APPENDIX D – GROUNDWATER CONDITIONS BENEATH THE CITY OF GILROY

KENNETH D. SCHMIDT AND ASSOCIATES
GROUNDWATER QUALITY CONSULTANTS
600 WEST SHAW, SUITE 250
FRESNO, CALIFORNIA 93704
TELEPHONE (559) 224-4412

April 14, 2003

Mr. Tony Akel
Carollo Engineers
7580 N. Ingram Ave.
Fresno, CA 93711

Re: City of Gilroy
Groundwater Conditions

Dear Tony:

Submitted herewith is our report on groundwater conditions beneath the City of Gilroy.

Sincerely yours,

Kenneth D. Schmidt
Geologist No. 1578
Certified Hydrologist
No. 176

KDS:ld

REGISTERED GEOLOGIST
KENNETH D. SCHMIDT
NO. 1578
STATE OF CALIFORNIA

REGISTERED GEOLOGIST
KENNETH D. SCHMIDT
NO. 176
CERTIFIED
HYDROGEOLOGIST
STATE OF CALIFORNIA

GROUNDWATER CONDITIONS
BENEATH THE CITY OF GILROY

prepared for
Carollo Engineers
Fresno, California

by
Kenneth D. Schmidt and Associates
Ground Water Quality Consultants
Fresno, California

March 2003

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GROUNDWATER CONDITIONS BENEATH THE CITY OF GILROY

INTRODUCTION

This report provides information on groundwater conditions beneath the City of Gilroy. The study area is approximately bounded on the north by the intersection of Highway 101 and Los Animas Avenue, on the west by Santa Teresa Boulevard, on the south by Southside Drive, and on the east by Camino Arroyo. The California Department of Water Resources (1981) discussed regional groundwater conditions in south Santa Clara County, which included Gilroy. The City is located in the Llagas sub-basin of the south Santa Clara Valley. The City is located between Uvas Creek and Llagas Creek, which flow through the area to the south. This evaluation focuses on City wells. Well construction data are first discussed. This is followed by a discussion of subsurface geologic conditions beneath the city. Water levels are then discussed, followed by well production and aquifer characteristics. Lastly, groundwater quality is discussed.

CITY WELL DATA

Table 1 summarizes construction data for active City wells. The locations of these wells are shown in Figure 1. Depths of the eight active wells range from 302 to 920 feet deep. In general,

TABLE 1 - CONSTRUCTION DATA FOR ACTIVE CITY SUPPLY WELLS

Well No.	Date	Depth Drilled (feet)	Casing Diameter (inches)	Depth Cased (feet)	Perforated Interval (feet)	Annular Seal (feet)
1	11/32	701	16	700	65-690	-
2	11/47	407	14	470	180-460	-
4	5/60	302	14	302	120-300	0-72
5-02	6/98	880	16	860	390-840	0-370
6	7/79	715	16	530	200-510	0-190
7	5/77	515	-	410	130-400	0-50
8	9/87	500	16	470	240-460	0-215
8A	8/87	920	16	800	530-790	0-505

Note: The perforated interval is from the top to the bottom of the perforations, which are not continuous.

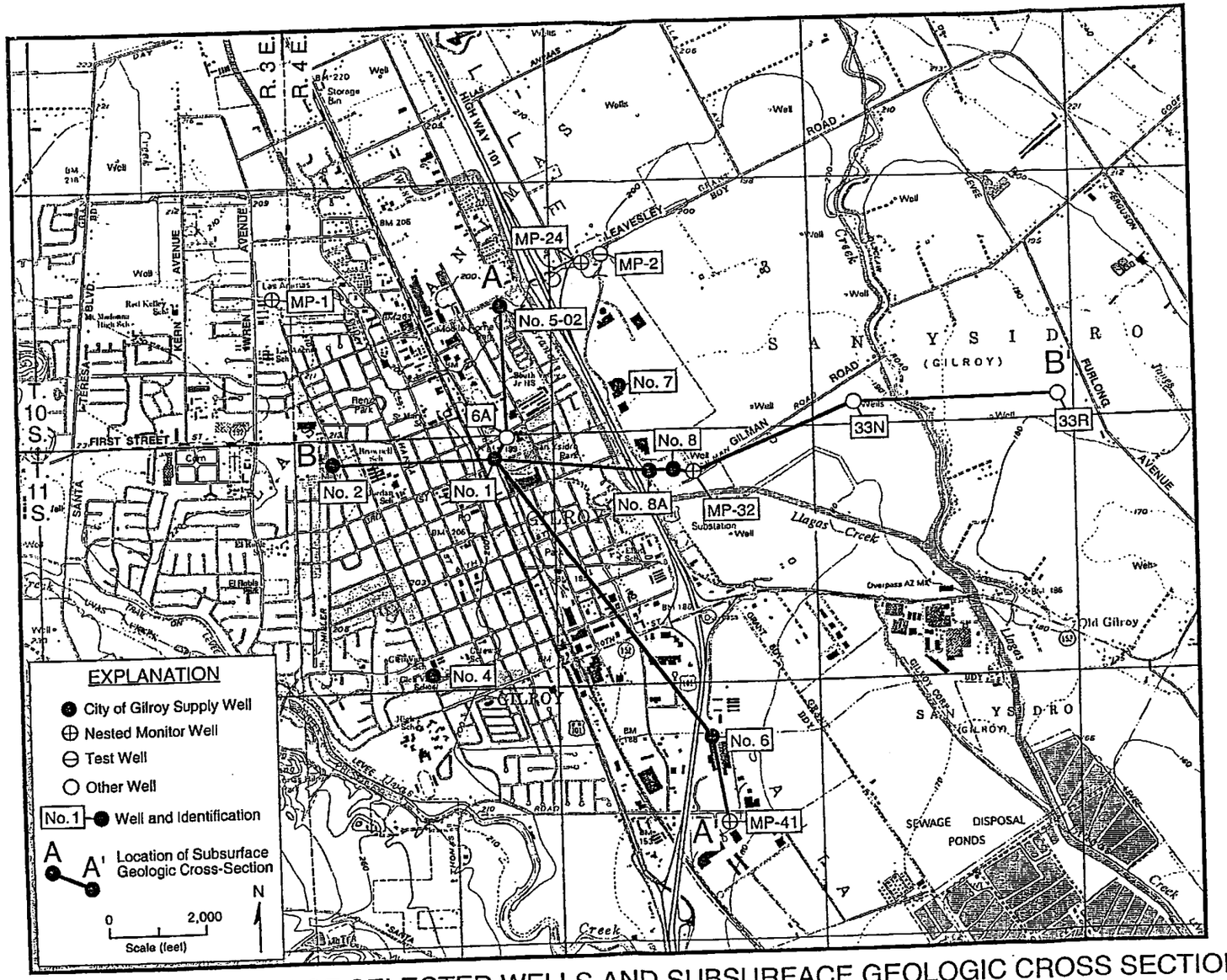

FIGURE 1 - LOCATION OF SELECTED WELLS AND SUBSURFACE GEOLOGIC CROSS SECTIONS

the older wells have shallower perforations. Wells drilled after 1978 have deeper annular seals than the earlier wells, extending from a depth of 190 feet to as deep as 505 feet. City Wells No. 5-02 and 8A tap strata only below a depth of 390 feet, and thus tap the deepest strata of the City wells. In addition to the supply wells, there are four nested monitor well sites in the City. Depth of the holes for these wells were from 460 to 1,200 feet.

SUBSURFACE GEOLOGIC CONDITIONS

The California Department of Water Resources (1981) extensively discussed subsurface geologic conditions beneath the Gilroy vicinity. They presented two generalized subsurface geologic cross sections extending through Gilroy. The Franciscan Formation generally comprises the bedrock or hardrock in the area. Consolidated silt, clay, and sand of the Santa Clara Formation underlie the valley fill or unconsolidated deposits. Alluvial deposits comprise the aquifer beneath the City. Lacustrine deposits (primarily clay) are found at depth, particularly in the south part of the Gilroy area. These were deposited in the ancestral Lake San Benito.

The California Department of Water Resources (1981) presented a map showing the elevation of the base of the water-bearing alluvial deposits in west part of the Gilroy area. Elevations

beneath the west part of the City ranged from about 200 feet above sea level to the west, to move than 200 feet below sea level to the east. At the time the map was prepared, there were no wells deep enough to reach the base of alluvium in the area east of Monterey Street. Information from City of Gilroy wells that were drilled after 1986 indicates that alluvial deposits extend to a depth of at least 900 feet beneath part of the City. These deposits thus thicken to the east beneath the City.

Figure 1 shows the location of two subsurface geologic cross sections that were developed as part of this evaluation. Cross section A-A' (Figure 2) extends from the north at City Well No. 5-02 to the south-southeast through City Wells No. 1 and 6, to nested monitor well MP-41. Coarse-grained deposits (sand or gravel), fine-grained deposits (clay), and intermediate textured deposits are shown. Several distinctive blue clay layers have been identified. One of these is near sea level along the south part of the section (City Well No. 6 and MP No. 41). This clay is about 40 to 50 feet thick, and appears to be associated with Lake San Benito. Two additional deeper clay layers are shown along the south edge of the section, between 100 and 200 feet below sea level. Several blue clay layers mixed with gravel were found at City Wells farther north. Deposits along Section A-A' are generally coarser to the north. Several stream channel deposits are present at city well

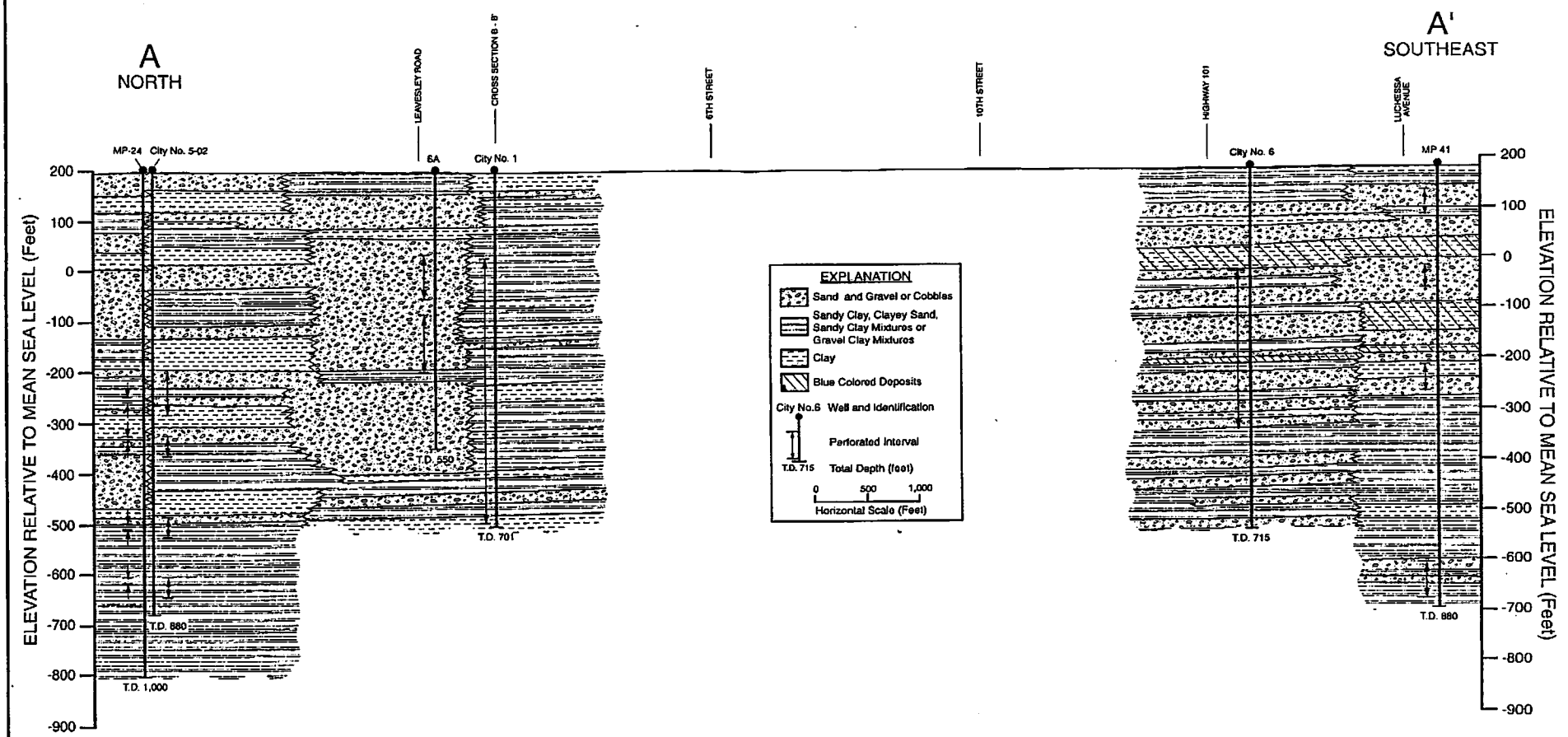

FIGURE 2 - SUBSURFACE GEOLOGIC CROSS SECTION A - A'

No. 5-02. Deposits below a depth of about 700 feet are indicated to be primarily fine grained along the north part of the section. Near the south edge of the section, deposits below a depth of about 450 feet are predominately fine-grained.

Cross Section B-B′ (Figure 3) extends from the west at City Well No. 2, then east through City Wells 1, 8A, 8 and several other wells east of the city. City Well No.2 apparently encountered the top of the Franciscan Formation at a depth of about 470 feet. Deeper City wells further to the east did not encounter the bedrock. A thick coarse-grained sequence is present above a depth of about 450 feet along the central and eastern parts of this section. These coarse-grained deposits appear to be related to the ancestral Llagas Creek. Fine-grained deposits are predominant below a depth of about 750 feet along this section. Deposits of an intermediate texture are predominant at City Well No. 1, and water-producing zones are relatively thin and deep.

WATER LEVELS

Semi-annual water-level measurements are available for the Gilroy Area since 1969. The California Department of Water Resources (1981) provided water-level maps for Fall 1914 and Fall 1974. Both maps indicated a south-southeasterly direction of groundwater flow beneath Gilroy. Groundwater flowed from northwest

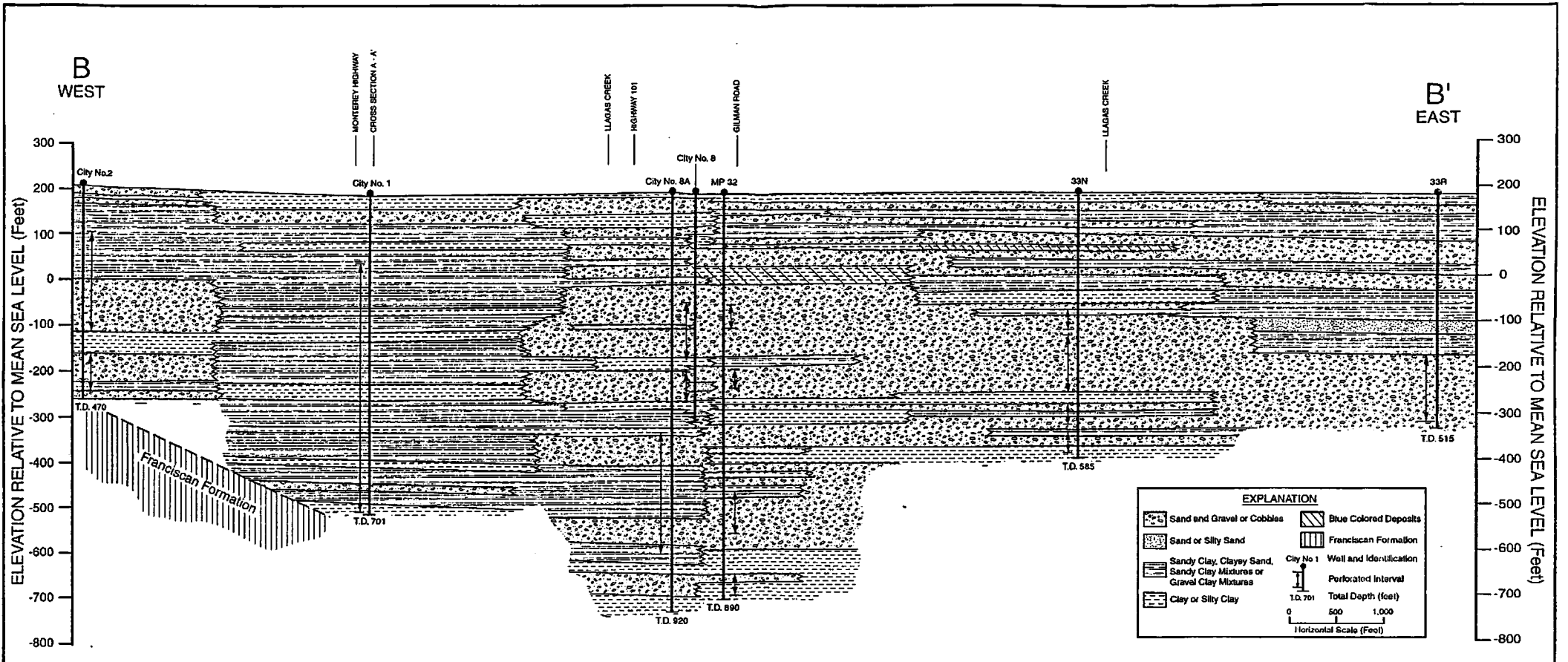

FIGURE 3 - SUBSURFACE GEOLOGIC CROSS SECTION B - B'

of Gilroy into the City, and from near the mountain fronts toward the central part of the Llagas sub-basin. Water levels in the Gilroy area were about 30 feet deeper in 1974 compared to 1914. Groundwater tapped by most wells in the Llagas sub-basin is generally present under unconfined conditions. However, groundwater in some of the deeper strata (below a depth of about 500 feet) is indicated to be confined. South of Gilroy, extensive lacustrine deposits are present, and groundwater at most depths is generally confined. There were a number of flowing wells in 1914 south of Old Gilroy, prior to the on-set of large scale pumpage. The Santa Clara Valley Water District (2002) presented a water-level elevation map for Spring 2001. This map indicates a southeasterly direction of groundwater flow.

Water-level decline in the Llagas sub-basin have been offset in recent decades by recharge in percolation basin along Llagas and Uvas Creeks. One such site is located southwest of Gilroy along Uvas Creek. Figure 4 is a water-level hydrograph for the SCVWD index well in the Llagas sub-basin (T10S/R3E-13D3). Water-level measurements for this well indicate no long term overdraft between 1969 and 2001. Water-levels have risen and fallen, and fluctuations are generally related to climatic periods. The deepest water levels were during the 1976-77 and 1987-93 drought periods.

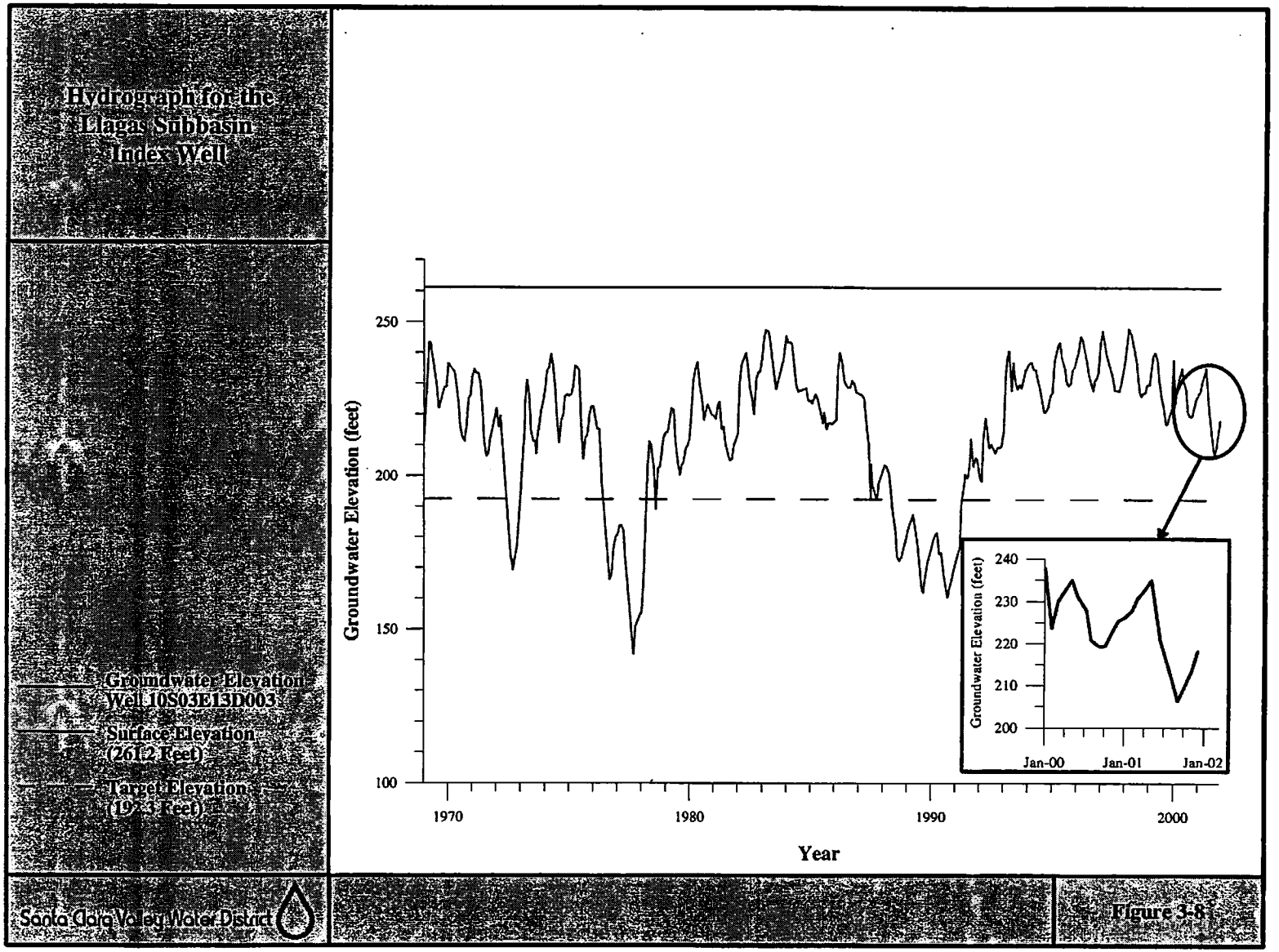
Hydrograph for the
Llagas Subbasin
Index Well
Groundwater Elevation
Well 10S03E13D003
Surface Elevation
(261.2 Feet)
Target Elevation
(192.3 Feet)
Groundwater Elevation (feet)
250
200
150
100
1970
1980
1990
2000
Year
240
230
220
210
200
Jan-00
Jan-01
Jan-02
Santa Clara Valley Water District
Figure 3-8

FIGURE 4

TABLE 2 - PUMP TEST RESULTS FOR
CITY OF GILROY WELLS

Well No.	Date	Pumping Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
1	2/11/00	1,971	58.0	34.0
2	2/11/00	1,197	16.6	72.1
4	3/3/01	1,279	39.6	32.3
5-02	2/21/01	1,917	26.1	73.4
6	2/1/00	2,210	19.8	111.6
7	2/1/00	2,527	17.8	141.9
8	2/1/00	2,878	40.7	70.7
8A	2/1/00	348	-	-

Pump tests conducted by Monterey County Pump Testing Service of Spreckels, California.

WELL YIELDS AND AQUIFER CHARACTERISTICS

Table 2 provides the results of pump tests for City wells that were tested during 2000-2001. Except for Well No. 8A, pumping rates ranged from about 1,200 to 2,900 gpm. Pumping rates for five of the City wells exceeded 1,900 gpm. Specific capacities of the City wells ranged from 32 to 142 gpm per foot, and exceeded 70 gpm per foot for five of the wells. Specific capacities were the highest (exceeding 110 gpm per foot) for Wells No. 6 and 7. Both of these wells tap the thick coarse-grained deposits above a depth of about 500 feet that were previously discussed for Cross Section B-B'. Based on specific capacities, transmissivities of the strata tapped by City wells likely range from about 100,000 to 200,000 gpd per foot. These indicate a prolific aquifer.

GROUNDWATER QUALITY

High nitrate concentrations are present in shallow groundwater beneath irrigated lands in much of the Llagas Sub-basin (Santa Clara Valley Water District, 2001). Typical nitrate concentrations in water from shallow wells are near the MCL of 45 mg/l. City of Gilroy wells tap either deep groundwater or both shallow and deep groundwater. Table 3 summarizes results of analyses of water from City wells during 2000-2001 for inorganic chemical constituents and alpha activity. TDS concentrations ranged for about 250 to 330

TABLE 3 - INORGANIC CHEMICAL QUALITY OF WATER FROM CITY WELLS

Constituent (mg/l)	No. 1	No. 2	No. 4	No. 5-02
Calcium	49	49	40	50
Magnesium	30	30	24	24
Sodium	24	24	18	28
Potassium	-	-	-	1
Carbonate	-	-	-	-
Bicarbonate	221	211	221	239
Sulfate	35	41	44	30
Chloride	26	25	16	28
Nitrate	33	29	18	31
pH	7.6	7.4	7.4	7.5
Electrical Conductivity (micromhos/cm @ 25°C)	497	502	456	517
Total Dissolved Solids	296	326	258	324
Iron	<0.1	<0.1	<0.1	<0.1
Manganese	<0.02	<0.02	<0.03	<0.02
Arsenic	<0.002	<0.002	<0.002	<0.002
Chromium	<0.01	<0.01	<0.01	<0.01
Alpha Activity (picocuries/l)	1.3	1.7	0.0	0.3
Date	4/12/00	4/12/00	6/6/00	10/5/01
Perforated Interval (feet)	65-690	180-460	120-300	390-840

Continued:

TABLE 3 - INORGANIC CHEMICAL QUALITY OF WATER FROM CITY WELLS (Continued)

Constituent (mg/l)	No. 6	No. 7	No. 8	No. 8A
Calcium	52	51	53	50
Magnesium	28	28	25	9
Sodium	26	25	26	53
Potassium	-	-	1	1
Carbonate	-	-	-	-
Bicarbonate	237	234	245	234
Sulfate	34	28	29	30
Chloride	20	25	29	31
Nitrate	22	29	36	15
pH	7.6	7.5	7.7	7.9
Electrical Conductivity (micromhos/cm @ 25°C)	449	502	500	515
Total Dissolved Solids	310	326	254	304
Iron	<0.1	<0.1	<0.1	<0.1
Manganese	<0.02	<0.02	<0.03	<0.03
Arsenic	<0.002	<0.002	<0.004	<0.002
Chromium	<0.01	<0.01	0.025	<0.01
Alpha Activity (picocuries/l)	1.0	0.7	1.6	2.7
Date	4/12/00	4/12/00	7/20/00	6/6/00
Perforated Interval (feet)	200-510	130-400	240-460	530-790

Samples were analyzed by Sequoia Analytical of Morgan Hill.

mg/l. The lowest concentrations were in water from Wells No. 4 and 8, which are relatively shallow wells. Nitrate concentrations ranged from 15 to 36 mg/l, below the MCL of 45 mg/l. The lowest concentrations were in water from Wells No. 4 and 8A. Well No. 4 is the shallowest City well, but is also downgradient from much urban land, and is relatively distant from irrigated agricultural land. Well No. 8A has the deepest perforated interval of the City wells.

The County of Santa Clara conducted an extensive well testing program for nitrate in the area in 1988, and the SCVWD conducted a similar program in 1998. Since February 1999, the SCVWD has been conducting a routine quarterly nitrate monitoring program for about 55 wells in the Coyote and Llagas sub-basins.

The water from City wells is either of the mixed cation bicarbonate or calcium-sodium bicarbonate type. Concentrations of iron, manganese, and arsenic were well below the respective MCLs. The only detectable arsenic and chromium concentrations were present in water from Well No. 8.

Perchlorate contaminated groundwater is present in part of the Llagas Sub-basin. However, water from all of the City wells has had no detectable concentrations. Tetrachoroethylene (PCE) has been detected in water from the oldest two active City Wells (No. 1 and 2) at concentrations below the MCL of 5 ppb in water. Water

from Well No. 1 had PCE concentrations ranging from 0.5 to 1.0 ppb during 2000 and 2002. This well has perforations extending up to a depth of 65 feet. Water from Well No. 2 had PCE concentrations ranging from 0.6 to 1.7 ppb during 2000-2002. Neither of these two wells has a documented annular seal, according to DOHS records. Potential sources of PCE in groundwater in the area include dry cleaners and other facilities that have handled solvents.

REFERENCES

California Department of Water Resources, 1981 "Evaluation of Groundwater Resources, South San Francisco Bay, Vol IV, South Santa Clara County Area", Bulletin 118-1, 143 p.

Santa Clara Valley Water District, 2001, "Santa Clara Valley Water District Groundwater Management Plan"

Santa Clara Valley Water District, 2002, "Groundwater Conditions, 2001".