California American Water
Monterey District

East Palo Alto Area

Gloria Way Well Investigation Summary Report

April 2004

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HDR

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Summary Report

East Palo Alto Area - Gloria Way Well Project

California American Water - Monterey District

April 2004

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Background

California American Water (Cal-Am) operates the water system in East Palo Alto and is considering building a water treatment facility on the existing Gloria Well site to treat the water and allow its use as an additional domestic water supply source. The well is located at the corner of Bay Road and Gloria Way and is currently operating only as a non-potable supply source.

East Palo Alto obtains water from the San Francisco Public Utility Commission (SFPUC). SFPUC's water supply comes from two major sources: Hetch Hetchy Reservoir in the High Sierra Nevada Mountains, and a local watershed in Alameda County. The purchased SFPUC surface water supply is known for its high quality and for consistently meeting regulatory criteria, with low turbidity, dissolved solids and hardness.

In the summer of 1981, the Gloria Well was put into operation to supplement the East Palo Alto water supply received from SFPUC. However, the Gloria Well water exhibited higher hardness and total dissolved solids (TDS) when compared with the SFPUC water supply. The water from the Gloria Well contained relatively high levels of iron and manganese. Shortly after the well was put into operation, consumers in close proximity to the well reported the water to be objectionable. The use of the well stopped in 1989 and eventually the well was taken out of domestic service in July 1999. The only CDHS approved East Palo Alto source of drinking water supply then became water purchased from the SFPUC. The reasons quoted in the available reports to explain why the well was removed from the system were high iron and manganese concentrations and elimination of a potential cross connection hazard.

Currently, the well is utilized, on a limited part time basis, for non-domestic use. The water from the well serves the City of East Palo's street cleaning, construction dust control and sewer line flushing programs. The well discharge line is physically disconnected (capped) from the domestic water supply line on Bay Road.

Purpose

The proposed re-introduction of the Gloria Well is intended to supplement the existing water supply from SFPUC. Use of the Gloria Well will improve reliability by providing emergency and redundant supply, and potentially reduce the expenses associated with purchased water supply. However it is necessary to consider public and regulatory acceptance when evaluating the feasibility of bringing this well back into potable supply operation. The current physical condition of the well, its hydraulic capacity and the water quality needed to be investigated prior to evaluating the alternatives for re-introducing the well into the water supply system. Only after examination of the well condition and water quality, will Cal-Am be able to adequately assess the potential capital improvements for wellhead treatment approaches and potential blending strategies.

A request for proposals was issued by Cal-Am to perform an evaluation and selection of recommended treatment process, consider integration of the well source with the regional water supply system, provide conceptual and detailed design aspects, and evaluate the project cost effectiveness.

Scope

HDR was retained by Cal-Am in August 2003 to perform the treatment evaluation and design services. The first task required performance of well inspection and evaluation services. These initial services included completing a video survey of well construction and condition, performing pump testing to establish yield data, and completing necessary water quality sampling and analysis. This information was required prior to beginning a conceptual design phase.

Martin B. Feeney, a consulting hydrogeologist was retained to collect and review background data on the existing well, oversee and evaluate the video and the well performance testing and well inspection tasks, and then provide recommendations related to potential well performance and use. Chappel Pump, a local pump and well contractor was employed to remove and inspect the existing pump and column, run the test pumping equipment, and re-install the existing pump. Newman Well Survey was employed to conduct the casing video, and Sequoia Analytical Laboratories was employed to complete the water quality analysis.

The findings of the investigation and preliminary recommendations are presented in this report.

Findings of the Well Investigation Phase

According to the original well driller's log, the well has a total drill depth of 351 feet and a completed well depth of 339 feet. The casing is 12-inch, spiral seam, steel. Also according to the driller's log the first screened perforation is 188 feet from the surface. This depth differs from the information ascertained from the video survey (see summary below). The well log (Water Well Drillers Report) is provided in Appendix A. Pictures taken of the site during visits between September and December of 2003 are provided in Appendix B. The following sub-sections provide summary information on the specific findings of the investigation.

Physical Condition of the Well

Appendix C contains the *East Palo Alto, Gloria Well, Well Assessment Report*, as prepared by Martin B. Feeney. The video surveys performed by Newman Well Survey on January 6, 2004 and subsequently on January 10, 2004 revealed relatively clean unobstructed perforations with limited encrustation, and negligible corrosion at the joints between the stainless steel screen and the mild steel blank. The casing itself was found to be in good shape with minimal encrustation or corrosion and no evidence of holes or deformation. The Video Survey Report can be found in the Appendix D. A full copy of the videotape from the survey was provided to Cal-Am for the well records.

HDR submitted a request to the County of San Mateo (the former operator) for as-built drawings of the Gloria Well; however these records are no longer available. But based on the available data the filter pack, sanitary seal, and pump pedestal appear to be structurally sound, and were constructed in accordance with applicable code (i.e., minimum 50-ft sanitary seal, etc). Additionally, based on the performance test and the video survey, the Gloria Well is in good structural and operating condition. Therefore the current physical condition of the Gloria Well does not limit its potential use as a water supply source.

Hydraulic Performance and Capacity

When originally placed into service, the capacity of the pump was rated at 300 gpm at 471 TDH. During the 72-hour constant pump discharge test performed for this investigation the well was capable of being continuously pumped at a rate of approximately 300 gpm. Discharge was kept constant by manually adjusting the hydrant valve. Flow rate was measured during the pump test with a meter provided by Cal-Am. Water level measurements were also collected as necessary during the extended pumping test period.

The extended pumping test was conducted December 12 through 15, 2003. The pumping flow rate from the well was kept at approximately 300 gpm during the test period. That flow rate was sustained for the full duration of the test, approximately 72 hours. Discharge was routed through the existing hydropneumatic pressure tank to an adjacent fire hydrant on Gloria Way and then conveyed through a 2-1/2 inch hose to the nearby storm drain catch basin. Pictures provided in Appendix B show the test operation. Discharge to the storm drain was permitted through the City of East Palo Alto and the Regional Water Quality Control Board after preliminary water quality testing had been performed for a limited list of constituents of concern. An Encroachment Permit for the three-day test was also filed with a City of East Palo Alto (Appendix G).

Results of the well inspection video determined that the screen perforations were located in the intervals between 259 - 282 feet and 319.5 and 325.5 feet below ground surface. The screen placements are generally consistent with the depth of the probable water bearing strata reported in the original driller's log. However, the upper screen, as reported and as placed, may not align well with available water bearing material. Fine sand is reported in the log at 250-269 feet whereas the screen is set at 259-282 feet. Above and below the sand the driller's log reports that there is clayey material. The lower screen aligns with the 6 feet of sand and gravel reported on the driller's log at a depth of between 319.5 and 325.5 feet. Based on the available data, it is not certain why the upper screen was placed at an interval that appears to be below the water-bearing zone. The original well design information (e-log, etc.) was not available to fully evaluate the as-built construction and determine the reason for the screen/strata offset. Further description of the existing well configuration and a well schematic are in Appendix C.

Due to the orientation of the screens and underlying water-bearing strata, the production capacity of the well is limited to the two zones within the as-built well depth. Based on the

pump testing performed for this investigation, the estimated yield from the well is expected to reasonably be between 350 gpm to 450 gpm (see Appendix C). There is a possibility that there may have been a change (increase) in the static water level in the area of the Gloria Well since it was constructed and this may have contributed to an increase in the pumping water level and a potential decrease in drawdown. Therefore this pumping test data should be compared to any available historic water level data for the well, and surrounding wells, to ensure that during the design phase the potential for seasonal level changes are being considered.

Water Quality

The water from the well was sampled on December 15, 2003 and tested in accordance with EPA methods and CCR Title 22 requirements, and for additional criteria as requested by Cal-Am. The water quality of the well was found to be moderately good for a groundwater source, and with appropriate measures the water is expected to be allowed again by CDHS as a permitted drinking water supply source.

As previously mentioned, the Gloria Well water supply must be compared with the SFPUC supply as a quality benchmark. Existing Cal-Am customers are used to the high quality surface water supply they currently receive. In comparison with the current SFPUC water supply, the Gloria Well water exhibits significantly higher conductance, alkalinity, hardness, TDS, and chloride. The manganese concentration is also above the current state SMCL (secondary) standard. The water quality lab results from this investigation help to explain why the water was found to be objectionable in the past to consumers from a taste and odor perspective. The well water, although safe for drinking, has concentrations of minerals typically associated with un-appealing taste and odor based complaints.

Table 1 summarizes the results of some of the historic water quality testing, as well as the water quality testing that was performed on the Gloria Well water during the investigation required for this report. The parameters of concern are further discussed and described below. Parameters and constituents other than those specifically identified below tested below the State MCL's and therefore should not cause a significant concern when compared with the SFPUC water supply.

Table 1. Gloria Way Well Testing Results and Water Quality Comparison.

WATER QUALITY TESTING RESULTS - GLORIA WAY WELL
(FOR SELECTED T-22 GM, GP, INORGANIC AND ORGANIC CONSTITUENTS ONLY)

PARAMETER	REPORTING UNIT	TYPICAL LAB DLR	LAB TEST RESULTS Dec 2003	STATE MCL	E Palo Alto or SFPUC ANNUAL AVERAGE 2001-2002	Historic Results 1986	Historic Results 1989	NOTES/COMMENTS
General Mineral / Physical:								
Bicarbonate Alkalinity	mg/L	5.0	200	(a)	66 (13-120)			Slightly elevated for GW
Calcium	mg/L	0.50	57	(a)	18 (4-31)	40	43	1963 WHO limit was 75 mg/L
Carbonate Alkalinity	mg/L	5.0	8.2	(a)				
Chloride	mg/L	100	280	500 (i)	5 (ND - 7)	450	264	Above reccom'd limit of 250
Color	color units	5.0	10	15 (e)	10	20	8	Possibly assocated with Mn
Corrosivity				Non-Corr.				Not tested
Fluoride	mg/L	0.10	0.33	2 (f)	0.2 (0.1-0.2)	0.1	0.9	Sub-optimal for dental
Hydroxide Alkalinity	mg/L	5.0	ND	(a)				
Lab pH	pH Units	2.0	7.95	6.5 to 8.5	9 (8.6 - 9.4)	8.1	7.9	Below SFPUC source.
Lab Turbidity	NTU	0.10	0.50	5 (e)	0.33 (0.20-0.66)	0.92	0.6	
Magnesium	mg/L	0.10	26	(a)				Mid point of typical range
MBAS	mg/L	0.050	ND	0.5 (e)				
Nitrate as NO3	mg/L	5.0	ND	45 (f)		<1	0.2	
Nitrite as NO2	mg/L	5.0	ND	(a)				
Nitrate + Nitrite (as N)	mg/L	2.0 (m)	ND	10 (f)				Not tested
Nitrite as N	mg/L		ND	1 (f)				Not tested
Odor	TON	1.000	ND	3 (e)				Lowest obtainable odor value
Phosphate (PO4)	mg/L			(a)				Not tested
Potassium	mg/L	2.0	ND	(a)				
Sodium	mg/L	0.50	230	(a)	18 (3-22)	220	240.4	20 ppm 1985 EPA guide value
Specfic Conductance (EC at 25C)	umho/cm	1.0	1500	1600 (h)	214 (13-340)	1500	1040	Above recom'd limit of 900
Sulfate (as SO4)	mg/L	5.0	30	500 (i)	17 (0.7-25)	30	36	Well below SMCL
TDS	mg/L	10	840	1000 (g)	114 (ND-190)	1040	800	Above recom'd limit of 500
Total Alkalinity (as CaCO3)	mg/L	5.0	210	(a)	66 (16-120)	210	250	Evidence of sulfate Ca/Mg
Total Hardness (as CaCO3)	mg/L	1.0	250	(a)	66 (11-120)	190	192	Considered "hard" water
Regulated Inorganics (Primary MCL is shown unless otherwise noted):								
Aluminum	ug/L	5.0	5.4	200 (b)				
Antimony	ug/L	1.0	ND	6				
Arsenic	ug/L	1.0	1.4	10 (c)	ND (j) (ND-180)	<10	<2	Relatively low
Asbestos	MFL		< 0.020	7				Results < analytical sensitivity.
Barium	ug/L	2.0	350	1000		<500	280	Elevated; saline environment?
Beryllium	ug/L	1.0	ND	4				
Boron	mg/L	0.10	0.26	1 (d)	ND (j)			>0.75 is problem for crops
Cadmium	ug/L	1.0	ND	5		<5	<10	
Total Chromium	ug/L	5.0	ND	50		<5	<20	
Cyanide	mg/L	0.0050	ND	0.15				
Copper	mg/L	0.010	ND	1 (e), 1.3 (d	0.059	<0.1	<0.01	
Iron	mg/L	0.10	0.14	0.3 (e)	ND (ND-140)	1.0	<0.1	1/2 the current MCL
Lead	ug/L	5.0	ND	15 (d)	ND	<5	<50	
Manganese	mg/L	0.010	0.19	0.05 (e)	NR (k)			4 times the current MCL
Mercury	ug/L	0.20	ND	2		<50	<1	
Nickel	ug/L	1.0	1.4	100				
Selenium	ug/L	1.0	3.1	50		<10	<50	
Silver	ug/L	1.0	ND	100 (e)		<0.02	<0.005	
Thallium	ug/L	1.0	ND	2				
Zinc	mg/L	0.050	ND	5.0 (e)		0.06	<0.01	
Radiological:								
Combined Radium 226 & 228	pCi/L		0.13 (l)	5				
Gross Alpha	pCi/L			15			0.56	
Tritium	pCi/L			20000				
Strontium-90	pCi/L			8				
Gross Beta	pCi/L			50				
Uranium	pCi/L			20				
Radon	pCi/L							
Bacteriological:								
Total Coliform	P/A	1.0	ND	> 1	0.17			
E-Coli	P/A	1.0	ND	A				
Regulated Organic Chemicals:								
VOC's	*Varies*	*Varies*	ND	*Varies*				Results for all T-22 VOC's
SOC's	*Varies*	*Varies*	ND	*Varies*				Results for all T-22 VOC's
MTBE	mg/L			0.005 (e)				
Thiobencarb	mg/L			0.001 (e)				

NOTES:

(a) Not specifically restricted/regulated
(b) Secondary MCL value is shown The primary MCL is 1,000 ug/L
(c) The Federal MCL is currently 10 ug/L State MCL is not yet established
(d) Current State Action Level
(e) Secondary MCL
(f) Primary MCL
(g) Secondary MCL Upper Limit Max recom'd is 500 mg/L Short-Term max MCL is 1,500 mg/L
(h) Secondary MCL Upper Limit Max recom'd is 900 mg/L Short-Term max MCL is 2,200 mg/L
(i) Secondary MCL Upper Limit Max recom'd is 250 mg/L Short-Term max MCL is 600 mg/L
(j) ND = not detected
(k) NR = not reported
(l) Feb. 2004 data
(m) Calculated from Lab Data

Specific Conductance

The results for Specific Conductance averaged 1,600 µmho/cm, above the State MCL secondary recommended upper limit of 900 µmho/cm. Historic records for this well are consistent with the high conductance results with 1,500 and 1,040 µmho/cm for 1986 and 1989 respectively. The average specific conductance detected in the SFPUC supply, as reported in the East Palo Alto 2002 Annual Water Quality Report is 214 µmho/cm.

Total Dissolved Solids (TDS)

The Gloria Well testing result for TDS was 840 mg/L, which is above the State Secondary MCL recommended limit of 500 mg/L. This result confirms the high mineral content of the well water. Samples in 1986 and 1989 measured 1,040 and 800 mg/L respectively. In comparison, SFPUC 2002 samples averaged 114 mg/L and ranged from "non-detect" to 190 mg/L.

Manganese

The testing result for manganese was 0.19 mg/L which when compared with the State Secondary MCL of 0.05 mg/L is found to be approximately 4 times the secondary regulatory limit. DHS historic results for the well are reported as 0.25 and 0.040 for 1986 and 1989 respectively. SFPUC did not report results for Manganese in 2002 but it is likely that the manganese concentration in the SFPUC source is below the MCL.

Iron

The testing result for iron is below the recommended secondary MCL and is discussed here because iron concentrations were reported as concern historically for this well. The iron testing result for this investigation was at 0.14 mg/L which is acceptable for well water, meets the regulatory requirements when compared with the recommended Secondary MCL of 0.3 mg/L. Iron results for 1986 and 1989 are 1 mg/L and <0.1 mg/L, while SFPUC has reported a non-detected result for iron concentration.

Chloride

Ground water in general and specifically in the East Palo Alto region is expected to exhibit higher chloride concentrations when compared with the SFPUC water supply due to the close proximity of the saline coastal environment. The chloride testing result was 280 mg/L, which is higher than the maximum recommended MCL limit of 250 mg/L but is below the Secondary MCL upper limit of 500 mg/L. Chloride results for 1986 and 1989 were 450 and 264 mg/L respectively. SFPUC water is reported at 5 mg/L with a range of "non-detect" to 7 mg/L as reported in the CCR for 2002.

Historic Perspective on Water Quality

Information from the California Department of Health Services (DHS) indicates that in the months that followed the installation of the well in 1981, taste and odor complaints from residents began and ultimately caused the East Palo Alto Waterworks District (operator of the system at the time) to scale back the operation of the well to 5 hours a day on week days (10 a.m. to 3 p.m.). In 1981, water samples taken of the well and of the blended water (downstream) discovered elevated levels of iron (0.06 mg/L) and manganese (0.15 mg/L) in the well water and objectionable odor for the blended water (3-32 odor units). It was suggested at the time that the oxidative reaction between manganese and iron in the well water, and chlorine in the SFPUC water supply produced taste and odor problems in the blended water. Correspondence pertaining to the water quality concerns is provided for reference in Appendix E.

Results for the Gloria Well are also provided for samples taken between 1984 and 1989 courtesy of available CDHS records. The 1984 and 1989 test results for the above problem constituents are summarized in Table 1.

Appendix F provides results for other wells in the Palo Alto area for comparison purposes.

Preliminary Recommendations

From the results of this initial feasibility study, upgrading the Gloria Way Well to a drinking water supply well remains a potential option for the City of East Palo Alto water system and Cal-Am. Alternatives and options for Cal-Am to consider as viable for the potential use of this source for drinking water supply include:

- **Alternative 1.** Wellhead Treatment for Removal of Manganese - Remove Mn and other constituents associated with TDS and taste and odor complaints, then distribute the treated water directly (locally).
  - Treatment Option A. Greensand oxidation/filtration process.
  - Treatment Option B. Membrane process (RO or NF).
- **Alternative 2.** Sequestering of Manganese - Addition of a sequestering agent for manganese, such as polyphosphate. Blend offsite to distribute (requiring a pipeline).
- **Alternative 3.** Offsite Blending with Surface Water - Commingling of only disinfected well water with surface source water from SFPUC (requiring a pipeline but potentially very limited treatment). Blending at SFPUC turnout, or at a storage tank.
- **Alternative 4.** Combined Treatment and Offsite Blending - Similar to Alternative 1, but with offsite blending with surface water (requiring a new pipeline). Blending could be at the SFPUC interconnection location, or at an offsite storage tank location.

It is recommended that the selection of a potential treatment and/or blending project proceed with cohesion, and that the potential aesthetic impact to the customers of the use of this supply be fully considered. Further analysis is necessary to select the most feasible alternative.

Additional consideration must be given to staffing and operator certification class level requirements when treatment facilities are evaluated. The routine sampling and water quality testing requirements associated with the addition of this well as a source of supply will need to be evaluated through CDHS during the design phase. Permitting requirements with CDHS to accept this source and add it back into the system will need resolution. And a Water Supply Permit will need to follow, along with compliance with the California Environmental Quality Act (CEQA). CEQA compliance will likely require a hydrogeologic evaluation of the impact of using this well upon the surrounding aquifer, and this evaluation may include a need to perform some groundwater modeling. Also, to use this well as a source of supply, a Drinking Water Source Assessment (DWSAP) will be required as a support document with the filing of an Amendment to the Drinking Water Supply Permit.

Considerations for Wellhead Treatment Options

Removal of TDS with technologies such as reverse osmosis (RO) or nanofiltration (NF) would improve water quality and taste and odor characteristics by reducing the mineral content in the water, but this alternative should be carefully evaluated against priorities of Cal-Am, the impact on water rates, budget and staffing requirements, and the anticipated yield limitations from the well of 350-450 gpm.

A greensand pressure filtration system is commonly used for manganese removal, and Cal-Am is familiar with this treatment process from its use at other properties. The treatment for manganese would also result in iron removal and a measurable reduction in TDS. The removal of these constituents would improve the esthetic characteristics of the water by reducing the potential for brown and black color in the water. To a lesser degree, it will reduce the potential of taste and odor complaints, but water with high manganese and iron is not necessarily always associated with taste and odor complaints. The use of polyphosphate as a sequestering agent could be an alternative to manganese greensand treatment. Under this approach manganese would stay in solution, but the sequestering agent will mask its presence.

The SFPUC has recently converted from chlorine disinfection to disinfection using chloramine. The chloramine implementation started on February 2, 2004. The conversion to chloramine is aimed at increasing the residence time of the disinfectant in the water, improving protection against pathogens and reducing the formation of harmful disinfection by-products. SFPUC has a target minimum chloramine residual of 1.5 mg/L for its distribution system.

Disinfection at the well site is likely to be required and therefore the well may need to have a chloramine disinfection system. The use of free chlorine at the well site may not be viable because of concerns of breakpoint reaction between the free chlorine in the well water and the chloramine in the SFPUC water. This potential reaction would possibly limit the effectiveness

of chloramine in the East Palo Alto water supply. Therefore it may be required that the disinfection system at the well site would require chlorine followed by ammonia injection. For on-site disinfection in this case, storage of aqueous hypochlorite and aqueous ammonia at the well site would be required but the use of these chemicals has some safety concerns associated with it.

To fully analyze the disinfection requirements for use of this well some additional water quality testing, bench testing to evaluate disinfection addition options, and some mass balance calculations may be needed. It may be possible to only add chlorine to a free chlorine concentration of 1 ppm and at this concentration the maximum 4.8:1 ratio of chlorine to ammonia may not be exceeded in a blended application. The SFPUC supply currently has a 4.3:1 ratio of chlorine to ammonia, with excess free ammonia available. Therefore a chlorine-only disinfection system may be feasible using the blending alternative.

It will also be necessary to evaluate and monitor the blending effects on pH. Chloramine is most stable above pH of 8.5. The SFPUC water starts with PH of about 9.0-9.4. Care should be given to maintain a high enough pH in blended water to ensure the beneficial use of chloramines disinfection. The current analysis of the Gloria well water reported a pH of 7.95. In 1986 and 1989 the pH reported for the Gloria well water was 8.1 and 7.9.

The size of the well lot is 50-ft by 80-ft. There is unoccupied space on the north and east portions of the lot for placement of treatment and chemical storage facilities. The well with the new treatment facility would be expected to aesthetically blend reasonably well with the neighborhood. The well site is currently fenced but the perimeter security system may need to be relocated or improved if new facilities are constructed at this site. As an added safety precaution, a new treatment facility with chemical storage could be concealed from the neighborhood by CMU wall or a building structure.

Considerations for Blending Options

A blending strategy could replace some expensive manganese or TDS treatment strategies but use of this alternative must assure that the water quality is not going to degrade for the customers in close proximity to the well. This alternative would require the construction of a new dedicated pipeline to deliver well water closer to the point where water from SFPUC enters the water supply system or at least to a major transmission ("backbone") main. Positive mixing and a greater volumetric ratio of SFPUC water to well water are critical for the success of this alternative. A 4:1 minimum mixing volumetric ratio of SFPUC water to well water is recommended. Assuming the Gloria well produces 400 gpm, the SFPUC flow at the blending location would need to be 1,600 gpm. Mixing the water at a 4:1 or greater volumetric ratio should result in water that is acceptable to the customers. By having no appreciable change in water quality the prior taste and odor complaints would be avoided. A low flow rate interlock signal at the SFPUC transmission line or the blending point would assure that well water is not supplied to the system when the flow rate from the SFPUC is below a pre-set rate.

Gloria Way Well was originally connected to an 8-inch cast iron pipe located in the street in front of the well lot and connected to a main at Bay Rd. The well connection at the street is currently capped off. According to Cal-Am operator's knowledge, the main is approximately 25 years old. The service main that runs into the well site is about 17 years old. The turnout that supplies water from the SFPUC to the East Palo Alto water system is located at the intersection of University Avenue and the Hetch Hetchy Aqueduct; some 2,600 feet from the well. From initial review of the East Palo Alto system maps, it appears that the most convenient location for blending SFPUC water with well water is at the corner of University Avenue and Bay Road. The distance from the well to that intersection is approximately 800 feet. The cost of construction of a 6-inch line, 800 feet long is estimated at approximately $50,000.

Another advantage of blending is the potential of eliminating the need of chloramine application at the well site, as long as the chloramines level in the SFPUC water is at or above 2.5 mg/L at the point of mixing. Currently SFPUC is feeding 2.7 mg/L at the Sunol Valley Chlorination Facility with a reported 0.15 mg/L decay to the East Palo Alto turnout. Therefore, disinfectant residual near the turnout is about 2.5 to 2.6 mg/L. After the mixing (assuming 4:1 mixing ratio) the resulting water would have a 2.0 mg/L chloramine concentration, which is acceptable and safe. SFPUC's disinfectant residual target is 1.5 mg/L and any blending strategy use for the Gloria Well must fully understand the chlorine decay in the system verifying that the level after mixing stays above 1.5 mg/L in the outer reaches of the East Palo Alto distribution system (areas with the longest detention time).

One disadvantage of blending is that the well water supply cannot be used as a reliable alternative or emergency source since its usage is dependent on the flow of the primary source. In case the primary source is significantly reduced or taken out of service, the well water would be turned to as the replacement source, a situation likely to cause taste and odor complaints.

The logistics of this approach must be closely coordinated with SFPUC's chloramine program for East Palo Alto. In the future, SFPUC may lower the disinfectant residual to 2.0-2.5 mg/L and this factor must also be considered in evaluating the alternatives for use of the Gloria Well.

Considerations for Combination of Wellhead Treatment and Blending

A combination of treatment for manganese in conjunction with mixing (blending) of the Gloria Well water with the SFPUC supply is a promising alternative. This alternative would involve installation of the selected treatment (or sequestering) system, and construction of the treated water line from the well site to an offsite transmission main or storage reservoir blending location.

Decision Considerations for the Design Phase

The following is a representative list of key considerations for the design phase:

- Customer acceptance (associated with blending surface water and ground water)

- Permitting considerations (including DWSAP)
- CEQA considerations (including aquifer impact)
- Cost considerations (based on a concise alternatives analysis)
- Treatment process/method selection
- Neighborhood relations
- Operator/Staffing requirements
- DHS approval process and challenges to bring the well online

In addition to the key considerations listed above, it is anticipated that the design phase of the project will also include additional detailed analysis of the following potential alternatives:

Alternative A - Wellhead Treatment and Direct Distribution. This alternative is the supply option originally planned for the Gloria Well as outlined in this summary investigation report. Supply water would receive wellhead treatment and then would be conveyed directly to the adjacent existing distribution pipeline.

Alternative B - Wellhead Treatment and Offsite Blending. This alternative would rely on wellhead treatment however, to address the aesthetics of providing this groundwater supply to customers receiving the existing surface water supply, a new discharge main would be installed from the Gloria Well site to be connected to an existing offsite, large diameter transmission main, or would be connected to the offsite Hetch-Hetchy turnout.

Alternative C - Blending of Untreated Well Water at T-Main. Under this alternative untreated water from the Gloria Well would be conveyed through a new discharge main from the well site to a nearby large transmission main or to a connection at the Hetch-Hetchy turnout.

Alternative D - Blending of Untreated Well Water at Tank. This alternative would involve use of a dedicated discharge main to convey untreated Gloria Well water from the well site to a new tank which would be constructed at an offsite property. Properties under consideration for the new storage tank include a nearby park and a nearby school however, other properties may be available and would be considered during the evaluation for this alternative.

References

East Palo Alto, Gloria Well, Well Assessment Report, Martin B. Feeney, January 2004.

Water System Master Plan, East Palo Alto County Waterworks District, Brown and Caldwell, April 1998.

Appendix A. Water Well Driller's Report (Well Log).

TRIPLICATE
Owner's Copy

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

F-151-6

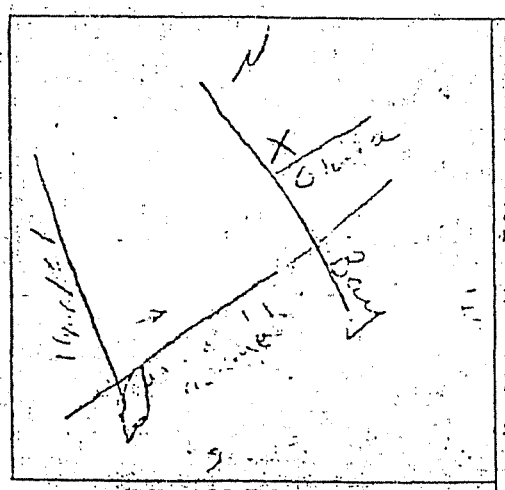
Do not fill in
No. 134143

Notice of Intent No.
Local Permit No. or Date

State Well No.
Other Well No.

(1) OWNER: Name County of San Mateo
Address Department of Public Works, County of San Mateo
City Redwood City, Ca. Zip 94063

(2) LOCATION OF WELL (See instructions):
County San Mateo Owner's Well Number
Well address if different from above Corner of Bay & Gloria in east Palo Alto
Township Range Section
Distance from cities, roads, railroads, fences, etc.



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic [ ]
Irrigation [ ]
Industrial [ ]
Test Well [ ]
Stock [ ]
Municipal [X]
Other [ ]

(5) EQUIPMENT:
Rotary [ ] Reverse [X]
Cable [ ] Air [ ]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:
Yes [X] No [ ] Size Monterey sand
Diameter of bore 24"
Packed from 100 to 350 ft.

(7) CASING INSTALLED:
Steel [X] Plastic [ ] Concrete [ ]

(8) PERFORATIONS: Johnson screen
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
+3	253	12 3/4	1/4	253	280	20 slot
280	313	12 3/4	1/4	313	323	100 slot
323	334	12 3/4	1/4			

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 100 ft.
Were strata sealed against pollution? Yes [X] No [ ] Interval 16'-34' ft.
Method of sealing pumped grout

(10) WATER LEVELS:
Depth of first water, if known ft.
Standing level after well completion ft.

(11) WELL TESTS:
Was well test made? Yes [ ] No [ ] If yes, by whom?
Type of test Pump [ ] Bailer [ ] Air lift [ ]
Depth to water at start of test ft. At end of test ft.
Discharge gal/min after hours Water temperature
Chemical analysis made? Yes [ ] No [ ] If yes, by whom?
Was electric log made? Yes [ ] No [ ] If yes, attach copy to this report

(12) WELL LOG: Total depth 351 ft. Depth of completed well 334 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	16	Top Soil
16	24	Gravel and Rock
24	39	Sticky brown clay
39	110	Blue clay
110	142	Joint blue clay
142	158	Sticky blue clay
158	182	Brown sticky clay
182	232	Joint blue clay
232	250	Sticky brown clay
250	269	Fine sand
269	280	Silty brown clay
280	286	Blue clay
286	302	Brown clay
302	311	Blue clay
311	319	Brown clay
319½	325½	Gravel and sand
325½	329	Sticky brown clay
329	351	Brown silt

Work started 11-13 19 74 Completed 1-9 19 75

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
SIGNED (Well Driller)
NAME The Water Development Corp.
P.O. Box 1333 (or corporation) (Typed or printed)
Address
City Woodland, Ca. Zip 95695
License No. 283326 Date of this report 1/7/80

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED: USE NEXT CONSECUTIVELY NUMBERED FORM

TRIPLICATE
Owner's Copy

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

F.151.4

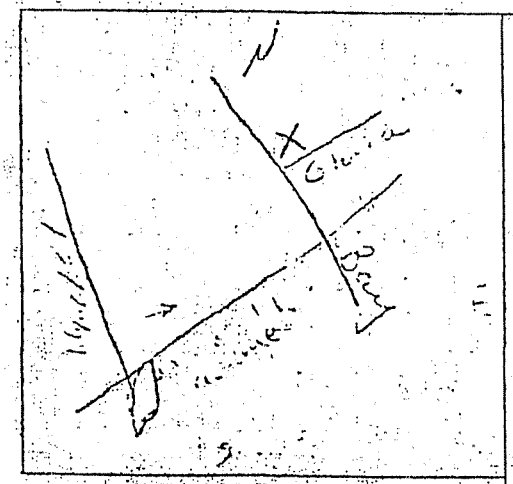
Do not fill in
No. 134143

Notice of Intent No. _____
Local Permit No. or Date _____

State Well No. _____
Other Well No. _____

(1) OWNER: Name County of San Mateo
Address Department of Public Works, County of San Mateo
City Redwood City, Ca. Zip 94063

(2) LOCATION OF WELL (See instructions):
County San Mateo Owner's Well Number _____
Well address if different from above Corner of Bay & Gloria in east Palo Alto
Township _____ Range _____ Section _____
Distance from cities, roads, railroads, fences, etc. _____



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☒
Other ☐

(5) EQUIPMENT:
Rotary ☐ Reverse ☒
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☒ No ☐ Size Monterey Sand
Diameter of bore 24" Packed from 100 to 350 ft.

(7) CASING INSTALLED:
Steel ☒ Plastic ☐ Concrete ☐

(8) PERFORATIONS: Johnson Screen
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
+3	253	2 3/4	1/4	253	280	20 slot
280	313	2 3/4	1/4	313	323	100 slot
323	334	2 3/4	1/4			

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 100 ft.
Were strata sealed against pollution? Yes ☒ No ☐ Interval 16'-34' ft.
Method of sealing pumped grout

(10) WATER LEVELS:
Depth of first water, if known _____ ft.
Standing level after well completion _____ ft.

(11) WELL TESTS:
Was well test made? Yes ☐ No ☐ If yes, by whom? _____
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test _____ ft. At end of test _____ ft.
Discharge _____ gal/min after _____ hours Water temperature _____
Chemical analysis made? Yes ☐ No ☐ If yes, by whom? _____
Was electric log made? Yes ☐ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 351 ft. Depth of completed well 334 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	16	Top Soil
16	24	Gravel and Rock
24	39	Sticky brown clay
39	110	Blue clay
110	142	Joint blue clay
142	158	Sticky blue clay
158	182	Brown sticky clay
182	232	Joint blue clay
232	250	Sticky brown clay9
250	269	Fine sand
269	280	Silty brown clay
280	286	Blue clay
286	302	Brown clay
302	311	Blue clay
311	319	Brown clay
319½	325½	Gravel and sand
325½	329	Sticky brown clay
329	351	Brown silt

Work started 11-15 19 79 Completed 12-7 19 79

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED _____ (Well Driller)
NAME The Water Development Corp.
P.O. Box 1853 (Person, firm or corporation) (Typed or printed)
Address _____
City Woodland, Ca. Zip 95695
License No. 283326 Date of this report 1/7/80

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES

RECEIVED
SANITARY ENGINEERING
JUN 04 1984

WELL DATA

(1) Place and Owner

(2) Source of Information

Collected by ____ Date ____

(3) Number or Name	055/09W-25F01M		
Date drilled	1979		
(4) Location: Neighborhood	EAST PALO ALTO		
Size of lot	50'X80'±		
Distance to: Sewer			
Sewage disposal			
Abandoned well			
Nearest property line	16'±		
(5) Housing: Type	NONE		
Condition			
Pit depth *(if any)*			
Floor *(material)*			
Drainage			
(6) Well Depth	351'		
(7) Casing: Depth	339'		
Diameter	12"		
Kind	STAINLESS STEEL		
Height above floor			
Distance to highest perforations	188' FROM SURFACE		
Surface sealed *(yes or no)*	YES		
Gravel pack *(yes or no)*	YES		
Second casing depth	NONE		
Second casing diameter			
Annular seal *(depth)*	100'		
(8) Impervious Strata Penetrated: Thickness			
Depth to			
(9) Water Levels: Depth to Surface			
Static	8.5		
When pumping	VARIES		
(10) Pump: Make	BYRON-JACKSON		
Type	8GH 16 STAGE DEEP WELL TURBINE		
Capacity, g.p.m.	300 GPM @ 471 TDH		
Lubrication	SHAFT		
Power	3 PHASE, 60 CYCLE	230/460V	
Auxiliary power	NONE		
Control	PROBES		
Discharge location	BAY ROAD		
Discharge to	WATER MAIN		
(11) Frequency of Use	NOT IN USE		
(12) Flood Hazard	NONE		
(13) Remarks and Defects (Use other side if necessary)			

(14) Show well log on other side.

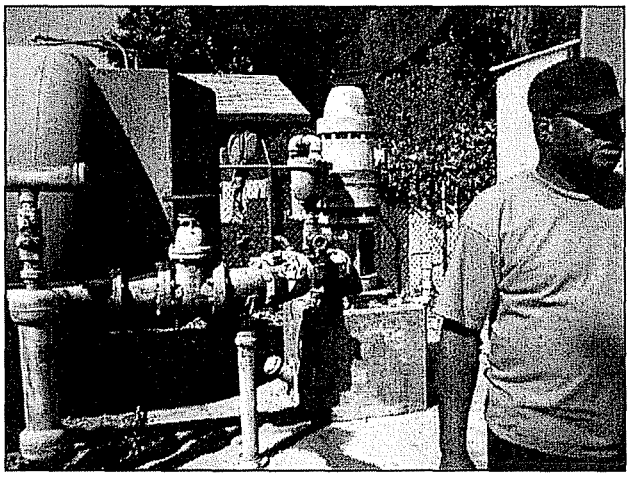
Appendix B. Site Photographs.

Gloria Well Site View

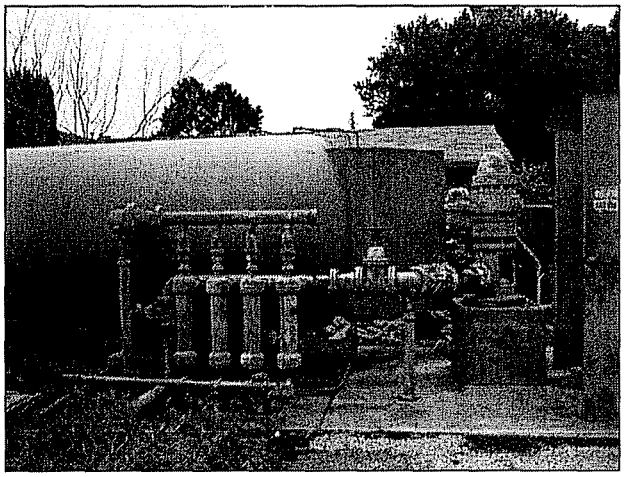
Gloria Well Hydropneumatic Tank

Gloria Well Entrance

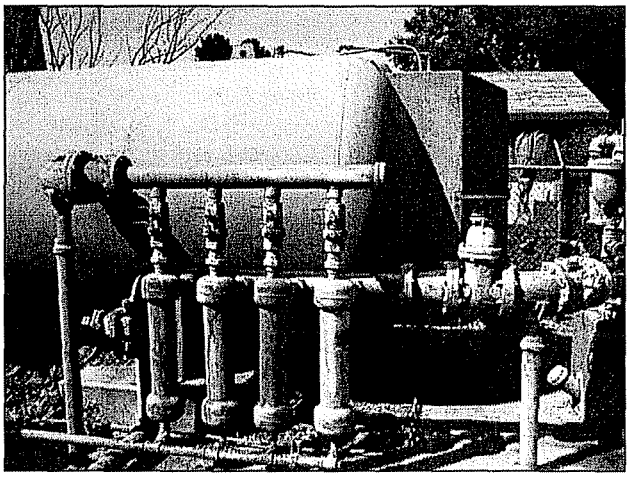
Gloria Well Discharge Piping Photo #1



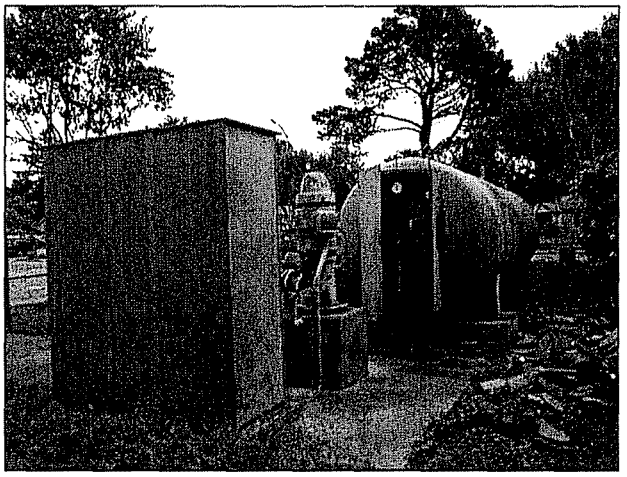
Gloria Well Discharge Piping Photo #2



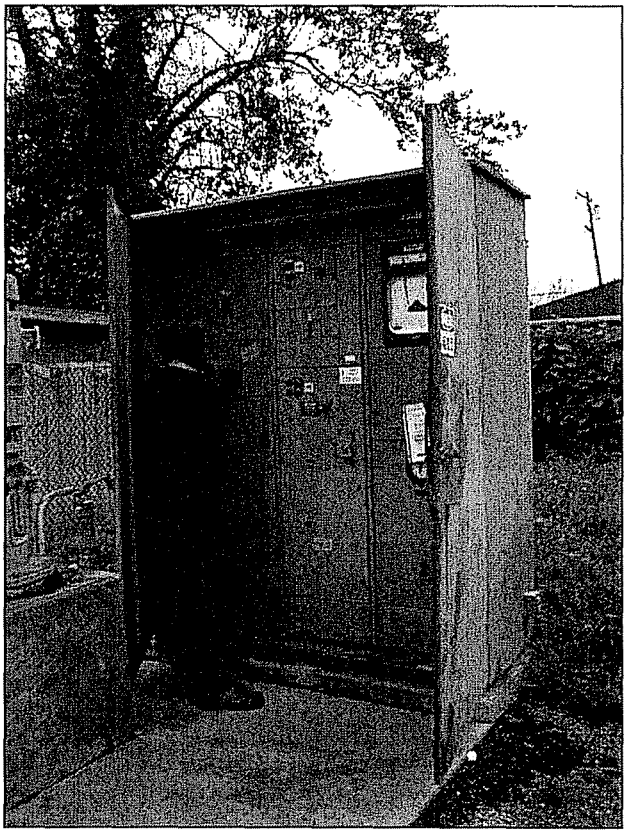
Gloria Well Discharge Piping Photo #3



Gloria Well Discharge Piping Photo #2



Gloria Well Discharge Piping Photo #3



Appendix C. East Palo Alto, Gloria Well, Well Assessment Report.

Martin B. Feeney
Consulting Hydrogeologist

R.G. 4634
C.E.G. 1454
C.Hg 145

January 20, 2004

HDR Engineering, Inc.
2365 Iron Point Road, Suite 300
Folsom, CA 95630

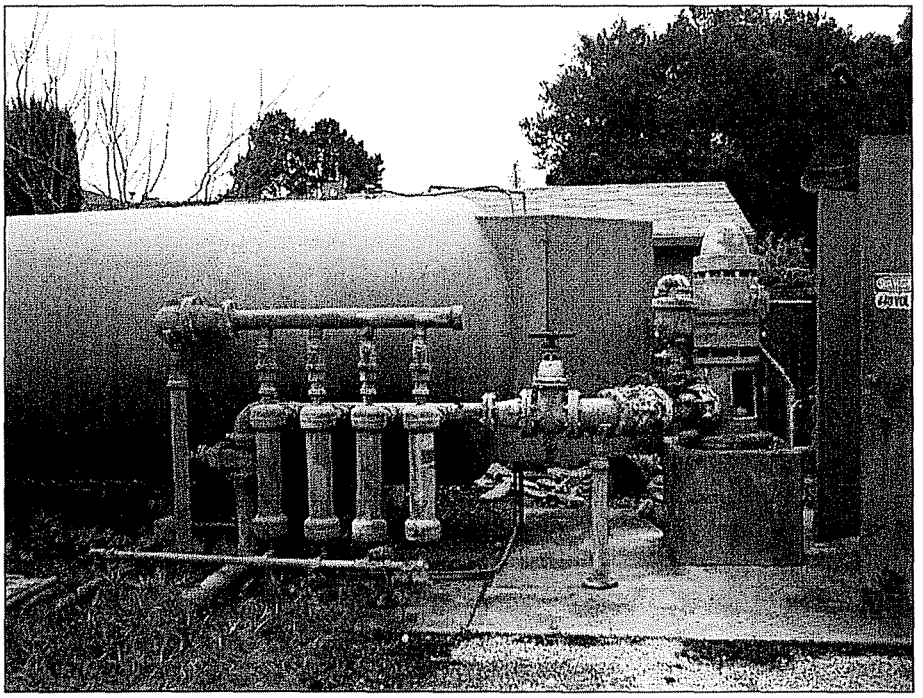
Attention: Rob Watson, PE

Subject: East Palo Alto – Gloria Well –Well Assessment

Dear Mr. Watson:

Presented in this letter report are the findings and conclusions resulting from an investigation into the performance and condition of the Gloria Way Well in East Palo Alto. It is understood that the well's operator, American Water Company, is considering building a water treatment facility to treat the water from this well to allow its use for municipal supply. The purpose of the assessment was to document the well's performance characteristics, condition and construction. These data, along with water quality data, will be used to determine the overall feasibility of the treatment and use proposal.

The work performed included the performance of a constant discharge test to assess the well's performance characteristics. The work also included the physical inspection of the well and pump. The well is located at the intersection of Gloria Way and Bay Street in East Palo Alto. The well is shown in the picture below.



P.O. Box 23240, Ventura, CA 93002 ♦ **Phone: 805/643-7710** ♦ e-mail mfeeney@ix.netcom.com

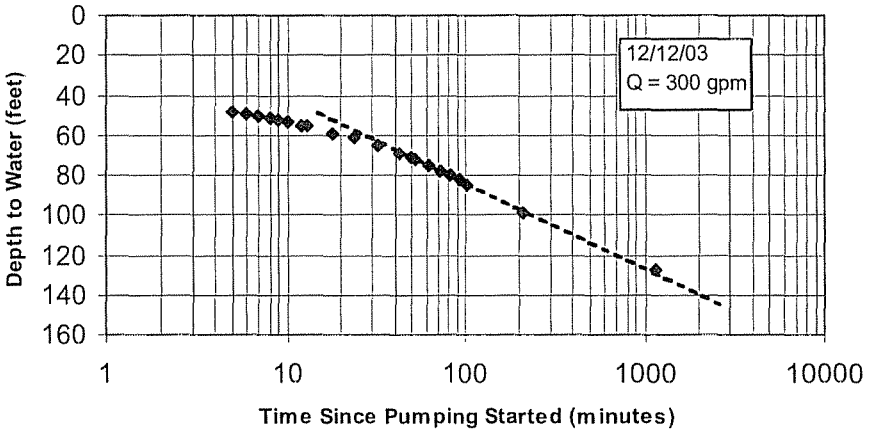
WELL PERFORMANCE TESTING

Well performance testing was performed concurrently with test pumping performed by HDR for purposes of collecting representative water samples for design of the treatment facility. The scope of work for well performance testing proposed a 100-minute test. However, for purposes of getting representative water quality samples HDR decided to perform a 72-hour constant discharge tests. The extended pumping period provided an opportunity to collect well performance data over a longer period.

The constant discharge test was conducted December 12 through 15, 2003. Discharge from the well was routed through the existing pressure tank to an adjacent fire hydrant and then discharged from the fire hydrant into the storm drain through collapsible pipe. Discharge to the storm drain was permitted through the City of East Palo Alto and the Regional Water Quality Control Board. Discharge from the well was controlled at the hydrant and measured with a flow meter. Discharge rate was adjusted to maintain a flow rate of approximately 300 gpm.

During testing, water level measurements were taken with an electric sounder. Static water level prior to testing was 16 feet below top of casing. Water level measurements were collected on a logarithmic schedule through the first 100 minutes and periodically for the next 1,100 minutes. The collected water level data are presented on Figure 1 – Gloria Well – Constant Discharge Drawdown Test.

FIGURE 1 – Gloria Well – Constant Discharge Test



As shown on Figure 1, water level declined from static to approximately 55 feet after 10 minutes. Then, as casing storage was depleted, water level decline steepened, falling along a conventional semi-logarithmic line with the pumping level at approximately 85 feet after 100 minutes and at 125 feet after 1,000 minutes. Utilizing the projected pumping level at 24-hours of 130 feet results in a 24-hour specific capacity[1] of 2.6 gpm/ft.

[1] Specific Capacity is the ratio of discharge to drawdown. The conventional units are gallons per minute per foot of drawdown (gpm/ft). Specific capacity values are useful for projecting drawdown at any given discharge rate and for comparing well performance over time.

PHYSICAL INSPECTION

Physical Inspection of the well entailed removal and inspection of the existing pump and the performance of a video survey to document condition of the well. Chappell Pump and Supply of Gilroy, CA removed and replaced the pump. Newman Well Surveys of Salinas, CA performed the video survey.

Pump

The pump was removed on January 5, 2004. Prior to the assessment program, the setting of the existing pump was unknown. The contractor removed 240 feet of 6-inch column pipe and 10-foot pump resulting in a pump setting of approximately 250 feet. Pump was an 8-inch diameter 16-stage Bryon-Jackson consistent with that reported on the DHS Form 228 dated 6/4/84. Column pipe, tube, shaft and spiders were in fair to good condition and were suitable for reuse. After the video survey was performed, the pump was reinstalled to original depth and returned to operating condition. Photographs of pump and column are attached.

Well

After removal of the pump, approximately 5,000 gallons of water was allowed to flow into the well overnight to improve clarity for the video survey. A video survey was performed on January 6, 2004. Visability in the upper portions of the well was very poor, limiting assessment of the upper casing. Below the uppermost perforations, visibility was good revealing the stainless steel wire-wrapped screen and intervening blank sections. Perforations were clean and in excellent condition. Surprisingly, no evidence of galvanically-driven encrustation or corrosion was visible at the joints between the stainless steel screen and mild steel blank. In order to create a complete record, a second video survey was performed on January 10, 2004. Clarity in the upper section was much improved, allowing observation of the upper casing. Casing appeared in good shape with minimal incrustation or corrosion and no evidence of holes or deformation.

Data from the video survey allows documentation of the "as-built" well[2]. Well is constructed of what appears to be 12 ¾ -inch diameter spiral weld mild steel casing. The blank casing is in very good condition. Perforated intervals are 12 ¾-inch diameter stainless steel wire-wrapped screen. No evidence of galvanic isolation couplings were visible. Perforations were visible in the intervals from 259 – 282 and 319.5 – 325 feet below ground surface. These screen placements are generally consistent with the depths reported on the drillers' logs. However, the upper screen, as reported and as placed, does not align well with the available water bearing materials. Fine sand is reported in the interval between 250 and 269 feet whereas the screen is set between 259 and 282 feet. Above and below the sand are clay materials. The lower screen aligns with the 6 feet of sand and gravel reported between 319.5 and 325.5 feet. Bottom of the well was encountered at 333.5 feet and compares well to the reported bottom of 334 feet suggesting minimal fill. An as-built schematic of the well is presented as Figure 2 – Well Schematic.

[2] Depths from video survey have been adjusted by -3 feet to correspond with the below ground surface depths reported in the drillers log

CONCLUSIONS

- Based on the performance test and the video survey, the Gloria Way well is in good structural and operating condition. Its current physical condition does not limit its use for a supply well for the proposed treatment facility.

- Performance testing reveals the well to have a 24-hour specific capacity of 2.6 gpm/ft at 300 gpm. No historical data are available to assess whether the current specific capacity represents a reduction from the performance when the well was new. However, the existing pump appears well matched with the current performance suggesting no degradation in performance. This conclusion is buttressed by the very clean condition of the well screen. Utilizing the specific capacity of 2.6 gpm/ft and assuming maintenance of regional static water level of approximately 15 feet the well might be capable of 450 gpm with a pumping level of 200 feet.

- However, water quality sampling for treatment facility design were taken at a discharge rate of 300 gpm. At a higher discharge rate the water quality may be different.

- At the time of the video survey static water level was approximately 13 feet below ground surface. Examination of available topographic maps allows estimation of ground surface elevation of 20 feet, resulting in a static water surface elevation of 7 feet msl. Pumping water levels will be substantially below sea level. If the well is to be utilized as a baseline source, operational water levels will be chronically below sea level. Some consideration of the potential for seawater intrusion from the Bay is recommended.

- Although not essential, prior to replacing the well pump, some limited well rehabilitation consisting of swabbing/air-lifting might be beneficial in maximizing well performance.

Sincerely,

Martin B. Feeney

Attachments:

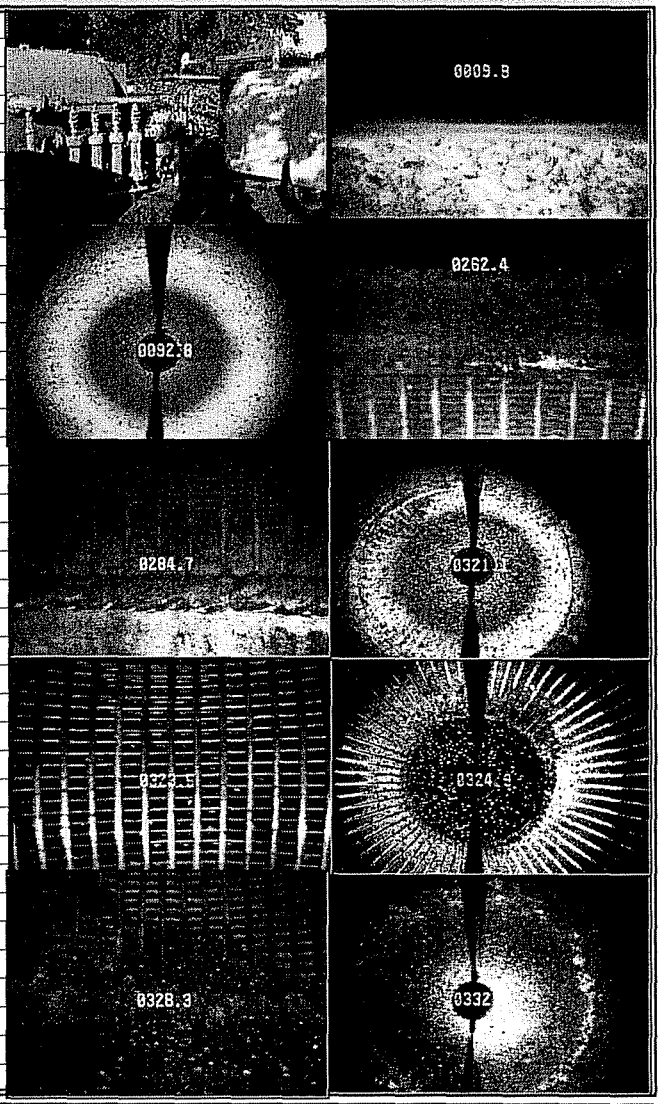
Video Survey Summary
Well Schematic
Well Log
Pump Removal Photographs

Newman Well Surveys

Video Survey Report

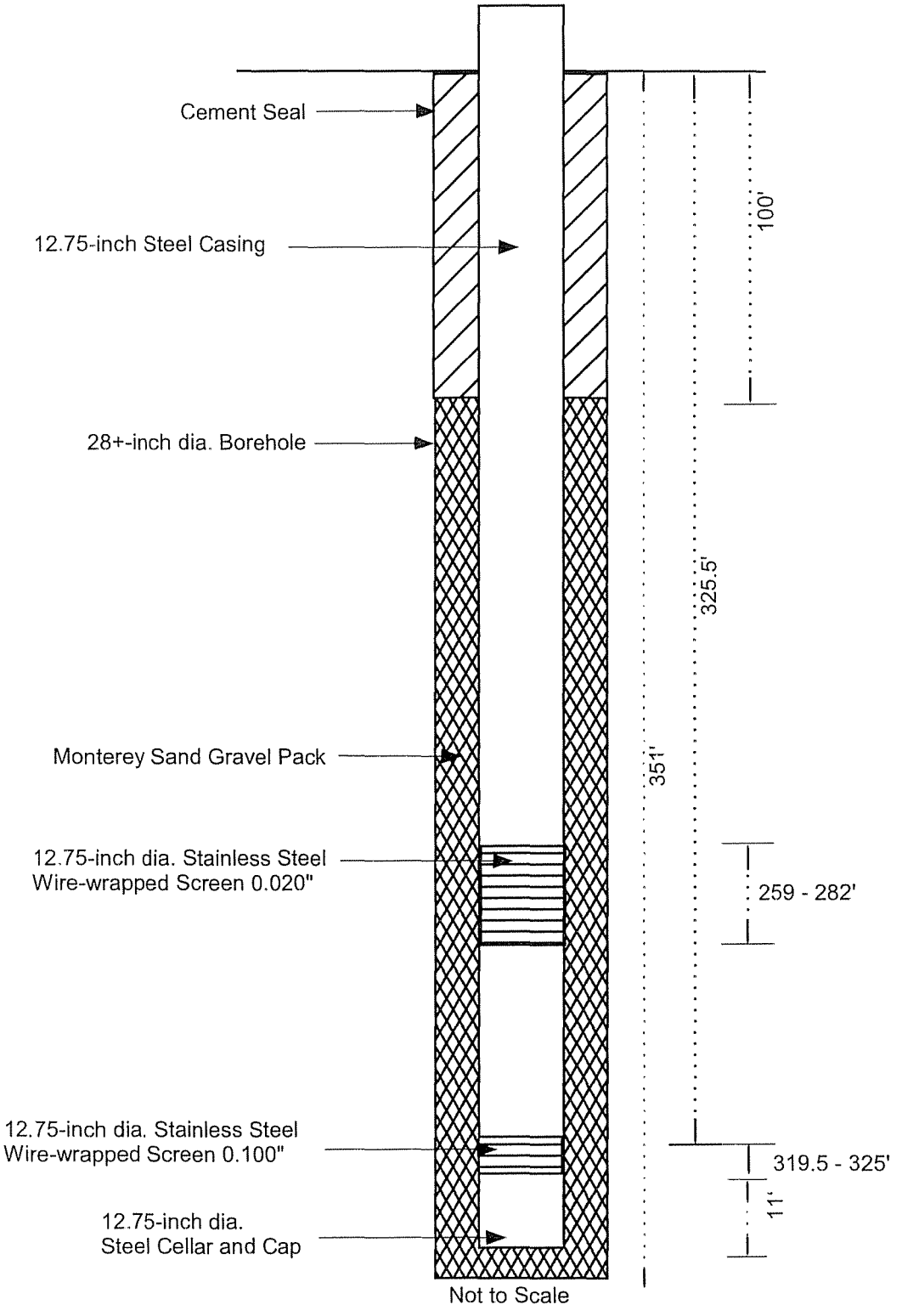
Company:	Martin Feeney	**Date:**	10-Jan-04
Well:	American Water, Gloria Way Well	**Run No.**	One
Field:	Palo Alto	**Job Ticket:**	69538
State:	California	**Total Depth:**	336.4 ft
		Water Level:	9.8 ft
Location:	NW C/O Gloria Way & Bay St.		
Zero Datum:	Top of pump pad	**Tool Zero:**	Side view lens (Add 1.5 ft. to downward view)
Reason for Survey:	General inspection		

Depth	Remarks
0.0 ft	12" Steel casing (spiral seam)
9.8 ft	Water level
262.0 ft	Well screen to 285 ft.
322.5 ft	Well screen to 328 ft.
336.4 ft	Bottom of well



Notes: Well appeared to be in good condition. No casing problems were seen.

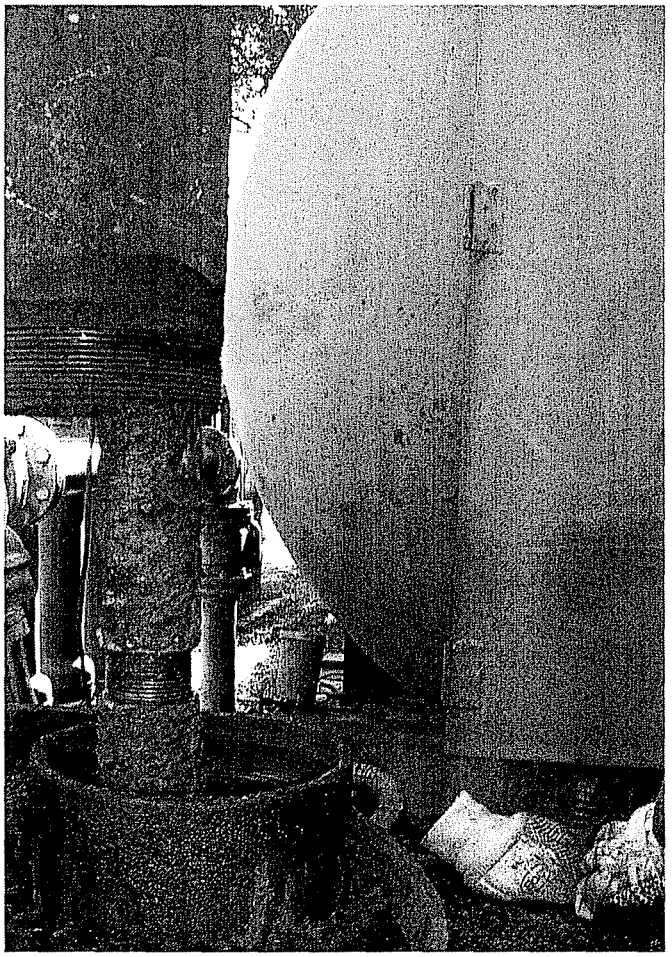
6080 sherry lee lane
salinas ca 93907
(831) 722-2388

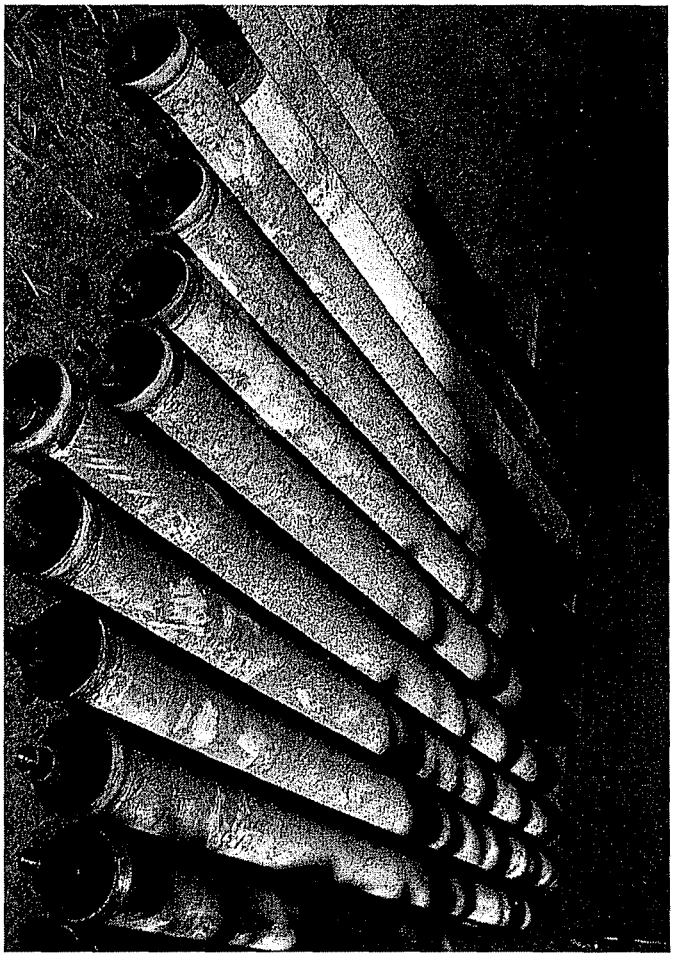


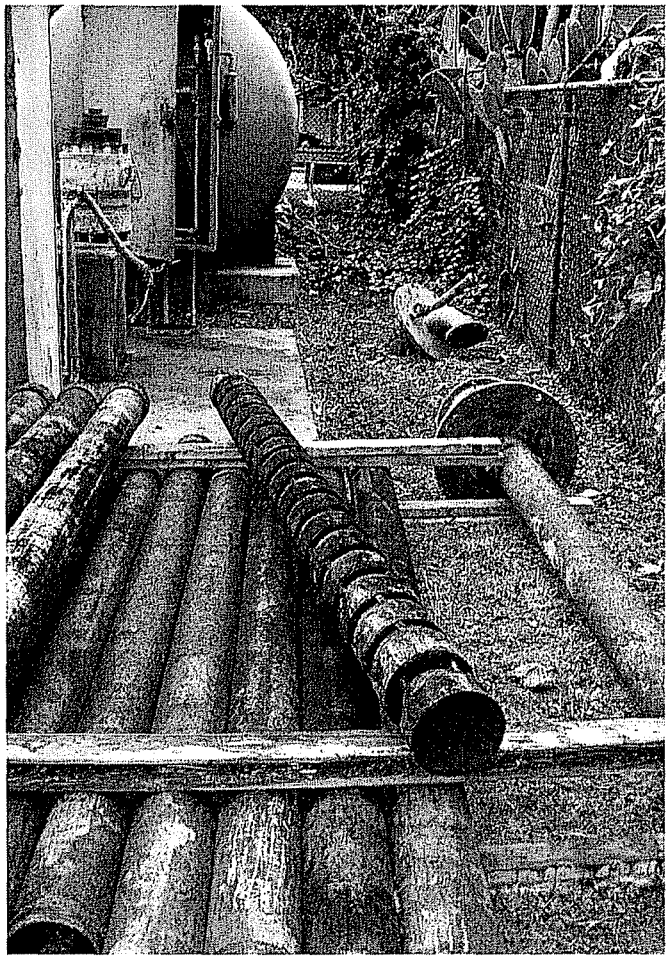
Construction details taken from Drillers Log as corrected by Video Survey

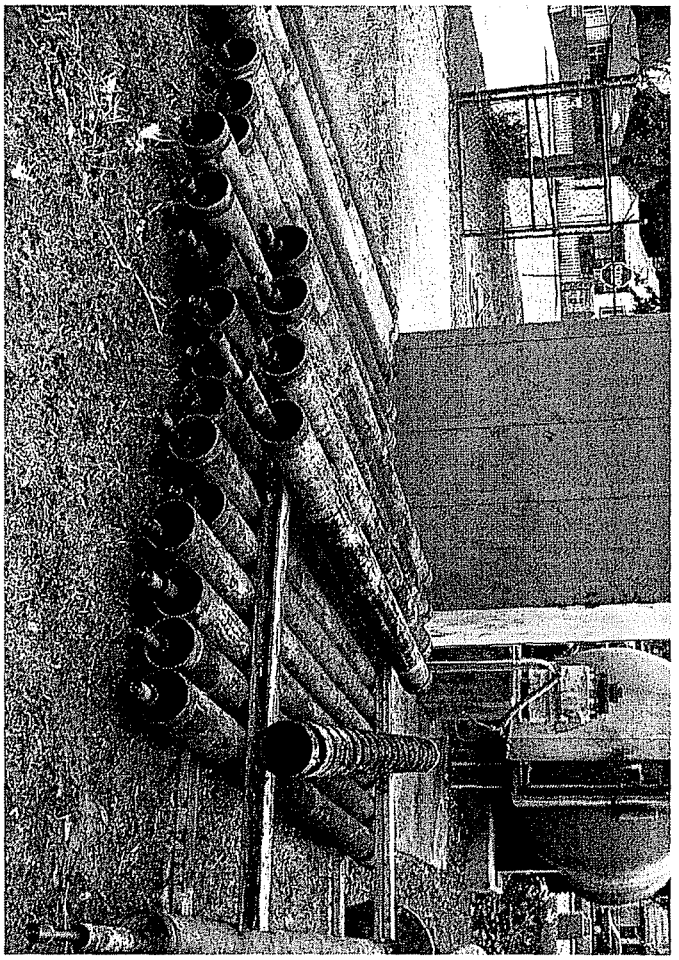
Figure 1 - Well Schematic "as-built" Gloria Way Well East Palo Alto

Insert Well Log Copy Here









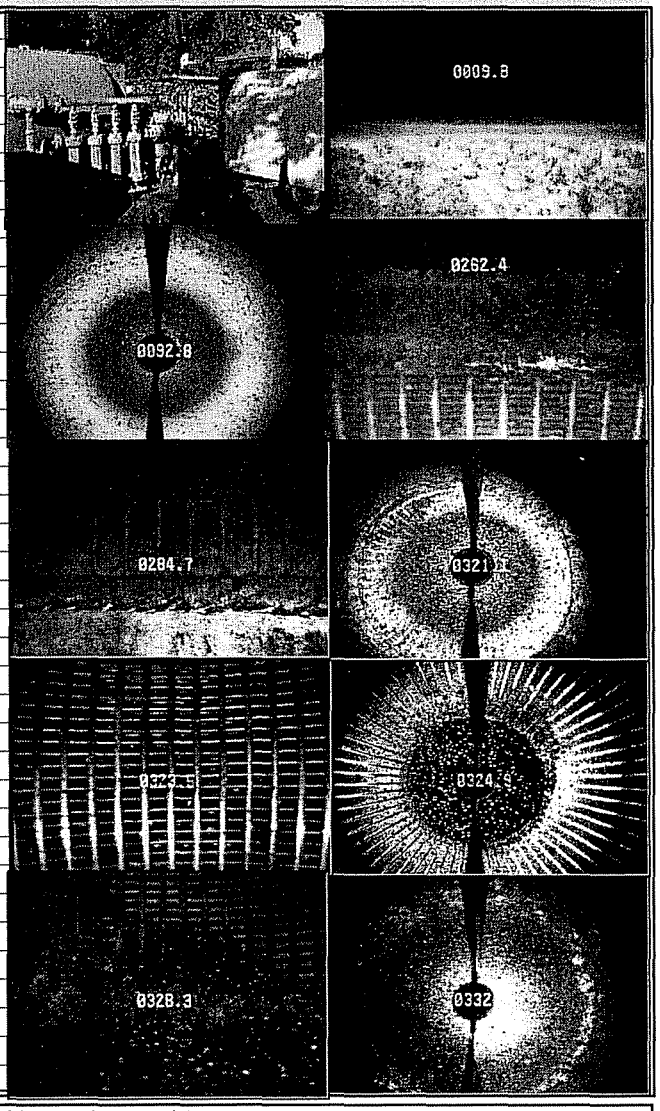
Appendix D. Video Survey Report.

Newman Well Surveys

Video Survey Report

Company:	Martin Feeney	**Date:**	10-Jan-04
Well:	American Water, Gloria Way Well	**Run No.**	One
Field:	Palo Alto	**Job Ticket:**	69538
State:	California	**Total Depth:**	336.4 ft
		Water Level:	9.8 ft
Location:	NW C/O Gloria Way & Bay St.		
Zero Datum:	Top of pump pad	**Tool Zero:**	Side view lens (Add 1.5 ft. to downward view)
Reason for Survey:	General inspection		

Depth	Remarks
0.0 ft	12" Steel casing (spiral seam)
9.8 ft	Water level
262.0 ft	Well screen to 285 ft.
322.5 ft	Well screen to 328 ft.
336.4 ft	Bottom of well



Notes: Well appeared to be in good condition. No casing problems were seen.

6080 sherry lee lane
salinas ca 93907
(831) 722-2388

Appendix E. Correspondence Regarding Water Quality Concerns.

FILE

STATE OF CALIFORNIA—HEALTH AND WELFARE AGE

EDMUND G. BROWN JR., Governor

DEPARTMENT OF HEALTH SERVICES
2151 BERKELEY WAY
BERKELEY, CA 94704 -9980

September 15, 1981

Mr. Edward Barnes
Senior Civil Engineer
County of San Mateo
Redwood City, CA 94063

Dear Ed:

EAST PALO ALTO COUNTY WATERWORKS DISTRICT

In reference to a water quality complaint registered by the Siri Brothers Nursery located at 940 O'Connor Street served by the subject system on August 19, 1981, I have enclosed some useful information in handling taste and odor complaints. Please report to this office corrective actions taken on this problem.

Yours Sincerely,

Catherine S. Ling, P.E.
Sanitary Engineer
Sanitary Engineering Section

CSL:gm

Enclosure

[illegible]
C. S. Ling

FILE NOTE July 22, 1981

E. PALO ALTO CWD WATER 41-024

The District's new well was inspected and approved on July 16, 1981. Ed Barnes indicated that they would put it in service next week.

The well is gravel-packed with adequate annular seal. All surface construction features were examined and are properly constructed. The air vent opens downward but was not covered. I told Ed Barnes to put #16 mesh screen on the vents. The sample bib is located downstream of the (after) the check valve and is inside a locked concrete structure. The well is equipped with 4 parallel sand separation units which then feed into a pressure tank (90-120 psi). Water enters distribution main also supplied by SFWD water. A check valve is installed on the well line to prevent backflow of SFWD water at high SFWD water pressure (100-150 psi).

Well water quality analysis results revealed high Fe and Mn. Since blending with SFWD water occurs in the distribution main, I have asked Ed to go ahead to put the well in line but closely monitor the Fe and Mn levels in the blended water. A 3-month demonstration study has been initiated to assess the performance and effectiveness of this blending process, necessary adjustments will be made based on the study results. All copies of quality analyses results will be forwarded to SES for review.

The District will also apply for Prop. 3 loan to put in a second well. The Prop. 3 loan financed Willow Road pipeline improvement project is now in the design stage. Some problem in sewer-main separation is anticipated. I have told Ed and George (City Engineer) to submit plans for comments.

Catherine S. Ling CSL July 20, 1981

CSL:gm

cc: R. E. McMillan
C. S. Ling

Stanford, CA
(Santa Clara C
Stanford Daily
(Cir. 5xW. 15,00

LING

OCT 14 1981

Allen's P. C. B Est. 1888

New well causes an odor in water

by Jonathan Greene

East Palo Alto's drinking water has often had a strong odor since a new well began operation in late July.

"The water is frequently so bad that I consider moving," said Joel Silberman, one of many Stanford students who live in the section of East Palo Alto west of the Bayshore Freeway.

According to Edward Barnes, senior civil engineer for the San Mateo County Department of Public Works, "Some elements in the well water combine with the chlorine in the San Francisco system water to produce an odor." He said he did not know what the substance was.

Until the installation of the new well at Bay and Gloria streets, the East Palo Alto Water District was supplied exclusively by San Francisco's Hetch-Hetchy aqueduct, as are Stanford, Palo Alto and other nearby communities. San Mateo County, which operates the district, decided to install the $200,000 well to replace some of the costly aqueduct water after San Francisco raised the rate to 43 cents per hundred cubic feet.

After tests demonstrated a violation of the state water standard for odor, Barnes was forced to "cut back use of the well to five hours a day, from 10 a.m. to 3 p.m. on weekdays only, when fewer residents are home." Complaints to his office have fallen off from "about seven or eight new ones per day to practically none."

Barnes said he wants to run the well as much as possible, both to detect any equipment problems before the well's warranty runs out and to save money for the district.

Meanwhile, Barnes suggested, residents who are dissatisfied with their water may install filters on their taps or use bottled water.

Barnes insisted the water is safe despite any odor. Art Burton, director of Sequoia Analytical Laboratory, which tests the water for the county, said "We've done all the state required tests, which are very extensive. The water meets all standards (except that) it has exceeded the state odor standard on occasion."

However, Burton admitted that "there are many possible contaminants not on the state list. Other tests to identify the source of the odor could be done and haven't been, such as a complete organic analysis. But they are very expensive — about $1000 a sample."

Catherine Ling, who is following the problem for the California Health Department, defended the state standards. "These criteria are used all over the country," she said. She said she was not aware of any additional tests that should be performed.

"It is not uncommon that this type of problem occurs," she said. "As far as we know, Barnes is doing the best he can to clear up the problem."

(Santa Clara Co.)
Peninsula Times Tribune
(Cir. D. 67,000)

LING
~~McMahon~~

OCT 5 - 1981

County doesn't know why water smells bad

39

By Phyllis Brown
Times Tribune staff

EAST PALO ALTO — The water in part of East Palo Alto smells and tastes bad, and a San Mateo County Public Works official said the department has not yet determined why.

Ed Barnes, a representative of the public works department, said last week that he believes the odor is caused by the mixing of water from a new well, sunk at the corner of Bay Road and Gloria Way, and water bought from the San Francisco Water Department.

The well, constructed at a cost of at least $200,000, began operation here in August.

Barnes said the well was sunk to save the department money. Up until August, all water was purchased from the San Francisco Water Department. Now, about a quarter of the area's water is supplied by the new well.

The savings will be used to pay off a $460,000 loan from the Department of Water Resources. The money is being used to make repairs in the East Palo Alto water system.

"Water from the earth is free," Barnes said. "We would like to make enough money on the well to pay off the state loan," Barnes said.

Barnes said the use of well water has not resulted in a rate decrease for the area's customers.

East Palo Alto resident Mike Siri said it was in August that he first noticed the smell, which he describes as that of iodine.

"From day one, when they started the well I noticed it," said Siri, who has a flower farm at 940 O'Connor St.

"There is definitely some kind of iodine smell," Siri said last Thursday.

Siri said the strength of the taste and odor varies, sometimes within a day.

The flavor was at its worst, though, when the well first started up, he said.

"What bothers me is that, seven or eight weeks ago, you would come in and want a drink of water, and it would make a knot in your stomach," Siri said.

Siri said he has talked with Barnes about the problem, but has not been satisfied with his explanation of it.

Siri said Barnes suggested he buy bottled water. "You will just have to learn to live with it," he quoted Barnes as saying.

While Barnes said he is certain that the mixture of the two waters is what causes the unpleasant taste, he said he does not know what chemicals are producing it.

"On the last tests we took eight days ago, there was no odor to the two waters combined," Barnes said. "As far as we know, we have no problem with the well water. Under normal circumstances, you get complaints," he said.

Barnes said, however, that all of the tests on the water have not yet come back from the laboratory.

Siri said his concerns led him to call the California Department of Health.

Catherine Ling, a Health Department representative, visited his farm.

She agreed that the well water is reacting with the water purchased from San Francisco. She also agreed that it smells and tastes badly.

While Barnes asserted that the chlorination from the San Francisco Water Department water might be reacting with the well water, Ling said she has her doubts.

"It is not really the chlorination that gives you the odor. It is more of the mineral content in the well water that gives you the odor," she said.

Ling said the water does meet the Health Department's "aesthetic" standards.

And it is definitely not harmful to drink, she said.

But, whatever the cause of the odor, the citizens of East Palo Alto should be provided a better product for their money, she said.

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY EDMUND G. BROWN JR., Governor

DEPARTMENT OF HEALTH SERVICES
2151 BERKELEY WAY
BERKELEY, CA 94704

(415) 540-2158

November 19, 1981

Mr. Ed Barnes
E. Palo Alto County Water District
County of San Mateo
590 Hamilton Street
Redwood City, CA 94303

Dear Ed:

Following are results of bacteriological analyses reported to us by the Division of Laboratories of this Department, on samples from E. Palo Alto County Water District. Date Collected 11-3-81 Collected By Catherine Ling.

Lab. No.		Source and Sample Point
1047	Volatile organics - None detected	Well site - Bay & Gloria (100% well water)
1048	Volatile organics - 72 µg/l ($CHCl_3$)	1593 Woodland (blended water SFWD & well)
1049	Fe - .06 mg/l *Mn - 0.15 mg/l	Well site - (100% well water)
1050	Fe - 0.04 mg/l Mn - <0.01 mg/l	1593 Woodland (Blended water)
1051	Odor - 1 unit	Well site (100% well water)
1052	Odor - 1.4 units	1593 Woodland (Blended water)

Analyses results with * indicate they did not meet California Secondary Drinking Water Standards during the time and on the day of sampling.

Sanitary Engineering Branch

By Catherine S. Ling, P.E.
Sanitary Engineer

cc: San Mateo County Health Department

High Fe and Mn contents in the water can be a possible cause of offensive taste and odor and therefore they should be monitored closely.

2. Odor Monitoring

Analysis reports dated on 8/21 and 9/21 indicated excessively high levels of odor in the water supplied by your system. This problem is also strongly supported by the increased frequency of taste and odor complaints registered by users of your system since the start of the well supply. Taste and odor are not generally hazardous to health, however, it is the water supplier's responsibility to provide pure, wholesome and pure water meeting both primary and secondary drinking water quality standards at all times. Users complaints are generally indicative of a quality problem which should be handled with due care and diligence in an effort to totally eliminate it. We are in full support of the several mitigative measures you have taken including system flushing, reduced well pumping, additional sampling and investigation of treatment alternatives. These efforts should be continued until a viable solution is sought. In order to more extensively assess the extent of this problem, we strongly recommend the following sampling plan to be performed daily continuously for a minimum of 7-day period:

Type of Analysis	Sampling Location	Time of Sampling
Odor	Well site (well water only)	Open
Odor	User's tap (SFWD water only)	Before well pumping
Odor	User's tap (blended water)	After well pumping

Additionally, taste and odor are general by-products of oxidative reactions of Fe, Mn, and other volatile organic compounds. During this 7-day period of odor monitoring, Fe, Mn and volatile organics contents of the well water should also be analyzed. Knowledge of the chemical quality of a water supply source is important in order to determine the type of treatment: aeration, activated carbon, or chlorination required to render the water acceptable for domestic use.

We strongly recommend that the above action plan be executed expeditiously and all findings and results of subsequent quality analyses be submitted to this Department for evaluation. Your cooperation will be greatly appreciated.

Sincerely yours,

CSL:jhb
cc: San Mateo CHD
bcc: R. E. McMillan

Catherine S. Ling, P.E.
Sanitary Engineer
Sanitary Engineering Section

FILE COPY

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STATE OF CALIFORNIA—HEALTH AND WELFARE AC .CY

EDMUND G. BROWN JR., Governor

DEPARTMENT OF HEALTH SERVICES
2151 BERKELEY WAY
BERKELEY, CA 94704

(415) 540-2158

November 19, 1981

Mr. Steve Aldridge
798 Green Street
East Palo Alto, CA 94303

Dear Steve:

E. PALO ALTO COUNTY WATER DISTRICT

Knowing of your interest and concerns on the quality of water supply in your area, I have enclosed for your information a copy of results of the most recent analyses performed on water samples collected in the distribution system of East Palo Alto County Water District.

Please note that the only non-compliance of drinking water standards was on manganese (Mn) in the well water (maximum contaminant level is 0.05 mg/l) as shown on the report. The water delivered to the users, however, was found to adequately meet the required standards.

We believe, however, it is the oxidative reactions between manganese and/or iron in the well water, and chlorine in San Francisco Water Department's water, that produce the odor problem in the blended water. Additional water testing and investigation on various treatment alternatives are still ongoing. We have also advised the District to take necessary actions to insure that safe and good quality water is provided for the public.

Your cooperation in providing assistance to resolve the taste and odor problem in the water supply is very much appreciated. Please feel free to contact us again if we can be of further assistance.

Sincerely yours,

Catherine S. Ling, P.E.
Sanitary Engineer
Sanitary Engineering Branch

Encl.
bcc: R. E. McMillan
C. S. Ling
CSL:jhb

STATE OF CALIFORNIA—HEALTH AND WELFARE AG ICY EDMUND G. BROWN JR., Governor

DEPARTMENT OF HEALTH SERVICES
2151 BERKELEY WAY
BERKELEY, CA 94704

(415) 540-2147

October 28, 1981

Mr. Ed Barnes
Senior Civil Engineer
County Government Center
590 Hamilton Street
Redwood City, CA 94063

Dear Ed:

Following are results of water quality analyses reported to us by the Division of Laboratories of this Department, on samples from E. Palo Alto CWD. Date Collected 8-20-81 Collected By Catherine S. Ling .

Lab. No.	Analysis Result	Source and Sample Point
0568	Odor - 3 units	Siri Brothers Nursery
0569	Odor - 1 unit	Gloria/Bay Well Site
0570	Fe <.05 mg/l Mn <.03 mg/l TDS - 225 mg/l *Spec. Cond. - 3370 μmhos/cm	Siri Brothers Nursery
0571	Fe <.05 mg/l *Mn <.07 mg/l TDS - 584 mg/l Spec. Cond. - 970 μmhos/cm	Gloria/Bay Well Site

Analysis results with * indicated that the water did not meet the California Secondary Drinking Water Standards at the time and on the day of sampling.

Additionally, reports of Fe, Mn and general physical analyses performed by your District from July 28 through October 20 have been reviewed by this Department. We have the following recommendations:

1. Iron and Manganese Monitoring of Well Water

   The three-month period Fe/Mn monitoring program established on July 15, 1981 should be continued. Reports submitted to this Department indicate that you have stopped sampling after the first month (August). Both well source and the blended water should be sampled to determine compliance with standards.

FILE NOTE October 23, 1981

E. PALO ALTO CWD WATER 41-024

I called Ed Barnes on 10/23/81 regarding the taste and odor problem associated with the District's new well. He said that recent lab analyses of the well water had been meeting standards. He also reported that chlorination, one of the treatment methods under investigation, did not eliminate the taste and odor. Activated carbon adsorption is now being evaluated as an alternate treatment.

He also indicated additional sampling had been performed on the well, however, the lab results had not been sent to him yet.

I again asked him to send lab reports to SES as soon as possible since up to present time, we have not received any follow-up reports relating to this problem. The monthly Fe and Mn sampling plan, set up in July to monitor the levels of Fe and Mn in the well water, has been carried out according to Ed. I told him to submit these reports to SES immediately.

C. S. Ling
CSL:jhb
cc: R. E. McMillan
C. S. Ling

415/697-4424

P.O. BOX 367

5

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION

SAN FRANCISCO WATER DEPARTMENT
WATER QUALITY DIVISION

MILLBRAE, CALIF. 94030

SUBJECT:-

September 28, 1981

Mrs. Kathy Ling
State Dept. of Health Services
2151 Berkeley Way
Berkeley, CA 94704

Rec'd 10/11/81 CSL

Dear Mrs. Ling,

On August 18 this Department received a complaint of bad tasting water from Siri Bros. Nursery, 940 O'Connor Street, East Palo Alto. They stated they had been experiencing this since Tuesday, August 11, 1981 and it had a medicinal taste. A Water Department Inspector investigated this complaint and I believe met with you at the nursery. The background of the operation of our system is as follows:

On Tuesday, August 11, 1981 our System increased Hetch Hetchy flow from 230 MGD to 300 MGD and reduced Sunol Filter Plant from 100+ MGD to 10-15 MGD. At about the same time San Mateo County Public Works placed on line in East Palo Alto an unchlorinated well. The well supply is providing approximately 25% of the water to the East Palo Alto service area and is mixing with our Hetch Hetchy supply. The well is operating between the hours of approximately 8:00 am-4 pm.

Approximately one week after the well was placed in service this Division received a call of bad tasting water from the Siri Nursery - Tuesday, August 18.

On Wednesday afternoon August 19 a sample was drawn from the nursery. At that time there was a strong medicinal taste and odor, chlorine residual was 0.30-0.40 mg/l and temperature was approximately 65°F. Analysis attached which indicates a definite influence of well water.

A discussion was held with Ed Barnes of San Mateo County Engineering Department but no decision was made at that time. He stated this was the only complaint, although the people at the nursery stated four or five area residents were complaining. San Francisco Water Department meter was checked and water was sampled at this point, from the SFWD transmission main; there was no taste or odor, chlorine residual was 1.1 mg/l, temperature 57°F.

Mrs. Kathy Ling September 28, 1981

On Friday, August 21, 1981 approximately 10:15 am the water was resampled at the nursery. No taste or odor was present; chlorine was 0.25 mg/l; temperature 59°F. Analysis indicated 100% Hetch Hetchy water. Sample taken at the well supply indicated the temperature was 71°F and had no taste or odor. Sample taken at Hetch Hetchy service indicated no taste or odor; chlorine residual 1.00 mg/l; temperature 56°F. Analysis checked at all locations.

From the above all indications are that the medicinal taste must be occurring from the mixing of the chlorinated Hetch Hetchy water with unchlorinated well water. In view of this there is nothing the San Francisco Water Department can do about the situation.

The analysis of the water samples collected is attached.

Very truly yours,

Harry W. Tracy
Manager

HWT:pd
Enc.
cc: Siri Bros. Nursery
Ed Barnes

SAN FRANCISCO WATER DEPARTMENT

WATER QUALITY DIVISION
P.O. BOX 367
MILLBRAE, CA 94030

Date report made by phone _____

by letter _____

Siri Bro's Nursery
940 O'Connor
East Palo Alto, Ca. 94303

The following analytical report is on water samples recently received from you.

Sampling Point	Siri Nursery	Well	H.H Meter	
Date Sampled	8/21/81	8/21/81	8/21/81	
pH	9.5	8.1	9.5	
Alkalinity (mg/l)	16	228	16	
Chloride (mg/l)	3	146	3	
Hardness (mg/l)	18	120	18	
Turbidity (NTU)	0.25	0.75	0.45	
Conductivity (μmhos)	50	958	49	
Copper (mg/l)				
Iron (mg/l)				
Fluoride (mg/l)				
Chlorine (mg/l)				
MPN	<2.2	<2.2	<2.2	
Membrane Filter				
odor (T.O.N.)	1	1	1	

1 T.O.N = No odor observed

Manager of Water Quality

SAN FRANCISCO WATER DEPARTMENT

WATER QUALITY DIVISION
P.O. BOX 367
MILLBRAE, CA 94030

Date report made by phone _____

by letter _____

Siri Nursery
940 O'Connor Street
E. Palo Alto, Ca. 94303

The following analytical report is on water samples recently received from you.

Sampling Point	Siri Nursery			
Date Sampled	8/19/81			
pH	8.6			
Alkalinity (mg/l)	110			
Chloride (mg/l)	65			
Hardness (mg/l)	66			
Turbidity (NTU)	1.0			
Conductivity (µmhos)	408			
Copper (mg/l)				
Iron (mg/l)				
Fluoride (mg/l)				
Chlorine (mg/l)				
MPN				
Membrane Filter				
Odor Threshold odor no. @24°C	2			

Manager of Water Quality

FILE NOTE October 2, 1981

E. PALO ALTO CWD WATER 41-024

Ed Barnes called on 9/17/81 regarding the taste and odor problem caused by blending the District's new well water with SFWD's. He indicated that reduced pumping of the well had only slightly reduced the number of user's complaints. I told him to investigate treatment alternatives for this problem. He said that he would run some chlorination tests on the blended water.

During the interim period, i.e., before any corrective method has been identified, they will run the well on a minimum basis - 4 hrs. on weekdays during industrial peak demand period. Ed indicated that they would voluntarily shut down the well if the problem becomes "unbearable", but they'd prefer to keep it operating as much as possible in order to trouble-shoot any existing operational/mechanical problems with the well before its one-year warranty expires.

Catherine S. Ling CSL September 30, 1981

CSL:gm

cc: C. S. Ling

FILE NOTE

October 2, 1981

E. PALO ALTO CWD

WATER 41-024

Ed Barnes called on 10/1/81 to report progress made in the taste and odor problem generated by blending the district's new well water with SFWD water. Last week's sample was tested to be 3 odor units (blended water; 1 unit for SFWD H_2O, 2 units for well water), as compared to the previously reported 32 units. He indicated that the reduced pumping of the well has lessened the T and O problem, lesser complaints were received last week. I asked him about the results of the Cl_2 tests on the water samples, he said he had not received the lab reports yet.

It was also learned that they have been taking the routine weekly general physical samples throughout the distribution system. I advised him to sample the problem area more frequently (recommended daily) to assess the degree of odor problem, with understanding that SFWD changes their supply sources from time to time, the end product of blended water also varies in quality. The one set of samples collected last week is not representative of the total dynamic system. I told him to continue monitoring the water daily and run chlorination tests on them accordingly. He concurred that he'd start doing it every other day.

Phillis Brown, reporter of the Palo Alto News, called to inquire about this problem. I told her that corrective measures are being investigated and that results of subsequent water analyses have indicated compliance with drinking 1° and 2° standards, and that the water district has taken positive actions to eliminate the problem, users should be patient and work with water district cooperatively to resolve any differences.

Catherine S. Ling CSL

October 1, 1981

CSL:gm

cc: R. E. McMillan
C. S. Ling

FILE

STATE OF CALIFORNIA—HEALTH AND WELFARE AGE

EDMUND G. BROWN JR., Governor

DEPARTMENT OF HEALTH SERVICES
2151 BERKELEY WAY
BERKELEY, CA 94704 -9980

September 15, 1981

Mr. Edward Barnes
Senior Civil Engineer
County of San Mateo
Redwood City, CA 94063

Dear Ed:

EAST PALO ALTO COUNTY WATERWORKS DISTRICT

In reference to a water quality complaint registered by the Siri Brothers Nursery located at 940 O'Connor Street served by the subject system on August 19, 1981, I have enclosed some useful information in handling taste and odor complaints. Please report to this office corrective actions taken on this problem.

Yours Sincerely,

Catherine S. Ling, P.E.
Sanitary Engineer
Sanitary Engineering Section

CSL:gm

Enclosure

[illegible]
C. S. Ling

FILE NOTE July 22, 1981

E. PALO ALTO CWD WATER 41-024

The District's new well was inspected and approved on July 16, 1981. Ed Barnes indicated that they would put it in service next week.

The well is gravel-packed with adequate annular seal. All surface construction features were examined and are properly constructed. The air vent opens downward but was not covered. I told Ed Barnes to put #16 mesh screen on the vents. The sample bib is located downstream of the (after) the check valve and is inside a locked concrete structure. The well is equipped with 4 parallel sand separation units which then feed into a pressure tank (90-120 psi). Water enters distribution main also supplied by SFWD water. A check valve is installed on the well line to prevent backflow of SFWD water at high SFWD water pressure (100-150 psi).

Well water quality analysis results revealed high Fe and Mn. Since blending with SFWD water occurs in the distribution main, I have asked Ed to go ahead to put the well in line but closely monitor the Fe and Mn levels in the blended water. A 3-month demonstration study has been initiated to assess the performance and effectiveness of this blending process, necessary adjustments will be made based on the study results. All copies of quality analyses results will be forwarded to SES for review.

The District will also apply for Prop. 3 loan to put in a second well. The Prop. 3 loan financed Willow Road pipeline improvement project is now in the design stage. Some problem in sewer-main separation is anticipated. I have told Ed and George (City Engineer) to submit plans for comments.

Catherine S. Ling CSL July 20, 1981

CSL:gm

cc: R. E. McMillan
C. S. Ling

STATE OF CALIFORNIA - HEALTH AND HUMAN SERVICES AGENCY GRAY DAVIS, *Governor*

DEPARTMENT OF HEALTH SERVICES
2151 BERKELEY WAY
BERKELEY, CA 94704-1011

July 22, 1999

Mr. Neil R. Cullen
Director of Public Works
County of San Mateo
10 Twin Dolphin Dr., Suite C-200
Redwood City, CA 94065-1065

East Palo Alto County Waterworks District -- System No. 4110024
Domestic Water Supply Permit Application

Dear Mr. Cullen:

The permit amendment application submitted by East Palo Alto County Waterworks District, dated July 1, 1999, to remove a well from the domestic water supply is considered complete and hereby accepted for filing. A domestic water supply permit amendment will be issued by the Department of Health Services within 90 days of this letter.

Thank you for your assistance and cooperation in this matter. Should you have any questions, please contact Ms. Mona Lee at (510) 540-2153.

Sincerely,

Clifford L. Bowen, P.E.
District Engineer
San Francisco District
Drinking Water Field Operations Branch

cc: San Mateo County Environmental Health Department

bcc: Permit file, Chron. file, M. Lee

CLB:MCL
4110024/990721.ltr

PARTMENT OF HEALTH SERVICES
BERKELEY WAY
KELEY, CA 94704-1011

July 27, 1999

Mr. Neil R. Cullen
Director of Public Works
County of San Mateo
10 Twin Dolphin Drive, Suite C-200
Redwood City, CA 94065-1065

East Palo Alto County Waterworks District – System No. 4110024
Permit Amendment

Dear Mr. Cullen:

The Department of Health Services (Department) has considered the application by East Palo Alto County Waterworks District for a domestic water supply permit amendment. The application, dated July 1, 1999, was made in accordance with Sections 116525 and 116550 of the *California Health and Safety Code*, and filed by the Department on July 22, 1999.

It is the Finding of the State Department of Health Services that Sections 116275 through 116750, inclusive, of the *California Health and Safety Code* can be met by East Palo Alto County Waterworks District. This finding is based on the enclosed Engineering Report, dated July 1999, prepared by the Drinking Water Field Operations Branch. The domestic water supply permit granted to East Palo Alto County Waterworks District on March 28, 1979 is hereby amended to operate the existing water system with the well source disconnected from the domestic water supply subject to the following provisions:

1. East Palo Alto County Waterworks District shall serve water only from approved sources of supply. Currently, the only approved source of supply is the water purchased from the San Francisco Water Department, an agency of the San Francisco Public Utilities Commission. East Palo Alto County Waterworks District shall submit for the Department's review and approval a permit application prior to the construction, connection, or use of any new water source.

2. East Palo Alto County Waterworks District shall submit a permit application when a change in ownership occurs.