



DEPARTMENT OF THE NAVY  
SOUTHWEST DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
1220 PACIFIC HIGHWAY  
SAN DIEGO, CA 92132-5190

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TREASURE ISLAND  
SSIC NO. 5090.3.A

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March 24, 2000

APR 1 2000

Mr. Chris Maxwell  
Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

SUBJ: EXEMPTION TO SWRCB SOURCES OF DRINKING WATER POLICY  
RESOLUTION 88-63 AND RWQCB RESOLUTION 89-39 FOR TREASURE ISLAND  
SAN FRANCISCO, CALIFORNIA

Dear Mr. Maxwell:

Shallow groundwater beneath Treasure Island is not of sufficient quality to be used as a potential drinking water source pursuant to State Water Resources Control Board (SWRCB) Sources of Drinking Water Policy Resolution 88-63 (SWRCB Resolution 88-63) and California Regional Water Quality Control Board San Francisco Bay Region (RWQCB) Resolution 89-39. The purpose of this letter is to request concurrence from the RWQCB that groundwater beneath Treasure Island meets the exemption criteria for SWRCB Resolution 88-63.

The Navy finds that groundwater beneath Treasure Island is not suitable as a drinking water source and meets the exemption criteria in SWRCB Resolution 88-63 and RWQCB Resolution 89-39 because:

- Water quality does not meet TDS criteria
- The artificial fill forming Treasure Island is not an aquifer
- There is no historic present or planned future use of groundwater at Treasure Island
- Well construction requirements prohibit water supply wells
- The shallow water-bearing zone is susceptible to contamination
- Pumping would cause saltwater intrusion and land subsidence.

The RWQCB is currently considering a basin plan amendment that would eliminate the municipal and domestic water supply designation for Treasure Island. However, the administrative process for the basin plan amendment may require a significant period of time to complete. The Navy is currently conducting environmental investigations and cleanup as part of the Installation Restoration Program prior to transfer of Naval Station Treasure Island; which was closed in 1997.

Cleanup levels for shallow groundwater must consider drinking water standards if groundwater beneath Treasure Island has a municipal and domestic water supply beneficial use designation. Since groundwater cleanup to drinking water standards is unnecessary and not appropriate in this instance, the Navy is requesting that the RWQCB concur with the Navy's determination that shallow groundwater beneath Treasure Island is not a potential drinking water source.

The RWQCB Staff Groundwater Committee completed a pilot project to reevaluate groundwater beneficial use designations in San Francisco and Northern San Mateo County, which included Treasure Island (RWQCB 1996). The RWQCB staff recommended removing the potential municipal and domestic supply beneficial use designation for Treasure Island based on the quality and nature of Treasure Island groundwater. Concurrence by the RWQCB that Treasure Island groundwater is exempt from SWRCB Resolution 88-63 criteria for a potential municipal and domestic water supply would be consistent with the RWQCB staff recommendation to de-designate Treasure Island groundwater from this beneficial use.

The Navy has determined that groundwater does not meet the criteria for a municipal and domestic water supply at the Navy Fleet and Industrial Supply Center Oakland (FISCO) and the Alameda Annex in Oakland, California based on the hydrogeologic conditions and other limiting factors. The RWQCB has written letters of concurrence that groundwater meets the exemption criteria in the SWRCB Resolution 88-63 for FISCO and the Alameda Annex (enclosures 1 and 2). The overall hydrogeologic conditions (artificial fill within San Francisco Bay) and groundwater quality at these two facilities are similar to conditions at Treasure Island. However, Treasure Island is located within the center of San Francisco Bay and the potential to use shallow groundwater at Treasure Island for a drinking water source is less reasonable for Treasure Island than for FISCO or Alameda Annex. The following discussion describes the groundwater conditions at Treasure Island and the factors limiting the use of shallow groundwater at Treasure Island.

## **GEOLOGY AND HYDROGEOLOGY**

Treasure Island is underlain by artificial fill material that is approximately 20 to 50 feet thick. Treasure Island's artificial fill consists mainly of sandy sediments dredged from San Francisco Bay, with occasional thin beds of clay. The dredged fill overlies shoal sands that in turn overlie Bay Mud sediments, which are significantly less permeable (Tetra Tech EM Inc. [TtEMI] 1999). The artificial fill should not be considered an aquifer. An aquifer is best defined as "a saturated permeable geologic unit that can transmit significant quantities of water under ordinary hydraulic gradients" (Freeze and Cherry 1979). Groundwater recharge at Treasure Island occurs through infiltration of precipitation, landscape irrigation, and piping system leakage. The groundwater at Treasure Island is under unconfined conditions at depths ranging from 1.5 to 5.4 feet below grade. Groundwater flow is generally uniform towards the San Francisco Bay with an average gradient of 0.001, although flow reversals occur in the tidally influenced strip along the shoreline.

**GROUNDWATER QUANTITY AND QUALITY**

Under the SWRCB Resolution 88-63, groundwater has a municipal and domestic supply beneficial use if it has a total dissolved solids (TDS) content of less than 3,000 milligram per liter (mg/L) and a minimum yield of 200 gallons per day (gpd). Table 1 lists the average TDS concentrations measured in monitoring wells on Treasure Island during 1998.

**TABLE 1  
 TREASURE ISLAND AVERAGE TDS CONCENTRATIONS DURING 1998**

Groundwater Monitoring Zones (depth below ground surface in feet)	Average TDS in May 1998 (mg/L) [Number of Wells Used to Calculate Average]	Average TDS in November 1998 (mg/L) [Number of Wells Used to Calculate Average]
3 to 13	1,752 [58]	3,608 [67]
16 to 28	3,422 [7]	2,951 [7]
35 to 48	26,105 [4]	24,452 [4]

Average TDS concentrations were not consistently less than the 3,000 mg/L standard cited in SWRCB Resolution 88-63 in any of the monitoring zones. During May, the average TDS concentration was less than 3,000 mg/L within the shallow water-bearing zone (3 to 13 feet below ground surface [BGS]). However, the average TDS concentration was greater than 3,000 mg/L during the November 1998 monitoring event. TDS concentrations were consistently greater than 3,000 mg/L in all wells screened greater than 28 feet bgs.

According to SWRCB Resolution 88-63, the minimum production criterion for "potential sources of drinking water" is more than 200 gpd. Although pumping tests have not been conducted on Treasure Island monitoring wells, well development rates and hydraulic conductivity values determined from slug testing (5 to 16 feet per day) indicate that Treasure Island wells may yield more than 200 gpd. Continuous pumping of fresh groundwater may result in degradation of groundwater quality due to upconing of underlying saline water.

**HISTORIC, CURRENT, AND POTENTIAL FUTURE GROUNDWATER USE**

There are no groundwater supply wells and no record of historic groundwater use at Treasure Island. The only groundwater wells at Treasure Island are monitoring wells which cannot be used for water supply because the wells do not meet state well construction standards for water supply wells. Groundwater at Treasure Island has not been used historically and is not currently used for any purposes. Two water supply systems currently serve Treasure Island.

The primary water supply is provided by the San Francisco Water Department through a 10-inch-diameter pipe that is attached to the Bay Bridge.

A secondary or emergency supply is provided by the East Bay Municipal Utility District through a 12-inch-diameter pipe that runs along the Bay Bridge to Emeryville.

## **WELL CONSTRUCTION REQUIREMENTS**

The California Department of Water Resources (DWR) has developed standard well construction requirements for annular surface seals to prevent contamination of water supply wells by chemicals and biologic hazards related to point and nonpoint sources. The minimum depth to which an annular seal must extend is 50 feet for community and industrial water supply wells and 20 feet for individual domestic, agricultural, and other types of water supply wells. To meet these requirements, the wells would be installed within saline water at Treasure Island.

## **POTENTIAL CONTAMINATION OF SHALLOW WATER-BEARING ZONE**

The shallow-water-bearing zone at Treasure Island is typically less than 5 feet bgs and is vulnerable to contamination from surface and near surface sources. Infiltration of chemicals from storm water runoff from roadways or other impervious surfaces, and even the application of fertilizers, pesticides, and herbicides in lawns and other planter areas could cause degradation of the shallow water-bearing zone at Treasure Island. In addition, contamination from leaking sewer lines, and other subsurface lines also makes the shallow water-bearing zone vulnerable to contamination. This vulnerability to surface and near surface contamination makes it impractical to use the shallow groundwater at Treasure Island as a potential drinking water source.

## **SALTWATER INTRUSION AND LAND SUBSIDENCE**

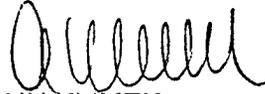
Treasure Island is wholly within San Francisco Bay and is surrounded and underlain by saltwater. Pumping of shallow groundwater from the artificial fill would induce further saltwater intrusion. Prolonged pumping of the shallow groundwater at Treasure Island would result in dewatering and compaction of the shallow sediments, which would result in land subsidence. Compaction would increase the potential for differential settlement of the soils and could lead to possible damage to overlying structures.

## **CONCLUSIONS AND RECOMMENDATIONS**

The groundwater at Treasure Island is not of sufficient quality and nature to be a potential drinking water source pursuant to SWRCB Resolution 88-63. The artificial fill forming Treasure Island is not an aquifer. There is no historic or current use of groundwater at Treasure Island, and potential future use of groundwater at Treasure Island for a drinking water supply is limited by State of California well construction requirements, potential contamination of the shallow water-bearing zone, saltwater intrusion, and land subsidence. The Navy requests that the RWQCB provide written concurrence that groundwater at Treasure Island meets the exemption criteria for SWRCB Resolution 88-63.

Please call Ms. Ellen Casados at (619) 532-0968, if you have any questions regarding this letter.

Sincerely,



ANN KLIMEK  
Environmental Business Line Team Leader  
By direction of the Commander

Encl: (1) Regional Water Quality Control Board, San Francisco Bay Region letter of November 10, 1998. Subject: CONCURRENCE THAT GROUNDWATER AT FISCO NAVY BASE, OAKLAND, MEETS THE EXEMPTION CRITERIA IN THE SWRCB SOURCES OF DRINKING WATER POLICY RESOLUTION 88-63

(2) Regional Water Quality Control Board, San Francisco Bay Region letter of June 9, 1999. Subject: CONCURRENCE THAT GROUNDWATER MEETS THE EXEMPTION CRITERIA IN THE SWRCB SOURCES OF DRINKING WATER POLICY RESOLUTION 88-63 AT FLEET AND INDUSTRIAL SUPPLY CENTER OAKLAND, ALAMEDA FACILITY/ANNEX, ALAMEDA COUNTY

Copy to:  
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Mr. James Ricks, Jr. (SFD-8-2)  
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Ms. Martha Walters  
San Francisco Redevelopment Agency  
770 Golden Gate Avenue  
San Francisco, CA 94102

## REFERENCES

- Freeze, R.A. and Cherry, J.A. 1979. *Groundwater*. Prentice-Hall, Inc.
- Regional Water Quality Control Board (RWQCB). 1995. "Water Quality Control Plan, San Francisco Bay Basin, Region (2)." San Francisco Bay Region. June 21.
- RWQCB. 1996. "San Francisco and Northern San Mateo County Pilot Beneficial Use Designation Project Part I: Draft Staff Report." San Francisco Bay Region Groundwater Committee. April 4.
- State Water Resources Control Board (SWRCB). 1988. "Resolution No. 88-63: Sources of Drinking Water." May 19.
- Tetra Tech EM Inc. (TtEMI). 1999. "Groundwater Status Report: Summary of Groundwater Monitoring from January to November 1998, Naval Station Treasure Island, San Francisco, California." May 7.



# California Regional Water Quality Control Board

## San Francisco Bay Region



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Pete Wilson  
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Date: NOV 10 1998  
File No. 2199.9080A(GWB)

Mr. Lou Ocampo, P.E.  
Remedial Project Manager  
Department of the Navy  
Engineering Field Activity West  
Naval Facilities Engineering Command  
900 Commodore Way  
San Bruno, California 94066-2402

**SUBJECT: CONCURRENCE THAT GROUNDWATER AT FISCO NAVY BASE, OAKLAND, MEETS THE EXEMPTION CRITERIA IN THE SWRCB SOURCES OF DRINKING WATER POLICY RESOLUTION 88-63.**

Dear Mr. Ocampo:

This is in response to the U.S. Navy's submittal, September 1998, Final Technical Memorandum, Examination of Beneficial Use of Groundwater at Fleet and Industrial Supply Center Oakland (FISCO), Oakland, California. The technical memorandum was primarily prepared to evaluate existing and potential beneficial uses of groundwater at FISCO.

We find that the quality and nature of the shallow groundwater beneath FISCO is such that this water is not a potential source of drinking water pursuant to State Water Resources Control Board Resolution No. 88-63 and Regional Water Quality Control Board Resolution No. 89-39. Furthermore, as the Navy demonstrated in the technical memorandum, the artificial land surface on which FISCO was built lies entirely within what was the San Francisco Bay prior to the early 1900's. The attached Regional Board staff report provides the results of our review and further background on this issue.

If you have any questions, please call Joseph Chou of my staff at (510) 622-2334.

Sincerely,

Richard K. McMurtry, Chief  
Groundwater Protection and  
Waste Containment Division

Attachment: November 6, 1998, Staff Report  
cc: Attached Mailing List

*California Environmental Protection Agency*

California Regional Water Quality Control Board  
San Francisco Bay Region

STAFF REPORT

TO: Richard K. McMurtry, Chief  
Groundwater Protection and Waste Containment Division

FR: Gregory W. Bartow, C.H.G. *GWB*  
Senior Engineering Geologist, Specialist

DATE: November 6, 1998

**SUBJECT: Evaluation of Navy's analysis of whether the groundwater beneath FISCO meets the exemption criteria in the State Water Resources Control Board's (SWRCB) Sources of Drinking Water Policy**

This memorandum provides a review of the U.S. Navy's analysis of whether the shallow groundwater beneath the Fleet and Industrial Supply Center Oakland (FISCO) Base meets the State Water Resources Control Board's (SWRCB) Sources of Drinking Water Policy (Resolution 88-63). This review is based on the Navy's submittal titled, "Examination of Beneficial Uses of Groundwater at FISCO, dated September 1998."

#### Introduction

FISCO is a 567-acre closing Navy base located adjacent to the Port of Oakland. The base will be transferred to the Port of Oakland to be used as an intermodal terminal and for shipping container staging and storage. No future residential use of the base is planned.

#### Hydrogeology

Two shallow water-bearing units have been defined at the site. The upper water-bearing unit occurs within the artificial fill to a depth of between 10 to 15 feet below the ground surface. The lower water-bearing zone is defined as a silty-sand unit within the upper portion of the Young Bay Mud. The lower water-bearing zone is approximately 5-7 feet thick. In a few areas where the Young Bay Mud is thin, the lower water-bearing unit extends into the uppermost portion of the San Antonio Formation.

The potential for migration of polluted groundwater to the Bay was evaluated as part of the ecological risk assessment. The risk assessment found that residual groundwater pollution is unlikely to impact ecological receptors in the Bay.

ATTACHMENT – NOVEMBER 6, 1988 STAFF REPORT  
PAGE 2

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Table 1. Total Dissolved Solids (TDS) Levels in Groundwater at FISCO Navy Base

Geologic Unit	Thickness	TDS Range	Average TDS and No. of samples (n) (mg/L)	Notes
Artificial Fill (equivalent to FISCO Upper water bearing zone)	10-15 feet thick	361-7180 mg/l based on measured TDS values	Avg. 1331 (n=15) Based on measured TDS values	Significant leakage of fresh water from broken water lines has resulted in lower TDS groundwater in the artificial fill.
		100-29,175 mg/l derived from specific conductivity measurements	Avg. 1586 (n=24) Derived from specific conductivity measurements	
Young Bay Mud (Equivalent to FISCO Lower water bearing zone) <sup>1</sup>	10-15 feet thick	515-36,000 mg/l based on measured TDS values	Avg. 9661 mg/L (n=14)	
		405-34,650 mg/L derived from specific conductivity measurements	Avg. 8721 (n=18) Derived from specific conductivity measurements	
San Antonio / Merritt Sand Formation	25-75 feet thick	5200-41,000 mg/l	Avg. 21,050 (n=4)	Note that further inland (and upgradient of FISCO) the groundwater in the Merritt Sand is much fresher than beneath FISCO.
Old Bay Mud (Yerba Buena Mud)	60-80 feet thick	No data	No data	Major aquitard separating high TDS groundwater in overlying aquifers from fresher underlying groundwater.
Alameda Formation	400 feet thick	730-1,300 mg/l	Avg. 940 (n=4)	Major fresh water aquifer separated from shallow brackish groundwater by overlying Old Bay Mud.

<sup>1</sup> Lower water bearing zone wells are primarily screened in a silty-sand unit within the Young Bay Mud. However, some wells are cross-screened into the upper few feet of the San Antonio/Merritt Sand Formation.

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**Maximum concentration of selected organics in groundwater from IR areas  
Except IR-02 (Building 740)**

Contaminant	Concentration (ug/L)	Monitoring Well	IR Site
1,2-DCE (total)	120	BW-MW20	IR-01
Benzene	4	A2-MW02	IR-21 and IR-15
TCE	53	A1-MW4	IR-14
Vinyl chloride	3	BW-MW17	IR-01

**Building 740, IR-02 Site** - This appears to be the only site at FISCO with significant groundwater pollution. Building 740 is located about 1000 feet from the Oakland Inner Harbor. The building has been used for a variety of purposes including an auto hobby shop, laundry works and originally as a clothing impregnation facility.

VOCs are detected at high concentrations in the upper water-bearing zone. However, only low or trace levels have been detected in the lower water-bearing zone. A summary of the highest concentrations detected at Building 740 is as follows:

**Maximum concentration of selected organics in groundwater from IR-02 (Building 740)**

Contaminant	Concentration (ug/L)	Monitoring Well
1,2-DCE (total)	49,000	A2-TMW07
Benzene	35	A2-TMW07
TCE	1,800	A2-TMW07
Vinyl chloride	5,300	A2-TMW07

Soil pollution that was identified at Building 740 during the initial Remedial Investigation (RI) has been addressed by excavating the soil. The Navy indicates that soil has been remediated to at least industrial PRG values. Due to the need for additional characterization of the Building 740 Site, the site has been split out of the base wide RI. The RI for Building 740 (Operable Unit 2) is currently in preparation and should be reviewed by Board staff to verify that the sources have been adequately characterized and remediated.

The Navy is also revising the risk assessment for the Building 740 area to evaluate other exposure pathways such as migration of the plume into the Bay and volatilization into trenches and buildings. This revised risk assessment will incorporate new subsurface data that was not available when the original risk assessment for the site was conducted.

At a minimum, long term groundwater monitoring of the Building 740 plume appears warranted. Such long-term monitoring will need to be coordinated with the Port of Oakland plans to excavate and regrade portions of FISCO for the Berth 55 Project. As with other sites on the FISCO base, source control is required pursuant to SWRCB Order 92-49.

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appears questionable whether artificial fill should be considered an aquifer at all, and thus be subject to the Source of Drinking Water Policy. While the Navy did not raise this issue in their evaluation, this is a question that should be given additional consideration by the Regional Board, perhaps as part of the upcoming Basin Plan Amendment process.

cc: Joseph Chou  
Dennis Mishek  
Stephen Morse



# California Regional Water Quality Control Board

## San Francisco Bay Region



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Date: JUN 09 1999  
File No. 2199.9284 (GWB)

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**SUBJECT: CONCURRENCE THAT GROUNDWATER MEETS THE EXEMPTION  
CRITERIA IN THE SWRCB SOURCES OF DRINKING WATER POLICY  
RESOLUTION 88-63 AT FLEET AND INDUSTRIAL SUPPLY CENTER OAKLAND,  
ALAMEDA FACILITY/ANNEX, ALAMEDA COUNTY**

Dear Mr. Tactay:

This is in response to the U.S. Navy's December, 1998, Draft Basewide Groundwater Beneficial Use Report, for the Fleet and Industrial Supply Center, Oakland, Alameda Facility/Annex (Alameda Annex), and the supplemental information submitted March 31, 1999. The technical memorandum was primarily prepared to evaluate existing and potential beneficial uses of groundwater at Alameda Annex.

We find that the quality and nature of the shallow groundwater beneath Alameda Annex is such that this water is not a potential source of drinking water pursuant to State Water Resources Control Board Resolution No. 88-63 and Regional Water Quality Control Board Resolution No. 89-39. Furthermore, as the Navy demonstrated in the technical memorandum, the artificial land surface on which the Alameda Annex was built lies entirely within what was the San Francisco Bay prior to the early 1900's.

Regional Board staff have reviewed the above referenced document. Staff concur with the Navy that the shallow groundwater at the Alameda Annex is not a potential source of drinking water, based on the high total dissolved solids (TDS) data of the shallow fill aquifer. However, the Navy must consider all other potential beneficial uses of the groundwater at the Alameda Annex as outlined in the 1995 Water Quality Control Plan, San Francisco Bay Regional Board.

### Hydrogeology of the Subsurface at the Alameda Annex

There are three water-bearing zones at the Alameda Annex. The first is the artificial fill, which extends from just below ground surface to the top of the Young Bay Mud aquitard, a depth of 15 feet below grade. The natural groundwater gradient for the shallow fill slopes toward the Bay. The Young Bay Mud at the site is about 10-15 feet thick. The Merrin Sand is the second water-bearing zone at the Alameda Annex. It underlies the Young Bay Mud and ranges in thickness from 25 to 75 feet. Beneath

the Merritt Sand is the Yerba Buena Mud and the Alameda Formation. The Alameda Formation is the third water bearing zone and a major fresh water aquifer, which is a potential source of drinking water.

#### Total Dissolved Solids Levels in the Shallow Fill Aquifer at the Alameda Annex

The TDS exemption criteria in the State Water Resources Control Board's, Sources of Drinking Water Policy, Resolution No. 88-63, states that all groundwater in California is considered a potential drinking water source unless the TDS levels exceed 3,000 mg/L, and it is not reasonably expected by the Board that the groundwater could supply a public water system. The artificial fill aquifer at the Alameda Annex contains water with a high TDS content due to naturally occurring saltwater intrusion. Figure 5-10 of the report illustrates the average TDS measurements for groundwater over nine monitoring events. Information submitted by the Navy indicates that the TDS concentrations range from 169 - 41,500 mg/L and average 12,100 mg/L. The location of low TDS groundwater is associated with leakage of freshwater from the water supply system. The Alameda Annex TDS data is similar to values for groundwater found at the Navy Fleet and Industrial Supply Center Oakland, the Oakland Army Base, and the Port of Oakland.

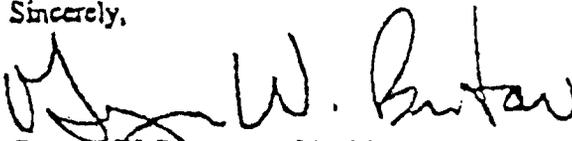
#### Additional Issues

While the Navy has adequately demonstrated that the TDS levels in the shallow groundwater are brackish and exceed the SWRCB's Sources of Drinking Water Policy exemption criteria, there are several other issues that must still be addressed. Other potential groundwater beneficial uses as outlined in the 1995 Basin Plan (Table 2-9), still apply to Alameda Annex (i.e., agricultural supply, industrial process supply, and industrial service supply).

Pursuant to SWRCB Resolution 92-49, the Navy must still demonstrate that 1) adequate source removal has occurred, 2) the plume or plumes have been adequately defined both laterally and vertically and 3) a long-term monitoring program is established to verify that the plume or plumes are stable and will not impact ecological receptors or human health (e.g., from volatilization into trenches and buildings).

If you have any questions on this matter, please contact Mr. Dennis Mishek at (510) 622-2390, or myself at (510) 622-2315.

Sincerely,

  
Gregory W. Barow, CHG, CEG  
Senior Engineering Geologist

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