DRAFT

WOOD RODGERS

March 2, 2010 Job Number: 8359.006

Ms. Dianna Jensen, Principal Civil Engineer
City of Davis Public Works Department
1717 5th Street
Davis, California 95616

Dear Ms. Jensen:

Subject: North Davis Meadows County Service Area - Groundwater and Well Assessments

In accordance with our contract, Wood Rodgers, Inc. is pleased provide you with this letter report detailing the groundwater quality in the North Davis Meadows County Service Area (NDMCSA) and our recommendations to improve water quality, well capacity, and system reliability for the NDMCSA municipal water supply system. Cost estimates for alternatives are also included in this report. This study utilized existing data and recent testing data conducted by the City of Davis (City) staff.

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.

Project Objectives
On November 9, 2009, Wood Rodgers met with the City of Davis, Yolo County, and representatives from the NDMCSA to establish clear short-term and long-term objectives for water quality, system capacity, and operational redundancy. Wood Rodgers met again with the City of Davis and Yolo County on January 13, 2010. The project objectives formulated at these meetings are summarized below:

1) Improve the water quality to bring the NDMCSA system into CDPH compliance.
2) Provide 100 percent system redundancy.
3) Provide long-term solutions.
4) Keep capital improvement costs as low as feasibly possible.

Data Review and Analysis
Wood Rodgers reviewed well construction and water quality data from five wells located within NDMCSA and two City of Davis municipal wells (Wells 27 and 31) located in northern Davis

(Figure 1). Well profiles of the five NDMCSA wells are shown in Figures 2 through 6. Each profile includes well construction information from existing well records and selected water quality summaries. All five NDMCSA wells have relatively shallow (50 to 65 foot) sanitary seals and all draw water from an aquifer located between 188 and 198 feet below ground surface (bgs). Wood Rodgers also reviewed geophysical logs from three natural gas wells and two domestic wells drilled near NDMCSA, also shown on Figure 1. Well construction information for the NDMCSA wells and the City of Davis Well 27 are shown in Table 1 below.

Table 1
NDMCSA and Davis Well 27 Well Construction and Water Quality Summaries

Well Name	Year Constructed	Total Well Casing Depth (feet bgs)	Perforations (feet bgs)	Nitrates (mg/L)	Specific Conductance µmhos/cm
Well 1	1987	490	150-340 370-490	8-57	880
Well 2	1996	502	182-202 302-352 452-462 472-482	21-49	1,200
Stand-by Well	1979	224	185-200 208-223	32	1,000
West Irrigation	1974	222	188-198	44	1,500
8-inch Domestic	1968	288	184-204 268-288	23-47	-
Davis Well 27	1990	364	296-334 342-354	21	870

Red denotes that the water quality exceeds the CDPH MCL

The geophysical logs, combined with the well construction and water quality data for each well, suggest that water quality with regard to nitrates and specific conductance both improve with depth until you reach a depth of approximately 1,000 feet bgs. Below 1,000 feet the nitrate concentrations remain low, however the specific conductance gradually begins to increase. The west irrigation well is completed in a single aquifer from 188 to 198 feet bgs. This aquifer appears to have unacceptable concentrations of both nitrates and specific conductance as shown in Table 1. The other four NDMCSA wells are a composite of the 188 to 198 foot aquifer and deeper aquifers that likely have water quality with lower specific conductance and nitrate concentrations. Possible reasons for the large variances in water quality observed for Well 1 and 2 are:

- There could be mixing of the aquifers when these wells are idle causing water with high nitrate concentrations to move into the deeper aquifers causing inter-aquifer mixing of water.
- Holes could exist is the upper portions of the well casings below the annular seal, but above the current perforations, allowing sporadic amounts of water with very high nitrates to enter the well casings.

The City of Davis Well 27 has a deep (260-foot) annular seal and is only completed in the aquifers between 296 and 354 feet bgs. Davis Well 27 has acceptable water quality as shown in Table 1. In theory a new well constructed with a 260-foot seal and screened between 300 and 350 feet bgs should have acceptable concentrations of nitrates and specific conductance in NDMCSA, however it is unclear from the data if this aquifer would yield the desired amount of water to meet the NDMCSA water demands. Deeper aquifers may be needed to increase well yields to desired capacities; however other water quality issues may exist for deeper wells as described below.

NDMCSA well completion reports indicate that the top of a blue clay layer is located at depth of approximately 350 feet bgs. Records indicate that this clay layer is 50 to 80 foot thick. Blue clay layers in Yolo County are often associated with elevated concentrations of manganese that are often above the CDPH secondary MCL of 50 ug/L. None of the existing NDMCSA wells have been reported to have high concentrations of manganese, however none of the wells that penetrate deeper aquifers exclude the shallower aquifers, thus zone specific water quality data under NDMCSA is not available for any aquifers under 200 feet. Zone specific data from Davis Well 27 indicates that the aquifer from 300 to 350 feet bgs at that site has acceptable water quality. Temporary zone sampling at Davis Well 31 suggests that the water quality between 740 and 860 feet bgs would also be acceptable; however some of the Well 31 data, with regard to manganese, is questionable.

Based upon all of the data that Wood Rodgers reviewed during this study, we have developed a simplified geologic/anticipated water quality profile depicting our current understanding of the water quality in the aquifers that exist beneath NDMCSA, as shown as Figure 7. It is our opinion that the aquifers between 65 and 180 feet likely have very high concentrations of nitrates. This profile represents our estimated zone specific water quality; however these estimations should be considered conjectures, not measurements, of water quality. Monitoring well construction in specific aquifers helps increase the confidence levels for zone specific water quality, however even monitoring well construction does not guarantee production well water quality.

Alternatives to Improve Water Quality

Packer Installation

A previous attempt in June 2009 to improve the water quality produced by Well 2 included a packer installation on the pump column pipe below the upper screen section (to eliminate the 188

to 198 foot aquifer). The water quality improved for about a month and then the water quality returned to unacceptable levels as shown in Figure 8. The packer was changed and the nitrate concentrations again deceased for about a month and have since fluctuated between 34 and 44 mg/L. Our assessment is that this packer did not provide a consistent reduction in nitrate concentrations. There are a few possible reasons for the variation in water qualities that have been observed since this packer was installed: 1) the packer is not seated well, allowing water to pass; 2) the packer could be losing pressure allowing water to pass; 3) water of poor quality could be migrating down the gravel envelope outside the well casing; 4) holes could exist in the casing allowing alternate paths of poor water quality to migrate down the well structure; and 5) all aquifers could now have increased concentrations of nitrates. Given the rapid 33 percent decline of nitrates that occurred when the packer was first installed, and the sporadic changes in nitrate concentrations since the packer was installed, the most plausible explanation is that the packer has reduced the contribution of the upper aquifer, but not eliminated it. On January 11, 2010 this theory was proven when the City of Davis conducted a pumping test and noted that 12 feet of drawdown occurred during the test. If the packer was providing a seal, no drawdown should have occurred above the packer. Given the poor results of the packer program we do not recommend packers as a viable long-term solution to improve the NDMCSA water quality.

Well Modifications/Rehabilitation

Given that the packer program did have short-term success reducing the nitrate concentrations in Well 2, there is hope that a more aggressive approach to well modification would have better long-term success. For Well 2, a program that includes perforating the casing below the upper aquifer, the installation of a permanent liner, and then the injection of cement grout outside the new perforations, into the upper aquifer, and between the liner and the existing well casing. This liner approach would have a much better chance of success over a packer program as it provides a permanent seal that is not dependent on inflation and the annular space outside the well casing is also sealed. The downside of this type of modification is that it will reduce the inside diameter of the well from 12.25 inches to 8.25-inches which limits the size of pumping equipment that could be installed. Also, if the upper aquifer is fully sealed off, the well yield will be significantly reduced. During the initial phases of this work, zone specific water quality samples from each of the three lower perforated intervals will be obtained prior to proceeding with the well rehabilitation. The cost to provide this well modification is approximately $70,000.

At this time we do not have sufficient information to prepare a preliminary well modification for Well 1. Well 1 is now 33 years old and is reported to be producing some sand. The yield (specific capacity) of this well has always been less than Well 2, likely because the upper 188 to 198 foot aquifer is not very permeable at this location (based on the driller's report). This is likely why this well has had lower nitrate concentrations. The spikes in nitrate levels for this well may be related to a shallow hole in the casing. A hole in the casing could also explain why this well is producing sand and why the specific capacity of this well has become higher (over double from when it was new). Repairs for this well may be as simple as installing a casing

patch over a hole at a cost of less than $20,000 or could require a complete liner program as described for Well 2.

Prior to conducting well rehabilitation for Well 1 or 2, additional well testing and video inspections will be required to characterize and assess the well structures.

New Wells

New wells are initially more expensive than well rehabilitations, however they will likely also provide better long-term results and value to NDMCSA. Wood Rodgers has provided two well conceptual design options as shown in Figures 10 and 11. Figure 10 includes a design to complete the intermediate aquifers between 300 and 500 feet while Figure 11 includes a deeper well design option that completes the aquifers between 770 and 880 feet. New wells should include deep continuous annular seals to help prevent the downward migration of water with high nitrate concentrations. The intermediate aquifer well design would also include annular seals to help isolate this well from the blue clay layer that could be associated with high concentrations of manganese. One potential draw back to new wells is that we do not currently have zone-specific water quality data for any aquifer below 200 feet under the NDMCSA. While projections of water quality data from the City of Davis Well 27 and 31 seem encouraging, a monitoring well at a proposed new well site would help provide site specific data that may help preferentially select the aquifers with the best water quality prior to committing the resources for production well construction. For planning purposes, new wells and pump stations for the intermediate well option would cost $520,000 while the deep aquifer well option would cost $630,000 as shown in Tables 2 and 3 respectively. A monitoring well, as shown in Figure 12, would add an additional $80,000 to a new well project. If a new well can be located at an existing well site, the pump station construction cost estimates may reduce depending on how much of the existing infrastructure can be reused for the new pump station.

Conclusions and Recommendations

All five of the existing NDMCSA wells are completed in the 188 to 198 foot aquifer which is known to have nitrate concentrations that are unacceptable. All five wells also have relatively shallow (50 to 65 foot) sanitary seals that do not prevent the downward migration of water with extremely high nitrate concentrations from the aquifers between 65 and 180 feet. It seems unlikely that any of these five wells could be considered a long term solution to provide water with acceptable nitrate concentrations without permanent modification.

Permanent well modifications may have a good chance of success as a long-term solution to improve water quality and, if successful, would be the quickest way to improve the water quality for the system. Modifications could however reduce the well capacity and thus leave the system short for redundant source capacity.

New wells and pump stations are expensive, however new wells provide the best long term solution to improve the NDMCSA water system for the next 30 to 40 years. Even if well

modifications are successfully implemented, a new well may be needed to increase source capacity for system redundancy to make up for well capacity reductions as a result of the well rehabilitation programs.

Wood Rodgers recommends proceeding with the investigative work to determine if Wells 1 or 2 are good candidates for well rehabilitation. Upon completion of these assessments, we could make recommendations on how, or if, to proceed with the well rehabilitations. We do not recommend rehabilitation for the other three NDMCSA wells.

As NDMCSA wells are removed permanently from service, they should be properly destroyed to stop/prevent the downward migration of poor water quality. All new domestic water supply wells in the NDMCSA should have a minimum sanitary seal depth of 250 feet.

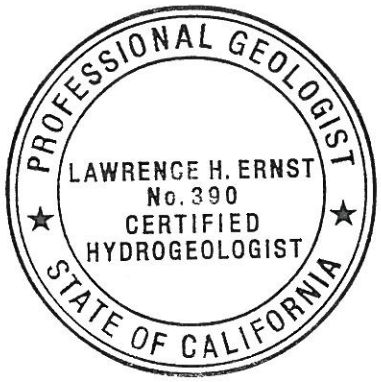
We look forward to working with you and the County to improve the NDMCSA well field water quality and system capacity. If you have any questions or require additional information, please call me at (916) 341-7447 (office) or (916) 417-7687 (cell).

Sincerely,

Lawrence H. Ernst

Lawrence H. Ernst, PG, CEG, CHG
Principal Hydrogeologist

Enclosure



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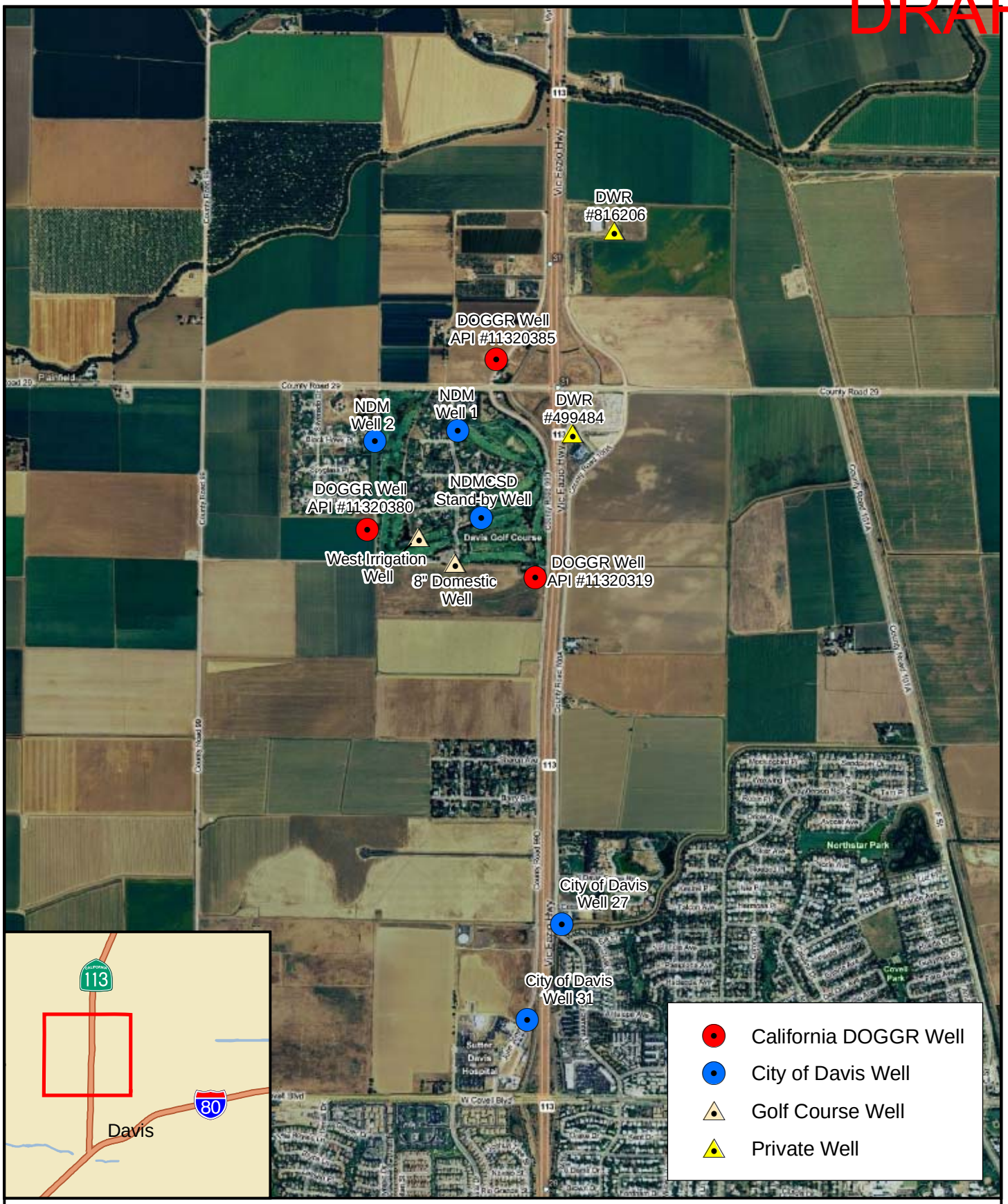

WELL LOCATION MAP
NORTH DAVIS MEADOWS CSA
FEBRUARY 2009

Figure 1

NOTES: ESRI Microsoft Virtual Earth

NORTH

0 0.125 0.25

MILES

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

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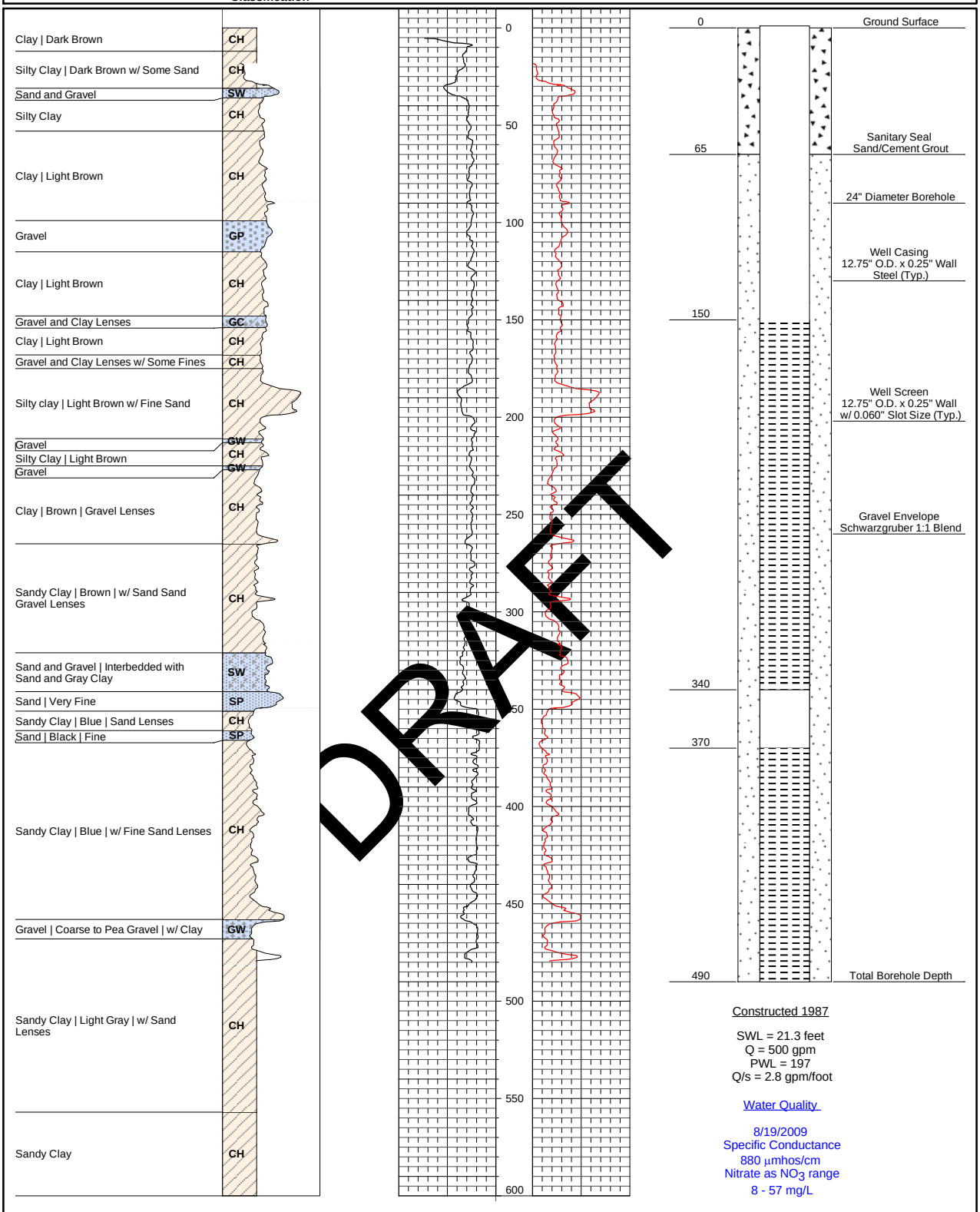
BOREHOLE DATA
(Geophysical Data from NDM CSA Well 2)

WELL 1
PRODUCTION WELL AS-BUILT



Constructed 1987

SWL = 21.3 feet
Q = 500 gpm
PWL = 197
Q/s = 2.8 gpm/foot

Water Quality

8/19/2009
Specific Conductance
880 µmhos/cm
Nitrate as NO_3 range
8 - 57 mg/L

PROJECT NO. 8359.006	AS-BUILT PLANS FOR **NORTH DAVIS MEADOWS COUNTY SERVICE AREA WELL 1** YOLO COUNTY, CA	WOOD RODGERS DEVELOPING INNOVATIVE DESIGN SOLUTIONS 3301 C Street, Bldg. 100-B Sacramento, CA 95816 Tel: 916.341.7760 Fax: 916.341.7767	DATE: 3/1/10 18:36
FIGURE 2			SCALE:
			DRAWN BY: S.SPAETH
			DESIGNED BY: LAYNE
			CHECKED BY: L. ERNST

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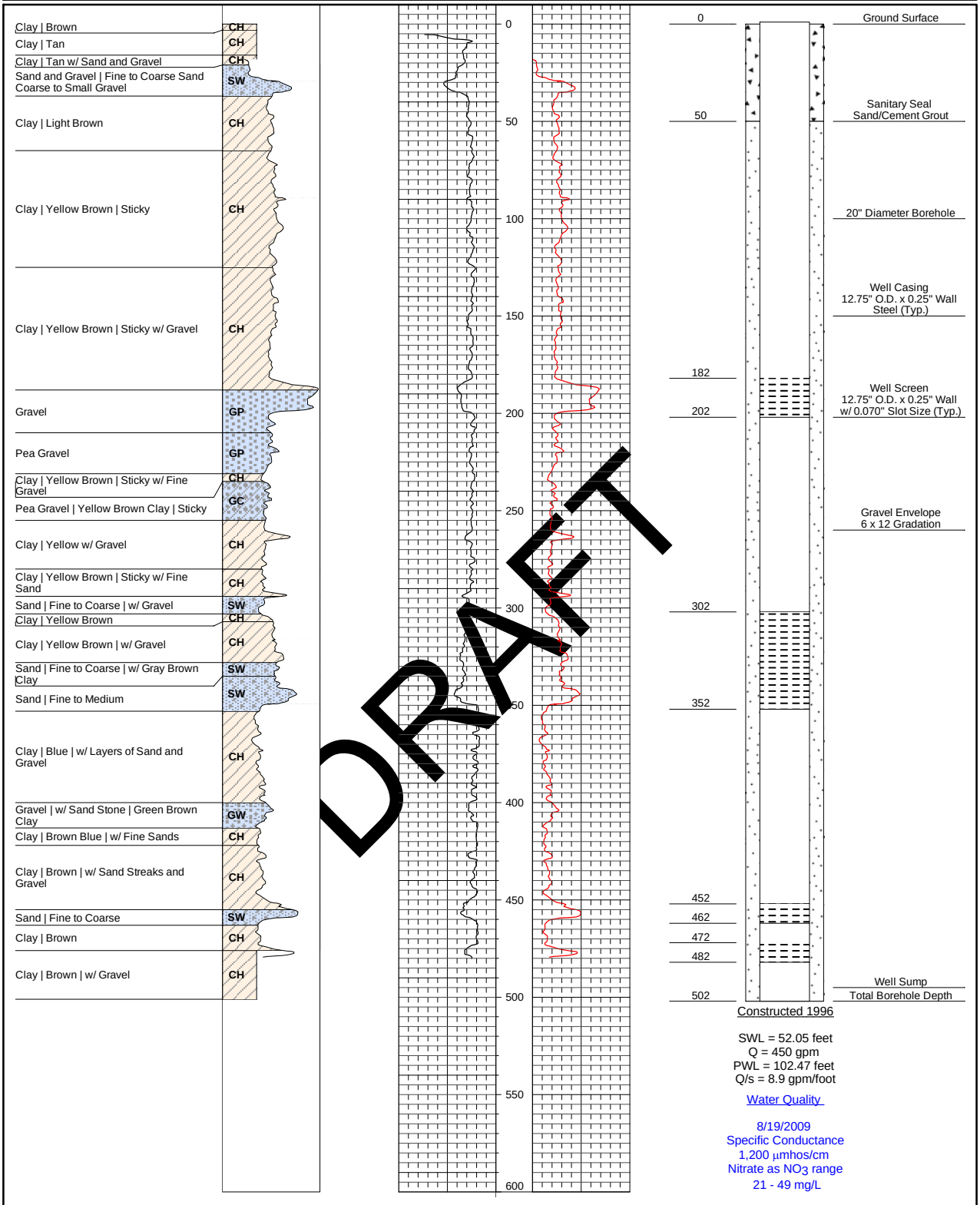
BOREHOLE DATA

WELL 2
PRODUCTION WELL AS-BUILT



Constructed 1996

SWL = 52.05 feet
Q = 450 gpm
PWL = 102.47 feet
Q/s = 8.9 gpm/foot

Water Quality

8/19/2009
Specific Conductance
1,200 µmhos/cm
Nitrate as NO_3 range
21 - 49 mg/L

PROJECT NO. 8359.006 FIGURE 3	AS-BUILT PLANS FOR **NORTH DAVIS MEADOWS COUNTY SERVICE AREA WELL 2** YOLO COUNTY, CA	WOOD RODGERS 3301 C Street, Bldg. 100-B, Sacramento, CA 95816 Tel: 916.341.7760 Fax: 916.341.7767	DATE: 3/1/10 18:37 SCALE: DRAWN BY: S.SPAETH DESIGNED BY: LAYNE CHECKED BY: L. ERNST

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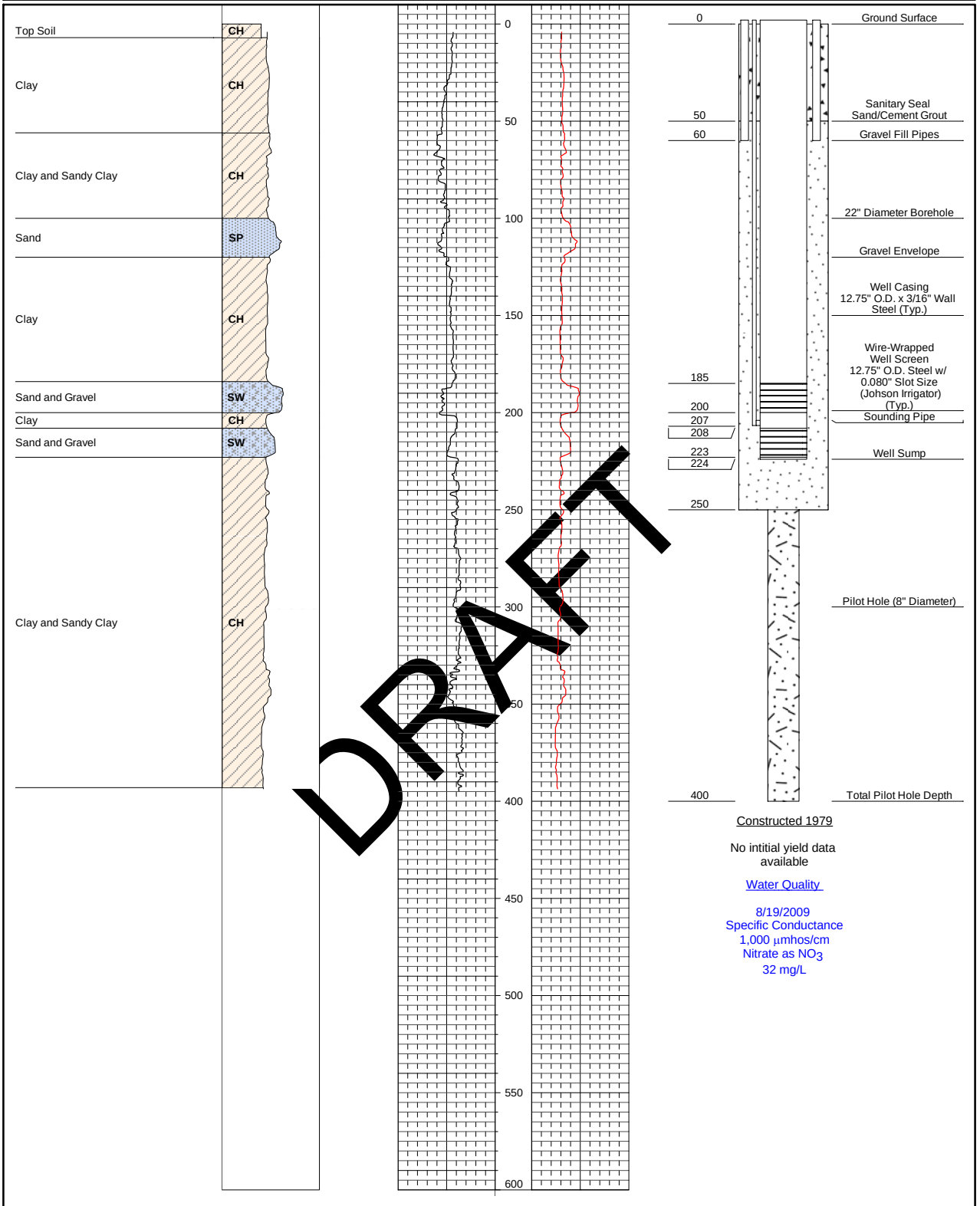
BOREHOLE DATA

(Geophysical Data from Davis Municipal Golf Course West Irrigation Well)

STAND-BY WELL
PRODUCTION WELL AS-BUILT



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Constructed 1979

No intitial yield data available

Water Quality

8/19/2009
Specific Conductance
1,000 µmhos/cm
Nitrate as NO_3
32 mg/L

PROJECT NO. 8359.006	AS-BUILT PLANS FOR **NORTH DAVIS MEADOWS COUNTY SERVICE AREA STAND-BY WELL** YOLO COUNTY, CA	WOOD RODGERS DEVELOPING INNOVATIVE DESIGN SOLUTIONS 3301 C Street, Bldg. 100-B Sacramento, CA 95816 Tel: 916.341.7760 Fax: 916.341.7767	DATE: 3/1/10 18:55
FIGURE 4			SCALE:
			DRAWN BY: S.SPAETH
			DESIGNED BY: CITY of DAVIS
			CHECKED BY: L.ERNST

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			APPROVED	

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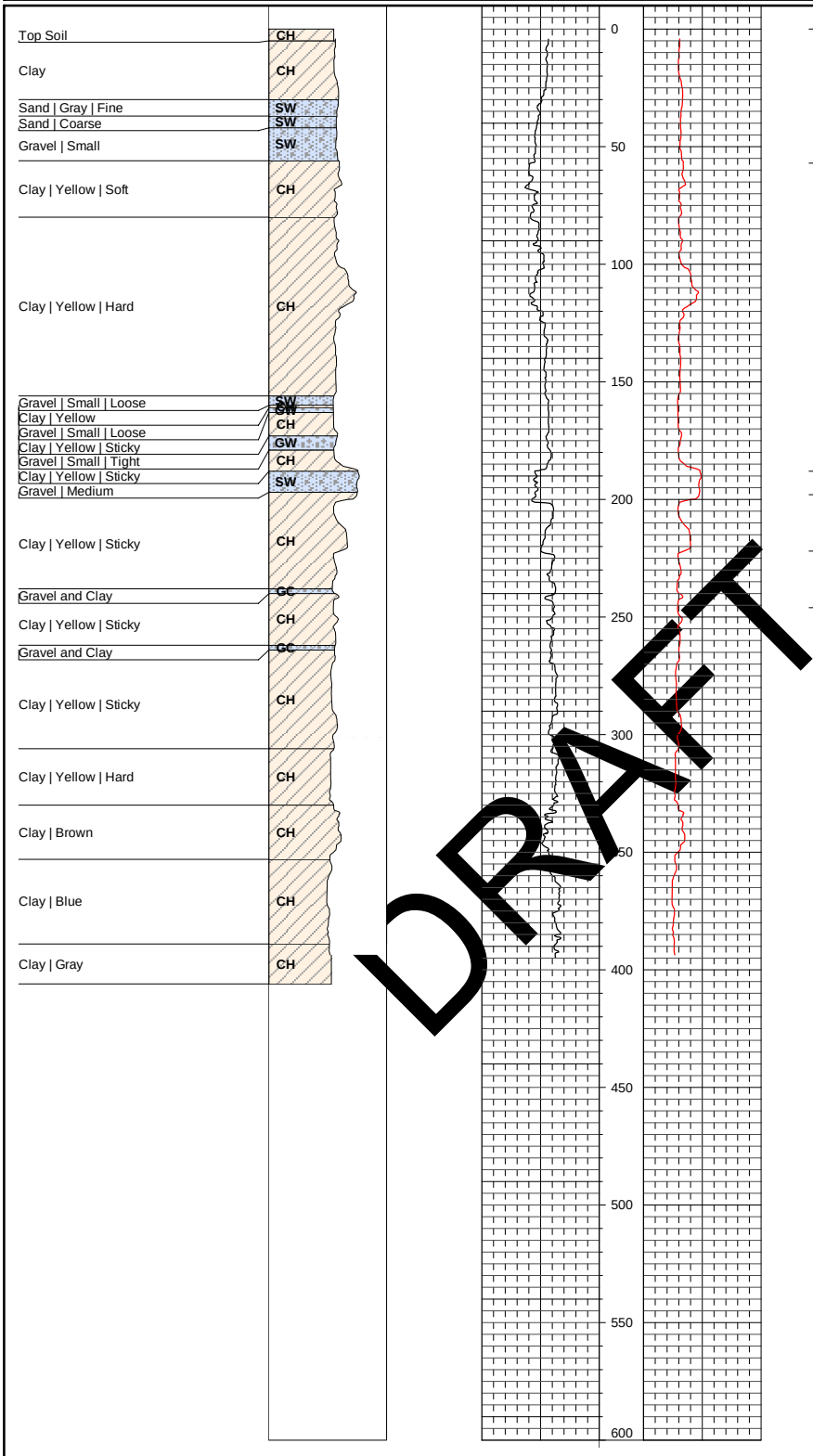
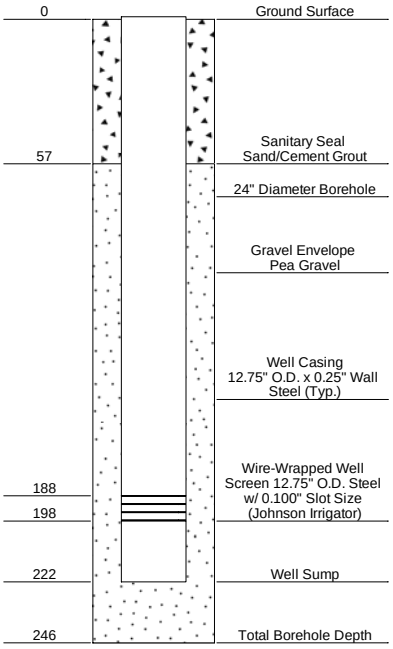
BOREHOLE DATA

WEST IRRIGATION WELL
PRODUCTION WELL AS-BUILT





Constructed 1974

SWL = 16.7 feet
Q = 500 gpm
PWL = 53.2 feet
Q/s = 13.7 gpm/foot

Water Quality

2/4/2010
Specific Conductance
1,500 umhos/cm
Nitrate as NO_3
44 mg/L

PROJECT NO. 8359.006 FIGURE 5	AS-BUILT PLANS FOR **NORTH DAVIS MEADOWS COUNTY SERVICE AREA WEST IRRIGATION WELL** YOLO COUNTY, CA	WOOD RODGERS 3301 C Street, Bldg. 100-B, Sacramento, CA 95816 Tel: 916.341.7760 Fax: 916.341.7767	DATE: 3/1/10 18:54 SCALE: DRAWN BY: S.SPAETH DESIGNED BY: E.E.LUHDORFF CHECKED BY: L. ERNST

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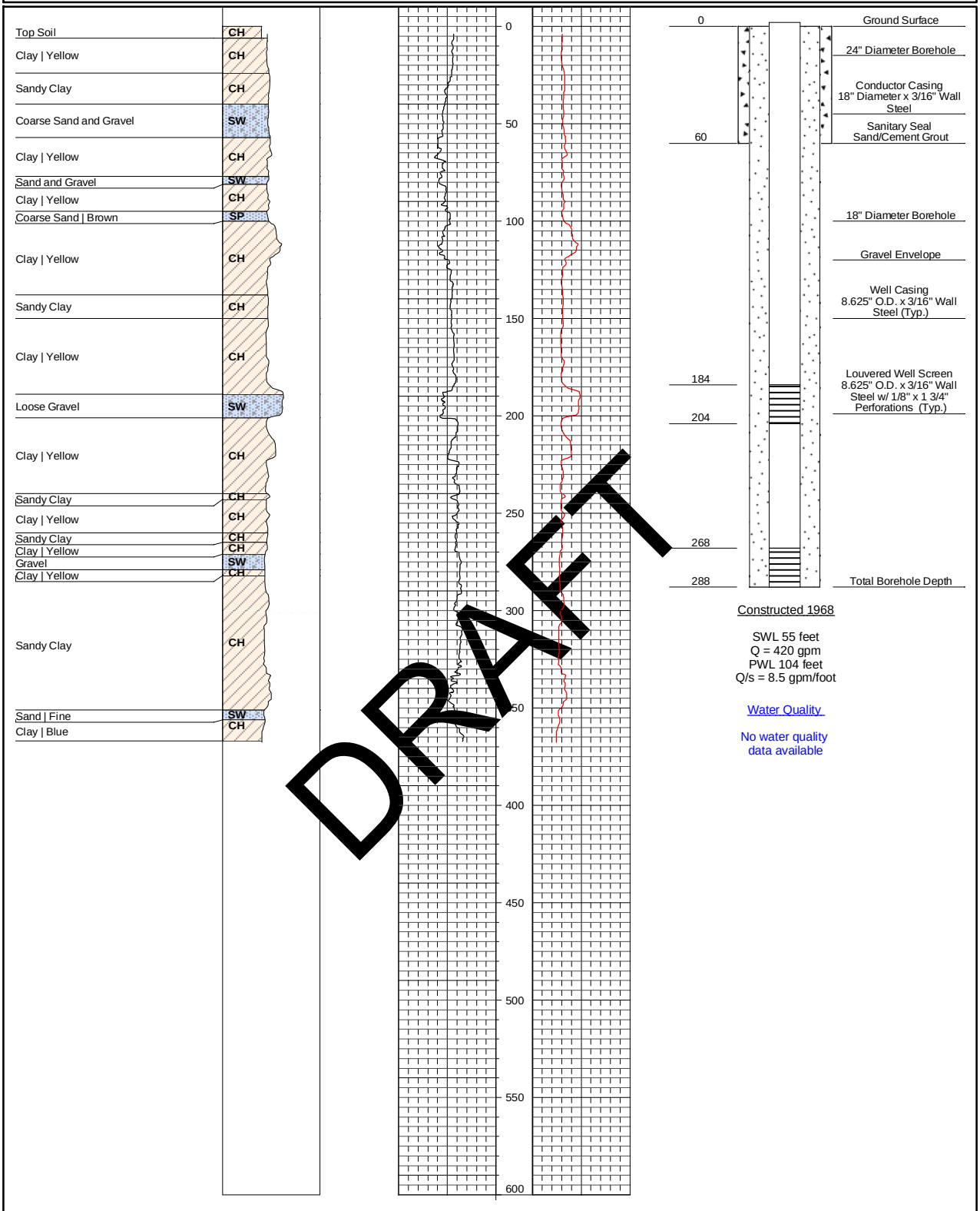
BOREHOLE DATA

(Geophysical Data from Davis Municipal Golf Course West Irrigation Well)

8-INCH DOMESTIC WELL AS-BUILT



Constructed 1968

SWL 55 feet
Q = 420 gpm
PWL 104 feet
Q/s = 8.5 gpm/foot

Water Quality

No water quality data available

PROJECT NO. **8359.006**	AS-BUILT PLANS FOR **NORTH DAVIS MEADOWS COUNTY SERVICE AREA DAVIS GOLF COURSE 8-INCH DOMESTIC WELL** YOLO COUNTY, CA	WOOD RODGERS DEVELOPING INNOVATIVE DESIGN SOLUTIONS 3301 C Street, Bldg. 100-B Sacramento, CA 95816 Tel: 916.341.7760 Fax: 916.341.7767	DATE: **3/2/10 13:21**
FIGURE **6**			SCALE: V: **1" = 50'**
			DRAWN BY: **S.SPAETH**
			DESIGNED BY: **CITY of DAVIS**
			CHECKED BY: **L.ERNST**

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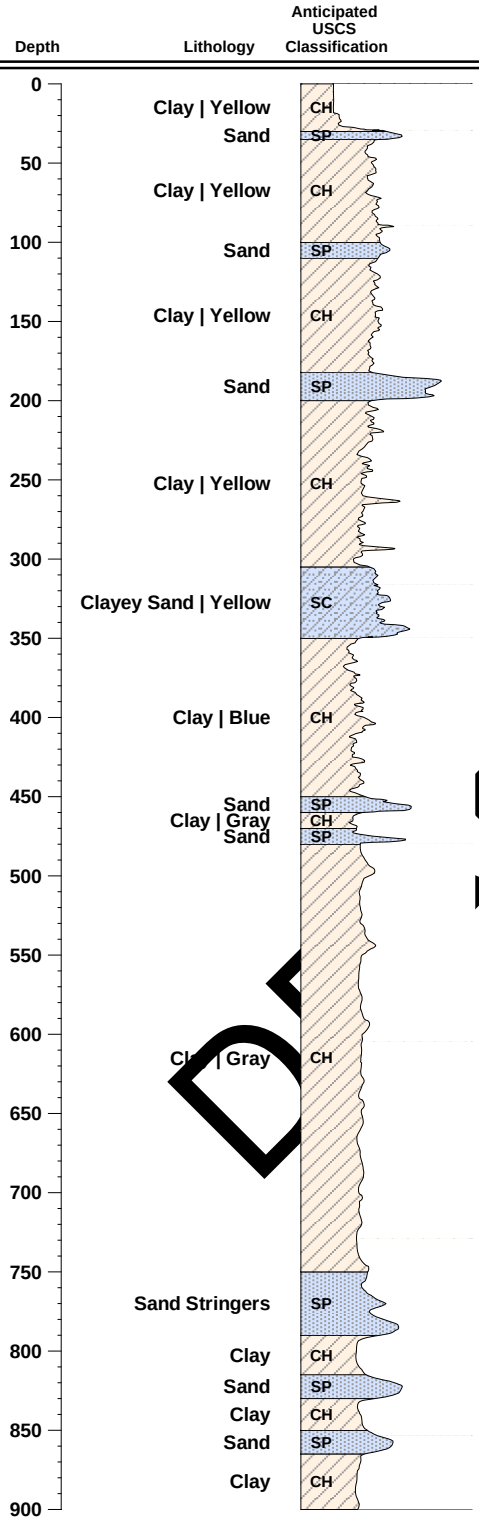
NORTH DAVIS MEADOWS COUNTY SERVICE AREA
CONCEPTUAL GEOLOGIC AND WATER QUALITY COLUMN



Anticipated Water Quality

EC - Likely Very High (above 900 µmhos/cm)
NO_3 - Likely Very High (above 45 mg/L)
Mn - Unknown
As - Unknown

EC - Likely Very High (above 900 µmhos/cm)
NO_3 - Likely Very High (above 45 mg/L)
Mn - Unknown
As - Unknown

EC - 1,500 µmhos/cm
NO_3 - Near or above 45 mg/L
Mn - <10 µg/L
As - 2 - 4 µg/L

EC - 800 - 1,000 µmhos/cm
NO_3 - <10 - 25 mg/L
Mn - <10 µg/L
As - 4 - 6 µg/L

EC - Unknown
NO_3 - Unknown (Likely <10 µg/L)
Mn - Unknown
As - Unknown

EC - 450 µmhos/cm
NO_3 < 10 mg/L
Mn - 10 - 40 µg/L
As - less than 5 µg/L

State of California DPH
Maximum Contaminant Level (MCL)

Constiuent	MCL/Units
Specific Conductance (EC)	900 µmhos/cm
Nitrate (NO_3)	45 mg/L
Manganese (Mn)	50 µg/L
Arsenic (As)	10 µg/L

PROJECT NO. 8359.006	CONCEPTUAL GEOLOGIC AND WATER QUALITYCOLUMN	WOOD RODGERS	DATE: 3/1/10 18:28
FIGURE 7	NORTH DAVIS MEADOWS COUNTY SERVICE AREA	3301 C Street, Bldg. 100-B, Sacramento, CA 95816 Tel: 916.341.7760 Fax: 916.341.7767	SCALE:
	YOLO COUNTY, CA		DRAWN BY: S.SPAETH
			DESIGNED BY: L. ERNST
			CHECKED BY: L. ERNST

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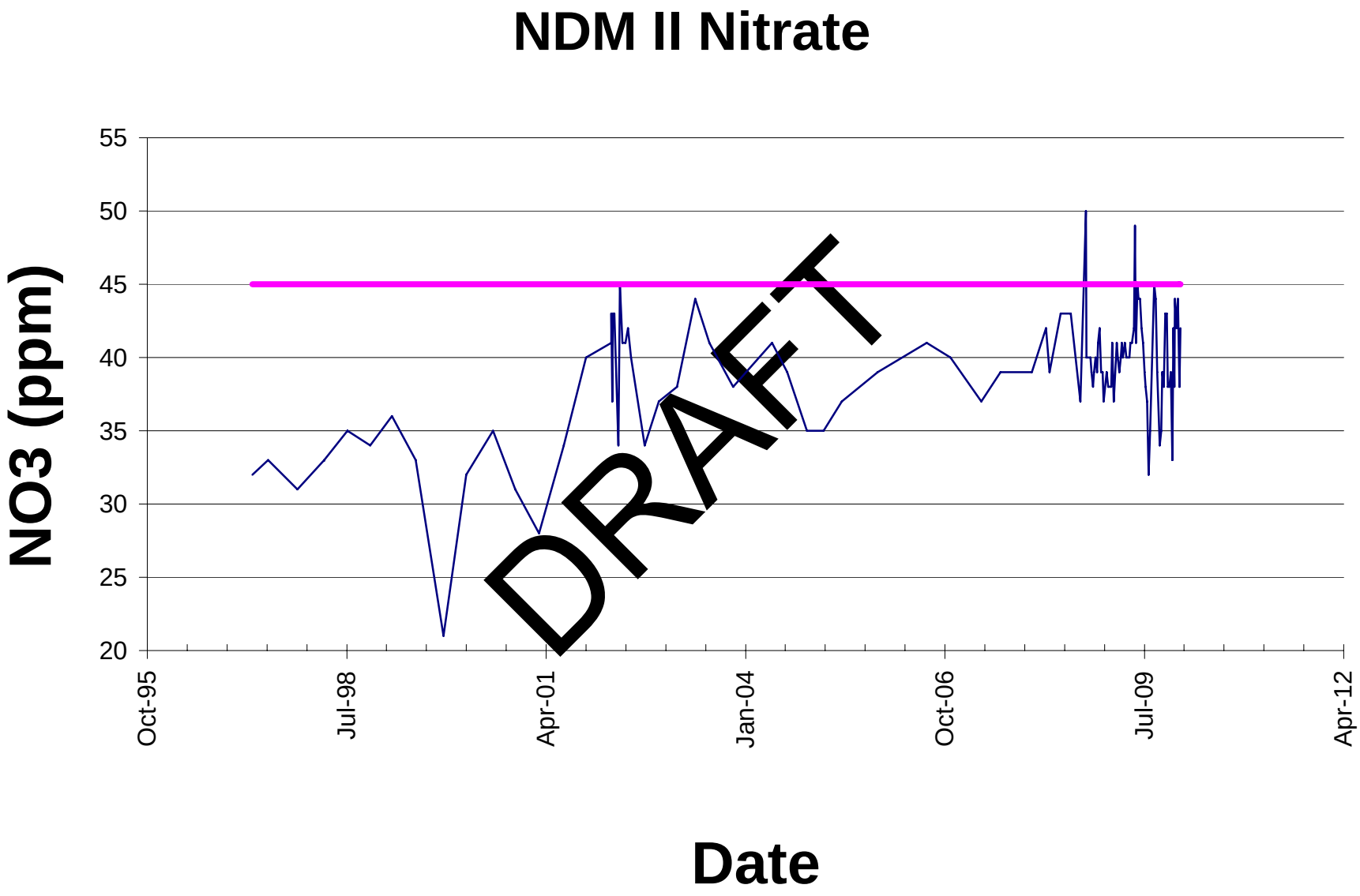

Figure 8

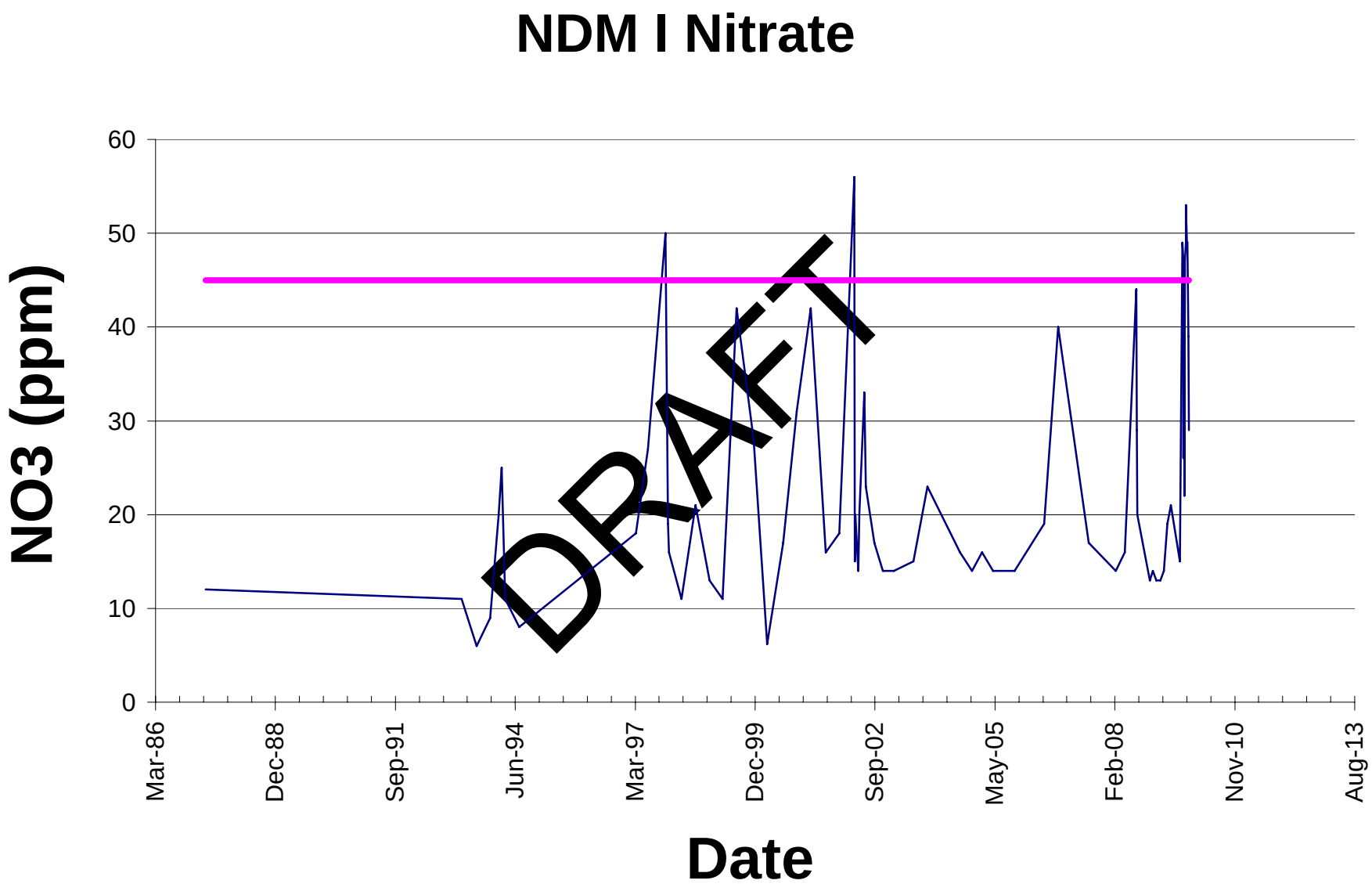

Figure 9

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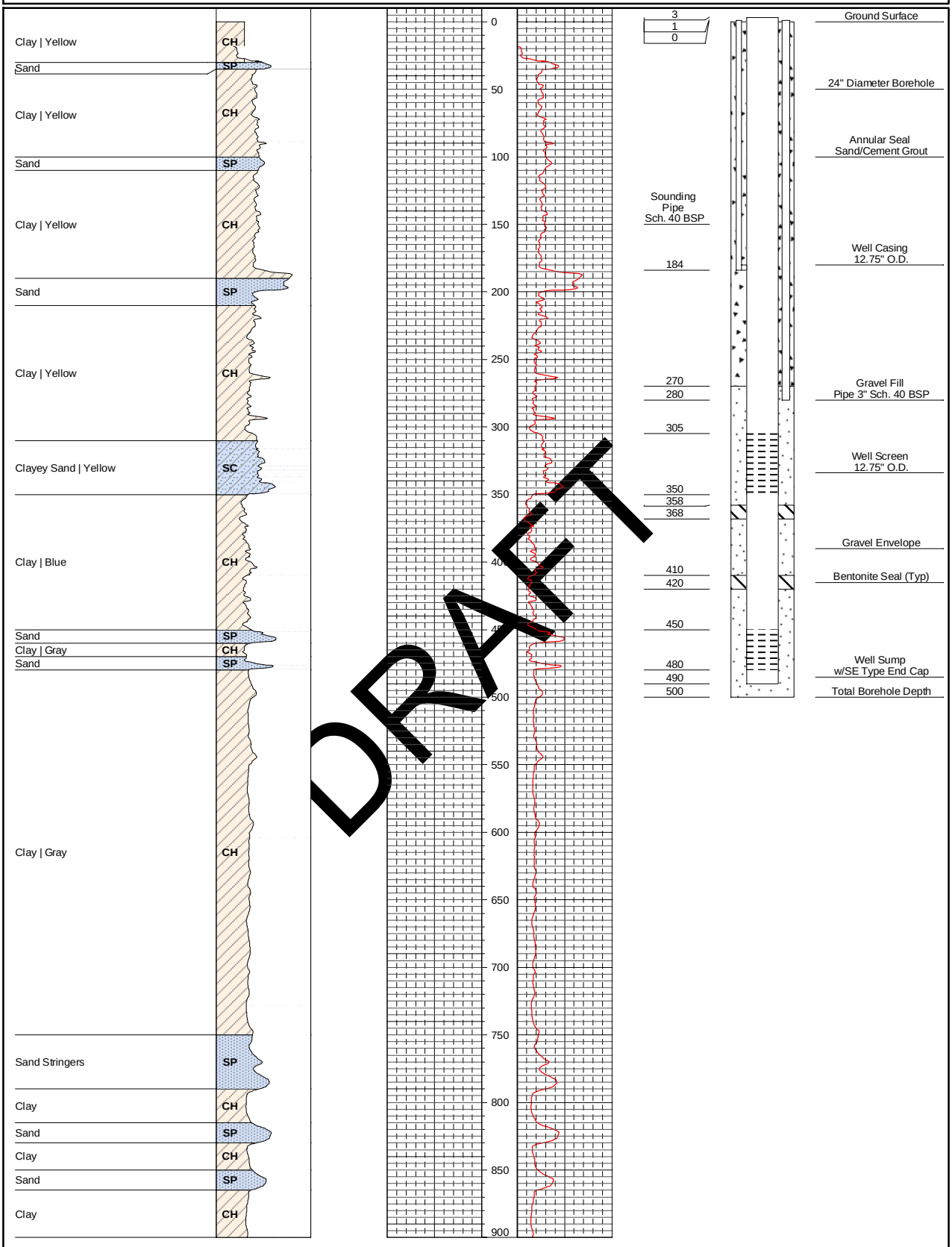
CONCEPTUAL BOREHOLE DATA

CONCEPTUAL PRODUCTION WELL DESIGN INTERMEDIATE AQUIFER OPTION



PROJECT NO. 8359.006	PRODUCTION WELL DESIGN FOR **NORTH DAVIS MEADOWS CONCEPTUAL PRODUCTION WELL INTERMEDIATE AQUIFER OPTION**	WOOD RODGERS DEVELOPING INNOVATIVE DESIGN SOLUTIONS 3301 C Street, Bldg. 100-B Sacramento, CA 95816 Tel: 916.341.7760 Fax: 916.341.7767	DATE: 3/2/10 10:48
FIGURE 10			SCALE:
	YOLO COUNTY, CA		DRAWN BY: S.SPAETH
			DESIGNED BY: L.ERNST
			CHECKED BY: L.ERNST

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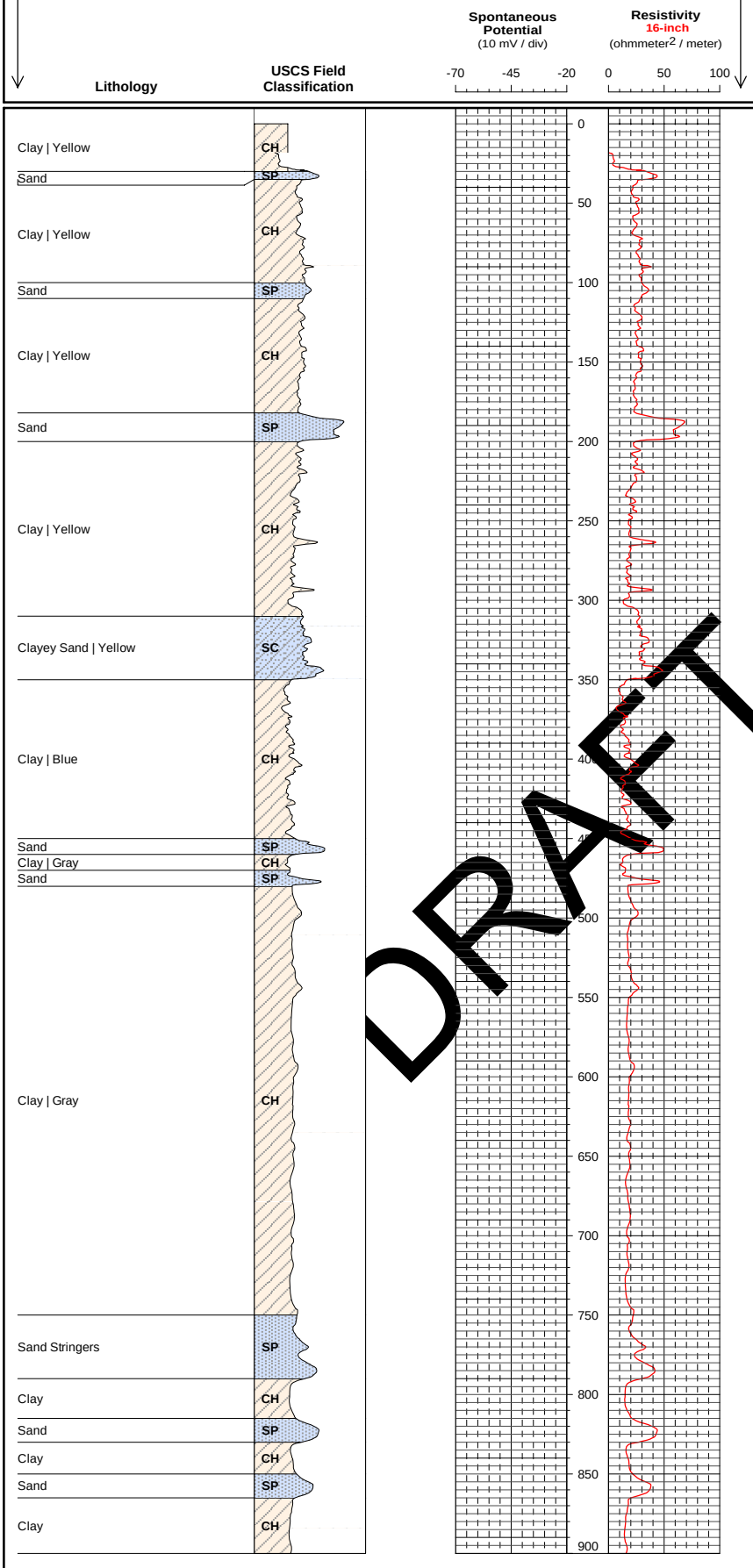
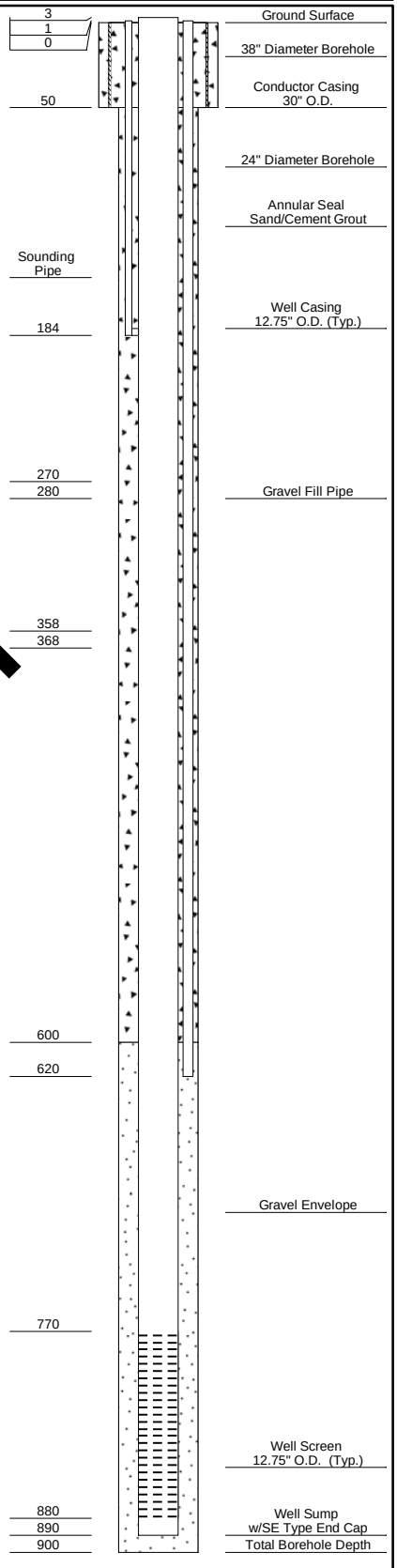
CONCEPTUAL BOREHOLE DATA



CONCEPTUAL PRODUCTION WELL DESIGN DEEP AQUIFER OPTION



PROJECT NO. **8359.006**	PRODUCTION WELL DESIGN FOR **NORTH DAVIS MEADOWS CONCEPTUAL PRODUCTION WELL DEEP AQUIFER OPTION**	WOOD RODGERS DEVELOPING INNOVATIVE DESIGN SOLUTIONS 3301 C Street, Bldg. 100-B Sacramento, CA 95816 Tel: 916.341.7760 Fax: 916.341.7767	DATE: **3/2/10 10:36**
FIGURE **11**			SCALE:
	YOLO COUNTY, CA		DRAWN BY: **S.SPAETH**
			DESIGNED BY: **L.ERNST**
			CHECKED BY: **L.ERNST**

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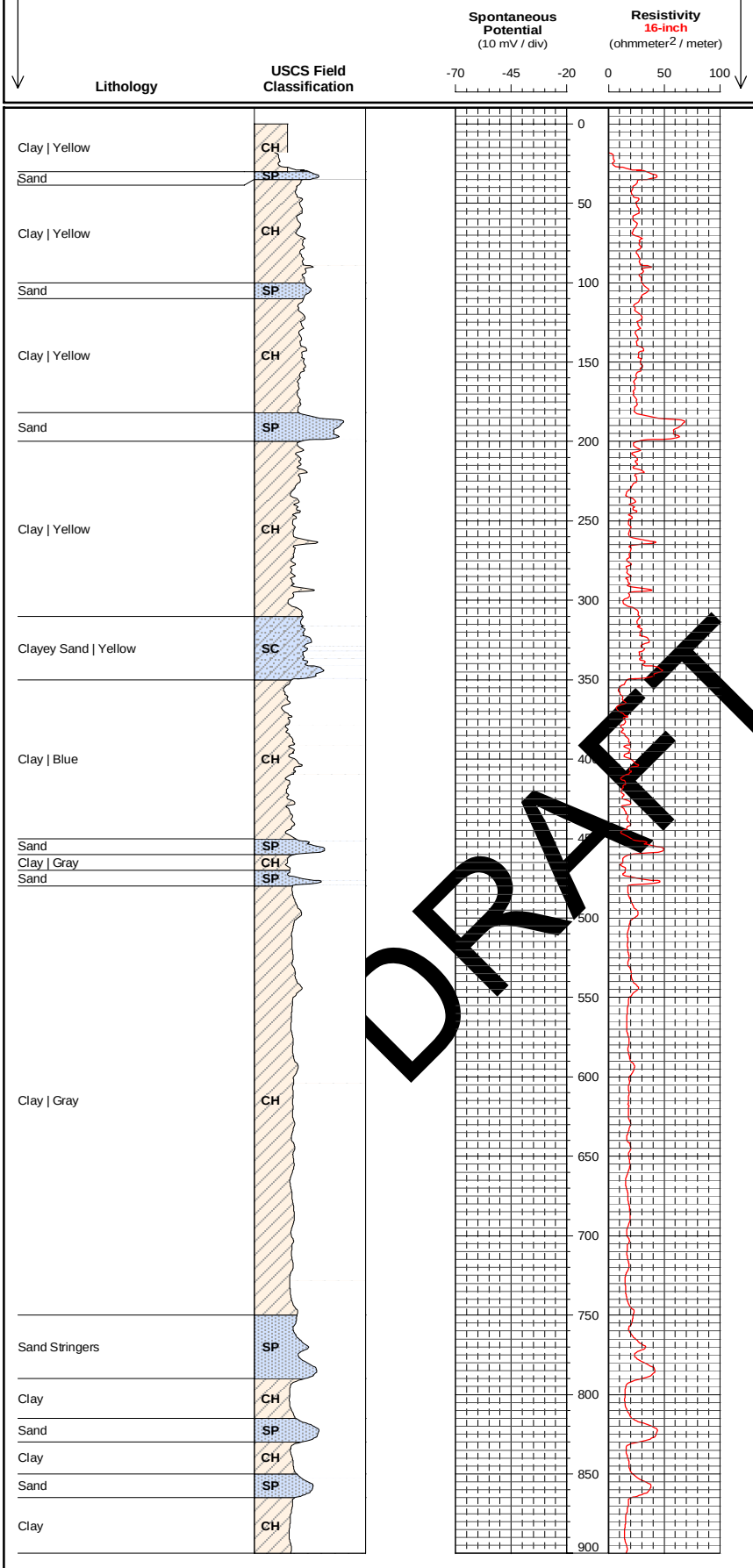
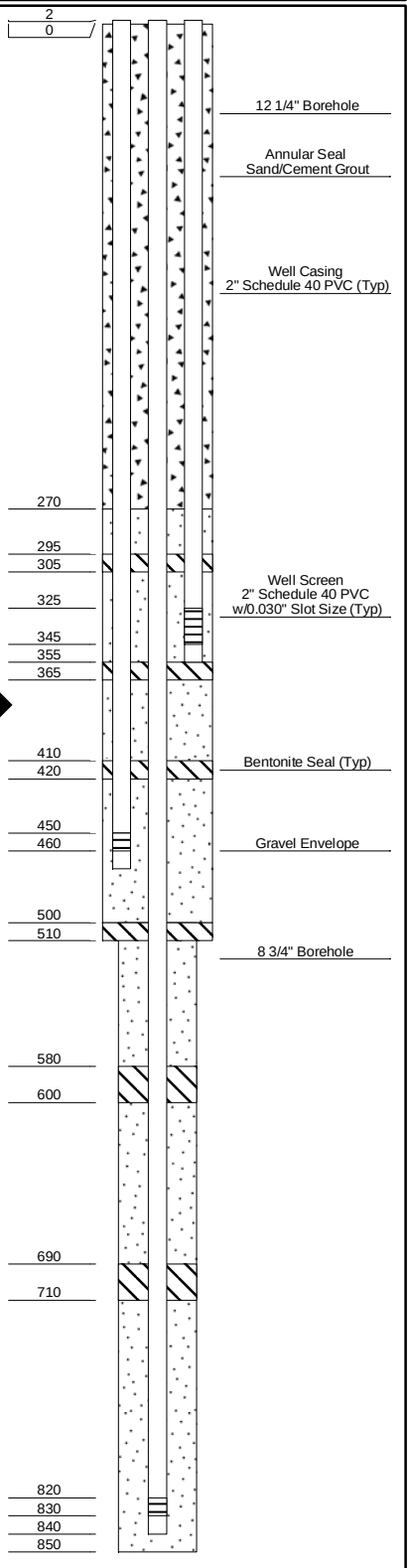
CONCEPTUAL BOREHOLE DATA



CONCEPTUAL DEEP MONITORING WELL DESIGN



PROJECT NO. **8359.006**	CONCEPTUALMONITORING WELL DESIGN FOR **NORTH DAVIS MEADOWS DEEP MONITORING WELL**	WOOD RODGERS DEVELOPING INNOVATIVE DESIGN SOLUTIONS 3301 C Street, Bldg. 100-B Sacramento, CA 95816 Tel: 916.341.7760 Fax: 916.341.7767	DATE: **3/2/10 10:44**
FIGURE **12**			SCALE:
	YOLO COUNTY, CA		DRAWN BY: **B. DEMUCHA**
			DESIGNED BY: **L. ERNST**
			CHECKED BY:

J:\Jobs\8359_Davis, City of\8359.006 North Davis Meadows CSA\Strater

NO.	DESCRIPTION	ENGR. INIT	BY	DATE APPROVED

ENGINEER'S ESTIMATE

North Davis Meadows
Intermediate Aquifer Option

Item No.	Description	Units	Unit Cost Estimate	Quantity	Extended Cost Estimate
1	Project Mobilization/Demobilization	LS	$30,000	1	$30,000
2	Test Hole Drilling	LF	$30	500	$15,000
3	Geophysical (E-Log)	EA	$2,500	1	$2,500
4	24-inch Borehole Drilling	LF	$60	500	$30,000
5	12.75-inch O.D. Steel Well Casing	LF	$60	418	$25,080
6	12.75-inch O.D. Well Screen	LF	$200	75	$15,000
7	2-inch Dia. Sound Tube Pipe, Sch 40 BSP	LF	$10	185	$1,850
8	3-inch Dia. Gravel Fill Pipe, Sch 40 BSP	LF	$12	281	$3,372
9	Gravel Envelope & Bentonite Seals	LF	$55	230	$12,650
10	Annular Seal	LF	$40	270	$10,800
11	Test Pump Installation	LS	$8,000	1	$8,000
12	Well Development	EA	$12,000	1	$12,000
13	Well and Aquifer Testing (Test Pumping)	HR	$250	24	$6,000
14	Plumbness & Alignment Test	EA	$3,000	1	$3,000
15	Site Cleanup and Records	LS	$3,000	1	$3,000
16	Well Disinfection	EA	$1,000	1	$1,000
17	Standby Time	HR	$150	4	$600
18	Pump Station	LS	$250,000	1	$250,000
19	Engineering	LS	$90,000	1	$90,000
					$519,852

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS

Table 2

ENGINEER'S ESTIMATE

North Davis Meadows
Deep Aquifer Option

Item No.	Description	Units	Unit Cost Estimate	Quantity	Extended Cost Estimate
1	Project Mobilization/Demobilization	LS	$30,000	1	$30,000
2	30-inch O.D. Conductor Casing and Sanitary Seal	LF	$400	50	$20,000
3	Test Hole Drilling	LF	$30	850	$25,500
4	Geophysical (E-Log)	EA	$2,500	1	$2,500
5	24-inch Borehole Drilling	LF	$60	850	$51,000
6	12.75-inch O.D. Steel Well Casing	LF	$60	783	$46,980
7	12.75-inch O.D. Well Screen	LF	$200	110	$22,000
8	2-inch Dia. Sound Tube Pipe, Sch 40 BSP	LF	$10	185	$1,850
9	3-inch Dia. Gravel Fill Pipe, Sch 40 BSP	LF	$12	621	$7,452
10	Gravel Envelope	LF	$40	300	$12,000
11	Annular Seal	LF	$40	600	$24,000
12	Test Pump Installation	LS	$8,000	1	$8,000
13	Well Development	EA	$15,000	1	$15,000
14	Well and Aquifer Testing (Test Pumping)	HR	$250	24	$6,000
15	Plumbness & Alignment Test	EA	$3,000	1	$3,000
16	Site Cleanup and Records	LS	$3,000	1	$3,000
17	Well Disinfection	EA	$1,000	1	$1,000
18	Standby Time	HR	$150	4	$600
19	Pump Station	LS	$250,000	1	$250,000
20	Engineering	LS	$100,000	1	$100,000
					$629,882

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS

Table 3