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Public Hearing (9/19/12)
General Waste Discharge Requirements for ASR Projects
Deadline: 9/13/12 by 12 noon

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September 11, 2012

Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814

Dear Ms. Townsend:

Subject: Comments on Proposed Waste Discharge Requirements for Aquifer Storage and Recovery (ASR) Projects that Inject Drinking Water into Groundwater

The Alameda County Water District (ACWD) thanks the State Water Resources Control Board for this opportunity to comment on the proposed General Waste Discharge Requirements (WDRs) for aquifer storage and recovery (ASR) projects that inject drinking water into groundwater.

ACWD manages the Niles Cone Groundwater Basin and distributes potable water to a population of over 328,000 in the cities of Fremont, Newark, and Union City, California. In typical years, groundwater constitutes 40% of our supply to the distribution system. ACWD intensely utilizes the basin, and over many decades, has substantially invested in managed aquifer recharge facilities, wellfields, and a 12.5 mgd brackish water desalination facility. It has been ACWD's aim to responsibly utilize the basin as a source of storage and supply, while reversing impacts from past salt water intrusion and preventing new salt water intrusion.

Provide Option for Continued Notification and Monitoring Requirements in Pre-existing WDRs

In the neighboring South East Bay Basin which is adjacent to the Niles Cone Groundwater Basin, the East Bay Municipal Utility District (EBMUD) operates the Bayside Groundwater Project, an ASR facility that has been constructed to extract water in dry years and inject potable distribution system water in wet years. Because of the physical interconnection between the two basins and the proximity of the Bayside Project, ACWD has been concerned about adverse impacts of this facility on the Niles Cone Groundwater Basin, specifically, excess drawdown in dry years and overflows to creeks in wet years. The ASR well is currently allowed to operate at 1 million gallon per day (mgd) of extraction and/or injection, but EBMUD has expressed interest

to increase this level up to 10 mgd in the future. There is a compelling basis of concern that levels of operation beyond the current Phase 1 project would interfere with ACWD's efforts to prevent new salt water intrusion reclaim parts of the basin still impacted from past salt water intrusion. The attached April 7, 2006, letter from ACWD to Michael Rochette of the Regional Water Quality Control Board (Region 2) explains the mechanics by which the Niles Cone Groundwater Basin could be impacted by Bayside Groundwater Project operations despite injection of water to compensate for extractions. Central to the concern is the absence of substantial unconfined storage in the South East Bay Plain, unlike the Niles Cone, to store water for future use. The Bayside Groundwater Project ASR well is screened in a deep confined aquifer that interconnects with the Niles Cone, and hence pressure fluctuation effects would be felt in the Niles Cone, substantially beyond the injected water zone of chemical influence. Pressure increases during injection would have limited benefit to the Niles Cone because the Niles Cone would likely be already full in wet years, and excess pressure would likely result in upwelling to creeks. In dry years, both ACWD and EBMUD would be pumping heavily. EBMUD's pumping would likely cause drawdown in the Niles Cone to a greater extent than would otherwise occur. This would require ACWD to purchase more imported water for managed aquifer recharge, or reduce pumping, to prevent new salt water intrusion and/or loss of capacity to cleanup salt plumes already in the basin.

EBMUD's plans for a Phase 2 expansion will depend on an evaluation of the Phase 1 Project, which has not yet operated in earnest beyond the testing stage. The Bayside ASR facility is presently subject to a project-specific WDR issued by the Regional Water Quality Control Board (Order R2-2007-0038, attached) in May of 2007. In addition to addressing concerns of chemical effects in groundwater near the ASR facility, the WDR includes reasonable provisions for groundwater level monitoring in the South East Bay Plain; reporting of Bayside (Phase 1) extraction flows, injection flows, and recorded South East Bay Plain groundwater levels; and pre-notifications to ACWD so that ACWD may have ample opportunity to adjust monitoring devices in the Niles Cone prior to planned changes modes of the Bayside ASR operation. This data is important in verifying previous assumptions of Phase 1 effects and allowing a possible future analysis to predict impacts of a potential Phase 2 expansion. The WDR also is intended to protect other groundwater users of the South East Bay Plain. Specifically, these WDR provisions require EBMUD to:

1. Adhere to maximum extraction and injection limits consistent with a pre-existing Environmental Impact Report (Part B, Sections 4 and 5, on Page 12 of 21 of the attached Order).
2. Monitor wells in the South East Bay Basin to "ensure that the Project does not result in significant groundwater level changes that adversely impact other groundwater users" (Part B, Section 1, Subsection a, (ii) on Page 5 of 12 in the Self-Monitoring Program).
3. Notify ACWD and RWQCB in advance of intentions to turn on the ASR system, or switch modes from extraction to injection, or vice versa (Part C, Section 19 on Page 17 of 21 of the Order). This notification provision provides the advance warning necessary for ACWD to make preparations for monitoring the Niles Cone side of the monitoring well network.

4. Provide an annual report over the life of the Project, and include the following:
    a. The amount of groundwater extracted, and the amount injected, over the past monitoring period (year) (Part A, Section 4, Subsection c, (xi) on Page 3 of 12 in the Self-Monitoring Program).
    b. Results of well levels in the monitoring well network (Part A, Section 4, Subsection a, (ii) and Subsection c, (v) on Page 3 of 12 in the Self-Monitoring Program).
5. Provide a copy of the annual report to ACWD (Part C, Section 11 on Page 16 of 21 in the Order).

As currently drafted, the State Board's proposed WDR would immediately relieve EBMUD of responsibility for Items #1, #2, and #3, and #5 of the above. In addition, the provisions described in Item #4 would not be required after two years. Therefore, ACWD requests the State Water Board to modify the General Order and draft Monitoring and Reporting Program to include provisions that would enable continuation of similar notification and reporting requirements for cases like the Bayside Groundwater Project (i.e., when a neighboring agency is subject to hydrologic effects) or to enable pre-existing provisions to be incorporated in the WDR.

Clarify Definition of "Area of Hydrologic Influence"

Under Attachment A, Glossary of Terms, "Area of Hydrologic Influence" is defined as the area underlain by injected water. However, pressure hydrologic influences could extend miles beyond the zone of chemical influence. Therefore, "Area of Hydrologic Influence" should be changed to "Area of Chemical Influence," or a new definition should be offered to include pressure effects.

ACWD appreciates the State Board's consideration of these comments. Questions on the content of this letter may be directed to Mike Halliwell at 510-668-4412.

Sincerely,

Robert Shaver
Assistant General Manager-Engineering

mh/ps
Attachments
By E-mail
cc w/o attachments: Steven Inn, ACWD
Eric Cartwright, ACWD
Mike Halliwell, ACWD
Michael Rochette, RWQCB
Cherie McCaulou, RWQCB
Ken Minn, EBMUD
Alex Ameri, City of Hayward

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April 9, 2007

Mr. Michael Rochette
Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Dear Mr. Rochette:

Subject: Comments on Tentative Order – Waste Discharge Requirements for East Bay Municipal Utility District, Bayside Groundwater Project, 2600 Grant Avenue, San Leandro, Alameda County

The Alameda County Water District (ACWD) appreciates the opportunity to comment on the Tentative Order – Waste Discharge Requirements for East Bay Municipal Utility District, Bayside Groundwater Project. Prior to providing ACWD's specific comments on the Tentative Order (TO), the following background information explains ACWD's role in managing and protecting the Niles Cone Groundwater Basin (NCGB), the relationship between the NCGB and the Southeast Bay Plain Basin (SEBP), and the potential impacts of EBMUD's Bayside Groundwater Project on the NCGB.

Background

ACWD's Role in Managing and Protecting the NCGB

ACWD provides approximately 55,000 acre-feet of potable water to a population of over 320,000 in the cities of Fremont, Newark and Union City. In 1914, ACWD was the first water district to be formed under the County Water District Act and was created for the purpose of protecting the water in the NCGB and conserving the water of the Alameda Creek Watershed. Local runoff along with imported water is percolated into the NCGB through recharge in Alameda Creek itself and through recharge ponds within the Quarry Lakes Regional Recreational Area and adjacent areas. The water is subsequently recovered through groundwater production wells and provided as potable supply to ACWD's customers.

In normal to wet years, approximately 40 percent of the supply to ACWD's distribution system is provided by groundwater pumped from the NCGB. In dry years, groundwater has contributed over 60 percent of the supply. The NCGB is adjacent to the SEBP which, in turn, would receive water injected at East Bay Municipal Utility District's (EBMUD) Bayside Groundwater Project facility. In addition to distributing potable water, ACWD devotes significant resources to protect and manage groundwater supplies in the NCGB. These management efforts have been motivated largely in response to historical degradation in groundwater quality that occurred due to sea water intrusion over several decades from about 1915 to 1973. Within most of that period, pumping demands, which largely served agricultural irrigation needs, exceeded the rate of replenishment, resulting in severe and prolonged drawdown of the upper aquifer (Newark Aquifer) to levels below sea level. Because of the pervasive interconnection between the Newark Aquifer and San Francisco Bay, the drawdown below sea level resulted in significant sea water intrusion in the NCGB.

In 1961, the state legislature adopted the Replenishment Assessment Act for the Alameda County Water District. This legislation, later amended in 1970, gave the District significant powers to protect and manage the basin, including the authority to require installation of meters on wells and to undertake various measures to ensure adequate replenishment of the NCGB. In 1962, ACWD contracted with the California Department of Water Resources to import state (delta) water to augment local supplies for groundwater recharge. This greatly boosted the District's artificial recharge operation. Today, this operation consists of an elaborate system including three inflatable rubber dams that impound water in Alameda Creek for in-creek percolation and off-stream diversion to several hundred acres of recharge ponds, enabling more efficient capture and storage of local Alameda Creek water in the groundwater basin. By 1973, well levels in the Newark Aquifer were returned above sea level, which reversed the flow in this aquifer unit back toward the natural direction; that is, toward San Francisco Bay. This ended the occurrence of new sea water intrusion, and began the gradual process of recovery of water quality which had been degraded by previous decades of sea water intrusion. The cumulative progress in restoration to date has enabled ACWD to continue and expand utilization of the NCGB for conjunctive use; however, because significant areas of brackish water remain and that the Niles Cone is a coastal aquifer system that could be subject to new sea water intrusion, continued careful basin management practices are essential.

ACWD's investments in protecting the NCGB include not only the artificial recharge program, but also other important groundwater protection programs, such as serving as the enforcing agency for city well ordinances, and entering into a cooperative agreement with the Regional Board to serve as the local agency overseeing investigation and cleanup of Leaking Underground Fuel Tank (LUFT) sites and Spills, Leaks, Investigations and Cleanup (SLIC) sites.

Relationship Between NCGB and SEBP

ACWD's interest in monitoring developments with the Bayside Groundwater Project relates to how the two basins (SEBP and NCGB) are geologically connected, and consequently, how operations at the Bayside facility could ultimately affect ACWD's efforts to manage and protect supplies and water quality in the NCGB.

The Hayward Fault acts as a barrier to lateral groundwater flow and thus divides the NCGB into two virtually independent sub-basins: the smaller Above Hayward Fault (AHF) sub-basin to the east and the larger Below Hayward Fault (BHF) sub-basin to the west. ACWD operates recharge facilities and wellfields on both sides of the fault (Figure 1, attached), but most of the groundwater storage in the NCGB is in the BHF basin, which is comprised of four regional aquifer units more or less stacked on top of one another. They are, by order of depth, the Newark Aquifer (uppermost), the Centerville Aquifer (upper intermediate), the Fremont Aquifer (lower intermediate), and the Deep Aquifer (lowest). These aquifers are generally confined and separated by low permeability aquitards throughout the sub-basin except in the forebay. For the NCGB, the forebay is the main recharge area, and therein, the Newark Aquifer is unconfined and receives recharge from percolation at ACWD's artificial recharge facilities. The aquitards separating the aforementioned major aquifer layers are thin and more permeable in the forebay, enabling recharge of the deeper units from percolation from the overlying Newark Aquifer.

As such, the amount of groundwater in storage in the BHF sub-basin is closely correlated with Newark Aquifer well levels in the (unconfined) forebay area, even when changes in storage occur due to pumping in deeper aquifers outside of the forebay. Between 0 and 20 feet above mean sea level (MSL) (as measured in the Newark Aquifer forebay indicator well), there are approximately 1,000 acre-feet of water storage in the BHF sub-basin per every 1 foot of elevation change in water level in the well. Over 20 feet MSL, little additional storage in the sub-basin is realized, and below 0 feet MSL the occurrence of new sea water intrusion is incipient. This gives a long-term working storage of about 20,000 acre-feet, a critical reservoir for the residents of the tri-cities. As the NCGB is a coastal aquifer system, there is constant outflow to the bay, which, though beneficial for water quality because of the associated export of salt, reduces the sustained, recoverable working storage to a value lower than 20,000 acre-feet. In normal to wet years, ACWD receives sufficient recharge water to fill the groundwater basin up to 20 feet MSL. Conversely, in dry years, the basin is expected to drop quickly, and it may be necessary to operate below sea level for short periods in severe long-term droughts. ACWD's strategy is to maximize levels in the groundwater basin in wet years, and minimize the duration of below sea level operations and the extent to which the Newark Aquifer must be brought below sea level during critically dry periods. In essence, the strategy is to continue reclamation of the basin, and avoid renewed long-term damage due to new sea water intrusion.

When the Bayside Groundwater Project was first proposed in 2001, ACWD was concerned that pumping at the Bayside Facility would induce severe pressure drawdowns in the Niles Cone, degrading water quality especially during dry years, or otherwise interfere with ACWD's efforts to maintain groundwater supplies and continue the restoration of water quality in the NCGB. This concern stems from the documented physical interconnection between the NCGB and the SEBP, and the fact that the EBMUD Bayside Groundwater Project facility is sited close to the border with NCGB.

The SEBP and NCGB are interconnected largely through the Deep Aquifer, and this interconnection is well documented by DWR bulletins, common long-term water level trends over time among the Deep aquifers of the two basins, and a pump test and hydrogeologic assessment jointly conducted by EBMUD and ACWD in 2002 (*East Bay Plain Aquifer Test Project, Southeast Bay Plain and Niles Cone Groundwater Basins*, Luhdorff & Scalmanini Engineers, April 2003). The conclusion of the latter study is that the interconnection appears to occur not so much as a laterally continuous aquifer, but as a 'transition zone' characterized by intervening sand and gravel units that hydraulically communicate through flow through thin separations (see Figure 2 in the TO). The 2002 pump test involved concurrent pumping of two of the City of Hayward's emergency supply wells – one located in the SEBP and the other in the NCGB- with only one well pumping at a time. The magnitude of the drop in water levels in monitoring wells in the opposite basin from that in which pumping occurred provided a sense of the pervasiveness of the interconnection.

Bayside Groundwater Project's Potential Impacts on the NCGB

The hydraulic interaction between the two basins has been a basis of concern because it presents a means for operations at the Bayside facility to affect confined storage, and ultimately unconfined storage, in the NCGB. EBMUD will inject water into, and extract from, the SEBP Deep Aquifer, which appears to be overlain by thick layers of clay throughout the SEBP. Thus, even if there were within the SEBP an unconfined aquifer of significant thickness, permeability, and of regional continuity and extent (to our knowledge, such is not documented), it likely would be too hydraulically insulated from the Deep Aquifer to effectively accept water displaced in response to injections, or yield water back to the Deep Aquifer and/or intervening gravel units in response to extractions, at the Bayside Project facility. Although slight storage may be available to the confined aquifer through the expansion and contraction of the clays and the very slight compressibility of water, confined aquifer storage is magnitudes smaller on a per gross unit volume basis than unconfined storage, which realizes its storage through exchange of air for water (filling), or vice versa (drainage), in the pore space. Hence, pumping or injection stresses in thickly insulated confined aquifers tend to result in pressure fluctuations that are great in magnitude and lateral extent, potentially impacting neighboring groundwater basins.

Unlike in the SEBP, the Deep Aquifer in the NCGB communicates relatively freely with the unconfined Newark Aquifer, via the Centerville and Fremont Aquifers in the forebay area, and this, in conjunction with the means of transmission across the transition zone between the NCGB and SEBP, would appear to provide a path of relatively low resistance in response to stresses on the SEBP Deep Aquifer exerted by injection and pumping at the Bayside facility. Thus, although the NCGB is largely outside the 'Aquifer Storage Zone' defined in the TO, operations at the Bayside facility, depending on their intensity and duration, would likely be noticeable in the Niles Cone, felt as pressure surges during injection and losses in supply during extraction periods. In essence, this would result in some borrowing of ACWD's groundwater reservoir capacity, which as mentioned before, is limited.

In wet years, when EBMUD would be injecting water, ACWD would already have sufficient surface water to recharge the NCGB up to 20 feet MSL. Hence, any water received into the NCGB from the SEBP during injection would not likely provide a one-to-one benefit to ACWD and compensate for all of the supply that would be lost from the NCGB during Bayside extraction periods, albeit the severity in loss of supply would be more severe without the injection component of the Project. Thus, we believe that pumping at the Bayside facility above a certain threshold of intensity or duration could interfere with ACWD's long term objective of restoring water quality in the Niles Cone and preventing long-term damage from new sea water intrusion. Even without the Bayside Project, the Newark Aquifer levels can be expected to drop to sea level, or even below sea level, for at least short periods during critical drought periods. Heavy pumping at the Bayside facility at such times would result in drawdowns in the NCGB of greater magnitude and duration below sea level, despite injections during wet years. Moreover, injections during wet periods, if they were to contribute to achieving well levels in the Newark Aquifer in excess of 20 feet MSL, might result in significant losses of potable groundwater in the NCGB through springs, creeks, abandoned wells, or other mechanisms; and such conditions could present operational difficulties and public perception problems for ACWD, as well as legal challenges from land owners perceiving adverse impacts.

ACWD communicated these general concerns in response to the 2001 EIR, which at that time had proposed a 10 to 15 mgd operation. To their credit, EBMUD subsequently suspended their EIR to allow a detailed study. Besides jointly sponsoring and participating in the aforementioned pump test and hydrogeologic assessment to characterize the inter-basin transition zone, the two agencies, working also in cooperation with the City of Hayward, developed a groundwater flow model to predict impacts on the NCGB in response to hypothetical operations at the Bayside Project facility. These hypothetical operations involved 5 and 10 mgd scenarios, and the model results confirmed that, despite injections during normal to wet years (40 percent of the time), the extractions would result in significant drawdowns in the NCGB relative to the no-Project alternative. Such impacts would necessitate mitigation in the form of supplying significant amounts of water to ACWD during dry periods. Ultimately, the proposed

Bayside Project proposal was scaled back to a 1 mgd-level of operation. The model demonstrated that the scaled back project would not necessitate mitigation to ACWD, provided that injections occur as planned. Hence, ACWD has no fundamental opposition to this Phase I Project.

Obviously, the actual impacts will depend on the accuracy of the model. The model was calibrated to historical water levels between 1964 and 2000. As there was a lack of data on historical pumping demand in the SEBP during this period to constrain the range of values of certain calibrated model parameters (pumping is an important stress affecting the values), more than one set of values could have met calibration targets. This gave rise to disagreement between the agencies over parameterization of the model, particularly the coefficients that regulate the simulated ease of vertical flow between aquifer layers in the SEBP. Potentially, the magnitude of drawdown during extraction (recovery) cycles and mounding during injection could be greater in the NCGB than predicted by the current model. Though a compromise was reached, ACWD remained (and remains) concerned with the final parameterization, but decided to not fundamentally oppose the Project in response to EBMUD's scaling back proposed operations to 1 mgd, and with the understanding that the model would be intensively verified under actual Phase I operations through a robust monitoring program that would involve water level measurements from a network of wells to be placed in strategic locations within the SEBP – not just in the immediate area of the Bayside facility. ACWD, in turn, would monitor wells in the NCGB.

Therefore, we consider joint basin-wide monitoring, sharing of data, and model verification under Phase I operations (and prior to startup to establish a baseline) absolutely essential to protecting water quality and supplies in the NCGB over the long term. This is underscored by the expectation that regional groundwater modeling will be eventually used to evaluate potential Phase II Project impacts on the NCGB, that Phase II operations would have significant impacts on the NCGB, and that water levels measured during knowable stresses of pumping and injection under Phase I operations are the only opportunity to gain a knowledge base for verification, or possible recalibration, of the model (or development of a new model) to be used to predict impacts of a possible Phase II Project.

Comments

1. Finding 3 (Project Location) and Finding 4 (Project Background) – pages 1 and 2 of 20.

   We recommend that these sections include some discussion of the hydrogeologic connections between the SEBP and the NCGB, and the relevance of the Bayside Project to ACWD's interests in protecting the NCGB, as provided in the above Background part of this letter.

2. Finding 17 (Vertical Conduits) – page 9 of 20.

   Vertical conduits that might facilitate transmission of water under vertical gradients induced by Bayside operations may exist in the northwest part of the Niles Cone. Chloride concentrations in the Deep Aquifer at this part of the NCGB are elevated, possibly consequential of vertical conduits, such as abandoned wells, that might have enabled brackish water to migrate downward from the salt ponds or Newark Aquifer. We suggest that EBMUD's interest in working with property owners to properly destroy (to appropriate standards) abandoned wells include this area as well.

3. Finding 28 (California Environmental Quality Act) – page 11 of 20.

   ACWD appreciates EBMUD's commitment to a new EIR should EBMUD decide to proceed with a Phase 2 Project. It is important to ACWD that this commitment apply to not just a full scale Phase 2 Project as currently envisioned, but also to any substantive incremental change in facilities, capacities, or operational concept (e.g., formal or de-facto abandonment of the injection component in favor of an extraction-only Project would constitute an obvious fundamental change in operational concept), relative to those (facilities, capacities, and operational concept) described, defined, allowed, or limited under the Phase I Project (EIR). Similarly, we appreciate that the Regional Board intends that this Order cover only the Phase I Project, and that submittal of a new Report Of Waste Discharge (ROWD) would be required for a Phase 2 Project.

4. Provisions – page 13 of 20.

   A notification provision should be included in the Order to require EBMUD to notify the Regional Board, ACWD and other interested agencies (such as, potentially, the City of Hayward) in advance (suggestion of 1 to 2 weeks) of any planned change in mode of operation at the Bayside facility over the life of this (Phase I) Project. Such advance notification would give ACWD the opportunity to monitor wells in the NCGB just prior to and following such a change. Such changes would include commencement of operations (initial startup) and then any mode alternation thereafter, such as switching from injection to pumping or vice versa, shutting-down operations to initiate an idle period, and re-starting operations after an idle period.

5. Attachment A, Self Monitoring and Reporting Program.

   Language should be added that reflects recognition of the need for a robust regional monitoring of hydraulic responses in NCGB and SEBP aquifers to Phase I operations so as to 1) provide the best attainable means to predict impacts on the NCGB from a possible Phase II Project, and 2) determine actual response of Phase I operations compared to previous predictions; and that the Order, as appropriate, may encourage for said purpose:

A. Monitoring of water levels in wells at regionally strategic locations and depths in the SEBP- not so much for focused evaluation of the Aquifer Storage Zone (although that is also an important objective) - but to enable verification of model assumptions affecting simulated vertical and horizontal flow within the SEBP on a basin-wide scale, because model-predicted impacts on the NCGB are sensitive to such assumptions. In previous communications with ACWD (most recent substantive communication was a meeting between ACWD and EBMUD staffs on March 28, 2006), EBMUD indicated its intent to measure water levels in a network of wells, including wells at locations greater than 5,000 feet from the Bayside site, for basin-wide model verification purposes and/or evaluation of aquifer response throughout the SEBP and within the transition zone between the SEBP and NCGB. Some of these wells appear in Table 1 within the Self Monitoring Program of Attachment A of the subject Tentative Order, but several, listed in the table below and indicated in the attached Figure 2, were left out:

OMITTED MONITORING WELLS		
Well ID	**Construction Status**	**Aquifer**
Davis Street-Deep	Existing	Deep
Davis Street-Shallow	Proposed new well	Shallow
Farmhouse-Shallow	Proposed new well	Shallow
Farmhouse-Intermediate	Proposed new well	Intermediate
Metal Masters	Existing	Shallow
Mount Eden	Existing	Deep
Weekes Park	Existing	Intermediate
Hayward (monitoring) Well B-Shallow	Existing	Shallow
Hayward (monitoring) Well B-Interm.	Existing	Intermediate
Hayward (monitoring) Well B- Deep	Existing	Deep
Hayward Well C	Existing	Deep
Hayward Well D	Existing	Deep
Hayward Well E	Existing	Deep

We request the language in the Order be modified to require monitoring of the these omitted monitoring wells (in addition to those already included in the Table 1 of Attachment A in the Self Monitoring Program), or an alternative network of wells that provide similar vertical and lateral coverage on a basin-wide scale, and that the monitoring of the network adhere to a schedule as follows:

- Establishment of Baseline Conditions. We understand that EBMUD has initiated pre-project baseline monitoring of water levels in wells listed in Table 1 of Attachment A of the Self Monitoring Program. We request that the omitted monitoring wells listed above be included for baseline monitoring, and that they be monitored no less frequently than monthly,

with the first monitoring event occurring as soon as possible. The planned new wells should be constructed within an appropriately early timeframe, or as early as practicable, to maximize the opportunity for these new wells to contribute toward the set of baseline data collected over the pre-Project monitoring period.

- Startup Period Monitoring, Including Higher Frequency Monitoring to Capture Short-Term Response to Startup. Table 1 of Attachment A of the Self Monitoring Program indicates EBMUD's intent to provide high frequency monitoring (readings every 30 minutes to 1 hour) of certain wells during the 1-year startup period for the Project. We applaud this, as we see it presenting an opportunity to gage short term hydraulic responses of the aquifer system to introduction of Bayside-related stresses, similar to what was provided through the 2002 pump test of Hayward emergency supply wells. In order to capture the response near and within the transition zone, we request that certain other wells listed in the above-noted table of omitted wells be included for similar high frequency monitoring during the startup period, particularly those wells located in Hayward and/or the transition zone. We request and recommend that high frequency monitoring of such wells occur for at least one week prior to each change in mode of operations (including initial startup of operations) plus one week following the change, to ensure adequate data to compare conditions just before a change in mode of operation to conditions following the change.

  During other times throughout the startup period, these wells (that is, those within the list of omitted wells chosen for high frequency monitoring) should be monitored with a frequency no less than monthly; and we request that other wells from the table of omitted wells, not selected for high frequency monitoring, be monitored monthly over the duration of the startup period.

- Monitoring over Long-Term Operations. EBMUD has proposed long-term monitoring of wells listed in Table 1 (See "Subsequent Years" column of Table 1 in Attachment A of the proposed Self Monitoring Program). We request that the omitted monitoring wells listed in the table above, or an alternative network of wells providing similar strategic coverage of the SEBP and transition zone, also be included for long-term monitoring. Furthermore, we request that each of these additional wells be monitored with a frequency of no less than monthly for at least the first year following the startup period. Monitoring of these omitted wells should continue in future years throughout the life of the Project, generally on a monthly basis, although a reduction in frequency to quarterly could be considered in certain wells, depending on the trends in data.

- Water Quality Monitoring for Sea Water Intrusion in the SEBP. Semi-annual to annual sampling is recommended.

B. Sharing of data on an annual basis with ACWD (and possibly the City of Hayward, too, depending on their interest), including monthly totals of Bayside injection and/or extraction, water levels from the overall network of monitoring wells in the SEBP (those identified in Table 1 of Attachment A of this TO, plus those listed in the table of omitted wells provided in these comments), geologic data obtained during installation of new wells, results of any investigations of sea water intrusion, and information on abandoned wells and active private wells identified in the course of EBMUD's fulfillment of the requirements of the Order (e.g. Item 17- Vertical Conduits). Such data would be helpful for evaluating actual responses of well levels to Bayside operations, improve understanding of groundwater quality, and would help verify and/or recalibrate the existing or a future groundwater model to predict impacts of a Phase II Project. EBMUD could include this information in the annual report required by the Regional Board, or in a separate correspondence to ACWD (and the City of Hayward).

C. ACWD would be willing to share with EBMUD data collected from monitoring wells in the NCGB, and other relevant information. Reporting and analysis of data from ACWD and the City of Hayward groundwater facilities should be included in the annual report in order to assess the regional impacts of the project in the NCGB.

We appreciate this opportunity to provide these comments. If you have any questions, please do not hesitate to contact Mike Halliwell at 510-668-4412.

Sincerely,

Robert Shaver
Engineering Manager

mh/mah
Enclosures
By E-mail
cc: Steven Inn, ACWD
Eric Cartwright, ACWD
Mike Halliwell, ACWD
Ken Minn, EBMUD
Alex Ameri, City of Hayward

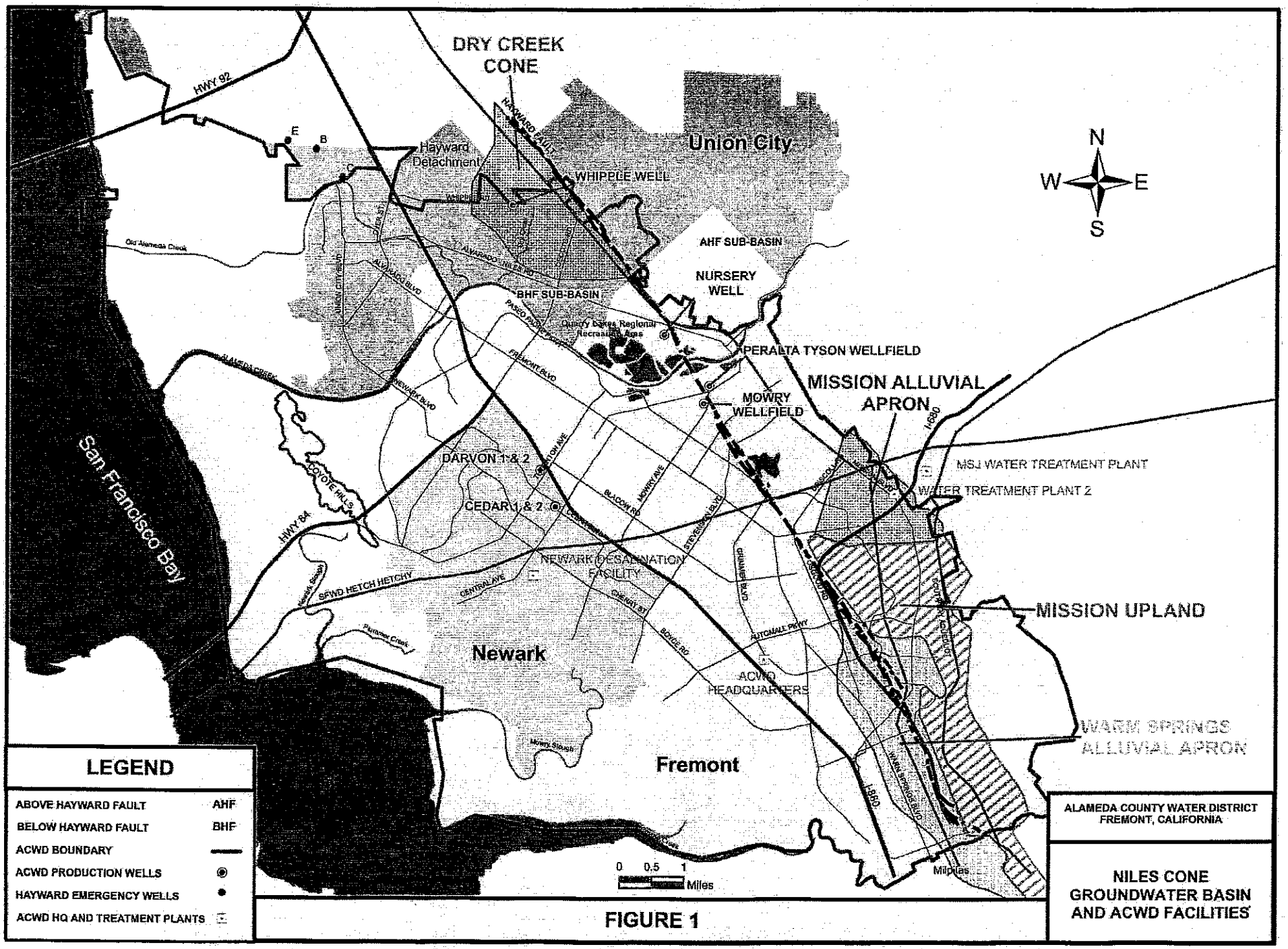
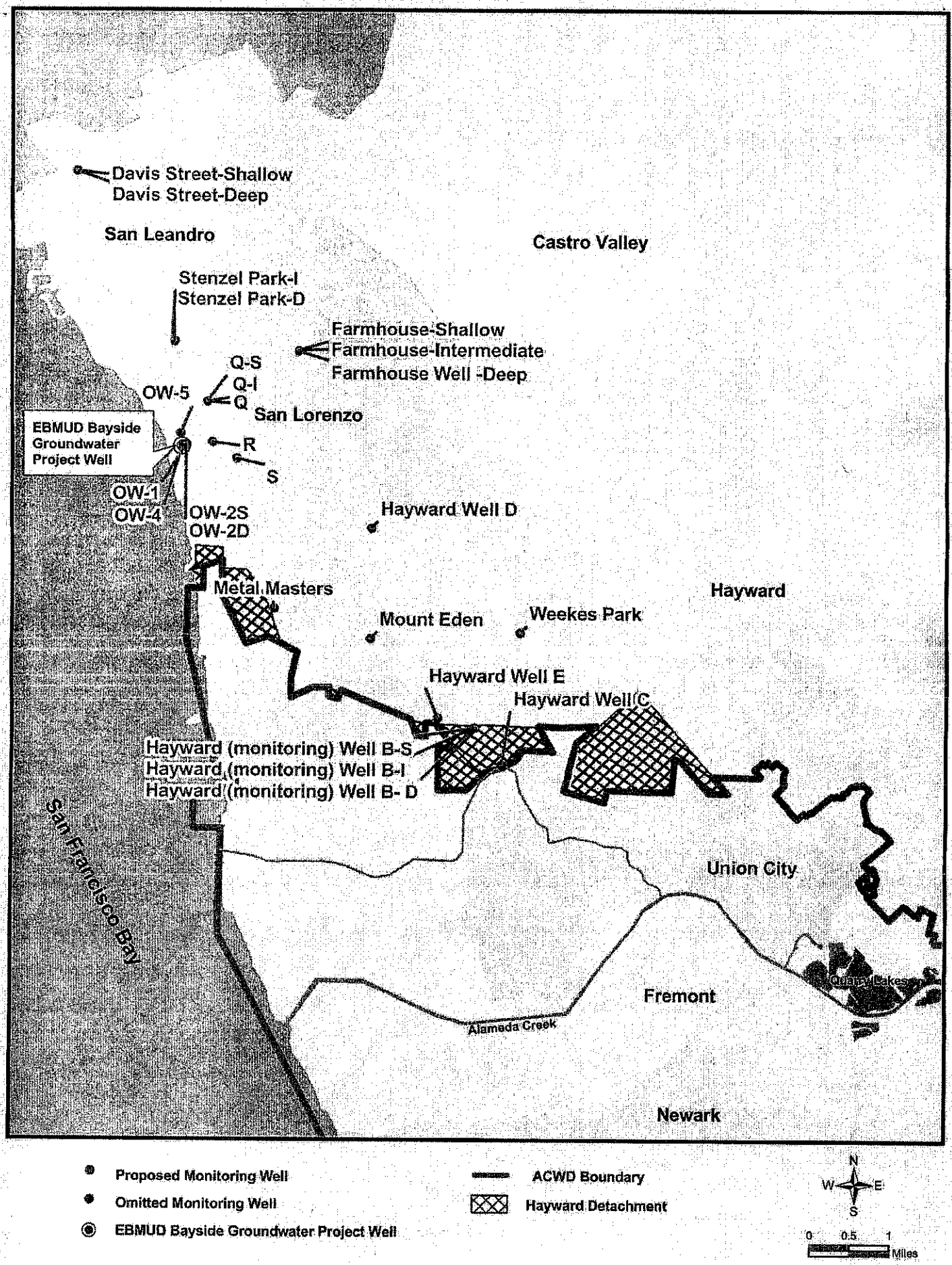


FIGURE 1

Attachment A

Figure 2


Davis Street-Shallow
Davis Street-Deep
San Leandro
Castro Valley
Stenzel Park-I
Stenzel Park-D
Farmhouse-Shallow
Farmhouse-Intermediate
Farmhouse Well -Deep
Q-S
Q-I
Q
OW-5
San Lorenzo
EBMUD Bayside Groundwater Project Well
R
S
OW-1
OW-4
OW-2S
OW-2D
Hayward Well D
Metal Masters
Hayward
Mount Eden
Weekes Park
Hayward Well E
Hayward Well C
Hayward (monitoring) Well B-S
Hayward (monitoring) Well B-I
Hayward (monitoring) Well B- D
San Francisco Bay
Union City
Quarry Lakes
Fremont
Alameda Creek
Newark
Proposed Monitoring Well
Omitted Monitoring Well
EBMUD Bayside Groundwater Project Well
ACWD Boundary
Hayward Detachment
N
W
E
S
0
0.5
1
Miles

California Regional Water Quality Control Board
San Francisco Bay Region EBMUD Bayside G.W. Project

Linda S. Adams
Secretary for Environmental Protection

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Arnold Schwarzenegger
Governor

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Date: MAY 17 2007
File No.: 2199.9459

Certified Mail No. 7005 1820 0005 8828 4615
East Bay Municipal Utility District
Attention: Mr. Kenneth Minn
375 11th Street, MS 407
Oakland, CA 94607

SUBJECT: **Transmittal of Adopted Order No. R2-2007-0038 for the East Bay Municipal Utility District's Bayside Groundwater Project, San Lorenzo, Alameda County**

Dear Mr. Minn;

Please find the enclosed Order No. R2-2007-0038, adopted by the San Francisco Bay Regional Water Quality Control Board at its regular monthly meeting on Wednesday, May 9, 2007, for the Bayside Groundwater Project.

If you have any questions concerning the Order, please contact me directly at (510) 622-2411 or via e-mail at **mrochette@waterboards.ca.gov**.

Sincerely,

Michael Rochette

Michael Rochette, P.G.
Planning Division

Enclosure: Order No. R2-2007-0038

cc: Steven Inn
Eric Cartwright

cc with enclosure:

City of San Leandro
Engineering and Transportation Department
835 East 14th Street
San Leandro, CA 94577
ATTN: Keith Cooke, Principal Engineer

City of San Leandro
Community Development
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San Leandro, CA 94577
ATTN: Hanson Hom, Director

Alameda County
Department of Environmental Health
1131 Harbor Bay Pkwy
Alameda, CA 94520-6577
ATTN: Ariu Levi, Director

Alameda County Water District
43885 South Grimmer Blvd
Fremont, CA 94538
ATTN: Robert Shaver, Engineering Manager

City of Hayward
Public Works Department
777 B Street
Hayward, CA 94541
ATTN: Alex Ameri, Deputy Director

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER No. R2-2007-0038
WASTE DISCHARGE REQUIREMENTS

for:
EAST BAY MUNICIPAL UTILITY DISTRICT
BAYSIDE GROUNDWATER PROJECT
SAN LORENZO, ALAMEDA COUNTY

Whereas, the California Regional Water Quality Control Board, San Francisco Bay Region (hereinafter Water Board), finds that:

1) **Project Sponsor**
The East Bay Municipal Utility District (EBMUD) is the Bayside Groundwater Project (Project) sponsor and has sole responsibility for the design, construction, operation, maintenance and management of the Project. EBMUD submitted a complete Report of Waste Discharge (ROWD) for the Project on September 1, 2006.

2) **Project Summary and Objectives**
The Project involves the injection and storage of treated drinking water from EBMUD's distribution system into the South East Bay Plain Groundwater Basin (SEBPB) during wet years for later recovery and use during dry years as a source of supplemental drinking water supply.

This type of project is known as an Aquifer Storage and Recovery (ASR) project. The Project will utilize a single, existing production well, identified as the Bayside Well, for injection and subsequent recovery to provide up to 1 million gallons per day (mgd) of supplemental water supply. The recovered water will be treated and piped back into EBMUD's existing water distribution system. Post recovery treatment will include fluoridation, chloramination and pH adjustment for corrosion control. The sequence and duration of injection, storage and recovery will be dictated by the natural hydrologic cycle, drought frequency and demand within the EBMUD service area.

EBMUD's overall objectives for the Project are:
a) To reliably provide more drinking water for customer use during drought periods than would be available from current water supplies alone;
b) To make beneficial use of local water resources;
c) To provide water that complies with state and federal drinking water standards while maintaining or enhancing groundwater quality.
d) To initiate EBMUD groundwater use within the SEBPB to prepare for both near-term (less than five years) and future drought conditions; and,
e) To collect data to inform decision making regarding whether it is appropriate to implement Phase 2, a larger-capacity facility, and, if so, how to design Phase 2.

3) **Project Location**
The Project is located in an unincorporated area of San Lorenzo and the City of San Leandro, within Alameda county. The facility address is 2600 Grant Avenue, San Lorenzo (Figure 1). The Project is located in a predominantly industrial area that is bounded by residential communities. The nearest residences are approximately 1,875 feet (ft.) to the north

and 2,250 ft. to the east. Historically, the area was a tidal marsh but has since been drained, filled, or otherwise altered by industrial and residential development during the past century.

Surface water bodies that are located within the Project area include the San Francisco Bay which lies approximately 1,100 ft. west of the facility and three channelized and concrete-lined surface water San Lorenzo Creek lies approximately 1,500 ft. to the north. Bockman Canal lies approximately 800 ft. to the south and Sulphur Creek lies approximately 4,600 ft. to south.

The groundwater basin underlying the Project area is referred to as the SEBPB. It is a subdivision of the larger East Bay Plain groundwater basin which extends from the Project area approximately twenty-five miles to the north to Richmond and approximately five miles to the south where it is bounded by the Niles Cone Groundwater Basin (NCGB). The SEBPB extends north to Berkeley, south to the NCGB , east to the Hayward Fault, and west beneath San Francisco Bay. Hydraulic connectivity between the deep aquifers of the SEBPB and the NCGB is known to exist but the specific mechanism is not certain (Figure 2). Suggested mechanisms include: a) wells in the transition zone between the two basin may by completed in aquifers which are common to both aquifer systems; b) there are overlapping and abutting relationships; c) there is natural vertical leakage; or d) communication occurs through well bore holes.

Groundwater of the NCGB is currently pumped by the Alameda County Water District to provide approximately 40% of their drinking water supply during wet years and, at times, over 60% during dry years.

4) **Project Background**

In October 1993, EBMUD adopted a Water Supply Management Program (WSMP) that serves as a planning guide for the provision of water to the EBMUD service area through the year 2020. The WSMP demonstrated that EBMUD's existing water supplies are insufficient to meet current and future customer demand during droughts, despite implementation of conservation and water recycling programs and an aggressive dry-year water rationing policy. Without additional near-term water supplies, EBMUD customers will experience potentially severe water shortages during prolonged droughts.

In 1997, EBMUD drilled the Bayside Well and initiated pilot studies to investigate the feasibility of using deep aquifer in the SEBPB to store water for times of drought. As part of the pilot studies, three complete cycles of injection, storage, and recovery were conducted between December 1, 1998, and July 27, 1999, using the Bayside Well. A total of approximately 99 million gallons of water were injected and approximately 116 million gallons were recovered.

Based on the pilot studies, EBMUD concluded that the Bayside Well is capable of long-term injection and extraction rates of 1.1 mgd and 1.6 mgd respectively, and that the recovered water can meet all drinking water standards with treatment.

In 2001, EBMUD circulated a Draft Environmental Impact Report (DEIR) on the Project. The 2001 DEIR evaluated the impacts of developing multiple injection wells in the Project area with a collective annual capacity of 15 mgd. Based on comments received on the DEIR, EBMUD conducted focused studies that have led to substantial Project changes that eliminate potentially significant impacts or reduce to less than significant levels the impacts that remain.

In 2005, EBMUD prepared a new Bayside Project Draft Environmental Impact Report. As analyzed in the new DEIR, the Project is proposed in two phases. The initial Phase 1 is designed to use only the Bayside Well for injection and recovery with a limited annual capacity of 1 mgd. If found feasible, Phase 2 would be designed to increase the annual capacity to a target range between 2 and 10 mgd with installation of additional wells at currently

undetermined locations within the SEBPB.

This Order only addresses the Phase 1 Project. EBMUD has made no commitment to implement Phase 2. If EBMUD decides to implement Phase 2 or make any substantive incremental change in facilities, capacities, or operational concept (e.g., formal or de-facto abandonment of the injection component in favor of an extraction-only project), EBMUD would need to submit to the Water Board a new ROWD that includes baseline data, such as, regional groundwater levels, together with any necessary CEQA documentation.

5) **Project Operation**
Since the Project is a supplemental drought water supply project, the sequence of injection, storage and recovery (ISR) cycles and their durations will be dictated by climatic conditions, drought frequency and duration, and demand within EBMUD service area. The following is a standard planned sequence of ISR operation.

a) Injection: Treated drinking water will be injected into the deep aquifer of the SEBPB solely utilizing the Bayside Well (a.k.a. Bayside Well No.1). The Bayside Well is an 18 inch diameter well screened in the deep aquifer of the SEBPB at depths between approximately 520 and 650 feet below ground surface (bgs). The deep aquifer is the major water-bearing unit in the basin and is present near the top of the unconsolidated alluvial deposits in the Lower Alameda Formation at depths of 500 feet or more beneath the ground surface. It is confined by thick clay layers hydraulically isolating it from shallow groundwater. A cross section of the deep aquifer, transecting northwest to southeast, is shown in Figure 2.

Injection would take place in wet years, defined as those years that include: 1) active flood releases on the Mokelumne River; and 2) sufficient runoff in the local watershed.

Based on hydrology of the last 70 years, it is anticipated that water will be available for injection approximately 40 percent of the time. However, the injection will be managed in accordance with basin hydraulic response and condition. For example, if deep wells overflow in the basin area, the injection will be postponed until these wells are modified to resist increased pressure. The average distribution pressure at the Project location is 85 pounds per square inch (psi). A flow control valve (pressure reducing valve) will be used to maintain and ensure injection rates of 1 mgd.

During the injection phase, stored water will be pumped out to flush the well approximately once every six weeks, and annually to redevelop the well to improve injection efficiency. This back flush water is planned to be discharged, under the appropriate discharge permits, to the Oro Loma Sanitary District Wastewater Treatment Plant or to the Alameda County Flood Control District's drainage system.

b) Storage: The injected drinking water will be stored in the deep aquifer, as described above, in an area delineated as the Aquifer Storage Zone (ASZ) (Figure 3). The storage volume of ASZ is directly related to the rate and duration of injection phases. Based on past hydrologic cycle, the injection phase is expected to span up to 15 years. At an annual average injection rate of 1 mgd for 15 consecutive years, the total storage volume of water in the ASZ would be 16,800 acre-feet. Based on groundwater modeling, the predicted boundary of ASZ is generally radial around the Bayside Well, with a maximum radius of about 3,500 feet after 15 years of injection.

c) Recovery: During dry years, EBMUD would recover both injected water and native groundwater by operating the Bayside Well in extraction mode during warm-weather months. The pumps would be operated at a 2 mgd extraction rate during this part-year

period to maximize warm-weather yield and well efficiency; however, the well would maintain an annual yield of 1,121 AF per year (1 mgd). Extraction operation is anticipated to resume in the dry months of succeeding years if the drought extends over multiple years.

The extracted volume of groundwater to remove all injected water will depend upon supplemental drought supply needs. However, the Project is planned to be a permanent water supply source and there are no plans to completely recover all the injected water.

Once the water is extracted, it will be pumped to a new treatment facility to be constructed approximately 400 feet east of the Bayside Well. Treatment will include fluoridation, chloramination and pH adjustment for corrosion control. It may also include a manganese removal process if needed.

Following treatment, the water will be routed through a new 12-inch diameter steel pipe to an existing 20-inch diameter distribution water line that runs along the south side of Grant Avenue immediately adjacent to the treatment facility. When the water enters the distribution system at Grant Avenue, it will mix with other treated water from EBMUD's treatment plants.

A number of connections (house and business laterals) are served off of the Grant Avenue distribution line. However, since the Project is small relative to the service area demand, system modeling shows that the recovered water will be delivered to customers that are within the vicinity of the Project.

6) **Source of Injection Water**
The source of injection water is from EBMUD's drinking water distribution system which consists of a blend of water collected from the Mokelumne river system and local runoff.

a) Mokelumne River Water Source: EBMUD obtains 90 percent of its municipal water supply from the Mokelumne system. EBMUD owns and operates Pardee and Camanche Reservoirs on the Mokelumne River to provide water storage, generate hydroelectric power, provide flood control protection for the lower Mokelumne River, and meet in-stream flow requirements.

Pardee Reservoir is located on the main stem of the Mokelumne River about 38 miles northeast of Stockton, near the town of Jackson. The maximum storage capacity of the reservoir is 197,950 acre-feet (AF). Raw water from Pardee Reservoir is transported about 90 miles to EBMUD service area water treatment plants and terminal reservoirs through the Pardee Tunnel, the Mokelumne Aqueducts, and the Lafayette Aqueducts. The Mokelumne Aqueduct system includes three parallel 82 mile-long steel pipelines which begin in Campo Seco in Calaveras County, traverse the Delta, and end at Walnut Creek in the East Bay Area.

Camanche Reservoir is located on the Mokelumne River just downstream of Pardee Reservoir. Camanche Reservoir, with a maximum storage capacity of 417,120 AF, is used principally to meet EBMUD's flood control obligations. Camanche releases also help to meet obligations to senior downstream appropriators, riparian users, and the lower Mokelumne River fishery.

b) Local Runoff: EBMUD obtains approximately 10 percent of their municipal water supply from local runoff collected in their five terminal storage reservoirs within their service area.

7) **Source Water Treatment**

Prior to injection, the source water will be treated at one of EBMUD's water treatment plants (WTPs) to California Department of Health Service's (DHS) drinking water standards. Raw untreated source water has not been considered for injection since it would require a separate piping system and would potentially create a high level of biological fouling of the injection well. EBMUD operates six WTPs but typically water distributed in the Project area is supplied from the Orinda and/or Upper San Leandro WTP.

Prior to reaching the WTPs, liquid lime is added to maintain a target pH of 8.7 to 8.9 to protect the aqueducts from internal corrosion and to control lead and copper corrosion. Sodium hypochlorite is also added to control biological growth and to meet disinfection requirements. Treatment at the two different WTP is as follows:

a) Orinda WTP: The Orinda WTP is an in-line filtration plant with coagulation, dual media filtration, and disinfection. Polyaluminum chloride, cationic polymer, and sodium hypochlorite are applied to the raw water during the rapid mix process. Sodium hydroxide and fluoride, as well as sodium hypochlorite and ammonia for secondary disinfection, are added after filtration.

b) Upper San Leandro (USL) WTP: The USL facility is a conventional plant with aeration, coagulation, flocculation, sedimentation, dual media filtration, and ozonation for primary disinfection. Alum and cationic polymer are added to the raw water during the rapid mix process. Potassium permanganate is also applied at this point to treat taste/odor and manganese problems when needed. For primary disinfection, chlorine is added before filtration and/or after filtration. Caustic soda, and fluoride are applied after filtration. For secondary disinfection ammonia to create chloramines.

c) Daily and Seasonal Water Quality Variation: The Orinda and USL WTPs provide consistent water treatment with no significant daily or seasonal water quality variation. However, injection water quality would vary depending upon which water treatment plant water serves the injection well area at a particular time. Further variation is possible with changes in water demand and demand distribution patterns in the Project area.

8) **Injection Water Quality**

EBMUD provided an *Injection Water Quality Characterization Report* which includes the results of water sampling in tabulated format as an appendix to the ROWD. In summary, the quality of the treated drinking water injected into the aquifer will meet DHS's drinking water standards for all constituents and the injection water is of better quality than native groundwater with the exception of disinfection by-products (DBPs), such as trihalomethanes (THMs) and haloacetic acids (HAAs). Although injection of treated drinking water will introduce DBPs into the groundwater basin, they are at concentrations below the applicable maximum contaminant levels (MCLs) for drinking water and are expected to undergo biological attenuation with their concentrations decreasing with distance from the injection point. The United States Environmental Protection Agency (USEPA) set the MCL for total THMs at 80 ppb and HAAs at 60 ppb.

The injection, native and recovery water quality data are presented below in Table 1.

Table 1: Injection, Native, and Recovered Water Quality Parameters

Parameter	Maximum Contaminant Level	Orinda WTP[b]	USL WTP[b]	Native GW [c,e,g]	Recovered GW [d,e,g]
Turbidity (NTU)	5.0 [a]	0.06	0.10	0.19	0.21 – 0.23
Total Organic Carbon, ppm	NS	1.5	3.3	2	0.6 – 2.5
Total Dissolved Solids (TDS), ppm	500 [a] (recommended)	41	210	440-520	85 – 240
Chloride, ppm	250 [a] (recommended)	4.4	15	64	9 – 52
Manganese, ppb	50 [a]	ND	ND-23	129-320	7 – 116
Iron, ppb	300 [a]	ND	ND	56	8-130
Arsenic, ppb	10	ND	ND	1.3– 2.1	<7 [f]
Radon, pCi/L	NS	NM	NM	800	470 – 700
Uranium, ppb	30	ND	ND	<1	0.1 - 2
Gross Alpha, pCi/L	15	ND	ND	1	0.6 - 3
Gross Beta, pCi/L	50	ND	ND	1	NM
Radium 226/228, pCi/L	5	NM	NM	NM	0.1
Trihalomethanes, ppb	80	32 – 47	17 – 45	ND – 0.45	19 – 45
Haloacetic Acids, ppb	60	13 – 18	7– 24	1	1 – 4
Alkalinity, bicarbonate, ppm	NA	20.2	114	210	44 – 170
pH	NA	8.9 – 9.5	8.6 – 9.0	7.9	7.6 – 8.1
Hardness, ppm	NA	15 – 30	95 – 130	110 – 170	31 – 82
Sulfate, ppm	250 [a] (recommended)	1.5	39	48	13 – 39
Aluminum, ppb	200 [a]	ND	ND – 126	ND – 10	9.2 – 70.6

Notes:
GW = groundwater; NA = not applicable; ND = not detected; NM = not measured; NS = no standard; NTU = nephelometric turbidity units; pCi/L = picocuries per liter; ppb = parts per billion; ppm = parts per million

[a] Secondary standard (aesthetic, not health based)
[b] 2000 data
[c] Bayside Well No. 1 (screened between 520 and 650 feet below ground level)
[d] Bayside Well No. 1 injection/extraction pilot test
[e] Values shown for native groundwater and recovered groundwater are for untreated water. Under the proposed project, water delivered to customers would be treated to reduce concentrations of manganese. Levels of iron and arsenic would also be reduced during treatment. pH would be increased during treatment to match current levels in EBMUD's distribution system. Levels of other constituents listed would not be expected to change during treatment.
[f] Arsenic concentrations in recovered groundwater were below the level of detection (7 ppb) for the analytical method used. Actual concentrations were likely similar to those shown for the injection water and native groundwater.

9) Native Groundwater Quality

Native groundwater quality data were evaluated at depth intervals in the same fashion as water levels, based on total well depth. This approach allows for evaluation of vertical variations in water quality data as shown below in Table 2.

Table 2: General Range of Native Groundwater Quality in South Eastbay Plain Basin[1,2]

Well Depth (ft bgs)	TDS (mg/l) MCL=1000	Chloride (mg/l) MCL=250	Nitrate as NO3 (mg/l) MCL=45	Sulfate (mg/l) MCL=250	Iron (mg/l) MCL=0.30	Manganese (mg/l) MCL=0.05
0 to <200 ft	500 to 1,000	40 to 250	30 to 45	50 to 250	0.05<	0.01 to 0.05
200 ft to <500 ft	500 to 1,000	40 to 250	1 to 30	25 to 100	0.01 to 0.3	0.02 to 0.05
>500 ft	400 to 500	40 to 150	<1	25 to 50	>0.30[3]	>0.05[3]

[1] Reference the CH2MHill report entitled *Regional Hydrogeologic Investigation South East Bay Plain, January 2000.* More accurate water quality data are summarized in Figures 33 through 50 in the report.

[2] Ranges shown above are to characterize and represent the general native groundwater quality in the South East Bay Plain Basin. However, specific water quality data that exceed or are below of these ranges are also observed in the basin.

[3] Wells with total depth greater than 500 ft are characterized by elevated concentrations of iron and manganese that commonly exceed their secondary MCLs.

10) **Age, Stratification and Source of Native Groundwater**

The chemistry of water from wells in the SEBPB ranges from fresh to saline; salinity is greater than seawater in shallow estuarine deposits near the Bay. Water from wells completed in the deep aquifer has higher pH, higher sodium, chloride, and manganese concentrations, and lower calcium concentrations and alkalinity than does water from wells completed in the overlying aquifers. Return from leaking water supply pipes was not found to be a significant source of ground-water recharge.

Based on tritium/helium-3 ages, most water in the upper aquifer system is relatively young and was recharged after 1952. Recharge occurs as infiltration of stream flow during winter months and as direct infiltration of precipitation. Water in the deeper aquifer system is older and does not contain detectable tritium. Carbon-14 ages range from 500 years to more than 20,000 years before present. The greatest ages were in water from wells completed in the partly consolidated deposits that underlie the northern part of the basin. Groundwater from deep wells near the Bayside Well was recharged about 9,400 years before present.

11) **Disinfection By-Products**

A primary groundwater quality concern is the introduction of disinfection by-products (DBPs) into the groundwater basin. While they are expected to undergo attenuation, some degradation will occur thus triggering the necessity for this Order.

DBPs form when disinfectants used to treat drinking water react with naturally occurring dissolved organic carbon in the water (e.g., decomposing plant material). Total trihalomethanes (chloroform, bromoform, bromodichloromethane, and dibromochloromethane) and haloacetic acids (monochloro-acetic acid, dichloro-, trichloro-, monobromo-, dibromo-) are widely occurring classes of DBPs formed during disinfection with chlorine and chloramines. The amount of DBPs in drinking water can change from day to day, depending on the season, water temperature, amount of chlorine added, the amount of plant material in the water, and a variety of other factors.

During the pilot test cycles, water samples were analyzed for HAA and THM compounds. HAAs were detected at concentrations ranging from 7 to 24 micrograms per liter (ug/L) in the injection water and at 1 ug/L in native groundwater. THMs were detected at concentrations ranging from 17 to 45 ug/L in the injection water and at non-detect levels to 0.45 ug/L in native groundwater. Results indicate that chloroform is the dominant THM compound present in both the injected water and recovered groundwater. Chloroform made up 93 percent of total THMs. This result reflects the low bromine concentrations present in treated drinking water used for injection.

Even though the Project's storage of treated drinking water may lead to lowering of groundwater quality with respect to DBPs, the injected water is not expected to adversely affect any current and anticipated beneficial uses. In addition, EBMUD will use chloramine, rather than chlorine, in the disinfection process to minimize the production of DBPs as the best practicable treatment and control for these constituents of concern.

12) **Saltwater Intrusion**

The Alameda County Water District (ACWD) installed eight monitoring wells in the northernmost portion of its service area to establish groundwater quality and to evaluate potential effects from the Project. ACWD's nearest monitoring well (3S/3W25C020) is perforated in the deep aquifer and located approximately 8,000 feet south of the Bayside Well. The water quality samples from that well revealed elevated chloride (495 ppm) and TDS (1,205 ppm) concentrations.

In United States Geological Survey's (USGS) report titled, "Hydrogeology and Geochemistry of Aquifers Underlying the San Lorenzo and San Leandro Areas of the East Bay Plain, Alameda County, California," water-level responses to tidal changes do not indicate that saline bay water moves into or out of the aquifer. Thick estuarine clay beds separate the saline water in the bay from the intervals monitored by the observation wells. The water quality in shallow monitoring wells indicates high-concentration of chloride. However, as the thick clay layers separate shallow aquifers from deep aquifers, deep aquifers are protected from saltwater intrusion.

The water quality monitoring of the deep aquifer underlying the Project does not show any elevated salt concentrations. EBMUD developed a groundwater flow model in collaboration with ACWD. Results of model-simulated heads and flows indicate that the Phase I Project will not impact seawater intrusion in the NCGB, provided that injection and extraction operations are consistent with the assumptions in the EIR.

As identified in the EIR for Phase 1 of the Bayside Groundwater Project, EBMUD will implement a regional groundwater level monitoring program. The Bayside Project Phase 1 Monitoring Well Network (BPMWN) will include a total of 26 monitoring wells to achieve the following objectives: 1) verify the model, 2) provide a basis for recalibration, and 3) to the extent possible, resolve uncertainties in various model parameters. A total of 20 wells (10 deep wells, 4 intermediate wells and 6 shallow wells) are located in the SEBPB, and 6 wells (4 deep wells, 1 intermediate well and shallow well) are located in the transition zone.

13) **Groundwater Mounding.**

For the purpose of analyzing localized effects of injection such as delineation of the zone of injected water and water level mounding in the well area, EBMUD applied a groundwater model using USGS's ModFlow code. The ModFlow model, in conjunction with the ModPath particle

tracking package, delineates the zone of injected water and local groundwater mounding for a hypothetical scenario of injecting at an average annual rate of 1 mgd over fifteen years and extracting 2 mgd for six months (average annual of 1 mgd) over 3 consecutive years.

Modeling results predict that at the end of the simulated15 year injection period, the piezometric surface of the deep aquifer, not of the actual groundwater table, will rise approximately 25 feet at the Bayside Well, and that during extraction the drawdown will be approximately 40 feet.

The initial injection creates most of the groundwater mounding in the first several years of injection. Due to the typical response of the confined aquifer in accordance with this equation, additional mounding in the following years near the injection well is minimal. Drawdown reaches a maximum at the end of each 6-month pumping cycle, with water levels returning close to pre-Project conditions after the 6 months of wet-season recovery.

14) **Potential Impacts to Local Creeks and Streams**

The Bayside Well is perforated in the deep aquifer of the SEBPB that is present at depths greater than 400 feet bgs. This is the aquifer that will be used for injection and extraction during operation of the Project. The regional hydrogeologic setting shows that the deep aquifer is confined by thick clay layers. The groundwater model used to evaluate Project impacts indicates a maximum of one to two feet of drawdown and drawup in the shallow aquifers. This small change in water levels is not expected to have a significant impact on streams in the area. Additionally, most of the larger streams in the area are concrete lined and have little connection to the groundwater.

15) **Groundwater Recharge Areas**

For the same reasons discussed in above, groundwater recharge areas or stormwater retention basins in the SEBPB are not expected to have a significant affect or be significantly affected by the operation of the Project.

16) **Aquifer Compressibility, Effective Stress, and Land Subsidence**

Elastic subsidence associated with the injection, storage, and recovery cycles is expected to range from about a quarter inch at the Bayside Well to about a tenth of an inch several miles from the Project site. This elastic subsidence would completely reverse following each groundwater pumping cycle as water levels recover. Conversely, inelastic subsidence is highly unlikely to occur since water levels are well above historical lows and the duration of pumping will be shorter than that which caused the historic low water levels.

Elastic and or inelastic land subsidence will be continuously monitored by direct measurement of ground elevation changes using high-resolution extensometers. These instruments detect compression in the deep and shallow aquifer sediments. The accuracy of well-constructed extensometers is on the order of 0:001 feet. Extensometer data will be reviewed continuously to assess whether subsidence is occurring and whether it is elastic or inelastic.

17) **Vertical Conduits**

EBMUD conducted a groundwater well inventory for the area of influence to find abandoned or inactive wells located in areas where predicted water levels could be raised above the ground surface in response to injection. For the inactive wells, EBMUD will work with the property

owners to properly destroy the wells in accordance with state standards. For active wells located in areas where water levels are anticipated to rise above ground surface during injection, EBMUD will retrofit wells prior to initiating injection that can be pressurized and will regularly monitor for flowing wells.

18) **New Well Installation and Permitting**
Well permitting of the Project is under the jurisdiction of the Alameda County Public Works Agency (ACPWA). ACPWA administers General Ordinance Code, Chapter 6.88 for the regulation of groundwater wells and exploratory holes in its jurisdictional area as required by California Water Code. The provisions of these laws are administered and enforced by ACPWA through its Well Standards Program.

There is no local ordinance that would prohibit a current or future well owner from extracting from the deep aquifer storage zone. However, the high cost to drill, develop and operate a well at the aquifer depth at which EBMUD would store and recover water make it unlikely that such an event would occur during the Project's life.

19) **Self Monitoring and Reporting Program**
A Self Monitoring and Reporting Program (SMP) (Attachment A) will be followed by EBMUD to monitor water quality and hydraulic control of injection water. The monitoring program incorporates a network monitoring wells, including new and existing bores (Attachment A, Figure 1). They will be placed to observe water level and water quality variations in each of the SEBPB aquifer zones. These wells will aid in the establishment of pre-operational benchmarks for water levels, and water quality. The SMP is built upon the principle that treated water proposed for use as the injection source water will meet all drinking water standards as set by the USEPA and DHS. The SMP includes a Contingency Plan that describes the measures that EBMUD will undertake if EBMUD detects water quality impacts or loss of hydraulic control.

20) **Basin Plan**
The *Water Quality Control Plan for the San Francisco Bay Basin* (Basin Plan) is the Water Board's master water quality control planning document. It designates beneficial uses and water quality objectives for waters of the State, including surface waters and groundwater. It also includes programs of implementation to achieve water quality objectives. The Basin Plan was duly adopted and approved by the State Water Resources Control Board, U.S. EPA, and the Office of Administrative Law where required. The latest version is effective as of December 22, 2006.

21) **Basin Plan Implementation.** The Basin Plan contains water quality objectives and beneficial uses for waters of the State within the San Francisco Bay Region, and an Implementation Plan. This Order implements the objectives and provisions of the Basin Plan. This Order includes water quality limits and discharge requirements intended to protect existing and potential beneficial uses of waters of the State, as well as to protect public health and the environment.

22) **Beneficial Uses for Groundwater**
As identified in the Basin Plan, the designated existing beneficial uses of groundwater of the East Bay Plain Ground Basin in the vicinity of the Project area are:

a) Municipal and domestic supply (MUN);
b) Agricultural supply (AGR);

c) Industrial process water supply (PROC);
d) Industrial service water supply (IND); and
e) Fresh Water Replenishment (FRSH).

23) **Water Quality Objectives for Groundwater**
Groundwater objectives consist primarily of narrative objectives combined with a limited number of numerical objectives.

24) **California's Antidegradation Policy**
The *Statement of Policy with Respect to Maintaining High Quality of Waters in California*, known as the "Antidegradation Policy" (SWRCB Resolution 68-16), requires the continued maintenance of existing high quality water. Change that reduces water quality must:

a) Be consistent with maximum benefit to the people of the State: and,
b) Not unreasonably affect present and anticipated beneficial uses of water: and,
c) Not result in water quality less than that prescribed in water quality control plans or policies.

25) **Project Consistency with Antidegradation Policy**
The Project would provide maximum benefit to the all people of the State, not just those within the EBMUD's service area. By storing surplus water during wet years and recovering the stored water during a drought, the Project will provide supplemental drought supply for the public. It would lessen demand on the State's limited water resources and result in an increased flow to the Delta to support its complex ecosystem. Increased flow to the Delta would also benefit fisheries in the Mokelumne River. By relying less on imported supply, the Project can serve as a more dependable source of emergency drinking water in the event of a disaster, and therefore protect public safety.

Even though the Project's storage of treated drinking water may lead to lowering of groundwater quality with respect to DBPs, the injected water is not expected to adversely affect any current and potential beneficial uses. A number of water quality parameters would improve within the storage zone including: Total Organic Carbon, Total Dissolved Solids, Chloride, Manganese, Radon, Hardness, and Sulfate. Based on this information the maximum benefit provided by this Project to the people of the State would significantly outweigh any minor degradation that may occur.

26) **Submittal of ROWD**
Water Code Section 13260(a) requires that any person discharging wastes or proposing to discharge wastes within the region that could affect the quality of waters of the State shall file a Report of Waste Discharge.

27) **Background and Rationale for Requirements**
The Regional Water Board developed the requirements in this Order based on information submitted as part of the application, through monitoring and reporting programs, and other available information.

28) **California Environmental Quality Act (CEQA)**
The California Environmental Quality Act (CEQA) requires that all Projects approved by State agencies be in full compliance with CEQA. EBMUD, as the lead agency, prepared and certified

a Final Environmental Impact Report (EIR) for this Project in November 2005. The Water Board considered the environmental impacts of the Project as shown in the EIR. The EIR did not identify any significant unavoidable impacts that could not be mitigated. The Water Board finds that all significant water quality impacts identified under CEQA have been mitigated to less than significant levels with implementation of mitigation measures as identified in the EIR.

29) **Notification of Interested Parties**
The Regional Water Board has notified the EBMUD and interested agencies and persons of its intent to prescribe Waste Discharge Requirements (WDRs) for the discharge and has provided them with an opportunity to submit their written comments and recommendations.

30) **Consideration of Public Comment**
At its meeting on May 9, 2007, the Water Board considered all comments concerning this matter;

IT IS HEREBY ORDERED that the East Bay Municipal Utility District, pursuant to the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, shall comply with the following:

A) PROHIBITIONS

1) The operation of the Project shall not create a condition of pollution or nuisance (as defined in Section 13050, California Water Code) outside the aquifer storage zone (ASZ) at any time.

2) The operation of the Project shall not create a condition of pollution or nuisance (as defined in Section 13050, California Water Code) inside the ASZ following Project discontinuation or closure.

B) SPECIFICATIONS

1) Injection water shall meet all DHS water quality standards for drinking water.

2) Only treated drinking water from the EBMUD's drinking water distribution system shall be used for injection.

3) The Bayside Well shall be used as the sole point of injection and recovery.

4) Injection shall not exceed an annual rate of 1,121 AF per year (1 mgd).

5) Recovery shall not exceed an annual rate of 1,121 AF per year (1 mgd).

6) Water used as back flush water to redevelop the well and/or improve injection efficiency shall be discharged under appropriate discharge permits.

7) The appropriate water quality limits for the disinfection by-products (DBPs), speciated as total trihalomethanes (THMs), and haloacetic acids (HAAs) USEPA's Primary MCLs are presented below in Table 3.

Table 3: Water Quality Limits for DBPs		
Constituent	Water Quality Limit, ug/l	Reference
Total THMs	80	USEPA Primary MCL
HAAs	60	USEPA Primary MCL

8) The points of compliance for the above water quality limits for DBPs shall be all groundwater monitoring wells both inside and outside the ASZ.

9) Within the ASZ, EBMUD shall maintain hydraulic control over the injected water and shall demonstrate through monitoring that degradation and/or dilution is reducing DBPs concentrations and restricting potential migration of DBPs beyond the ASZ.

10) The maximum extent of the ASZ is shown on Figure 3 and shall be verified by data collected at Monitoring Wells: MW -5 and MW-7.

11) As part of the SMP, EBMUD shall also monitor for ammonia, chloride, chlorine residual, iron, manganese, nitrate as NO_3, pH, total dissolved solids, and standard minerals for notification purposes on the effectiveness of the ASR operations and hydraulic control on injection water (Table 4 of the SMP).

12) While the Project is anticipated to be permanent, if the Project is discontinued or closed, sufficient water must be extracted such that the remaining groundwater meets all water quality limits.

C) PROVISIONS

1) **DHS Approval:** Prior to completion of construction of the recovered groundwater treatment facility, EBMUD shall provide the Water Board with a brief technical report confirming California Department of Health Service's (DHS) approval of the incorporation of recovered groundwater into the drinking water distribution system.

2) **Five Year Review:** EBMUD shall submit a five year review of the Project due within 6 months following the fifth anniversary and every subsequent 5 year anniversary of the start-up date. The report should include:

   a) Summary of effectiveness in Project operation and protection of human health and the environment;

   b) Comparison of groundwater monitoring data to water quality limits;

   c) Comparison of observed groundwater quality affects with the initial groundwater modeling (e.g. extent of ASZ, groundwater mounding);

   d) Performance data (e.g. volume of water injected, groundwater volume extracted, injection and extraction rates and durations, well efficiency);

   e) Summary of any additional investigations (including results) and/or significant modifications to facility systems;

f) Any new information on drinking water criteria and protection of human health; and

g) Any new ASR technical information.

3) **Order Compliance:** EBMUD shall comply with all sections of this Order immediately upon adoption;

4) **Self-Monitoring and Reporting Program**: EBMUD shall comply with the Self-Monitoring and Reporting Program (SMP) as attached to this Order (Attachment A), and as may be amended by the Executive Officer. EBMUD shall submit an annual self-monitoring report that shall include any available data collected from the Bayside Project Phase 1 Monitoring Well Network. The SMP may be amended by the Executive Officer in response to a written request by EBMUD, or as necessary to assure collection of information to demonstrate compliance with this Order.

Due Date: Each Annual Self-Monitoring Report shall be submitted by March 1, of the following year.

5) **Contingency Plan:** As part of the SMP, EBMUD shall comply with the following provisions.

a) **Trigger Levels:** EBMUD shall immediately implement the contingency measures below if any of the following trigger conditions are detected:

(i) Water Quality Limit Exceedance: Disinfection by-products, speciated as THMs, HAA, (as identified in Table 3 of the Order) detected at levels exceeding applicable water quality limits (WQLs) :

- Within or beyond the aquifer storage zone (Figure 3) during Project operation;
- Within or beyond the aquifer storage zone at the potential discontinuation or closure of the Project.

(ii) Loss of Hydraulic Control

- Detection of injection water migrating beyond the maximum extent of the aquifer storage zone as verified by data collected at Monitoring Wells: MW-5 and MW-7;
- Flowing wells within or beyond the ASZ.

b) **Contingency Measures:** The following contingency measures are to be implement if the above trigger conditions are met:

(i) EBMUD shall report by telephone to the Water Board within 24 hours of discovering an exceedance. EBMUD shall submit a written report with the Water Board within five days of discovery of the condition. The written report shall contain the following information:

- A map showing the location(s) of exceedance or condition;
- Nature of exceedance or condition, e.g., WQL, time, concentration;

- Nature of effects, e.g., all pertinent observations and analyses; and
- Corrective measures underway or proposed to address the condition.

(ii) Water Quality Exceedances
In addition to (i), if a WQL is exceeded the following measures are additionally required:

- EBMUD shall submit a technical report to the Water Board within 30 days of determining that a statistically significant difference occurred between a monitoring sample set and an WQL. The report shall indicate what WQL(s) have been exceeded and propose any necessary modification to the Project operations to address the cause(s) of the WQL exceedances and to prevent any recurrence.
- Decrease the rate of water injection and increase monitoring frequency at the points of compliance from annually to monthly. Annual monitoring and injection at the normal flow rate shall only resume upon reestablishment of WQL compliance for three consecutive months at the boundary of the storage zone. With detection of two consecutive months of WQL exceedances, EBMUD will cease water injection altogether.

(iii) Loss of Hydraulic Control
In addition to (i), if loss of hydraulic control is detected the following measures are required;

- Injection of water will be immediately decreased or stopped to prevent the loss of hydraulic control.
- EBMUD shall submit a technical report to the Water Board within 30 days of detecting a loss of hydraulic control. The written report shall characterize the groundwater flow conditions and propose any necessary modification to the Project operations to address the loss of hydraulic control and to prevent any recurrence.
- In the case of flowing wells, EBMUD shall implement mitigation measures as identified in the Environmental Impact Report (EIR) such as contacting affected well owners to assess whether the wellheads could be modified to allow for pressurization.

6) **Title 22 Sampling Report:** As part of the SMP, EBMUD shall submit a technical report characterizing the existing groundwater with a full analysis of constituents of concerns pursuant to Title 22 California Code of Regulations for drinking water within 3 months of adoption of this Order.

7) **Annual Fees:** EBMUD must pay annual fees in accordance with the fee schedule given in California Code of Regulations Title 23, Division 3, Chapter 9, Article 1, Section 2200 and annual fee invoices issued by the State Board. Annual fees for Waste Discharge Requirements are based on Threat to Water Quality and Complexity ratings. The current rating for this Order is 2 B. The current fee is $5,720, plus a 9% Ambient Water Monitoring surcharge, for a total annual fee of $6,235. This fee is subject to change, if the fee schedule of Title 23 Section 2200 is changed. Annual Fee invoices are issued each year by the State Board, for the state fiscal

year (July 1 though June 30).

8) **Good O&M**: EBMUD shall maintain in good working order and operate as efficiently as possible any facility or control system installed to achieve compliance with the requirements of this Order.

9) **Contractor / Consultant Qualifications**: All technical documents shall be signed by and stamped with the seal of a California registered geologist, a California certified engineering geologist, or a California registered civil engineer.

10) **Lab Qualifications**: All samples shall be analyzed by State-certified laboratories or laboratories accepted by the Board using approved EPA methods for the type of analysis to be performed. All laboratories shall maintain quality assurance/quality control (QA/QC) records for Board review. This provision does not apply to analyses that can only reasonably be performed on-site (e.g. temperature).

11) **Document Distribution**: Copies of all correspondence, technical reports, and other documents pertaining to compliance with this Order shall be provided to the following agencies in paper copy and electronic format as specified in Provision 20:

a) City of San Leandro;
b) County of Alameda;
c) Alameda County Water District; and
d) City of Hayward.

12) **Order Compliance:** EBMUD shall comply with all sections of this Order immediately upon adoption.

13) **Non-Compliance Reporting:** In the event the EBMUD is unable to comply with any of the conditions of this Order due to:

a) Breakdown of ASR or treatment equipment;
b) Accidents caused by human error or negligence; or
c) Other causes such as acts of nature.

EBMUD shall notify the Board by telephone as soon as EBMUD or EBMUD's agents have knowledge of the incident. Written confirmation of this notification shall be submitted within five working days of the telephone notification. The written notification shall include pertinent information explaining reasons for the non-compliance and shall indicate what steps were taken to correct the problem and the dates thereof, and what steps are being taken to prevent the problem from recurring.

14) **Entry, Access and Inspection:** The EBMUD shall permit the Board or its authorized representatives, in accordance with Section 13267(c) of the California Water Code:

a) Entry upon premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this Order;

b) Access to and copy of, at reasonable times, any records required by conditions of this

Order;

c) Inspection, at reasonable times, of any facility, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; or

d) To photograph, sample or monitor, at reasonable times, for the purpose of assuring compliance with this Order.

15) **Change in Control or Ownership:** In the event of any change in control or ownership of land or aquifer storage and recovery facilities presently owned or controlled by EBMUD, EBMUD shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to this Board. The succeeding owner or operator, in order to obtain authorization for discharges regulated by this Order, must apply in writing to the Executive Officer, requesting transfer of the Order. This request must include complete identification of the new owner or operator, the reasons for the change, and effective date of the change.

16) **Project Modifications:** EBMUD shall submit to the Water Board a Report of Waste Discharge at least 180 days before making any material change in the character, location, or volume of the Project or Project facilities, or any changes to the aquifer storage and recovery system as described in this Order, except for emergency conditions. In the event of changes implemented in response to emergency conditions, the Board shall be notified immediately by telephone, and in writing or by facsimile transmission within five calendar days of such changes.

17) **Order Review and Update:** EBMUD shall furnish to the Executive Officer of this Regional Board, within a reasonable time, any information which the Executive Officer may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order. EBMUD shall also furnish to the Executive Officer, upon request, copies of records required to be kept by this Order.

18) **Order Termination:** After notice and public meeting, this Order may be terminated or modified by the Board for any reason.

19) **Operational Notifications:** Except for emergency conditions and routine maintenance activities, EBMUD shall notify the Water Board, ACWD, City of Hayward, and other interested agencies, a minimum of two weeks prior to the planned start up or shut down of the injection or recovery mode of operation at the Bayside Well over the life of the Project.

20) **Electronic Reporting:** All Technical Reports and correspondence greater than 3 pages in length shall be submitted to the Board in electronic format. The electronic copy of the report should be submitted as one PDF file. It is preferred that reports be converted from their original format (e.g., Microsoft Word) rather than scanned except for signature pages and perjury statements, which must be scanned and included.

I, Bruce H. Wolfe, Executive Officer, do hereby certify the foregoing is a true, full, and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on May 9, 2007.

Bruce H. Wolfe, Executive Officer

Attachments
Figure 1 Project Location
Figure 2 Deep Aquifer Cross Section
Figure 3 Aquifer Storage Zone Map
Attachment A: Self Monitoring and Reporting Program Parts A and B

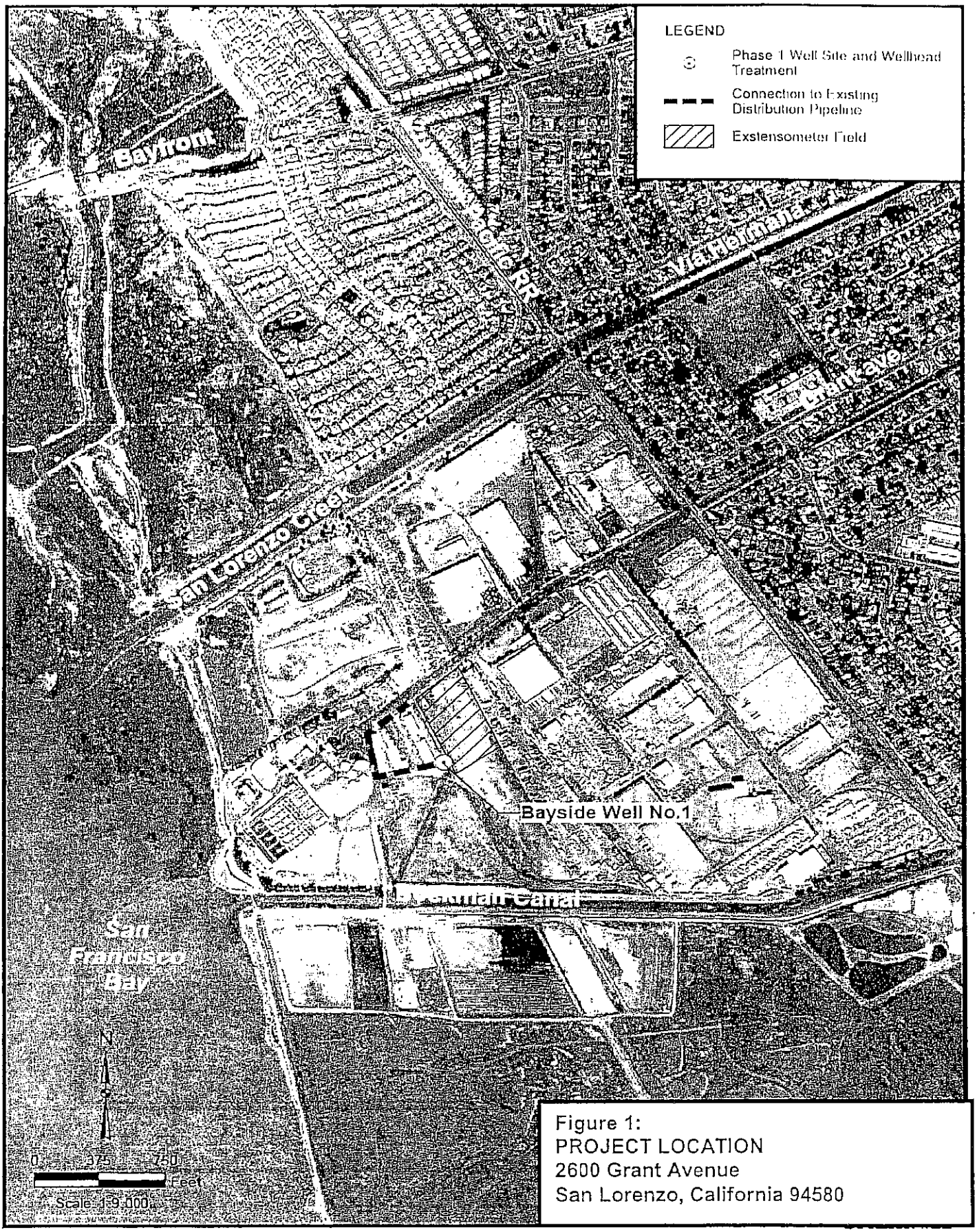

Figure 1:
PROJECT LOCATION
2600 Grant Avenue
San Lorenzo, California 94580

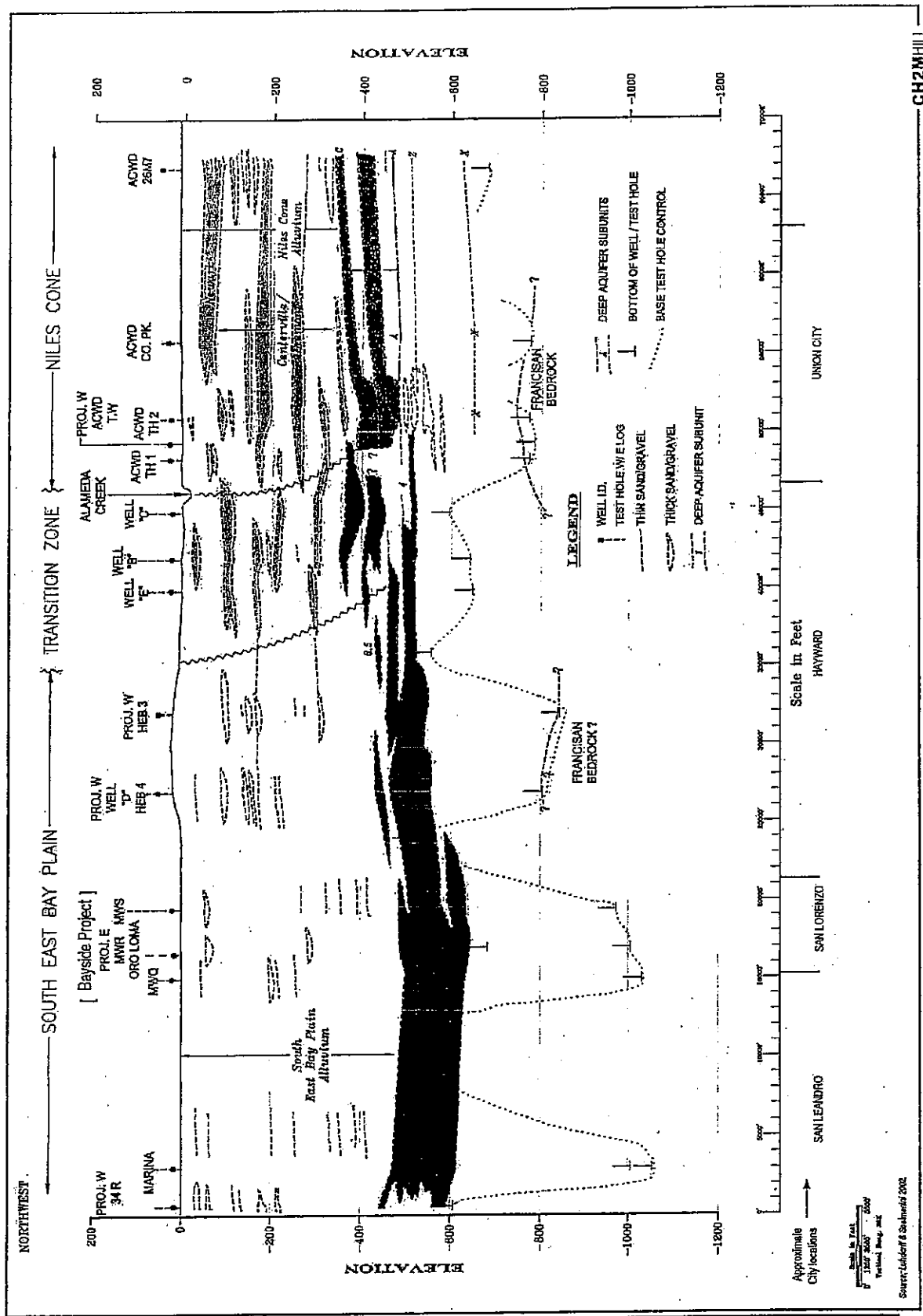

Figure 2: B Groundwater Project
Deep Aquifer Cross Section

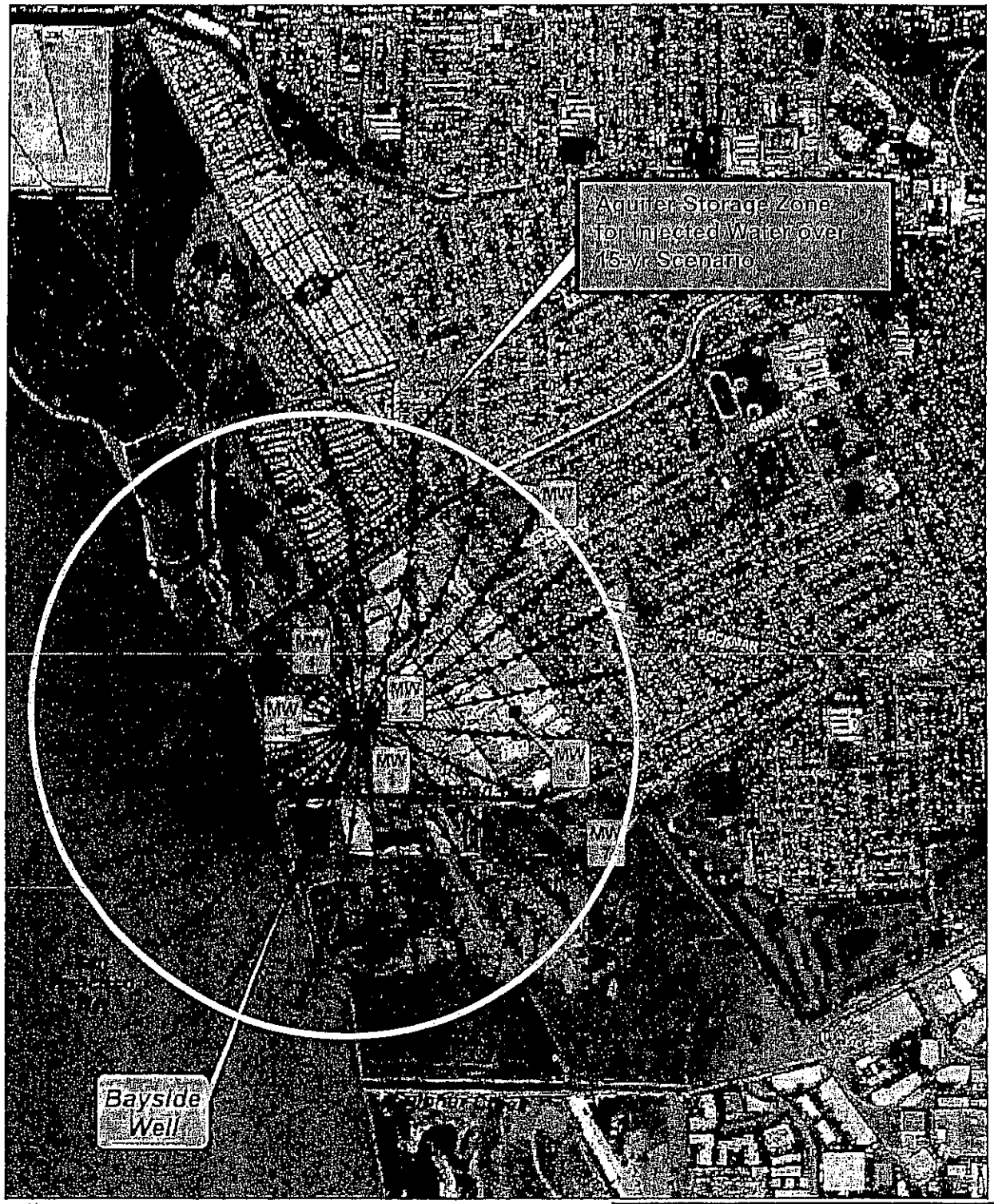

Figure 3:
Bayside Groundwater Project
Aquifer Storage Zone Map

Attachment B

ATTACHMENT A

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

SELF MONITORING and REPORTING PROGRAM

for

EAST BAY MUNICIPAL UTILITY DISTRICT
BAYSIDE GROUNDWATER PROJECT
SAN LEANDRO, ALAMEDA COUNTY

ORDER NO. R2-2007-0038

CONSISTS OF

PART A

AND

PART B

I) PART A

1) MONITORING REQUIREMENTS

Pursuant to this Self Monitoring and Reporting Program (SMP), monitoring refers to the measurement and sampling of environmental media, the making of standard observations in and around the East Bay Municipal Utility District (EBMUD) Bayside Groundwater Project (Project) area, the inspection of project facilities, and monitoring or potential monitoring of injection water, groundwater, and recovered water. Monitoring locations, frequencies, parameters, and analytes are specified in Part B of this SMP.

a) Monitoring of Environmental Media

The Water Board may require monitoring of groundwater and surface water and any other environmental media that may pose a threat to water quality or provide an indication of a water quality threat at the site. This SMP specifically monitors groundwater quality.

Sample collection, storage, and analyses shall be performed according to the most recent version of EPA-approved methods or in accordance with an approved sampling and analysis plan. Water and waste analyses shall be performed by a California State approved laboratory for the required analyses. The director of the laboratory whose name appears on the certification shall supervise all analytical work in his/her laboratory and shall sign all reports of such work submitted to the Water Board.

All monitoring instruments and devices used to fulfill the prescribed SMP shall be properly maintained and calibrated as necessary to ensure their continued accuracy. All flow measurement devices shall be calibrated at least once per year, or more frequently, to ensure continued accuracy of the devices.

b) Standard Observations

Standard observations refer to observations within the limits project area, at their perimeter, and of the receiving waters beyond their limits. Standard observations include:

(i) Bayside Well:
- Continuous operational log showing injection, recovery, and non-operational periods with flow rates;
- Evidence of flowing well conditions.

(ii) Aquifer Storage Zone (ASZ):
- Installation of new wells;
- Any surface or subsurface spill, release, or discharge potentially impairing or found to impair surface water and/or shallow groundwater;
- Evidence of flowing well conditions.

(iii) Beyond of ASZ:
- Evidence of flowing conditions.

2) REPORTING REQUIREMENTS

Each SMP submittal shall include the following information:

a) **Transmittal Letter**
A letter transmitting essential points shall be included in each report. The transmittal letter shall discuss any violations during the reporting period and actions taken or planned to correct the problem. The letter shall also certify the completion of all monitoring requirements. The letter shall be signed by the EBMUD's principal executive officer or his/her duly authorized representative, and shall include a statement by the official, under penalty of perjury, that the report is true and correct to the best of the official's knowledge.

b) **Compliance Evaluation Summary**
(i) A summary and certification of completion of all environmental media monitoring, standard observations, and facilities inspections;
(ii) A graphic presentation of the extent of groundwater injection, based upon the past and present water level elevations and pertinent visual observations;
(iii) The quantity of water injected and/or recovered;
(iv) Map(s) or aerial photograph(s) showing monitoring locations; and,
(v) The signature of the laboratory director or his/her designee indicating that he/she has supervised all analytical work in his/her laboratory.

c) **Appendices**
Include the following information in appendices, unless the information is already contained in an approved Sampling and Analysis Plan. Print copies of the following information need not be included in the report if the information is submitted in electronic (e.g., PDF) format. The appendices need not include the actual laboratory analytical data sheets and QA/QC report summary, however, this information shall be provided upon request
(i) New boring and well logs;
(ii) Method and time of water level measurements;
(iii) Purging methods and results including the type of pump used, pump placement in the well, pumping rate, equipment and methods used to monitor field pH, temperature, and conductivity, calibration of the field equipment, pH, temperature, conductivity, and turbidity measurements, well recovery time, and method of disposing of the purge water;
(iv) Sampling procedures, field and travel blanks, number and description of duplicate samples, type of sample containers and preservatives used, the date and time of sampling, the name and qualifications of the person actually taking the samples, and any other relevant observations;
(v) Documentation of laboratory results, analytical methods, detection limits, and Quality Assurance/Quality Control (QA/QC) procedures for the required sampling, including:
- Laboratory statements of results of analyses;
- Descriptions of analytical methods used (note, if methods other than EPA approved methods or Standard Methods are used, the exact methodology must be submitted for review and approval by the Executive Officer prior to use);
- Actual detection limits for each sample results (note, detection limits must be appropriate for the expected concentrations); and,
- Laboratory quality assurance/quality control (QA/QC) information and results including analytical methods, detection limits, recovery rates, explanations for low recovery rates (less than 80%), equipment and method blanks, spikes and surrogates, and QA/QC sample frequency.

3) SUBMITTAL OF REPORTS

The Annual report shall be received by the Water Board on: March 1st of the following year.

4) **ANNUAL REPORTS**

EBMUD shall submit an annual report to the Water Board covering the previous calendar year. The annual report must summarize all monitoring, investigation, and remedial activities that have occurred in the previous year. The annual report shall include the following information for each monitoring event during the year required pursuant to Part B of this SMP. Information in appendices may be presented in electronic format rather than print copy.

a) Graphic Presentation: Include site maps that are drawn to a scale that remains constant from reporting period to reporting period. These maps shall include the following information, if applicable:
   - **(i)** Well locations;
   - **(ii)** Groundwater elevation contours;
   - **(iii)** Extent of injected groundwater flow;
   - **(iv)** Extent of dissolved chemical constituents (e.g., isoconcentration maps);
   - **(v)** Appropriate analytical results

b) Line or bar graphs are helpful to illustrate variations in groundwater elevations, and dissolved chemical concentrations with time. Geologic cross sections are required if new data is available and/or the previous interpretation of subsurface conditions has changed. When required, geologic cross sections shall include the following:
   - **(i)** Vertical and lateral extent of ASZ;
   - **(ii)** Geologic structures;
   - **(iii)** Soil lithology;
   - **(iv)** Water table/piezometric surfaces;
   - **(v)** Sample locations;
   - **(vi)** Sample analytical results;
   - **(vii)** Subsurface utilities and any other potential natural or manmade conduits for preferential groundwater horizontal and/or vertical migration.

c) Tabular Presentation: Present all of the following data (if applicable to the site) in one or more tables to show a chronological history and allow quick and easy reference:
   - **(i)** Well designations;
   - **(ii)** Well location coordinates (latitude and longitude);
   - **(iii)** Well construction (including top of well casing elevation, total well depth, screen interval depth below ground surface, and screen interval elevation);
   - **(iv)** Groundwater depths;
   - **(v)** Groundwater elevations;
   - **(vi)** Horizontal groundwater gradients;
   - **(vii)** Vertical groundwater gradients (including comparison wells from different zones);
   - **(viii)** Current analytical results (including analytical method and detection limits for each constituent);
   - **(ix)** Historical analytical results (including the past five years unless otherwise requested);
   - **(x)** Measurement dates;
   - **(xi)** Groundwater injection and/or recovery, including:
     - Average daily injection/recovery rate;
     - Total volume injected/recovered for monitoring period; and,

- Cumulative total volume injected/recovered since system inception.

d) Discussion: Provide a discussion of the field and laboratory results that includes the following information:
   (i) Data Interpretations;
   (ii) Conclusions;
   (iii) Recommendations;
   (iv) Data anomalies;
   (v) Variations from protocols;
   (vi) Conditions of wells;
   (vii) Effectiveness of ASR facilities.

5) ELECTRONIC REPORTING FORMAT

In addition to print submittals, all submittals pursuant to this SMP must be submitted as electronic files in PDF format. The Water Board has implemented a document imaging system, which is ultimately intended to reduce the need for printed report storage space and streamline the public file review process. Documents in the imaging system may be viewed, and print copies made, by the public, during file reviews conducted at the Water Board's office. PDF files can be created by converting the original electronic file format (e.g., Microsoft Word) and/or by scanning printed text, figures and tables. Upon request by Water Board staff, monitoring results, including water level measurements, sample analytical results, coordinates, elevations, etc., shall be provided electronically in Microsoft Excel® or similar spreadsheet format. This format facilitates data computations and/or plotting that Water Board staff may undertake during their review. Data tables submitted in electronic spreadsheet format will not be included in the case file for public review. All electronic files, whether in PDF or spreadsheet format, shall be submitted via the Water Board's file transfer protocol (FTP) site, email (only if the file size is less than 3 MB) or on CD. CD submittals may be included with the print report. Email notification should be provided to Water Board staff whenever a file is uploaded to the Water Board's FTP site.

6) MAINTENANCE OF WRITTEN RECORDS

EBMUD shall maintain information required pursuant to this SMP for at least five years. The five-year period of retention shall be extended during the course of any unresolved litigation regarding this discharge or when requested by the Water Board.

II) PART B

1) MONITORING PROGRAMS

a) **Groundwater Monitoring**

As part of groundwater monitoring program, EBMUD is required to:

(i) Ensure that the Project does not result in significant groundwater level changes that adversely impact other groundwater users;

(ii) Collect groundwater level data using monitoring methods and frequencies for the 14 wells as shown in Table 1 and in Figure 1;

(iii) Monitor prior to project start-up period, and continue throughout project operation; and,

(iv) Refine the monitoring program after actual locations of new monitoring wells are identified and data collection and any data sharing arrangements with other agencies are made;

(v) Perform regular monitoring of injection operations and phased monitoring at the seven wells described in Table.2;

(vi) Identify key water quality parameters for water from EBMUD's distribution system;

(vii) Delineate the extent of the vertical and horizontal injected water front;

(viii) Monitor groundwater for excedances of the applicable water quality limits at the edge of the storage zone;

(ix) Utilize MW-5D and MW-7 as the points of compliance with the applicable water quality limits.

(x) Construct an addition groundwater monitoring well screened in the deep aquifer (Tentatively identified as MW-10D) to serve as a sentry well to detect potential migration of any existing contamination toward the Project area.

(xi) Track water molecule, using tracers such as chlorides, injected water quality and/or stable isotopes, to verify the model used to determine appropriateness of aquifer storage zone modeling and to assess the fate and transport of injected water and its constituents.

(xii) Confirm that all constituents of concern are removed from the storage zone upon discontinuation or completion of the Project.

b) **Groundwater Monitoring Schedule**

EBMUD is required to schedule a phased approach for groundwater quality monitoring

(i) Using the four groupings of monitoring locations described in Table 3, groundwater monitoring will be conducted for the parameters and the schedule

following Table 4.

(ii) Groundwater level and quality monitoring will begin three months prior to initiating operation, and will continue for one additional year after operation ceases.

(iii) Monitoring will begin with Group 1, starting at three months prior to the start of operations[1]. This effort will continue on an annual basis until the expanding injected water front reaches MW-4.

(iv) Monitoring of Group 2 will then begin on an annual basis until the storage front reaches MW-6, which will then trigger monitoring of Group 3.

(v) Monitoring of Group 4 will commence with the detection of injected water at MW-5D or MW-7, or 15 years after initiating operation, whichever is earlier.

(vi) With the exception of injection water monitoring at Bayside Well, Group 4 monitoring will continue for one additional year upon completion of operation.

2) **Contingency Plan**

a) **Trigger Levels:** EBMUD shall immediately implement the contingency measures below if any of the following trigger conditions are detected:

(i) Water Quality Limit Exceedance: Disinfection by-products, speciated as THMs, HAA, (as identified in Table 3 of the Order) detected at levels exceeding applicable water quality limits (WQLs) :

- Within or beyond the aquifer storage zone (Figure 3) during Project operation;
- Within or beyond the aquifer storage zone at the potential discontinuation or closure of the Project.

(ii) Loss of Hydraulic Control

- Detection of injection water migrating beyond the maximum extent of the aquifer storage zone as verified by data collected at Monitoring Wells: MW-5 and MW-7;
- Flowing wells within or beyond the ASZ.

b) **Contingency Measures**: The following contingency measures are to be implement if the above trigger conditions are met:

(i) EBMUD shall report by telephone to the Water Board within 24 hours of discovering an exceedance. EBMUD shall submit a written report with the Water

[1] For one time only, concurrent with the start of Group 1 monitoring, MW-10D will be monitored for all parameters under CCR Title 22 for drinking water.

I, Bruce H. Wolfe, Executive Officer, hereby certify that the foregoing SMP:

1. Has been developed in accordance with the procedures set forth in this Board's Resolution No. 73-16 in order to obtain data and document compliance with waste discharge requirements established in this Board's Order No. R2-2007-0038;

2. Is effective on the date shown below; and,

3. May be reviewed or modified at any time subsequent to the effective date, upon written notice from the Executive Officer.

Bruce H. Wolfe
Executive Officer

Date Ordered: May 9, 2007

Attachments
Figure 1: Monitoring Well Network
Table 1: Water Level Monitoring Frequency
Table 2: Injection and Groundwater Monitoring Locations
Table 3: Groundwater Monitoring Location Groups
Table 4: Injection Water and Groundwater Sampling Parameters and Schedule

Attachment B

Table 1: Groundwater Level Monitoring Frequency

No.	Well ID	Well Name	Monitoring Method	Monitoring Frequency			Distance from Bayside Phase 1 Well (feet)	Remarks
				Preproject	1st Year	Subsequent Years		
1	MW-1	OW-1	Manual/Transducer	monthly	30 min	hourly	175	SEBPB Deep Well
2	MW-2D	OW-2D	Manual/Transducer	monthly	30 min	hourly	180	SEBPB Intermediate Well
3	MW-2S	OW-2S	Manual/Transducer	monthly	30 min	hourly	180	SEBPB Shallow Well
4	MW-3	OW-4	Manual/Transducer	monthly	30 min	hourly	60	SEBPB Deep Well
5	MW-4	OW-5	Manual/Transducer	monthly	Quarterly	Quarterly	675	SEBPB Deep Well
6	MW-5D	Q	Manual/Transducer	monthly	hourly	hourly	3250	SEBPB Deep Well
7	MW-6	R	Manual/Transducer	monthly	Quarterly	Quarterly	1,900	SEBPB Deep Well
8	MW-7	S	Manual/Transducer	monthly	hourly	hourly	3,600	SEBPB Deep Well
10	MW-9	Farmhouse Well	Manual/Transducer	monthly	hourly	hourly	9,800	SEBPB Deep Well
11	MW-10 I	Stenzel Park-I[1]	Manual/Transducer	monthly	hourly	hourly	7,000	SEBPB Shallow Well
12	MW-10 D	Stenzel Park-D[1]	Manual/Transducer	monthly	hourly	hourly	7,000	SEBPB Deep Well
13	MW-5 S	Q-S[1]	Manual/Transducer	monthly	hourly	hourly	3,250	SEBPB Shallow Well
14	MW-5 I	Q-I[1]	Manual/Transducer	monthly	hourly	hourly	3,250	SEBPB Intermediate Well

[1]Proposed new wells

Attachment B

Table 4: Injection Water and Groundwater Sampling Parameters and Schedule

Parameter	Unit	Test Method	Frequency
Groundwater Elevation[1]	± 0.01 ft	Field measurement	Annually
Depth to Groundwater[1]	± 0.01 ft	Field measurement	Annually
Gradient[1,2]	ft/ft	Calculated	Annually
Gradient Direction[1,2]	Degrees	Calculated	Annually
pH	pH units	Field measurement	Annually
Chlorine Residual	mg/l	Field measurement	Annually
Total Dissolved Solids	mg/l	EPA 160.1	Annually
Ammonia	mg/l	EPA 350.2	Annually
Nitrate as NO_3	mg/l	EPA 300.0	Annually
Chloride	mg/l	EPA 300.0	Annually
Manganese	µg/l	EPA 200.7	Annually
Iron	µg/l	EPA 200.7	Annually
Total Trihalomethanes[3]	µg/l	EPA 8260B	Annually
Haloacetic Acids[3]	µg/l	EPA 8260B	Annually
Standard Minerals[4]	mg/l	Various	Annually
All Parameters under CCR Title 22 for Drinking Water[5]	Various	Various	Annually

[1] Not applicable to potable water monitoring prior to injection.

[2] Not applicable to MW-2D and MW-2S.

[3] Individual and total trihalomethanes and haloacetic acids concentrations should be monitored and reported.

[4] Standard minerals to include: calcium, magnesium, potassium, sodium (EPA 200.7), sulfate (EPA 300.0), total alkalinity (including alkalinity series) (EPA 310.1), and hardness (EPA 200.7).

[5] Only applicable to the following locations and situations: MW-10D only once at the beginning of Group 1 monitoring; MW-5D and MW-7 with Group 4 monitoring.