DRAFT
TECHNICAL MEMORANDUM NO. 5

STETSON ENGINEERS INC.

2171 E. Francisco Blvd., Suite K • San Rafael, California • 94901
TEL: (415) 457-0701 FAX: (415) 457-1638 e-mail: curtisl@stetsonengineers.com

TO: John Gray
URS Corp., Santa Barbara, CA

DATE: July 19, 2005

FROM: Stetson Engineers

JOB NO.: 1944

RE: **ASSESSMENT OF IMPACTS OF PROPOSED SOLVANG PUMPING ON ALISAL RANCH WELLS**

1. INTRODUCTION

This technical memorandum addresses the potential impacts on Alisal River Ranch (Alisal Ranch) wells from the proposed increased pumping by the City of Solvang (City). The City issued a revised Notice of Preparation of a Draft Environmental Impact Report (February 24, 2005) indicating as a part of its Water System Master Plan Update that one aspect of the proposed project is "to achieve the permitted diversion amount of 5 cfs (to meet peak hour demand) and produce up to 3,600 acre-feet per year when river underflow conditions are favorable."

The impact of increased Solvang pumping on seasonal water level declines during low flow periods of the Santa Ynez River was addressed in Draft Technical Memorandum No. 3 (July 19, 2004) by Stetson Engineers. The results of groundwater modeling by Stetson Engineers indicated that the increased pumping by Solvang would have a severe affect on nearby wells during dry periods when there is no flow in the Solvang reach of the Santa Ynez River. This technical memorandum explores the nature and extent of the pumping impacts specifically on Alisal Ranch River wells and discusses a potential mitigation measure, pumping threshold.

2. EVALUATION OF IMPACTS ON ALISAL RANCH WELLS FROM INCREASED CITY OF SOLVANG PUMPING

Alisal Ranch has five irrigation wells including three for the golf course north of the Santa Ynez River, herein referred to as the River Course, and two for the golf course south of the river along Alisal Creek, herein referred to as the Ranch Course. The wells for the Ranch Course may have been recently damaged in the 2005 flood. Alisal Ranch also has as a monitoring well (Alisal Ranch Monitoring Well No. 3, 6N/3W-22F1) within the proposed Solvang well field, near the

confluence of Alamo Pintado Creek and the Santa Ynez River. This well is measured monthly by the U.S. Bureau of Reclamation (USBR). All of these Alisal Ranch wells are shown on Figure 1.

Impacts of proposed Solvang pumping under various scenarios were evaluated using surface (SYRHM) and groundwater (Modflow) modeling by Stetson Engineers. A discussion of previous modeling efforts including development and results were presented in draft technical memorandums by Stetson Engineers (4/23/04; 5/10/04; 7/19/04; and 11/11/04). Table 1 summarizes the four assumed Solvang pumping scenarios.

TABLE 1

CONDITIONS SIMULATED FOR THE CITY OF SOLVANG EIR SCENARIOS

Scenario	Alternatives	Gross Pumping (afy)	Cachuma Reservoir Surcharge (ft)	Fish Flow Operations
GW1	SWRCB EIR Alt 2 with current Solvang pumping 600 afy	600	0.75	Interim BO/FMP
GW2	SWRCB EIR Alt 3C with Solvang pumping 2400 afy	2,400	3.00	Final BO/FMP
GW3	SWRCB EIR Alt 3C with Solvang pumping 3600 afy	3,600	3.00	Final BO/FMP
GW4	SWRCB EIR Alt 3C with Solvang pumping 1053 afy (baseline)	1,053	3.00	Final BO/FMP

Previous model analyses of each scenario were updated with recently received information (Fax from Stan Hatch to Ali Shahroody, 6/27/2005) regarding the last five years of pumping (2000-2004) for the Alisal Ranch golf courses. The estimated pumping rates of the Alisal Ranch wells were previously based on data from the SYRHM. Table 2 shows a pumping summary for the Alisal Ranch (including both the River and Ranch golf courses wells). For the EIR scenarios GW1-4, a total gross pumping of 366 acre-feet per year is used for the Ranch golf course, and a total gross pumping of 464 acre-feet per year is used for the River golf course. Thirty percent of this pumping is assumed to return to the Santa Ynez River alluvial aquifer.

Information recently received from Alisal Ranch identifies the proper locations of the golf course wells, information not previously available. Review of recent materials (Figure 1, Notice of Preparation, 2/24/05) indicates that the previously assumed locations of River Course Well Nos. 1 and 2 were correct. However, the locations of Ranch Course Well Nos. 1 and 2, near Alisal Bridge, were offset by two model cells (~ 400 feet). Also, River Course Well No. 3 located above the ID

Table 2
Pumping Summary for Alisal Ranch (River and Ranch) Golf Course Wells
for Solvang EIR Scenarios GW1, GW2, GW3, and GW4

		Model Runs Prior to July 2005 [1]												Model Runs July 2005 [2]															Recharge	
	% of Annual Demand	Average Net Pumping Total			River Course No. 1			River Course No. 2			Ranch Course No. 1&2			Average Gross Pumping Total			River Course No. 1			River Course No. 2			NEW River Course No. 3			NEW Ranch Course No. 2			River Course	Ranch Course
		afm	cfs	gpm	afm	cfs	gpm	afm	cfs	gpm	afm	cfs	gpm	afm	cfs	gpm	afm	cfs	gpm	afm	cfs	gpm	afm	cfs	gpm	afm	cfs	gpm	afm	afm
Jan	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0
Feb	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0
Mar	1	2	0.0	18	1	0.0	7	1	0.0	7	0	0.0	4	8	0.1	61	2	0.0	15	2	0.0	12	1	0.0	7	4	0.1	27	1	1
Apr	3	7	0.1	56	3	0.1	23	3	0.1	23	1	0.0	11	25	0.4	188	6	0.1	47	5	0.1	37	3	0.0	21	11	0.2	83	4	3
May	9	22	0.4	164	9	0.1	65	9	0.1	65	4	0.1	33	75	1.2	545	19	0.3	137	15	0.2	107	8	0.1	61	33	0.5	240	13	10
June	19	47	0.8	357	19	0.3	143	19	0.3	143	9	0.2	71	158	2.7	1190	40	0.7	299	31	0.5	233	18	0.3	133	70	1.2	525	26	21
Jul	24.1	60	1.0	438	24	0.4	175	24	0.4	175	12	0.2	88	200	3.3	1460	50	0.8	367	39	0.6	286	22	0.4	163	88	1.4	644	34	26
Aug	20	50	0.8	364	20	0.3	145	20	0.3	145	10	0.2	73	166	2.7	1212	42	0.7	305	32	0.5	237	19	0.3	135	73	1.2	534	28	22
Sep	14	35	0.6	263	14	0.2	105	14	0.2	105	7	0.1	53	116	2.0	876	29	0.5	220	23	0.4	171	13	0.2	98	51	0.9	386	19	15
Oct	8.5	21	0.3	155	8	0.1	62	8	0.1	62	4	0.1	31	71	1.1	515	18	0.3	130	14	0.2	101	8	0.1	58	31	0.5	227	12	9
Nov	1.4	3	0.1	26	1	0.0	11	1	0.0	11	1	0.0	5	12	0.2	88	3	0.0	22	2	0.0	17	1	0.0	10	5	0.1	39	2	2
Dec	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0
Sum	100	**249**			**100**			**100**			**50**			**830**			**209**			**162**			**93**			**366**			**139**	**110**

1) Represents net pumping for USBR Nodes 19-20 (golf courses) from SYRHM for Solvang EIR Scenarios GW1, GW2, GW3, and GW4.
80% assumed for River Course and 20% for Ranch Course.
(Stetson Engineers, Technical Memoranda 3 and 4, 7/19/04 and 11/11/04)

2) Represents gross pumping based on 5-year production average, Fax from Stan Hatch to Ali Shahroody 6/27/2005
464 afy is for River Course and 366 afy is for Ranch Course.
Distribution by well not provided, so assumed River Course breakdown is 45-35-20 % for Wells 1, 2, and 3 respectively.
(Current Technical Memoradum)

No.1 6-cfs well field was previously not assumed to be pumping in the Modflow model because geologic mapping by Dibblee indicated that this well may be outside the river alluvium. All well locations and number of wells were updated in the model for these revised model runs. The distribution of pumping by well has not yet been provided, so the standby well for Ranch Course (Ranch Course Well No. 1) was not assumed to be pumping due to its close proximity to Ranch Course Well No. 2. The distribution of the River Course pumping was assumed to be 45, 35, and 20 percent for River Course Well Nos. 1, 2, and 3, respectively.

Figure 2 compares the simulated and reported water levels at the USBR monitoring Well 22F1 for the revised model run. Figure 3 shows the resulting simulated water level elevations for Well 22F1 for EIR scenarios GW4 (Baseline), GW 2, and GW3 for Solvang pumping quantities of 1053, 2400, and 3600 acre-feet per year respectively. Figure 3 also shows that after even extreme dry periods, water levels recover the following winter. This response is due to the resumption of Santa Ynez River flows and resulting recharge in the river alluvium. The water level declines of 30 feet or more only occur in Scenarios GW2 and GW3 during four periods: 1961, 1964 to 1965, 1977, and 1990 to 1991. The wells could not actually be operated at the simulated rates during those periods. The model analyses currently assume no reductions in pumping by either ID No. 1, Solvang, or Alisal Ranch in order to evaluate the maximum impacts.

Table 3 summarizes results for the average and maximum water level declines from full aquifer conditions at the model cell locations of the Alisal Ranch wells. The water level declines shown in Table 3 represent the average for the model cell (200 by 200 feet) and could differ from the actual declines at a particular well. The proposed Solvang pumping in GW2 and GW3 scenarios would impact water levels at the Alisal Ranch Well locations by about two to seven feet on average compared with the baseline scenario (GW4). During dry years when surface flows are not available to recharge the small river aquifer, the increased pumping of the proposed Solvang wells would cause even greater incremental drawdowns of about 14 feet or until the Alisal Ranch wells go dry. These results are very similar to those presented in Technical Memorandum No. 3 for water levels located at 2500 feet downstream to 2000 feet upstream of the proposed Solvang well field center which showed declines of three to eight feet on average and areas going dry during prolonged periods of no surface flow.

Table 3
Summary of Simulated Groundwater Level Declines
at Alisal Ranch Wells - 1953-1993 (41 years)
(feet)

Ground Water Model Simulation	Fish Releases	USBR Groundwater Node 19-20 Pumping: City of Solvang (afy)	ID No.1 (afy)	Alisal Ranch (afy)	Total (afy)	River Course Irrigation Well No. 1: Avg	Max	Max Mon/Yr	River Course Irrigation Well No. 2: Avg	Max	Max Mon/Yr	River Course Irrigation Well No. 3: Avg	Max	Max Mon/Yr	Ranch Course Irrigation Well No. 2: Avg	Max	Max Mon/Yr
Solvang EIR GW1	SWRCB Alt 2	600	2,400	830	3,830	3.8	21.2	Oct-90	3.9	21.1	Jan-91	4.6	23.2	Jan-91	3.1	16.7	Sep-90
Solvang EIR GW2	SWRCB Alt 3C	2,400	2,400	830	5,630	8.0	dry	Oct-90	8.4	dry	Oct-90	6.2	37.9	Jan-91	7.0	34.4	Oct-90
Difference with GW4	(baseline)					4.0	dry		4.2	dry		2.3	13.7		4.1	16.5	
Solvang EIR GW3	SWRCB Alt 3C	3,600	2,400	830	6,830	11.1	dry	Feb-91	11.7	dry	Feb-91	8.0	dry	Feb-91	10.3	dry	Feb-91
Difference with GW4	(baseline)					7.1	dry		7.5	dry		4.1	dry		7.4	dry	
Solvang EIR GW4	SWRCB Alt 3C	1,053	2,400	830	4,283	4.0	24.0	Oct-90	4.2	24.1	Oct-90	3.9	24.2	Oct-90	2.9	17.9	Dec-90

dry = Groundwater level dropped below bottom of aquifer

3. MITIGATION – PUMPING THRESHOLD

One means of mitigating the impact of additional Solvang pumping is to identify the threshold water level (trigger level) at which pumping is reduced. The goal would be to control pumping by Solvang when "the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted" (Environmental Checklist, Appendix G of the CEQA Guidelines, Title 14. California Code of Regulations, Chapter 3).

Before a threshold or trigger water level for reducing or ceasing the pumping by Solvang can be identified, more information should be provided and compiled on all wells in the area including:

- Well depths, perforations, drillers logs, alluvium thickness,
- Measured pumping rates for Alisal Ranch wells relative to available measured drawdown measurements at the well and/or monitoring wells,
- Static and pumping water level measurements, and
- Historical pumping rate data or monthly groundwater demand.

Complete data regarding well performance and water demand would help develop the criteria for determining an appropriate threshold for well interference and seasonal drawdown.

A preliminary concept for developing a threshold to reduce or cease pumping is based upon the current agreement between ID No. 1 and the Alisal Ranch dated 8/18/1981. This agreement basically states that when observation well 6N/31W-22F1 is at or below elevation 375 feet and Alisal Ranch's River wells are being significantly and adversely impaired as a result of the water level decline, ID No. 1 must either refrain from pumping from its River wells or supply water at the Alisal Ranch well head at a price Alisal Ranch would have expended. Figure 4 shows the water surface elevation and depth to water as reported by the USBR each month.

The USBR chose 392 feet as the full water surface elevation at Well 22F1. Water surface elevations below 392 feet relates to the amount of dewatered storage for USBR Node 19/20. USBR Node 19/20 is part of the nodal system tracked under the Above Narrows Account established under WR89-18 (WR73-37). The water surface elevation for the easement agreement of 375 feet was chosen due it being the historic low elevation before ID No. 1 started pumping at the 6-cfs well field.

Because Solvang's water right would be senior to ID No. 1, the trigger for Solvang would have to be below the trigger for ID No.1. In other words, ID No. 1 would have to stop pumping or supply water to Alisal Ranch before Solvang would have to stop pumping or supply water. If the

water surface elevation declines below 375 feet after ID No.1 stops pumping or provides water, Solvang should then stop pumping. A threshold trigger elevation for Solvang needs to be established. For example, an additional water level decline of 10% of fully saturated conditions would represent an additional decline of 1.7 feet. Thus, the trigger for Solvang to stop pumping or provide water would be 373.3 feet.

Well 22F1 may be suitable for monitoring conditions at the River Course wells but the wells most likely affected by water decline are the Ranch Course wells by Solvang Bridge, which would be closer to Solvang pumping wells. This is area is more easily affected by water level decline because the aquifer is thinner, the width of the alluvium is narrower, and the aquifer is less permeable. In 2004, Alisal Ranch sent a letter to ID No. 1 stating that the Alisal Ranch golf course wells were being affected by ID No.1. The closest ID No. 1 6-cfs well field wells (11 or 23, Figure 1) to the Ranch Golf Course wells is about 4,350 feet away. The closest Solvang wells (3 or 9, Figure 1) to the Ranch Golf Course wells are only about 200 feet away. Therefore, it may be necessary to establish a second observation well with an appropriate trigger water level near the Ranch Course wells.

Figure 1. Existing and Proposed Wells in and Near the Project Reach
(from Administrative Draft EIR for Water System Master Plan Update Nov. 2004, not to scale)

Figure 2

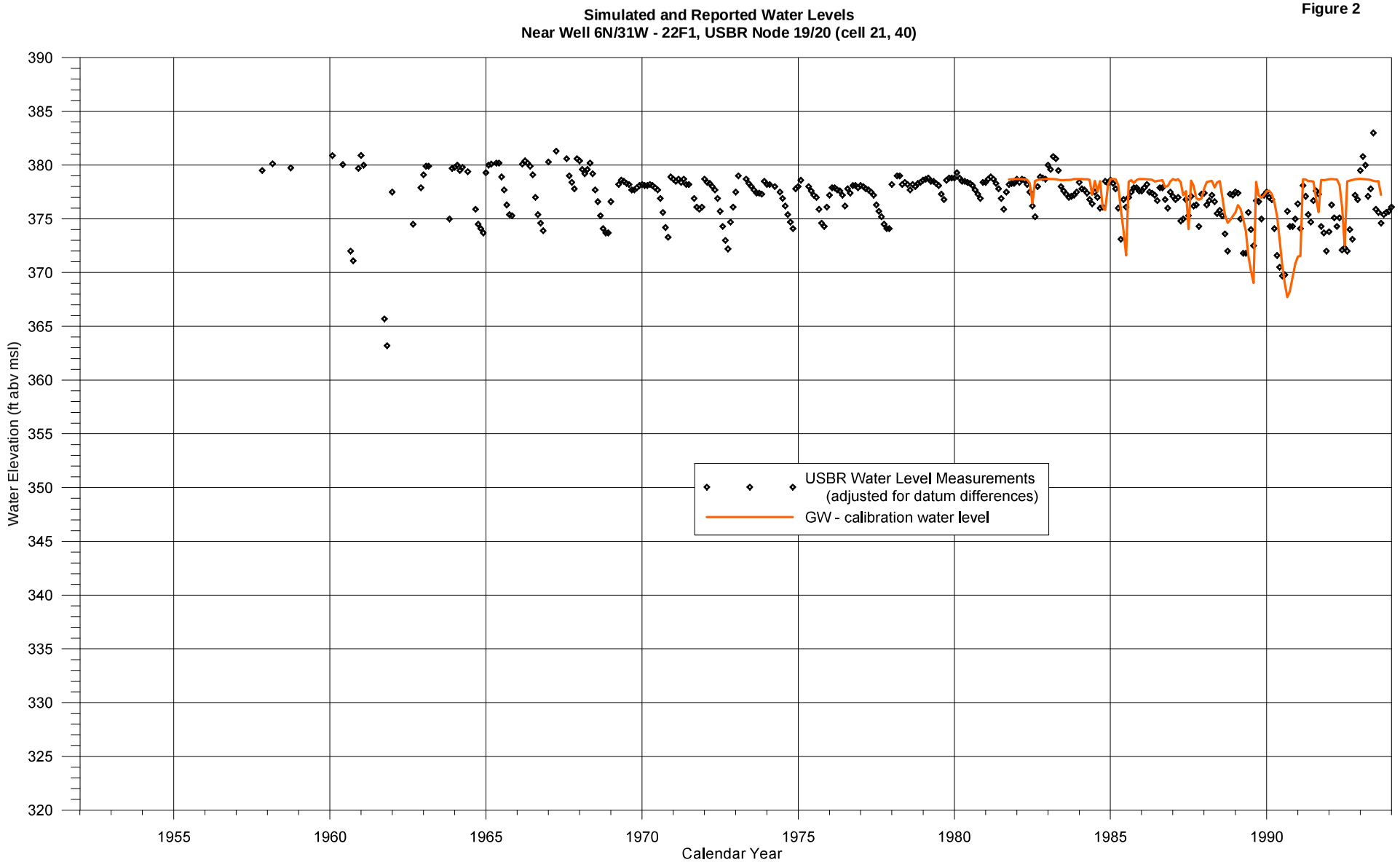

Simulated and Reported Water Levels
Near Well 6N/31W - 22F1, USBR Node 19/20 (cell 21, 40)
Water Elevation (ft abv msl)
390
385
380
375
370
365
360
355
350
345
340
335
330
325
320
1955
1960
1965
1970
1975
1980
1985
1990
Calendar Year
USBR Water Level Measurements
(adjusted for datum differences)
GW - calibration water level

Figure 3

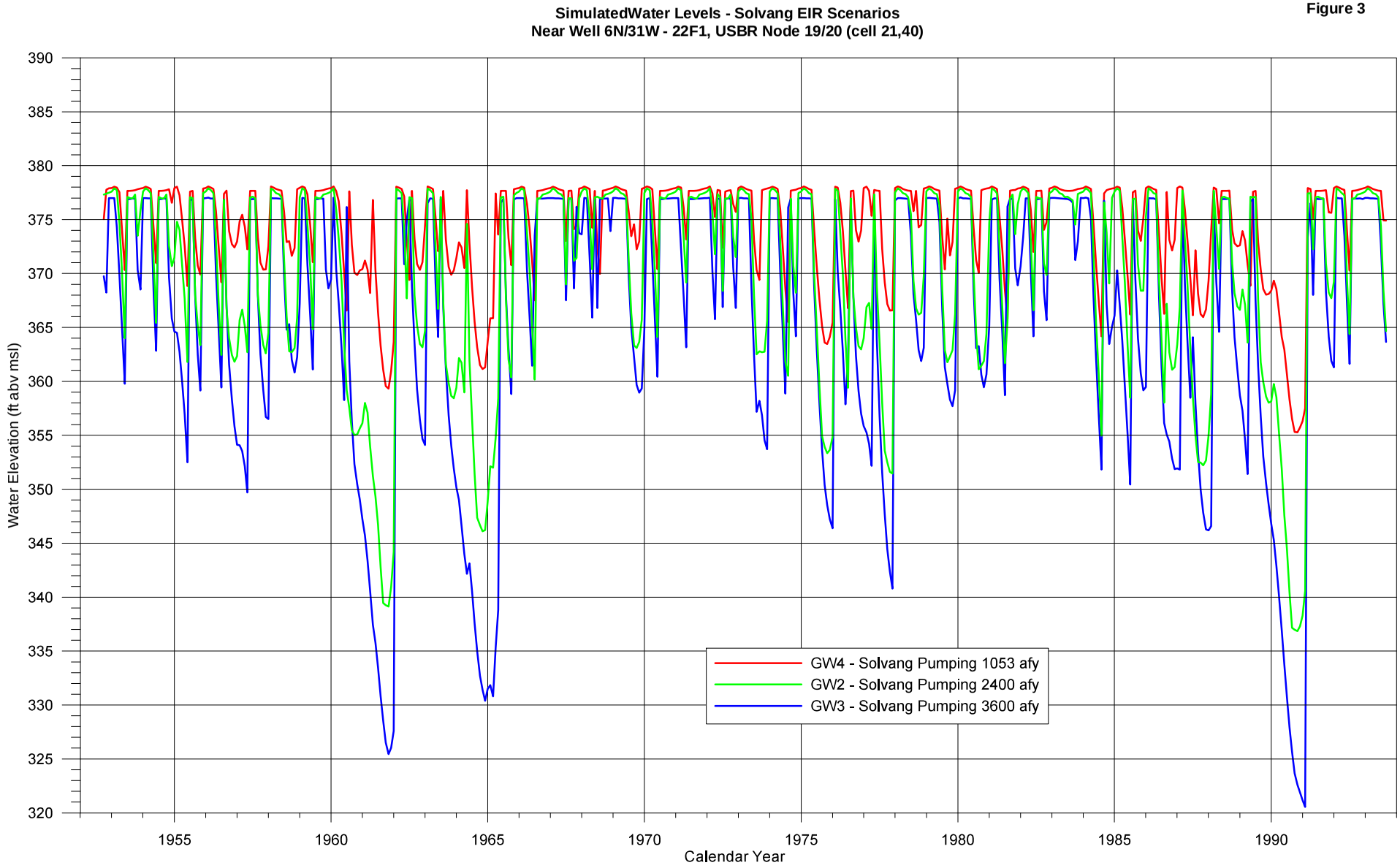
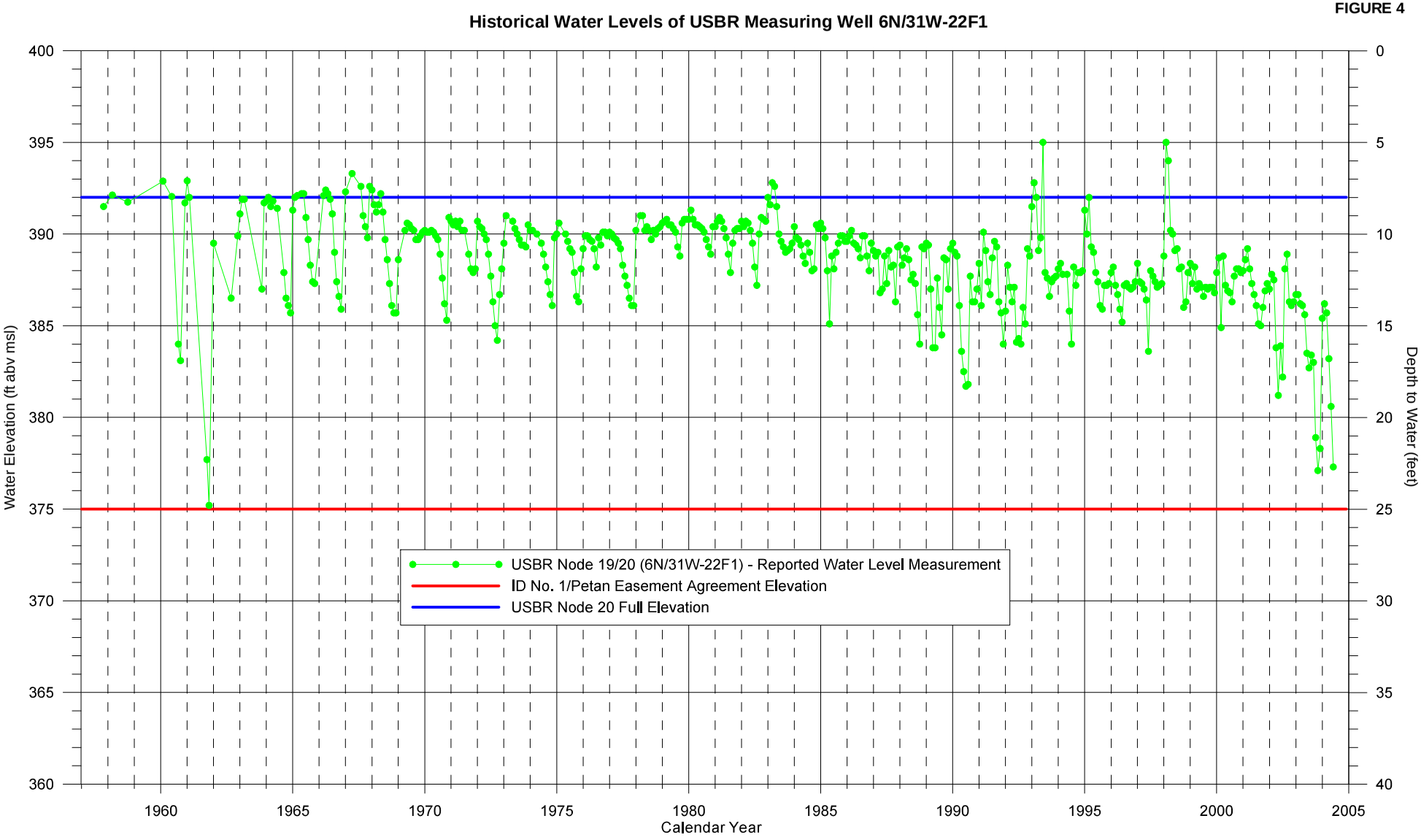

SimulatedWater Levels - Solvang EIR Scenarios
Near Well 6N/31W - 22F1, USBR Node 19/20 (cell 21,40)
Water Elevation (ft abv msl)
390
385
380
375
370
365
360
355
350
345
340
335
330
325
320
1955
1960
1965
1970
1975
1980
1985
1990
Calendar Year
GW4 - Solvang Pumping 1053 afy
GW2 - Solvang Pumping 2400 afy
GW3 - Solvang Pumping 3600 afy

FIGURE 4


Historical Water Levels of USBR Measuring Well 6N/31W-22F1
Water Elevation (ft abv msl)
Depth to Water (feet)
Calendar Year
400
395
390
385
380
375
370
365
360
0
5
10
15
20
25
30
35
40
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
USBR Node 19/20 (6N/31W-22F1) - Reported Water Level Measurement
ID No. 1/Petan Easement Agreement Elevation
USBR Node 20 Full Elevation