WOOD RODGERS

TECHNICAL MEMORANDUM

TO: Ms. Regina Espinoza
Yolo County Planning and Public Works

FROM: Larry Ernst, PG, CEG, CHG
Ron Berry, P.E. # C 65879

DATE: January 7, 2011

SUBJECT: North Davis Meadows CSA Well Replacement

This technical memorandum details our recommendations for the North Davis Meadows County Service Area (NDMCSA) water supply system improvements. A cost estimate for the proposed facilities is included in this memorandum.

BACKGROUND

NDMCSA Wells 1 and 2 have concentrations of nitrate that exceed the California Department of Public Health (CDPH) primary (health based) maximum contaminant level (MCL). Both wells have also exceeded the CDPH secondary (aesthetic) MCL for specific conductance and the CDPH notification level for boron. The Yolo County, Health Department, Environmental - Health Division issued Compliance Order No: 12-09 on December 1, 2009, which stated that this water system must be brought into compliance by December 1, 2010. Previous attempts to improve water quality have not achieved the desired level of success with regard to water quality improvements.

WELL PUMPING AND STORAGE

Wood Rodgers recommends constructing two new wells at the Tank Site. The Tank Site location (see Figure 1) for the new wells is selected because of its proximity to existing storage, back-up power supply, and booster/fire pumping facilities. The following sections describe the current operating strategy at the Tank Site and the proposed operating strategy with facility improvements.

Existing Facilities

The existing facilities at the Tank Site includes a domestic well (Well 1) with a capacity of about 360 gpm, a 30-diameter tank with about 29,000 gallons of useable storage capacity, three booster pumps rated at 100 gpm each, a single fire pump rated at 180 gpm, a 1,600 gallon hydropneumatic tank with a drawdown volume of about 800 gallons, and an 100 kW emergency stand-by electricity generator for booster pump operation. The system operational set points for pressure are 55 psi, minimum and 65 psi, maximum. The maximum combined pumping capacity

Corporate Office: 3301 C Street, Bldg. 100-B • Sacramento, CA 95816 • 916.341.7760 • Fax 916.341.7767
Offices located in California, Nevada, and Idaho
www.woodrodgers.com

with all booster pumps and the fire pump in operation has not been measured since there is no flow meter downstream of the pumps, but is inadequate for fire flow protection requirements of 875 gpm at 20 psi for a duration of 2 hours per the 2010 California Fire Code[1]. Per CDPH, the maximum day flow for the distribution system is 411 gpm. CDPH also requires 100% redundancy of this capacity.

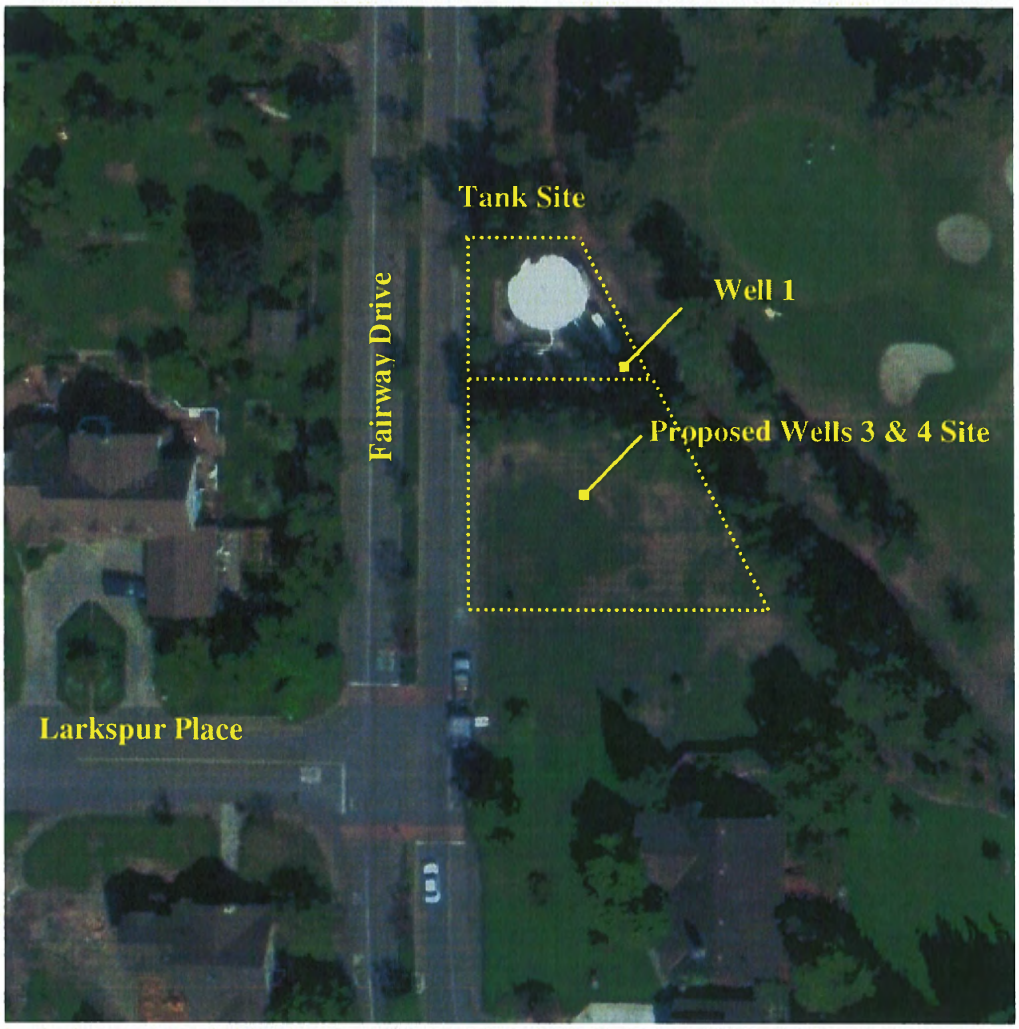

Figure 1. Tank Site and Proposed Wells 3&4 Site

Under the current operating strategy, water is pumped from Well 1 into the storage tank. The well pump operates based on level set points within the storage tank. The storage tank has an emergency overflow to prevent overfilling. A flow meter is located on the well discharge line between the well and the storage tank. The storage tank is connected to the suction side of three booster pumps and a fire flow pump via a header pipe. The three booster pumps are activated

[1] Per January 6, 2011 email correspondence from Tim Annis, Acting Fire Marshal, City of Davis Fire Department.

based on pressure settings measured by pressure switches located at the discharge side of each pump. The booster pumps operate on a lead-lag basis; the lead and lag pumps can be manually adjusted at the operator panel. The fire pump is activated when the system pressure drops below the low-low set point. To prevent running the pumps dry, the booster pumps and the fire flow pump will not operate when the low-low level in the storage tank is reached. The discharge sides of the pumps are connected to the distribution system with a branch connection to a hydropneumatic tank. The hydropneumatic tank provides water to the meet water demands from the distribution system between the lead booster pump shut down pressure and the pump turn on pressure. Additionally, the hydropneumatic tank provides a cushion to maintain necessary pressure in the distribution system to prevent the lead booster pump from short-cycling.

Beyond water quality concerns, the existing system is hydraulically limited in that it cannot produce the needed fire flow and max day demand even when all pumps are operating. Additionally, there is no storage redundancy so the existing storage tank cannot be taken off-line without shutting down the whole Well 1 facility.

Currently, Well 1 is not used due to elevated nitrate concentrations. Well 2 has been temporarily modified with a packer on the pump column to shut off water contribution from the upper aquifer which has reduced the nitrate concentration to under the CDPH maximum contaminant level (MCL). Well 2 has provided all of the water supply for the NDMCSA water system for the past several months. Well 2 operates with a VFD and feeds the NDMCSA water system directly. Water produced from Well 2 does not replenish the storage tank. Well 2 is currently able to produce approximately 450 gpm.

Proposed Facility Improvements

The proposed facility improvements are presented schematically on Exhibit 1 and include the addition of two 525 gpm domestic water wells, a 20,000 gallon storage tank, upsizing the existing fire pump to meet fire flow requirements, and adding a system discharge flow meter. With the addition of an extra storage tank, the existing storage tank can be temporarily brought off-line for service without bringing the entire system off-line. Under the proposed system, the two new wells would normally pump to the new storage tank, which would be hydraulically connected to the inlet piping to the existing storage tank. The proposed hydraulic connection would ensure flow-through for each storage tank to prevent water stagnation. Additionally, the proposed system is plumbed so that either of the tanks can be temporarily brought off-line for service and the pumping system would still be able to operate with the remaining tank.

Additional major improvements include upsizing the existing fire flow pump to meet the design condition of maximum day + fire flow (411 gpm + 875 gpm ~ 1,300 gpm[rounded]) and adding a flow meter on the system discharge line to capture flows which would otherwise not be measured if the existing tank were brought off-line. A minor but important improvement is to add an additional backflow prevention device to the existing hose connection piping branching from the discharge header of the booster pumps to prevent a potential cross-connection hazard.

COST ESTIMATE

An engineer's opinion of probable cost estimate for the proposed facility improvements is included in the following table. The estimate includes a 20% estimating contingency to reflect project uncertainty. This contingency can be reduced once more detailed site-specific information is gathered.

WOOD RODGERS

North Davis Meadows CSA Well Replacement
Engineer's Estimate of Construction Costs
Project No. 8359.008

Updated: 2011-January-07

Prepared By: RB/LE

ITEM NO	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
	A. General				
1	Mob/Demob/Bonds/Ins/Contract Admin/Incidentals (10%)	1	LS	$100,000	$100,000
2	Engineering - Bridging for pump station design build	1	LS	$85,000	$85,000
	General Subtotal				**$185,000**
	B. Well Construction and Development				
3	30-inch O.D. Conductor Casing and Sanitary Seal	100	LF	$450	$45,000
4	Geophysical (E-Log)	2	EA	$2,500	$5,000
5	28-inch Borehole Drilling	1,700	LF	$65	$110,500
6	16-inch O.D. Steel Well Casing	1,566	LF	$100	$156,600
7	16-inch O.D. Well Screen	220	LF	$300	$66,000
8	2-inch Dia. Sound Tube Pipe, Sch 40 BSP	1,400	LF	$10	$14,000
9	3-inch Dia. Gravel Fill Pipe, Sch 40 BSP	1,240	LF	$14	$17,360
10	Gravel Envelope	600	LF	$40	$24,000
11	Annular Seal	1,200	LF	$45	$54,000
12	Test Pump Installation	2	LS	$10,000	$20,000
13	Well Development	2	EA	$20,000	$40,000
14	Well and Aquifer Testing (Test Pumping)	48	HR	$250	$12,000
15	Plumbness & Alignment Test	2	EA	$3,000	$6,000
16	Video Camera Survey	2	LS	$2,500	$5,000
17	Site Cleanup and Records	2	LS	$3,000	$6,000
18	Well Disinfection	2	EA	$1,000	$2,000
19	Standby Time	8	HR	$250	$2,000
20	Monitoring well	1	LS	$80,000	$80,000
	Well Construction and Development Subtotal				**$665,460**
	C. Civil Site Work and Underground				
21	Site Grading	1	LS	$3,000	$3,000
22	Paving and Aggregate Base Surfacing	800	SF	$5	$4,000
23	Tank Base	1	LS	$15,000	$15,000
24	Steel Tank - 30,000 gal	1	LS	$30,000	$30,000
25	18" AWWA C900 PVC Drain Pipe	65	LF	$200	$13,000
26	48" Drainage Manhole	1	EA	$6,000	$6,000
27	Sheeting, Shoring, and Bracing	1	LS	$5,000	$5,000
28	SWPPP Implementation and Maintenance	1	LS	$5,000	$5,000
	Sitework and Underground Subtotal				**$81,000**
	D. Well Pumps, Fire Pump, Appurenances				
29	50hp Well Pumps, Prem.Efficiency Motors	2	EA	$16,000	$32,000
30	100hp Fire Pump, Prem.Efficiency Motor	1	EA	$18,000	$18,000
31	Flow meter	1	EA	$8,000	$8,000
32	Piping, Valving, and Appurtenances	1	LS	$25,000	$25,000
	Well Pumps, Fire Pump, Appurenances Subtotal				**$83,000**

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North Davis Meadows CSA Well Replacement
Engineer's Estimate of Construction Costs
Project No. 8359.008

Updated: 2011-January-07

Prepared By: RB/LE

ITEM NO	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
	E. Electrical				
33	Utility Fee Estimate	1	LS	$15,000	$15,000
34	Utility Primary Conduit and Transformer Pad	300	LF	$120	$36,000
35	Utility Transformer	1	EA	$30,000	$30,000
36	Switchboard/MCC	1	LS	$55,000	$55,000
37	RTU including Panel	1	LS	$12,000	$12,000
38	PLC	1	LS	$35,000	$35,000
39	Conduit & Cable	1	LS	$22,500	$22,500
40	Remote Metering Panel	1	EA	$1,500	$1,500
41	Pressure Measurement	6	EA	$3,000	$18,000
42	Level Measurement	2	EA	$2,000	$4,000
43	Grounding: rods, grid, connections	1	LS	$8,000	$8,000
44	Terminations, splices, labels, nameplates	1	LS	$5,000	$5,000
45	Stanchions, anchors, supports	1	LS	$5,000	$5,000
46	Miscellaneous materials	1	LS	$10,000	$10,000
47	Miscellaneous electrical	1	LS	$15,000	$15,000
48	City of Davis required SCADA system	1	LS	$30,000	$30,000
49	Testing and Start-up in mandays	3	EA	$800	$2,400
50	Training in mandays	1	EA	$800	$800
	Electrical Subtotal				**$305,200**
				Subtotal (rounded):	**$1,320,000**
				Contingency (20%) :	**$264,000**
				Total Estimated Construction Cost :	**$1,584,000**

Note: The Probable Construction Cost above is based on the assumptions outlined in the attached Technical Memorandum. Neither Wood Rodgers nor the Client has any control over the cost of labor, materials, equipment, the Contractors' methods of determining bid prices, or other competitive bidding markets. Prices may vary from engineer's estimate due to bidding climate, competition, and materials escalation at time of receiving bids. The above cost estimate represents preliminary amounts that are subject to change.

OPERATING STRATEGY

PUMP	PRESSURE (PSI) ON	PRESSURE (PSI) OFF	COMMENTS
Well Pump (Lead) Well Pump (Lag)	–	–	Rotating Duty. Fills Storage Tanks based on level. Lag pump activated based on low-level set point.
Booster 1	45	60	Rotating duty by manual operator selection
Booster 2	40	55	
Booster 3	35	50	
Fire Pump	30	60	Fire pump activation based on low-pressure set point

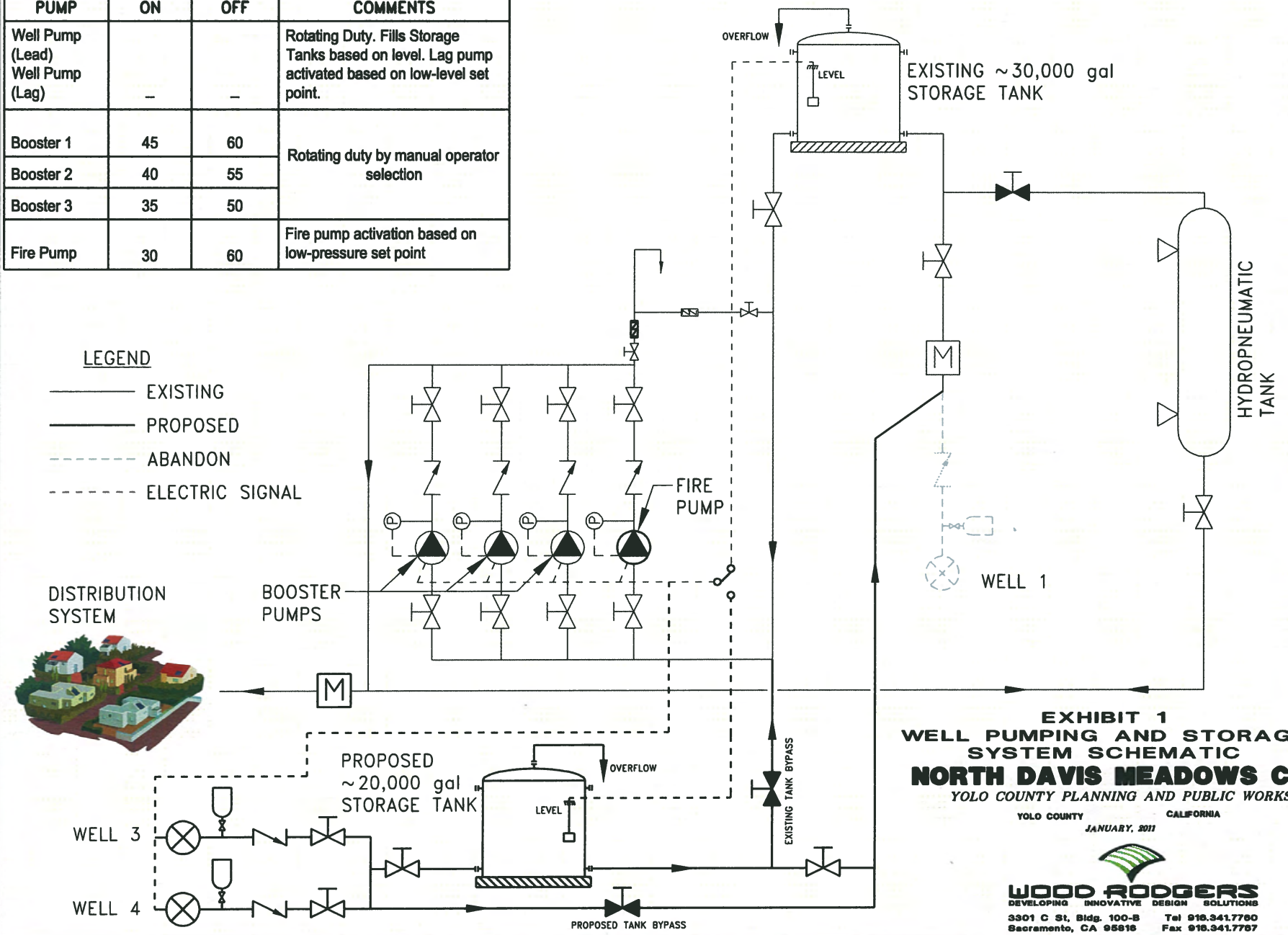

EXHIBIT 1
WELL PUMPING AND STORAGE SYSTEM SCHEMATIC
NORTH DAVIS MEADOWS CSA
YOLO COUNTY PLANNING AND PUBLIC WORKS
YOLO COUNTY CALIFORNIA
JANUARY, 2011

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
3301 C St, Bldg. 100-B Tel 916.341.7760
Sacramento, CA 95816 Fax 916.341.7767

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