Sausalito – Marin City Sanitary District (NPDES No. CA 0038067)
Wastewater Treatment Plant Inspection
US EPA and San Francisco Regional Water Quality Control Board
Date of Inspection: Wednesday, March 21, 2007

Inspection team: JoAnn Cola, EPA
Andrew Sallach, EPA
Myriam Zech, Regional Water Quality Control Board

Facility representative: Robert Simmons, General Manager, Sausalito-Marin City Sanitary District

Report prepared by: JoAnn Cola   Date prepared: 5/31/07

Plant Location. The Sausalito-Marin City Sanitation District's Wastewater Treatment Plant is located at 1 Fort Baker Road in Sausalito, California. (Fig. 1) The WWTP was constructed on a hillside over San Francisco Bay, a few miles north of the Golden Gate Bridge. The plant is constructed on a National Park Service easement, with an agreement to treat NPS influent in exchange. The WWTP discharges to San Francisco Bay under the authority of NPDES Permit No. CA0038067.

The inspection started at 10:10 AM. We met with Robert Simmons in the office, showed credentials, exchanged business cards, and briefly discussed the purpose of the inspection.

The plant has experienced numerous exceedances of effluent limits for suspended and settleable solids over the past several years. We asked Mr. Simmons about these violations of the NPDES permit. He responded that the violations began approximately 2 years ago and that the District has begun to address the problems.

Current Upgrade Plans. The District hired CH2M Hill to perform an operational audit, which was completed in March 2006. Hill's audit report identified three possible causes for poor settling of the wastewater: The report identified Inflow & Infiltration (I/I) to the collection system as a primary cause of the exceedances. CH2M Hill considered the possibility of the high TDS bay water infiltration correlating to plant upsets, and that chlorides in the WWTP influent seemed to increase with high tides. The report also pointed out the poor quality of the recycle streams and the poor functioning of the Fixed Film Reactor distributors ("FFRs").

CH2M Hill recommended chemical enhancement of primary treatment, motorized distributors for the FFRs, screw press for solids treatment, microturbine for cogeneration, and improvements to the Gate 5 pump station as "Tier I" improvements, which the District expects will resolve the effluent limitation exceedances.

Tier I of the improvements will include chemical enhancement using ferric and polymer although Bob Simmons indicated that the District's initial tests were unsuccessful in improving solids settling. The Gate 5 Pump Station, a City of Sausalito pump station, which experiences I/I as a result of the tides raising the groundwater table higher than the level of the collection system, will have variable frequency drives installed. The variable frequency drives would operate the pumps more efficiently by reducing on/off cycling. These have been purchased by the City of Sausalito. CH2M Hill also hopes that the improvements will eliminate the supernatant waste stream from the sludge digester – eliminating one source of the poor quality recycle streams.

The District began design of the "Tier 1" improvements during summer 2006, with a 90% design submittal due during the week of March 18, 2007. The project has been broken up by the District to expedite construction. To further expedite construction, the District is pre-purchasing the long lead time items, such as a new digester mixing system, distributors, macerators, and pumps. Construction is expected to be complete in early Fall 2007.

CH2M Hill also made "Tier 2" recommendations in the event the "Tier 1" improvements do not meet the operational goals of the District. Tier 2 improvements include adding 3.5 MGD package headworks units, as well as adding aerated/mechanical flocculation, secondary polymer system, and a rotary drum thickener.

CH2M Hill's report also suggests that improvements addressing I//I may also reduce or eliminate blending that now occurs approximately 7 times per year. When flows exceed the 6 mgd capacity of the FFRs the operators are required to bypass the excess flows around the FFRs. The suggestion to reduce I/I was not included in either Tier I or Tier II improvements.

WWTP Description. The plant was constructed in 1953 with a design capacity of 1.8 million gallons per day (MGD). The plant was last upgraded in 1987. Wet weather design capacity is 5.5 MGD. Average flow is currently 1.4 MGD. Average dry weather diurnal flow ranges from .5 MGD during the night to an instantaneous peak of approximately 2.5 MGD peak during the day. Mr. Simmons said that instantaneous peak wet weather flows reach 12 MGD.

Influent to the WWTP is contributed from four satellite collection systems: National Park Service, Tamalpais Community Services District (TCSD), Marin City, and the City of Sausalito. National Park Service (NPS) flow comes from Ft. Baker. NPS owns and operates its own collection system. The City of Sausalito owns and operates its own collection system, but operation and maintenance of its pump stations is contracted to SMCSD. SMCSD owns and operates the collection system in Marin City, while the TCSD owns and operates the collection system in the unincorporated part of Marin County known as Tamalpais Valley. When asked about satellite systems' contributions to influent, Mr. Simmons found the following figures for the dwelling equivalents attributable to each satellite system. Based on the dwelling equivalents, the flow contributions from each system are calculated as:

Satellite System Name	% Flow Contrib.	Dwelling Equivalents	Operation & Maintenance
National Park Service	2	254	NPS
Tamalpais Community Services District	33	4327	TCSD
Sausalito-Marin City	18	2402	SMCSD
Sausalito	47	6300	City; SMCSD operates pump stations under contract

SMCSD has no agreements with its subscriber (satellite) agencies limiting flow into the plant.

The influent flow enters the WWTP from the Main Street and Fort Baker sewers to an energy dissipation box. Flow enters the primary clarifier, and then flow is split between the two Fixed Film Reactors. Effluent from the FFRs enters one of two secondary clarifiers, and the flow is split between five sand filters. Following sand filtration, the effluent flow is chlorinated, dechlorinated, and finally discharged to San Francisco Bay.

From the primary clarifier, primary sludge is sent through a grit removal screen prior to entering a sludge thickening tank. The thickened primary sludge is mixed with secondary sludge and then this enters the digester. Solids from the digester pass through the belt press and the dewatered solids are trucked to Redwood Landfill. Thickener tank supernatant and belt press filtrate are returned to the primary clarifier.

WWTP Observations. Plant tour began at 11:00 AM. The WWTP is unusual in that it is constructed vertically on a hillside. The plant footprint is minimal with treatment units stacked one on top of the other. The lack of space does not allow for standby and spare equipment, and equipment must be taken off-line in order to perform maintenance and repair work.

Many of the plant staff are long-time employees, with at least two of its operators having more than 15 years on the job. The District's operators have State certifications, with one Grade V, Grade III, and Grade I operators. Bob Simmons said that the District is anticipating upcoming retirements and so plans to hire and train new staff. Cross-training is encouraged by the District.

Influent flow is measured at each of the two pump stations (Main St. and NPS) and enters the plant at an energy dissipation box (Fig. 2). Influent sampling occurs at the Main St. pump station, from which 97% of flow enters. The remaining 3% of the influent flow enters from Ft. Baker (NPS). The total influent flow metering capacity at the two pump stations, according to the CH2M Hill report, is 10.4 MGD. The inspection team was told that the instantaneous wet weather flow probably exceeds this. This may mean that SMCSD does not accurately measure influent flow rates when wet weather peaks exceed 10.4 MGD.

One of the most remarkable features of this plant is the absence of a headworks. Influent flow is not screened prior to entering the primary clarifier. Without a headworks, debris enters the primary clarifier, reducing its efficiency. In addition, the debris appears to be carried on to the Fixed Film Reactors, effectively reducing the efficiency of the secondary treatment.

Flow from the energy dissipation box enters the primary clarifier (Fig. 3), along with plant return flows. The primary clarifier weir is covered and the covers must be removed prior to cleaning or maintenance of the weirs, which seems to significantly add to the complexity of routine maintenance. Without preliminary screening, the need for cleaning and routine maintenance would seem to be increased. Mr. Simmons did not recall how frequently the clarifier was maintained. Because there is only one primary clarifier, it must be taken off-line to perform certain routine maintenance procedures. During such procedures, primary clarification is bypassed, routing the flow to one of the secondary clarifiers, which serves temporarily as primary clarification. When this occurs, capacity of secondary clarification is reduced, which could adversely affect removal of BOD and TSS.

Primary clarifier effluent is normally passed through a grit screen, but capacity is limited and the screen is bypassed at higher flows. Primary clarifier effluent not passing through the grit screen would enter the FFRs containing an excess amount of debris, potentially clogging the FFRs. Primary clarifier effluent enters one of two fixed film reactors (FFRs), which operate in parallel and can handle a total of up to 6 MGD. When 6 MGD capacity of the FFRs is exceeded, the excess flow bypasses the FFRs. According to Bob Simmons, this occurs approximately 7 times per year. FFRs operate in counter-current mode. Distributors spray primary clarifier effluent in at the top of the reactor, while air is blown upward from the bottom. The FFRs are not covered. Mr. Simmons said it was suggested to the District by CH2M Hill that co-current operation with both water and air entering from the top of the unit may result in improved odor control. Inspectors noted significant debris on the screen at the top of each fixed film reactor, which was likely due to the absence of a headworks to provide preliminary screening. Such a layer of debris could cause poor performance of the reactor.

Debris clogged a number of distributor nozzles, and the end cap on a distributor arm of FFR #1 appeared to be broken (Fig. 5). The distributor arm on FFR #1 appeared to rotate slower than the distributor on FFR #2. FFR #2 appeared to have more evenly distributed flow. Uneven distribution of flow across the FFRs would likely cause a number of operational problems, including "short-circuiting" of flow through the reactors, uneven flushing of the biomass, and reduced secondary treatment efficiency. According to the CH2M Hill report, distributor arm speed is controlled only by flow to the arm – the more flow, the faster the distributor arm is propelled.

The hydraulic rotary distributors on the fixed film reactors are now 20 years old. According to Mr. Simmons, they presently rotate at 8 revolutions per minute. CH2M Hill recommends slowing to one revolution per 8 minutes to increase flushing of the biomass, as continual shearing of the biomass should improve the settling. A variable speed motorized distributor has been purchased.

Because both FFRs are required to operate simultaneously without a standby unit, maintenance can only occur when at least one tower can be removed from service. When this occurs, secondary treatment capability of the WWTP is reduced. To avoid bypassing secondary treatment at the FFRs, flow would have to be less than 3 MGD.

FFR effluent passes through the two rectangular secondary clarifiers located underneath the FFRs. This arrangement would seem to be somewhat difficult to maintain. Maintenance requirements would be increased if flow is bypassing the primary clarifier (e.g., during repair or maintenance of the primary clarifier) because the lack of preliminary screening would deposit an unusually large amount of debris in the secondary clarifier.

Effluent from the secondary clarifiers is then passed through sand filters (Fig. 6) for additional removal of suspended solids. The sand filters are limited to 1.5 MGD. Flow over 1.5 MGD bypasses the sand filters. This would occur during peak diurnal flow periods. The purpose of the sand filters is to remove suspended solids remaining after secondary treatment. When flow bypasses these units, more suspended solids remain in the final effluent. The sand filters are self-cleaning and the filter backwash is returned to the primary clarifier.

The effluent from the sand filters passes through a rotating screen (Fig. 7) and from there to the chlorine contact chamber which is also located underneath the FFRs (Fig. 9).

The outfall is located beneath the FFRs (Fig. 10), and is not visible unless tide is low. Discharge occurs 300 feet from the facility into San Francisco Bay.

Solids removed from the primary clarifier are screened for grit (Fig. 11) prior to entering the sludge thickening tank (Fig. 12). The thickened sludge enters the digester, located under the primary clarifier (Fig. 13). The digester is 14 feet deep, with most of it below the level of the Bay. Supernatant from the digester is returned to the primary clarifier. Dewatered biosolids are sent to the Redwood Landfill.

Primary and secondary sludge is thickened prior to entering the digesters. The sludge in the gravity thickeners does not settle well, which results in high solids levels in waste streams generated by the sludge processes. These include overflow from the thickeners and sludge belt press filtrate. According to CH2M Hill's audit report, SMCSD must "get control" of its recycle streams to improve settling of solids. Currently the thickener overflow and belt press filtrate are routed to the primary clarifier. CH2M Hill's recommendation is to route these streams to the influent channel and treat the total influent with chemical addition.

The inspectors entered the laboratory area and met with lab director Omar Arias. The lab takes influent, effluent, and process control samples and conducts analyses. Mr. Arias said that the on-site lab processes BOD, TSS, enterococcus and coliform, DO, and pH. The current permit, as amended, requires enterococcus analysis. They plan to switch to coliform under the new permit. Laboratory data sheets and calibration sheets are maintained in the lab. Mr. Arias transfers raw data to a spreadsheet which calculates averages. Effluent samples are flow-proportioned to an ultrasonic level detector flow measuring device.

The inspection team visited Gate 5 pump station (Fig. 14) and Locust St. pump station. Much of the collection system that is tributary to the Gate 5 pump station is below the groundwater table during high tides, which causes I/I problems at the pump station. The pump station itself, although below ground surface, does not become submerged during high tides.

The inspection team returned to the office. Mr. Simmons said that a comprehensive I/I study which will take into account both the collection system and WWTP is being contracted by the District and will be completed by early summer.

Mr. Simmons gave us electronic copies of the CH2M Hill Operational Audit and schematic diagrams of the plant. We requested a schedule and budget for the Tier I projects, and Mr. Simmons sent both by e-mail the week following the inspection.

Following up on the conclusions of the December 2006 TetraTech inspection report, the inspection team asked Mr. Simmons about quality control for entering lab data to the spreadsheet and then to the DMR. Mr. Simmons said that he reviews the spreadsheets and DMRs to make sure the values on both are the same, but does not compare them to the raw data. Mr. Arias said that problems transcribing data from lab sheets to DMRs that occurred during October 2006 occurred because the lab was running a sample for CCCSD and transcribed this data to the spreadsheet as though the sample were SMCSD's. He did not discover the error until after the DMR was submitted. He now highlights "other" samples and began a log book of influent sample collection times, and the times the samples are received in the lab.

All Phase I improvements are to be completed by early fall 2007. Mr. Simmons anticipates it will take 6 months to return to permit compliance. He expects to achieve TSS of 23 mg/l to give a margin of safety. According to Mr. Simmons, if Phase I does not accomplish this level of improvement, Phase II improvements will be considered for implementation.

Inspection ended at 3:05 PM.

Figure 1: Aerial view showing the location of SMCSD WWTP in Sausalito, California.

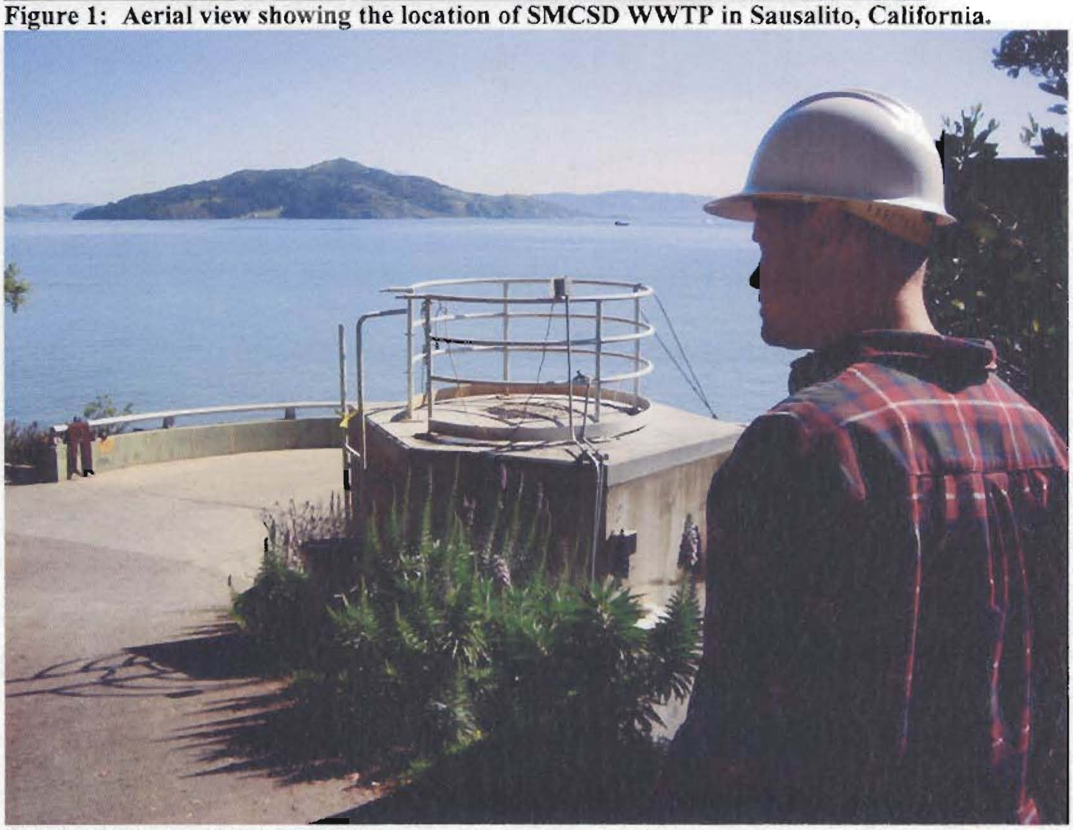


Figure 2: Energy dissipation box


Figure 3: Primary clarifier. Note covered weir.


Figure 4: FFR #2. Note extensive debris on screen and debris-clogged nozzles.

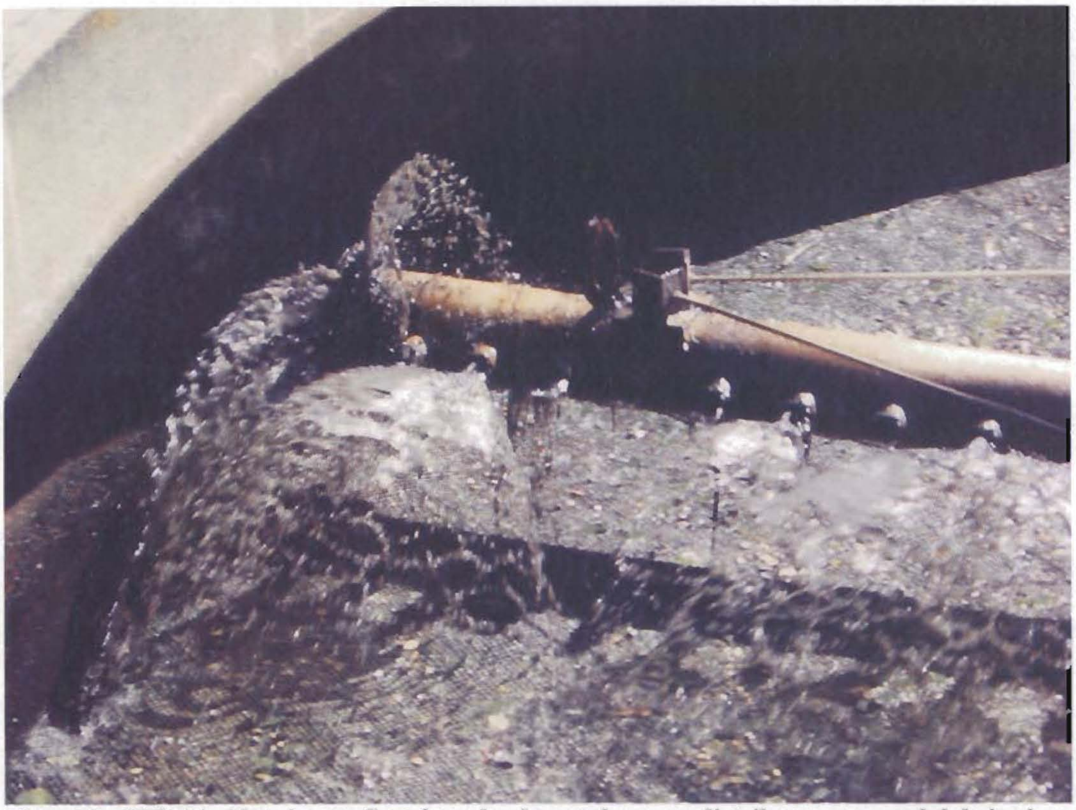


Figure 5: FFR #1. Note heavy flow from broken end cap on distributor arm and debris-clogged nozzles.

Figure 6: Sand filters. Photo taken from top of FFRs.

Figure 7: Secondary effluent passes through rotating screen.

Figure 8: "Water Champ" chlorination point.

Figure 9: Chlorination chamber beneath FFRs.

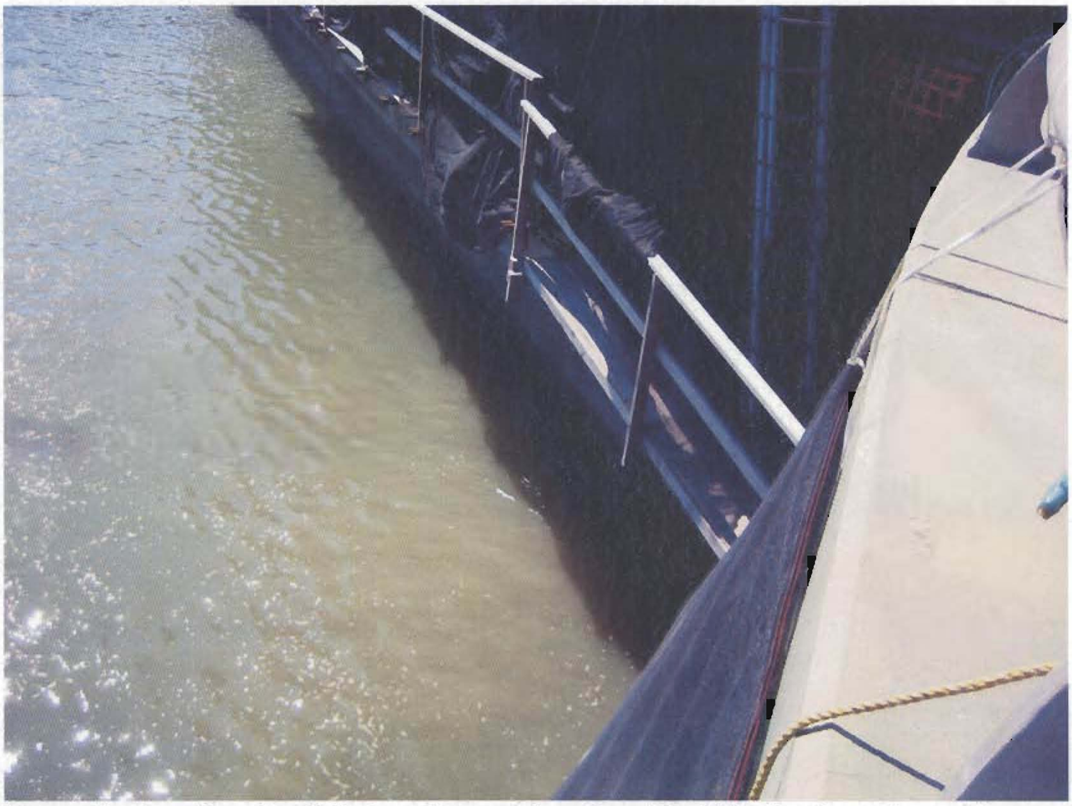


Figure 10: Location of outfall pipe. Note patches of small bubbles floating at bay surface next to plant, which were visible along the shore adjacent to the plant. Cause of bubbles is unknown.

Figure 11: Grit removal at primary clarifier.

Figure 12: Gravity thickener tank.

Figure 13: Digester located beneath primary clarifier.

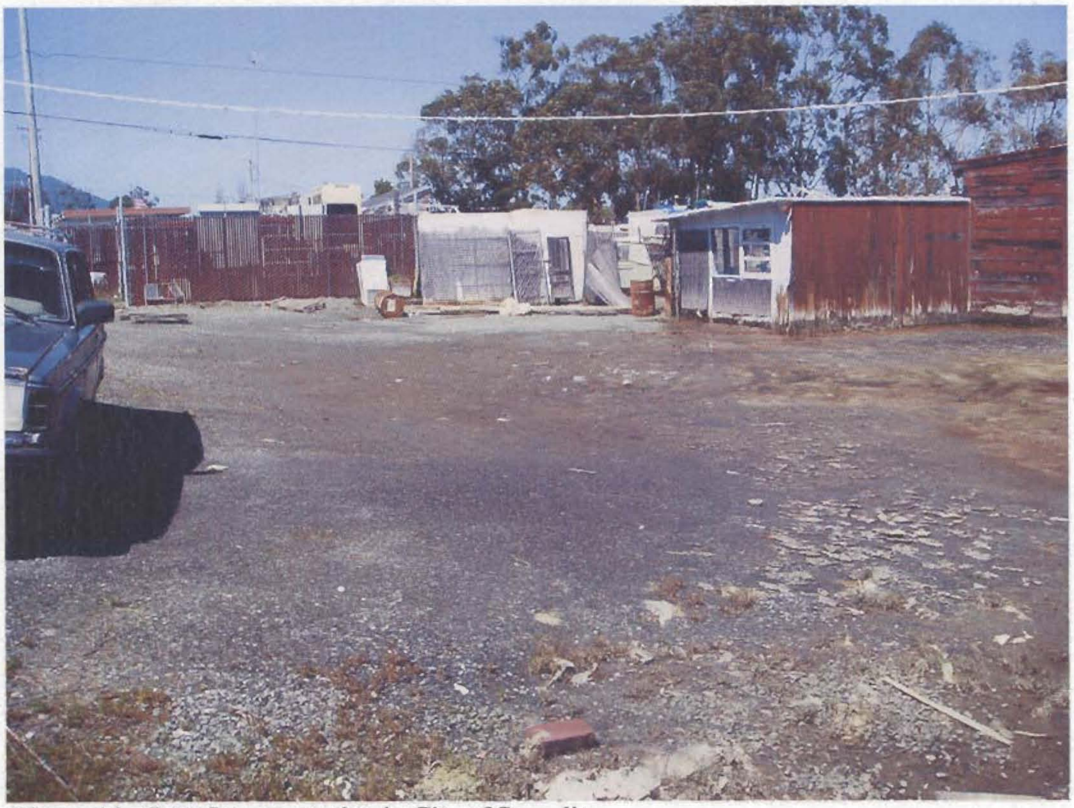
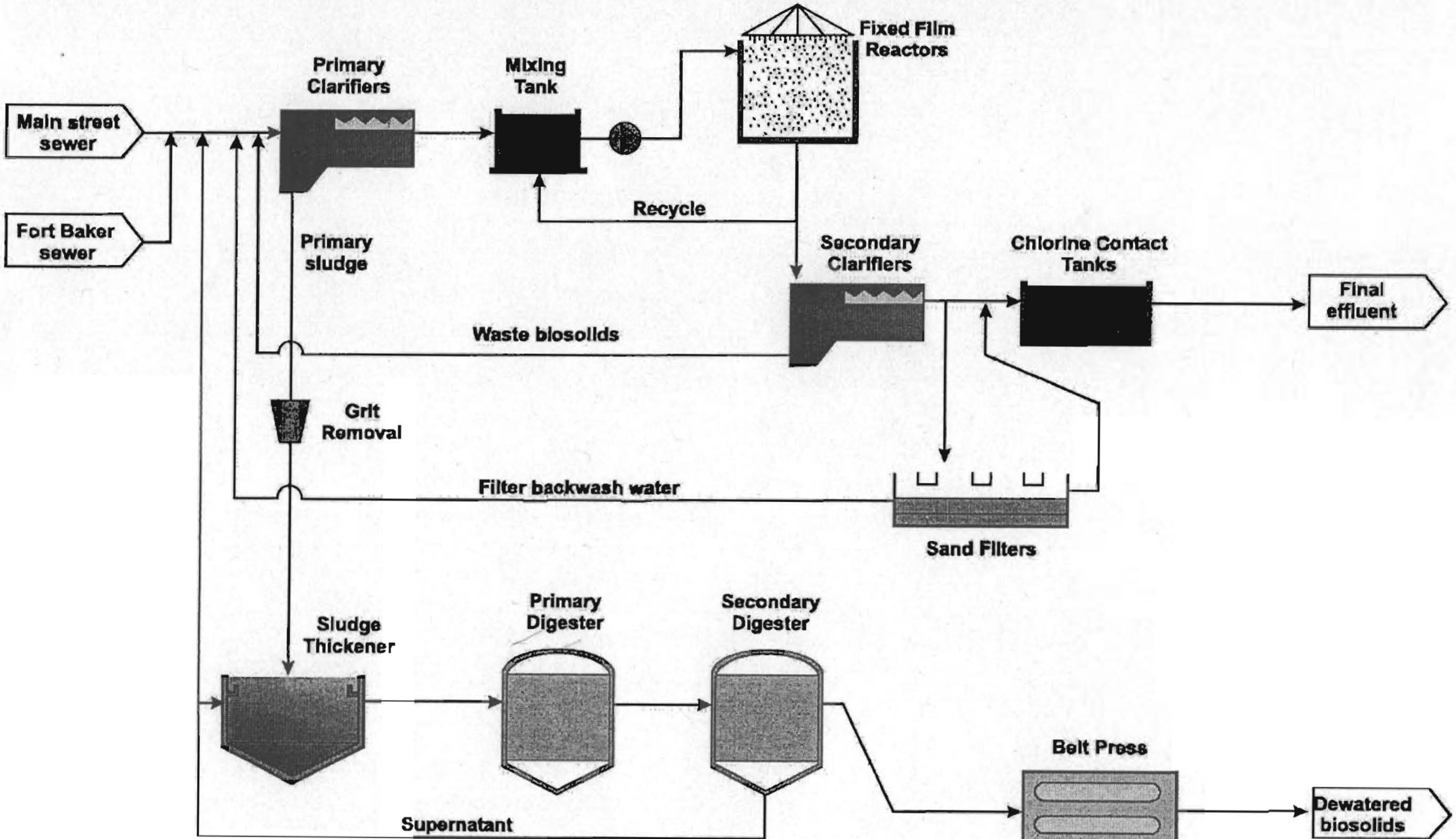


Figure 14: Gate 5 pump station in City of Sausalito.

Wastewater Treatment Process Schematic Diagram



Sausalito-Marin City Sanitary District
Plant Improvement Project
March 30, 2007

The budgetary cost of the Plant Improvement Project is presented in the attached table. Included is the budget for design, construction, construction management and start-up and testing:

Item No.	Project Element	Budgetary Cost Estimate ($)
1	New Digester Mixing System	$300,000
3.	Sludge Handling Upgrades	$140,000
2.	Fixed Film Reactor Distributors	$320,000
3.	Ferric Chloride and Polymer Storage and Dosing Facilities	$150,000
4.	Recycle Stream Pump Station Improvements	$75,000
5.	Engineering Design	$250,000
6.	Construction Management	$100,000
7.	Start-up and Operational Testing	$50,000
8.	Contingency at 15%	$135,000
	Total	$1,520,000

Project Schedule

The 90% design submittal for the Plant Improvement Project was received during the week of March 26, 2007. The preliminary schedule for the completion of the design documents, bidding, construction and start-up calls for a completion date by December 2007. A breakdown of the schedule is as follows:

	Project Element	Estimated Completion Date
1	New Digester Mixing System	July 1, 2007
2	Sludge Handling Upgrades	July 1, 2007
3	Fixed Film Reactor Distributors	Aug 15, 2007
4	Ferric Chloride and Polymer Storage and dosing Facilities	Sept. 15, 2007
5	Recycle Stream Pump Station improvements	Sept 15, 2007
6	Start-up and Operational Testing	October and November, 2007
7	Project Completion	December, 2007

Photo Log from 3/21/07 Sausalito Marin City Sanitary District Inspection

IMG_0766	Energy dissipation box
IMG_0767	Primary clarifier, showing name of WWTP
IMG_0768	Primary clarifier and exterior top of digester. Plant is "stacked" down hill.
IMG_0769	Primary effluent screener
IMG_0770	Primary clarifier
IMG_0771	Primary clarifier
IMG_0772	Primary clarifier. Note covered weirs requiring additional work to service. Note material piled along rail.
IMG_0773	Fixed film reactor #2
IMG_0774	Fixed film reactor #2; note small bubbles on surface of bay below.
IMG_0775	Fixed film reactor #1; note condition of distributor, several nozzles are plugged, large amount of debris at nozzles and on surface of screen
IMG_0776	Sand filters from top of FFRs showing height of towers
IMG_0777	Sand filters used for polishing secondary effluent
IMG_0778	Rotating screen for secondary effluent
IMG_0779	Location of "Water Champ" chlorination point
IMG_0780	FFRs showing size of reactors
IMG_0781	Odor control scrubbers next to FFRs
IMG_0782	Chlorine contact chamber, below odor control scrubbers
IMG_0783	Location of outfall; note bubbles on surface of bay. Outfall not visible except at low tide.
IMG_0784	Effluent sampling pump, just upstream from outfall at dechlorination.

P3210006	Primary Clarifier with belt press and secondary clarifier return solids flowing in
P3210007	Primary clarifier, solid floating
P3210008	Gravity thickener
P3210009	Primary clarifier
P3210010	Biofilter 1, note heavy flow from inner most nozzle, no flow in 2nd
P3210011	Biofilter 1, note no flow from inner 3 nozzles
P3210012	Biofilter 1, note the cap end the end of the arm is broken, heavy flow from end
P3210013	Biofilter 1, note the cap end the end of the arm is broken, heavy flow from end
P3210014	Biofilter 2, a more even flow than from biofilter 1
P3210015	Biofilter 2
P3210016	Biofilter 2 overview
P3210017	Biofilter 2
P3210018	Sand filters
P3210019	Biofilter 1
P3210020	Bay from biofilter ladder, note bubbles
P3210021	Sand filters again
P3210022	Discharge from secondary clarifier, rotating screen
P3210023	Primary clarifier
P3210024	Pump station in Sausalito, Gate 5.