

SOAH DOCKET NO. 582-22-0585
TCEQ DOCKET NO. 2021-1001-MWD

APPLICATION BY
CITY OF GRANBURY,
FOR TPDES PERMIT NO.
WQ0015821001

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BEFORE THE STATE OFFICE
OF
ADMINISTRATIVE HEARINGS

EXHIBIT GF-300

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BEFORE THE STATE OFFICE
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PREFILED TESTIMONY

OF

STEVEN E. ESMOND, P.E.

ON BEHALF OF

GRANBURY FRESH

SUBMITTED ON FEBRUARY 4, 2022

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EXHIBITS

GF-301	Resume & Selected Bibliography
GF-302	<i>BOD/Oxygen Deficit Model for the West Arm of Lavon Lake</i> by S.C. Chapra, Ph.D. and S.E. Esmond, P.E., January 1983
GF-303	Photograph of Biological Nutrient Removal (BNR) Units
GF-304	Excerpts from Permit Application
GF-305	U.S. EPA Recreational Water Quality Criteria Document, 2012
GF-306	Lake Granbury Watershed Protection Plan
GF-307	Rucker Creek Station 2022 SWQM Data

1 I. INTRODUCTION

2 Q: Please state your name.

3 A: Steven Esmond.

4 Q: Please state your address.

5 A: 9936 Osprey Drive, Fort Worth, Texas 76108.

6 Q: Please describe your current occupation.

7 A: I am a senior engineer, specializing in water and wastewater engineering, with over 40
8 years of experience. I founded my own engineering consulting firm in Texas which I sold
9 in 1999 and was transferred to California. Upon retirement, I started another firm with
10 offices in California and Texas which specializes in the treatment of storm water runoff.

11 II. QUALIFICATIONS

12 Q: Please describe your educational background.

13 A: I received my Bachelor of Science in Structural Engineering from Texas A&M University
14 in 1970 and then went on to receive my Master of Science in Civil/Environmental
15 Engineering from Texas A&M University in 1974.

16 Q: Are you a licensed professional engineer in the State of Texas?

17 A: Yes. License No. 38830.

18 Q: How long have you been a licensed professional engineer in the State of Texas?

19 A: Since 10/06/1975.

20 Q: Do you have any other licenses or registrations?

21 A: I am a licensed professional engineer in the State of California (since 01/25/2002). I also
22 am registered as a Class A Wastewater Treatment Operator in Texas (since 02/05/1993),

1 Wastewater Operations Company License in Texas (since 09/10/2020), and a Grade V
2 Wastewater Treatment Operator in California (since 12/12/2002).

3 **Q: Have you authored any publications?**

4 A: Yes. I have authored approximately 30 technical publications in the fields of wastewater,
5 environmental engineering, and civil engineering.

6 **Q: Are any of those publications particularly relevant to this matter in your opinion?**

7 A: Yes. I used my 1983 publication on Lavon Lake to formulate my opinions in this case.

8 **Q: Please describe that publication.**

9 A: It examined and evaluated the impact of wastewater discharges to coves of Texas
10 reservoirs. The results of that publication were used to set effluent permit standards for
11 wastewater treatment plants, and the Texas Water Commission hired me to perform field
12 studies to quantify dispersion rates in Texas reservoirs.

13 **Q: Please describe your work experience that is related to your opinions regarding this
14 proposed wastewater treatment plant permit application.**

15 A: Approximately 40 years of wastewater treatment plant design, both in California and
16 Texas, in the capacities of project engineer, project manager, and engineer-of-record. I
17 have completed numerous wastewater permit applications in Texas and evaluated the
18 conditions suitable for siting wastewater treatment plants (WWTPs). I have completed
19 numerous wastewater permit applications and obtained permits for large and small Texas
20 cities as well as privately-owned WWTPs. A handful of these were greenfield plants, some
21 of which I served as design engineer, and in one case, I am currently the operator of record.
22 I have also obtained RCRA permits and other types of permits from TCEQ and its
23 predecessor agencies.

1 **Q: Do you have experience in water resource management?**

2 A: Yes. In the mid-1970s, I led the preparation of the Angelina-Neches River 208 Water
3 Management Plan.

4 **Q: Can you identify what has been marked as Exhibit GF-301?**

5 A: Yes. This exhibit is a representative resume summarizing my experience in various areas
6 of practice.

7 **Q: Can you identify what has been marked as Exhibit GF-302?**

8 A: Yes. This exhibit is a copy of my 1983 publication on Lavon Lake that I mentioned
9 previously, where I evaluated the impact of wastewater discharges to coves of Texas
10 reservoirs.

11 **Q: What materials have you reviewed in preparation for your testimony?**

12 A: __Lake Granbury Watershed Protection plan.pdf (408 pages)

13 __Permit Application Granbury East WWTP TPDES Permit with Attachments as
14 permitted (4) (1).pdf (165 pages)

15 _201908 Granbury EID with Appendix.pdf (236 pages)

16 _20200903 Daryl Knowles Comments turned into TCEQ Comment Format.pdf (10 pages)

17 _20210630 Bennett Hearing Request Letter.docx (11 pages)

18 _Budget (1).pdf, a City of Granbury City Council document dated 10/09/2018, (215 pages)

19 _Contractor (2).pdf, City Council Resolution 19-29 regarding the contract for construction
20 (173 pages)

21 _Draft Permit City of Granbury East Wastewater.pdf (71 pages)

22 _Engineer (2).pdf, eHT Contract with the City (27 pages)

1 _Fishing Contested Case Final PDF.pdf, “Summary of Concerns Pertaining to Aquatic Life
2 Risks” (17 pages)
3 _Fishing Introduction to attached Public Comment.pdf, prepared by Walter Shaw, dated
4 09/08/2019 (4 pages)
5 _P100S961.pdf, “Life Cycle Assessment and Cost Analysis of Water and Wastewater
6 Treatment Options for Sustainability: Influence of Scale on Membrane Bioreactor
7 Systems,” EPA Contract No. EP-C-12-02, dated 12/19/2016 (171 pages)
8 _Permit Granbury East WWTP TPDES Permit with Attachments as permitted (4) (1).pdf,
9 permit application (165 pages)
10 _Purchase Price (3).pdf, real property closing statement (06/03/2019)
11 _Revised_SSOI_Agreement_Packet_City_of_Granbury-kd.pdf, Sanitary Sewer Overflow
12 Initiative (28 pages)
13 _SPIF Granbury East WWTP TPDES Permit with Attachments as permitted.pdf, permit
14 application (165 pages)
15 _Survey Plat (1).pdf, real property survey (2 pages)
16 _TCEQ Response - TPDES Permit No. WQ0015821001.pdf, Executive Director’s
17 Response to Comments (51 pages)
18 _Water Quality Evaluations Requested PDF.pdf, (10 pages) DUPLICATE
19 _Watershed Protection Plan pdf summary.pdf (3 pages)
20 _Surface Water Quality Monitoring Station 20222 Sampling 9/7/06 - 7/13/10 (Excel
21 Spreadsheet)

22 **Q: What other type of research have you done in preparation for your testimony?**

1 A: Telephone conversations to gather background information from Firoj Vahora (TCEQ),
2 Anita Branch, Victoria Calder, Trey Nesloney, Stacy Rist, and newspaper reports in the
3 Fort Worth Star Telegram.

4 **Q: Did you visit the property of the proposed WWTP site?**

5 A: Yes, on January 28, 2022.

6 **Q: Describe the circumstances of your site visit.**

7 A: I conducted a field trip to visit the site of the proposed plant and proposed discharge, as
8 well as inspected a portion of the discharge route.

9 **Q: Describe your observations from the site visit.**

10 A: When I visited the proposed plant site on January 28th, I observed a couple of locations of
11 ponding water in the creek bed. The last rain event, according to Weather Underground,
12 was only 0.01” on 01/25/2022, and before that, 0.2” on 12/30/2021. This indicates the
13 potential presence of perennial pools within the discharge route prior to reaching Rucker
14 Creek.

15 The land is rough and undulating and will require a lot of earthwork expense just to level
16 it up to correct drainage problems and make the site suitable for a wastewater treatment
17 plant. The soil is soft and uneven, and having walked over it, I am wondering about its
18 load-bearing capacity. I have not seen soil borings but would hope that the City of Granbury
19 has already performed a geotechnical survey and is assured that the foundation design will
20 not be a huge expense. The proposed plant site is situated behind retail outlets fronting
21 Highway 377. Tenants include a CPA firm, chiropractor, financial advisor, law office, RV
22 park containing residences, jewelry store, etc. Based upon my experience serving on a

1 Planning & Zoning Commission, I would say that the adjacent land uses do not appear to
2 be compatible with a WWTP.

3 III. SUMMARY OF OPINIONS

4 **Q: Have you developed any opinions regarding the Application by the City of Granbury**
5 **(“the City” or “Applicant”) for Permit No. WQ0015821001?**

6 A: Yes.

7 **Q: On what subjects have you developed opinions?**

8 A: I have developed opinions related to the adequacy of the odor buffer zones set forth in the
9 application, as well as opinions related to the potential impact of the discharge upon water
10 quality in Rucker Creek and Lake Granbury, particularly *e. coli* impacts.

11 **Q: Please summarize your opinions with regard to the City’s Application for Permit No.**
12 **WQ0015821001.**

13 A: In my opinion, the Application does not include an adequate buffer zone to prevent odor
14 impacts. Furthermore, the proposed discharge will worsen already concerning bacterial
15 levels in the receiving waters.

16 IV. OPINIONS RELATING TO ODOR BUFFER ZONES

17 **Q: Can you outline the concerns you have with the odor buffer zone?**

18 A: Yes.

19 The applicable rules require that “lagoons” with zones of anaerobic activity may not be
20 located closer than 500 feet to the nearest property line. In this case, the biological nutrient
21 removal (BNR) reactor will include an anaerobic zone. That unit is located only 150 feet
22 from the nearest property line. In fact, there are inhabited RVs located within 500 feet of
23 that unit. This is much too close to provide sufficient protection against odor impacts. In

1 addition, the Applicant seems to rely heavily on the 150-foot buffer zone referenced in the
2 State rules. The 150-foot distance is illustrated on the Plant Location Map and on the
3 Buffer Zone Map. It is absolutely inadvisable to locate odor sources this close to housing
4 units in the absence of source testing and dispersion modeling.

5 **Q: In the wastewater treatment plant context, what is meant by the term “anaerobic**
6 **activity”?**

7 A: Anaerobic refers to the absence of oxygen as a terminal electron acceptor in the oxidation
8 treatment process. In anaerobic conditions, oxidation reactions are supplied by nitrogen in
9 the place of oxygen. An anaerobic environment by definition is depleted of oxygen, and
10 the anaerobic environment is susceptible to the formation of odorous chemicals including
11 hydrogen sulfide (H₂S). The “BNR Anaerobic Zone” in the Applicant’s site plan is an
12 anaerobic zone. Similarly, the “BNR Anoxic Zone” in the Applicant’s site plan is a process
13 devoid of oxygen. The anoxic zone is on the borderline between oxygenated and
14 anaerobic, making it vulnerable to becoming anaerobic and thus odor-producing. By strict
15 definition of the word “anaerobic,” both the anaerobic zone and the anoxic zone would
16 qualify as anaerobic.

17 **Q: Can you identify what has been marked as Exhibit GF-303?**

18 A: Yes. This exhibit is an image of Biological Nutrient Removal units at a wastewater
19 treatment plant, similar to those proposed to be built by the City of Granbury.

20 **Q: Is this a true and accurate depiction of what typical BRN units look like?**

21 A: Yes.

22 *Granbury Fresh offers Exhibit GF-303.*

1 **Q: Are you aware of correspondence by which the Applicant sought to justify the**
2 **location of the BNR anaerobic zone less than 500 feet from the nearest property line?**

3 A: Yes.

4 **Q: Do you agree with the justifications offered?**

5 **A:** There is correspondence in the file between TCEQ and eHT, indicating the Executive
6 Director's concern that 150 feet is insufficient (Administrative Record Bates # Admin
7 Record-0297 to 0305). Concerns were raised regarding proposed equalization basins (EQ
8 basins) in a 150-foot buffer zone, suggesting the buffer zone should be 500 feet instead
9 (also stipulated in the State rules). The EQ basins in the original permit application appear
10 to have been taken out of the project.

11 The Executive Director also raised the issue of the anaerobic and anoxic zones in the BNR
12 process, in the context of requiring a 500-foot buffer zone. Although the Executive Director
13 has concerns, the Applicant's engineer seems to think there will be no H₂S formation nor
14 would there be any odor problems emanating from these zones. Apparently, the engineer
15 initially defended the unaerated, uncovered EQ basin, then removed it from the project.
16 The need for ORP control in the BNR process is fully understood, as well as the operation
17 of selector zones, but the Applicant's assumptions concerning odor problems doesn't align
18 with the fact that "anaerobic" and "anoxic" refer to the absence of oxygen, a biochemical
19 environment in which H₂S and other odor-causing substances are known to form. The
20 BNR units will include zones of anaerobic activity, and thus are subject to the 500-foot
21 property line buffer zone requirement contained in the TCEQ rules.

22 **Q: Can you identify what has been marked as Exhibit GF-304?**

1 A: Yes. This is an excerpt from the Permit Application wherein the Applicant provides its
2 justification for the buffer zones in the application.

3 *Granbury Fresh offers Exhibit GF-304.*

4 **Q: Would a 150-foot buffer zone provide adequate odor protection?**

5 A: No. Having designed odor control facilities for WWTPs, I am also convinced that a 150-
6 foot buffer zone is insufficient, even where chemical odor control facilities are provided.
7 At other plants, I have seen problems evolve over time to the point that both the sewer
8 agency and the adjacent landowners were equally unhappy being located in such close
9 proximity. All of the greenfield treatment plants I have been associated with are thousands
10 of feet from the nearest residence, and the property boundary is much more than 150 feet
11 from the nearest treatment unit. This is the best way to avoid complaints of not only odors,
12 but also dust, noise, and light. It is unfair to blame the plant operators for these problems
13 when a greenfield plant is sited this close to residential and retail land uses.

14 I would also question whether the EQ basins were removed from the project in order to
15 obtain a 150-foot buffer zone instead of the 500-foot buffer zone. Yet, EQ basins are
16 absolutely an integral part of a membrane bioreactor (MBR) facility, as stated elsewhere.

17 **Q: What is a greenfield plant?**

18 A: “Greenfield” refers to a brand-new plant site.

19 **Q: In your opinion, will the use of equalization basins be necessary for the functioning of
20 the plant?**

21 A: Yes. The MBR process is notoriously dependent on EQ basins to provide efficient
22 operation and permit compliance. Based on the state of the art in wastewater engineering,
23 EQ basins are an essential part of the MBR process. All sorts of membranes that are used

1 in water and wastewater will operate best when they are loaded at a constant flow rate.
2 This feature dictates the need to establish a constant flux rate across the membranes, and
3 that cannot be provided without EQ basins. I do not recall ever visiting an MBR plant that
4 did not have EQ basins.

5 **Q: Would equalization basins contain zones of anaerobic activity?**

6 A: Yes.

7 **Q: Please explain.**

8 A: 30 TAC 309.13(e)(1) states that “un-aerated equalization basins, etc.” are “zones of
9 anaerobic activity,” and “may not be closer than 500 feet to the nearest property line.”

10 **V. PROPOSED *E. COLI* DISCHARGE IMPACTS UPON DESIRED WATER**

11 **QUALITY LEVELS AND PUBLIC HEALTH**

12 **Q: Now, I would like to discuss your opinions related to *E. coli* discharges from the
13 proposed facility. What is *E. coli*?**

14 A: *Escherichia coli* (*E. coli*) is commonly found in the lower intestine of warm-blooded
15 animals including humans. The presence of *E. coli* is widely used in the water and
16 wastewater industries as an indicator of human pollution. Where human pollution is
17 present, other types of bacteria, including infectious biological agents, may be present. *E.*
18 *coli* is frequently referred to as an “indicator organism,” being a surrogate for other
19 biological hazards. And, for this reason, EPA sets standards for *E. coli* in both water and
20 wastewater applications. For the protection of public health and prevention of infectious
21 diseases, EPA sets standards for drinking water, for freshwater, and for wastewater
22 treatment plant outfalls. An EPA publication, “Recreational Water Quality Criteria,” sets
23 a standard of 126 *E. coli* colony-forming units (CFU) per 100 mL for fresh recreational

1 waters, and it seems that the draft permit has adopted this value. Even so, wastewater
2 effluent containing *E. coli* is far from safe in terms of recreational use. In the publication
3 referenced above, EPA states that the estimated illness rate for *E. coli* at 126 CFU/100 mL
4 is 36 per 1,000 primary contact recreators. When the *E. coli* level is reduced to 100
5 CFU/100 mL, the estimated illness rate is 32 per 1,000 primary contact recreators. Thus,
6 the lower the *E. coli* concentration, the fewer illnesses would be expected for individuals
7 who come in contact with the water.

8 **Q: Can you identify what has been marked as Exhibit GF-305?**

9 A: Yes. This is the EPA publication on “Recreational Water Quality Criteria” from 2012,
10 referenced above.

11 *Granbury Fresh offers Exhibit GF-305.*

12 **Q: What limit is currently contained in the permit for *E. coli*?**

13 A: The draft permit contains a limit of 126 CFU per 100 ml.

14 **Q: In your opinion, has Granbury demonstrated that an *E. coli* limit of 126 CFU/100ml
15 will maintain desired water quality levels and protect public health?**

16 A: No. There are several aspects of this location that render an *E. coli* limit of 126 CFU/100
17 mL insufficient to accomplish those goals. The Lake Granbury Watershed Protection Plan
18 has recognized that high bacteria levels are already a problem in the coves of Lake
19 Granbury. In addition, Rucker Creek Cove is used extensively for contact recreation
20 purposes that would be adversely impacted by increased bacteria concentrations.
21 Furthermore, water quality needs to be protected in order to preserve the quality of water
22 entering downstream public water supply intakes. Lower *E. coli* levels are technically and

1 economically feasible to achieve, and if the permit was granted such lower levels should
2 be required in this case to protect public health and maintain water quality.

3 **Q: You mentioned the Lake Granbury Watershed Protection Plan. Can you please**
4 **explain how your concerns related to *E. coli* relate to that Plan?**

5 A: Yes, of course. Lake Granbury is designated for use for primary contact recreation and
6 public water supply. The standard for accomplishment of these uses is 126 CFU/100 ml.
7 This standard is frequently not met within the coves of Lake Granbury, which prompted
8 the development of the Lake Granbury Watershed Protection Plan (WPP). That plan notes
9 that periodic elevated concentrations of *E. coli* and fecal coliform bacteria have been found
10 in the coves of Lake Granbury, causing a failure to meet the criteria for contact recreation
11 use. The WPP goes on to note that the coves around Lake Granbury are, “shallow, dead-
12 end bodies of water with little mixing or interaction with the main body of the reservoir.”
13 As a result of this flow pattern, bacteria can tend to build up within coves such as Rucker
14 Creek Cove. The discharge of wastewater at a volume of 2.0 million gallons per day with
15 a concentration of 126 CFU/100 mL would greatly aggravate this problem that the WPP is
16 intended to solve. The proposed discharge with the high *E. coli* limits greatly undermines
17 the water quality that the WPP desires to achieve.

18 **Q: Please identify Exhibit GF-306.**

19 A: This exhibit is a copy of the Lake Granbury Watershed Protection Plan. I understand that
20 this was provided by the Executive Director in this matter.

21 *Granbury Fresh offers Exhibit GF-306.*

22 **Q: Have problems with bacteria levels particularly been observed within Rucker**
23 **Creek?**

1 A: Yes. I have examined historic water quality sampling performed by the TCEQ within
 2 Rucker Creek and the related cove. *E. coli* levels above 126 CFU/100 ml have often been
 3 measured. Bacteria levels exceeding 126 CFU/100 ml were measured in TCEQ sampling
 4 performed on the following dates, with the respective concentration:

Date	<i>E. coli</i> concentration (CFU/100 ml)
3/12/2007	460
5/9/2007	390
2/7/2008	1000
4/10/08	2400
3/4/08	650
10/8/08	290
2/11/09	6100
10/13/09	1600
2/10/2010	1300
3/10/2010	160
4/14/2010	130

5 **Q: Can you identify what has been marked as Exhibit GF-307?**

6 A: Yes. This is a spreadsheet with TCEQ’s surface water quality data from monitoring station
 7 (SWQM data) 20222 on Rucker Creek, approximately 30 meters upstream of Lake
 8 Granbury.

9 *Granbury Fresh offers Exhibit GF-307.*

10 **Q: How do your concerns relate to the location of public drinking water intakes**
 11 **downstream of the discharge?**

12 A: Drinking water quality should always be the primary consideration when locating the
 13 outfall near a freshwater intake. In regard to this Application, this issue comes front and
 14 center on the very last page (which is a map). Nothing is said about this map. But shown
 15 on it is a freshwater intake for domestic drinking water supply downstream of the outfall.
 16 I would estimate the intake to be roughly 2 miles downstream of the point of discharge to
 17 Rucker Creek. While the *E. Coli* standard of 126 CFU/100 mL mentioned above is based

1 upon human contact, far more dangerous to human health is the ingestion of *E. Coli* and
2 other infectious organisms that may be indicated from the presence of *E. Coli*. Zero *E.*
3 *Coli*/100 mL is the target for the water supply industry. Coliforms are routinely tested in
4 drinking water, and when a positive test occurs, additional testing is immediately
5 implemented along with aggressive measures to eliminate the risk.

6 **Q: How would the presence of *E. coli* in high concentrations potentially impact the health**
7 **of persons recreating in Rucker Creek?**

8 A: As explained in the EPA report mentioned above, the presence of *E. coli* indirectly
9 indicates the potential presence of fecal pathogens capable of causing gastrointestinal
10 illnesses.

11 **Q: Would you consider that the addition of this amount of *E. coli* to have an insignificant**
12 **impact upon water quality?**

13 A: No.

14 **Q: Please explain.**

15 A: Since the *E. coli* levels in Rucker Creek are already quite high, there is no room to add
16 more *E. coli*.

17 VI. CHARACTER OF UNDESIGNATED TRIBUTARY

18 **Q: How has the Applicant characterized the immediate receiving water for the**
19 **discharge?**

20 A: In Section 4A of the permit Application, the Applicant states the receiving water is an
21 “intermittent stream” and in Section 4B an “intermittent” flow. Page 30 of the Application
22 states that Rucker Creek is dry during normal dry weather conditions.

1 **Q: In your opinion, is this an accurate characterization of the unnamed tributary for**
2 **permitting purposes?**

3 A: No.

4 **Q: Please explain.**

5 A: As I noted above, when I visited the proposed plant site on January 28th, I observed
6 ponding water in the creek bed. The last rain event, according to Weather Underground,
7 was only 0.01” on 01/25/2022 and, before that, 0.2” on 12/30/2021. The City of Granbury
8 has not shown that these pools are not subject to seasonal aquatic life use, which warrants
9 a higher level of protection than the effluent limitations provide. Once the plant is started
10 up, plant effluent discharge will flow into the receiving stream and proceed directly to the
11 lake. Clearly, Rucker Creek is going to be effluent-dominated when this treatment plant
12 goes into service. On page 29, the Applicant says Lake Granbury is 3 miles from the
13 WWTP, perhaps referring to the main stem of the lake. I scaled about one river mile from
14 the outfall to Rucker Creek, and the land ownership map states the distance to be 0.89 river
15 mile. So, using 0.89 river mile distance and assuming Rucker Creek will flow at only 1.0
16 feet per second velocity, the effluent will travel from the treatment plant to the lake in only
17 an hour and 20 minutes. In such a short time, the effluent is not mitigated to any significant
18 degree by Rucker Creek, therefore this plant basically discharges its effluent to Rucker
19 Creek for all intents and purposes. The City of Granbury has not shown that Rucker Creek
20 itself will not be impaired by the discharge, as well as the cove it empties into and the
21 portion of the main stem of Lake Granbury at the freshwater intake.

1 **VII. TOTAL SUSPENDED SOLIDS**

2 **Q: In your opinion, does the permit contain adequate effluent limitations for total**
3 **suspended solids (TSS)?**

4 A: No.

5 **Q: Please explain.**

6 A: Since the plant will be discharging into Lake Granbury, the need is there to produce high
7 water quality. An MBR plant is definitely capable of producing much better effluent
8 quality than 12 mg/l TSS. Embedded within the solids are other unwanted pollutants, and
9 therefore TSS is a key parameter. I would recommend the daily average limit for TSS be
10 changed to around 5 mg/l.

11 **Q: Please explain your opinion that an MBR plant is capable of producing effluent of a**
12 **much better quality than 12 mg/l TSS.**

13 A: The membranes are capable of removing TSS to less than 12 mg/l. *E. coli* and most other
14 bacteria are hydrophobic, that is, they travel on solids rather than in the water. Reducing
15 the TSS from 12 mg/l to a lower value will provide additional protection against disease-
16 causing bacteria. The proposed disinfection process is ultraviolet (UV) irradiation. One
17 well-documented feature of UV is that re-growth of bacteria is commonplace downstream
18 of the UV treatment process. At lower concentrations of TSS, the regrowth of bacteria
19 may be mitigated.

20 **VIII. CONCLUSION**

21 **Q: Does this conclude your testimony?**

22 A: Yes, this concludes my testimony at this time.