City of Atwater

CIVIC CENTER
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ATWATER, CALIFORNIA 95301

November 17, 2006

Ms. Pamela C. Creedon
Executive Officer
California Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova CA 95670

Project No.: 715\04-05-01

SUBJECT: Tentative Waste Discharge Requirements—City of Atwater Wastewater Treatment Facility, NPDES No. CA 0079197

Dear Ms. Creedon:

The purpose of this letter is to provide comments from the City of Atwater (City) regarding the revised Tentative Waste Discharge Requirements (TWDRs) for renewal of the National Pollutant Discharge Elimination System (NPDES) permit authorizing surface water discharge from the City's Wastewater Treatment Facility (WWTF). The revised TWDRs were circulated by the Central Valley Regional Water Quality Control Board (RWQCB) on October 12, 2006 and are open for comment until November 17, 2006. West Yost Associates, Inc., consulting engineers to the City, participated in the preparation of this letter. These comments will be discussed during the December 7/8 RWQCB Public Hearing.

On April 13, 2005, the RWQCB circulated a first draft of the TWDRs. The City and our consultants reviewed this document and provided comments to the RWQCB on June 1, 2005. The RWQCB then circulated revised TWDRs and Time Schedule Order (TSO) for Ammonia on July 12, 2006 along with responses to the City's comments. The City then provided on August 18, 2006 comments pertaining to the new information in the revised TWDRs and TSO.

On August 18, 2006, the RWQCB issued a letter stating that the TWDRs would be revised to remove the variable ammonia limitations and that they would be replaced with limitations expressed as a single value. These new limitations were based on assumed combinations of worst-case receiving water conditions. The August 18 letter also indicated that a schedule for compliance with the new ammonia limits would be included in the TWDRs, instead of a separate TSO.

Following the issuance of the August 18, 2006 letter, discussions with RWQCB staff revealed that a revised TWDRs would be re-issued based on the changes needed to address comments received from interested parties. Therefore, as documented in our letter dated September 18, 2006, the City elected to reserve our comments regarding the new ammonia limitations until receipt of this revised TWDRs.

On October 12, 2006 the RWQCB circulated the final revision to the TWDRs. Responses to the City's previous comments and comments by other agencies were also included with this circulation. The City greatly appreciates the RWQCB's consideration of our previous comments. However, based on our review of the revised TWDRs and new information developed since the circulation of the previous version of TWDRs, the City has several additional comments that will need to be addressed.[1]

The organization of these comments is as follows:

I. General Comments Applicable to Multiple Provisions of the Tentative Waste Discharge Requirements

II. Comments Applicable to Specific Tentative Waste Discharge Requirements Provisions and Findings

III. Comments on Monitoring and Reporting Program

The City respectfully requests that revisions recommended below be incorporated into the TWDRs prior to adoption. It is the City's position that revisions to address the comments are sufficiently significant to require re-noticing and recirculation of the TWDRs for comment.

I.

GENERAL COMMENTS APPLICABLE TO MULTIPLE PROVISIONS OF THE TENTATIVE WASTE DISCHARGE REQUIREMENTS

AMMONIA LIMITATIONS

The first draft of the TWDRs, circulated by the RWQCB in April 2005, included fixed limitations for both effluent ammonia Continuous Criterion Concentration (CCC) and Criterion Maximum Concentration (CMC). These criteria were calculated using a maximum discharge pH of 8.5 and a reported maximum discharge temperature of 30°C.

The City commented in April 2005 that variable ammonia limits based on the real-time receiving water temperature and pH would be more appropriate because the toxicity of ammonia to the aquatic organisms is highly variable and a function of the ambient water pH and temperature. In response to the City's comments, the RWQCB issued revised TWDRs on July 12, 2006 that included "floating" ammonia limitations following the

[1] These comments focus on those issues raised by review of the revisions to the tentative permit since the prior draft. The City does not reiterate all the points included in its prior written submissions to the RWQCB regarding the proposed permit. The previous comments submitted by the City are included in the permit record and incorporated by reference here.

guidelines provided by the United States Environmental Protection Agency (USEPA) in the publication *1999 Update of Ambient Water Quality Criteria for Ammonia*. These revised TWDRs accounted for the variable nature of ammonia toxicity in the calculations of CCC and CMC by using the actual, real-time, pH and temperature conditions in the receiving water (at the City's R-2 monitoring location) to determine the criteria as outlined in the USEPA. Therefore, these "floating" limitations were protective of the beneficial uses of the receiving water and were developed in accordance with the Fourth Edition of the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan).

Nevertheless, the RWQCB has proposed to remove the "floating" limitations and has prescribed fixed limitations based on assumed "worst-case" temperature and pH scenarios. These limitations require a one-hour maximum ammonia concentration of less than 3.2 mg/L and 30-day average concentration of less than 2.36 mg/L.

As outlined in detail below, these fixed limitations are overprotective of the beneficial uses of the Atwater Drain and do not reflect the actual potential impact of the effluent on aquatic life in the receiving water. Furthermore, the fixed limitations were not applied in accordance with the guidelines of the Basin Plan or the USEPA. Therefore, the City specifically requests that the fixed ammonia limitations prescribed in the revised TWDRs be revoked and that the "floating" limitations, as outlined in the July 2006 TWDRs, be reinstated.

Basin Plan Policy for Implementation of Narrative Objectives

The Basin Plan includes a narrative objective stating that "all waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life". As outlined in the TWDRs, ammonia limitations are prescribed in the City's permit for purposes of satisfying this narrative objective.

The Basin Plan also includes guidelines for the implementation of narrative objectives in Section IV, Pages 16 to 18, Item 8, Policy for Application of Water Quality. Specifically, this policy states:

> Where compliance with these narrative objectives is required (i.e., where the objectives are applicable to protect specified beneficial uses), the Regional Water Board will, on a case-by-case basis, adopt numerical limitations in orders which will implement the narrative objectives.
>
> To evaluate compliance with the narrative water quality objectives, the Regional Water Board considers, on a case-by-case basis, direct evidence of beneficial use impacts, all material and relevant information submitted by the discharger and other interested parties, ***and relevant numerical criteria and guidelines developed and/or published by other agencies*** and organizations (e.g., State Water Board, California Department of

> Health Services, California Office of Environmental Health Hazard Assessment, California Department of Toxic Substances Control, University of California Cooperative Extension, California Department of Fish and Game, USEPA, U.S. Food and Drug Administration, National Academy of Sciences, U.S. Fish and Wildlife Service, Food and Agricultural Organization of the United Nations). In considering such criteria, the Board evaluates whether the specific numerical criteria, which are available through these sources and through other information supplied to the Board, are relevant and appropriate to the situation at hand and, therefore, should be used in determining compliance with the narrative objective.

Therefore, the Basin Plan requires that the RWQCB rely on the guidelines developed by the other agencies (such as the USEPA) for development of the numeric toxicity objectives for ammonia that would be protective of the beneficial uses of the Atwater Drain.

<u>USEPA Guidance Specially Outlines a Specific Procedure for Establishing pH and Temperature-Dependent Criteria</u>

As documented in the TWDRs, the USEPA publication *1999 Update of Ambient Water Quality Criteria for Ammonia* is the appropriate guidance document for determining the applicable toxicity objective for ammonia. This document discusses the dependence of the toxicity of ammonia to aquatic organisms on various properties of the ambient water, especially temperature, pH, and ionic composition. Since ionic composition is not an important factor in the fresh water, pH and temperature are the key factors determining ammonia toxicity of the City's effluent in the Atwater Drain. Specifically this document states:

> "...except possibly where an unusually sensitive species is important at a site, freshwater aquatic life should be protected if both of the following conditions are satisfied for the temperature, T, and pH of the waterbody:
>
> 1. The one-hour average concentration of total ammonia nitrogen (in mg N/L) does not exceed, more than once every three years on the average, the CMC calculated using the following equation when salmonid fish are not present:
>
> $$CMC = \frac{0.411}{1 + 10^{7.204-pH}} - \frac{58.4}{1 - 10^{pH-7.204}}$$
>
> 2A. The thirty-day average concentration of total ammonia nitrogen (in mg N/L) does not exceed, more than once every three years on the

average, the CCC (chronic criterion) calculated using the following equations when fish early life stages are present:

$$CCC = 0.854 \cdot \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) \cdot MIN(2.85\ ,\ 1.45 \cdot 10^{0.028 \cdot (25 - T)})$$

2B. In addition, the highest four-day average within the 30-day period should not exceed 2.5 times the CCC."

Salmonid fish are not present in the Atwater Drain; nor are unusually sensitive species. Therefore, the criteria listed above would be applicable to the Atwater Drain.

The same chapter of the *1999 Update of Ambient Water Quality Criteria for Ammonia* that contains the above equations also discusses the choice of pH and temperature values to be used with these calculations in the following text:

> "... if samples are obtained from a receiving water over a period of time during which pH and/or temperature is not constant, the pH, temperature, and the concentration of total ammonia in each sample should be determined. For each sample, the criterion should be determined at the pH and temperature of the sample, and then the concentration of total ammonia nitrogen in the sample should be divided by the criterion to determine a quotient. The criterion is attained if the mean of the quotients is less than 1 over the duration of the averaging period."

Thus, the use of real-time pH and temperature data to determine the applicable criteria for effluent ammonia is consistent with the USEPA guidelines. Moreover, the variable effluent limitations included in the July 2006 TWDRs were based on the use of this methodology, and are therefore appropriate.

<u>The Ammonia Limitations Included in the TWDRs are a new interpretation of the Basin Plan Objective</u>

The ammonia limitations included in TWDRs were developed using the maximum allowed receiving water pH of 8.5 in the CMC equation discussed above in order to calculate the one-hour average effluent ammonia limitation of 3.2 mg/l. The monthly average effluent limitation of 2.36 mg/l in the TWDRs is based on the CCC value calculated from the median effluent and receiving water pH of 7.20 and the highest monthly average receiving water temperature of 27°C.

This procedure used by the RWQCB of establishing the criteria appropriate for the Atwater Drain is not described in any guidance document. Therefore, the proposed fixed limit is a new interpretation of the Basin Plan's narrative toxicity objective. Furthermore, this new interpretation of the water quality objective that results in a fixed ammonia limit must be adopted in accordance with the Porter-Cologne Water Quality Control Act (Wat.

Code, § 13000, et seq.) and, in particular, Water Code sections 13241 and 13263. This new interpretation results in either a new water quality objective that must be adopted in accordance with Water Code section 13241 or a limitation more stringent than existing water quality objectives that must be adopted in accordance with Water Code section 13263, which requires consideration of the factors in Water Code section 13241.

Ammonia Is Not a Priority Pollutant and Is Not Subject to the Provisions of the SIP

A comment was raised by the California Sportfishing Protection Alliance with respect to the "floating" ammonia limitation included the July 2006 TWDRs. This comment stated that the use of a "floating" limitation was contrary to the State Water Resources Control Board (SWRCB) Order for Yuba City (WQO 2004 – 0013). Specifically, the Order in questions included the following statement (as a footnote):

> "We recommend that the Regional Board establish either fixed or seasonal effluent limitations for metals, as provided in the SIP, rather than "floating" effluent limitations."

This statement specially addresses the establishment of a fixed hardness value for determining effluent metal toxicity limitations following the guidelines of the SIP (Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California). This statement should not be interpreted as being applicable to the establishment of ammonia limitations because ammonia is not a metal, nor is it subject to the provision of the SIP. Specifically, Page 1 of the SIP states:

> "This Policy establishes: (1) Implementation provisions for priority pollutant criteria promulgated by the U.S. Environmental Protection Agency (U.S. EPA) through the National Toxics Rule (40 CFR 131.36) (promulgated on 22 December 1992 and amended on 4 May 1995) and through the California Toxics Rule (40 CFR 131.38) (promulgated on 18 May 2000 and amended on 13 February 2001), and for priority pollutant objectives established by Regional Water Boards in their basin plans."

Ammonia is not listed as a priority pollutant by the USEPA. Therefore, the SIP is not the appropriate guidance document for establishing effluent limitations for ammonia.

Furthermore, the statement by the SWRCB in the Yuba City Order does not prohibit the RWQCB from using effluent limits that are not fixed within the permit. The footnote is included as the SWRCB stated preference. However, the SWRCB has not made a finding that prohibits the use of variable effluent limits. Moreover, the use of a "floating" limit was not an issue on appeal. In fact, the SWRCB did not require that the RWQCB remove the "floating" limits applied in the Yuba City WWTP permit that was under consideration; and the statement in question is not supported by any technical or legal reasoning contained in the Order or the larger Administrative Record.

The pH and Temperature Values Used to Establish the Fixed Ammonia Limitations in the TWDRs are Arbitrary and Overprotective

The City has calculated the CMC and CCC that would be applicable to the WWTF discharge based on historic receiving water data collected downstream from the WWTF between January 1995 and September 2006. In total, over 500 individual receiving water samples for pH and temperature were collected. Figure 1 (attached) shows the distribution of these calculated variable limitations with respect to the fixed limits established in the TWDRs.

Based on this data, the minimum CMC that would have ever been applicable to the discharge is 8.2 mg/L, well above the prescribed fixed limit of 3.2 mg/L. Essentially, the conditions used to establish the fixed limitation have a *zero* percent probability of ever occurring. (Note that the maximum receiving water pH value ever recorded was 8.01, which occurred on February 10, 1998.)

Also note that based on over 3,500 effluent pH measurements taken between January 1995 and July 2006, the effluent has only exceeded the pH of 8.0 on two occasions (the City reported an effluent pH of 8.96 on May 12, 1996 and February 1, 2000). However, based on the fact the pH value in the receiving water on these dates was approximately 7 and that the effluent pH on the day before and the day after these samples was approximately 7, the City believes that these two data point represent data that was either measured or recorded improperly. Nevertheless, even if these two data point are considered, the statistical probability of the effluent pH exceeding 8.0 is 0.014%. This probability of exceedance would fall within the 99.9% compliance standards outlined by the USEPA.

The chronic limitation calculated based on the actual receiving water conditions range from 1.4 mg/L to 7.1 mg/L. The variable CCC based on the actual receiving water data would have been less than the prescribed fixed limit of 2.36 mg/L only 10% of the time.

Nitrification is a Biological Process Inherently Subject to Upsets

The City completed a preliminary analysis of the WWTF aeration basin's capability to achieve the fixed ammonia limits prescribed in the TWDR, using treatment process computer model BioWin (see the attached memo "City of Atwater Preliminary BioWin Modeling to Assess Permit Compliance"). Based on this analysis, the existing facility can meet both the "floating" and the fixed limitations for ammonia (as is demonstrated by existing effluent data). However, the facility would need to be significantly modified to comply with the both ammonia limitations and the 10 mg/L nitrate limitation. Compliance with the "floating" ammonia limitations and the nitrate limitation can likely be achieved with the existing reactor volume. However, compliance with the fixed ammonia limitations and the nitrate limitation would require additional tankage.

Nevertheless, performance cannot be continuously guaranteed due to the sensitive nature of the nitrifying bacteria. Specifically, nitrifying bacteria can be inhibited by slight variations in the chemical composition of the wastewater, temperature, and pH. These factors are much less likely to affect the populations of other bacteria populations essential for BOD reductions. Also, the influent ammonia concentrations to the Atwater WWTF are unusually high (40 mg/L on average). Taking this into account, periodical biological upsets in the nitrifying population are likely to result in some non-compliance incidents that could not be in any way prevented or alleviated by the personnel, regardless of the limitations prescribed (either variable or fixed).

The City collects process control data in an effort to ensure conditions are maximized for the nitrifying bacteria population; and based on the effluent data collected since January 2000, the treatment process has been capable of providing full nitrification. Specifically, approximately 80% of all effluent ammonia measurements were below the detection limit of 1.0 mg/L. Any incidence where the effluent ammonia concentrations exceed the detection limit can therefore be classified as an upset. However, based on available data, the number of upsets in the nitrifying population will vary throughout the year, where the majority of upsets appear to occur in the summer months (see attached Figure 2).

Another condition that is apparently leading to nitrification upsets is low temperatures. Based on available data, historic upsets that have resulted in effluent ammonia concentrations in excess of 6 mg/L occurred during periods when receiving water temperatures were less than 20°C (see attached Figure 3). Note that ammonia toxicity is much lower when ambient temperatures are cooler. Therefore, upsets that are a result of cooler temperature are less likely to exceed a variable limitation than a fixed limitation that is based on assumed higher receiving water temperatures.

Based on the information presented in Figures 2 and 3, biological upsets to the nitrifying population are apparently caused by a variety of factors that can occur throughout the year and are not specially connected to any particular biological incident that could be readily identified.

Fixed Limits will Result in a Significant Increase in Periods of Non-Compliance

The attached Figure 4 shows the cumulative distribution of compliance ratios, calculated in accordance with USEPA's *1999 Update of Ambient Water Quality Criteria for Ammonia* and the July 2005 TWDRs from data collected for the Atwater WWTF between January 2000 and July 2006.

The acute compliance ratio was determined by dividing the effluent ammonia concentration by the acute criteria (calculated using the CMC equation outlined in the USEPA guidance document and pH values measured in the downstream receiving water on the same day or the closest date when the effluent ammonia data was collected). Compliance with the acute criteria is achieved when the Acute Ratio is below 1, which happened in 100% of the measurements. Note that the non-detect values were used to determine the plotting position of the detected values shown in Figure 4, but are not actually plotted on the figure. Also note that tall of the non-detect values would be less than the CMC.

The chronic compliance ratio was determined by dividing the effluent ammonia concentration (non-detect values were approximated at ½ of the detection limit) by the 30-day running average chronic criteria (calculated using the CCC equation outlined in the USEPA guidance document and pH and temperature values measured in the downstream receiving on the same day or the closest date when the effluent ammonia data was collected). Compliance was determined by calculating the 30-day averages of these individual chronic ratios. Non-compliance occurred when the 30-day average chronic ratio exceeded 1. This is the methodology outlined in the July 2006 TWDRs. As shown in Figure 4, approximately 10% of the 30-day average chronic ratios were above one.

Based on this analysis, the City would have achieved 100% compliance with variable acute limit and 90% compliance with variable chronic limit as stated in the July 2006 Tentative NPDES Permit.

In contrast, comparison of the same historic data from 2000-2006 to the proposed fixed limits shows approximately 90% compliance with the fixed acute ammonia limit of 3.2 mg/L and approximately 85% compliance with the fixed 30-day average chronic limit of 2.3 mg/L (see attached Figure 5). Based on these statistics, the City would be out of compliance with the fixed acute limit 37 days of the year and out of compliance with the fixed chronic limit for at least one monthly period in a year.

Because excursions in effluent ammonia concentration tend to be a result of a system upset, several violations would be "clumped" together. Under a worst-case scenario, all of the violations could occur during one six-month period. Given a $3,000 fine for any one-time exceedance of the hourly ammonia limit after the first three violations in any six-month period, 10% noncompliance with the fixed acute limit may cost the City up to over $100,000 per year in fines (assuming daily samples were taken during periods of non-compliance). If the "floating" limits were applied, the City would only have had one yearly exceedance of the chronic limit, which would not have resulted in a fine. ***Therefore, the fines that would be incurred for exceedances of the fixed limit could be significant even though none of the exceedance of the fixed limit would result in an actual toxic condition.***

Technical violations of the ammonia limit that do not result in toxicity are inconsistent with the purported basis for the ammonia limit (i.e., the narrative toxicity objective). As discussed above, applying a limit that is not necessary to implement the Basin Plan's water quality objective is unreasonable and violates the Porter-Cologne Water Quality Control Act (Wat. Code, §§ 13000, 13001, 13241, 13263.)

The City notes that Section 13385 of the California Water Code provides a basis for protecting the City under incidents that result in a biological upset, stating that a biological upset shall be counted as only one violation given the "operational upset was not the result of operator error and/or negligence and that but for the operational upset of the biological treatment process, the violations would not have occurred." However, the onus of proof is on the City and due to the sensitivity of the nitrifying bacteria, identification of the cause of a given upset is very difficult. Therefore, significant degree of guidance from the RWQCB is requested such that the City can collect the data needed to "prove" that an upset is due to factors outside the control of the operators.

CHLORINE RESIDUAL MONITORING

In response to the previous comment document submitted by the City on August 18, 2006, the RWQCB has revised the TWDRs to give the City six months for installation of the second continuous chlorine monitoring device. In the interim period, continuous monitoring of the effluent chlorine residual is required, using the existing analyzer. Grab samples, collected every 15 minutes, can be used when the analyzer is taken offline for calibration.

The revised TWDRs also allow the City to demonstrate through data collected from the City's back-up monitoring system that a chlorine spike recorded by the continuous monitor was not actually due to chlorine. The recorded spike will then be considered and reported as a false positive.

Since the issuance of the July 2006 tentative order, the City has been working diligently to achieve the necessary chlorine residual detection limits with the current monitoring device. Despite these efforts, the current chlorine analyzer (which achieves the lowest detection limits applicable for such a device) still cannot register consistent results, and many "false positives" have occurred. Therefore, the City plans to change treatment processes to use both calcium thiosulfate and sodium bisulfite for dechlorination. This planned change in the City's treatment method will require minor modifications to the language of the revised TWDRs (see Section II.A below).

The City will add small quantities of sodium bisulfite to the effluent after it has been dechlorinated with calcium thiosulfate. Detectable concentration of sulfite residual in the dechlorinated effluent is an indicator of zero chlorine residual. A sulfite residual analyzer will be installed within the next six months. Sulfite measurement is made at much higher detection limit and does not require the same calibration accuracy as measuring chlorine residual directly. Therefore, data from this analyzer will be used to verify "false positives" as outlined in the TWDRs. The City will also install the second chlorine analyzer discussed in the TWDRs.

II.

COMMENTS APPLICABLE TO SPECIFIC TENTATIVE WASTE DISCHARGE REQUIREMENTS PROVISIONS AND FINDINGS

A. FINDINGS

1. Finding 4 / Description of WWTF

The City requests to include the following modification to *Finding 4* in the *Background* section of the TWDRs to allow the addition of sodium bisulfite as a dechlorinating agent and compliance indicator (as discussed in section I.A above):

> Treated wastewater is disinfected with chlorine gas and dechlorinated with calcium thiosulfate and sodium bisulfite.[2]

B. GROUNDWATER LIMITATIONS

1. D. Groundwater Limitations / Background Water Quality

The proposed language of the Groundwater Objectives in the TWDRs permit may require the City to improve upon the background groundwater quality. According to the Basin Plan, improvement of the naturally occurring background concentrations is not required:

> "The following objectives apply to all ground waters of the Sacramento and San Joaquin River Basins, as the objectives are relevant to the protection of designated beneficial uses. ***These objectives do not require improvement over naturally occurring background concentrations.*** The ground water objectives contained in this plan are not required by the federal Clean Water Act."

Background concentrations have not yet been established. They will be established through the completion of Provision 14 of the NPDES Permit. Therefore, the City requests that the Groundwater Limitations of the Tentative Permit be modified as follows:

> "Release of waste constituents from any storage, treatment, or disposal component associated with the WWTF shall not cause groundwater within influence of the WWTF to be degraded above naturally occurring background concentrations or, in combination with other sources of the waste constituents, to contain waste constituents in concentrations equal to or greater than that listed below (whichever is greater)"

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[2] Similar change should be made to the WWTF Description in the Fact Sheet

III.

COMMENTS ON MONITORING AND REPORTING PROGRAM

A. EFFLUENT MONITORING

1. Priority Pollutants / Comment 16

The City is concerned that 24-hour composite sampling could lead to "false" detections for some constituents, even though EPA standard testing protocols do not specifically require grab samples (as they do with volatile organics). Studies show that some constituents (e.g. cyanide) are likely to form as a result of the standard preservation methods. Additionally, contamination of samples from the composite sampling collection equipment can result in "false positives" (e.g. bis-2(ethyl hexyl phthalate)).

Therefore, the City requests that footnote 16 of the Effluent Monitoring Table (which refers to the composite sampling requirement for priority pollutants) be modified as follows:

> [16] Except where required otherwise by constituent testing protocol or approved by the Executive Officer.

B. RECEIVING WATER MONITORING

1. Receiving Surface Water Monitoring/ Fecal Coliform Testing

The proposed revised TWDRs would require fecal coliform testing of the receiving water to be performed two times per week (eight samples per month, or 104 samples per year). However, only five samples per month (or 60 samples per year) are needed for compliance verification with the receiving water limit.

Since the sampling cost is about $100 per test, these additional samples would result in an added total cost of over $5,400 per year. Furthermore, the staff would need to visit the receiving water sampling site once per week for the sole purpose of collecting this additional sample (all other sampling is required on a weekly basis or less).

For these reasons, the City requests that the monitoring frequency for receiving water fecal coliform testing be changed by requiring weekly sampling and adding a footnote to the receiving water monitoring table that states:

> One additional sample will be collected per 30-day period to demonstrate compliance with receiving water limitation D.14. Sample must not be collected at the same time as other weekly monitoring.

Thank you for your consideration of these comments.

Sincerely,

Mr. David Church
Public Works Director

cc: Mr. Bert E. Van Voris, Supervising WRC Engineer, CVRWQCB, Fresno Branch Office
Mr. W. Dale Harvey, Senior WRC Engineer, CVRWQCB, Fresno Branch Office
Mr. Matt Scroggins, WRC Engineer, CVRWQCB, Fresno Branch Office
Mr. Mo Khatami, Deputy City Manager, City of Atwater
Mr. David Church, Director of Public Works, City of Atwater
Mr. Monte Hamamoto, Veolia Water North America-West. LLC
Mr. Bruce West, West Yost Associates
Ms. Kathryn Gies, West Yost Associates
Ms. Melanie Carr, West Yost Associates
Ms. Roberta L. Larson, Somach, Simmons & Dunn
Ms. Kelley M. Taber, Somach, Simmons & Dunn
Ms. Kristen Castanos, Somach, Simmons & Dunn
Ms. Andrea L. Shephard, Ph.D, EDAW, Inc.

ATTACHMENTS

Figures 1 – 5

Technical Memorandum: City of Atwater Preliminary BioWin Modeling to Assess Permit Compliance

Figure 1. City of Atwater WWTF Variable Limits for Effluent Ammonia

Figure 2. City of Atwater WWTF Instances of Fixed Acute Ammonia Limit Exceedance by Month

Figure 3. City of Atwater WWTF Effluent Ammonia Concentration vs. Receiving Water Temperature

Figure 4. City of Atwater WWTF Compliance with Variable Limits for Effluent Ammonia

Figure 5. City of Atwater WWTF Compliance with Fixed Limits for Effluent Ammonia

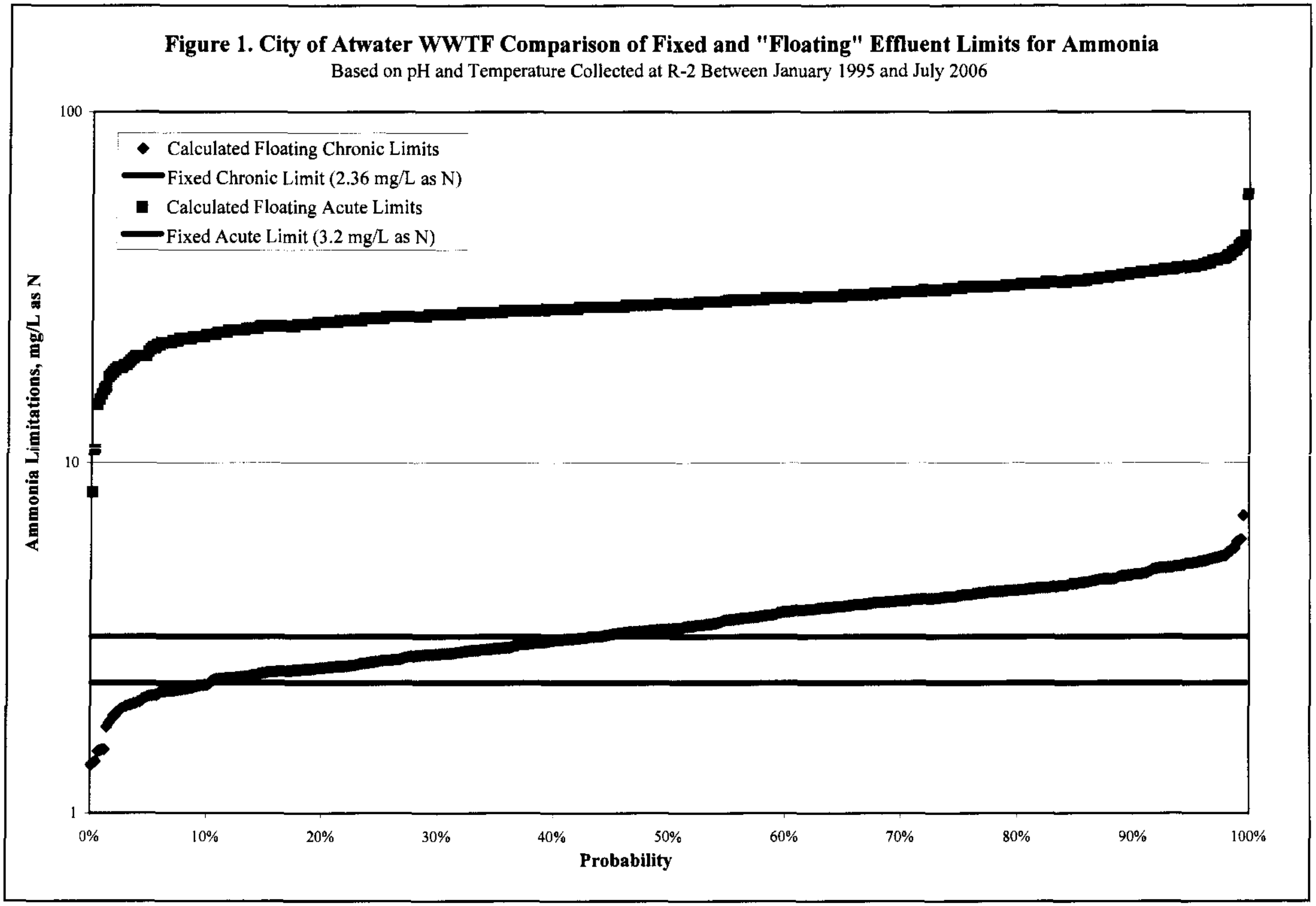

Figure 1

Comments on the City of Atwater WWTF TWDRs

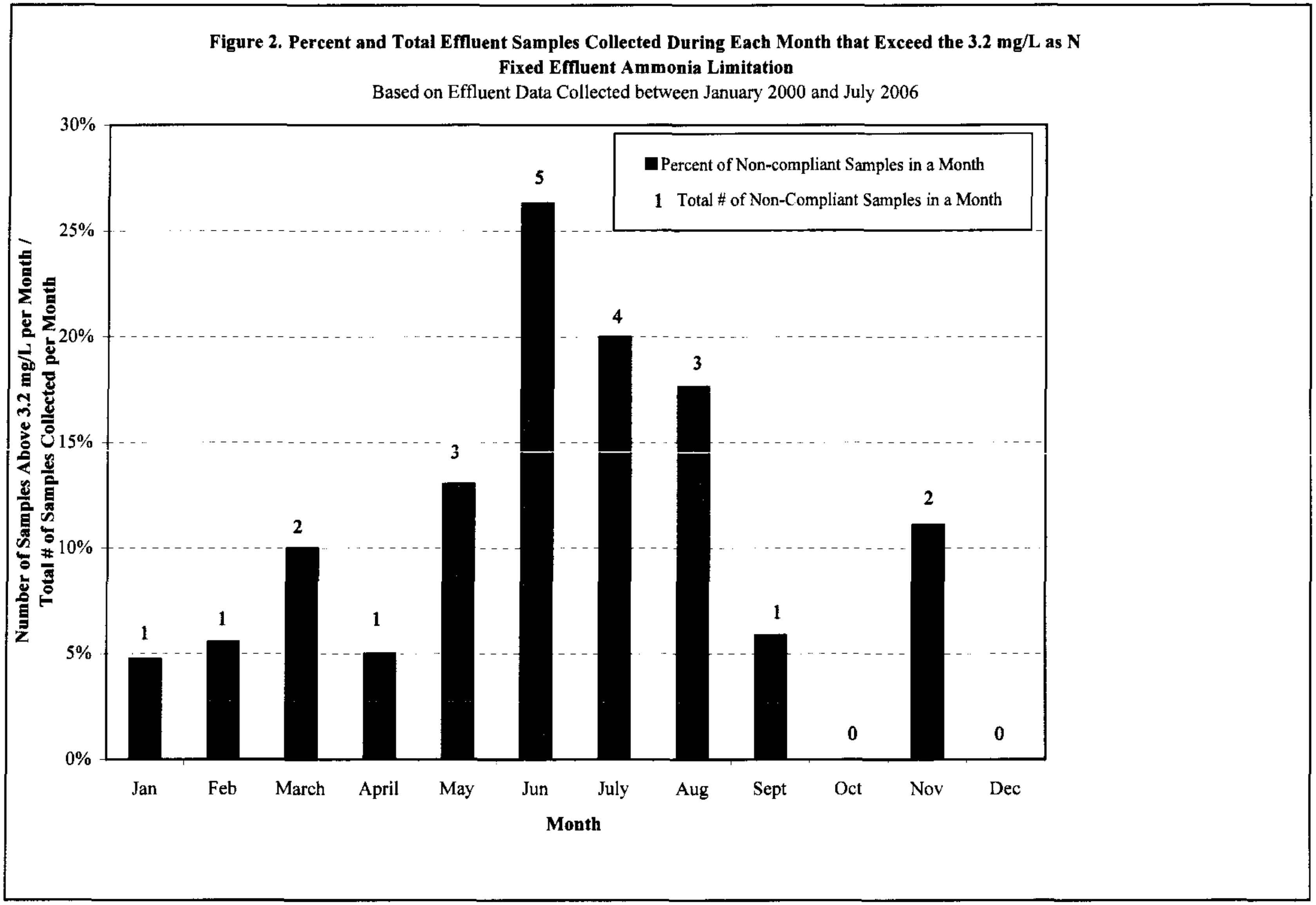
Figure 2. Percent and Total Effluent Samples Collected During Each Month that Exceed the 3.2 mg/L as N Fixed Effluent Ammonia Limitation
Based on Effluent Data Collected between January 2000 and July 2006
Percent of Non-compliant Samples in a Month
1 Total # of Non-Compliant Samples in a Month
Number of Samples Above 3.2 mg/L per Month / Total # of Samples Collected per Month
30%
25%
20%
15%
10%
5%
0%
1
1
2
1
3
5
4
3
1
0
2
0
Jan
Feb
March
April
May
Jun
July
Aug
Sept
Oct
Nov
Dec
Month

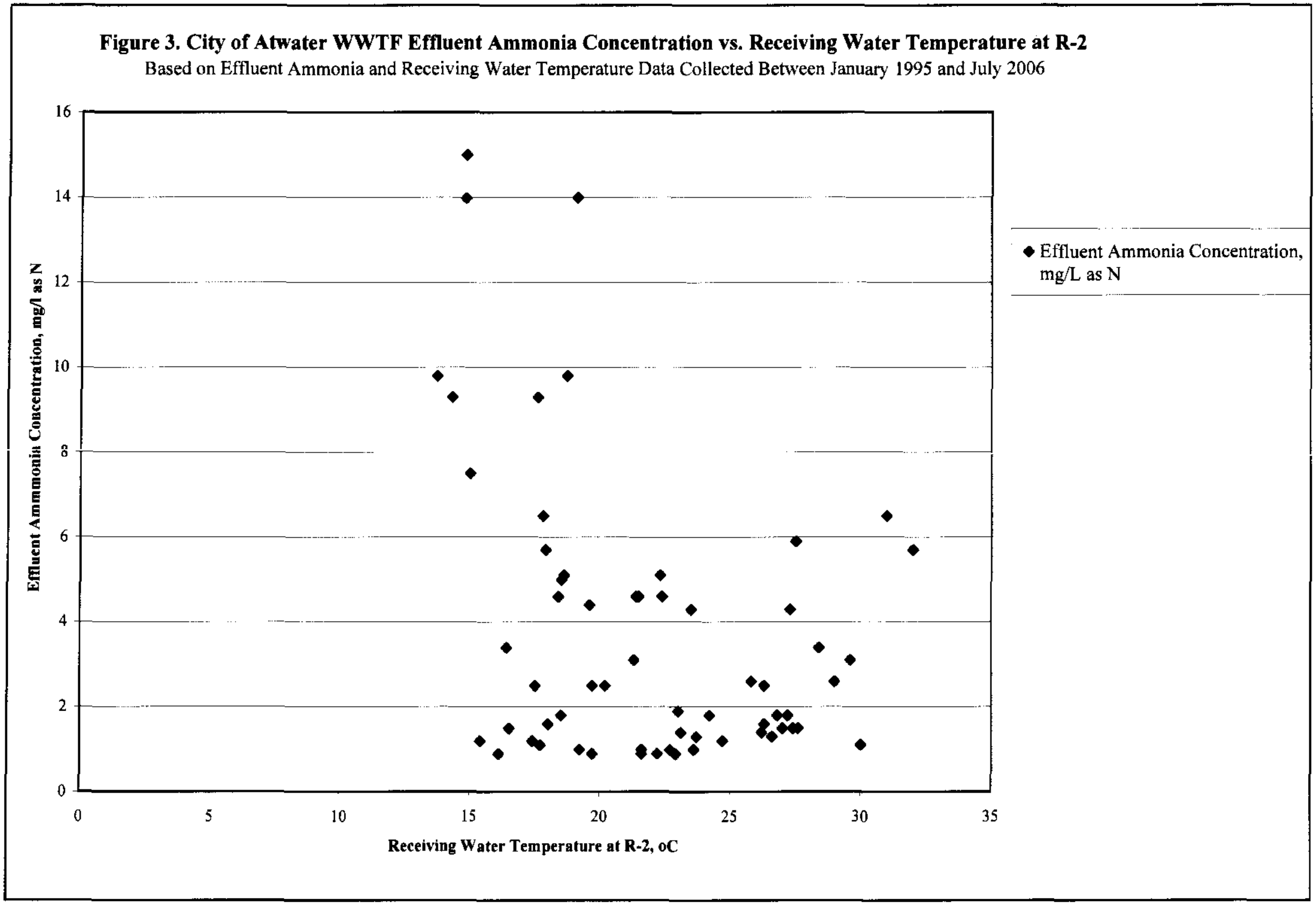

Figure 3. City of Atwater WWTF Effluent Ammonia Concentration vs. Receiving Water Temperature at R-2
Based on Effluent Ammonia and Receiving Water Temperature Data Collected Between January 1995 and July 2006
Effluent Ammmonia Concentration, mg/l as N
16
14
12
10
8
6
4
2
0
0
5
10
15
20
25
30
35
Receiving Water Temperature at R-2, oC
Effluent Ammonia Concentration, mg/L as N

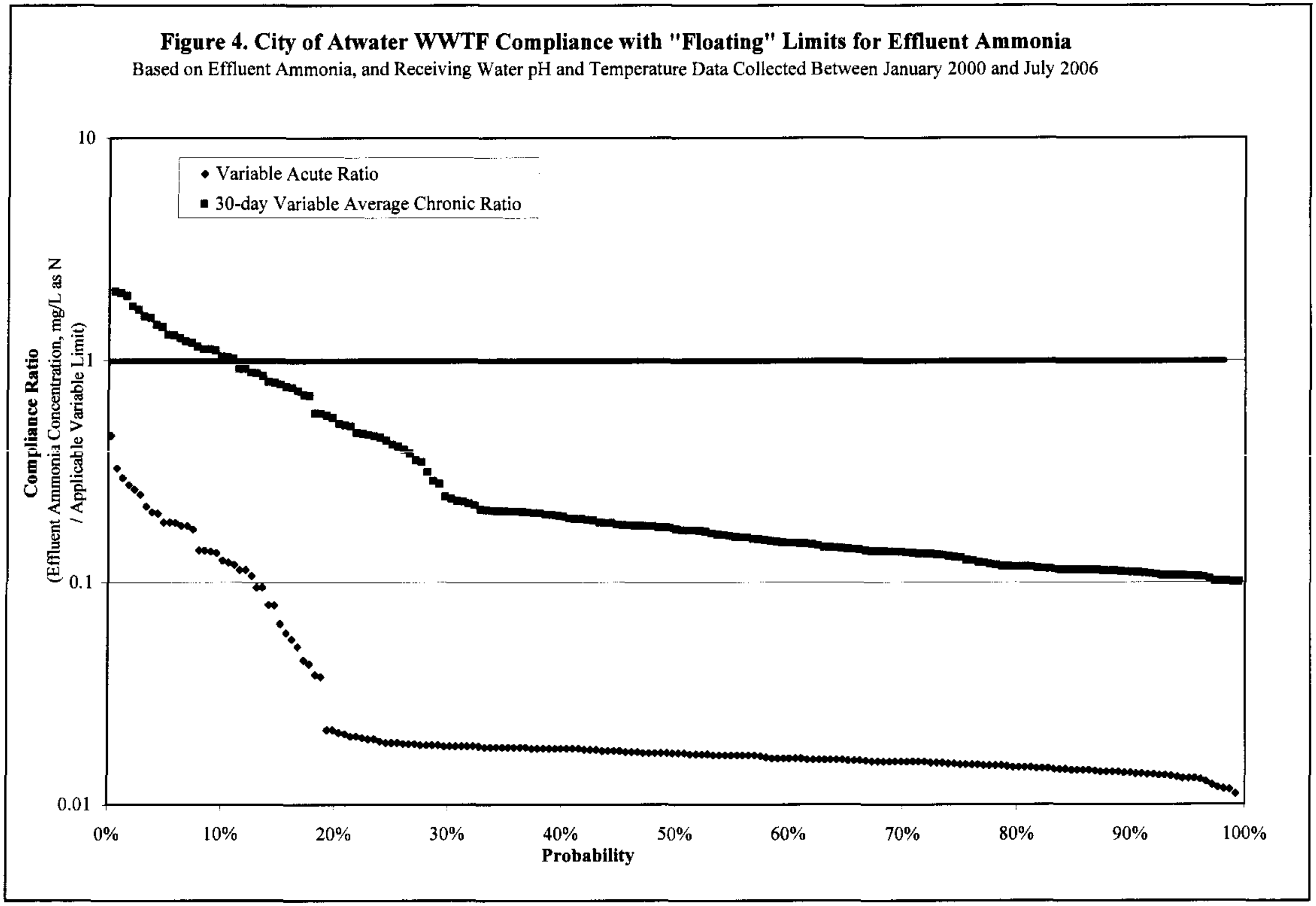
Figure 4. City of Atwater WWTF Compliance with "Floating" Limits for Effluent Ammonia
Based on Effluent Ammonia, and Receiving Water pH and Temperature Data Collected Between January 2000 and July 2006
Variable Acute Ratio
30-day Variable Average Chronic Ratio
Compliance Ratio
(Effluent Ammonia Concentration, mg/L as N / Applicable Variable Limit)
10
1
0.1
0.01
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability

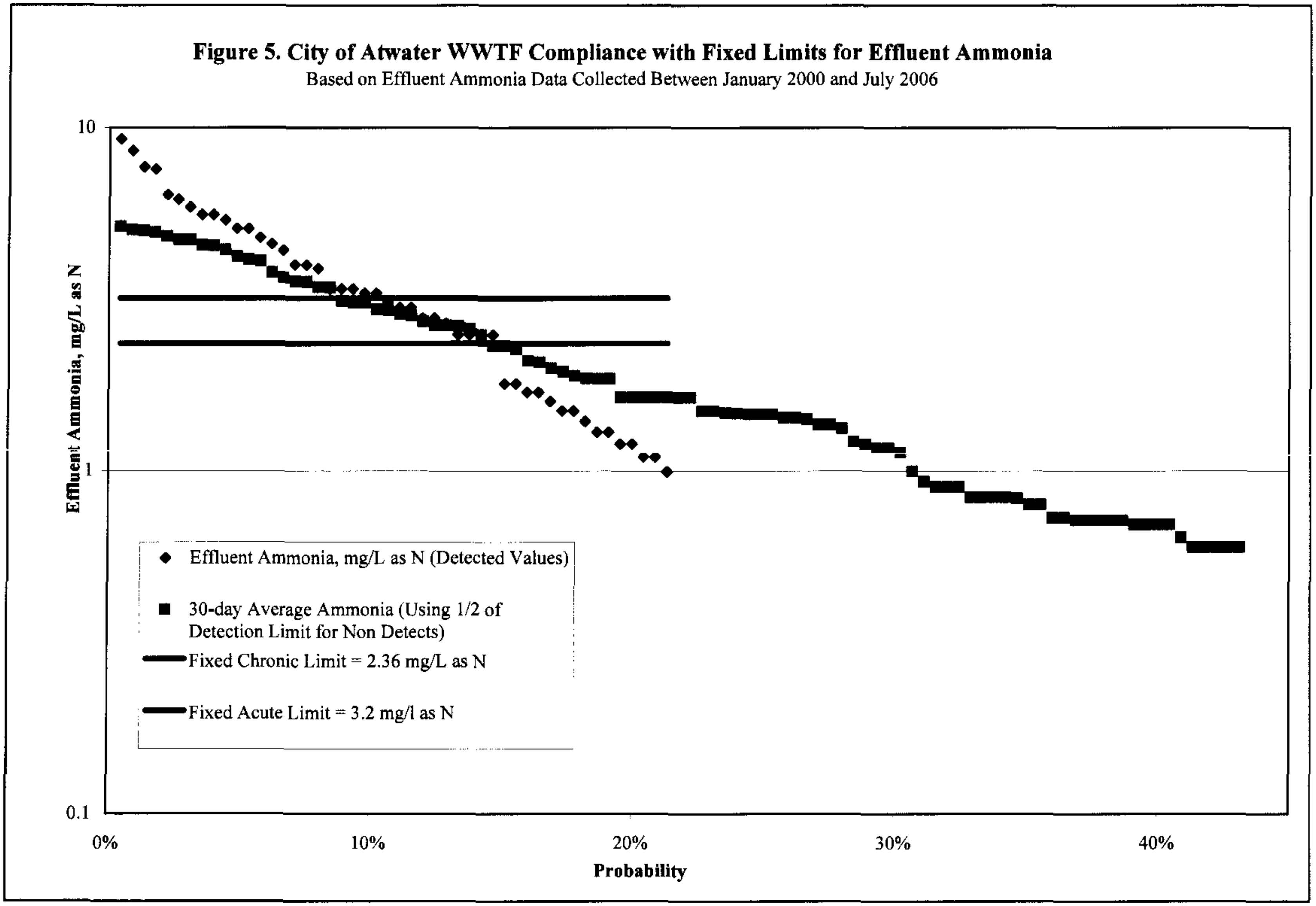
Figure 5. City of Atwater WWTF Compliance with Fixed Limits for Effluent Ammonia
Based on Effluent Ammonia Data Collected Between January 2000 and July 2006
10
1
0.1
Effluent Ammonia, mg/L as N
0%
10%
20%
30%
40%
Probability
Effluent Ammonia, mg/L as N (Detected Values)
30-day Average Ammonia (Using 1/2 of Detection Limit for Non Detects)
Fixed Chronic Limit = 2.36 mg/L as N
Fixed Acute Limit = 3.2 mg/l as N

WEST YOST
ASSOCIATES
Consulting Engineers

TECHNICAL MEMORANDUM

DATE:	November 17, 2006	Project No.: 715-04-05-01.001
TO:	Kathryn Gies	
FROM:	Steve Celeste	
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REVIEWED BY:	Steve Celeste	
CC:	Bruce West	
SUBJECT:	City of Atwater Preliminary BioWin Modeling to Assess Permit Compliance	

This technical memorandum provides a preliminary assessment of the City of Atwater (City) Wastewater Treatment Plant's (WWTP) estimated treatment capabilities with respect to anticipated effluent ammonia and nitrate limits. This study investigated ways to incorporate the existing aeration basins into an upgraded treatment process that would comply with the anticipated treatment requirements. The treatment process computer model BioWin was used in the evaluation.

BACKGROUND INFORMATION

The City's existing liquid stream treatment processes are shown schematically in Figure 1. The treatment processes include screening, primary clarification, secondary treatment in aeration basins, secondary clarification, and disinfection in chlorine contact basins.

Table 1 provides design data for existing primary and secondary treatment units.

Figure 1. Existing Liquid Stream Process Schematic

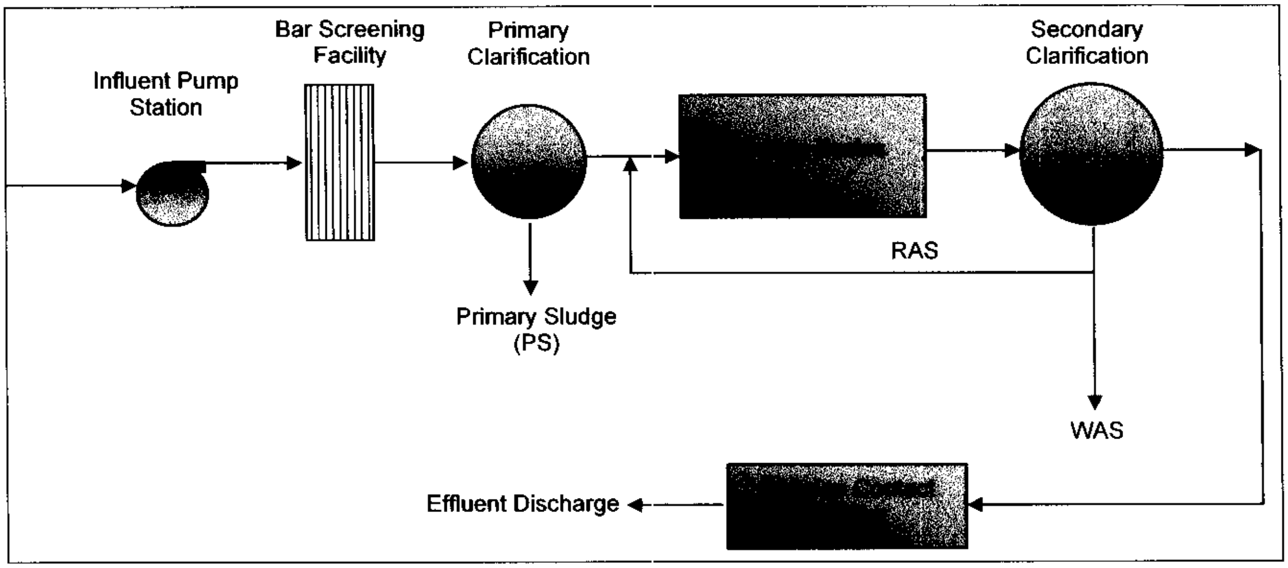

Table 1. Design Data for the Primary and Secondary Facilities

Description	Value
Primary Clarifiers	
Number	2
Diameter, ft	70
Sidewater Depth, ft	12
Aeration Basins[a]	
Number	2
Volume, each, million gallons (MG)	2.49
Depth, ft	15.5
Aerators	
Number	5
Type	Surface Turbine and BioMixer
Horsepower, each	75
Secondary Clarifiers	
Number	4
Diameter, ft	70
Sidewater Depth, ft	2@11 ft, 2@12 ft

[a]Only one aeration basin is used during normal operation.

ANTICIPATED PERMIT REQUIREMENTS

The City has the responsibility to comply with the wastewater treatment requirements set by the Regional Board. The requirements are established to ensure the protection of the receiving water's beneficial uses and comply with applicable water quality standards. The anticipated future effluent ammonia and nitrate requirements for the City's WWTP as presented in Table 2.

Table 2. Anticipated Effluent Requirements for Ammonia and Nitrate

Description	Ammonia, mg/L	Nitrate, mg/L
Hard Limits	3.2	10
Floating Limits	Varies[a]	10

[a]Floating limits are a function of receiving water pH.

FLOWS AND LOADS

Modeling was based on the wastewater flows and load data for the month of March 2005 (Table 3).

Table 3. Wastewater Characteristics Summary (March 2005)

Influent Parameter	Value
Flow, mgd	3.54
Biochemical Oxygen Demand (BOD_5), mg/L	183.3
Total Suspended Solids (TSS), mg/L	151.5
Ammonia, mg/L	44.4
Temperature, °C	20.0
Alkalinity, mg/L	240.3
pH	7.82

MODEL CALIBRATION

Perhaps the most important step in a process evaluation, model calibration is an iterative process. Measured values for critical operating and performance parameters for the influent, primary effluent, aeration basins, and effluent are evaluated and summarized. A computer model of the existing secondary treatment process is developed and adjustments are made to the influent characteristic coefficients and various treatment coefficients until the model value for each parameter matches the measured value. The accuracy of the calibration and subsequent modeling increases as the amount of available operating and performance data increases. For the purposes of this model calibration, the available data (summarized in Table 3) is minimal. Therefore, only a rudimentary calibration was possible. This absence of data directly impacts the accuracy of the modeling results.

The calibration is summarized in Table 4. This table compares measured values with model values for a number of parameters.

Table 4. BioWin Calibration Summary[a]

Item	March 2005	
	Reported Value	Model Value
Temperature, F	20.0	**20.0**
Influent flow, mgd	3.54	**3.54**
Influent BOD5, mg/L	183.3	**183.3**
Influent TSS, mg/L	151.5	**151.5**
Influent Nitrate, mg/L	-	**0**
Influent ammonia, mg/L	44.4	**44.4**
Primary sludge flow, mgd	-	**0.08**
RAS flow, mgd	-	**1.36**
Aeration Basin Mixed Liquor Volatile Suspended Solids Concentration (MLVSS), mg/L	-	2,600
Hydraulic Retention Time (HRT), hours	-	16.9
AB Solids Retention Time (SRT), days	-	51
Effluent COD, mg/L	-	30
Effluent Nitrate, mg/L	8.6	16.36
Effluent BOD_5, mg/L	<7	2.64
Effluent TSS, mg/L	<5	9.9
Effluent ammonia, mg/L	0.44	0.25
Effluent pH, mg/L	7.2	6.74

Bold values are model inputs
[a]Calibration is based on operating one aeration basin (2.49 MG) only.
- Not available

Based on the results from the model calibration, the effluent BOD_5, TSS, and ammonia values compared reasonably well with the reported concentrations. The calibration work revealed two important factors.

Denitrification

The reported effluent nitrate concentration is approximately one-fifth of what would be expected for a conventional activated sludge process. In order for the model to predict the reported effluent nitrate concentrations, it was necessary to configure the model's aeration basin to partially denitrify. Denitrification is the process of reducing nitrate to nitrogen gas in the absence of oxygen. The low effluent nitrate levels suggest that the aerators in the basin maybe spaced too far apart, creating anoxic zones between the mechanically aerated aerobic zones. These possible anoxic zones would cause denitrification.

Additionally, there is a discrepancy in the simplified nitrogen mass balance (based on a comparison of influent ammonia-N to the effluent ammonia-N and nitrate-N concentrations). As seen in Table 3, the 44.4 mg/L influent ammonia compare to 9.04 mg/L total of ammonia and nitrate in the effluent. This loss of nitrogen further suggests that denitrification is occurring in the aeration basin.

Alkalinity

Biological nitrification is defined as the conversion of ammonia to nitrate in the presence of oxygen. Nitrification consumes alkalinity, which can result in a pH drop. Theoretically, 7.2 parts of alkalinity is consumed per part of ammonia-N oxidized to nitrate-N. When alkalinity is reduced to approximately 70 mg/L as $CaCO_3$, the resulting drop in pH can lead to inhibition of nitrification.

Based on the reported influent ammonia concentration, approximately 320 mg/L of alkalinity is required for full nitrification (compared to 240 mg/L of alkalinity available). However, since the reported effluent pH is not depressed and full nitrification occurred, the alkalinity demand for the nitrification process was satisfied. This is achievable in one of the two ways:

1. Addition of chemicals to increase alkalinity.
2. Denitrification, which returns half of the alkalinity lost during nitrification.

Since the City does not add chemicals to increase alkalinity, this further supports the idea that denitrification is occurring in the aeration basin.

MODELING RESULTS

The calibrated model was used to simulate operations for a set of influent data representative of current maximum day loading conditions. Because the calibration results showed that significant denitrification would be needed to comply with the nitrate limits and recover alkalinity, the model was modified to include intentional denitrification.

Based on preliminary modeling, it was apparent that in order to comply with the anticipated nitrate limits, a large anoxic zone and extremely high mixed liquor (ML) recycle rates would be required. High ML recycle is an inherent characteristic of oxidation ditch activated sludge processes. Figure 2 illustrates a simple flow schematic of the primary and secondary processes used for modeling.

The influent characteristics for the current maximum daily condition are presented in Table 5. Tables 6 and 7 present the results from the modeling analysis to meet potential effluent limits.

Figure 2. Model Primary and Secondary Process Schematic

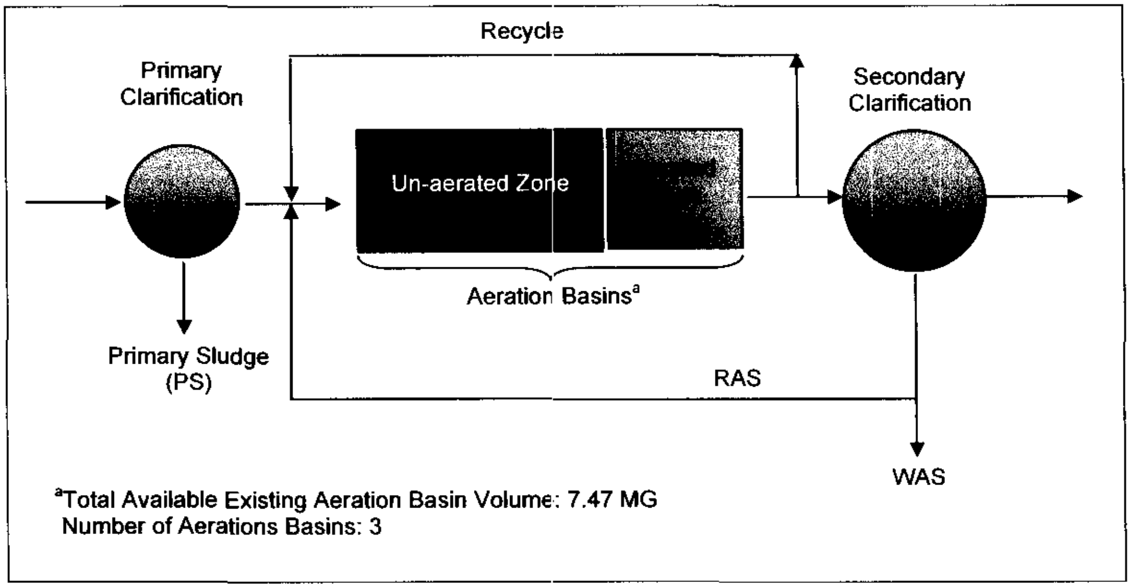

Table 5. Influent Characteristics – Typical Maximum Daily Condition

Description	Value
Date	March 8, 2004
Flow, mgd	3.74
Biochemical Oxygen Demand (BOD_5), mg/L	252
Total Suspended Solids (TSS), mg/L	358
Ammonia, mg/L	56.1
Temperature, ^{o}C	19.2
Alkalinity, mg/L	330
pH	8.12

Table 6. Modeling Results for Compliance with Hard Limits

Description	Value
Model for Meeting Hard Limits	
HRT in the Aeration Basins, Days	2.0
ML Recycle Rate, mgd	41
Aerated Volume Used, Million gallons (MG)	1.2
Un-aerated Volume Used, MG	6.3
Total Aeration Basin Volume, MG	7.5
MLVSS Concentration, mg/L	2,600
Effluent Ammonia Concentration, mg/L	3.13
Effluent Nitrate Concentration, mg/L	9.13

Table 7. Modeling Results for Compliance with Floating Limits

Description	Value
Model for Meeting Floating Limits	
HRT in the Aeration Basins, Days	1.3
ML Recycle Rate, mgd	41
Aerated Volume Used, Million gallons (MG)	0.73
Un-aerated Volume Used, MG	4.25
Total Aeration Basin Volume, MG	4.98
MLVSS Concentration, mg/L	2700
Effluent Ammonia Concentration[a], mg/L	12.45
Effluent Nitrate Concentration, mg/L	4.7

[a]Partial nitrification is difficult to maintain consistently. Losing nitrification would result in higher effluent ammonia concentrations. Increasing nitrification would result in higher effluent nitrate levels.

Conclusions and Recommendations

Due to inconsistencies between the available data and the model calibration, the conclusions and recommendations in this section should be considered preliminary.

- The City's influent wastewater appears to have inordinately high ammonia levels.

- In order to meet effluent nitrate limits, a proportionally large un-aerated volume and high ML recycle rates are required.
- Compliance with both the nitrate limit and the hard ammonia limit would require additional reactor volume. Compliance with the floating ammonia limit and the nitrate limit could likely be achieved with the existing tankage.
- While the modeling results show the potential for compliance with the anticipated hard and floating limits, performance cannot be continuously guaranteed due to the sensitive nature of the nitrifying bacteria. These bacteria can be inhibited due to slight variations in the chemical composition of the wastewater, temperature, and pH. Dozens of chemicals are known to inhibit nitrifying bacteria.
- Due to their inherent high recycle rate it may be beneficial to further investigate one of the proprietary oxidation ditch processes, such as VertiCel™, VLR and Orbal.

PROPRIETARY TREATMENT PROCESSES

This section provides a brief description of some proprietary treatment processes that the City may want to consider evaluating further.

Orbals

Orbal is an extended aeration secondary treatment process marketed by U.S. Filter/Envirex. An offshoot of oxidation ditches, Orbals are typically configured as three concentric channels, with raw sewage and RAS entering the outer channel and moving sequentially in toward the center. Although aerated, the outer channel operates with no measurable dissolved oxygen (DO). This reportedly allows for simultaneous nitrification and denitrification. The middle channel is aerated such that an average DO concentration of about 1 mg/L is maintained. However, there is typically no DO control in the middle channel so peak loading conditions result in zero DO. Aeration of the inner channel is such that DO concentrations above 2 mg/L are maintained.

Aeration and mixing is provided by rotating disk aerators. DO is controlled by varying the rotational speed and/or submergence of the disks. The aeration system is sized to provide velocities within the channels of 1-2 feet per second. The tanks are typically structurally and mechanically designed so that one channel can be taken out of service for maintenance while the others are operational.

Vertical Loop Reactor (VLR)

Vertical loop reactors are another product offered by U.S Filter. VLRs are essentially oxidation ditches tipped on their side. A flat baffle separates the upper and lower zones and permits ML recycling between these two zones.

From a process perspective, VLRs are essentially identical to oxidation ditches. Existing rectangular aeration basins are often modified to be VLR reactors.

VertiCel™

The VertiCel™ is also an extended aeration process marketed by U.S. Filter/Envirex. The VertiCel is a series of Vertical Loop Reactors (VLRs) tanks, operated as aerated and anoxic reactors, followed by a two-stage series of conventional fine bubble reactors maintained in an aerobic state. After entering the system, raw wastewater passes progressively through the VLR basins and the fine bubble basins.

Sequencing Batch Reactors (SBRs)

SBRs are generally viewed as an economical treatment option for small communities. As the name implies, the wastewater is treated in batches. This unique approach allows for a variety of treatment refinements based on primarily on time. For example, within the limits of available volume, nitrification and denitrification can be optimized by varying the sequence and duration of the treatment phases. U.S Filter's Jet Tech is one example of a common SBR.

An SBR sized to treat the City's flows and loads would be among the largest SBRs in operation. As such, there may be issues that could impact operations and performance that are not currently well defined.

Conclusion

Preliminary discussions with US Filter/Envirex representatives revealed that there are numerous oxidation ditch installations in the US with capacity and effluent limits requirements comparable to the City's. However, there are few such SBR installations. Consequently, U.S. Filter representatives recommended considering their oxidation ditch processes in lieu of their SBR. For the oxidation ditch processes, U.S. Filter may provide a process guarantee for the anticipated ammonia and nitrate limits, despite the high influent ammonia loads.