Exhibit 1

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September 21, 2012

Mr. Bruce Wolfe
Executive Officer
San Francisco Bay Regional Water Quality Control Board
Elihu M. Harris State Office Building
1515 Clay Street, Oakland, CA 94612

Subject: Proposed Settlement Agreement and Stipulation for Entry of Order in the matter of Administrative Civil Liability Complaint No. R2-2010-0102

Dear Mr. Wolfe:

The purpose of this letter is to provide you with details concerning the conclusions I reached from my analysis of the March 2007 digester cleaning event at the Novato Sanitary District ("NSD") Plant. Specifically, I relied on my extensive background in environmental engineering and wastewater treatment processes to form conclusions concerning: 1) the propriety of the method of digester cleaning employed, and 2) the value of photographic evidence to predict whether there were exceedances of the effluent discharge limits associated with the digester cleaning during the period from March 17 to 19, 2007 (as listed in the Proposed Settlement Agreement, Item 4.c.

Background

I was retained by the NSD Board of Directors in May 2011 to provide expert consulting and analysis in connection with the San Francisco Bay Regional Water Quality Control Board ("RWQCB") investigation of NSD's wastewater treatment plant operations.

The attached resume shows my education and honors. A list of publications is also attached. In summary, I was educated in England with a first class honors B.Sc. in Applied Biochemistry from Birmingham University and a PhD. in Public Health Engineering from the University of Durham, Kings College. I taught and conducted research in the Civil and Environmental Engineering Department at the University of California at Berkeley from 1960 to 1999. My research and teaching were in the areas of wastewater treatment processes and water and wastewater chemistry and microbiology. My work and service to the profession have been recognized nationally and internationally. Among my many honors are: I was elected to the National Academy of Engineering in 2001; I received the International Water Association Global Water Award in 2012; on retirement from the University of California, I was granted the Berkeley Citation (Berkeley's equivalent of an honorary doctorate). My professional work has mirrored my research and teaching areas. I specialize in troubleshooting at wastewater treatment plants and solving practical problems involving water chemistry and microbiology. I practice my profession through David Jenkins & Associates Inc.

Approach

During my engagement, I worked with employees of NSD and with the law firm of Barg Coffin Lewis and Trapp, LLP ("Barg Coffin"). In the course of my work, I completed the following tasks:

- Visited the NSD plant and observed the wastewater treatment processes in place. At the time of my visit, the new NSD Plant was in operation; however, I had previously visited the original NSD plant (not during this engagement).
- Evaluated the method employed to clean the secondary anaerobic digester. In particular, I analyzed whether it was appropriate to introduce fluidized and screened contents of the secondary digester into the headworks of the plant from a wastewater treatment processing and engineering perspective.
- Evaluated from a wastewater chemistry perspective whether photographic evidence of the contents of the chlorine contact basin and effluent storage pond could be used to predict the quality of the effluent discharges during the cleaning of the secondary anaerobic digester.
- Participated in a settlement meeting with the RWQCB and State Water Resources Control Board ("SWRCB") staff and supervisors. This was a joint task with Barg Coffin.
- Assisted NSD in documenting the results of my analysis in writing. These results were previously presented orally with the aid of PowerPoint slides to RWQCB/SWRCB staff.

Findings

Background

In preparation for the construction of an upgraded NSD wastewater treatment plant, it was necessary for NSD to clean, and then remove, an existing secondary anaerobic digester that had not been in service for several years. The secondary digester contained inactive solids that had remained in the digester after the practice of secondary digestion was terminated at the plant.

NSD hired a professional digester cleaning contractor to clean out the inactive solids using a method that consisted of fluidizing the solids with chlorinated secondary effluent and screening the fluidized contents through a ¾ inch screen. The screened solids were disposed off-site. The screened fluidized material was then returned to the plant headworks and processed together with the incoming wastewater. The returned solids were removed by the primary clarifier and then treated and disposed of through the plant's existing primary digester and sludge thickening and dewatering processes, together with the sludge being generated at the plant.

Basic Principals of Wastewater Treatment Processing Support the Cleaning Method Employed

It has been alleged that the introduction of material from the secondary anaerobic digester into the wastewater flow of a wastewater treatment plant is improper. I disagree with this allegation for the following reasons.

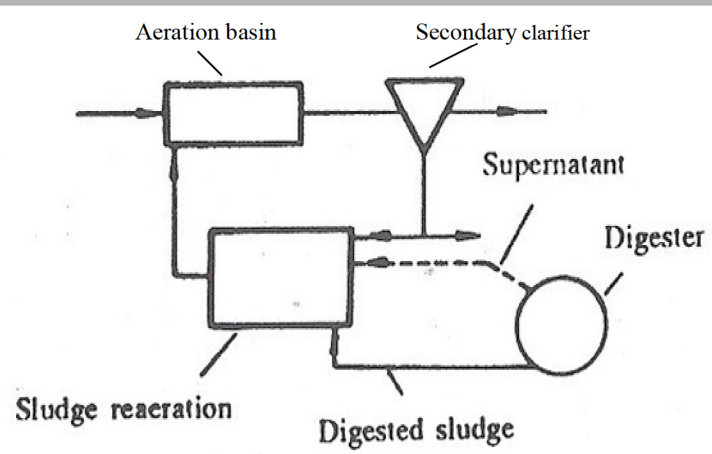
Currently, just about every plant that has an anaerobic digester processing mixed primary and waste activated sludges returns the liquid from post-anaerobic digestion dewatering processes to the plant wastewater flow.

In older wastewater treatment processes, when primary wastewater treatment plants were common, anaerobic digestion of the primary sludge was practiced in a combination of primary and secondary digesters. The secondary digester largely served the function of concentration of the primary digested sludge by quiescent settling. The anaerobic digester supernatant separated from this digested sludge was returned to the plant wastewater flow.

In newer wastewater treatment processes, nearly every plant that has an anaerobic digester that processes mixed primary and waste activated sludges returns the liquid from post-anaerobic digestion dewatering processes to the plant wastewater flow.

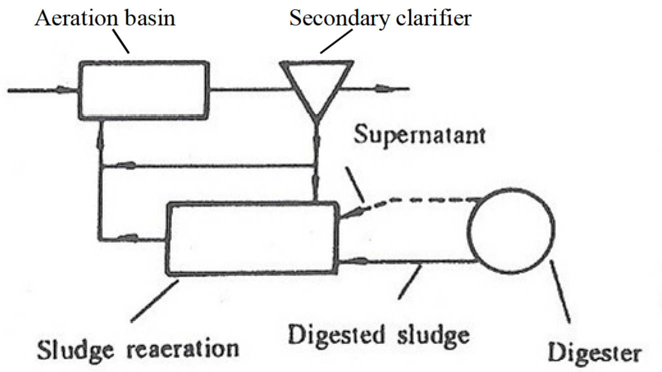
In addition to these two almost universal practices, there are two activated sludge process modifications that purposely utilize the return of anaerobic sludge digester contents directly to the activated sludge process for the purpose of providing a weighting agent to improve the activated sludge settlability. These processes are the Hatfield Process and the Krauss Process, which are depicted in the following diagrams.

Hatfield Process



Hatfield, W.D. (1959) Modified plant process to handle shock loadings. *Waste Eng., 30*, 612.

Krauss Process



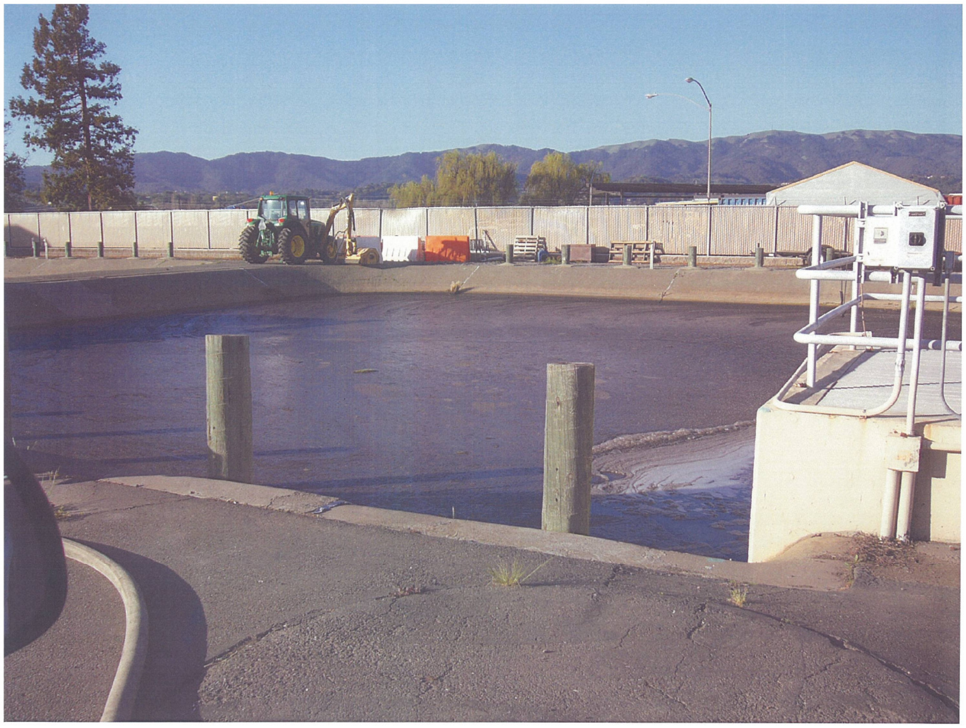
Krauss, L. S. (1945) The use of digested sludge and digester overflow to control bulking activated sludge. *Sew. Wks J., 17*,1177.
Krauss, L. S. (1946) Digested sludge - an aid to the activated sludge process. *Sew. Wks J., 18*, 1099.

Indeed, the secondary wastewater treatment process at the largest wastewater treatment plant in the San Francisco Bay Area (San Jose Santa Clara Water Pollution Control Plant) was originally designed using the Krauss process modification of the activated sludge process.

For all of these reasons, it is my conclusion that from a wastewater treatment processing and engineering perspective, cleaning the secondary digester by returning anaerobic digester supernatant to the plant headworks was appropriate.

Photographic Evidence Should Not Be Used To Predict the Quality of the Effluent Discharges during Digester Cleaning

During the March 2007 secondary digester cleaning and solids transfer process, the NSD plant experienced some operating problems which resulted in the presence of floating materials on the surface of the chlorine contact basin ("CCB") and effluent storage pond ("ESP"). As can be seen in Photograph 1, below, which was allegedly taken by plant operator James Lynch during the weekend of March 17 or 18, 2012, floating solids appeared on the surface of the CCB during the digester cleaning process. It has been alleged that this photograph can be used as proof that the plant's effluent quality limitations were exceeded during that weekend.



Photograph 1: Photo of Surface of CCB on March 17 or 18, 2007

To determine whether this photograph could be used to predict effluent quality, I obtained similar photographs of the CCB and ESP taken on other dates for which effluent quality data was available. Photographs 2A and 2B below, taken on September 25, 2009, depict floating solids in the ESP and a beaker holding a sample of the plant effluent, respectively.

Photograph 2A: Surface of ESP on September 25, 2009

Photograph 2B: Sample of Plant Effluent on September 25, 2009

Consistent with the plant's typical sampling schedule and procedures, the plant's effluent on September 25, 2009 was analyzed in the NSD laboratory and found to be good quality secondary effluent. The Total Suspended Solids (“TSS”) concentration was 10 mg/L. This concentration is well within NSD’s permit limits.

Similarly, Photographs 3A and 3B below, taken on October 15, 2009, depict floating solids in the CCB and a beaker holding a sample of the plant effluent, respectively.

Photograph 3A: Surface of CCB on October 15, 2009

Photograph 3B: Sample of Plant Effluent on October 15, 2009

Consistent with the plant's typical sampling schedule and procedures, the plant's effluent on October 15, 2009 was analyzed in the NSD laboratory and found to be good quality secondary effluent. The TSS concentration was 15 mg/L. Again, this concentration is well within NSD’s permit limits.

Based on these specific examples and my extensive background in wastewater chemistry, it is my opinion that the surface appearance of liquid in a basin such as the CCB and ESP at the NSD plant cannot be used to provide a quantitative assessment of the quality of an effluent discharge because the bulk of the liquid is below the surface and not visible.

To give a familiar example, consider a cup of cappuccino. Looking at the surface of the cup, you could conclude that it is full of foam -- but luckily this is not the case, as most of the volume of the cup actually contains a brown liquid!

This reasoning applies especially to the situation that existed at NSD during the March 2007 digester cleaning event because, as can be seen in Photograph 4, below, the points of withdrawal of the secondary effluent from the CCB are located well beneath the surface layer observed in the photographs.

Photograph 4: The Discharge Withdrawal Points from the CCB

A further consequence of this physical situation is that the sub-surface withdrawal points will result in the trapping of floating material in the CCB. This is because the floating material never gets anywhere near the point at which liquid is being removed from the CCB. Therefore a photograph of the surface will not only be unrepresentative of the effluent leaving the CCB, but also it will greatly exaggerate the amount of floating material present because it represents an accumulation that has been trapped on the surface of the CCB from many volumes of effluent that have passed through the basin.

Consistent with this conclusion, the records of regulated discharge did not show any such exceedance of Bay discharge standards during the period of the digester cleaning operation. The weekly average TSS values were 44 mg/L (during the week of March 12) and 34 mg/L (during the week of March 19) compared to the discharge limit of 45 mg/L. The weekly average BOD value was 18 mg/L (during the week of March 12) and 10 mg/L (during the week of March 19) compared to the discharge limit of 45 mg/L. The daily *enterococcus* values were all less than the daily permit limit of 276 MPN/100mL during the period when the plant was discharging to the Bay. There was one exceedance of the daily total coliform value of 10,000 MPN/100 mL, but this was when the plant was discharging to the reclamation ponds, and not the Bay. The daily maximum oil and grease was 2.7 mg/L compared to the daily maximum limit of 10 mg/L. In addition, there was no evidence that the effluent toxicity values during the period of the digester cleaning (measured by *C. dubia* responses) were any different from those obtained during the entire period from 2000 to 2009.

Evaluation of Lynch Statements and Claims

This section contains my responses to Mr. J. Lynch's letter of June 21, 2012 concerning the proposed Settlement Agreement and Stipulation. I have presented my responses together with the statements in Mr. Lynch's letter to which they are directed.

Lynch: "I am baffled and beyond disappointment at the outcome of the State's investigation of the dumping of the contents of a digester to San Pablo Bay by the Novato Sanitary District"
Comment: The contents of the digester were not dumped to San Pablo Bay. A slurry of the old secondary digester contents was introduced into the headworks of the treatment plant and then subjected, together with the incoming wastewater, to the complete set of treatment processes in the NSD plant. The analysis of the plant effluent showed that at no time when the effluent was being discharged to San Pablo Bay was any effluent permit limit exceeded.

Lynch: "Did the State's legal staff look at the evidence…the photos of the ponds full of sludge…"
Comment: You cannot judge whether the "ponds" (*sic*. CCB and ESP) were "full of sludge" from a picture of its surface. Moreover, the CCB and ESP could not have been full of sludge because if they had been, the secondary effluent TSS and BOD concentrations would have been at least in the hundreds of mg/L and could have been in the thousands of mg/L.

Lynch: "…there was no chlorine residual due to the fact the effluent to the Bay was sludge not treated wastewater"
Comment: As stated in the comment to the Lynch allegation above, it is impossible that sludge was being discharged to the Bay rather than treated wastewater because the analytical results for BOD and TSS produced values that were consistent with those of a secondary effluent.

Lynch: "To a person none have ever heard of an intentional dumping of this magnitude."
Comment: There is a good reason that no one has heard about an intentional dumping of this (or any other magnitude) by NSD…and that reason is because no intentional dumping of any magnitude ever occurred at NSD.

Thank you for the opportunity to provide this information and my comments for use in support of the proposed Settlement Agreement and Stipulation.

Respectfully submitted

David Jenkins

President
David Jenkins & Associates Inc.

Lawrence E. Pierano Chair Emeritus
Department of Civil and Environmental Engineering
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DAVID JENKINS

Professor Emeritus
Department of Civil and Environmental Engineering
University of California at Berkeley

Education

B.Sc. Applied Biochemistry, Birmingham University, England, 1957
Ph.D. Public Health (Sanitary) Engineering, Kings College, University of Durham, England, 1960

Honors and Awards

Foyle Prize, Birmingham University, 1957
Post Doctoral Research Fellow, Harvard University, 1969-70
Harrison Prescott Eddy Medal, Water Environment Federation (WEF), 1974, 1985 and 1988
Engineering-Science Award, Assoc. of Environmental Engineering and Science Professors (AEESP), 1978, 1982
Distinguished Service Award, WEF, 1981
Fellow, Chartered Institution of Water Engineering and Management, England, 1982
Japan Society for the Promotion of Science Fellowship, 1982
Thomas Camp Medal, WEF, 1988
Honorary Life Member, WEF, 1988
Simon Freeze Award and Lectureship, American Society of Civil Engineers, 1988
Distinguished Lecturer in Environmental Engineering, AEESP, 1988
George Bradley Gasgoine Medal, WEF, 1989 and 2001
National Research Council Fellow, Chinese Taiwan, 1992
Samuel H. Jenkins Medal, International Water Association (IWA), 1992
Honorary Life Member, IWA, 1994
Gordon Maskew Fair Medal, WEF, 1995
Outstanding Publication Award, AEESP, 1995
Berkeley Citation, 1999
AEESP, CH2M Hill Award, 1999
National Academy of Engineering, 2001- present
Presidential Award, California Water Environment Association (CWEA), 2001
Arden-Lockett Award, IWA, 2001
AEESP/WEF Distinguished Lecturer, 2007
Distinguished Visiting Professor, University of Newcastle, England 2009 - present
Global Water Award, IWA, 2010
Frederick Pohland Medal, AEESP/American Academy of Environmental Engineers, 2010

Professional Service

Member, Joint Editorial Board, 15th and 16th editions of *Standard Methods for the Examination of Water and Wastewater,* 1974 - 1981
Member, California Water Resources Control Board, Operator Certification and Advisory Board, 1980-1997
Director, AEESP, 1972-1975 and 1983-1986
Member, Governing Board, IWA, 1990 -1992
Member, Program Committee, IWA, 1987-1992
Chair, Specialist Group on Nutrient Removal, IWA, 1980 -1990
Member, Research Council, Water Environment Research Foundation, 1989 -1991, 2009 - present
Director, Board of Control, WEF, 1989-1992
Chair, USA National Committee to IWA, 1990-1992
Member, Editorial Board, Water Environment Research, 1992-1997
Member, Editorial Board, Water Quality 21, 1997- present

Research and Professional Practice

Wastewater and Solids Treatment Processes and Operation
Wastewater Treatment Microbiology
Mechanism and Control of Activated Sludge Bulking and Foaming
Chemical and Biological Removal of Nitrogen and Phosphorus from Wastewater
Water and Wastewater Chemistry

David Jenkins

List of Publications

1. Isaac, P.C.G. and **Jenkins, D.** (1958) "Biological Oxidation of Sugar-Based Detergents". **Chem and Ind**,, 976.

2. **Jenkins, D** and Isaac, P.C.G. (1959) "A Laboratory Investigation of the Breakdown of Some of the Newer Synthetic Detergents in Sewage Treatment". **J. Inst. Sew. Purif.,** 48.

3. **Jenkins, D.** (1960) "*A Laboratory Investigation of the Biological Breakdown of Some of the Newer Synthetic Detergents in Sewage" **Ph.D. Dissertation.*** Faculty of Applied Science University of Durham, Kings College, Newcastle-upon-Tyne, England.

4. **Jenkins, D.** (1960) "The Use of Manometric Methods in the Study of Sewage and Trade Wastes" in "*Waste Treatment*", Ed., Isaac, P.C.G., Pergamon Press, Oxford, England.

5. Klein, S.A., **Jenkins, D.** and McGauhey, P.H. (1961) "*Travel of Synthetic Detergents with Percolating Waters". First Ann. Rept,* Sanit. Eng. Res. Lab. Univ. of Calif., Berkeley, CA.

6. Klein, S.A., **Jenkins, D.** and McGauhey, P.H. (1962) "*Travel of Synthetic Detergents with Percolating Waters". Second Ann. Rept,* Sanit. Eng. Res. Lab., Univ. of Calif., Berkeley, CA.

7. **Jenkins, D.** (1962) "An Improved Volatile Suspended Solids Method". **Water and Waste Treat. J**., **9,** 66.

8. Klein, S.A., **Jenkins, D.** and McGauhey, P.H. (1963) "The Fate of ABS in Soils and Plants". **J. Water Pollut. Control Fedn, 35**, 63.

9. Isaac, P.C.G. and **Jenkins, D.** (1963) "Biological Oxidation of Some of the Newer Synthetic Detergents". **Adv. Biol. Waste Treatment,** Pergamon Press, 61.

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11. McGauhey, P.H. and **Jenkins D,** (1964) "*Application of Foam Fractionation to Sewage Treatment, II: Foam Fractionation of Sewage and Sewage Effluents".* Rept 64-10, Sanit. Eng. Res. Lab., Univ. of Calif., Berkeley, CA.

12. Medsker, L.L. and **Jenkins, D.** (1964) "A Brucine Method for Determination of Nitrate in Ocean, Estuarine and Fresh Waters". **Anal. Chem., 36,** 610.

13. Cripps, J. and **Jenkins, D.** (1964) 'A COD Method Suitable for the Analysis of Highly Saline Waters". **Intl J. Air Water Polln, 36,** 1240.

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15. Pipes, W.O. and **Jenkins, D.** (1965) "*Zoophagus* in Activated Sludge - A Second Observation". **Intl J. Air Water Polln,** 495.

16. **Jenkins, D.** and McGauhey, P.H. (1965) "*Broad Characterization of the Improvement of Sewage Effluents by Foam Separation"*. Report 65-5, Sanit. Eng. Res. Lab., Univ. of Calif., Berkeley, CA.

17. **Jenkins, D.,** Selleck, R.E. and Pearson, E.A. (1965) "*A Comprehensive Study of San Francisco Bay, I: Physical, Chemical and Microbiological Sampling and Analytical Methods".,* Report 65-7, Sanit. Eng. Res. Lab., Univ. of Calif., Berkeley, CA.

18. **Jenkins, D. (**1965) "*A Study of the Sources of Phosphorus in the Sewage of a Small Residential Community"*. Report 65-6, Sanit. Eng. Res. Lab., Univ. of Calif., Berkeley, CA.

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20. **Jenkins, D.,** (1967) "Analysis of Estuarine Waters". **J. Water Polln Control Fedn, 39,** 159.

21. Medsker, L.L., **Jenkins, D.** and Thomas, J.F. (1967) "Odorous Compounds in Natural Waters: Some Sulfur Compounds Associated with Blue-Green Algae". **Environ. Sci. Technol., 1,** 731.

22. **Jenkins, D** and Menar, A.B. (1967) "*The Fate of Phosphorus in Sewage Treatment Processes I: Primary Sedimentation and Activated Sludge"*. Report 67-6, Sanit. Eng. Res. Lab., Univ. of Calif., Berkeley, CA.

23. **Jenkins, D.** (1967) "*Sanitary Engineering Education in the Graduate Program Engineering at the Central University of Venezuela with Special Reference to Sanitary Chemistry and Research"* Pan Amer. Hlth Org., Washington, DC.

24. Eckhoff, D.W. and **Jenkins, D.** (1967) "*Activated Sludge Systems - Kinetics of the Steady and Transient States"*. Report 67-12, Sanit. Eng. Res. Lab., Univ. of Calif., Berkeley, CA.

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44. Orhon, D. and **Jenkins, D.** (1973) "The Mechanism and Design of the Contact Stabilization Activated Sludge Process". **Adv. Water Pollut. Res.,** 353.

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47. Gujer, W. and **Jenkins, D.** (1974) "*The Contact Stabilization Process-Oxygen and Nitrogen Mass Balances".* Rept No. 74-2, Sanit. Eng. Res. Lab. Univ. of Calif., Berkeley, CA.

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54. Lefingwell, J.T., Spear, R.C. and **Jenkins, D,** (1975) "The Persistence of Ethion and Zolone Residues on Grape Foliage in the Central Valley of California". **Arch. Environ. Contam. Toxicol., 3,** 40.

55. Klein, S.A., **Jenkins, D.** and Cooper, R.C. (1975) "The Toxicity to Fish of the Jet Fuel JP-9, its Components RJ-4, RJ-5 and Methylcyclohexane". **Proc. 6th Ann. Conf. Environ. Toxicol.,** USAF, Wright-Patterson AFB, Dayton, OH, 143.

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61. Orhon, D., Weddle, C.E. and **Jenkins, D.** (1976) "A New look at the Activated Sludge Process". **Prog. Water Technol., 7.** 143.

62. **Jenkins, D.** (1976) "A Tribute to P.H. McGauhey". **Bull. Calif. Water Pollut. Control Assoc.,**13.

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Exhibit 2

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September 21, 2012

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Subject: Proposed Settlement Agreement and Stipulation for Entry of Order in the matter of Administrative Civil Liability Complaint No. R2-2010-0102

Dear Mr. Wolfe:

The purpose of this letter is to provide details regarding my professional engineering opinions regarding the March 2007 digester cleaning event at the Novato Sanitary District ("NSD") plant. Specifically, my forensic analysis allowed me to form professional engineering opinions concerning the causes of plant impacts occasioned by secondary digester cleaning as well as the likelihood of a possible exceedance of the effluent suspended solids NPDES permit limits during the period of March 17-19, 2007 (as listed in the referenced Proposed Settlement Agreement, item 4.c).

Background

I was retained by the NSD Board of Directors in November 2009 to provide expert consulting and forensic analysis and opinions in connection with the federal investigation of NSD's wastewater treatment operations.

My resume showing my education, experience, publications and awards is attached to this letter. Briefly, I have three degrees from the University of California, Berkeley, with my undergraduate degree focusing on civil engineering, and my graduate degrees focusing on environmental engineering. I am a nationally recognized process engineer experienced in wastewater treatment planning, process design and optimization, and in recognition of this, have won eight national awards. In 2004, I was elected to the National Academy of Engineering, one of our nation's three prestigious national academies. I have worked in plants both small and large (2 to 350 million gallons per day), with technologies ranging from primary treatment, to secondary treatment, and on to advanced wastewater treatment. I am currently the Director of Technology and an officer of the firm of Brown and Caldwell.

Approach

I worked with the law firm of Barg Coffin Lewis & Trapp, LLP (”Barg Coffin”) during my engagement. I reported to the NSD Board of Directors on the progress of our work as a team with Barg Coffin. In the course of our work, we completed the following tasks:

- Reviewed critical documents (plans, operational records, operator's logs, lab reports, etc.); this was a joint task with Barg Coffin;
- Interviewed NSD employees and NSD's design consultant; this was a joint task with Barg Coffin;
- Assessed the impacts of digester cleaning on plant operations and performance, and actions taken by NSD managers and staff to address the impacts of the digester cleaning operations. This was my separate forensic investigation. Based upon this assessment, I formulated my professional engineering opinions about the causes of the impacts to the plant.
- Assessed the impacts of digester cleaning on plant effluent quality based on all available information and formation of a professional engineering opinion about the impacts on effluent quality. This was my separate investigation.
- Attended settlement meetings, first with the Department of Justice and the U.S. Environmental Protection Agency, and subsequently with the RWQCB and SWRCB staff and supervisors; this was a joint task with Barg Coffin. During the meetings I attended, my conclusions were orally conveyed and supported by data, assessments, and graphical depictions (PowerPoint slides).
- Assisted NSD in documenting the results of my investigation in writing. These results were previously presented orally with the aid of PowerPoint slides to RWQCB and SWRCB staff.

Findings

Background. The cleaning of the secondary anaerobic digester at the Novato Treatment Plant site was occasioned by the need to demolish the unit to prepare the way for construction of a new primary digester. The new digester (in combination with an existing operating primary digester that would be retained) was required to stabilize the solids that would result from consolidation of all treatment plant functions from two sites to a new plant to be located at the Novato Treatment Plant site. This was one of two projects (the other being site preloading) that were undertaken by NSD in advance of the main plant construction contract.

Methods employed for digester cleaning. At the time of cleaning, the secondary digester had not been in service for years and was filled with consolidated and biologically inactive materials. As opposed to most digester cleaning operations, where the contents are actively digesting, the removal of this inactive material was seen as primarily a materials processing issue, although the methods employed were adapted from those that had been used in the wastewater industry for cleaning digesters containing actively digesting solids. A specification was written for the removal and the contract was let to an experienced digester cleaning firm, Wastewater Solids Management ("WWSM"), in March 2007.

In addition to reviewing the specification for digester cleaning, I interviewed NSD staff (operators and collections crew members) who observed the cleaning operation and I relied on their descriptions of the contractor's cleaning operations. Figures 1 and 2 illustrate the methods WWSM used.

WWSM pumped secondary effluent (wastewater that has been treated and disinfected) from the chlorine contact basin and used this water source to fluidize the solids in the digester and move them to the suction of another pump located within the digester (Figure 1). Once pumped from the digester, the solids were passed through a ¾ inch screen, where screenings were removed and placed in a screenings dumpster (Figure 2). Records show that 16 dumpsters were taken to a landfill, although there may have been more loads, as the contract conditions of the garbage hauler were that NSD was not charged for dumpster hauling or disposal, so additional loads may not have been recorded.

The screened fluid was then sent to the plant headworks (preliminary treatment units at the "head" of the plant that receive raw wastewater). I analyzed the plant influent data, which included the impact of the screened fluid (i.e., the plant influent data described the flow and constituents of the combined wastewater and the screened fluid.) My analysis shows that during the period of digester cleaning, the influent Total Suspended Solids (TSS, the amount of solids suspended in the wastewater) increased, but the organic loading, as measured by Biochemical Oxygen Demand (BOD, a measure of the oxygen demand exerted by biologically active constituents) essentially remained in the same range of normal influent plant loadings. This can be seen from Figure 3, by comparing data before and after the cleaning operations. This indicates very little organic content returned during the cleaning operation, indicating that the secondary digester contents after long term storage were inactive, or virtually inert. Thus, they would not have imposed an additional organic loading on either the anaerobic digestion or the activated sludge process (a wastewater treatment process that removes and/or reduces soluble wastewater constituents).

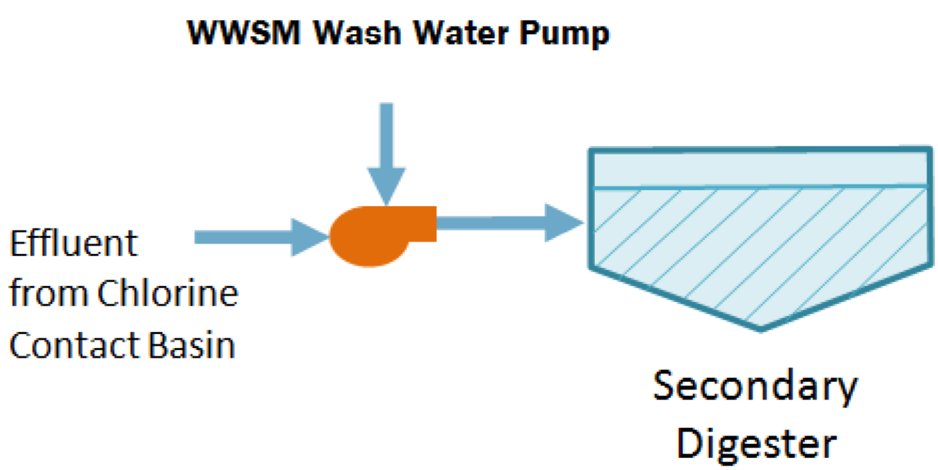

Figure 1. Secondary Effluent Was Used to Fluidize the Contents of the Secondary Digester

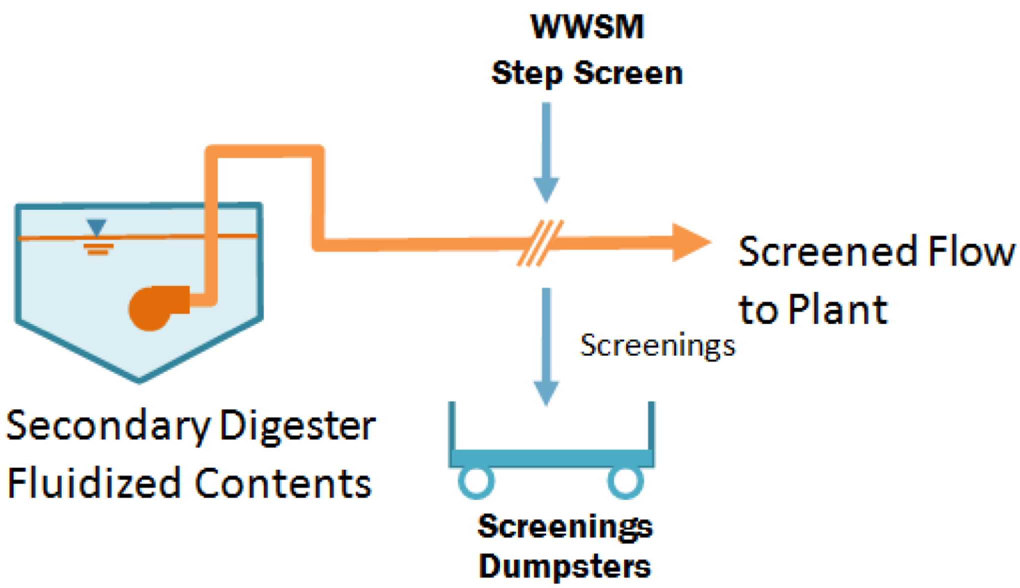

Figure 2. Digester Contents Were Pumped to a Screen and Screenings Deposited in a Dumpster

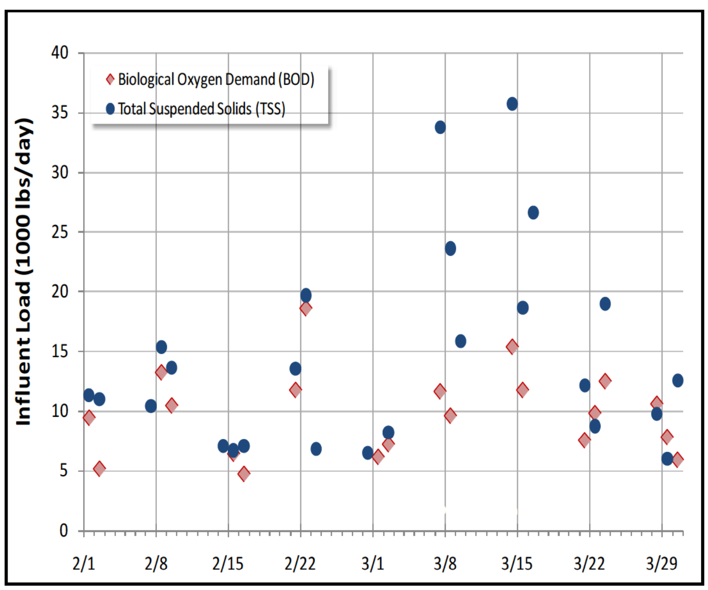

Figure 3. Influence of Digester Cleaning on Plant Influent Loadings

To assess whether the digester cleaning method adopted represented a proper standard of care, I consulted the current design and operations Manuals of Practice (MOPs) available from the wastewater industry professional association, the Water Environment Federation (WEF). Surprisingly, none of the WEF MOPs described digester cleaning methods, although they included materials on safe digester entry, tools that should be available and the like. In any case, using just the MOPs, no plant manager or plant engineer could design and specify a standard digester cleaning method. Visits to multiple websites for digester cleaning contractors failed to show a single description of digester cleaning methods, apparently to prevent any proprietary methods from being used by competitors. Instead the websites conveyed only advertising (i.e., touted each firm's digester cleaning prowess).

To determine if there was anything unusual in the methods chosen to clean the secondary digester at NSD, Brown and Caldwell conducted a survey of other California treatment plants of the same general size as the NSD plant and that had performed digester cleaning recently (Table 1). Coincidentally, three of the plants in Table 1 had used the same contractor as NSD. All of the plants but one had returned the screened digester fluid to the headworks, and the plant that did not used an on-site sludge lagoon (a containment that allows the digestion process to continue, albeit at a slower rate) for the material. However, another plant that also had an on-site sludge lagoon did not send the fluids to the lagoon, but to its headworks.

Table 1. Survey of Digester Cleaning Methods

Description	Agency	Plant A	Plant B	Plant C	Plant D	Novato Sanitary District
	Capacity	2 mgd	10 mgd	12 mgd	12 mgd	5 mgd
Retained contractor		WWSM	WWSM	NADC Presidio Systems	WWSM	WWSM
Screened digester contents		✓	✓	✓	✓	✓
Fluid returned to headworks			✓	✓	✓	✓
Dewatered fluid following screening			✓	✓		
Fluid sent to sludge lagoons		✓				
On-site sludge lagoons		✓			✓	

Finally, Brown and Caldwell evaluated the cost of alternative digester cleaning methods and determined that the cost differences in methods were so low that they would not have been a driver in the method chosen by NSD for digester cleaning. We confirmed the overall philosophy of decision-making of the NSD staff and Board by interviewing NSD's design consultant and finding that in no case were cost-driven short cuts taken during the entire project. NSD's prior experience with its plants made it seek long term value for its expenditures, rather than seeking the lowest possible initial project cost. In my own review of the new plant design concepts, I also found this to be the case. Illustrating these points, Figure 4 compares the digester cleaning methods and costs relative to the recorded treatment plant construction costs.

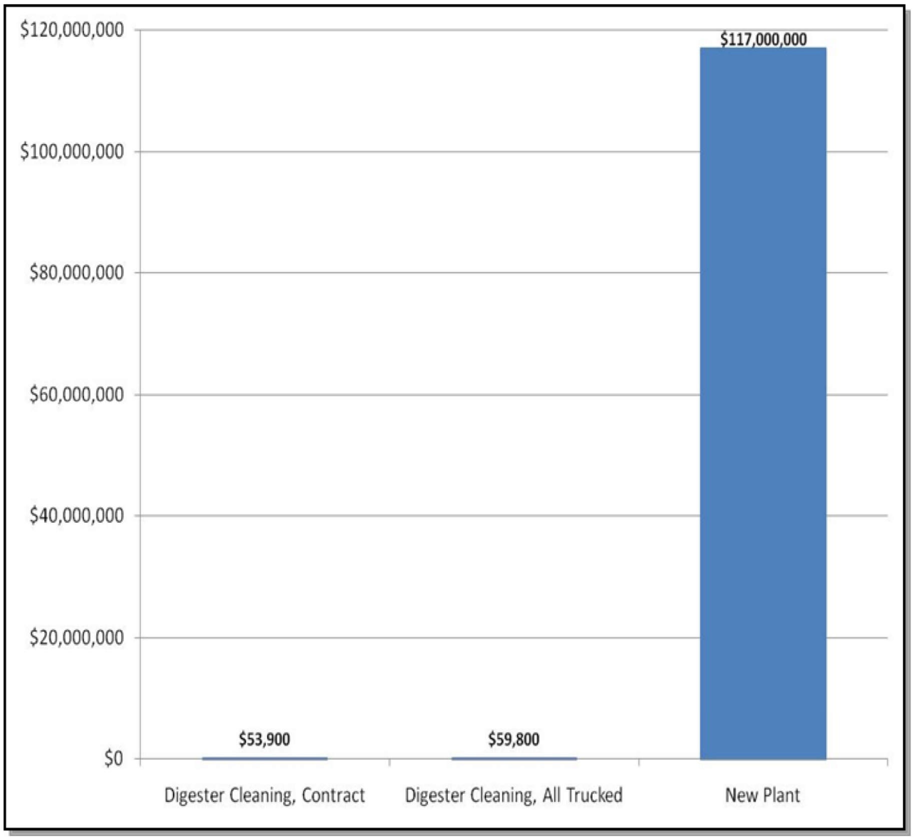

Figure 4. Comparison of Alternative Digester Cleaning Methods Costs to New Plant Costs

My conclusion is that each cleaning method used by the plants in our survey was tailored to the individual plant situation. Further, there was nothing improper in the method selected and specified for digester cleaning as written in the NSD specification governing WWSM's activities. The method selection was based on best engineering judgment at the time.

Unanticipated impacts of digester cleaning on plant operations. My forensic analysis has revealed that the digester cleaning operation caused an unanticipated impact on plant operations. Rather than a direct biological impact on the secondary process causing a disruption to normal plant operations (e.g., very high BOD or toxic materials), instead a unique physical problem manifested in the operating primary digester that subsequently led to other physical problems and subsequent secondary process impacts.

The primary digester is a fixed cover digester where the contents are hidden and not readily observable by plant operators (e.g., in contrast to the more exposed tanks of the activated sludge process then in operation at the NSD plant). Figure 5 shows the digester features. Shown on either side of the digester are external pumped recirculation systems (pumps are not shown) which mix the contents of the digester.

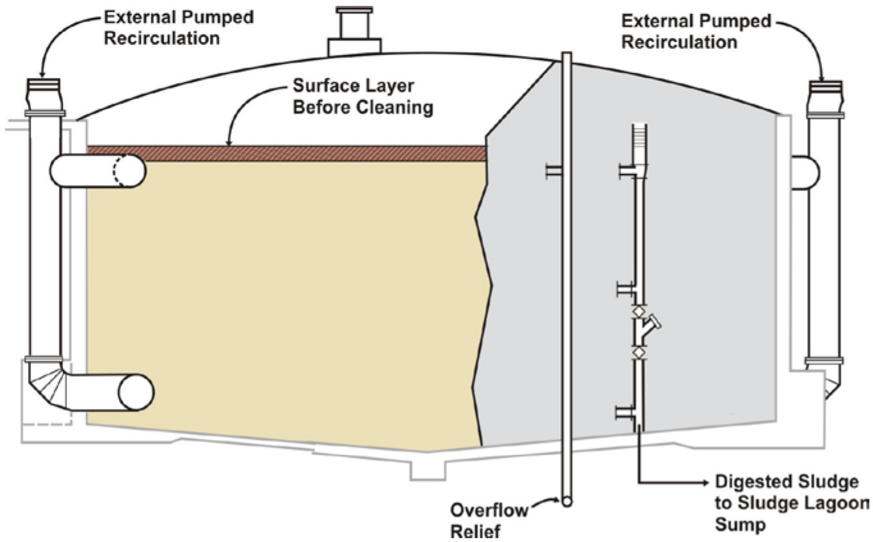

Figure 5. Primary Digester Features at NSD When Functioning Properly Showing a Cut-out View on the Left of Digester Contents and the Tank Wall on the Right

The normal operation is to feed thickened sludge (raw solids and waste activated sludge solids) by pumping them into the digester, thereby displacing digested solids out of the upper overflow shown (the two other overflow points can also be used). This digested sludge then flows by gravity to the sludge lagoon sump where the sludge is pumped by force main (a pressure pipeline used to convey process fluids under pressure) to offsite sludge lagoons. Also shown is an overflow relief line designed to prevent a structural failure of the fixed digester cover roof should the main overflow line become clogged.

Figure 5 also shows a thin layer of floating solids and debris on the digester liquid surface. While such layers are not uncommon in digesters, several aspects of the one in NSD's plant were quite uncommon in retrospect. (Again, as this is a fixed cover digester, the extent of the layer was not apparent to the operators.) The older plant then in service lacked a screening facility at its headworks. Instead, rags present in the influent were ground up and returned to the wastewater flow. This material would be removed in the primary clarifier (the process unit used to remove readily settleable solids from the wastewater, sometimes called a settling tank or basin) and sent to the digester. The rag residues, being lighter than the other solids, accumulated with other floating material at the surface. Because the extent of this long term accumulation of rag residues was not apparent, there was no way for NSD to anticipate the type of plant impacts that would be caused when the material was dislodged during digester cleaning. This long-term rag accumulation was the unique aspect at NSD's facility that caused the unanticipated impacts.

The impact of secondary digester cleaning was to increase the solids added to the digester (these additional solids were removed in the primary clarifier and wasted from the activated sludge step and then pre-thickened to increase the concentration and reduce the volume of the solids). While this additional solids load was anticipated, the mobilization of rags caused by the surface layer expansion was not. The additional solids from the digester cleaning carried additional floating materials into the primary digester which caused the layer of floating solids to expand such that it now penetrated down into the zone of the digester overflow (as shown in Figure 6), as well as the influent zone of the pumped recirculation systems.

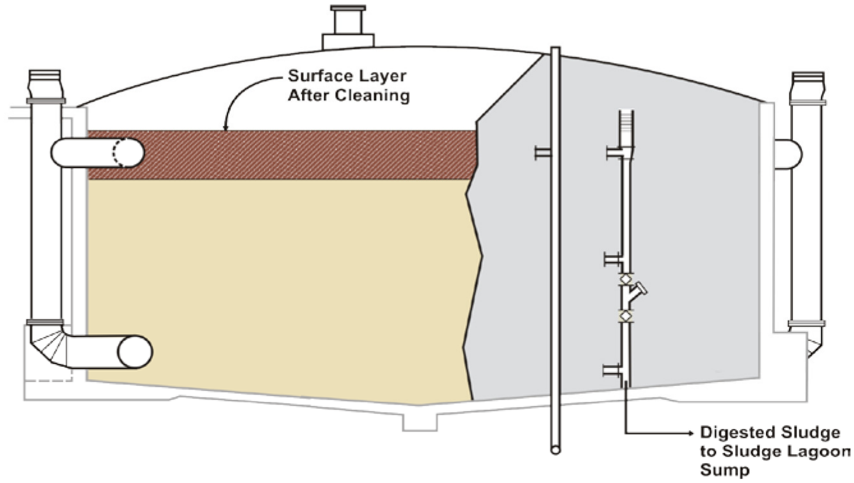

Figure 6. Expansion of Floating Surface Layer during Digester Cleaning

With the expansion of this surface layer, rag residues that were in the surface layer were conveyed into the recirculation pumps. The recirculation pumps clogged repeatedly; this required heightened maintenance activities. Rag residues were also carried into the digester overflow (Figure 7). This flow of the digested sludge to the sludge lagoon sump contained the rag residue and caused frequent ragging up of the sludge pumps with consequential failure, which sent digested solids back to the headworks for periods of time until repairs were effected. The additional rag residues then passed through the liquid process, sometimes overloading primary sedimentation and thickener mechanisms (similar to overloading a food mixer with heavy dough), and causing equipment failures. Plant operations and maintenance staff spent considerable additional time clearing rag-related equipment failures during the period of digester cleaning.

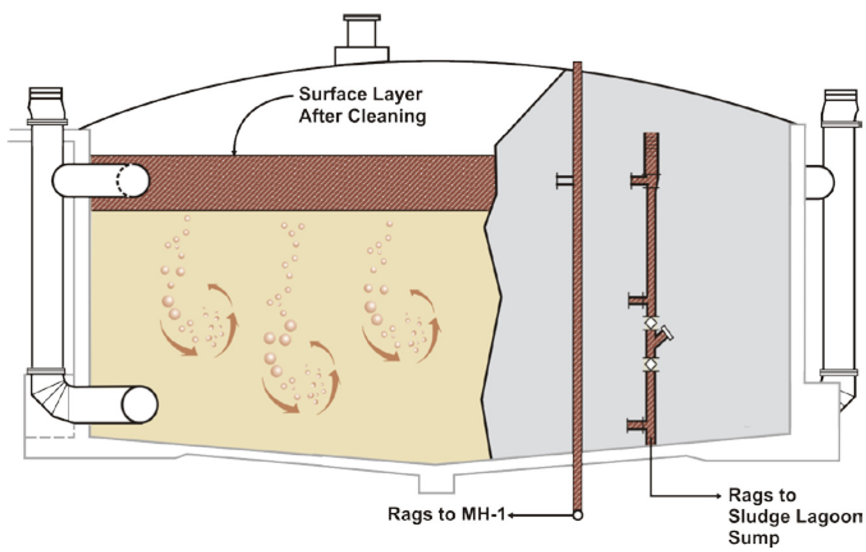

Figure 7. Conveyance of Rag Residues from the Digester
after Expansion of the Surface Layer

On the weekend of March 17-18, a digester overflow occurred through the emergency overflow line that carried digested sludge via the pavement over to Manhole 1 on the plant site (which drains to the headworks). Collections staff were called and reported that the flow did not go over the berm between the digester and the chlorine contact basin, and the responsible staff member interviewed said that this material was safely washed down to Manhole 1 for transmission to the headworks (and reprocessing through the plant).

Another impact of the recycle of solids and rag residues to the headworks was foaming on the activated sludge aeration tanks on the weekend of March 17-18. Operator logs reported that this foam overflowed the tank onto the ground adjacent to the basins. Again, Collections staff was called out to clean up the area and reported that none of this material left the site, but was instead all washed down to drain (again to the plant headworks).

Figure 8 presents a photo taken by a plant operator (Jim Lynch) which shows floating solids on the surface of the Chlorine Contact Basin (CCB). Assuming that the photo was taken on the weekend as asserted by Mr. Lynch, this is evidence that some of the foam on the aeration tank was passed through to the secondary clarifier where it appeared in the clarifier effluent. This flow then passed through the Biotower (used for nitrification) and on to the CCB. Entry to the quiescent conditions of the CCB caused foam to form on the surface of the CCB.

It should be noted that the photo is of the surface of the CCB and not the plant effluent. Floating solids on the surface of the CCB are not readily conveyed to the Effluent Storage Pond (ESP) because the flow from the CDB to the ESP is subsurface. This is illustrated in Figure 9 where the pipes can be seen in the empty basin relative to the water surface level (staining on concrete).

Confirming the lack of transport of floating solids to the effluent, Jim Lynch's photos of the ESP purportedly taken at the same date and time (for instance Figure 10) show that within the forebay of the diesel-powered effluent pumps, there were essentially no floating solids on the water surface.

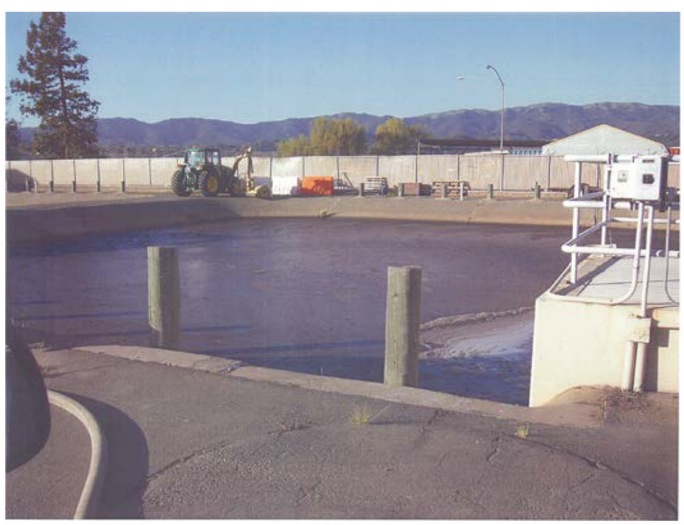

Figure 8. Floating Solids on Surface of Chlorine Contact Basin

Figure 9. Water Line Stain Shows Flow from CCB is Subsurface as is the Pump Withdrawal for Bay Discharge from the ESP behind

Figure 10. Floating Solids Were Absent from the Forebay of the Diesel Driven Discharge Pumps

NSD employees and outside contractors responded to the operating problems occasioned by the cleaning of the secondary digester in order to return the plant to normal operations and prevent effluent violations. These included:

- Stopping digester cleaning operations
- Increasing the chlorine dosage to the CCB
- Cleaning up spills and containing them on site
- Hauling and pumping solids from the plant site
- Providing temporary solids storage in a rental tank
- Treating secondary effluent in an effluent filter normally used only during wet weather events
- Repairing and cleaning impacted process equipment
- Ultimately diverting plant effluent away from San Pablo Bay as the discharge point by pumping effluent to an off site reclamation storage pond

My conclusion is that the unique situation facing NSD in attempting to clean an out-of-service secondary digester led to unanticipated plant impacts. The causes of the impacts on the plant by the methods used by NSD and its contractor were initially quite puzzling to me, even after multiple staff interviews and a complete review of the operating records and available data. It was only after several weeks of my forensic investigation that the primary digester physical problems occurred to me as the initiator of all the observed plant impacts. This was a conclusion drawn after all the facts were available to me and the speed of determination was accelerated by my advanced training and experience.

It is my judgment that no plant manager or plant engineer could have anticipated these impacts in advance or, moreover, drawn these conclusions "on the fly" as the problems began to manifest so as to focus all remedial efforts in precisely the right areas for the most immediate gains. After the fact, with hindsight and with all the information now available, a digester cleaning procedure without the same impacts could be designed, but that was not an alternative obvious or available to NSD at the start of its digester cleaning project.

Measured Impacts on Effluent Quality of Digester Cleaning Incident

This section reviews available plant effluent data coincident with the digester cleaning. NSD's standard practices were to monitor their effluent on a fixed schedule and to not depart from that schedule. As a result, there were no measures taken of plant effluent suspended solids or BOD or pathogens on the weekend of March 17-18; however, measurements were taken as scheduled on the weekdays before the digester cleaning, and on the scheduled weekdays following the weekend during plant remedial actions. Significantly, there was a scheduled chronic bioassay sampling/analysis (a sample and analysis required to demonstrate the absence of toxic constituents in the treated effluent) that was completed without interruption and did, in fact, span the weekend in question. This particular test is the most sensitive test the RWQCB required of NSD as it attempts to indicate the subtle biological impacts in the receiving water of the effluent.

TSS samples taken during digester cleaning and during subsequent NSD response to plant impacts are shown in Table 2. These values were compliant with discharge requirements.

Bacterial sampling of the effluent (Table 3 and 4) showed one violation after the discharge point had changed from the Bay to the off site reclamation ponds.

The acute toxicity testing use flow through bioassays using the Fathead minnow for the period of March 12-16 during digester cleaning showed 100 percent survival and was compliant with permit requirements.

Chronic toxicity testing, the most sensitive test applied to the NSD effluent, used Ceriodapnia dubia (water flea). As noted this testing included the digester cleaning period and extended through the weekend of March 17-18. Table 5 shows the results.

Table 2. Measured TSS Values on Days Monitored during Digester Cleaning and Response to Plant Impacts				
Date in 2007	TSS Discharge			TSS Permit Limit
	mg/l	kg/d	Weekly Avg. (mg/l)	Weekly Avg. (mg/l)
Wed., Mar. 14	20.0	312.0	43.6	45.0
Thurs., Mar. 15	46.7	770.0		
Fri., Mar. 16	64.0	975.0		
Wed., Mar. 21	55.0	807.0	33.6	45.0
Thurs., Mar. 22	19.5	277.0		
Fri., Mar. 23	26.4	416.0		

Table 3. Bacterial Sampling during Discharge to the Bay		
Date in 2007	Enterococcus Result	Enterococcus Permit Limit
Mon., Mar. 12	4.1	<276MPN/100mL
Tues., Mar. 13	5.2	<276MPN/100mL
Thurs., Mar. 15	5.2	<276MPN/100mL

Table 4. Bacterial Sampling during Discharge to the Reclamation Ponds		
Date in 2007	Coliform Result	Coliform Permit Limit
Wed., Mar. 21	9,200	<10,000 MPN/100mL
Thurs., Mar. 22	54,000	<10,000 MPN/100mL
Fri., Mar. 23	3,500	<10,000 MPN/100mL

The chronic toxicity data for March 2007 is identical to other adjacent data obtained at the plant when there was no digester cleaning, indicating no impact of digester cleaning on effluent quality.

Table 5. Ceriodaphnia dubia Chronic Toxicity Data		
Date	Toxic Units	
	Survival	Reproduction
2000 Jan.	2	2
2000 Feb.	2	2
2000 Mar.	4	4.1
2000 Apr.	2	2
2000 May	2	2
2000 Nov.	1	1
2002 Mar.	1	1
2002 Dec.	1	1
2003 May	1	1
2003 Nov.	<1	1.2
2003 Dec.	<1	<1
2004 Jan.	<1	<1
2004 Mar.	1	1
2004 Dec.	1	1
2005 Dec.	1	1
2006 Nov.	3.2	2.5
2007 Jan.	<1	<1
2007 Feb.	<1	<1
2007 Mar.	<1	<1
2007 Apr.	<1	<1
2008 Apr.	<1	<1
2009 Jan.	<1	<1
2009 May	<1	<1
2009 Dec.	<1	<1

It is my conclusion that there is no credible evidence as to an effluent suspended solids violation during the period of March 16-18. Further, NSD did not preferentially sample its effluent, continuing instead on its regular schedule. That schedule included chronic toxicity testing during the critical period of interest using the most sensitive test that the RWQCB required of this agency, and this test detected no problem with the effluent.

Evaluation of Lynch Observations and Claims

I have been provided and reviewed the letter from Mr. Jim Lynch, dated June 21, 2012, concerning the proposed Settlement Agreement and Stipulation. Based on my forensic investigation, I do not find Mr. Lynch's claims that there was a proven effluent violation to be credible. Specifically, in response to his observations and claims:

- Our investigation did include staff interviews, including an interview with Mr. Lynch.
- There was no evidence of intentional dumping of digester solids to the Bay. As noted previously, we interviewed a staff member who was on site at the digester in question who verified that this did not occur. A digester overflow did occur, but this was completely contained on the site, did not enter the Chlorine Contact Basin and was washed down to the plant headworks.
- There was an alarm for a malfunction of the dechlorination station, but NSD records show that a staff member was sent out to remedy the problem.
- The plant was not "disabled" for days, although it was demonstrably impacted by the digester cleaning project. It could not have achieved the effluent quality it did obtain if it were "disabled" for days.
- As noted previously in my forensic evaluation, the photos of the surface of the "effluent ponds" are not proof of a suspended solids discharge. Subsequent to my investigation, NSD staff provided me photos of the basins in question where floating solids had accumulated but effluent suspended solids measured on the date of the photos were well within permit limits. This speaks directly to the lack of value of the original photos of the surface of these basins of proving anything with respect to effluent suspended solids concentrations discharged to the Bay.

I appreciate the opportunity to provide this additional information in support of the proposed Settlement Agreement and Stipulation.

Very truly yours,

BROWN AND CALDWELL

Denny S. Parker, Ph.D., P.E., NAE
Director of Technology, Senior Vice President
Walnut Creek
California License No. C 24965

DP:ma

Attachment A: Denny Parker Resume

Limitations:
This document was prepared solely for the Novato Sanitary District in accordance with professional standards at the time the services were performed and in accordance with the contract between the Novato Sanitary District and Brown and Caldwell dated May 23, 2011. This document is governed by the specific scope of work authorized by the Novato Sanitary District; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work.

Experience Summary

Dr. Denny Parker has developed and implemented new wastewater processes and modifications and regularly serves as process design reviewer for major wastewater and reclaimed water projects. Dr. Parker has lectured at EPA technology transfer sessions across the U.S. on the subjects of nitrogen removal, innovative and alternative technologies, and oxidation pond upgrading. He has played significant roles in wastewater master planning and facilities planning projects for major communities and metropolitan areas. He is the inventor, co-inventor of four widely used treatment processes: the Trickling Filter/Solids Contact process, the flocculator-clarifier, the Classifying Selector, and the BAR process for bioaugmentation of nitrification in the activated sludge process. Dr. Parker has won seven national awards for his process engineering work, including election to the National Academy of Engineering in 2004.

Assignment

Education

Ph.D., Engineering, University of California, Berkeley, 1970

M.S., Environmental Engineering, University of California, Berkeley, 1966

B.S., Civil Engineering, University of California, Berkeley, 1965

Registration

Registered Professional Engineer (Civil) 24965, California, 1975

Registered Professional Engineer (Civil) 20319, Kentucky, 1998

Registered Professional Engineer (Civil) 38461, Maryland, 2010

Experience

40 years

Joined Firm

1970

Relevant Expertise

- *Facilities planning*
- *Process engineering and process development*
- *Innovative wastewater treatment technologies*
- *Secondary clarifier design and upgrading*
- *Lagoon upgrading*
- *Development of trickling filter/solids contact process*
- *Invention of the biological contact process for wet weather treatment*
- *Suspended growth and attached growth nitrification and denitrification systems*

Wastewater Planning and Design

Owner's Rep, Apra Harbor Wastewater Treatment Plant Repairs and Upgrade, United States Navy, Guam

Senior Reviewer. BC served as the Owner's Representative for a DB contract to upgrade the Apra Harbor Wastewater Treatment Plant. Denny reviewed and commented on the condition of the media removed for the trickling filter (examined photos), the process design calculation assumptions for the TF/SC process, ventilation requirements, and proposals for distributor speed control. He also answered questions and reviewed aspects of the DB proposals, and produced reports and technical memorandum.

WWTP Master Plan, Napa Sanitation District, Napa, California

Process Engineering Reviewer. Dr. Parker is reviewing the evaluation of treatment process capacity requirements and process alternative development for this master planning effort. This project involves developing a comprehensive master plan and capacity analysis for the District's WWTP. The existing plant includes both activated sludge and oxidation pond systems operating in parallel, with complete biosolids treatment. The plant currently produces recycled water and also discharges to the Napa River during the wet season. The team reviewed existing facilities and evaluated capital improvements needed for growth and adherence to more stringent regulations anticipated in the future. A comprehensive assessment of existing capacity was followed by alternatives development, with a business case evaluation used to compare alternatives. The duration of the $1.5 million project will be 18 months, with completion scheduled for late 2010.

DCWASA Design of Enhanced Nitrogen Removal Facilities at Blue Plains

Lead Process Technologist. Dr. Parker leads selection and application of core project technology solutions for an increase in nitrogen removal capability to reduce the current effluent TN from to 6 to 3 mg/L TN on annual average basis. This design project for the 350 mgd plant serving our national capital considered multiple technologies, finally selecting extending the current separate stage nitrification/denitrification activated sludge system with additional denitrification and post aeration tanks. He led the efforts to ensure that saturated conditions produced by denitrification conditions did not lead to flotation in the final sedimentation tanks. Dr. Parker also provided overall review of the process design for enhanced nitrification and denitrification including a new waste carbon storage facility as well as expansion in the methanol facility and conversion of an existing denitrification stage to a nitrification stage.

WWTP Master Plan, City of San Jose, California

Secondary Treatment/Advanced Treatment Process Lead. Dr. Parker led the evaluation of treatment process capacity requirements, and process alternative development for this current master planning effort. The Carollo/Brown and Caldwell Team is developing a Plant Master Plan that fully integrates technical, regulatory, and financial solutions with a "green," whole-systems approach that maximizes community benefits and provides a state-of-the-art wastewater treatment system. Effluent requirements considered include providing for current requirements (complete nitrification) plus extensions nitrogen removal to TN levels of 8 and 3 mg/L annually. Liquid treatment alternatives evaluated include conventional activated sludge with anoxic selectors, step feed BNR, membrane bioreactors and effluent polishing with denitrification.

WERF/WEF Study Quantifying Nutrient Removal Technology Performance

Co-Principal Investigator (WERF)/Workshop Chair (WEF). This unique joint effort of the Water Research Foundation and the Water Environment Federation is surveying the best performing nutrient removal plants in the US (22 plants), using both the plant data, design data and operating schemes to identify the LOT (Limit of Technology) for conventionally nutrient removal technologies. LOT has previously loosely been described as meeting a TN of 3.0 mg/L or a TP of 0.1 mg/L without specifying any averaging period. Parker developed the experimental plan, worked with a steering committee that developed the statistical analysis approach and recruited the plant managers and volunteers participating in the investigation. Dr. Parker provided engineering assessment of the results in progress reports and technical papers. Results from the investigation will impact the wastewater industry broadly, in terms of establishing technology rankings, guidance for features or operating schemes that enhance reliability and the appropriate use of performance statistics in permit writing.

Anaerobic Selector Investigation, Santa Rosa, California

Technical Lead. At the Laguna Wastewater Treatment Facility in Santa Rosa, CA, Dr. Parker led the demonstration scale conversion of the anoxic selector to an anaerobic selector to invoke biological phosphorus removal. Principal concerns were: 1) maintaining selector effectiveness in SVI control in the anaerobic mode, 2) controlling floc strength to minimize filter influent turbidity, and 3) preventing premature release of phosphorus in the RAS. A secondary concern was the return of nitrate in the RAS and the extent to which denitrification might deplete the availability of readily degradable organics for inducing the biological phosphorus mechanism required to make the anaerobic selector work successfully. Operating conditions for the trial conditions were defined and a sampling program was developed. Desired SVI, DO, RAS nitrate and phosphorus levels were achieved. Plant staff and Brown and Caldwell analyzed the test data and jointly established conditions that met the several criteria necessary for a success biological phosphorus removal application: good P removal, SVI control and creation of strong floc. The successful trial allowed the plant to confirm that only minimal capital needs would be required if a conversion to nutrient removal is required in the future.

Water Pollution Control Plant Infrastructure Plan, City of Sunnyvale, California

Liquid Treatment Process Engineer. Dr. Parker developed two major alternatives for Sunnyvale's treatment future, one based on upgrading and refurbishing existing facilities, the other based on adoption of new state-of-the-art technologies to replace the existing facilities. Suggested sub-alternatives to consider are 1) repair and rehabilitation, plus debottlenecking the existing processes to enhance performance and flexibility; 2) transitioning to a new "high technology" state-of-the-art facility; 3) transitioning to a conventional state-of-the-art facility; or 4) a combination of some state-of-the-art technologies with upgrades of some of the City's existing facilities. Effluent requirements considered current conditions (ammonia levels seasonally to 5 mg/L) to full nitrification in the future. Alternatives considered include modification of current nitrifying trickling filters for higher efficiency, to conventional activated sludge and membrane bioreactors.

Facility Plan Update, Metro Wastewater Reclamation District (Denver Metropolitan Region), Colorado

Member Expert Peer Review Panel. This facility plant update concerns the phased upgrading of Metro's facilities over a 30 year period to daily maximum total nitrogen TN requirements of 10 mg/L with monthly averages as low as TN of 3 mg/L and total phosphorus (TP) average effluent of 0.03 to 0.1 mg/L The existing

North (now BNR) and South complexes (now high purity oxygen activated sludge) must be reconfigured while staying within effluent requirements and expanding the regional plant from current flows of 160 mgd to predicted flows of 220 mgd (ADWF). Technologies included in the design include a nitrifier bioaugmentation process developed by Dr. Parker (at Appleton, WI) to accelerate nitrification rates and minimize future aeration tank requirements (the BAR process). Dr. Parker influenced the selection of design criteria, such as developing a way for anaerobic selector and classifying selectors to work in the plant in concert with the bioaugmentation scheme, thereby reducing the propensity of the activated sludge process to "bulk" and reducing the required number of secondary clarifiers.

Regional Optimization Master Plan, County of Pima, Arizona

Member Expert Peer Review Panel. This master planning effort is a 30-year treatment plant upgrade project for the Tucson metropolitan area in Arizona. A key issue in the planning effort is the fate of the two regional plants: the Ina Road Plant (37.5-mgd capacity) and the Roger Road Plant (50-mgd capacity). Issues to be addressed include reducing the impact on the dense urban environment through mitigation measures (e.g., odor control), the siting of new treatment facilities to accommodate growth (should it occur at both sites or one, or should facilities be consolidated at one site), planning for nitrogen removal, and co-location of facilities with water reclamation facilities owned by the City of Tucson to optimize and expand urban water use. Plants are required to achieve a high level of nitrogen removal and have capability for future biological phosphorus removal. Dr. Parker played a significant role in identifying appropriate treatment technologies and reviewing planning criteria.

Nitrification and Nitrogen Removal Enhancements, City of Greeley, Colorado

Process Reviewer for Capacity Rating and Enhancements. Faced with anticipated requirements requiring a higher degree of nitrification and denitrification, Dr. Parker participated in the development of field rerating studies and modeling of the plant, where unique characteristics for nitrifier growth rates and the influence of operating dissolved oxygen levels were found. This work has directly impacted the model defaults the firm and the industry uses for model platforms for the activated sludge process (e.g. BioWin). The sophisticated modeling has lead to a design project at the site.

Biological Nutrient Removal (BNR) Initiative, JEA, Jacksonville, Florida

Member Expert Panel. Dr. Parker participated in panel of experts to evaluate process kinetics and determine treatment capacities of JEA's four regional plants. The BNR initiative program has an overall goal of achieving a 50 percent reduction in nitrogen contained in its effluents discharge to the St. Johns River. Modeling and process evaluations were conducted by the firm of each panel member on one of the regional plants, ranging in capacity from 7.5 to 52.5 mgd. The $30 million program that was identified allowed JEA to most effectively meet its nitrogen reduction goal, while saving $60 million over that previously identified in a consultant report. Parker conceptualized the improvement for the Mandarin plant and went on to serve as the process reviewer for BC's design of the plant.

Advanced Waste Treatment Technology Review Committee, New York Department of Environmental Protection, New York City, New York

Chairman and Panel Member. An expert blue ribbon panel was formed in 2004 (to advise on the designs of the upgrading of five of the City's secondary treatment plants to full nitrogen removal. The panel has reviewed the designs and recommended changes to instrumentation and controls to enhance reliability as well as to add process elements that will allow the City to meet its consent degree requirements. This has included changes to aeration systems, alkalinity addition, baffle arrangements, and nuisance foam management.

Nitrogen Technical Advisory Committee, New York Department of Environmental Protection, New York City, New York

Panel Member. An expert blue ribbon panel formed in 1995 met until 2005 to advise on the research program supporting the upgrading of the City's secondary treatment plants to full nitrogen removal. The City has 14 plants processing a total average daily flow of 70 m3/s. The panel recommended process flow sheets that maximized the utilization of existing facilities that are now being pilot or full-scale tested in a $50 million dollar pilot program. Provided ongoing review of pilot program design and results. Results of these studies have saved the City hundreds of millions of dollars. Dr. Parker played a significant role in the development of process tools used for nitrogen loads in centrates, relying on the first stage of the step feed process for nitrification, thereby stabilizing nitrogen removal (this is a process developed by Parker at Appleton, WI, called the BAR process). Methods for nuisance foam management (classifying selector) that Dr. Parker had lead for Brown and Caldwell's plants were pilot tested and now are standard features of the City's new step BNR plants.

Enhanced Nutrient Removal Options, Blue Plains Advanced Water Treatment Plant, District of Columbia Water and Sewer Authority

Member Expert Peer Review Panel. This 350 mgd plant will be required to upgrade its existing nitrification/denitrification facility and reduce its average annual TN discharge from an equivalent of 7.5 mg/L to an equivalent of 4.0 mg/L. Various processes were considered including a base case of expanding the existing system to various options such as using a tertiary polishing denitrifying Moving Bed Biofilm Reactor. Dr. Parker's contributions were related to viewing the system as a whole (such as optimizing existing secondary clarifiers) so as to reduce the cost of the base case and save space. In evaluating the main alternative to the base case, Dr. Parker refined the test plan for the alternative to the base case, such as proposing a new concept termed the biofilm controlled MBBR or BCMBBR, where the two stages of treatment would be alternated to ensure a robust biofilm would always be available in this unusual polishing application. Parker reviewed the experimental work throughout its conduct and participated in commenting and editing the final technical product.

Process Evaluation, Sweden Environmental Protection Agency

Process Consultant. Dr. Parker was a consultant to the Swedish EPA on the conversion of existing plants as well as the use of new installations for nitrogen removal and enhanced nitrification for six municipalities. The largest were Gothenberg (average flow 4.0 m3/s) and Malmö (average flow 1.65 m3/s) plants that are the second and third largest plants in Sweden. He was subsequently engaged to serve as a process consultant by both wastewater agencies. He also provided technology reviews and presented technology transfer seminars to Swedish engineers.

Facility Plan, Lynchburg Regional WWTP, Virginia

Process Design Reviewer. This Chesapeake Bay discharger will be required to progressively upgrade its annual average total nitrogen and total phosphorus levels of 3 mg/l and 0.1 mg/l. After calibrating an activated sludge plant simulator to this existing 22 mgd nutrient removal plant, several upgrading alternatives were evaluated. Most attractive for detailed evaluation were several variants of the Step Feed BNR process, the Bardenpho process and the Integrated Fixed Film Activated Sludge (IFAS) process. Dr. Parker's role was QA/QC, to be sure reasonable assumptions were made and to recommend revisions to the process design when necessary.

Nitrogen Control Manual, U.S. Environmental Protection Agency

Project Manager and Senior Author. Dr. Parker was senior author of EPA's Nitrogen Control Manual (1975 edition). He also consulted to EPA on needed revisions to the manual including organization of the effort as well as a reviewer (1993 edition). The 1975 manual strongly influenced the 1993 product as well as current WEF MOPs as well as academic textbooks such as by Tchbanoglous, et al. ("Metcalf & Eddy").

Secondary Treatment Improvements and Biological Phosphorus Removal, Metropolitan Council Environmental Services, St. Paul, Minnesota

Quality Peer Review Committee Member. Dr. Parker was involved in planning and design services for secondary treatment improvements at the 250-mgd Metropolitan Wastewater Treatment Plant. Brown and Caldwell's assignments include biological phosphorus removal, wintertime nitrification (for process stability) centrifuge dewatering, levee expansion, and side stream treatment. He participated in the development of secondary clarifier modifications encompassing "fixed Towbro" suction sludge removal in rectangular sedimentation tanks that increased their capacity by 50 percent, obviating the need for a plant expansion beyond the battery limits of the plant. Process design reviews of biological phosphorus removal and nitrification elements of the plant.

Blue Lake and Seneca Wastewater Treatment Plant Facilities Planning, MCES, Minneapolis/St. Paul, Minnesota

Project Director, Liquid Stream Planning and Process Reviewer, Detailed Design. This project involved expanding the average flow capability of the Blue Lake Plant from 28 to 47 mgd and the Seneca plant from 25 to 31 mgd. Planning involved condition and capacity assessments, process proving trials for the plants innovative biological phosphorus removal system, hydraulic assessments and ancillary equipment and facility needs. Dr. Parker developed several innovative elements which were included so as to constrain needed new facilities, such as the use of separate return stream nitrification in a side stream tank fed a portion of the return activated sludge so as to accelerate cold weather nitrification kinetics. This bioaugmentation was first developed by Dr. Parker at Appleton, Wisconsin. (BAR process). A significant expansion in wet weather treatment capacity was needed. Rather than a full biological treatment expansion of primaries, aeration tanks and secondary clarifiers, the biological contact process was used. This involves bypassing screened raw wastewater to a separate aeration tank designed for biological treatment and grit removal, and then recombination with the main plant flows prior to secondary clarification. In addition, Parker assisted in the evaluation of the stress test program of innovative anaerobic selector zone mixing using coarse bubble aeration, while preserving biological phosphorus removal in the plant. Parker subsequently served as process reviewer for the detailed design of the Blue Lake liquid process expansion.

Lower Molonglo Water Quality Control Centre, Canberra, Australia

Project Engineer. Startup and commissioning of the state-of-the-art nutrient removal plant designed to remove nitrogen and phosphorus to low levels (TN of 2.0 mg/L and TP of 0.2 mg/L). Serves the national capital of Australia (Canberra).

Process Design of Separate Stage Denitrification, Central Contra Costa Sanitary District (CCCSD) and River Oaks WWTP, Hillsborough County, Florida

Process Developer and Inventor. Dr. Parker developed (US Patent 3,953,327) an anoxic denitrification process followed by an aerated stabilization step to flocculate dispersed solids. Process development occurred at CCCSD's Advanced Treatment Test Facility, a 1-mgd demonstration facility. Employed at River Oaks plant; the plant has demonstrated attainment of effluent containing less than 2.0 mg/l of total nitrogen on a monthly average basis. Attained this goal over a 20-year period at Hillsborough County, FL. In a recent WEF/WERF survey, the plant was found to be one of the two plants nationwide to produce the lowest level of effluent TN.

Biofilm Controlled Nitrifying Trickling Filter (BCNTF), Various Clients

Inventor/Process Engineer/Reviewer. The BCNTF is a nitrifying trickling filter placed downstream from conventional secondary treatment and has demonstrated high nitrification rates and smaller structures than previously used. Pilot tested at Central Valley, Utah and Malmö, Sweden. Dr. Parker was the technical reviewer or process designer for applications at Central Valley, Utah; Fulton County, Georgia; Malmö, Sweden; Boulder, Colorado and Littleton/Englewood, Colorado. Dr. Parker was process consultant for full-scale rerating studies at latter two client sites. He also developed the process model BC uses today for its BCNTF designs.

Development of the Classifying Selector

Co-inventor and Developer. Biological nutrient removal plants often suffer from nuisance foam conditions, causing effluent problems as well as anaerobic foaming. A selector developed in South Africa saw no full-scale trials there, but a beta version was first tested by City of Atlanta staff at the Utoy Creek plant. Nuisance organisms are removed as soon as they are formed through use of continuous flotation in aerated channels. The concept was refined and applied first at the Sacramento Regional WWTP by BC and other plants such as in modified form by BC at Atlanta's Utoy Creek plant, along with MCES's Metro and Blue Lake plants, a Cobb County's South, El Paso's Haskell St. plant, Dublin San Ramon Services plant and in many other of BC's activated sludge designs. Based on published research by BC, a number other design firms have now implemented them as well.

Development of the Biological Contact Process

Inventor and Process Reviewer. The biological contact process borrows inventory from a mainstream activated sludge process, such as a BNR plant, and in a short residence aerated tanks bioflocculates particles and oxidizes soluble organics before passing the mixed liquor onto high rate secondary clarification; settled solids are returned to the mainstream process. This allows plants to meet wet weather treatment needs without bypass and comply with secondary treatment regulations. A recent development, its first application is at OWASA's Mason Farm plant in North Carolina (a BNR plant).

Development of Three Bioaugmentation Processes for Accelerated Nitrification (BAR, BASIN, TF/PAS)

Inventor/Developer for BAR Process. The BAR processes directs ammonia laden reject water from dewatering of digested sludges to a reaeration tank whereby complete nitrification is achieved; nitrifiers are the transferred to the contact tank, thereby accelerating the mainstream nitrification process. The process was first used by Brown and Caldwell in the early nineties at Appleton, WI and is now incorporated in a Brown and Caldwell design under construction at the MCES Blue Lake plant, near St. Paul, MN. Now adopted widely in the wastewater industry, it has been incorporate into a number of European plants, as well as designs for New York City, Metro Denver and others in the US.

Co-Inventor/Developer/Process Consultant for TF/PAS Process. The Trickling Filter/Pushed Activated Sludge (TF/PAS) process was developed out of observations made during the pilot study and full-scale operation of the City of Garland's TF/SC plant. Design for partial nitrification in the TF allowed for completion of nitrification in the downstream solids contact tank, even at low solids residence times. After its discovery at Garland, further pilot testing at the City of Atlanta's research center, it was subsequently designed by BC for the Central Valley Water Reclamation Facility in Utah, and the City of Melrose in Minnesota.

Inventor/Co-Developer for BASIN Process. The BASIN process uses a moving bed biofilm reactor directly coupled to an activated sludge step. The differentiation of this patented process is that intensive shearing at low night time flows allow wasting of the sloughed biomass away from the following activated sludge step (thereby resulting in nitrifier enrichment there) and to the primary clarifier. Tested at bench-scale, it has not yet seen a full-scale application.

Nitrogen Control Plants Process Engineering, Various Clients

Process Design Consultant or Process Engineer. Nitrogen control plants including: Gwinnett County, Georgia; Santa Fe, New Mexico; Boulder, Colorado Springs and Littleton-Englewood, Colorado; El Paso, Texas, Sunnyvale, California; Hillsborough County, Florida; Corvallis, Oregon; Central Valley (South Salt Lake), Utah and Appleton, Wisconsin.

IFAS Model Development, Brown and Caldwell

Project Manager. The Integrated Fixed Film Activated Sludge (IFAS) process has been implemented with empirical models and models of biofilms with activated sludge kinetics for enhanced nitrification in small activated sludge reactors. To improve designs, Dr. Parker supervised the development of a new IFAS model based on the best fixed film research available and then calibrated it against existing plant data. The model allows identification of appropriate applications in alternative analyses and optimization of the IFAS process for design.

Littleton/Englewood Wastewater Treatment Planning and Design, Colorado

Process Engineer and Process Design Reviewer. Dr. Parker has been involved with this client since the beginning of Brown and Caldwell's remodeling and expansion of the plant, beginning in the mid-eighties and continuing to date. A high rate activated sludge plant and parallel rock tricking filter plant were converted to a Trickling Filter/Solids Contact process followed by nitrifying trickling filters (NTFs). The NTFs also provide treatment of foul gases and provide excellent odor removal. Later expansions involved changes to digestion and dewatering and included the addition of tertiary denitrification filters. Detailed process models were developed, calibrated and then recalibrated as plant units came on line. Today this is a 50 mgd plant providing full nitrogen removal, while in 1985 it was rated at 27 mgd and provided only secondary treatment.

Biofilm Controlled Nitrifying Trickling Filter (BCNTF), Various Clients

Developer. The BCNTF is a nitrifying trickling filter placed downstream from conventional secondary treatment and has demonstrated high nitrification rates and smaller structures than previously used. Pilot tested at Central Valley, Utah and Malmö, Sweden. Dr. Parker was the technical reviewer or process designer for applications at Central Valley, Utah; Fulton County, Georgia; Boulder, Colorado and Littleton/Englewood, Colorado. Dr. Parker was process consultant for full-scale rerating studies at latter two sites.

BCNTF pilot study, City of Malmö, Sweden

Process Engineer/Consultant. Dr. Parker served as a process consultant for the two-year pilot that used two 10-ft-diameter test filters to establish the conditions which would maximize tertiary nitrification in the City's existing trickling filters. The study minimized the cost of conversion of the plant to advanced wastewater treatment for nutrient removal.

Johns Creek Environmental Campus, Fulton County, Georgia

Process Design Reviewer. This facility is a 15 mgd Membrane Bioreactor (MBR) water reclamation facility. Using a design-build approach, this below ground facility includes an influent pump station, bar screens, vortex type grit removal, double entry type fine screens, primary clarification, aeration basins incorporating biological nutrient removal (limit is 0.13 TP), membrane tanks, UV disinfection and post aeration. Solids processing includes aerobic digestion and centrifugal dewatering. Parker's role was QA/QC, to be sure reasonable assumptions were made and to recommend revisions to the process design when necessary.

Blue Ribbon Panel, City of Atlanta, Georgia

Panel Chairman. A Blue Ribbon Panel was formed to advise on effluent compliance and plant operations (performance and cost) for the City's three largest wastewater treatment plants. The plants must meet a pooled effluent total phosphorus limit of 0.7 mg/l with their existing facilities prior to a major upgrading program that is currently underway. The plants lacked the effluent filtration units that ultimately will allow them to reliably meet this requirement. The BRP was initiated after an upset in February 1997. Implementation of operation recommendations and independent City actions has resulted in an unblemished compliance history for phosphorus for 44 months. Cost reduction recommendations have also been made.

Atlanta Region Sub-Area Future Wastewater Treatment Feasibility Study, Atlanta Regional Commission, Georgia

Technical Review Board Member. Brown and Caldwell prepared this feasibility study for the four-county area surrounding and including the City of Atlanta. This study planned for regional treatment needs to the year 2040, when average flows are expected to reach 540-mgd. Regional consolidation was considered because of the need to upgrade all the area's wastewater treatment plants to advance degrees of phosphorus removal. Considered varying degrees of subregional and regional consolidation as well as the need to consider future water reclamation needs in the as yet undeveloped areas due to potential future water supply shortages. Served in the same role for the City of Atlanta's comprehensive control plan which developed the concept of linking the city's three plants by pipelines and tunnels to optimize CSO control, phosphorus removal, and shift loads.

Lime and Iron and Lime Use for CEPT Design Manual, U.S. Environmental Protection Agency

Project Manager. Senior author of the process design manual Lime Use in Wastewater Treatment: Design and Cost Data. The manual covers the fundamentals of lime, handling of lime, liquid processing, lime sludge thickening and dewatering, lime reclamation, air quality, ash disposal and cost estimating.

Biological Phosphorus Removal Plants Process Engineering, Various Clients

Process Design Consultant or Technical Reviewer. Process design for biological phosphorus removal at various plants, including the City of Atlanta's Utoy Creek plant; Fulton County, Georgia and the Unified Sewerage Authority, Durham, Oregon.

Biological Aerated Filter (BAF) pilot study, City of San Diego, California

Technical Advisor, Q/QC. Served as a process consultant for the yearlong pilot that trialed two BAF vendors' designs for the 250-mgd Point Loma plant. Denny reviewed and modified the experimental design to help ensure the constrained site could accommodate the future BAF design. He assisted with data interpretation and in drawing conclusions from this important study. While performance was similar for the Biostyr and Biofor units, sludge production was significantly different, a difference that was only determined after procedures were developed to allow a full mass balance to be done on the BAFs. Other innovative testing including oxygen transfer testing and determination of impact of nitrifier seeding on exertion of nitrogenous oxygen demand with the five-day BOD test.

Haskell R. Street Wastewater Treatment Plant, El Paso Utilities, Texas

Project Reviewer. This 29 mgd plant was converted to from high purity oxygen activated sludge to a nitrifying plant with two types of selectors for bulking control (anaerobic and classifying). Parker reviewed the process design and suggested appropriate changes as well as assisted in process startup. The plant has operated without foam and very low and stable SVIs.

Clean Water Master Plan, Scope B Wastewater Treatment, City and County of San Francisco Public Utilities Commission (SFPUC), San Francisco, California

Treatment Technology Lead. Dr. Parker is the treatment technology lead for this significant planning effort. He provides technical direction to the engineering staff. The project involves a 30-year time horizon for the planning for San Francisco's wastewater treatment. The City's 22-mgd Oceanside Wastewater Treatment Plant and the 80-mgd Southeast Wastewater Treatment Plant must be reconfigured and rehabilitated for anticipated future requirements. The Southeast plant is sited in one of the more blighted areas of the City, and there have been historic environmental justice issues with the site. Consideration is being given to either completely screening it like the Oceanside plant with significant changes to its odor control system, or replacing it at a new site either on the ocean side of the City or on the bayside. Consideration is being given to decentralizing the plant into as many as three bayside locations. Because of space constraints at existing and new sites, compact treatment technologies are being favored, including deep aeration tank processes, biologically augmented processes, and very compact technologies (biological aerated filters and membrane bioreactors). Bayside locations are being planned for advanced wastewater treatment because of the higher receiving water quality anticipated in the future and including layouts for both nitrification and effluent filtration facilities. Both existing and new sites are being considered for centralized solids processing facilities, again with consideration of the aesthetic development of the sites, all which exist in a dense urban environment. Small, decentralized wastewater plants are being considered to make up part of the water deficit projected in the City's Water Master Plan. The work is being done in collaboration with SFPUC, which is taking on some of the site considerations using the design criteria developed by Brown and Caldwell. Sustainability is a hallmark of the treatment plant and overall planning effort. The work is being integrated with the rest of the master planning efforts being carried on in parallel with other firms, including work on upgrading the combined sewer system and planning for low impact development as the City gradually redevelops over time.

Review of Strategic Sewage Disposal Scheme Stage II Options, Hong Kong Government Environmental Protection Department, China

Peer Reviewer and Process Specialist. Reviewed all the unit process capability descriptions and plant layouts as well as the alternative schemes and their impact on water quality. The review was prepared for the Hong Kong Environmental Protection Department by Pypun Engineering Consultants. Provided key input on the capabilities of chemical primary treatment/secondary treatment combinations and UV disinfection to the study team as well as to the Hong Kong Government appointed Review Panel.

Belmont TF/SC Design for Wet Weather Treatment, City of Indianapolis, Indiana

Process Engineer. This proposed 60-mgd (ADWF) facility places a TF/SC process ahead of an existing nitrifying high oxygen activated sludge (HPOAS) process, so as to double the facilities secondary treatment capability for treating combined wastewater flows from a tunnel/storage system. During wet weather, the TF/SC process is decoupled from the downstream HPOAS system. Dr. Parker determined the process size using BC developed process design programs; this included trickling filter sizing, media selection, aeration tank and flocculator clarifier sizing.

TF/SC Design for Full Secondary at Plant 2, Orange County Sanitation District, California

Process Engineer. This new 60 mgd (ADWF) facility follows primary treatment operated with chemical addition to reduce the loading and sludge production from the secondary treatment process. Dr. Parker determined the process size using BC developed process design programs; this included trickling filter sizing, media selection, aeration tank and flocculator clarifier sizing. In order to protect the parallel secondary process from washout, the TF/SC process had to sustain peak flows up to 170 mgd. He used CFD modeling to establish clarifier peak overflow rates sustain able during infrequent but high flow events.

Preliminary Evaluation of Fixed Film Reactor Media Condition, City of Modesto, California

Project Engineer. Dr. Parker performed the assessment and evaluation of the fixed film reactor (FFR) media. The inspection consisted of surface inspection of the media, without removing or damaging any of the media. Based on the assessment, it was concluded that the worst damage was sustained on the FFR 2 media. Dr. Parker recommended a survey of FFR 1 be conducted to determine if shifting of the structure had occurred. An additional recommendation was for a detailed investigation to be conducted to investigate the possibility of damage to the underlying layers.

Water Pollution Control Facility Plan, City of Hayward, California

Process Engineer. Dr. Parker served as process engineer for evaluation of the fixed film reactor at the Water Pollution Control Facility (WPCF). He designed sampling program for establishing an overall plant mass balance. During the course of the investigation, internal plant recycles and process inefficiencies were identified that have allowed the plant staff to make incremental improvements to the plant's effluent quality. He prepared process designs for the four alternatives evaluated during the Master Plan (modifications to the existing process, upgrading with chemical addition, the TF/SC process and activated sludge). Dr. Parker input to the development of cost evaluation, attended workshops of cost evaluation and attended workshops with City of Hayward public works and WPCF staff.

Assistance in Negotiations and Review for Advanced Water Treatment Facility, City of Hayward, California

Consultant to Public Works Director and Assistant Public Works Director (and Project Manager). The Calpine/Bechtel Joint Development Company proposes to construct a 600 MW plant adjacent to the City of Hayward's WPCF. There is agreement that cooling water will be served from an Advanced Water Treatment Facility (AWTF) that will produce reclaimed water from the City of Hayward's WPCF. The AWTF will be designed and constructed by Calpine/Bechtel and turned over to the City for ownership and operation. Brown and Caldwell was engaged to provide Dr. Parker to serve as the principal engineering consultant to City staff to advise during contract negotiations. In addition, Dr. Parker has managed the firm's review of Calpine's proposals for the AWTF preliminary planning and detailed designs. He has helped the City obtain superior technologies for water treatment, and for metals removal from AWTF reject water streams. In addition, the interrelationships between the AWTF and WPCF have been optimized. As an example of process improvements, promising metals removal chemicals have been identified to replace the favored high lime treatment (with its onerous sludge production). With respect to reactor units, a problem in dealing with scaling was identified with a favored reactor clarifier unit, causing Calpine/Bechtel to select a lower maintenance technology. A deficiency in building arrangements for maintenance activities, offices and locker rooms was identified and improvements and costs suggested to the City for negotiation with Calpine/Bechtel. A facility layout was proposed and then adopted by the City that moved some of the process units to the WPCF site, allowing greater expandability to the water treatment facilities so that other future users could be served from an integrated, single facility.

Pond Improvements, Napa County Sanitation District, California

Process Consultant. Dr. Parker consulted on reconfiguring oxidation ponds to prevent odor development. He conceived modifications to clarifiers to operate as dissolved air flotation units (DAFs) for algae removal.

Algae Separation and Concentration, LiveFuels, Menlo Park, California

Process Consultant. Dr. Parker helped develop algae separation and concentration technologies for this start-up biomass to energy company. Details are confidential.

Algae Separation and Concentration, Sapphire Energy, San Diego, California

Process Consultant. Development of algae separation and concentration technologies for this start-up biomass to energy company. Details are confidential.

Algae Removal, City of Modesto, California

Process Consultant. Fast track project to install 6 mgd of algae removal capacity to allow pond discharge during a formerly "no discharge" low flow period for the San Joaquin River. Consulted on identification of new high rate DAF technology with a novel air dissolution system.

Stage 1 Liquid Waste Management Plan, Greater Vancouver Regional District, British Columbia

Senior Expert Consultant. This planning study for the urbanized area that includes Vancouver covered a 50-year planning horizon for a year 2036 population of 2.7 million. Assessment of the existing water quality in the region's water bodies established the initial priorities for planned improvements. Dr. Parker's role was to provide management level input to the study and provide technical review of all study efforts including water quality assessment, urban and rural run-off, combined sewer overflows, wastewater discharge impact, treatment needs, sludge processing and disposal, and industrial source control.

Annacis Island and Lulu Island Secondary Treatment Facility Predesign and Design, Greater Vancouver Regional District (GVRD), British Columbia

Project Director. Starting in the late 1980s, Denny served as the senior expert consultant to GVRD for its Stage 1 Liquid Waste Management Plan. This planning study for the urbanized area that includes Vancouver and surrounding cities covered a 50-year planning horizon for a year 2036 population of 2.7 million. Assessment of the existing water quality in the region's water bodies established the initial priorities for planned improvements. Denny provided management-level input to the study and provided technical review of all study efforts, including water quality assessment, urban and rural run-off, combined sewer overflows, wastewater discharge impact, treatment needs, sludge processing and disposal, and industrial source control.

The Annacis Island (MMF of 204-mgd) and Lulu Island (MMF of 21-mgd) wastewater treatment plants feature the use of the Trickling Filter/Solids Contact process for secondary treatment and provide anaerobic digestion and sludge dewatering. Both plants have extensive covering and odor control features and the larger plant will provide thermophilic digestion in a series mode for production of Class A sludge for unrestricted beneficial reuse. Master planning elements of the predesign effort included detailed evaluations of treatment alternatives and plant locations, a sludge reuse master plan, and an assessment of infiltration/inflow in the separated portions of the system.

Secondary Treatment for Regional Plant, Sacramento Regional County Sanitation District, California

Project Engineer for Planning/Project manager for Pilot Study/Process Reviewer for Design/Process Consultant on Operations. In the 70s, served as process engineer that compared secondary treatment alternatives for the regional plant—conventional activated sludge was compared to oxygen-activated sludge and the latter was selected because of increased process stability for treatment of seasonal canning wastewaters. Dr. Parker laid out site for future nitrogen removal using a three-sludge system to reserve space on the site. Subsequently, Dr. Parker was project manager on the pilot plant study that defined oxidation tanks and secondary clarifier design criteria for the Sacramento Regional Wastewater Treatment Plant. He provided technical review on the final process design and for the subsequent expansion. Dr. Parker was the process consultant on operating problems relating to Nocardia foam generation and oxygen transfer in the regional plant. He also was the process designer for a classifying selector installation on the RAS channels and with consultation on its effectiveness after startup.

Roger Road Treatment Investigation: Proposed Changes to Remedy High Effluent Solids, Pima County, Arizona

Process Engineer. Denny investigated alternatives to upgrade the plant, including process changes in the aeration basins, as well as potential conversion to a TF/SC process.

Biological Treatment Pilot Study, City of Windsor, Ontario

Expert Process Control Consultant. Pilot study of biological treatment following an existing chemically enhanced primary treatment process. The coagulants used are low dose iron and anionic polymer and are applied for phosphorus removal. Processes tested for BOD polishing and nitrification are Biological Aerated Filters (BAFs) and the Trickling Filter/Solids Contact Process followed by UV irradiation. Completely redesigned the TF/SC pilot to enhance flocculation and provided operations guidance so that process was moved from the failing category to where its effluent equaled that of the BAF process. Directed predesign of full-scale trickling filter facilities.

Pilot Studies of Iron Coprecipitation of Heavy Metals, Electric Power Research Institute, Palo Alto, California

Principal-in-Charge. Studies were conducted at the Carolina Power and Light Company, Roxboro, North Carolina, and the Pennsylvania Power and Light Company, Washingtonville, Pennsylvania, USA. Designed, constructed, and operated an iron coprecipitation pilot plant (55 m3 capacity) to metals from power plant effluents. This test program evaluated the effects of iron dose (ferric chloride), mixing, flocculation, and clarifier overflow rate on arsenic and selenium removal. The study also evaluated sludge production (as influenced by chemical dose and raw water quality), sludge thickening rates (via column testing), and sludge dewatering performance (via bench-scale filter press operations). Both pilot studies concluded with a cost analysis (capital, operating and maintenance, and life-cycle costs) of the treatment process.

Addition of Chemically Enhanced Primary Treatment (CEPT) Facilities, Orange County Sanitation District (OCSD), California

Process Consultant. Denny evaluated high rate alternatives to CEPT, including ballasted sedimentation and plate separators as well as enhancement to CEPT including improved chemical addition, flocculation and sedimentation tank features. Prepared experimental design for field program and 2-D hydrodynamic modeling and evaluated the cost-effectiveness of alternative improvements. Recommended improved coagulant dosage control and point of chemical addition and provided process design input into detailed design of 156 mgd of new and updated facilities.

Combined Sewer Overflow Control Plan Five-Year Update, King County Department of Natural Resources, Washington

Board Member/Technical Review. Work tasks include consideration of Seattle metropolitan system interactions using Metro's models, development of decision-making criteria, and identification and evaluation of alternatives. Alternatives considered include separation, storage, capacity improvements and treatment. Relative impacts on water quality using risk assessment techniques were used in ranking the alternatives.

San Diego Clean Water Program Framework Plan, San Diego Metropolitan Wastewater Department, California

Technical Advisory Board Member. This comprehensive framework plan (master plan) provides for sewage collection, treatment, effluent and sludge disposal as well as water reclamation for the service area until the year 2050. Projected service area population at that time is 2.8 million.

Wastewater Facilities Planning Study, City of Santa Cruz, California

Project Manager. A 1.7 million dollar master planning effort for the metropolitan area centered on Santa Cruz, California. This planning effort encompassed oceanographic studies to support outfall design, extensive reclamation studies done jointly for Santa Cruz and the City of Watsonville, analysis of alternatives to prevent seawater intrusion into the aquifer underlying the Pajaro Valley, evaluation of alternative treatment plant and sludge disposal sites, and evaluation and wastewater treatment and solids process and disposal alternatives including codisposal with solid waste in an energy recovery facility.

Plan of Study Development of Toxicant Pretreatment Planning Study (TPPS), King County Department of Natural Resources, Washington

Project Manager. This multiyear, multimillion-dollar investigation studied the source of toxic pollutants (organics and metals) in the service area, their transformation and removal through treatment processes, and their ultimate fate in sludges, to the air, or to the environment. The TPPS also quantified industrial and commercial and residential sources, examined pretreatment and household source control effectiveness, and proposed changes to Metro's pretreatment system. Served as technical reviewer for collection and treatment system evaluations.

Water Reclamation Studies, Various Clients, California

Principal-in-Charge. Water reclamation studies for the City of San Jose's San Jose-Milpitas-Santa Clara water reclamation project and the Napa-American Canyon Wastewater Reuse program.

Wet Weather Facilities Plan, East Bay Municipal Utility District, California

Project Manager. Planned new interceptors and storage facilities to capture overflows from the District's separated collection system during wet weather events.

Sludge Handling and Treatment Investigations, East Bay Municipal Utility District, California

Principal-in-Charge. Study included a compost pilot study, sludge stabilization optimization, in plant treatment optimization and an economic and technical evaluation of sludge processing, recycling and disposal alternatives.

Clarifier Evaluation, East Bay Municipal Utility District, California

Principal-in-Charge. Dye studies of the District's rim feed/rim flow clarifiers and member of a blue ribbon committee that recommended modifications to these units to combat destabilizing density currents causing direct short-circuiting from influent to effluent.

Flocculation Process Research, Clemson University, South Carolina

Adjunct Professor. Research on activated sludge flocculation and breakup that has led to design practice recommendations for reducing the levels of suspended solids in activated sludge effluents.

Secondary Clarifier Improvements, Various Clients

Process Consultant. Modifications to secondary clarifiers to improve suspended solids removal at Lincoln, Nebraska; Colorado Springs, Colorado; San Mateo, California; Boise Cascade's International Falls plant, Minnesota; International Paper's plant, Vermont; Albany, Georgia and Pierre, South Dakota.

Research Priorities for Debottlenecking, Optimizing and Rerating Wastewater Treatment Plants Water Environment Research Foundation (WERF), Report for Project 99-WWF-1

Project Subcommittee Chair. Organized and led the agenda-setting workshop that originated WERF's optimization program that has lead to projects on development of protocols for rerating primary clarifiers, activated sludge and secondary clarifiers (all subsequently developed by BC for WERF).

Determine the Effect of Individual Wastewater Characteristics and Variances on Primary Clarifier Performance, Draft Final Report for Project 00-CTS-2

QA/QC Reviewer. Reviewed the original draft and comments of external reviewers and recommended changes.

Methods for Wastewater Characterization in Activated Sludge Modeling, WERF

Reviewer and Advisor. Served as QA/QC reviewer for the preparation of the protocol.

Clarifier Testing Protocol, ASCE's Clarifier Research Technical Committee (CRTC) and WERF's Final Protocol (Project 00-CTS-1)

Steering Committee Member. Worked on testing protocol development and reviewed site testing reports from LASCD, Denver Metro, and New York City. Served as QA/QC reviewer for the revision of the protocol for the Water Environment Research Foundation. Testing procedure is now accepted as the industry standard.

Secondary Settling Tanks Report, International Association of Water Quality

Member of the Author Panel. Scientific and technical report on secondary settling tanks.

Trickling Filter/Solids Contact (TF/SC) Process, Various Clients

Project Director. Co-inventor of the Trickling Filter/Solids Contact (TF/SC) process first tested full-scale at Corvallis, Oregon. Directed full-scale studies funded by EPA at Corvallis, Oregon; Tolleson, Arizona; Oconto Falls, Wisconsin; Medford, Oregon and Morro Bay (California). Process consultant for TF/SC pilot studies for Omaha, Nebraska; Everett, Washington; Stockton, California; Garland, Texas; Chino Basin Municipal Water District, California; Windsor, Canada and Atlanta, Georgia. Technical reviewer or process consultant for TF/SC plant rerating studies at Tolleson, Arizona; Central Valley, Utah; Boulder, Colorado; Littleton/Englewood, Colorado and Monterey, California. Process designer for the Greater Vancouver Regional District's TF/SC plants at Annacis Island and Lulu Island.

Central Valley Water Reclamation Facility Treatment Planning and Design, Colorado

Process Engineer and Process Design Reviewer (multiple projects). This project involved the design of a new TF/AS plant for an initial design of 50 mgd. Regulatory requirements for nitrification were postponed and state funding levels changed, so the initial design was changed to the TF/SC process. Subsequently, the facility was expanded to 70 mgd, and nitrification requirements were reimposed, the design configuration was changed to the TF/PAS (Trickling Filter/Pushed Activated Sludge) process whereby half the nitrification occurs in the trickling filter and then nitrifiers are seeded to the downstream activated sludge step, and the SRT reduced to three to four days from the seven to eight normally required with the TF/AS process. Each stage of the project involved evaluating existing plant data, conducting field studies to establish kinetic rates and calibrating BC's suite of models for the process. Overall, the plant process framework has shown itself readily adaptable to regulatory change while maintaining a better than a 10-10 monthly average effluent at all times. The TF/PAS process was an invention of Dr. Parker, who found through observation of BC's TF/SC pilot plants that low loaded trickling filters could readily establish full nitrification at much lower cost than the conventional TF/AS technology. As a result, a number of TF/SC plants have adopted the process configuration as their normal operating mode.

Development of the Flocculator-Clarifier

Process Engineer and Inventor. First full-scale test of a clarifier with a flocculator centerwell in full-scale practice was in 1979 at Corvallis, Oregon and Santa Rosa, California. Flocculator-clarifiers have been able to obtain an effluent TSS of 10 mg/L of effluent total P without filtration. Subsequently employed at multiple sites, including: Santa Rosa, California; Central Valley, Utah; Sacramento, California; Atlanta, Georgia; Gwinnett County, Georgia; Cobb County, Georgia; Vancouver, Canada; Santa Cruz, California, Appleton, Wisconsin and other clients.

Italian Municipal TF/SC Plants and Industrial Waste Applications

Principal-in-Charge and Project Manager. Process designs and support services for Smogless, s.p.a., an Italian turnkey constructor.

Georges River and Botany Bay Water Quality Modeling, Sydney Water, Sewer and Drainage Board, Australia

Project Manager. This investigation studied the effect of upstream organic and nutrient sources on the river and estuary and predicted the biostimulation that later occurred with development. Advanced wastewater treatment for nutrient removal was recommended and later was implemented by the Board.

Floc Breakup, City of Gothenberg, Sweden

Project Director. Evaluation of the effects of mixed liquor pumping. The City proposed a plant expansion with double-decked clarifiers and found that sludge pumping seemed to breakup the floc, resulting in higher effluent suspended solids and effluent phosphorus levels that would exceed permit levels. A field study of Archimedes screw pumping showed that indeed floc breakup was occurring, but that it could be mitigated by a flocculation step after sludge pumping.

Chemically Enhanced Primary Treatment Pilot Study, Central Contra Costa Sanitary District, Concord, California

Project Manager. Prototype scale pilot study of chemical primary treatment followed by nitrogen removal for testing of chemically enhanced primary treatment used a full-scale tank having a capacity of 0.11 m3/s. In two years of testing, major test variables were pH (10.2 to 11.5), supplemental coagulant dose (ferric chloride from 0 to 24 mg/l) and various overflow rates. This facility supported Brown and Caldwell's design for both the 1.31 m3/s (ADWF) CCCSD plant as well as the 1.27 m3/s (ADWF) Lower Molonglo Water Quality Control Centre (LMWQCC) for Canberra, Australia.

Refinery Wastewater Plant Upgrades, Various Clients

Process Reviewer or Principal-in-Charge. Upgrade studies and predesigns for refineries including Exxon's Baytown Refinery (Texas), Shell's Martinez refinery (California), and Union Oil's San Francisco refinery (California).

Pulp and Paper Wastewater Treatment Plant Upgrades, Various Clients

Principal-in-Charge. Studies or predesigns at seven pulp and paper plants for clients including Boise Cascade, James River, and International Paper.

Site Assessments, Various Clients

Principal-in-Charge. Contaminated site assessment for numerous clients including Westinghouse, Southern Pacific, and Union Chemical Company.

Metals Removal Process, Electric Power Research Institute

Principal-in-Charge. Selenium and arsenic removal from coal fired power plants using iron coprecipitation technology. Technology demonstrated capability to remove metals down to microgram per liter levels.

Memberships

American Society of Civil Engineers
American Water Works Association
International Water Association
National Academy of Engineering
Water Environment Federation
Water Environment Research Foundation
WERF Board, 1988-1989
WERF Research Council, Chair, 1989-1993
WERF Research Council, Member, 1994-1998

Publications/Presentations

A separate list of publications is available.

Honors/Awards

ASCE's Samuel Arnold Greeley Award, 1977
WEF's George Bradley Gascoigne Medal, 1983
ASCE's Simon W. Freese Award, 1987
WEF's Harrison Prescott Eddy Medal, 1995
AEEP's Outstanding Publication Award, 1995
WEF's Thomas R. Camp Medal for Basic Research Contributions to Wastewater Applications, 2003
Elected to the National Academy of Engineering, 2004
WEF Fellow, 2012

Publications/Presentations

1. "Water Quality Management and the Time Profile of Benefits and Costs," Water Resources Research, Vol. 4, No. 2, pp. 233-246, April 1968.
2. "Unit Process Performance Modeling and Economics for Cannery Waste Treatment," with John R. Monser and Robert G. Spicher, proceedings of the 23rd Purdue Industrial Waste Conference, Purdue University, Lafayette, Indiana, pp. 710-739, May 7-9, 1968.
3. "Effect of Turbulence on Activated Sludge Effluent Clarity," presented at the Twelfth Annual Northern Regional Conference of the California Water Pollution Control Association (now the California Water Environment Association), Stockton, California, October 3, 1970.
4. "Physical Conditioning of Activated Sludge Floc," with Warren J. Kaufman and David Jenkins, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 43, No. 9, pp. 1817-1833, September 1971.
5. "Floc Breakup in Turbulent Flocculation Processes," with Warren J. Kaufman and David Jenkins, Journal of the Sanitary Engineering Division, Proceedings of ASCE, Vol. 98, No. SAl, pp. 79-99, February 1972.
6. "Tidal Exchange at Golden Gate," with Dan P. Norris and Austin W. Nelson, Journal of the Sanitary Engineering Division, Proceedings of ASCE, Vol. 98, No. SA2, pp. 305-323, April 1972.
7. "Full Scale Test Plant at Contra Costa Turns Out Valuable Data on Advanced Treatment," with David G. Niles, Bulletin of the California Water Pollution Control Association (now the California Water Environment Association), Vol. 9, No.1, pp. 25-27, July 1972.
8. "Improving Pond Effluent by Algae Removal," with James B. Tyler and Thomas J. Dosh, Water and Wastes Engineering, Vol. 10, No. 1, January 1973.

9. "Marine Waste Disposal, A Comprehensive Environmental Approach to Planning," with Dan P. Norris, Lawrence E. Birke, Jr. and Robert T. Cockburn, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 45, No. 1, pp. 52-70, January 1973.
10. "Full-Scale Testing of a Water Reclamation System," with D. H. Caldwell, G. A. Horstkotte and D.G. Niles, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 46, No. 1, pp. 181-197, January 1974.
11. "Nitrification and Denitrification Facilities," prepared for the EPA Technology Transfer Design Seminar for Wastewater Treatment Facilities, Boston, Massachusetts, September 10, 1974.
12. "Processing of Combined Physical-Chemical-Biological Sludge," with David G. Niles and Fred J. Zadick, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 46, No. 10, pp. 2281-2300, October 1974.
13. "Carbon Oxidation-Nitrification in Synthetic Media Trickling Filters," with Richard J. Stenquist and Thomas J. Dosh, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 46, No. 10, pp. 2327-2339, October 1974.
14. "Upgrading Lagoon Effluent for Best Practicable Treatment," with R. W. Stone and J. A. Cotteral, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 47, No. 8, pp. 2019-2042, August 1975.
15. "Lime Recovery and Reuse in Primary Treatment," with Geoffrey A. Carthew and Gerry A. Horstkotte, Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 101, No. EE6, pp. 985-1004, December 1975.
16. "Performance of Alternative Algae Removal Systems," Water Resources Symposium Number Nine: Ponds as a Wastewater Treatment Alternative, Center for Research in Water Resources, College of Engineering, The University of Texas at Austin, pp. 401-416, 1976.
17. "Design of an Integrated Approach to Nutrient Removal," with David L. Eisenhauer and Ronald B. Sieger, Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 102, No. EE1, pp. 37-54, February 1976.
18. "A Discussion of 'Air or Oxygen Activated Sludge,'" presented at the 48th Annual Conference of the California Water (now the California Water Environment Association) Control Association, South Lake Tahoe, California, April 14-16, 1976.
19. "Oxygen and Air Activated Sludge: Another View," with M. S. Merrill, Journal Water Pollution Control Federation (now the Water Environment Federation), Volume 48, No. 11, November 1976.
20. "Development and Implementation of Biological Denitrification for Two Large Plants," with Richard C. Aberley and David H. Caldwell, Prog. Wat. Tech., Vol. 8, Nos. 4/5, pp. 673-686, 1977.
21. "Long-Term Performance of a Coupled Trickling Filter-Activated Sludge Plant," Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 49, November 1977.
22. "A Unified Theory of Filamentous Activated Sludge Bulking," with Mesut Sezgin and David Jenkins, Journal of Water Pollution Control Federation (now the Water Environment Federation), Vol. 50, pp. 362-381, February 1978.
23. "Discussion of 'Nitrification Design Approach for High Strength Ammonia Wastewaters,'" with P.M. Sutton, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 50, pp. 2050-2053, August 1978.
24. "Secondary Treatment Alternatives: Suspended Growth," Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 105, No. EE2, pp. 283-296, April 1979.
25. "Evaluation of Ozone Treatment in Cooling Towers," with Douglas T. Merrill and Joseph A. Drago, proceedings of the 35th Annual Purdue Industrial Waste Conference, Purdue University, Lafayette, Indiana, pp. 307-315, May 13-15, 1980.
26. "Efficiencies of Advanced Waste Treatment Obtained with Upgraded Trickling Filters," with Dan P. Norris and Marvin L. Daniels, Civil Engineering, ASCE, Vol. 50, No. 9, pp. 78-81, September 1980.
27. "Relationship Between Organic Loading, Dissolved Oxygen Concentration, and Sludge Settleability in the Completely-Mixed Activated Sludge Process," with Jonathan C. Palm and David Jenkins, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 52, No. 10, pp. 2484-2506, October 1980.
28. "High-Quality Trickling Filter Effluent Without Tertiary Treatment," with Dan P. Norris, Marvin L. Daniels and Eben L. Owens, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 54, No. 7, pp. 1087-1098, July 1982.
29. "Relation of Inflow/Infiltration Costs to Varying Policy Requirements," with Daniel I. Wilkowsky, Charles T. Way and David L. Tucker, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 54, No. 10, pp. 1361-1375, October l982.
30. "Designing for Trickling Filter/Solids Contact Process Applications," with Roy C. Fedotoff, Douglas T. Merrill, Denis M. O'Malley and Michael C.R. Owen, presented at the 55th Annual Conference of the Water Pollution Control Federation (now the Water Environment Federation), St. Louis, Missouri, October 7, 1982.
31. "Relationship Between Bench Scale and Prototype Activated Sludge Systems," with D. Jenkins, A.M. van Niekerk, Y-J Shao and S-E Lee, in Norbert W. Schmidtke and Daniel W. Smith (eds.), Scale-Up of Water and Wastewater Treatment Processes, Butterworth, pp. 307-322, 1983.

32. "Assessment of Secondary Clarification Design Concepts," Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 55, No. 4, pp. 349-359, April 1983.
33. "Reducing Water Demand and Wastewater Flow," with William O. Maddaus and Alfred J. Hunt, Journal American Water Works Association, pp. 330-335, July 1983.
34. "Use of Flocculation Concepts to Improve Secondary Clarifier Performance," presented at Wastewater Treatment Seminar, Canada Centre for Inland Waters, Burlington, Ontario, March 7, 1984.
35. "Research Needs for Trickling Filter Design: A Consultant's Perspective," proceedings of the Second International Conference on Fixed-Film Biological Processes, Arlington, Virginia, pp. 1155-1166, July 10-12, 1984.
36. "Effect of Plastic Media Configuration on Trickling Filter Performance," with Douglas T. Merrill, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 56, No. 8, pp. 955-961, August l984.
37. "Use of Return Activated Sludge Chlorination to Control Sludge Bulking," with B. A. Curley, proceedings of the TAPPI 1985 Environmental Conference, pp. 177-184, Mobile, Alabama, April 22-24, 1985.
38. "Field Evaluation of Arsenic and Selenium Removal by Iron Coprecipitation," with D. T. Merrill, M. A. Manzione, J. J. Petersen, W. Chow, and A. O. Hobbs, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 58, No. 1, pp. 18-26, January 1986.
39. "Flocculator-Clarifier Performance" with Richard Stenquist, Journal Water Pollution Control Federation (now the Water Environment Federation), Vol. 58, No. 3, pp. 214-219, March 1986.
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163. "Analysis of Organic Nitrogen Removal in Municipal Wastewater by Reverse Osmosis," with Rion Merlo, Joe Wong, Victor Occiano, Kyle Sandera, Anil Pai, Seval Sen, Jose Jimenez and John Burcham. CD Rom Proceedings of the 84th Annual Water Environment Federation Technical Exposition & Conference, Los Angeles, CA, October 15-19, 2011.
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168. Analysis of Organic Nitrogen Removal in Municipal Wastewater by Reverse Osmosis," with Rion Merlo, Joe Wong, Victor Occiano, Kyle Sandera, Anil Pai, Seval Sen, Jose Jimenez and John Burcham. Water Environment Research, Vol. 84, No. 7, July 2012, pp. 588-595.

Exhibit 3

Results of Digester Cleaning Method Survey Conducted by Brown and Caldwell

Table 1. Survey of Digester Cleaning Methods

Description	Agency	Plant A	Plant B	Plant C	Plant D	Novato Sanitary District
	Capacity	2 mgd	10 mgd	12 mgd	12 mgd	5 mgd
Retained contractor		WWSM	WWSM	NADC Presidio Systems	WWSM	WWSM
Screened digester contents		✓	✓	✓	✓	✓
Fluid returned to headworks			✓	✓	✓	✓
Dewatered fluid following screening			✓	✓		
Fluid sent to sludge lagoons		✓				
On-site sludge lagoons		✓			✓	

Exhibit 4

Diagram of Fluidization of Solid Contents in Digester

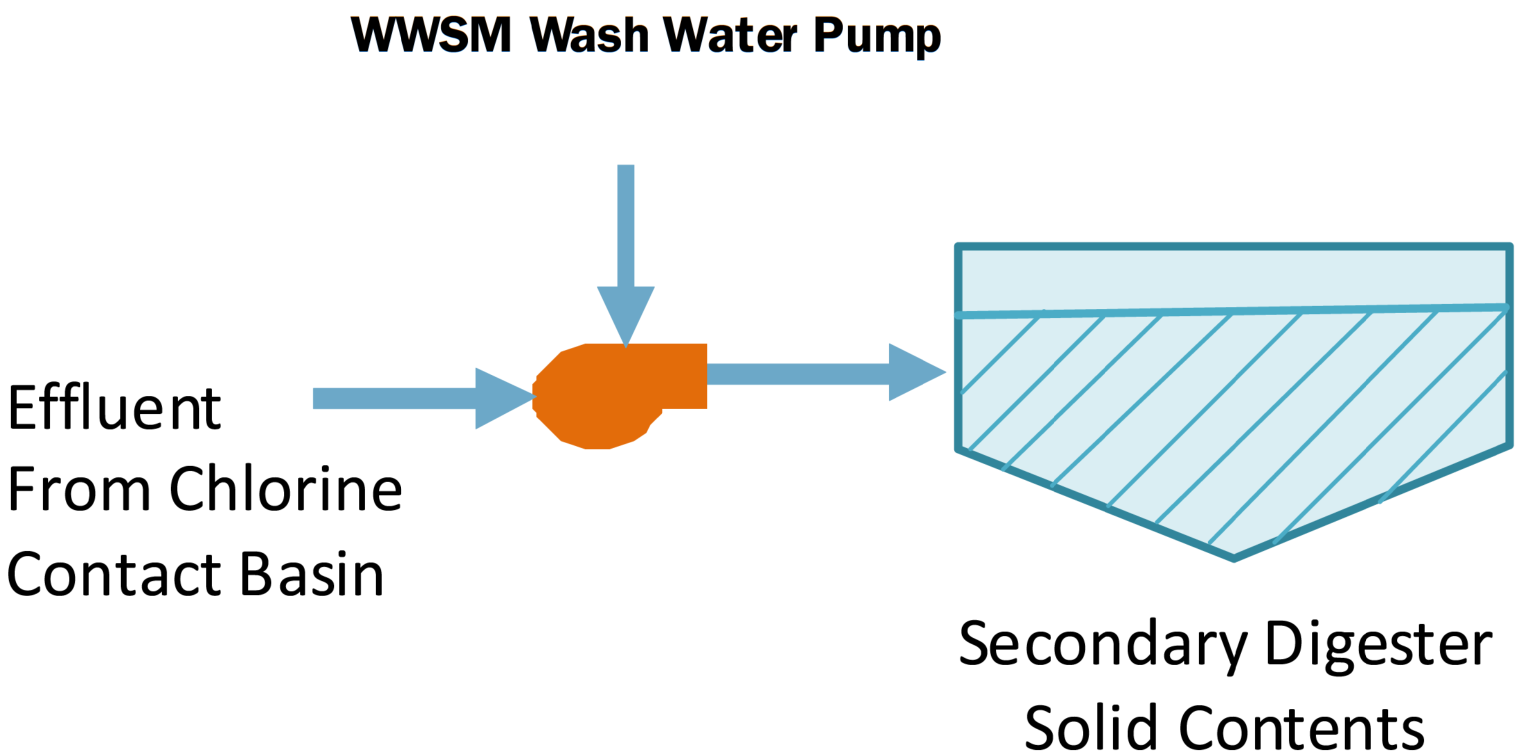


Exhibit 5

Diagram of Fluidized Contents Pumped and Screened

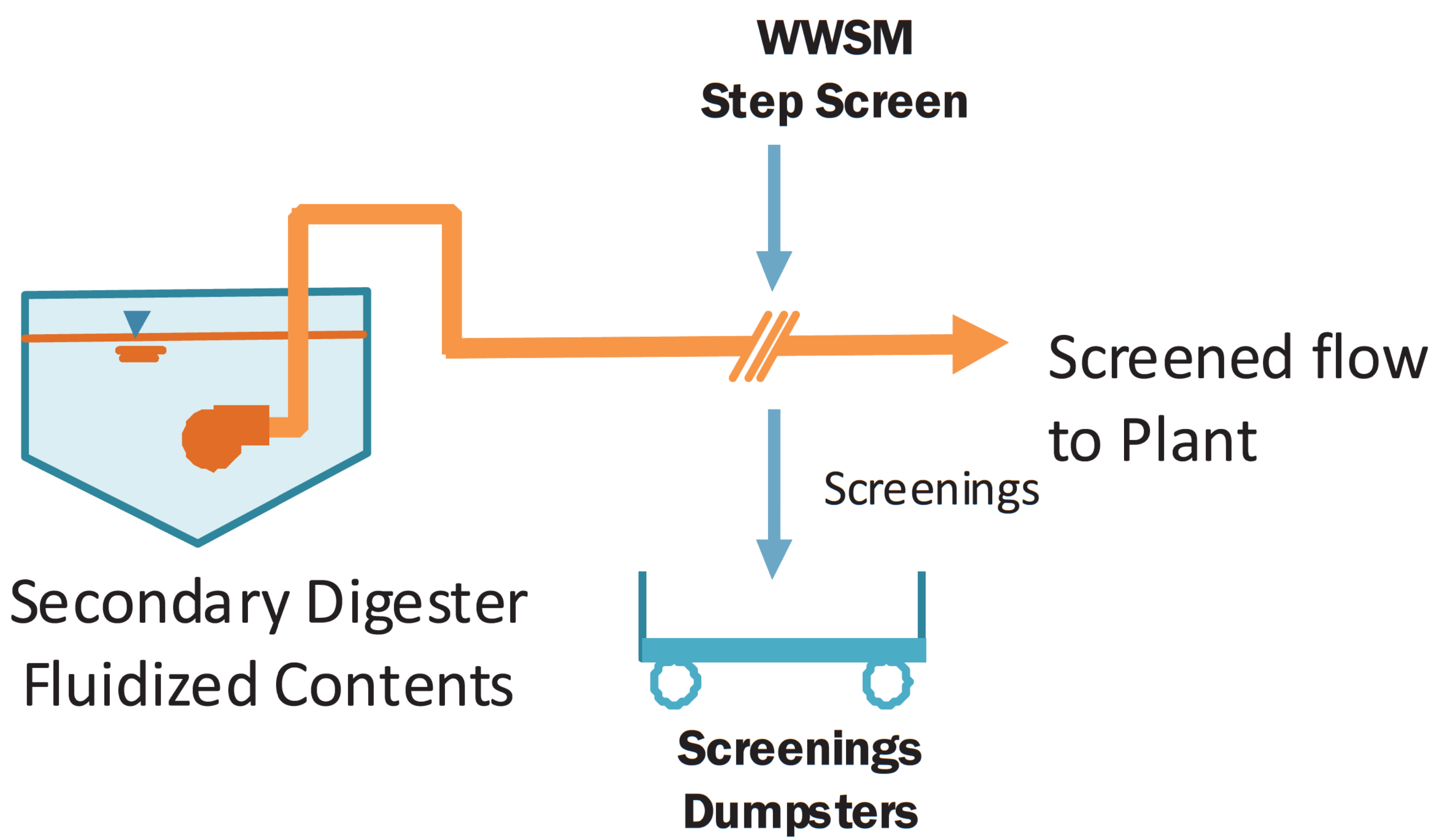


Exhibit 6

Photographs of Screenings Being Deposited in Dumpsters that were Hauled to Landfill During the March 2007 Digester Cleaning

Exhibit 7

Chart of Influent Samples Showing that Only Inert Suspended Solids Were Sent Back To the Treatment Plant Headworks

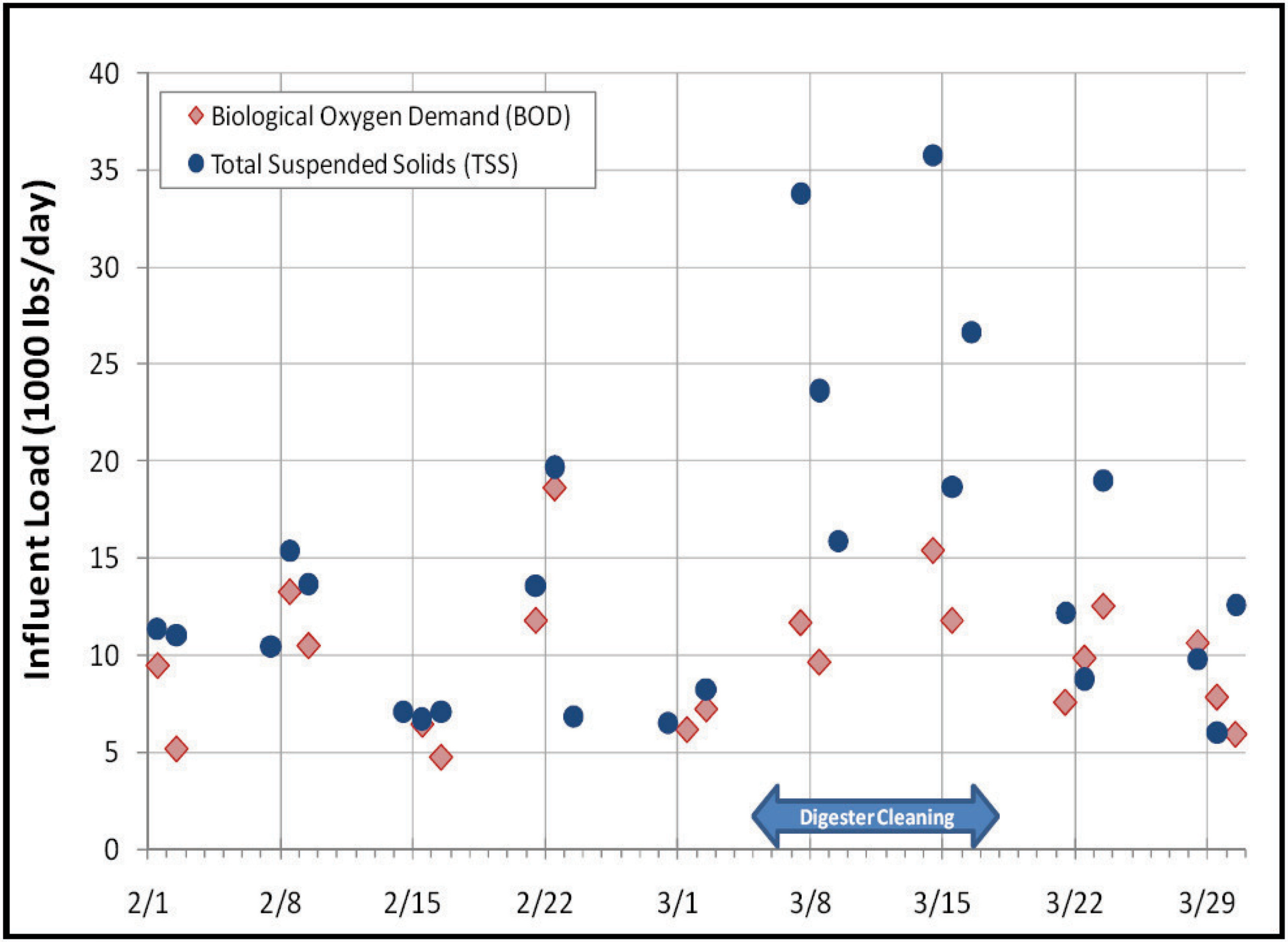


Exhibit 8 a, b, and c

Diagram Showing Primary Digester Functioning Properly

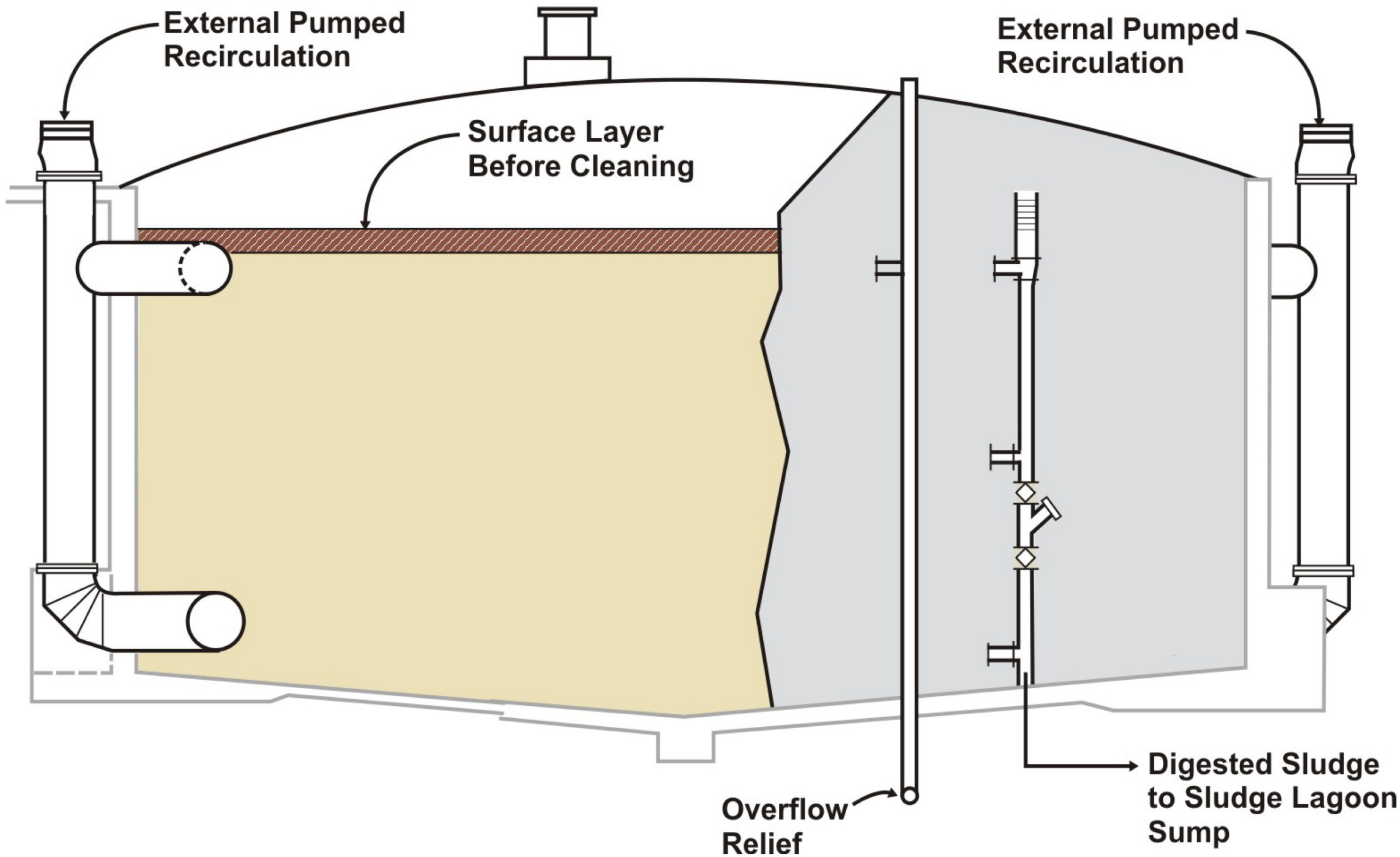


Diagram Showing Expansion of Floating Surface Layer During Digester Cleaning

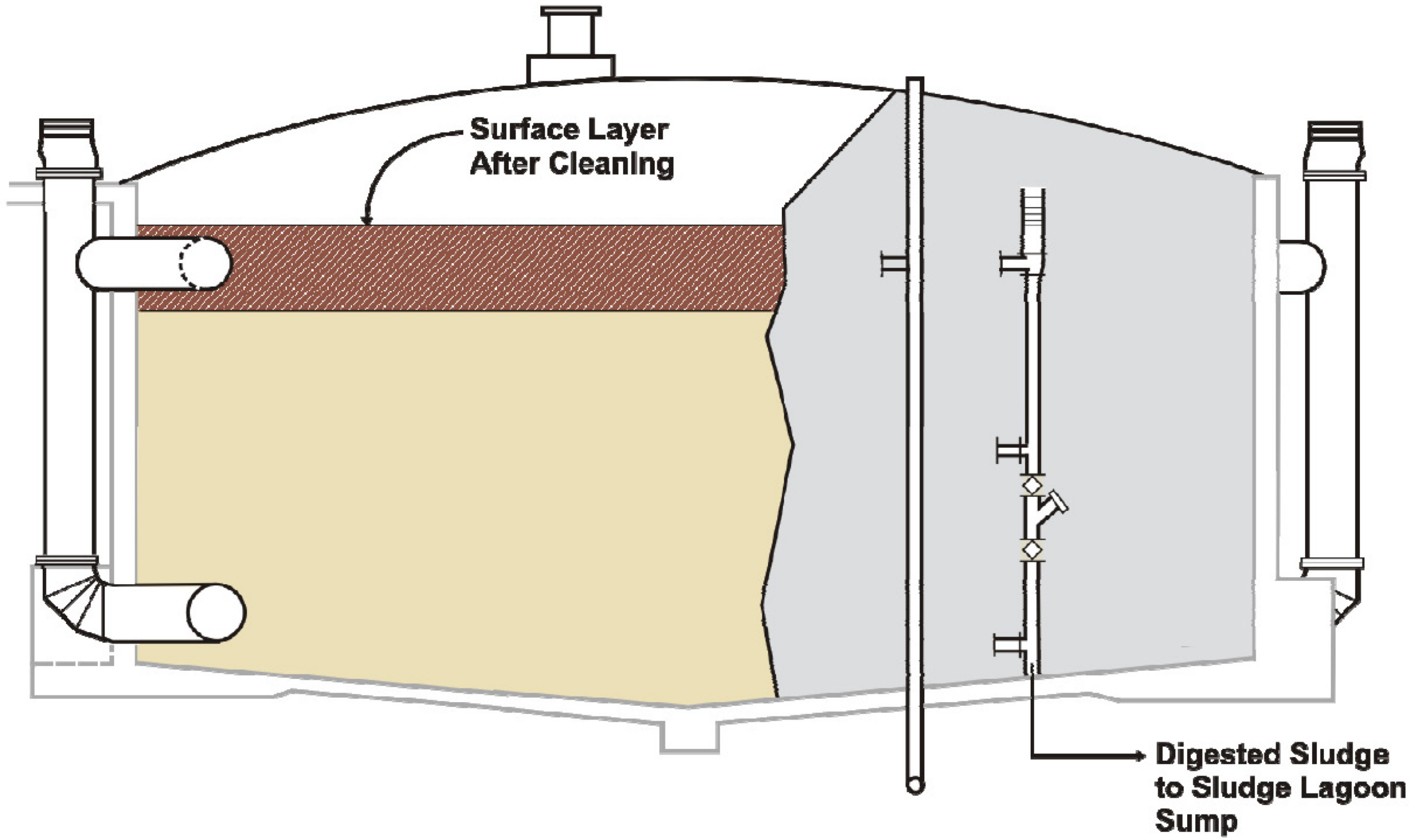


Diagram Showing Conveyance of Rag Residues from the Digester after Expansion of the Surface Layer

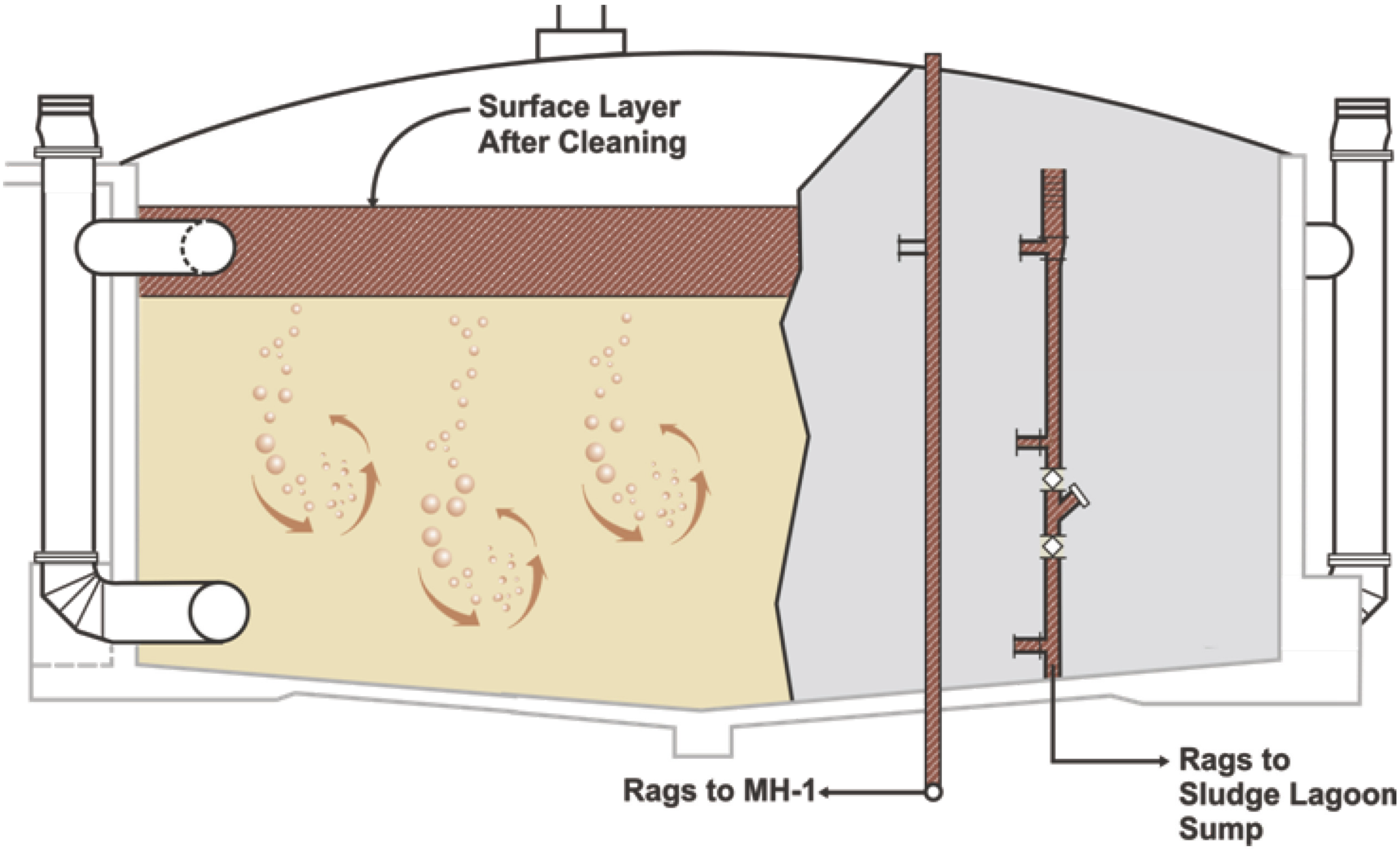


Exhibit 9

Photograph Taken of the Chlorine Contact Basin
During the March 2007 Digester Event

Exhibit 10

Photograph Taken of the Effluent Storage Pond During the March 2007 Digester Event

Exhibit 11

Photograph of Chlorine Contact Basin (with Water Line Stain) and Effluent Storage Pond (with Effluent Pumps) Showing that Flow from Basin and Pond is Subsurface

Exhibit 12

Photographs of Effluent Storage Pond Sampled on September 25, 2009 and Beaker of Water from Sample Spigot on Same Day

Exhibit 13

Photographs of Chlorine Contact Basin Sampled on October 15, 2009 and Beaker of Water from Sample Spigot on Same Day

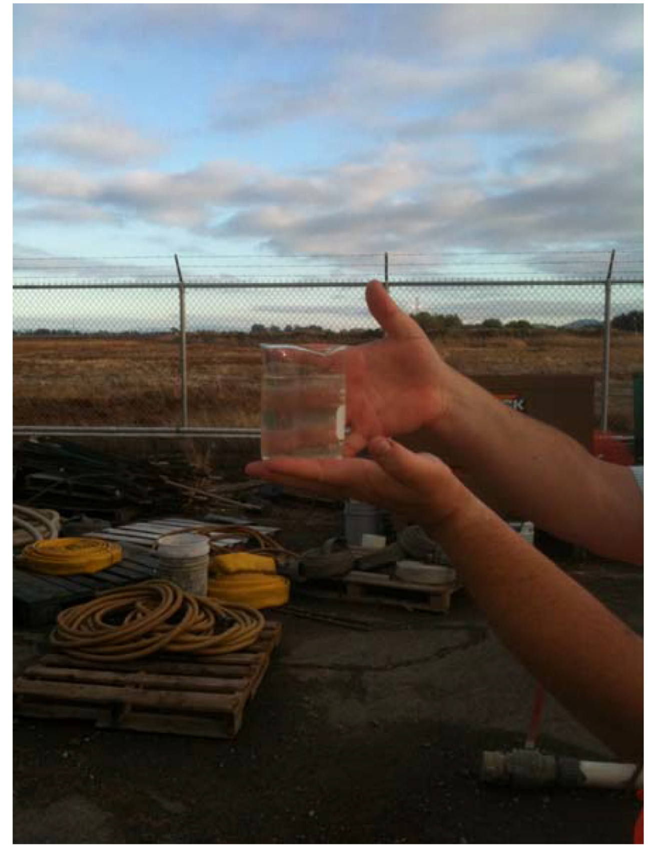


Exhibit 14

Table of Effluent Sampling Data for TSS During March 2007 Digester Event

Table 2. Measured TSS Values on Days Monitored during Digester Cleaning and Response to Plant Impacts

Date in 2007	TSS Discharge			TSS Permit Limit
	mg/l	kg/d	Weekly Avg. (mg/l)	Weekly Avg. (mg/l)
Wed., Mar. 14	20.0	312.0	43.6	45.0
Thurs., Mar. 15	46.7	770.0		
Fri., Mar. 16	64.0	975.0		
Wed., Mar. 21	55.0	807.0	33.6	45.0
Thurs., Mar. 22	19.5	277.0		
Fri., Mar. 23	26.4	416.0		

Exhibit 15 a and b

Table of Bacterial Sampling Data During March 2007 Digester Event

Table 3. Bacterial Sampling during Discharge to the Bay		
Date in 2007	Enterococcus Result	Enterococcus Permit Limit
Mon., Mar. 12	4.1	<276MPN/100mL
Tues., Mar. 13	5.2	<276MPN/100mL
Thurs., Mar. 15	5.2	<276MPN/100mL

Table of Bacterial Sampling Data During Discharge to Reclamation Ponds During March 2007 Digester Event

Table 4. Bacterial Sampling during Discharge to the Reclamation Ponds

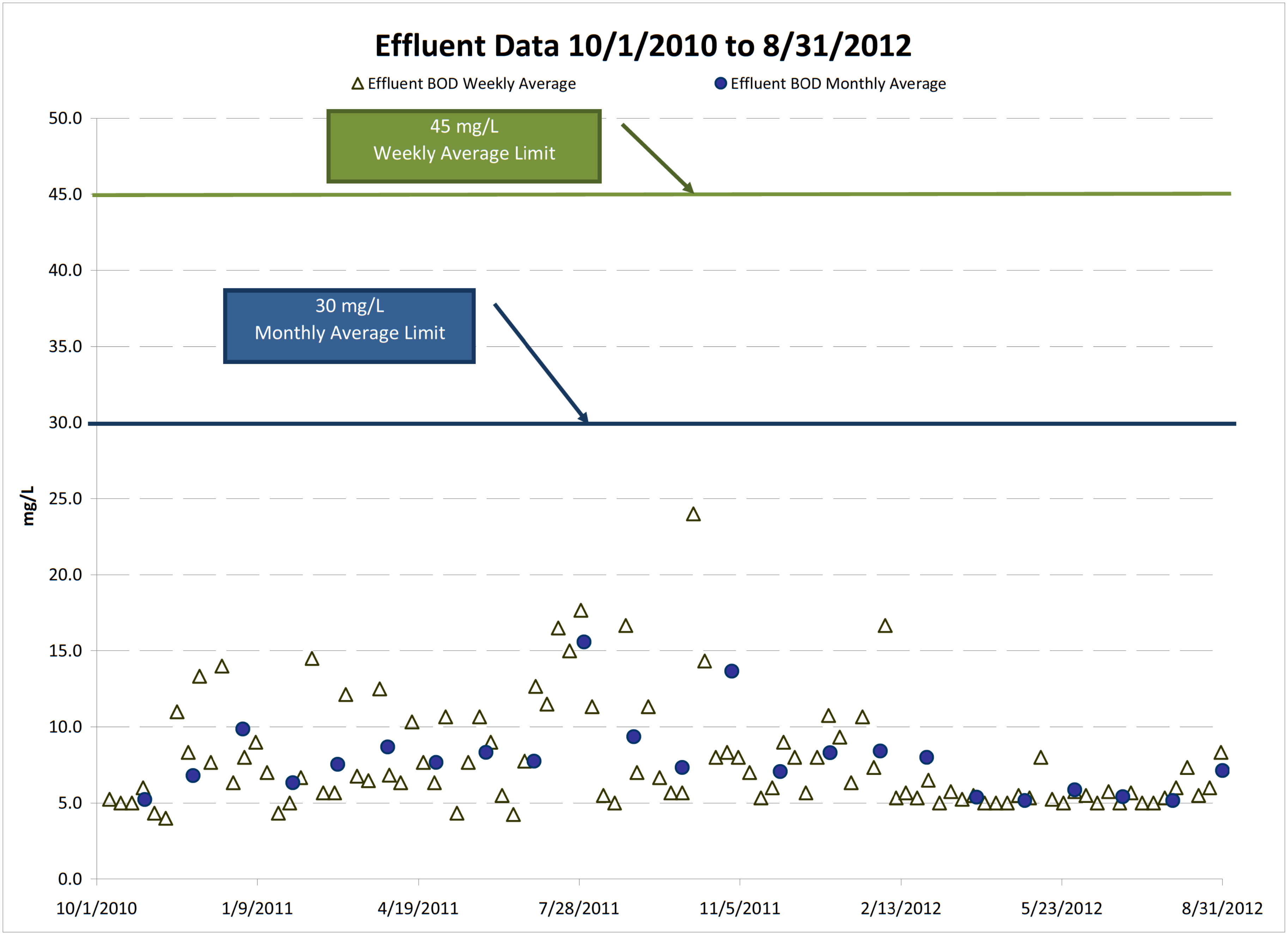
Date in 2007	Coliform Result	Coliform Permit Limit
Wed., Mar. 21	9,200	<10,000 MPN/100mL
Thurs., Mar. 22	54,000	<10,000 MPN/100mL
Fri., Mar. 23	3,500	<10,000 MPN/100mL

Exhibit 16

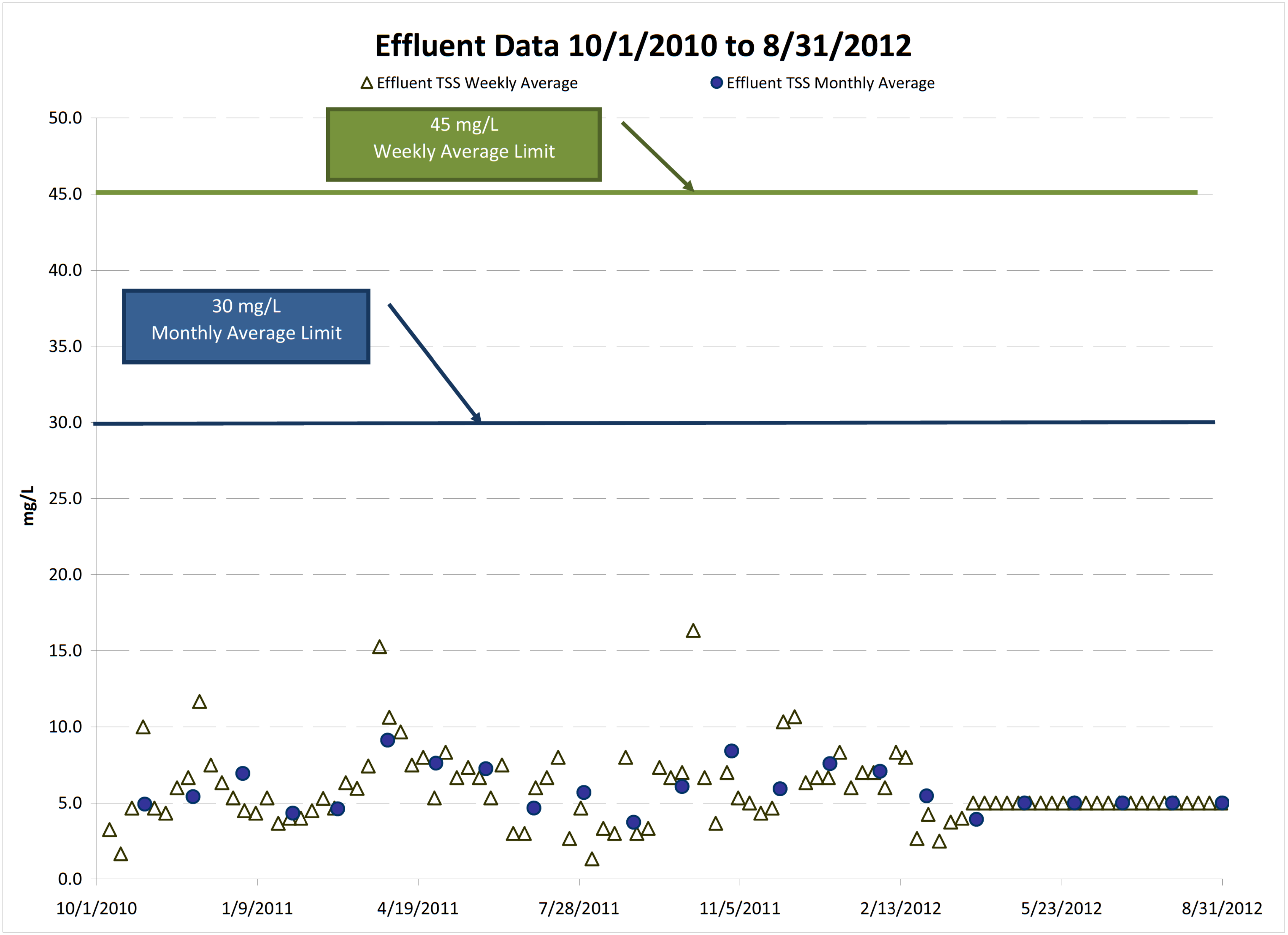
Aerial Photograph of New NSD Plant

Exhibit 17

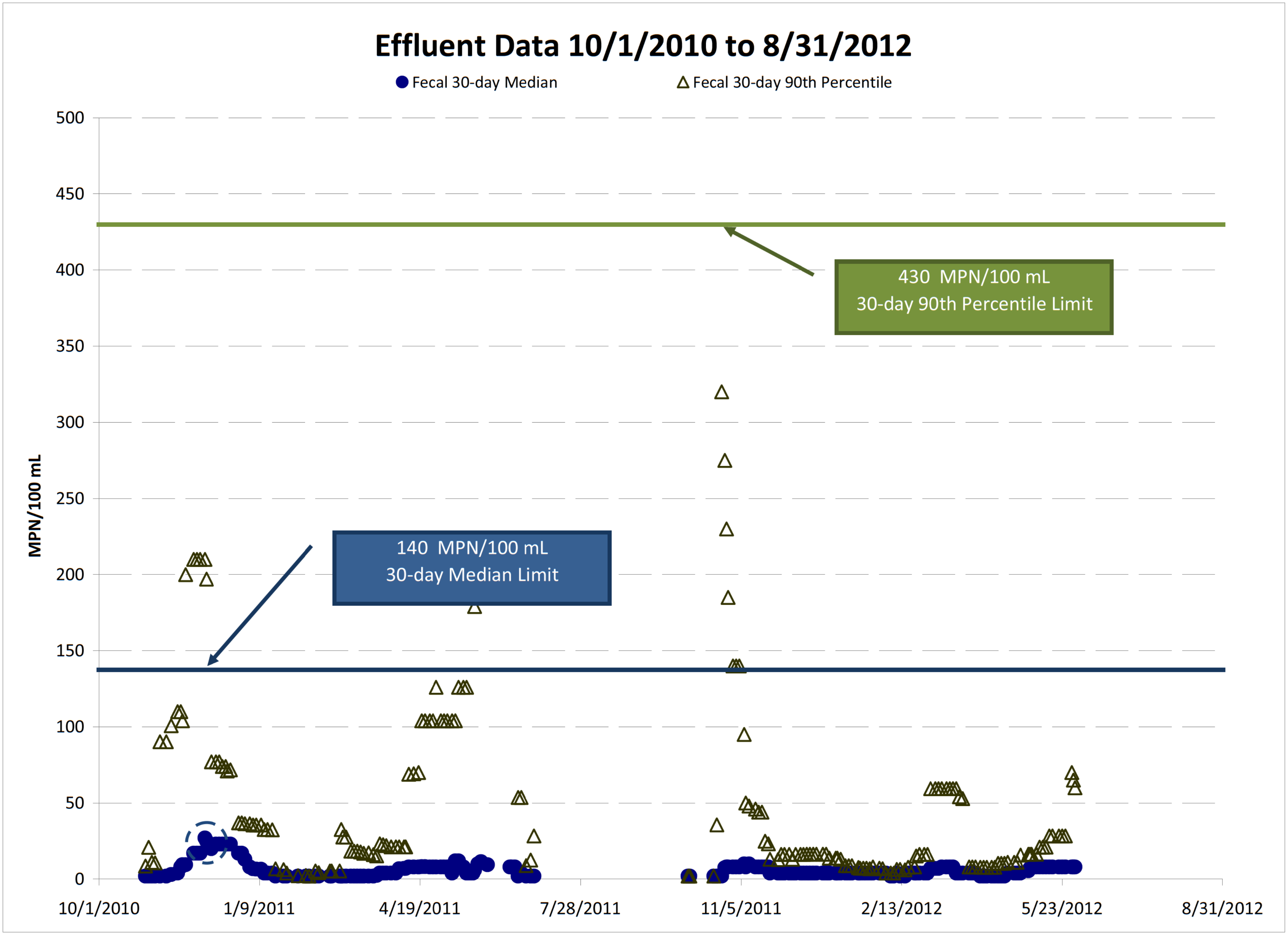
BOD Performance is Below Permit Limits
October 2010 - August 2012



TSS Performance is Below Permit Limits
October 2010 - August 2012



Fecal Coliform Performance is Below Permit Limits
October 2010 - August 2012



Enterococcus Performance is Below Permit Limits
October 2010 - August 2012