LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

November 12, 1996
File No. 96-2-071

Mr. Steve Cusenza
City of Pleasanton
P.O. Box 520
Pleasanton, CA 94566-0802

SUBJECT: ANALYSIS OF POTENTIAL MOVEMENT OF CONTAMINANT PLUME NEAR WELL NO. 7

Dear Mr. Cusenza:

As requested during our recent discussions concerning Well No. 7, Luhdorff and Scalmanini, Consulting Engineers (LSCE) have analyzed the potential impacts that might arise in the event that the City reactivates this facility without further mitigation of the hydrocarbon plume associated with the Exxon station across Valley Avenue. Our analysis focused on the potential for hydrocarbon contaminants to move vertically downward or horizontally in response to regional gradients or locally induced gradients caused by nearby municipal pumping. The main concern is whether the municipal pumping will influence the stability of the plume and, in particular, whether there is a potential for the hydrocarbons to migrate and contaminate Well No. 7 if it is returned to production. The analysis discussed below, which is based on field measurements and analytic calculations, **indicates that a potential threat to the water quality of Well No. 7 does exist and must be considered as a constraint to operating the well in the future.**

Introduction

In 1994, LSCE reviewed historical reporting of monitoring and cleanup operations concerning shallow ground-water contamination in the vicinity of the City's Well No. 7. The contamination source was a hydrocarbon leak at the Exxon gas station located across Valley Avenue from the City's well facility (see attached location map). From our review, we noted that, among the several monitoring wells installed as a result of the clean-up and abatement measures, the deepest monitoring well was completed in aquifer materials which correspond to the upper intake portion of Well No. 7. Subsequent analysis of water level trends in all of the wells revealed that water levels in the deep monitoring well, and one other, closely matched the water levels measured in Well No. 7. This led to the conclusion that hydraulic continuity exists among these three wells. In contrast, water levels in the shallower monitoring wells followed trends which are different than those noted in the deeper wells, suggesting a lower degree of hydraulic continuity with the deeper aquifer system.

At the time of our review, we noted that the most recent sampling and testing results available (4/12/93) indicated the presence of hydrocarbons in the deep monitoring well (MW-8) and the

other monitoring well which had exhibited hydraulic similarities (MW5-D). We notified the City that this might pose a threat to Well No. 7 if it were reactivated. This is because pumping in Well No. 7 would induce a vertical and horizontal gradient that could result in hydrocarbon contamination of that drinking water source. Follow up correspondence with Exxon as well as subsequent sampling and testing of the monitoring wells suggested at the time that the presence of hydrocarbons in monitoring wells MW-8 and MW5-D might have been anomalous.

During 1995, the two deep monitoring wells again tested positive for various hydrocarbon compounds, leading to the concern that if Well No. 7 were reactivated, contamination of the drinking water might occur. The following sections discuss the contamination threat in terms of the hydrogeologic setting and how the local ground-water gradient is affected by municipal pumping.

Hydrogeologic Setting

In response to remediation requirements for the hydrocarbon contamination underlying the Exxon station at 2991 Hopyard Road, numerous monitoring wells were drilled and constructed between 1988 and 1989. These borings revealed the presence of shallow ground water and sequences of sands, gravels, and silty clays at depths of less than 100 feet below the ground surface. The occurrence of shallow ground water at this site is consistent with the presence of an unconfined shallow aquifer system which is observed on a regional scale throughout the Amador Valley. In contrast, the City of Pleasanton's Well No. 7 is completed in a deeper aquifer system which is developed for municipal supply throughout the basin. This deeper aquifer system is confined to semi-confined in nature and is actively managed by the Zone 7 Water Agency which operates municipal supply wells and surface water facilities. Of note is the fact that, throughout the ground-water basin, surface water is used to recharge the deep aquifer system. This reflects the hydraulic continuity between the shallow aquifer system and the deeper one as well as the presence of a vertical hydraulic gradient (required for the movement of recharge water downward).

Of the wells drilled in response to the hydrocarbon leakage at the Exxon station, well MW-8 is completed below 100 feet in aquifer materials which are considered part of the deep aquifer system. Attachment 1 is an excerpt from a 1990 consultant report prepared on behalf of Exxon to document cleanup and abatement operations. From this depiction, it can be seen that your Well No. 7, which is completed at a depth of 120 to 440 feet below the surface, and well MW-8 share common intake intervals. All other monitoring wells are technically isolated from Well No. 7 by a conductor casing set to 84 feet in the latter (although monitoring well MW5-D, which is screened at an interval less than 80 feet, exhibits hydraulic continuity with the deeper aquifer system).

Attachments 2 an 3 are hydrographs excerpted from the review we performed in 1994 and depict static water levels measured in the various wells. From these hydrographs, it can be seen that

Well No. 7 and monitoring wells MW8 and MW5-D exhibit essentially the same water level trends. In contrast, water levels in the other shallow monitoring wells do not indicate the same trends associated with the deeper system. Although there is little discernable horizontal gradient between water levels in MW-8 and Well No. 7, there is a clear vertical gradient between the shallower monitoring wells and the deeper ones since about March 1990. This is evident by comparison of the two hydrographs which indicate a water level difference between the upper, or shallow, aquifer system and the deep aquifer of over 35 feet in recent years. The fluctuating ground-water levels in MW-8, MW5-D, and your Well No. 7 reflect seasonal pumping from municipal wells in the basin, most significantly at Zone 7's Hopyard well field, and natural and managed recharge.

The vertical hydraulic gradient cited above is consistent with what occurs on a regional scale in the Valley and is likely exacerbated by pumping at the Hopyard well field. It has been observed by the City that pumping from Hopyard Well No. 6 induces about 10 feet of drawdown in the idle Well No. 7. Noting that the distance between the wells is about 1,000 feet and using the Cooper-Jacob modification of the Theis formula for ground-water flow, the aquifer transmissivity in the deep system, from which the municipal wells produce water, is on the order of 200,000 gallons per day per foot (gpd/ft). This is consistent with numerous other sources concerning characteristics of the deep aquifer system in the greater Pleasanton area.

Potential for Contaminants to Reach Well No. 7

As cited above, there is a clear vertical gradient between the shallow monitoring wells, which delineate the Exxon contaminant plume, and the deeper aquifer system that serves as a driving force for hydrocarbons to move downward. There is a less apparent horizontal gradient that might cause the plume to migrate away from the Exxon site; however, this does not mean that one is not present. In this situation, a significant horizontal gradient is induced for relatively short periods of time when the Hopyard well field is used, generally in the summer (see depiction of attached location map). The result of pumping at Hopyard creates a gradient that will cause horizontal flow that is of shorter duration and is not necessarily reflected in the hydrographs discussed above. As a result, if hydrocarbons moved downward through the various shallow layers of sands, gravel, and silty clays, they could then continue to move toward Well No. 7 through the upper portions of the deep aquifer system (e.g., in the interval screened MW8) in response to the influences of pumping at Hopyard.

If Well No. 7 were operated again, the impacts discussed above would be even greater due to its proximity to the gas station. At 100 to 200 feet away, Well No. 7 could induce a drop in the ground-water elevation at the gas station site of another 8 to 10 feet at a pumping capacity of 1,500 gpm. This would exacerbate the tendency for hydrocarbons to move downward (albeit slowly due to the presence of the interbedded silty clay layers) as well as create a significant driving force to move hydrocarbons toward Well No. 7 once they have reached the deep aquifer. The fact that hydrocarbons have been detected in monitoring wells MW8 and MW5-D, on more

than one occasion, suggests that movement of hydrocarbons through the deep aquifer system to Well No. 7 can readily occur under the induced drawdown from pumping at Hopyard and future pumping in Well No. 7.

Conclusions

Considering the presence of hydrocarbon compounds in monitoring wells MW5-D and MW8, the City may be constrained in its ability to operate Well No. 7 because of the potential to induce movement of ground water downward and toward the well. To further investigate the threat to this drinking water source, retesting of the monitoring wells and Well No. 7 is recommended together with a thorough review of all the data. In addition, some discrete pumping tests may be useful to refine the analysis provided above. However, the re-testing or a refined analysis cannot mitigate the adverse impacts posed by contaminants reaching the deep aquifer system (i.e., reaching MW8 and/or MW5-D). If that occurs, or if it has already occurred as suggested by monitoring results during 1995, then there are no other influences which might counteract the tendency of ground water to move in the direction of Well No. 7 in response to local pumping.

We trust that the information provided above addresses the questions we discussed concerning Well No. 7. If you have any questions, we would be happy to respond further.

Sincerely,

LUHDORFF AND SCALMANINI
CONSULTING ENGINEERS

Joseph C. Scalmanini

Thomas D. Elson

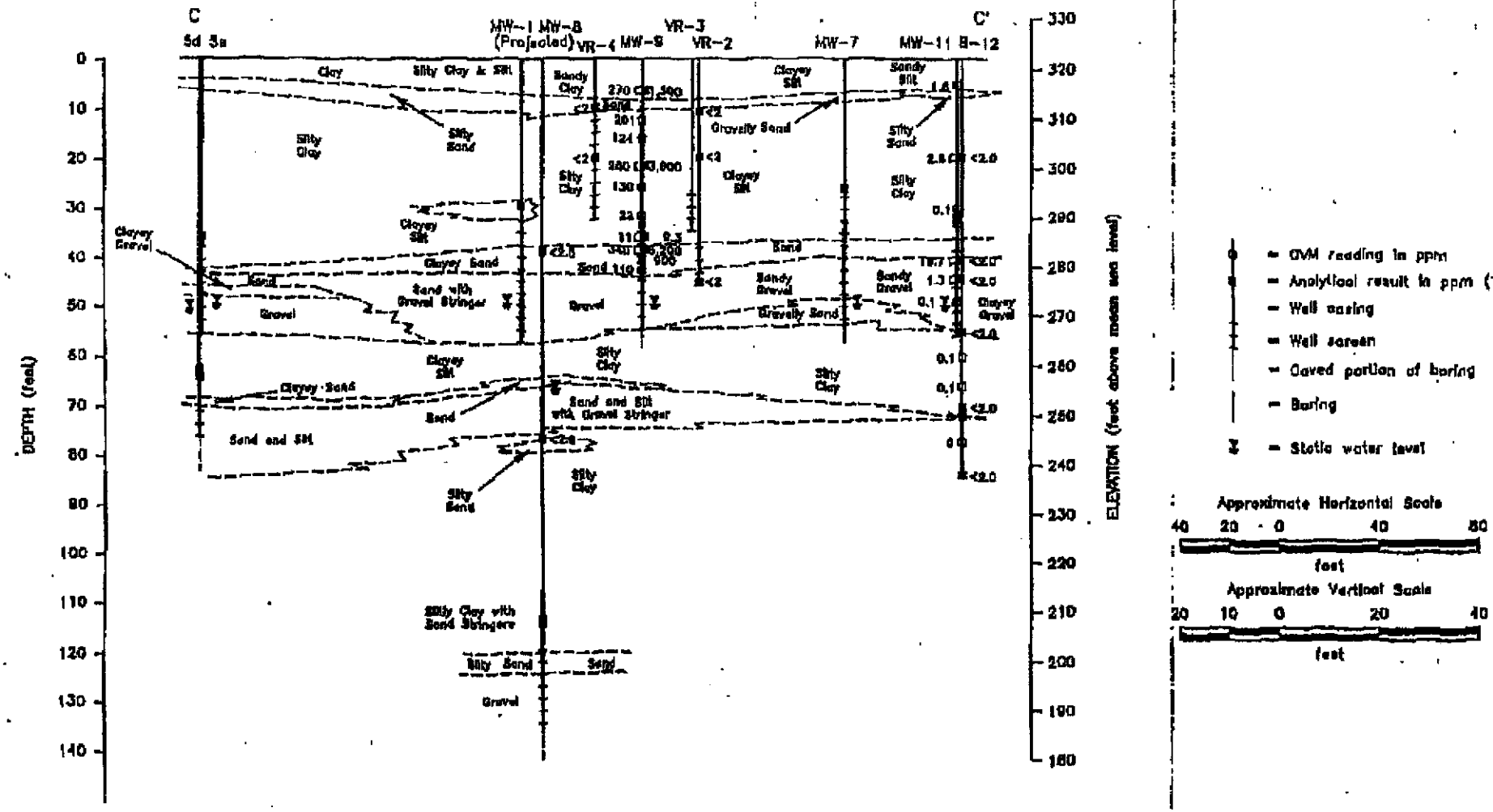
TDE/lb

Attachments

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Analysis of Well No. 7
Contaminant Threat

ATTACHMENT 1



Applied GeoSystems

PROJECT NO. 18034-7

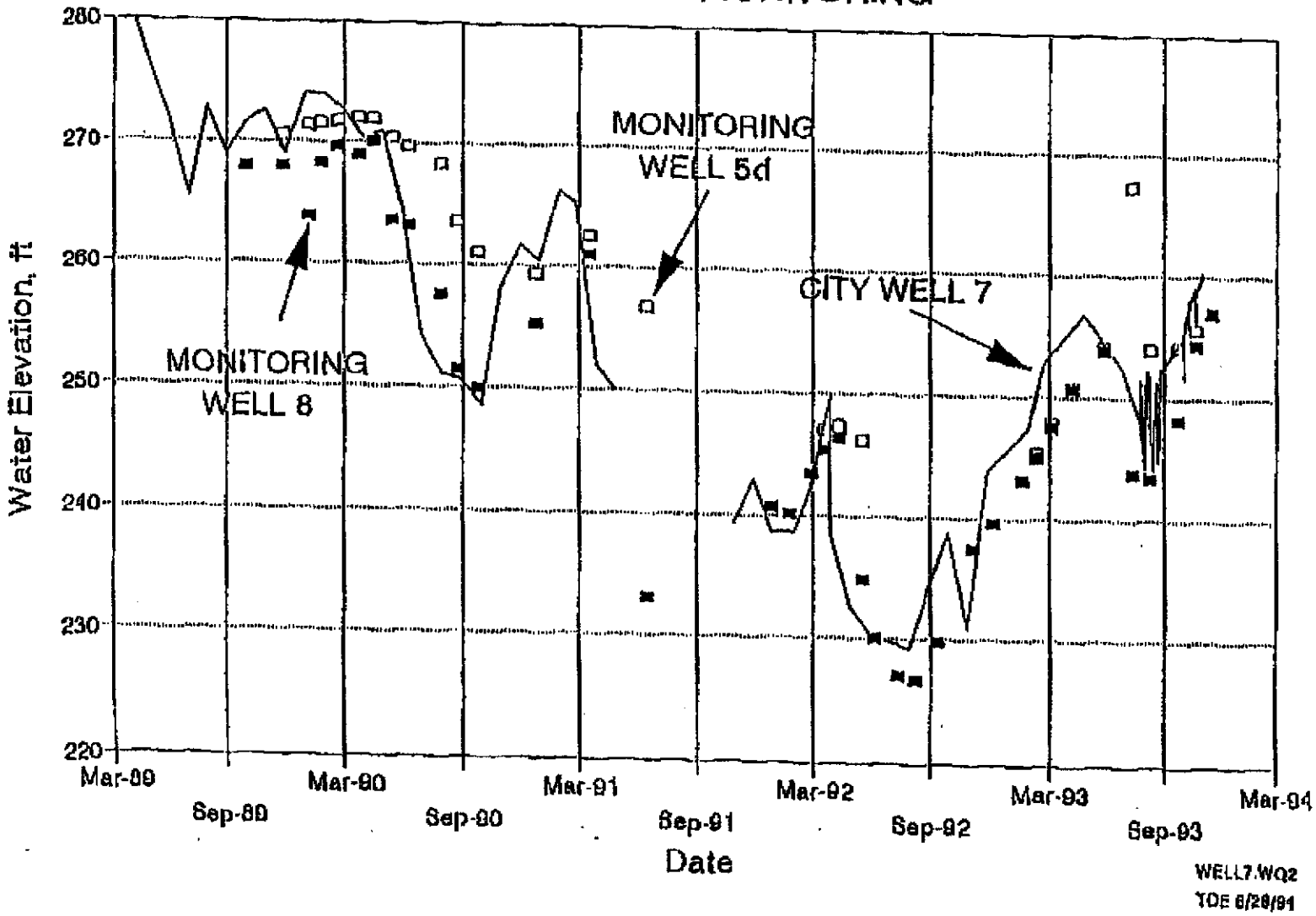
HYDROGEOLOGIC CROSS SECTION C-C'
Exxon Station No. 7-3399
2991 Hopyard Road
Pleasanton, California

PLATE
P - 29

ATTACHMENT 2

FIGURE 1

CITY OF PLEASANTON WELL 7
WATER LEVEL MONITORING



ATTACHMENT 3

FIGURE 2
CITY OF PLEASANTON WELL 7
WATER LEVEL MONITORING