
2001-2002 MARIN COUNTY GRAND JURY

TITLE OF REPORT: Bridging Troubled Waters – The Marin Municipal Water and Las Gallinas Valley Sanitary Districts

Date of Report: April 19, 2002

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BRIDGING TROUBLED WATERS – THE MARIN MUNICIPAL WATER AND LAS GALLINAS VALLEY SANITARY DISTRICTS

SUMMARY

Marin Municipal Water District (MMWD) provides treated water for domestic use in Southern and Central Marin. Las Gallinas Valley Sanitary District (Las Gallinas) treats and disposes of sewage effluent in the Northern portion of San Rafael. Much of MMWD's water winds up as part of the sewage going to Las Gallinas for treatment. At any given time up to half of the treated water from Las Gallinas's plant goes to a water recycling plant owned and operated by MMWD on Las Gallinas's land adjacent to Las Gallinas's plant. This recycled water is used for irrigation and for toilets in commercial and public buildings within the County. Thus the two Districts share the same water and customers.

MMWD is regulated by the California Department of Health Services. Las Gallinas is regulated by the California Regional Water Quality Control Board. Since the two regulatory agencies have dissimilar objectives, the two Districts have significantly different regulatory standards for the water they produce.

The two Districts face several problems which have been exacerbated by a lack of cooperation. This has distracted both Districts and undermined the effectiveness of their services. The problems are solvable and should be addressed together and in a spirit of cooperation for the good of their customers.

The primary issues for the two Districts are:

- (a) MMWD uses a zinc-based corrosion inhibitor which almost doubles the amount of zinc in water treated by Las Gallinas. This makes it hard for Las Gallinas to keep the level of zinc in its wastewater discharge below the regulatory maximum.
- (b) The two Districts have had a number of disagreements about the cost sharing and operation of MMWD's wastewater recycling plant.

The Grand Jury conducted an investigation which included a review of the regulations governing both agencies, the operations of both, and the way they have historically communicated.

As a result of its investigation, the Grand Jury concludes that incipient changes in sanitary discharge regulations, coupled with a change in the membership of the Las Gallinas Board, provide both technical and political opportunities for both Districts to work together and, by doing so, to solve these existing issues.

BACKGROUND

The Grand Jury received a recommendation that it look into several issues involving the Las Gallinas Valley Sanitary District (Las Gallinas). One of these was cooperation with the Marin Municipal Water District (MMWD) on wastewater recycling. The specific concerns were:

- Disagreement over how much Las Gallinas should contribute to the cost of expanding MMWD's water recycling plant, which is located on Las Gallinas property and which takes Las Gallinas plant effluent as its input.
- Lack of coordination between the two agencies in the manner of transfer and quality of water going to the recycling plant.
- Las Gallinas's concern that MMWD's use of zinc orthophosphate as a corrosion inhibiting agent makes it difficult for Las Gallinas to stay below their permitted discharge limit for zinc. This concern raised a general question about the compatibility of standards for drinking water on the one hand and discharged treated sewage water on the other.

The Grand Jury initially agreed to investigate the standards compatibility question. Specifically we wanted to find out if the water treatment methods used by MMWD are incompatible with the sewage discharge limitations imposed on the various sanitary districts within the County, and whether such incompatibility leads to increased costs, a risk of water pollution, or other problems. We also wanted to know if there are steps the Districts can take to ameliorate their problems.

While reviewing the standards compatibility issue, it became apparent that the two agencies, who share both water and customers, have often been working at cross-purposes to one another, with resultant operational inefficiency. For that reason we broadened the investigation to include the issues of coordination and communication.

METHODOLOGY

To understand the regulations governing MMWD we interviewed members of the engineering staff of the San Francisco District of the Department of Health Services, Drinking Water Field Operations Branch. This is the state agency to which MMWD reports water quality data in order to demonstrate compliance with California and Federal regulations.

To understand the operations and viewpoint of MMWD, we interviewed several members of its senior staff. We also interviewed senior staff members of the North Marin Water District. In addition, we spoke with representatives of the Santa Clara Valley, San Jose, and Sonoma County Water Districts in order to better appreciate different approaches to corrosion control.

To understand the regulations governing Las Gallinas we interviewed a member of the engineering staff of the California Regional Water Quality Control Board, San Francisco Bay Region. This is the agency which issues the Sanitary District's wastewater discharge permit.

To understand the operations and viewpoint of Las Gallinas, we interviewed both staff and a representative of its principal engineering consultant. We also attended two meetings of the Las Gallinas Board of Directors to observe the proceedings. Finally, we interviewed a sanitary engineer with another nearby sanitary district in order to obtain a contrasting view of wastewater treatment.

In addition to the foregoing, we obtained and reviewed numerous documents. These included reports (generated both internally and by consultants), correspondence, memoranda, technical tables, submittals by each District to their oversight agencies, the permit under which Las Gallinas operates (as well as conditions imposed in that permit), scientific data available on the internet, and other information put out by each of the agencies to its customers (see Bibliography).

DISCUSSION

Fresh water regulations

Standards for drinking water are established by the Federal Environmental Protection Agency (EPA) as directed by the Safe Drinking Water Act of 1972. These are further elaborated in the California Health and Safety Code (California Safe Drinking Water Act), which can be stricter than federal requirements. State regulations are enforced by the Department of Health Services (DHS).

There are two levels of standards. Primary standards are meant to ensure that there is no adverse affect on public health. These address chemical and biological properties by specifying limits on materials such as toxic metals and bacteria. Secondary standards address aesthetic issues such as odor, appearance, and the content of staining agents such as iron.

Of particular importance to large system water providers is the "Lead/Copper Rule" (contained in portions of Chapter 17.5, Title 22 of the California Safe Drinking Water Act). This "rule" became law in 1992, and it establishes a protocol for minimizing lead and copper content of water at the end user's tap. These metals may leach into a

customer's water as a result of corrosion of water supply lines and of the customer's own plumbing fixtures. The law states that each district "will install and operate an optimal corrosion control system", and it sets maximum permissible levels ("action limits") of lead and copper in the water.

Water agencies control corrosion by treating the water to change its properties. The most common methods of controlling corrosion are by adjusting the water's pH (a measure of acidity) to make it more alkaline and/or by adding various metal-containing chemicals which act as film-forming agents, coating pipes and fixtures. These chemicals include, among others, sodium carbonate, sodium polyphosphate, zinc orthophosphate, and/or blends of these.

Drinking water agencies comply with regulations by self-monitoring, submitting the results of tests run by certified laboratories (which may include their own).¹ Compliance with the Lead/Copper Rule is established through a special program consisting of two 6-month rounds of testing. The agency reports test results and water quality data supporting its corrosion control treatment to the DHS. If the program results are satisfactory, the DHS then approves the corrosion control treatment used by the agency. In spite of the wording of Title 22, the DHS does not require an agency to show that its anti-corrosion treatment is truly optimal. However, once an agency has qualified a corrosion control system it cannot change the water treatment without DHS approval.

Marin Municipal Water District

Marin Municipal Water District (MMWD) provides treated water for domestic use in Southern and Central Marin County. It owns and manages seven reservoirs having a total storage capacity of 79,566 acre-feet² of water, enough water to service, for approximately two years, the needs of the rate paying customers serviced by its 58,889 water meters. About 80% of its water comes from rainfall which empties into its several reservoirs, and about 20% is purchased from Sonoma County and comes through a pipeline from the Russian River.

Surface water from the Mt. Tamalpais watershed is treated at plants at Bon Tempe and San Geronimo. Water treatment starts in the reservoirs, where it is aerated to "maintain a proper oxygen balance." At the plants, "suspended matter is removed in clarifiers, microscopic particles are removed in deep-bed, multi-media filters, and bacteria and

¹ Tests are run on samples of the district's source water and on samples obtained at various points in the district's distribution system. The frequency of testing ranges from once every two weeks for certain water quality parameters to quarterly, annually or once every three years depending on what is being tested and the district's prior compliance record.

² An acre-foot equals 325,851 gallons, enough water to cover one acre (about the size of a football field) to a depth of one foot. One acre-foot is generally considered enough water to supply the needs of three families for one year.

pathogens are inactivated by disinfectants” (chlorine and chloramine). The water is then treated with zinc orthophosphate (ZOP) to control corrosion. Fluoride is also added to reduce tooth decay.

Russian River water enters the MMWD system at a treatment plant in Ignacio. Clarification is not needed, since the water has been naturally filtered by the riverbed. Otherwise treatment is similar to the process used at the other two plants.

At the time the “Lead/Copper Rule” became law, MMWD was using ZOP as the primary means to control corrosion. Indeed, its use of ZOP dates back to 1986. It uses two different ZOP materials, specified as 1:1 and 1:3, according to the weight ratio of zinc to phosphate in the material. MMWD qualified this corrosion inhibitor system with the DHS in 1992-3.³

MMWD has had limited experience with alternative corrosion inhibiting systems.⁴ Except for the current ZOP protocol, MMWD has not developed any data on the levels of lead corrosion resulting from the use of alternative corrosion inhibitors.

MMWD has a perfect record of regulatory compliance. It is proud of the reputation it enjoys with DHS as a model agency. Its managers view a change of corrosion inhibitor as risky. They see lead as extremely toxic, and they want to be below the limit of detection. They don’t want to experiment with changes which might possibly result in increasing the lead level in their water, even if the resultant amount of lead would still be

³ 102 homes were sampled twice during the year. The data reported to the DHS and copied to the EPA was summarized as follows: “The 90th percentile for lead and copper was 4.3 µg/L (micrograms per liter) and 270 µg/L, respectively. Both these values are well under the action levels for lead and copper of 15 µg/L and 1300 µg/L respectively.” Lead levels were below the practical limit of detection. In its submittal letters to both the DHS and EPA, MMWD declared, “The data indicate that the treatment level is optimized.” Subsequent monitoring by MMWD has been reported once every three years for 50 homes.

⁴ Prior to 1986 sodium hydroxide was used to increase alkalinity (pH), and lime was added to control corrosion. The lime was a solid, was messy to handle, and tended to coat unevenly. The high pH increased the levels of trihalomethanes (THM’s), a toxic disinfection by-product which is also regulated. Data reported to us by MMWD show that copper corrosion with this system is about 2/3 that obtained with ZOP. However, steel corrosion rates increased 50-150%. MMWD ran tests by placing copper and steel coupons in special sections of pipelines at different locations and measuring the weight loss of the coupons after a period of time. There were no coupon tests on lead, either in the laboratory or in pipelines.

In 1986 a 1:1 zinc:phosphate ratio and pH adjustment with sodium hydroxide was tested. This led to increased zinc levels in wastewater, but THM’s dropped 30%.

When Las Gallinas expressed concerns about the level of zinc in their influent water, MMWD tested a sodium polyphosphate product in 1990-91. Copper corrosion rates increased 300% relative to ZOP. Steel rates also increased significantly.

In 1992 MMWD resumed the use of ZOP, but changed to the 1:3 ratio material for the San Geronimo and Ignacio plants, the primary sources of water which winds up at Las Gallinas. The average zinc level in water leaving these plants is 340-400 µg/L. The average zinc level in water leaving Bon Tempe, which uses 1:1 material, is around 560 µg/L.

well below regulatory action limits. They see this issue as both a regulatory compliance and a public relations matter. Thus, if there were an increase in the reported lead level, customers might become upset, and the District might be seen as potentially moving to a lower level of customer health protection. Also, if a change were made which should result in higher lead/copper corrosion, they believe they could be legally found to be out of compliance with Title 22. MMWD admits that it might be possible to demonstrate an alternative inhibitor system with equivalent protection, but it feels no incentive to open this investigation, which involves costly and lengthy testing.

Wastewater Discharge Regulations

Once MMWD's treated water is delivered to its customers, much of it is drained in the form of sewage. Depending on geographic location, that sewage is captured by one of four treatment plants serving more than a dozen sanitary districts and agencies.

Whereas water suppliers are regulated by the DHS, sanitary districts are regulated by a different governmental agency, the California Regional Water Quality Control Board (Regional Board). The DHS and the Regional Board have different regulatory objectives. In regulating drinking water, the DHS is concerned about the health of humans who have a relatively large body mass. In contrast, the Regional Board worries about the health of much smaller marine organisms in the waters of the Bay and Bay Delta and the effect of different contaminants on the tissues of those organisms and on the fish and animals which consume them. Humans can tolerate higher levels of metals than lower-mass organisms such as marine invertebrates and fish. The invertebrates are part of the diet of fish and shellfish which, in turn, are part of the human food chain. Furthermore, bioaccumulation of metals in fish can deliver large amounts of metals to humans who eat them. Thus, while the DHS allows drinking water to contain up to 5,000 micrograms per liter ($\mu\text{g/L}$) of zinc, the Regional Board sets the maximum level of zinc in wastewater discharge at 58 $\mu\text{g/L}$, or 1.2% of the fresh water limit.

Wastewater discharge into the San Francisco Bay is controlled by regulations promulgated by the both the federal Environmental Protection Agency (EPA) and by The State of California through its "Toxics Rule" and the California Water Code. Enforcement of both the Federal and State rules and regulations is provided by the Regional Board through its "Basin Plan."⁵

⁵ The California Legislature established the State Water Resources Control Board and nine Regional Water Quality Control Boards in 1967. The San Francisco Bay Area is Region 2. By law, the Region 2 Board is required to develop and implement a Water Quality Control Plan (the Basin Plan) for the San Francisco Bay region. The Basin Plan is the master policy document that contains descriptions of the legal, technical, and programmatic bases of water quality regulation in the San Francisco Bay region. The Plan establishes conditions (discharge prohibitions) that must be met at all times.

The Regional Board also administers the National Pollutant Discharge Elimination System (NPDES) program which sets the guidelines for the issuance of permits to wastewater dischargers in the Region. These permits specify maximum discharge levels of toxic metals (such as mercury, copper, zinc, lead, and chromium), ammonia, total suspended solids, chlorine, and coliform bacteria, as well as setting other limits. Compliance is a self-monitoring process.⁶

The Regional Board's regulations regarding zinc and other heavy metals are ten times as strict for shallow water dischargers⁷ as they are for deep water dischargers – the rationale being that the dilutive effect of discharge into shallow waters is about one tenth that of deep water. Of the sanitary districts receiving MMWD water, only Las Gallinas is a shallow water discharger.⁸

The permit under which Las Gallinas currently operates imposes a maximum allowable zinc standard of 86 micrograms per liter ($\mu\text{g/L}$). That standard was imposed as an interim standard and is effective until October 15, 2003. The final standard is proposed at 58 $\mu\text{g/L}$. That proposed final standard will go into effect two weeks before Las Gallinas's operating permit is scheduled to expire. Las Gallinas is concerned that unless the proposed final limit is relaxed before the current permit expires, it could be difficult for Las Gallinas to persuade regulators (who are watched carefully by environmental groups) to "backslide" by agreeing to a less restrictive limit after a new permit has been issued.

However, there is some prospect that metals discharge limits may be relaxed in the future. The U.S. EPA promulgated new standards for 126 priority pollutants in 2000. The new standards for zinc and other metals are, in effect, somewhat higher than the

⁶ Sampling points are specified in the NPDES permit. Data is reported monthly in an electronic format specified by the Regional Board. Raw data and lab sheets are kept for 3-5 years in the event an audit is desired. Data submissions are signed by the agency under penalty of perjury. There are two levels of enforcement:

- Mandatory: Data are reviewed every 6 months. The Migden legislation applies. The Migden legislation (Water Code Section 13385(i)), which went into effect 1/1/00, requires the Regional Board to fine sanitary districts a minimum of \$3,000 if discharge limits are exceeded four or more times in a 6-month period, and \$3,000 per incident for serious violations
- Discretionary: If there is a consistent problem with violations, the Regional Board will actively interact with the agency to obtain corrective action. Thereafter, continued violations can result in the administration of civil liability.

⁷ A shallow water discharger is a treating facility whose effluent is discharged into the Bay at a depth of less than 30 feet. The Regional Board considers that effluent which is discharged at a depth greater than 30 feet can be diluted by tidal flow and mixed into the surrounding waters with far greater dilution than is the case for shallow discharge.

⁸ There are six North Bay shallow water dischargers: Las Gallinas, Novato Sanitary, Napa, Petaluma, Sonoma Valley and Fairfield-Suisun.

current limit.⁹

Las Gallinas's future permit limits could also possibly be affected by the results of studies of the properties of Bay water.¹⁰ These studies, which have been ongoing in the South Bay for the past 10 years or more, have demonstrated to the apparent satisfaction of the Regional Board that a higher level of total metals than is currently allowed can be discharged by wastewater agencies into the South Bay with no increase in risk to living organisms. Wastewater agencies located north of the Dumbarton Bridge are now collaborating on their own study. Sampling has been completed. A technical review committee is being formed, including environmental specialists. If findings similar to those of the South Bay can be demonstrated, discharging agencies could apply for more relaxed metals discharge limits.

Another process which could affect metals discharge limits is the determination of Total Maximum Daily Load, or TMDL.¹¹ Where a body of water is considered "threatened",

⁹ Although the numbers will not automatically supersede those currently in the Basin Plan, that is the probable ultimate outcome. The current review of the Basin Plan will likely incorporate the new EPA standards. (The Basin Plan is supposed to be reviewed every three years, but the schedule has lagged. The last review (minor) was in 1995; the last major review was in 1986.) Public comment on this review will commence in 2002. The review process takes 1-2 years.

The current Basin Plan limits *total* metal discharged. Total metal is the sum of dissolved metal and suspended metal. The new EPA numbers are based on better science than was available in 1986. Limits for metals are now expressed as "*dissolved* metal", which is defined as the amount remaining after an effluent sample is passed through a filter with a nominal pore size of 45 μ . After the Basin Plan is revised, and as permits for wastewater dischargers are reissued, the new limits for metals will still be based on total metal content, but they may be less onerous. For example, the new EPA limit for *dissolved* zinc is 86 $\mu\text{g/L}$. The current interim number for Las Gallinas is also 86 $\mu\text{g/L}$, but this is *total* zinc. The new Las Gallinas zinc limit will be derived by multiplying 86 times the ratio of total zinc to dissolved zinc. This ratio will be determined from measurements of Las Gallinas effluent. The same process will be used to derive revised limits for copper, mercury, nickel, and other metals.

¹⁰ The waters of the South Bay (South of the Dumbarton Bridge) have been the subject of a study conducted over the past 10-15 years. The sanitary districts which discharge into that part of the Bay are proposing site-specific limits based on their scientifically collected data which shows that those waters have more metals binding capacity than the laboratory water used by the EPA in setting their new standards. Specifically, their studies have demonstrated to the satisfaction of the Regional Board that a given level of metals discharged into the South Bay is less bioavailable (i.e., less of the metal is taken up by marine organisms) than the same level in EPA laboratory water. The study has persuasively shown that the increased metal binding which occurs in South Bay waters decreases the amount of dissolved metal and thus increases the ratio of total to dissolved metals. Therefore, the argument goes, a higher level of total metals can be discharged by the agencies into the South Bay with no increase in risk to living organisms.

¹¹ Every two years the State is required to report to the EPA the results of monitoring of water bodies which have been designated as "threatened" (Section 303D of the Clean Water Act). If a water body is "impaired" by a pollutant, the State must develop a TMDL for that pollutant. The TMDL must take into account all sources, including natural runoff, man-caused discharges, rain, influx of silt, and disturbance of bottom soils by water movement. A source assessment for the Bay was reported in June 2000. The next step is allocating the pollutant load to each sector. A workshop for this was established on Dec. 19, 2001.

studies are conducted to identify pollutants which impair its quality and to assess the maximum daily load of such pollutants which the water body can safely tolerate. In the case of North Bay waters, mercury, copper and nickel are on the list of pollutants for which TMDL's have been identified. As a result of recent studies, the Regional Board will likely propose that the North Bay be reclassified from "impaired" to "watch". At this time it appears possible that the next NPDES permit limit for mercury could be based on this TMDL process rather than an EPA number. The effect of that change is uncertain.

Las Gallinas Valley Sanitary District

Las Gallinas Valley Sanitary District is a special district which was created in 1954 in order to treat and dispose of sewage effluent. Las Gallinas currently serves over 29,000 customers in the northern portion of San Rafael. Its plant treats approximately 2.3 million gallons of effluent per day (average dry weather flow). Of the total dry weather flow, about 50% is routed into MMWD's recycled wastewater plant. The balance of Las Gallinas's effluent is discharged into Miller Creek (which flows to the North Bay) during seven months of the year, and into ponds and irrigated pasturelands owned by the District during the other five months when its permit prohibits Bay discharge.¹²

The plant was built in 1955. It is designed to provide what is termed secondary level treatment. Influent is first passed through rock and grid chambers to remove "massive solids". Next it goes to a primary settling tank. Solids which settle out are processed in an anaerobic digester and then injected into a dedicated disposal site on District land. The supernatant is piped to a second settling tank (the primary clarifier), and from there to a series of two trickling filters. These filters spray water from rotating arms across a bed of rocks. These filters effect both aeration and biotreatment. The treated water then goes to a secondary clarifier. From there the water is processed through a fixed film reactor with plastic media, which removes ammonia. The processed water is treated with chlorine and sodium hypochlorite, and is then dechlorinated with sodium bisulfite. Las Gallinas says its service cost is the 3rd lowest among 17 sanitary agencies operating in Marin. The last equipment upgrade was in 1983.

From November to late May the treated effluent is discharged to the Bay. From June to October it goes to the "reclamation project." The reclamation project consists of the MMWD recycling plant and a 385-acre complex which includes 200 acres of irrigated pasture, 40 acres of storage ponds, a 20-acre freshwater wetland, a 10-acre salt marsh, and landscape irrigation. The disposition of treated effluent during the period from late May through October is shown in the following table:

¹² The Basin Plan requires that the ratio of stream flow to plant discharge be 10:1. Also there can be no discharge to a dead end slough (e.g., one which does not get enough tidal action). The flow at the outfall from Miller Creek into the shallow Bay waters at that point would have inadequate dilution during summer months if discharge were permitted. Hence, it is not permitted during the period of June 1 through October 31.

Acre Feet of Water	Where It Goes
330	Irrigation of 200 acres of pasture. Sprayed on the ground from 3 pivots. This is equivalent to 20" of rainfall. The water leaches into the soil, and is also evaporated by the sun.
120	Evaporated from 60 surface acres of ponds. The average depth is 11 feet.
650	Transferred to MMWD recycling plant for tertiary treatment.
250	Net transfer to ponds. The ponds have a holding capacity of 400 acre-feet.
1350	TOTAL acre-feet of effluent.

Las Gallinas operates under NPDES Permit No. CA0037851, which was adopted by the Regional Board on October 21, 1998. This permit is contingent on the reclamation project being in place and operational. In the absence of this project, Las Gallinas would be prohibited from operating during the summer months. The Basin Plan allows the Regional Board to grant Las Gallinas an exemption because it participates in a project which provides a net environmental benefit.

It is noteworthy that MMWD's recycling plant takes and disposes of nearly 50% of the treated effluent. Since Las Gallinas concedes that it has no options to expand either the ponds or the spray fields, it is clear that the recycling plant is critical to its ability to operate. Stated another way, if there were no water recycling plant, Las Gallinas would have to negotiate with the Regional Board to be able to operate at all, and there is no assurance that it could demonstrate a sufficient mitigating environmental benefit (which the current recycling plant is considered to be) to enable it to prevail in any such negotiations. Since shutting down during summer months would be simply unacceptable, Las Gallinas might, under those circumstances, be forced to consider very expensive options (such as tying into Central Marin's Sanitary District, running a deep water pipeline to San Pablo bay, or others which are presently unknown).

Due to limitations of its treatment process, Las Gallinas was able to negotiate interim discharge limits for several metals. The proposed final limits will be impossible to meet in some cases without improvements in the treatment process. The table on the following page compares the interim and final limits for three metals with Las Gallinas's measured performance during the period January 1993 – May 2001. In all cases the interim limits are exceeded more often than desirable, and the final limits are, for all practical purposes, not obtainable.

Las Gallinas has incurred some fines for exceeding discharge limits for zinc and other materials such as chlorine and total solids. The District says it paid \$15,000 in 2000 and

\$12,000 in 2001. The Regional Board says that Las Gallinas’s compliance rating is about average compared to other shallow water dischargers in Region 2.

Metal	Copper	Mercury	Zinc
Interim Limit, µg/L	17	0.11	86
Final Limit, µg/L	4.9	0.012	58
Date for Compliance with Final Limit	10/15/05	10/15/05	10/15/03
Average Effluent, µg/L	11.1	0.052	74
<u>Effluent Measurements</u>			
No. of Data Points	159	165	154
Per Cent of time -			
-Interim Limit Exceeded	13%	5%	21%
-Final Limit Exceeded	94%	95%	84%

At the present time, influent to the Las Gallinas plant averages approximately 230 µg/L of zinc. The plant is able to remove approximately 2/3 of the zinc through its secondary treatment methods. It is still at a disadvantage to the other North Bay treatment plants which accept MMWD water, all of which are deep-water dischargers and therefore are allowed to discharge 10 times more zinc than Las Gallinas. Data reported by EOA, Inc., a consultant for Las Gallinas, suggests that MMWD contributes over 40% of the total zinc in Las Gallinas’s influent. The data also shows that Las Gallinas’s is comparable to other shallow water dischargers in terms of its efficiency in removing zinc.¹³

¹³ The following averages were reported by EOA, Inc. The District retains EOA as a consultant to develop and communicate test data to the regulatory agencies and to negotiate permit requirements. EOA also participates in the California Association of Sanitary Agencies (CASA). Las Gallinas is the only sanitary district in the table which receives water from a provider treating with zinc.

<u>Plant</u>	<u>Treatment Method</u>	<u>Zinc in Influent</u> µg/L	<u>Zinc in Effluent</u> µg/L	<u>% Removed</u>
Las Gallinas	Trickling Filter	230	77	67
Novato / Ignacio	Trickling Filter	127	47	61
Novato / Novato	Activated Sludge	129	31	70
Petaluma WWTP	Activated Sludge / Trickling Filter + Oxidation Ponds	103	21	77
Union (City) Sanitary	Activated Sludge	138	40	69
Hayward WWTP	Trickling Filter	173	72	56

Since its inception the District has used Nute Engineering as an operations consultant. Nute Engineering designed most of the plant facilities, and has recently put together a Capital Improvement Program for the District. This program is predicated on the necessity for Las Gallinas to cooperate with MMWD. It states, "...it is imperative that the District and MMWD maintain a successful partnership to assure continued and possibly expanded recycled water use." The report recommends that Las Gallinas cooperate with MMWD on the design and operation of new facilities. It also states that "The District should ... continue its efforts toward possible modification of its discharge requirements to achieve a greater comfort level in achieving compliance."

The Capital Improvement Program includes elements which would allow Las Gallinas to remove more metals from its wastewater while improving process control:

- (a) The installation of two new Parkson Dynasand filters at a cost of \$6,000,000. These filters can be operated in either a parallel mode, which increases plant capacity in winter months when there is heavy storm water runoff, or a dual stage (sequential) mode, which allows for better metal removal in summer months when contaminants in the effluent are more concentrated. This improvement in metals removal would extend also to copper and mercury, and could enable Las Gallinas to meet its final limits for these metals consistently.
- (b) A contract now in place to modernize the chemical feed system, including chlorine control. Another part of the Capital Improvement Program proposes to eliminate the use of chlorine altogether in favor of disinfection using ultra-violet light.

The forecast demand for Las Gallinas capacity is predicated on slow, but ultimately complete, development of the available zoning in its district. The plant's dry weather capacity is rated at 2.92 million gallons/day, and currently treats 2.3 million gal/day average in dry weather. The goal of the master plan design is to boost this plant rating to 3.9 million gal/day.¹⁴ A substantial amount, if not all, of the expanded plant's throughput will have to be taken by MMWD's recycling plant. That plant is stated to have a capacity of 2 million gal/day, and is currently processing around 1.1-1.4 million gal/day. Therefore, if the expected development in Las Gallinas's service area occurs, the capacity of the recycling plant will have to be expanded.

Communications between MMWD and Las Gallinas

In Marin County there are 36 special agency districts, some of which provide follow on services to others. Such is the case with MMWD and Las Gallinas. Each shares

¹⁴ Nute Engineering arrived at this figure based on planned zoning for all the undeveloped property in the District. Also, a figure of 200 gal/day/house was used, vs. a current estimated actual use of 155 gal/day/house.

customers with the other, and each takes part in the overall water to wastewater utility service cycle for their common clients. It would, therefore, seem to make sense for the two agencies to cooperate as partners, not just for the common good but also for the sake of efficiency and optimal use of their customers' dollars.

As an example, Santa Clara County also has sanitary districts which are shallow water dischargers. One, the San Jose treatment plant, violated its zinc discharge limit. In response, its upstream water supplier, the Santa Clara Valley Water District, which (like MMWD) uses ZOP as a corrosion inhibitor, has conducted a study of alternate, non-zinc inhibitors and will likely stop using zinc some time this year.¹⁵ This would help its sanitary district partner to come back into compliance with the Regional Board's regulations.

Closer to home, the North Marin Water District (NMWD), which does not use zinc as a corrosion inhibitor, recently learned that it was creating problems by discharging sludge from its water treatment directly into sewer lines going to its sanitary district partner, Novato Sanitary District. NMWD, acting in the spirit of cooperation, undertook to provide extra filtration and to remove the solids and truck them to a landfill at a cost of \$14,000 per month. When questioned about this, NMWD described its actions as "doing its part."

Interestingly, NMWD gets 20% of its water from surface water runoff which fills Stafford Lake. That raw water is similar in physical properties to the water which empties into the reservoirs which provide MMWD with its raw water. NMWD, which sends Stafford lake water directly to a number of its customers, finds that it does not need to use zinc or any other phosphate to control corrosion. Instead, they find it is safe and effective to control corrosion through the use of sodium hydroxide to control pH. They also recognize that, by not using zinc as a corrosion inhibitor, they are helping their downstream sanitary district (Novato Sanitary District) which is also a shallow water discharger. Their managers told us that another water agency on the Peninsula (Mountain View), which also uses water captured in reservoirs, has similarly moved away from treating water with zinc or other metal-coating agents.

Unfortunately, MMWD and Las Gallinas have not, for some years, enjoyed a good working relationship. If they did, MMWD might consider running laboratory tests to determine if a reduced zinc formulation, or a different corrosion inhibitor altogether, might help to solve Las Gallinas's problems at no cost in terms of health effects to MMWD's own customers. In fact, MMWD has rejected overtures to undertake such tests in order to determine the feasibility of that sort of an approach and whether any alternative corrosion control formulation or inhibitor product might be acceptable to

¹⁵ Santa Clara did a two-month bench top study with metal coupons, following a protocol used by the City of Santa Cruz. The data were reported to the DHS, and follow up studies are planned.

DHS. MMWD points to a letter from DHS in August, 2000 in order to reinforce its position against making any change to its corrosion inhibitor treatment.¹⁶

There are a number of reasons why the two agencies have historically not worked well together. Some of those reasons involve personality clashes between the agencies. This situation may be changing as a result of the November, 2001 election when new directors were voted onto the Las Gallinas Board.

Much of the animosity between the two agencies dates to the drought years in the mid-1970s. At that time MMWD designed and ultimately constructed, at a cost of \$16,000,000, a wastewater recycling plant which was located adjacent to the Las Gallinas treatment plant on land leased from Las Gallinas. That plant benefits Las Gallinas greatly by taking roughly 50% of Las Gallinas's treated dry weather effluent, providing additional treatment up to tertiary level, and piping it back through specially coded purple pipes for landscaping and toilets in County buildings and a number of privately owned commercial buildings. Indeed, and as discussed above, were it not for the 650 acre feet per year which that plant accepts from Las Gallinas, it is quite possible that Las Gallinas simply could not operate. Depending on the source, Las Gallinas contributed as little as \$350,000 or as much as \$700,000 to the cost of construction of the recycling plant. If Las Gallinas's contribution were at the high end of that estimate, it would still have paid less than 5% of the total capital cost of that project which is so critical to its very existence.

MMWD loses at least \$1,200,000 per year operating that recycling plant.¹⁷ For reasons which are still not understood, Las Gallinas has historically refused to contribute to the annual operating losses. This is despite the fact that Las Gallinas is admittedly sitting on cash reserves which it estimates at "between \$10 and 11 million." It is, therefore, understandable that MMWD argues that Las Gallinas should solve its problem on its own.

The current contract for the recycling plant, written in 1989, expires 12/31/04. MMWD wants to expand the plant, and would like an increased financial contribution from Las Gallinas. MMWD hired a consultant to study the expansion project. The consultant said that it would cost \$2800/acre-foot to expand the system as well as outflow piping which is needed to enlarge its customer base. The consultant has suggested to MMWD that

¹⁶ DHS's letter read in part, "The Department has determined that the MMWD is currently providing optimum corrosion control with the use of zinc orthophosphate at the dosage currently in use.....The basis for this determination was the reduction of Lead and Copper tap levels in the District system with the introduction of zinc orthophosphate." In fact, we have seen no data from MMWD that lead levels were changed by the introduction of ZOP. MMWD stated in their 1992 Lead and Copper Monitoring Plan that "District records indicate that there is no lead pipe or service lines in service in the distribution system."

The DHS letter also said, "If any change in the District's corrosion control strategy.....resulted in an increase in Lead or Copper levels at consumer taps, we would no longer consider the District's corrosion control to be optimized and the District would no longer be in compliance with Chapter 17.5 of Title 22..."

¹⁷ Las Gallinas believes that MMWD's annual operating loss might be as high as \$1.6M.

Las Gallinas should contribute \$1540/acre-foot to help pay for it. This would amount to 40% of Las Gallinas's operating budget and would result in increased annual service charges to their customers of as much as \$200,000. The Las Gallinas Board recognizes the benefit of expanding the recycling plant, but it has not, at least as yet, agreed that the proposed allocation is fair, reasonable, or necessary, nor has it quantified the value of this benefit to Las Gallinas.¹⁸

MMWD also complains that Las Gallinas has not upgraded its treatment plant and that, due to a combination of inadequate technology and sloppy operations, Las Gallinas often allows unacceptable levels of residual chlorine to remain in the effluent sent to the recycling plant. Also, MMWD's plant is set up to receive a constant volume, but the flow through Las Gallinas's plant is variable.¹⁹ Therefore, MMWD, which must meet its customers' peak time demand, often has to draw from an effluent storage pond in order to meet that demand. Because the pond is open to nature, its effluent requires more treatment than does the treated water coming from Las Gallinas's plant. This has, on several occasions, caused MMWD to have to either shut down the plant entirely or to incur extra expense to treat the effluent so it can be used as intended, or to supplement the supply of recycled water with potable water.

In order to address the issue of peak time demand, MMWD is planning to build a 1 million gallon storage tank on the hill above the recycling plant to stockpile the output from the recycling plant. This project will go to bid later this year. This tank would provide a pressure head for the distribution system and will increase total storage capacity for reclaimed water to 2.7 million gallons. That tank is intended to act as a buffer to stabilize the recycling plant's output, giving MMWD greater flexibility to meet peak demand.

MMWD believes that Las Gallinas has the capacity to solve its zinc problem. First, they suggest that Las Gallinas extend its pipeline further out into the Bay in order to become a deep-water discharger. Las Gallinas evaluated that option in the 1970s. At that time, the cost to build a direct outfall to San Pablo Bay was estimated at \$35 million; to tie in to the Central Marin Sanitation Agency (CMSA) was estimated to cost \$25 million plus "buy-in costs" likely to be charged by CMSA. Those cost figures exclude annual maintenance and monitoring. Las Gallinas does not presently consider this to be either viable or financially feasible as an option.

¹⁸ A second option for Las Gallinas to expand its effluent disposal capacity is the Napa Salt Water Pond Project. Regulators are proposing to reclaim salt ponds at the confluence of the Napa River and San Pablo Bay by pumping the effluent from 5 North Bay shallow water dischargers to dilute the ponds. A pipeline is needed. The Army Corps of Engineers is the lead agency. The Regional Board is a proponent and presented the plan to the Las Gallinas Board on Jan. 30. The timeline for any startup is likely 8-10 years away. The life expectancy of the project is 15 years (year-round discharge from all 5 agencies).

¹⁹ The maximum demand for MMWD's recycled water is around 5 AM. This coincides with a low influent period for Las Gallinas.

Secondly (and more reasonably), MMWD suggests that Las Gallinas upgrade its treatment plant and install filters which it believes could solve the problem. Las Gallinas proposes to install two new Parkson Dynasand filters at a cost of \$6,000,000. Results from recent field tests of these filters at another location show that these filters would allow Las Gallinas to remove virtually all of the insoluble zinc, thereby leaving only dissolved zinc. Unfortunately, however, Nute Engineering has calculated that the level of dissolved zinc for Las Gallinas approaches 50 µg/L. Hence, even after having spent this money, Las Gallinas is concerned that it would have an insufficient margin of safety to consistently meet the proposed final limit in its permit.

A collateral issue has to do with the location of the new filters which Las Gallinas wants to install. Las Gallinas's proposed location of the filters would eliminate one of two ponds which contain recycling plant backwash. MMWD needs these ponds in order to meet peak demand for its recycled water. Since Las Gallinas is land-poor, it may have no choice but to take this pond. Las Gallinas believes the logistics can be worked out, with Las Gallinas taking MMWD's backwash directly into their primary clarifier.

A mechanism exists which can help the two Districts improve their communications. A "Liaison Committee", which has two Board members from each District, exists. This committee has met on an *ad hoc* basis – about 3 times in 6 years. It used to meet more often. This committee could resume more frequent meetings, which, in turn, could catalyze increased trust and better working relations at the operations level between the two Districts. This will be important as work begins on the new contract for the recycling plant, which is scheduled to go into effect on Jan. 1, 2005.

FINDINGS

1. Marin Municipal Water District (MMWD) is regulated by the California Department of Health Services. The Las Gallinas Valley Sanitary District (Las Gallinas) is regulated by the California Regional Water Quality Control Board. Since the two regulatory agencies have dissimilar objectives, the two Districts have significantly different regulatory standards for the water they produce.
2. Las Gallinas treats and disposes of sewage effluent which contains MMWD's water. At any given time up to half of the treated water from Las Gallinas's plant goes to a water recycling plant owned and operated by MMWD on Las Gallinas's land adjacent to Las Gallinas's plant. In order for the two agencies to operate with the lowest overall cost, not only must they comply with their own individual regulatory requirements, but also they must help each other meet these requirements.
3. The change in membership of the Las Gallinas Board resulting from the November, 2001 election creates an opportunity to improve communications and cooperation between Las Gallinas and MMWD.

4. The Capital Improvement Program prepared by the consulting engineer for Las Gallinas sets a tone which is encouraging. It recommends that the District partner with MMWD “to assure continued and possibly expanded recycled water use.” The report recommends that Las Gallinas cooperate with MMWD on the design and operation of new facilities.
5. MMWD feels they have expertise in water treatment which could benefit Las Gallinas. Las Gallinas agrees that this is needed for the most productive interaction.
6. The MMWD water recycling plant has been a source of friction between the two agencies because of (a) its high cost to MMWD and (b) inconsistent effluent flow and control of chemicals at the Las Gallinas plant.
7. If the MMWD water recycling plant did not exist, Las Gallinas could not operate during the June – October period without renegotiating its discharge permit. This could place Las Gallinas in serious jeopardy. Since shutting down during summer months is really not a viable option, the District could face huge costs in order to find acceptable alternatives.
8. The 1 million gallon storage tank which MMWD plans to build later this year should help greatly to stabilize the recycling plant’s output, giving MMWD the flexibility to treat and store, and to thereby increase its ability to meet its peak demand.
9. In order to accommodate projected growth in its service area, Las Gallinas will have to expand its plant capacity. Much of the expanded plant’s throughput will have to be taken by MMWD’s recycling plant. Therefore, at some point the capacity of the recycling plant will have to be expanded.
10. Las Gallinas has made no significant treatment plant improvements since 1983. Since that time wastewater discharge regulations have become more stringent. Las Gallinas’s plant process is not designed to meet the current requirements for a shallow water discharger. This has led to ongoing permit violations.
11. Las Gallinas has options to improve its treatment to reduce metals in its effluent and improve control of its treatment process (chlorination and solids). These include:
 - (a) The installation of two new Parkson Dynasand filters, allowing for better metal removal in summer months when contaminants in the effluent are more concentrated. This improvement in metals removal will extend also to copper and mercury, and should enable Las Gallinas to meet its final limits for these metals consistently.
 - (b) A contract to modernize the chemical feed system, including chlorine control.

12. As urged by its Capital Improvement Program, Las Gallinas “should ... continue its efforts toward possible modification of its discharge requirements to achieve a greater comfort level in achieving compliance.”

- (a) Recent advances in the ability of scientists to measure toxic levels of metals in marine organisms have led EPA to suggest that the proposed final zinc limit of 58 µg/L may be overly strict. Las Gallinas has reason to expect that the actual permanent standard for *dissolved* zinc may be set at 86 µg/L. This implies that the *final* limit for *total* zinc could be significantly higher than Las Gallinas’s current *interim* limit of 86 µg/L. Similarly, the limits for other metals could be relaxed.

If EPA issues guidelines that are consistent with this thinking, and if those guidelines are implemented by the Regional Board, such action could lead to a revised discharge permit for Las Gallinas with a significant relaxation of permitted metals discharge limits,²⁰ thereby affording Las Gallinas a greater margin of safety.

- (b) Studies are now in progress in the North Bay which aim to demonstrate that specific metal binding properties of North Bay water may provide a rationale for relaxing certain metals discharge limits for sanitary districts, including Las Gallinas, that discharge into the North Bay. Those studies are designed to mimic similar studies already conducted on Bay waters south of the Dumbarton Bridge, which have been persuasive to the Regional Board.
- (c) The ongoing process to calculate Total Maximum Daily Load (TMDL) could result in a change in the permitted discharge limits for certain metals, in particular mercury, and Las Gallinas needs to be alert to its impact.

13. MMWD water contributes over 40% of the total zinc in Las Gallinas’s plant influent. MMWD has done no work since 1991 to look for alternatives to its use of zinc orthophosphate as a lead/copper corrosion control agent. MMWD “has told [Las Gallinas] that it would consider trying other corrosion inhibitors if zinc is still a problem” after Las Gallinas has improved its treatment process. Six months ago MMWD and Las Gallinas met to review the Santa Clara Water District studies to

²⁰ When Las Gallinas’s NPDES permit was adopted in October, 1998 with interim discharge limits, the Regional Board required the District to identify and control the sources of zinc and several other metals. A source identification report was submitted Oct. 1999 and the source control effort has been ongoing. In November, 2000 the District proposed a study to address the zinc, copper and nickel compliance issue from the effluent limit standpoint rather than the source standpoint. The goal was to define the ratios of total to dissolved zinc, copper, and other metals discharged into Miller Creek. The Regional Board approved the study in December, 2000. Results were submitted on November 14, 2001 and the District and the Board staff met on December 12 to discuss the results and next steps. The Regional Board asked for more information. This was provided in a report from EOA, Inc. dated Jan. 9, 2002. The District saw a positive response from the Regional Board staff and expects to have more meetings with them. These discussions are important in determining future changes to Las Gallinas’s permit limits.

reduce zinc treatment. Las Gallinas offered to fund similar studies for MMWD. The consulting engineering firm for Las Gallinas has also recommended that the District “undertake a separate study or participate with MMWD in a joint study of alternative corrosion inhibitors.”

RECOMMENDATIONS

1. MMWD and Las Gallinas should improve communications by re-establishing regular meetings of the Liaison Committee and by requiring regular dialog between Las Gallinas’s Plant Manager and MMWD’s Water Quality Manager.
2. MMWD and Las Gallinas should work cooperatively to expand MMWD’s wastewater recycling plant, to enlarge the capacity for storing treated effluent, and to improve the integration of water treatment process flow. As part of this process, the Districts should agree on an equitable sharing of costs.
3. Las Gallinas should implement its Capital Improvement Program and complete other steps currently under way to upgrade its plant in order to improve effluent quality, eliminate permit violations, and assure consistent control of the sewage treatment process.
4. Las Gallinas should work actively with its regulatory agencies to obtain less restrictive metals discharge limits consistent with the anticipated EPA guidelines and the properties of its water system.
5. Las Gallinas should participate in industry activities such as the North Bay Watershed Association’s study on mercury and the study by dischargers north of the Dumbarton Bridge of metal-binding properties of North Bay water.
6. In anticipation that Las Gallinas’s permitted discharge limit for zinc might not be relaxed, MMWD should begin immediately to study alternative corrosion treatments and attempt to qualify one with performance equivalent to or better than the current protocol. The immediacy of this recommendation is based on the fact that Las Gallinas’s permit is up for renewal in October, 2003, whereas it will take time for MMWD to conduct and complete its studies and obtain DHS approval, should that become necessary, for an alternative means of corrosion control. Las Gallinas should be a partner in these studies.

REQUEST FOR RESPONSES

Pursuant to Penal Code section 933.05, the Grand Jury requests responses as follows:

- From the Board of Directors of the Marin Municipal Water District to Findings 1 through 9 and 13; and to Recommendations 1, 2, and 6; and
- From the Board of Directors of the Las Gallinas Valley Sanitary District to Findings 1 through 7 and 9 through 13; and to Recommendations 1 through 6.

BIBLIOGRAPHY

The following documents were among those reviewed:

- Memorandum from Mr. Ray Goebel, EOA, Inc. to Mr. Eddy So, Regional Water Quality Control Board, dated Jan. 9, 2002 – “Las Gallinas Valley Sanitary District Zinc Issues – Follow-up to 12/12/01 Meeting.”
- California Department of Health Services website, <http://www.dhs.ca.gov/ps/ddwem/chemicals/MCL/mclindex.htm>.
- Regional Water Quality Control Board’s Water Quality Control Plan (June 21, 1995), in particular the following tables:
 - 3-3 – Water Quality Objectives for Toxic Pollutants for Surface Waters with Salinities > 5 ppt [i.e., salty water]
 - 3-4 – Water Quality Objectives for Toxic Pollutants for Surface Waters with Salinities < 5 ppt [i.e., fresh water]
 - 3-5 – Water Quality Objectives for Municipal Supply
 - 6-1 – Parameters Analyzed for in the Regional Monitoring Program

This document was obtained from the web site, <http://www.swrcb.ca.gov/%7Erwqcb2/basinplan.htm>,

- “Corrosion Control at MMWD”, 2-page memo from the Water Quality Manager. This was prepared at the Grand Jury’s request during an interview on Sept. 18, 2001 and presented to the Grand Jury during a follow up interview on Dec. 14, 2001.
- Table, “Corrosion Rate Data Assessing Calcium Deposition (CDM), Zinc Orthophosphate (ZOP), and Polyorthophosphate (POP) Treatments – compiled by MMWD and attached to a transmittal letter to the Grand Jury dated Dec. 28, 2001.
- Letter dated Oct. 23, 2001 from the District Manager, Las Gallinas to the General Manager, MMWD. Contains historical data on zinc levels in Las Gallinas influent and effluent.

- Letter dated Oct. 26, 2001 from the General Manager, MMWD to the District Manager, Las Gallinas explaining zinc orthophosphate treatment and including historical data on average, maximum, and minimum zinc levels.
- Memorandum from the President, Nute Engineering to the Manager, Las Gallinas, dated 10/3/01 – “Zinc Orthophosphate Addition for Corrosion Control.”
- “Las Gallinas Valley Sanitary District Waste Discharge Requirements”, Nute Engineering, 11/6/01.
- Table, “Las Gallinas Valley Sanitary District Influent and Effluent Metals Concentrations”. This gives system measurements for copper, mercury, nickel, silver, and zinc from 1/1/93 to 5/24/01.
- “Water Quality Annual Report – 2001”, brochure issued by MMWD.
- Portions of Chapter 17.5, Title 22 of the California Safe Drinking Water Act. This Chapter addresses requirements for lead and copper.
- Letter from the District Engineer, Department of Health Services, Drinking Water Field Operations Branch to the Water Quality Manager, MMWD, dated 8/2/00, confirming the requirements for optimized corrosion control as they apply to MMWD.
- Brochure, “Meet the Marin Municipal Water District”.
- Marin Local Agency Formation Commission fact sheet on the Marin Municipal Water District, obtained from the web site, http://lafco.marin.org/District_revu.cfm?DistrictID=37.
- Website for MMWD, <http://www.marinwater.org/>.
- Submittals from MMWD to the Sanitary Engineer, Department of Health Services, reporting lead and copper monitoring during the period 1992 – 1998.
- Report, “Wastewater Treatment Plant Capital Improvement Program,” Nute Engineering, Dec. 4, 2001.

GLOSSARY

DHS – California Department of Health Services. This agency regulates agencies which collect, treat, and distribute water for human consumption.

Las Gallinas – Las Gallinas Valley Sanitary District.

MMWD – Marin Municipal Water District.

$\mu\text{g/L}$ (*Micrograms per Liter*) – A unit of concentration of trace metal in water. A microgram is one millionth of a gram.

μ (*Micron or Micrometer*) – A unit of length. One micron is one millionth of a meter.

NPDES - National Pollutant Discharge Elimination System.

pH – A measure of acidity of water. It is defined as the reciprocal of the concentration of hydrogen ions in the water. Water with a pH of 7.0 is neutral. A lower pH is acidic; higher than 7.0 is alkaline.

ppt – Parts per thousand.

Regional Board – California Regional Water Quality Control Board. Region 2 regulates wastewater treatment agencies whose discharges empty into San Francisco Bay. The Regional Board is a department of the California Environmental Protection Agency.

ZOP – Zinc orthophosphate.