Current Status:** *Done*

– **Initiative**

Addition of information details inside scorecards as Golfers then to read these as the score card is integral to the game whereas signs can become little more than another form of white noise.

**Current Status:** *Feedback from club management is that this initiative has raised awareness with players although all of the normal members have always been aware of the use of effluent but this initiative is proving useful for visitors to the golf club.*

– **Initiative**

The formalisation of the procedures into a new end user agreement that has had to be negotiated with golf course management that has raised overall awareness of the issues involved.

**Current Status:** Done.

- **Initiative** Stressed and work with Golf Club Management to ensure the withholding period is achieved and where possible exceeded including minimal irrigation in the winter months.

**Current Status:** As above

### **3.3 Specific Initiatives to Increase the Understanding of Water Quality in the Existing System**

The historical data has revealed that there is a great deal more that needs to be understood in relation to the performance of the existing plant in managing water quality in the interim period. It was initially thought that the two weekly monitoring supported by more frequent faecal testing may be able to be ceased after a short time as they revealed the plant was performing as it has but the truth is there is insufficient known of the winter period and the spring period that Council has determined to maintain this two weekly testing until well into Spring when it has a better overall pattern of behaviour and this behaviour is married in with the recommencement trials.

- Overall water quality monitoring has been increased from quarterly to every two weeks, but daily analysis also carried out for bacteria when notable rainfall events occur. Results of that additional monitoring are scrutinised carefully, and any responses initiated.

*Note: It has been discovered that water quality can drop off for two to three days after significant rainfall events but appears to recover after that. Given that getting results of this bacterial degradation generally takes 10- 12 days at minimum given the nature of the testing then the event is over before any rectification can be done. Better that a specific procedure be put in place to guard against this and reference is drawn to Part C where specific extended withholding periods are put in place to avoid this reduced water quality escaping in the end user agreement.*

### **3.4 Evaluation of the Initiatives**

Council would believe these initiatives are all of the reasonable and affordable steps that Council can realistically take to deliver the new plant otherwise further capital works would be required and that would both slow the delivery of the new plant and translate into parts of that sewage augmentation scheme having to be overlooked as there are insufficient funds available. However, if all of these initiatives have been tried without sufficient impact then Council will seek further external expertise to try and address the problems.

**END USER AGREEMENT EXERTS**

Set out below are the new End User Agreement's Table of Contents to provide an overall context in support of the water quality monitoring and the more specific arrangements that will apply in the interim or Section 5 from that End User agreement has also been included as it details some of the implementation of the initiatives in more detail. This document is currently being revised.



**COOTAMUNDRA-  
GUNDAGAI REGIONAL  
COUNCIL**

## **Contractual Agreement**

# **Reuse of Treated Effluent from the Gundagai STP on the Gundagai Golf Course**

**January 2019**

## Table of Contents

<b>1.0</b>	<b>Introduction</b> .....	Error! Bookmark not defined.
<b>2.0</b>	<b>Need for a Formal Contractual Agreement</b> .....	Error! Bookmark not defined.
<b>3.0</b>	<b>Definitions</b> .....	Error! Bookmark not defined.
<b>4.0</b>	<b>Effluent Reuse in NSW in General (Background to this Agreement</b>	Error! Bookmark not defined.
<b>5.0</b>	<b>Specific Issues Pertaining to the Bidgee Banks Golf Club (2019 to 2022)</b> .....	<b>39</b>
5.1	The Proposed New Treatment Plant.....	39
5.2	Failure of the Old Plant .....	40
5.3	Reuse during the Construction Period .....	41
5.4	After the Construction of the New Plant .....	44
<b>6.0</b>	<b>Administrative Details</b> .....	Error! Bookmark not defined.
6.1	Nature of the Reuse on Site. ....	<b>Error! Bookmark not defined.</b>
6.2	Period of the Agreement.....	<b>Error! Bookmark not defined.</b>
6.3	Quality of the Effluent Produced .....	<b>Error! Bookmark not defined.</b>
6.4	Volume of Effluent that can be Extracted by the End User .....	<b>Error! Bookmark not defined.</b>
6.5	On selling of Effluent.....	<b>Error! Bookmark not defined.</b>
6.6	Topping up End User Supplies.....	<b>Error! Bookmark not defined.</b>
6.7	User Notice when Ceasing to Use the Effluent .....	<b>Error! Bookmark not defined.</b>
6.8	Council Notice to Cease Using the Effluent.....	<b>Error! Bookmark not defined.</b>
6.9	Council Notice when Effluent is in Short Supply .....	<b>Error! Bookmark not defined.</b>
6.10	End User Wanting to Modify the Agreement. ....	<b>Error! Bookmark not defined.</b>
6.11	End User Wanting to Increase their Allocation .....	<b>Error! Bookmark not defined.</b>
6.12	End Use Notification of Incident at the User Site .....	<b>Error! Bookmark not defined.</b>
6.13	Contact Details within Both Parties .....	<b>Error! Bookmark not defined.</b>
6.14	Cost of Effluent to the End User.....	<b>Error! Bookmark not defined.</b>
6.15	Auditing the Operation .....	<b>Error! Bookmark not defined.</b>
6.16	Monitoring the Site .....	<b>Error! Bookmark not defined.</b>
6.17	Failure to Comply with the Terms of this Agreement....	<b>Error! Bookmark not defined.</b>

6.18	Point of Supply .....	<b>Error! Bookmark not defined.</b>
6.19	Emergency Response Plan .....	<b>Error! Bookmark not defined.</b>
6.20	O and M Plan .....	<b>Error! Bookmark not defined.</b>
6.21	Matters Not Covered in this Agreement.....	<b>Error! Bookmark not defined.</b>
<b>7.0</b>	<b>Designated Operational Requirements .....</b>	<b>Error! Bookmark not defined.</b>
7.1	Hours of Operation of the Irrigation System.....	<b>Error! Bookmark not defined.</b>
7.2	Details of the Site to Be Irrigated .....	<b>Error! Bookmark not defined.</b>
7.3	Warning Signs.....	<b>Error! Bookmark not defined.</b>
7.4	Irrigation Regime.....	<b>Error! Bookmark not defined.</b>
7.5	Operation on Windy Days .....	<b>Error! Bookmark not defined.</b>
7.6	Wet Days .....	<b>Error! Bookmark not defined.</b>
7.7	Site Inspections .....	<b>Error! Bookmark not defined.</b>
7.8	Surface Outlets for the Irrigation System.....	<b>Error! Bookmark not defined.</b>
7.9	Rectification Works on the Golf Course .....	<b>Error! Bookmark not defined.</b>
7.10	Interconnection of Pipes .....	<b>Error! Bookmark not defined.</b>
7.11	Sprinkle Head Maintenance .....	<b>Error! Bookmark not defined.</b>
7.12	Chlorination of the Effluent.....	<b>Error! Bookmark not defined.</b>
7.13	Year Round Operation of the Reuse Scheme.....	<b>Error! Bookmark not defined.</b>
7.14	People Entering the Oncourse Water Storage .....	<b>Error! Bookmark not defined.</b>
7.15	Recovering from Floods .....	<b>Error! Bookmark not defined.</b>
7.17	Separate Metering of the Golf Club .....	<b>Error! Bookmark not defined.</b>
7.18	Fertilisation of Golf Course.....	<b>Error! Bookmark not defined.</b>
7.19	Players Complaining of Illness or Rashes .....	<b>Error! Bookmark not defined.</b>
7.20	Golfers Entering the Treatment Plant.....	<b>Error! Bookmark not defined.</b>
7.21	Operator Vehicles.....	<b>Error! Bookmark not defined.</b>

## **5.0 Specific Issues Pertaining to the Golf Club (2019 to 2022)**

When the new sewage treatment plant is constructed in Gundagai, the effluent produced will be treated to a higher standard than the levels of treatment that the existing plant is capable of and it will also be disinfected with sodium hypochlorite before it is reused, adding further protection for users of the golf course. Hopefully, this new plant will be online in late 2020 but that will depend upon several factors during the construction phases.

The new treatment plant, which is to occur on the same site as the existing treatment plant will also be raised above the height of the current plant so that it is not impacted by all but the most extreme of floods. This includes the construction of a mound for the new operations building, chemical storage as well as the electrical control room and the blower room. As such the plant will be more visible than the old plant but trees will be planted as part of the overall landscaping to reduce the long-term visibility of the plant. The plant has already been fenced off with a modern security fence replacing the old rural fence, but new shrubs planted along the fence's length will endeavour to reduce the visual component of this fence and the structure in general.

The old plant will be removed and to all extent and purpose apart from a slightly more visible plant there should be little difference in its operation excepting that the new treatment plant will add some flexibility to the reuse process and a cleaner effluent that will see less fouling of sprinkler heads.

However this period of 2109 to 2022 includes the transition to the new plant which means that a new plant will need to be constructed on the site of the existing plant and clearly that construction will impact the performance of the old plant. As such there is a need for greater caution to be applied during this construction period until the new plant is online. That will require some operating conditions that will uniquely apply to the golf course during this construction period but will not apply after the new plant comes online.

It also needs to be remembered that the current plant has been damaged in recent years by significant floods and that there is a possibility of failure of parts the existing plant in this intervening period and if that occurs a full emergency plan will be invoked. This plan will have implications for the golf club, and the irrigation of the reuse water. This failure scenario however will like the construction requirements disappear once the new plant is online.

### **5.1 The Proposed New Treatment Plant**

The new plant will be (for those that are so inclined) an intermittently decanted extended aeration plant (IDEA) that will be capable of being able to discharge to the river as it will produce a much higher quality effluent. The area of the new plant is smaller than the current plant but the treatment process is more intensive and will involve 6.0 m deep tanks and for that reason access inside the plant will be limited to plant operators and essential to Council personnel. Hence the need for an appropriate security fence, particularly as buoyancy in the tanks is minimal during the aeration cycle.

The new plant will have UV disinfection for the final effluent as well as chlorination of the effluent to be reused. The treated sewage effluent will be discharged to a large above ground sealed tank and the effluent will be taken from there directly into the irrigation system. The effluent for irrigation purposes will no longer be stored in the earthen storages and this provision should improve water quality further and reduce the potential for algal growth in this effluent. The capacity of this tank will be such that it will store more than the average day's flow through the plant and will be topped up each day with new discharges from the treatment plant. Water will be discharged directly from this tank to the golf course pumps for the irrigation purposes.



On any wetter than average days or during when there is no irrigation required then the overflow from this tank will flow into the old on course storage which will be retained more for aesthetic purposes or as an emergency source of water. Typically, on average there should be around 500 KL of water available each day that there is no rain unless there is some problem at the treatment plant. This should see a considerable increase in available effluent during the summer months when historically the golf course has struggled as the old plant's maturation ponds were responsible for considerable evaporation losses. However, the playing fields will return to the irrigation requirements from this effluent once the water quality is improved and the irrigation cycle needs to be set up around these requirements.

In prolonged wet weather events when there is no need for the effluent once the new plant is constructed then the overflow effluent will be used initially to top up the ornamental pond but once full, the effluent will then be discharged directly to the Murrumbidgee River with this discharge subject to extensive monitoring of the water quality. This arrangement will ensure that the best possible water quality finds its way into the Murrumbidgee River and for the golf club this will mean that there is no pressure to irrigate an already wet golf course, due to the need to dispose of the effluent. Nevertheless, Council's desire with any treatment plant is to maximise the volume of reused water where possible and the extent of that ornamental water are areas for further discussion with the golf course.

In addition Council has applied for a licence to extract raw water from the river at this location and when this is granted it will make it possible to top up the storage or the water tanks at the pumps after the new plant is on line, with water directly from the Murrumbidgee River. This will ensure supply if there was to be a problem at the plant but the sewage treatment technology to be installed is well proven in several other locations around the state and few if any problems are anticipated.

Council will also clean out the existing golf course storage pond once the new plant is on line to remove accumulated biosolids should the course want to retain the pond for aesthetic reasons as it will represent a much reduced risk with the improved effluent quality. The operation of the reuse system and the irrigation technology will be discussed further when details are available (post the detail design phases) with the delineation of responsibilities to occur near the completion of the construction phases for the new plant and added to this document as an attachment. It is also intended that there will be a review of the performance of the system of the new plant around 6 months after the new plant is on line to determine what if any modifications to this agreement may need to be made.

## **5.2 Failure of the Old Plant**

Should a physical failure of the existing plant occur before the new plant is on line then the Golf Club will be immediately notified by Council and this will mean that all play on the golf course will need to cease after the day of notification as future effluent irrigation may be unsuitable for human presence on the course for a period of time. There will be a need to dispose of this effluent which will require that the golf course will need to continue to be irrigated during the interim period, but play will not be possible due to this reduced water quality. Council will advise the golf club when the water quality has improved, and play is able to recommence.

Council is endeavouring to get the works completed by the earliest possible date so this the execution of this emergency plan will not be required but it is imperative that there be a disaster recovery plan in place and there will be regular communication between Council and the Golf Club management if this recovery plan does need to be invoked.

### 5.3 Reuse during the Construction Period

Until the new plant is constructed and formally brought online, Council has to operate the existing plant with reduced maturation capacity, as one of the old maturation ponds will now be required as the site for the new treatment plant. This requires extra care be exercised to ensure the maximum possible care is taken to avoid any threats to humans or their pets in the irrigation processes, during this interim or construction period. Accordingly, the following procedures are needed during this construction period.

- Increased water quality monitoring as part of the new works investigation has observed that during significant wet weather events water quality can decrease for a few days but recovers relatively quickly. In winter however water quality remains unacceptable due to the shorter days, lower temperatures, etc, and this is not normally a problem as there is not normally any winter irrigation.

To ensure that the water quality is given sufficient time to recover the following steps are to be employed:

- For rainfall events greater than 25 mm in a 24-hour period, there is to be no irrigation of the golf course for a period of four days as a minimum. Discussion with Council officers should occur before recommencing.
- For rainfall events between 10mm and 20 mm in a 24-hour period there is to be no irrigation of the golf course for a period of two days as a minimum.
- For rainfall events of less than 10mm in a 24-hour period there is no need to withhold the irrigation. However, where there are rainfall events that occur over several continuous days (say three or more days) then the 10 mm to 20 mm requirement should be applied. If this becomes over 5 days, then the over 25 mm implications should occur.

The above are a guide and need some common sense interpretation. For example clearly a series of days of 1 mm rain on each day will not mandate the restrictions used above and discussions with relevant Council officers should be able to clarify this in such instances but numerous continuous wet days would be unusual in this region.

- In a very dry winter period where there may be a need to irrigate the golf course then it can be expected that the plant will not be performing to its full capacity and chlorination procedures will need to be included in with that irrigation until the plant performance improves in the summer months. Once the new plant is operational then this will not be a consideration.

**Note:**

*Close ongoing monitoring of the water quality may necessitate some changes to the time periods, and this will be advised to the golf club should this become necessary.*

In all cases the withholding period i.e. that time between when irrigation ceases, and the first tee offs occur should be maximised to beyond the 4 hour minimum to ensure the maximum possible protection is provided on a just in case basis. Monitoring and analysis of water quality sampling can take in excess of 10 working days to get the results and as such it is imperative to have in place a system that

safeguards all golfers and other users of the site in case there is a decrease in water quality. These requirements will not be required once the new plant is commissioned unless there is an emergency at the new plant which is not expected, as the technology being adopted has proved to be most reliable in other locations.

Council will be closely monitoring water quality during this period with increased water quality testing being carried out. If there are any issues, then Council will advise the Golf Club at the earliest possible date.

It is not anticipated that this should cause problems for the golf club as these requirements mirror current course operational procedures to maximise the use of the effluent available.

- Council will be depending upon the golf course storage to provide extra treatment during this period and thus the golf course storage must not be altered during this period or any work carried out on it other than peripheral works to stabilise banks or other similar tasks. The structure has been fenced off and additional warning signs provided and as such there is to be no access to this pond as well
- During the winter months the performance of the maturation ponds will normally decrease due to the combined effects of increased rainfall, reduced sunlight hours, fog and overcast weather, lower temperatures etc. This will not normally be a problem as typically the Club does not irrigate during this period. However, if there is an excessively dry period there may be a need to do some irrigation during these cooler months. If this is the case then the golf course needs to provide Council with three working days' notice as it will need to do water quality improvement works (chlorination in the storage pond) prior to the recommencement of any irrigation and to offset any of this reduced performance.

The same notice should be provided to Council prior to any recommencement of the normal irrigation period to ensure that the water quality is appropriate and if Council needs to take extra measures until the performance of the maturation ponds returns to normal. In these initial start-ups the irrigation cycle should commence as early as possible to maximise the withholding period, recognising that irrigation cannot occur until there are no persons on the course and no real chance of them coming onto the course.

- Council will continue to maintain the reuse pumps and pipework as they have since the inception of the reuse scheme but the club needs to report any problems with the storage or the irrigation system immediately to Council officers if they occur.
- The reduced maturation surface area and the plans to remove the sporting ovals from the reuse irrigation system in the interim should see more water available to the golf course and in addition it is anticipated that the raw water supplement will be in place before the summer of 2019/2020.
- The current golf course storage has been fenced off to prevent entry by others and appropriate warning signs placed on the edges of the pond to discourage entry and warn anyone wishing to extradite a ball of the dangers they face. Additional signs will be added to the course in general during this transition period. This will be done as part of the augmentation project. A modification to Council's water extraction license has already been sought.

It is critical that irrigation occurs in accordance with the requirements set out in section 7.0 of this document during this interim period and that the course be dry before golfers come onto it in the morning except where that moisture is the result

of overnight rain, hence there is a need to maximise the withholding period to prevent these area being wet when players are on the golf course or ensure there is no irrigation onto a wet course.

- The construction should not create excessive dust, nor should activities occur on the golf course except for entry along the access road should the contractor vehicles be on the course without prior agreement. Should this occur then Club Management should contact the Council Project Manager who will investigate.
- Golfers should take care in relation to construction traffic when crossing the access road, particularly during the normal working hours of 7.00 am to 6.00 pm. They should similarly be mindful of this traffic when playing shots which may impact this traffic.
- The proposed irrigation of the playing fields with raw water from the river may add some pressure in terms of storing winter or wet period volumes of the effluent. When the volume nears maximum storage volume the club should continue contact Council (see the note below).
- Golf course staff from the Pro shop and Office will need to be particularly vigilant during this construction period to note any discussions of illness or rashes etc coming from several golfers which may be indicative of problems with the effluent. This needs to be raised immediately to the attention of the Council Asset Manager who will investigate and take appropriate actions based upon the findings of that investigation.
- There is a need to advise golfers to be careful during this construction period in respect to the effluent irrigation of the golf course. Good personal hygiene practiced at an individual level significant decreases any risk.
- No one from the golf course is to enter the treatment plant site without site induction training and should not come on site without prior arrangement with the Council Project Manager. Indeed, all concerns should be directed initially to this project manager or to Council's Asset Manager.

Club management and Council need to work closely together to prevent any potential escape of effluent during cold or wet periods when there is not sufficient storage in the existing on course storage pond to accommodate the volume of effluent if no irrigation is required for a long period of time. As per section 1.1 when the initial scheme was commissioned this whole dry creek bed was part of that agreed reuse scheme with all the relevant bodies at the time of its inception scheme and as it has not been removed from that system remains a location in which to place all of this extra effluent to prevent it flowing into the river.

**Note**

*The current "storage" was created because of an inability for the foot valve to retain its prime without increasing the depth of the effluent when it was along the length but the creek bed. Thus, the creek bed as part of the initially approved scheme remains available for additional emergency storage if required as there can be no discharge of the effluent directly to the river. However, if this additional storage becomes full then emergency measures may need to be implemented and this will occur after meetings with Council and the appropriate regulators.*

## 5.4 After the Construction of the New Plant

Once the new plant has been constructed there are a number of potential new initiatives that will need to be put in place to support the proposed irrigation requirements of Section 7.0 that will still be applicable post the construction of the new plant. These include:

- On the initial operation of the new water quality the Golf Club should try and give a long irrigation period in something of an effort to flush out the irrigation pipelines which will continue to improve over time. This should be done however under reasonable weather conditions such that the course will nevertheless be dry the next day for play to resume.  
  
Ideally the sprinkler heads should be cleaned soon after this initial flush to ensure good operation of the system.
- The new pumping arrangement of an elevated storage tank for the treated effluent should see a marginal increase in the duty point of the pumps. In addition, there will be a need to inspect the system for the first few weeks of operation to ensure that this increased duty point does not lead to increased pipe breakages. If required a day operation can be undertaken for this inspection to occur but the course will need to be closed to the public on the day of this irrigation.
- This direct feed into the pumps will allow the current golf course storage pond to be clean of biosolid material but the cleaning will not occur until the new system has operated for a reasonable period of time to give Council the confidence that it is past any potential teething problems. When this occurs, the pond will be drained first and then allowed to dry. This may produce some minor odours for a period and thus carrying out this draining of the pond will need to be carried out when this odour generation is least likely to occur. The biosolid material will then be removed and transported to Council's landfill site. The storage pond will be restored to become an ornamental lagoon that will be topped up using non - required or overflow effluent assuming the golf club wishes to retain the pond for ornamental purposes.  
  
The club will need to advise Council of its preferences in respect to any ornamental water usage by the end of October 2019.
- When the new plant is operation there will be greater ability to monitor inflows into the plant with relatively minor evaporation losses and thus the irrigation program for the golf course can be set up around this likely daily inflow in the summer periods. Understandably that in hot dry periods the club management may from time to time have an extended irrigation cycle and that will be managed by;
  - Having a further extended irrigation program built into system modifications and can be alternated in the irrigation controllers. The total volume of this to be worked through between the golf club and Council officers.
  - Checking with the treatment plant operators what volume there is available in the reuse storage tanks to see if this increased cycle can be accommodated.
  - Organising for Council to top up the tanks with raw water from the raw water arrangement. The course however will need to meet the costs of that raw water costs which will alter with the purchase prices per ML from the Murrumbidgee River at the time. Those are matters to be covered with Council at the time that this is required.

- In prolonged droughts it may not be possible to direct flow into the storage pond and as such the surface levels will drop and may even totally dry out. Council will try and add some raw water to prevent the clay base from drying out but cannot guarantee that it will be able to provide further water due to potential restrictions on its own water extraction imposed by the government or State Water.
- If there is a desire to retain the creek bed, then this will require extra warning signs on the course as well as inclusion in any direct river flow diversion requirements. However, the water will be chlorinated and whilst that chlorine will soon dissipate in any open water conduit it may impact any proposed fish life. There should not be sufficient chlorine to impact the fauna.
- Disinfection of the system will be undertaken by Council but in any cleaning out of downstream infrastructure by golf course personnel needs to ensure that the appropriate safety mechanisms are followed and that they discuss arrangements with Council officers before undertaking these operations.
- Council will not be returning any golf balls that come onto the site either in the interim or the ultimate operation of the plant but hopefully the new security fence and landscaping should significantly reduce this possibility.
- Council will plant and take care of the landscaping during the construction periods but after the construction is completed the responsibility for ongoing maintenance of this landscaping will fall to the golf course.
- If there is a problem at the plant, then a raw water supply will be brought on online as soon as possible to overcome the loss of supply.

As identified Council and the Golf Club Management will sit down around six months after the new treatment plant is online and discuss how the system is working and if further arrangements need to be added to this end user agreement. At the very least this will be a more than useful input into the next end user agreement.