DRAFT TECHNICAL MEMORANDUM

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TO: Mr. Chris Dahlstrom DATE: May 4, 2010

FROM: Joe DeMaggio JOB NO: 1155-87

RE: 5-cfs and 6-cfs Well Fields

It is the purpose of this technical memorandum to evaluate the water system performance when operating the proposed 5-cfs well field, the 6-cfs well field, and the Mesa Verde Pumps at the same time in the combined Santa Ynez River Water Conservation District, Improvement District No. 1 (ID1) and the City of Solvang (Solvang) water systems.

In this analysis, 3.8 cfs from the proposed 5 cfs well field was assumed to flow into ID1 and 1.2 cfs flow into the Solvang. The 1.2 cfs flow to Solvang was based on the average day demand during the lowest month demand which occurred in February 2007. The WaterCAD hydraulic model (Model) was used to perform this analysis with the July long-term average demand condition.

The July long-term average demand condition for ID1's system was estimated at 31.1 acre-feet per day (afd) by ID1. The ratio of the average day demand to July long-term average demand is approximately 1.75. Applying this ratio to Solvang's average day demand (4.6 afd), the July long-term average demand in Solvang was estimated to be 8.1 afd.

Model Update and Demand Distribution

The combined Model was updated to include the area moved from Zone-2 to Zone-3 in ID1's system. The Zone-2 high elevation areas located near Dove Meadow Road and the area south of Baseline Road were moved to Zone-3 as shown in Figure 1.

The average day water demand for ID1's system was based on water use data in 2002 which is the highest water usage for the period of 2002-2005. The water demand was distributed in the ID1 water system proportionally based on water delivery records for 2005. The average day demand for Solvang's system was based on the 2007 historical use which was the highest average day demand recorded for the period of 2000-2007. This demand was distributed

throughout the system based on 2003 water meter deliveries. With the new pressure zone configuration in ID1, the average day demand and the July long-term average demand for ID1's and Solvang's water systems are shown in Table 1.

Table 1: Water Demand Distribution by Pressure Zones

	Average Day Demand (gpm)			July Long-Term Average Demand (gpm)		
Pressure Zone	**ID1**	**Solvang**	**Total**	**ID1**	**Solvang**	**Total**
Zone-1	528	664	1,192	926	1,162	2,088
Zone-2	2,248	354	2,597	3,929	619	4,548
Zone-3	1,246	12	1,258	2,182	21	2,203
Zone-4	0	11	11	0	20	20
Total (gpm)	4,017	1,041	5,058	7,037	1,822	8,859
Total (afd)	17.8	4.6	22.4	31.1	8.1	39.1

Notes: gpm = gallons per minute
afd = acre-feet per day

5-cfs Well Field

The proposed 5-cfs well field with six new wells is located upstream of Alisal Bridge and is approximately 0.3 miles west of the existing 6-cfs well field in the Santa Ynez River alluvium. The recommended pipeline route to connect the proposed five wells (labeled as Pro-Well-29 to Pro-Well-34) to the combined ID1 and Solvang system is shown on Figure 2. 1.2 cfs from the proposed 5-cfs well field will be pumped to the Solvang system, and 3.8 cfs (5 cfs minus 1.2 cfs) will be pumped to the ID1 system. The 1.2 cfs flow was estimated based on a minimum month historical water production of 66.5 acre-feet (or 1.2 cfs) for Solvang in February 2007. When the water demand exceeds 1.2 cfs, water will be supplied from ID1 through the interconnection valves located in Zone-1 and Zone-2.

Recommended System Operational Settings

Satisfying the system demands and providing the best system pressures were the two main factors for considering the well pump and booster pump operation setting. In this analysis, water is mainly supplied from the existing 6-cfs well field, the proposed 5-cfs well field and the

Mesa Verde pump station in ID1's Zone-1. Therefore, most Zone-2 booster pumps will need to operate to pump water to other zones. Other wells and booster pumps in other zones are operated as needed to supplement the water supply to meet the demands, and to minimize the system deficiencies (i.e. Low/ High pressures, high pipe velocities).

The operational settings for water supply pumps under the July long-term average demand is recommended as follow:

Groundwater Wells

- Zone-1: 6-cfs well field (Wells # 8, 9, 10, 19, 21, 22, 23) , 5-cfs well field (3.8 cfs flow to ID1 , 1.2 cfs flow to Solvang)
- Zone-2: Wells # 27 and 28

Other Production

- Zone-1: Mesa Verde Pumps # 1, 2, 3, 4 and 5

Booster Pumps

- Meadow Lark Booster Pumps # 2, 3, 4
- Refugio Booster Pump 2-1
- Alamo Pintado Booster Pump #1
- Solvang's Zone-2 Booster Pump #1
- Solvang's Zone-3 Booster Pump #1

For comparison purpose, the simulation results of the combined ID1 and Solvang water system without the new 5-cfs well field were also presented in this memorandum.

Evaluation Criteria and Modeling Results

The California Code of Regulations Title 22 criteria were used to evaluate the system pressures. The Title 22 criteria for service pressure, is to provide a minimum 20 pounds per square inch (psi) at all service connections. Since the Model was calibrated to plus and minus 3 psi, a minimum pressure of 25 psi was used to evaluate the system pressures. In distribution mains, ID1 requires velocities of no more than 4 feet per second (fps) without fire flows.

Without the 5-cfs Well Field, Combined system, July Long-term Average Demand

Based on the Model simulated results, the combined system without the 5-cfs well field has 18 model nodes and 22 model pipes that do not meet the evaluation criteria, as shown in Figure 3, Tables 2 and 3. Five of the low pressure nodes are demand nodes (i.e. model nodes assigned with water demands) in ID1. They are located in the intake of Meadowlark pump station, west of Loma Yucca Road and Still Meadow Road. Fourteen of the high velocity pipes are in ID1 and are located on the main discharge line of the 6-cfs well field, and the main line from the well fields to the Zone-2 booster pump stations. The simulated flow rate of the 6 cfs well field and Mesa Verde booster pumps are 2,330 gpm and 5,480 gpm, respectively, with a total flow of 7,810 gpm.

Table 2: Model Nodes with Pressures Less than 25 psi, Without 5-cfs Well Field, July Long-Term Average Demand

ID	Label	Elevation (ft)	Zone	Demand (gpm)	Pressure (psi)
ID1's Water System					
454	J-62	952	ID1-Zone-3	0.00	5.81
498	Z1-44-D-0-2-1-0-0	577	ID1-Zone-1	19.12	21.13
514	Z1-43-D-0-0-4-0-0	570	ID1-Zone-1	23.23	24.66
526	J-8	667	ID1-Zone-1	0.00	5.70
574	Z1-45-D-0-1-0-0-1	580	ID1-Zone-1	10.39	19.65
620	Z2-07-D-0-1-0-1-0	741	ID1-Zone-2	0.00	22.08
639	J-120	775	ID1-Zone-2	0.00	6.49
671	Z2-11-D-0-0-3-0-0	749	ID1-Zone-2	5.12	18.32
706	J-103	745	ID1-Zone-2	2.67	20.84
1018	J-178	922	ID1-Zone-3	0.00	18.61
Solvang's Water System					
2147	J-SOL-637	652	SOL-Zone-1	0.00	0.08
2148	J-SOL-636	644	SOL-Zone-1	0.00	3.33
2149	J-SOL-635	649	SOL-Zone-1	0.00	1.16
2150	J-SOL-634	652	SOL-Zone-1	0.00	0.08
2153	J-SOL-631	651	SOL-Zone-1	0.00	0.21
2195	J-SOL-588	607	SOL-Zone-1	1.44	19.51
2196	J-SOL-587	617	SOL-Zone-1	1.37	15.27
2197	J-SOL-586	631	SOL-Zone-1	0.47	9.14

Table 3: Pipes with Velocities Greater than 4 fps, Without 5-cfs Well Field, July Long-Term Average Demand

ID	Label	Diameter (in)	Length (ft)	Hazen-Williams, C	Flow (gpm)	Velocity (ft/s)
ID1's Water System						
1281	P-317	21	1,544	120.0	4,361	4.0
1282	P-313	21	952	120.0	4,361	4.0
1287	P-289	21	740	120.0	4,399	4.1
1288	P-285	21	1,248	120.0	4,384	4.1
1290	P-273	21	1,610	120.0	5,360	5.0
1291	P-269	21	1,359	120.0	5,251	4.9
1292	P-265	21	1,522	120.0	5,023	4.9
1293	P-261	21	776	120.0	4,970	4.6
1304	P-217	12	1,980	130.5	2,329	6.6
1305	P-213	12	481	130.5	2,290	6.5
1315	P-173	20	1,835	110.0	4,972	5.1
1316	P-169	20	300	143.0	5,480	5.6
1328	P-125	12	272	56.0	1,932	5.5
1336	P-93	8	785	149.8	660	4.2
Solvang's Water System						
2831	P-SOL-936	6	68	142.5	575	6.5
3115	P-SOL-518	12	314	142.5	1,632	4.6
3116	P-SOL-517	12	163	142.5	1,632	4.6
3117	P-SOL-516	12	310	142.5	1,690	4.8
3118	P-SOL-515	12	207	142.5	1,689	4.8
3119	P-SOL-514	12	158	142.5	1,691	4.8
3120	P-SOL-513	12	203	142.5	1,694	4.8
3530	P-SOL-343	6	104	142.5	575	6.5

With the 5-cfs Well Field, Combined system, July long-term Average Demand

With the 5-cfs well field connected to the combined system and 3.8 cfs flow to ID1, 18 model nodes and 21 model pipes that do not meet the evaluation criteria as shown in Figure 4, Tables 4 and 5 .

Comparing to the model results without the 5-cfs well field, the pressures of the low demand nodes are slightly improved as shown in Table 4. Although one high velocity pipe, which is immediately downstream of Well#10 in the 6-cfs well field, is eliminated, the average velocity of the high velocity pipes is increased, as shown in Table 5. Table 5 also shows two 12-inch segments of the 6-cfs well filed discharge line have velocities over 10 fps when an additional flow of 3.8 cfs from the 5-cfs well field into ID1's system. The simulated flow rate of the 6 cfs well field and Mesa Verde booster pumps are 2,047 gpm and 5,472 gpm, respectively, with a total flow of 7,519 gpm.

Table 4: Model Nodes with Pressures Less than 25 psi, With 5-cfs Well Field, July Long-Term Average Demand

ID	Label	Elevation (ft)	Zone	Demand (gpm)	Pressure (psi)	Pressure Difference (psi)
ID1's Water System						
454	J-62	952	ID1-Zone-3	0.00	5.81	0.00
498	Z1-44-D-0-2-1-0-0	577	ID1-Zone-1	19.12	21.26	0.13
514	Z1-43-D-0-0-4-0-0	570	ID1-Zone-1	23.23	24.78	0.12
526	J-8	667	ID1-Zone-1	0.00	5.70	0.00
574	Z1-45-D-0-1-0-0-1	580	ID1-Zone-1	10.39	19.77	0.12
620	Z2-07-D-0-1-0-1-0	741	ID1-Zone-2	0.00	22.08	0.00
639	J-120	775	ID1-Zone-2	0.00	6.49	0.00
671	Z2-11-D-0-0-3-0-0	749	ID1-Zone-2	5.12	18.32	0.00
706	J-103	745	ID1-Zone-2	2.67	20.85	0.01
1018	J-178	922	ID1-Zone-3	0.00	18.61	0.00
Solvang's Water System						
2147	J-SOL-637	652	SOL-Zone-1	0.00	0.11	0.03
2148	J-SOL-636	644	SOL-Zone-1	0.00	3.36	0.03
2149	J-SOL-635	649	SOL-Zone-1	0.00	1.19	0.03
2150	J-SOL-634	652	SOL-Zone-1	0.00	0.11	0.03
2153	J-SOL-631	651	SOL-Zone-1	0.00	0.23	0.02
2195	J-SOL-588	607	SOL-Zone-1	1.44	20.00	0.49
2196	J-SOL-587	617	SOL-Zone-1	1.37	15.73	0.46
2197	J-SOL-586	631	SOL-Zone-1	0.47	9.54	0.40

Note: Pressure Difference= Simulated pressures of the combined system with the 5 cfs well field – Simulated pressures of the combined system without the 5 cfs well field.

Table 5: Pipes with Velocities Greater than 4 fps, With 5-cfs Well Field, July Long-Term Average Demand

ID	Label	Diameter (in)	Length (ft)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Velocity Difference (ft/s)
ID1's Water System							
1281	P-317	21	1,544	120.0	4,367	4.0	0.0
1282	P-313	21	952	120.0	4,367	4.0	0.0
1287	P-289	21	740	120.0	4,405	4.1	0.0
1288	P-285	21	1,248	120.0	4,389	4.1	0.0
1290	P-273	21	1,610	120.0	5,367	5.0	0.0
1291	P-269	21	1,359	120.0	5,259	4.9	0.0
1292	P-265	21	1,522	120.0	5,030	4.7	0.0
1293	P-261	21	776	120.0	4,977	4.6	0.0
1304	P-217	12	1,980	130.5	3,757	10.7	4.1
1305	P-213	12	481	130.5	3,718	10.5	4.0
1315	P-173	20	1,835	110.0	4,964	5.1	0.0
1316	P-169	20	300	143.0	5,472	5.6	0.0
1328	P-125	12	272	56.0	1,955	5.5	0.0
Solvang's Water System							
2831	P-SOL-936	6	68	142.5	575	6.5	0.0
3115	P-SOL-518	12	314	142.5	1,642	4.7	0.0
3116	P-SOL-517	12	163	142.5	1,642	4.7	0.0
3117	P-SOL-516	12	310	142.5	1,711	4.9	0.1
3118	P-SOL-515	12	207	142.5	1,710	4.9	0.1
3119	P-SOL-514	12	158	142.5	1,712	4.9	0.1
3120	P-SOL-513	12	203	142.5	1,715	4.9	0.1
3530	P-SOL-343	6	104	142.5	575	6.5	0.0

Note: Velocity Difference= Simulated velocities of the combined system with the 5-cfs well field – Simulated velocities of the combined system without the 5-cfs well field

Conclusions and Recommendations

Based on the system operation model, it appears that connecting the 5-cfs well field with 3.8 cfs flows to ID1 will slightly improve the system pressures but slightly adverse the pipe velocity problem. There are 21 pipes with velocity greater than 4 fps and two pipes (12-inch segments of the 6-cfs well filed discharge line) that have velocities over 10 fps when the proposed 5-cfs well field, the 6 cfs well field, and the Mesa Verde pump station are all operating

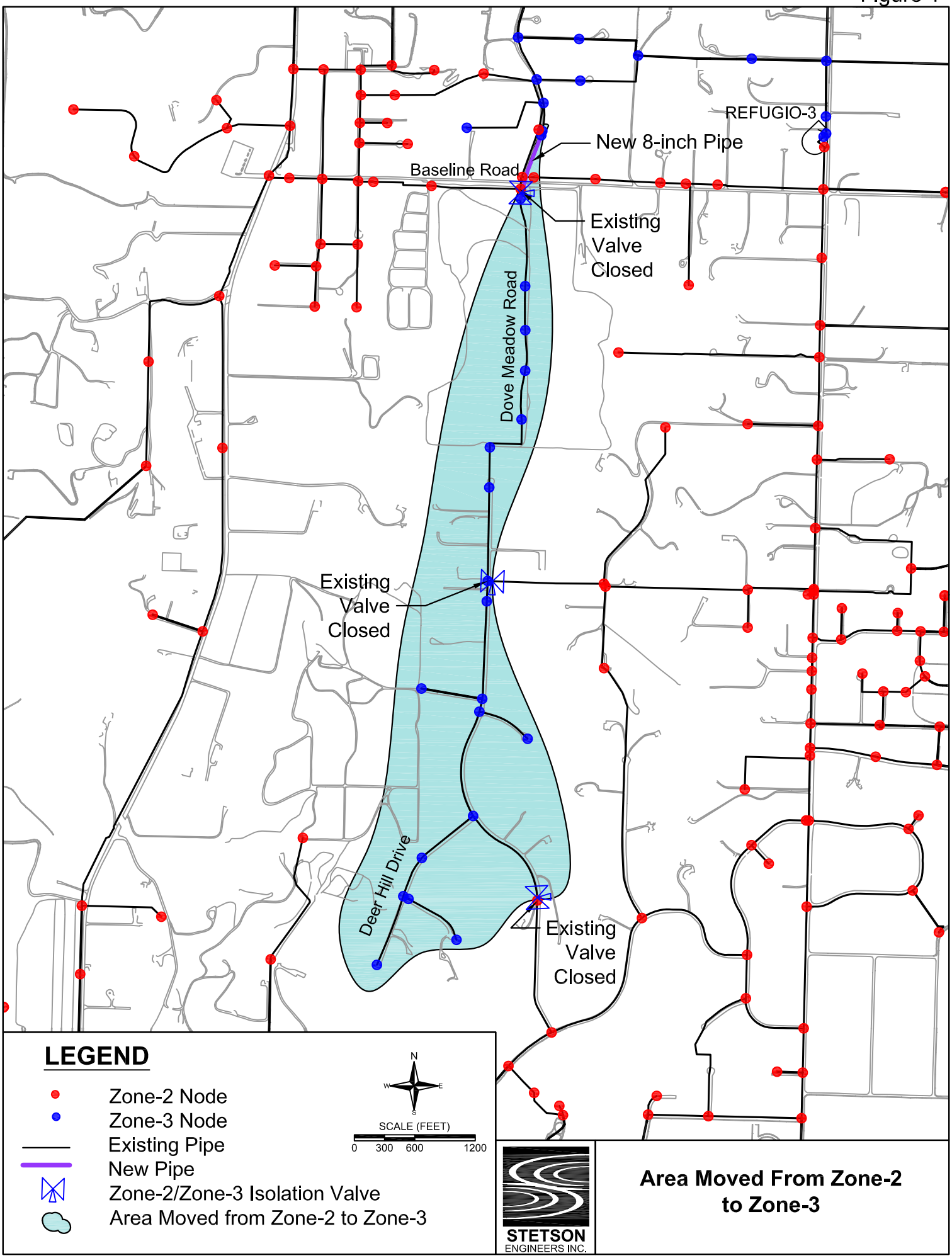
at the same time. It is recommended to replace these high velocity pipes with larger diameter pipes. Note that with the proposed 5-cfs well field connecting to the water system, the simulated flow rate from the 6-cfs well field and the Mesa Verde pump is reduced by 291 gpm (7,810 gpm minus 7,519 gpm). The flow rate reduction is due to a slightly increase of system pressure when the 5-cfs well pumps are operating.

Water Rights

ID1 has two permits from the California State Water rights to divert water from the subterranean stream of the Santa Ynez River. Two well fields were developed under the permits; 6-cfs well field (Permit 17734) and 4-cfs well field (Permit 17733). Well fields water use records need to be maintained to establish water use to prevent forfeiture of the water right through nonuse. The water rights for the 4-cfs and 6-cfs well fields may be subject to forfeiture for a period of five years of nonuse of the supply. A license inspection report was prepared for the 6-cfs well field by Stetson on October 30, 2009 for the State Water Resources Control Board. The report is entitled *"Permit 17734 License Inspection Report (6 cfs Well Field) Improvement District No. 1 Santa Ynez River Water Conservation District"* dated October 30, 2009. Because of the low water system demand during the winter months it will be difficult to operate both well fields at full capacity at the same time. It is recommended that the two well fields (4-cfs and 6-cfs) are operated in alternate years so that the water rights are maintained and the total well fields pumping rate does not exceed the system demand.

The water right for the 5-cfs well field has different criteria. Additional information will be provided in a separate memorandum.

Figure 1



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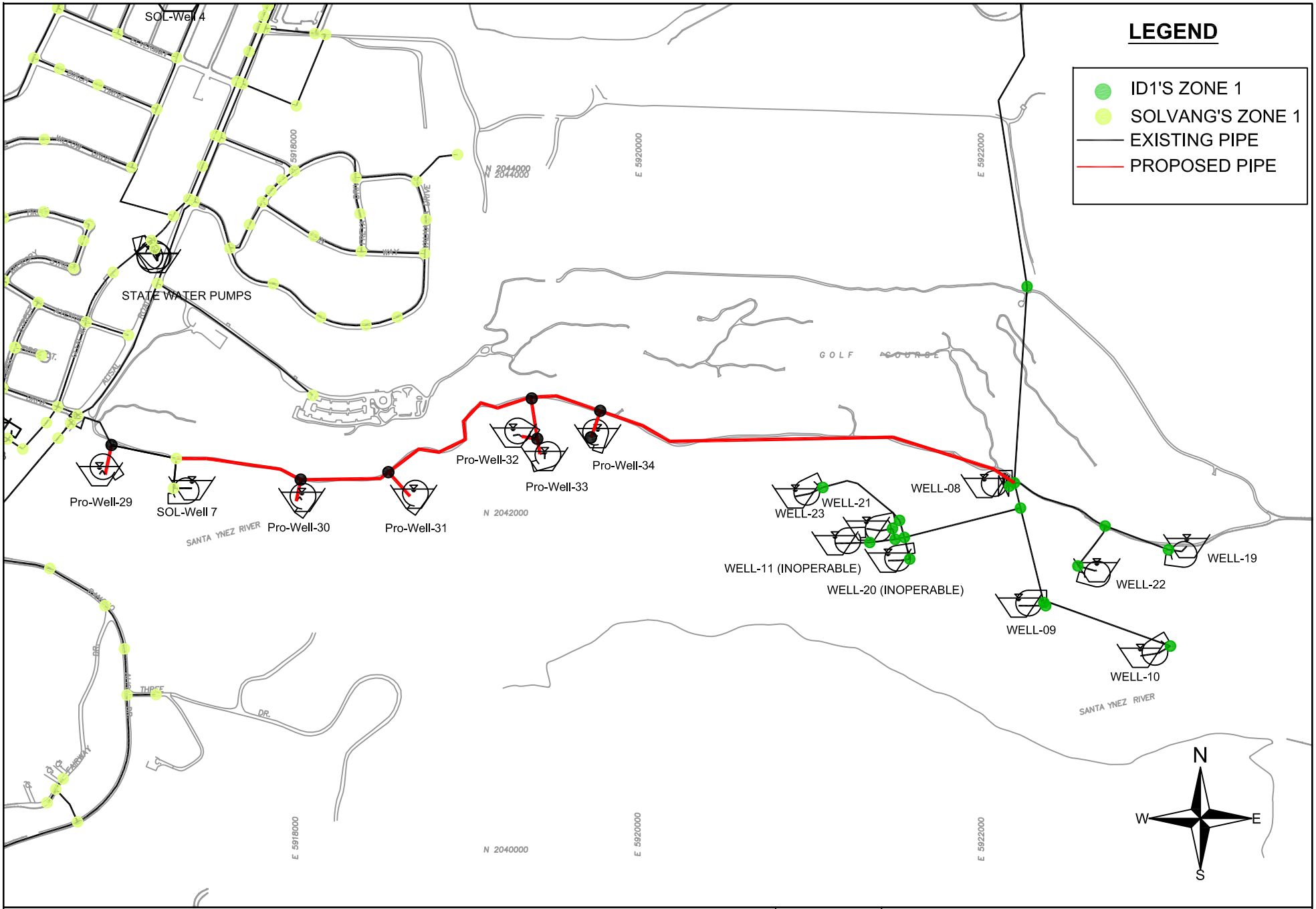

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STETSON
ENGINEERS INC.

Proposed 5-cfs Well Field and Pipe Route Location

SANTA YNEZ RIVER WATER CONSERVATION DISTRICT, IMPROVEMENT DISTRICT NO.1

FIGURE 2

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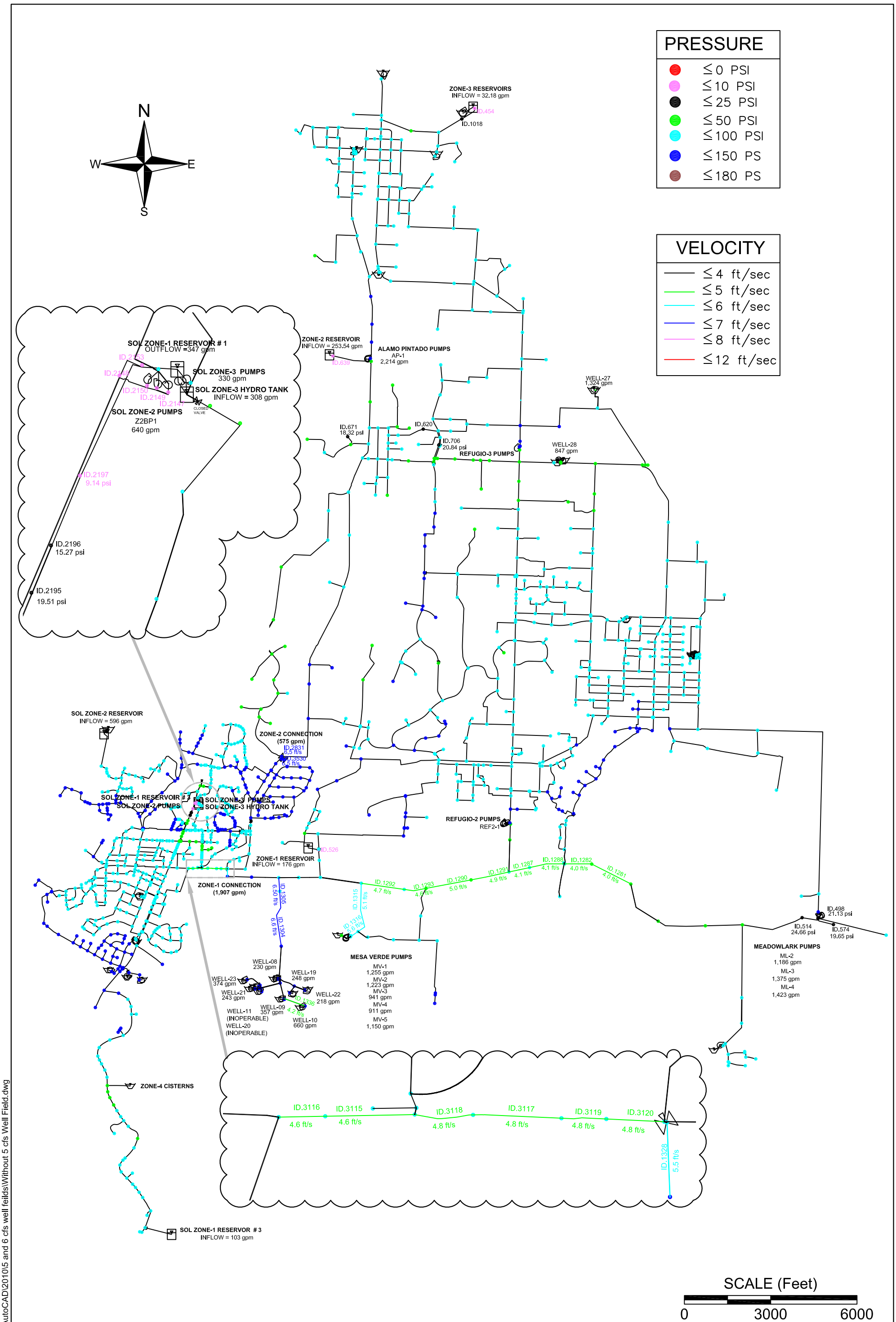

NOTES:
1. MODEL NODE ANNOTATIONS SHOWING IDENTIFICATION NUMBER (ID) OF MODEL NODES AND SIMULATED PRESSURE OF DEMAND NODES WITH PRESSURES LESS THAN 25 PSI.
2. PIPE ANNOTATIONS SHOWING ID AND VELOCITY OF PIPES WITH VELOCITY GREATER THAN 4 FPS

STETSON ENGINEERS INC.

Without 5 cfs Well Field

ID1 AND SOLVANG COMBINED SYSTEM,
JULY LONG-TERM AVERAGE DEMAND

FIGURE 3

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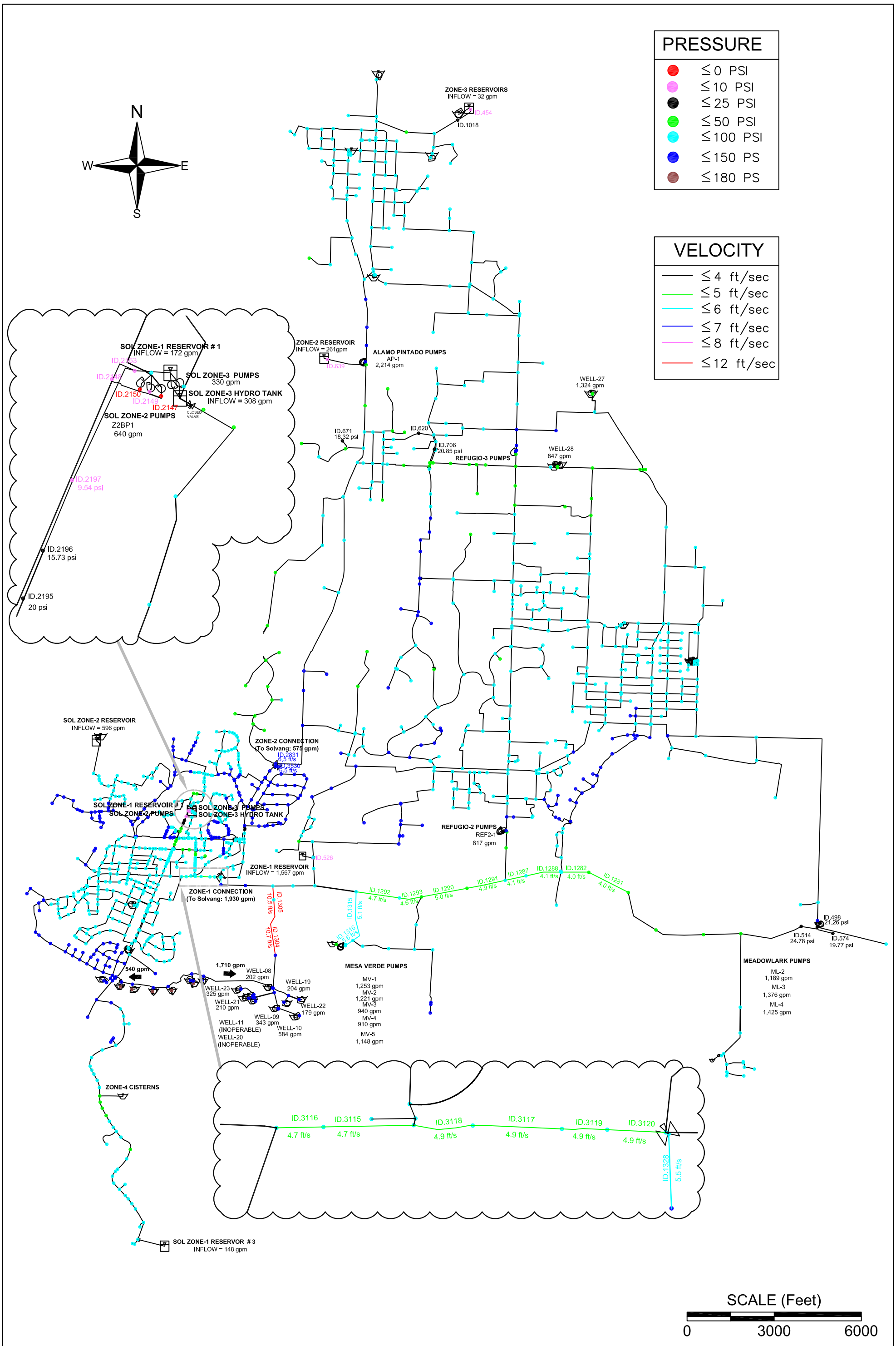

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STETSON ENGINEERS INC.

With 5 cfs Well Field

ID1 AND SOLVANG COMBINED SYSTEM,
JULY LONG-TERM AVERAGE DEMAND

FIGURE 4

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