

Summary of First-Year Operations and Performance of the Utica Aquifer and North Lake Basin Wetlands Restoration Project in October 2004–November 2005

prepared by Environmental Science Division Argonne National Laboratory



The University of Chicago for the U.S. Department of Energy



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by Applied Geosciences and Environmental Management Section Environmental Science Division, Argonne National Laboratory

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Notation

BGL below ground level

CCC Commodity Credit Corporation

°F degree(s) Fahrenheit

ft foot (feet) gal gallon(s)

gpm gallon(s) per minute

GWEX groundwater extraction

hr hour(s)

μg/L microgram(s) per liter

mph mile(s) per hour MW monitoring well

NDEQ Nebraska Department of Environmental Quality

NGPC Nebraska Game and Parks Commission

NPDES National Pollutant Discharge Elimination System

USDA U.S. Department of Agriculture

VOC volatile organic compound

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1 Introduction

This document summarizes the performance of the groundwater restoration systems installed by the Commodity Credit Corporation of the U.S. Department of Agriculture (CCC/USDA) at the former CCC/USDA grain storage facility in Utica, Nebraska, during the initial period of system operation, from October 29, 2004, until November 31, 2005.

In the project at Utica, the CCC/USDA is cooperating with multiple state and federal agencies to remove carbon tetrachloride contamination from a shallow aquifer underlying the town and to provide supplemental treated groundwater for use in the restoration of a nearby wetlands area. Argonne National Laboratory has assisted the CCC/USDA by providing technical oversight for the aquifer restoration effort and facilities during this review period.

This document presents overviews of the aquifer restoration facilities (Section 2) and system operations (Section 3), then describes groundwater production results (Section 4), groundwater treatment results (Section 5), and modifications and costs during the review period (Section 6). Section 7 summarizes the first year of operation.

2 Overview of the Aquifer Restoration Facilities at Utica

The principal components of the groundwater restoration systems at Utica are shown in Figure 2.1. The facilities consist of two main operating units, as described below. The facilities include four groundwater extraction (GWEX) wells. Table 2.1 summarizes construction details for these wells. The well registration forms are in Appendix A.

2.1 Wells GWEX1-GWEX3 and the Spray Irrigation Treatment Units

Extraction wells GWEX1–GWEX3, located in the northern portion of the town, are used to extract contaminated groundwater from the upgradient portion of the contaminant plume. The wells are linked by a distribution system that selectively carries untreated groundwater to either of two discharge points in the northern and southern subbasins of the North Lake Basin Wildlife Management Area (Figure 2.1). At each discharge point, the water is treated to remove carbon tetrachloride by using a custom spray irrigation treatment unit (Figure 2.2). The three extraction wells are operated simultaneously to maintain a critical operating pressure at each treatment unit.

Wells GWEX1–GWEX3 are operated intermittently during the year, subject to local weather conditions and in consultation with the Nebraska Game and Parks Commission (NGPC). NGPC owns most of the property occupied by the wetlands and has administrative and technical responsibility for management of the wildlife area.

TABLE 2.1 Summary of construction details for GWEX wells at Utica.

		Depth (ft BGL)		
Well	Depth	Screen Interval	Gravel Pack Interval	Casing Diameter (in.)
GWEX1	132	106–126	97–132	8
GWEX2	148	110-145	106-148	8
GWEX3	146	105-140	101-146	8
GWEX4	150	115–145	110–150	6

2.2 Well GWEX4 and the Conventional Air Stripper

Extraction well GWEX4 is located near the downgradient toe of the carbon tetrachloride plume and is operated continuously as a containment well. Groundwater produced from GWEX4 is treated by using a conventional (shallow-tray) air stripping technique, and the effluent is discharged to the surface for reinfiltration into the shallow Utica aquifer.

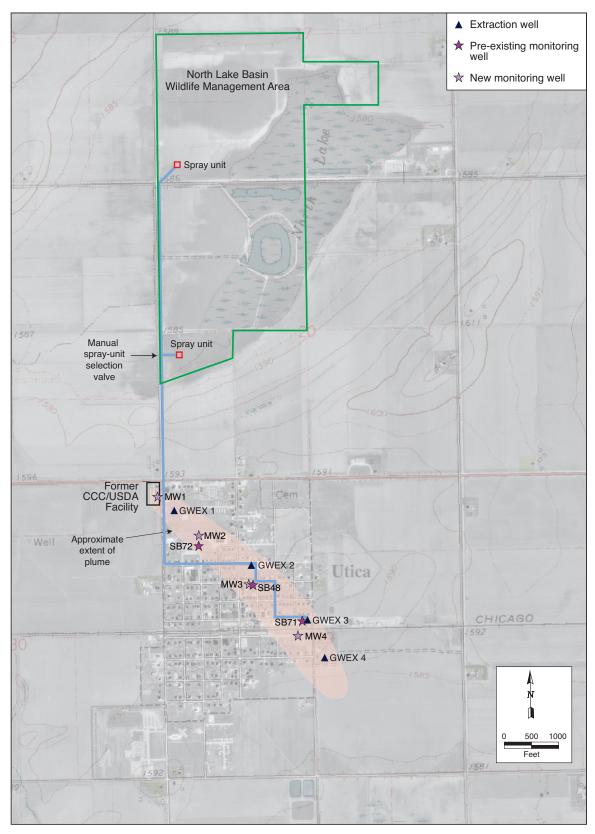


FIGURE 2.1 Locations of the restoration facilities, contaminant plume, and permanent monitoring wells at Utica.



FIGURE 2.2 Spray irrigation unit in operation at Utica.

3 Overview of System Operations

3.1 Operation of Wells GWEX1-GWEX3 and the Spray Irrigation Treatment Units

Routine operation of wells GWEX1–GWEX3 and the spray irrigation treatment units began on November 22, 2004. The wells were pumped intermittently, under automated control, during 11 of the 13 months during the review period. The daily operation of the spray treatment units is governed primarily by weather conditions; to ensure effective removal of the carbon tetrachloride and to prevent excessive drift of the resulting spray discharge, a minimum air temperature of 40°F and sustained winds of less than 15 mph are required for operation.

Wells GWEX1–GWEX3 and the treatment units were not operated in late May 2005 and all of June and July 2005, because heavy storms in early May caused rapid, widespread flooding throughout the Utica area and persistent high water levels in the North Lake Basin and on surrounding private properties. The pumping was curtailed at the request of the NGPC, in response to concerns expressed by the neighboring property owners regarding the continued flooding.

For reasons including apparent power supply fluctuations and outages, unexpected shutdowns of the wells and the spray treatment units occurred sporadically during the review period. Investigations to determine the quality of the electrical power supplied by the local utility company led to adjustments to the drive units for the well pumps that reduced the frequency of shutdowns. Occasional pumping interruptions have continued, however. Investigation into the cause(s) of these shutdowns were still in progress at the end of the review period.

Treated groundwater from the spray irrigation systems was selectively routed to both the north and south subbasins at the request of the NGPC. Groundwater was discharged exclusively to the north subbasin during the winter of 2004 and early spring of 2005, then to both subbasins during the remainder of the review period.

3.2 Operation of Well GWEX4 and the Conventional Air Stripper

Operation of well GWEX4 and the associated air stripper began on October 29, 2004. GWEX4 operated continuously during the review period, with only two brief interruptions of less than one day each. The interruptions were as follows:

- On August 12, 2005, the equipment was temporarily shut down to permit the local utility company to repair power supply connections to the well house.
- On October 26, 2005, the system was shut down for routine inspection and cleaning of the shallow-tray air stripping unit.

Treated groundwater from well GWEX4 is discharged to an open ditch that serves as part of Utica's storm drainage system. The ditch borders a county road leading eastward from the town, as well as an adjacent private farm property. During the review period, Argonne received no reports of drainage or other problems associated with discharge from GWEX4.

4 Groundwater Production Results

The volumes of groundwater extracted from the Utica aquifer, treated, and discharged are summarized in Table 4.1.

4.1 Production by Wells GWEX1-GWEX3

Wells GWEX1–GWEX3 are equipped with electronically controlled pump drive units linked to digital flow meters that automatically and continuously adjust the flow from each well to maintain user-specified pumping rates. The programmed flow rates for these wells were as follows:

- GWEX1, 50 gpm
- GWEX2, 180–200 gpm
- GWEX3, 125 gpm

The selected rates were achieved, within ± 1 gpm, throughout the review period.

Wells GWEX1–GWEX3 were pumped for approximately 1,560 hr during the review period and discharged approximately 34.6 million gallons (106 acre-feet) of treated water to the North Lake Basin wetlands. Approximately 64% of the total production was routed to the northern wetlands subbasin, at the request of the NGPC.

4.2 Production by Well GWEX4

Measured groundwater pumping rates (determined from an inline flow meter) at GWEX4 ranged from approximately 51 gpm to 64 gpm. Periodically, the rates were adjusted manually to compensate for a very slow decline in the flow rate from the well over time. The groundwater volumes pumped in any one complete month (Table 4.1) ranged from approximately 2.1 million gallons to 2.7 million gallons. A total of 31.7 million gallons (97.5 acre-feet) of groundwater was treated and discharged during the review period, at a net average pumping rate of approximately 56 gpm.

TABLE 4.1 GWEX operation and groundwater production data for the first year of restoration at Utica.^a

							GWE:	X4 ^d
		dwater Produ WEX1–GWE		Operating Time	Volume Dis Wetland	•	Groundwater	Operating
Month	GWEX1	GWEX2	GWEX3	GWEX1–3 ^c (hr)	North	South	Produced (gal)	Time (days)
Oct 2004	_e	_	_	_	_	_	263,520	3
Nov 2004	130,800	470,880	327,000	43.6	928,680	_	2,687,040	30
Dec 2004	151,800	546,480	379,500	50.6	1,077,780	_	2,660,544	31
Jan 2005	21,000	75,600	52,500	7.0	149,100	_	2,544,480	31
Feb 2005	288,900	1,040,040	722,250	96.3	2,051,190	_	2,298,240	28
Mar 2005	585,300	2,107,080	1,463,250	195.1	4,155,630	_	2,620,368	31
Apr 2005	407,944	1,631,776	1,019,860	135.9	1,780,680	1,278,900	2,397,600	30
May 2005	243,933	975,733	609,833	81.3	_	1,829,500	2,410,560	31
Jun 2005	_		_ `	_	_	_	2,332,800	30
Jul 2005	_	_	_	_	_	_	2,332,800	31
Aug 2005	200,827	803,307	502,067	66.9	1,506,200	_	2,096,460	31
Sept 2005	899,880	3,599,520	2,249,700	300.0	3,644,514	3,104,586	2,273,000	30
Oct 2005	1,201,093	4,804,373	3,002,733	400.5	2,648,411	6,359,789	2,455,905	31
Nov 2005	546,267	2,185,067	1,365,667	182.1	4,097,000	_	2,379,375	31
TOTAL	4,677,744	18,239,856	11,694,360	1,559.3	22,039,185	12,572,775	31,752,692	399

^a Combined total production: 66,364,652 gal. Total production to wetlands: 34,611,960 gal.

^b Routine operation of GWEX1–GWEX3 and the spray irrigation treatment units began on November 22, 2004.

^c Wells GWEX1–GWEX3 operate simultaneously.

^d Routine operation of GWEX4 and the air stripping unit began on October 29, 2004.

^e Unit not in operation.

5 Groundwater Treatment Results

Treated groundwater at Utica is discharged under a National Pollutant Discharge Elimination System (NPDES) Permit, number NE0137456, issued by the Nebraska Department of Environmental Quality (NDEQ) on October 1, 2004.

To comply with the NPDES permit, samples of treated groundwater are collected monthly

- At the outlet of the air stripping unit at GWEX4 and
- From the spray discharge at each of the irrigation treatment units (during months of operation).

The samples are analyzed to determine the residual concentrations of carbon tetrachloride in the treated groundwater and the pH of the effluent. The results of these analyses are reported to the NDEQ quarterly.

The discharges of treated groundwater at Utica are considered by the NDEQ to contribute to the surface waters of the state. On this basis, NDEQ has specified the following compliance limits for the outfall from each treatment unit:

- A target maximum residual carbon tetrachloride concentration of 44.2 µg/L
- An acceptable pH range of 6.5 to 9.0

In conjunction with the compliance sampling, Argonne collects monthly samples of the untreated groundwater from each extraction well. The samples are analyzed for volatile organic compounds (VOCs) to enable estimation of the following:

- Carbon tetrachloride removal efficiencies for the treatment units
- Quantities of carbon tetrachloride removed from the contaminated aquifer

The results of the sampling and analyses during the review period are summarized in Tables 5.1 and 5.2.

5.1 Results for Wells GWEX1–GWEX3, with Treatment by Spray Irrigation

The concentrations of carbon tetrachloride found in the untreated groundwater from extractions wells GWEX2 and GWEX3 remained fairly stable and showed no clear trends throughout the first year of pumping (Table 5.1). Carbon tetrachloride concentrations in the produced water from GWEX2 ranged from 57 μ g/L to 118 μ g/L; the concentrations at GWEX3 ranged from 88 μ g/L to 196 μ g/L.

Well GWEX1, which is located in the upgradient portion of the identified plume, was constructed to intercept carbon tetrachloride contamination in the upper portion of the Utica aquifer, near the former CCC/USDA grain storage facility. Carbon tetrachloride was not detected in the untreated groundwater from GWEX1 in the first four months of its operation (November 2004–February 2005; Table 5.1); however, contamination began to appear at increasing levels in March–early May 2005, before pumping temporarily ceased during the summer months (see Section 3.1). The concentrations of carbon tetrachloride detected at this well have risen steadily since pumping began again in August 2005. A maximum carbon tetrachloride concentration of 74 µg/L was detected at GWEX1 in November 2005.

The groundwater produced from wells GWEX1–GWEX3 is combined into a single stream for conveyance to the wetlands via a common pipeline. This combined flow is also sampled monthly, as an indicator of the weighted average concentration of carbon tetrachloride in the untreated groundwater supplied to the spray irrigation treatment units. The measured concentrations in the combined flow showed minimal variation during the review period, ranging from $100 \, \mu g/L$ to $122 \, \mu g/L$.

Treated groundwater sprayed from the irrigation units is collected for analysis at the following four locations at the treatment site during each sampling event:

- Beneath the center point of the "west" irrigation span
- Beneath the center point of the "center" irrigation span

TABLE 5.1 Analytical results for carbon tetrachloride in untreated groundwater samples and treated effluent samples.

						Carbon	Tetrachloride	e Concen	tration (µg	/L)				
	GW	EX1–GWE	X3 Untre	ated	N	lorth Spray	/ Unit Effluen	t		luent				
Month	GWEX1	GWEX2	GWEX3	Mixed ^a	West ^b	Centerb	East ^b	Max ^c	West ^b	Center ^b	East ^b	Max ^c	GWEX4 Untreated	Stripper Effluent
Nov 2004	ND ^d	103	160	115	ND	2.3	ND	ND	_e	_	_	_	77–94 ^f	ND
Dec 2004	ND	108–118	98	112	2.2	1.2	ND	1.6	_	_	_	_	88–95	ND
Jan 2005	ND	90	175–196	103	1.9	1.6-1.7	1.6	1.3	_	_	_	_	74–88	ND
Feb 2005	ND	104	133–142	101	2.0	7.2	5.6-6	ND	_	_	_	_	88-94	ND
Mar 2005	2.5	135	118–143	111	1.5	ND-1.4	0.9 J ^g –1.6	ND	_	_	_	_	89–92	ND
Apr 2005	20	83–87	120	100-102	1.8	0.4	0.7J	1.2	4.0-4.2	0.4J-0.5 J	0.8 J	5.1-5.3	87–91	ND
May 2005	22	98-104	121	103	_	_	_	_	0.4 J	0.7 J	0.8 J	0.6 J-0.8 J	65–77	ND
Jun 2005	_	_	_	_	_	_	_	_	_	_	_	_	65–68	ND
Jul 2005	_	_	_	-	_	-	-	_	_	_	_	_	66–72	ND
Aug 2005	6.4	97-100	144	117	0.8 J	6.1-6.2	0.8 J	ND	_	_	_	_	56-58	ND
Sep 2005	37	108	170-183	115	0.7 J	0.7 J	0.3 J	0.3 J	1.8–1.9	0.2 J	0.4 J	ND	62-67	ND
Oct 2005	51	57–61	88	101	1.4	0.4 J	1.6	1.8	1.2	0.3 J	0.5 J	0.5 J-0.6 J	55–57	ND
Nov 2005	74	109–114	166	114–122	5.0	4.0	1.7	0.7 J	-	-	_	-	53	ND

^a Analytical results for samples from the combined flows of GWEX1–GWEX3.

^b Samples of spray collected below the center point of the respective irrigation span.

^c Samples of spray collected at the estimated location of maximum spray outfall.

 $^{^{\}rm d}\,$ ND, not detected at a method detection limit of 0.1 µg/L.

e Unit not in operation.

^f Ranges of values represent both primary samples and quality control replicates and duplicates.

g Qualifier J indicates an estimated concentration below the quantitation limit of 1 µg/L for the purge-and-trap method.

TABLE 5.2 Values for pH in untreated groundwater samples and treated effluent samples.

				рН				
		GWEX1–GWI	EX3 Untreated	d	North Spray	South Spray	GWEX4	Stripper
Month	GWEX1	GWEX2	GWEX3	Mixed ^a	Unit ^b	Unit ^b	Untreated	Effluent
Nov 2004	NR ^c	NR	NR	NR	7.7	_d	6.28-6.67 ^e	7.76–8.06
Dec 2004	6.80	6.76	6.72	6.80	7.7 7.6	_	8.23	7.70-8.00
Jan 2005	6.89–7.27	6.86–7.13	7.23–7.24	7.35–7.53	7.82–7.84	_	6.74	7.82
Feb 2005	6.44–6.62	6.94–7.10	7.07	7.15–7.20	7.36–7.68	_	6.29	7.82
Mar 2005	7.16–7.30	7.10–7.21	7.05–7.21	7.23–7.25	7.98–7.99	_	6.46	7.85
Apr 2005	6.91–7.00	7.08–7.17	7.02–7.07	7.08–7.18	7.58	7.85	6.45–6.56	7.83–7.98
May 2005	7.10–7.15	7.09–7.12	7.11–7.22	7.20-7.24	_	7.82-7.90	6.55-6.65	7.93-8.14
Jun 2005	_	_	_	_	_	_	6.90-6.93	8.03-8.34
Jul 2005	_	_	_	_	_	_	6.92-6.95	8.34-8.35
Aug 2005	7.03-7.04	6.90-7.04	6.87-7.18	7.00-7.09	7.46-7.52	_	6.37-6.40	7.83-7.86
Sep 2005	6.93-6.96	6.90-6.96	7.06-7.09	6.77-6.81	7.60-7.73	7.70-7.82	6.28-6.37	7.58-7.69
Oct 2005	7.22	7.14	7.05	7.15	7.01-8.12	7.98-8.15	6.30-6.36	7.47-7.73
Nov 2005	7.04–7.11	6.98–6.99	6.97–6.99	6.73–6.87	8.01–8.18	_	6.59–6.78	8.03-8.24

a Values for samples from the combined flows of GWEX1–GWEX3.

- Beneath the center point of the "east" irrigation span
- At a fourth location visually chosen to reflect the estimated site of maximum spray outfall ("max" value; position varying from month to month; based on prevailing wind and spray conditions at the time of sampling)

The results summarized in Table 5.1 show that, with only a few exceptions, the concentrations of all spray samples collected during the review period were below the maximum contaminant level of $5.0 \,\mu\text{g/L}$ promulgated by the U.S. Environmental Protection Agency for carbon tetrachloride in drinking water. The *maximum* carbon tetrachloride level identified for a single sample in spray discharged from the irrigation treatment units was $7.2 \,\mu\text{g/L}$. The *average* concentration of carbon tetrachloride in the treated groundwater discharged to the wetlands was $1.45 \,\mu\text{g/L}$. The concentrations of carbon tetrachloride in all spray samples were below the

b Average value for spray samples collected at one or more locations at the discharge site.

^c NR, not recorded.

d Unit not in operation.

^e Ranges indicate pH values over the sampling period each month.

maximum target concentration (44.2 $\mu g/L$) allowed under the NPDES permit, by roughly an order of magnitude.

The results of the groundwater and spray sample analyses suggest the following *minimum* carbon tetrachloride removal efficiency values for the spray irrigation treatment process:

- More than 94% (based on data for individual samples)
- Approximately 99% (based on the average concentration delivered to the wetlands during the review period)

The results of pH measurements recorded for samples of the treated spray discharge are presented in Table 5.2. In all cases, the observed pH levels (7.01 to 8.18) were within the acceptable range (6.5 to 9.0) specified under the NPDES permit.

5.2 Results for Well GWEX4, with Treatment by Air Stripping

Carbon tetrachloride concentrations in the untreated groundwater produced by GWEX4 were relatively stable (53 μ g/L to 95 μ g/L) during the review period; however, a possible trend of gradually decreasing levels is suggested in the data of Table 5.1. Carbon tetrachloride was not detected in the effluent from the air stripping unit throughout the review period, indicating a carbon tetrachloride removal efficiency of > 99% for this process. Measured pH levels in all samples of the air stripper effluent (7.01 to 8.35; Table 5.2) were within the acceptable range (6.5 to 9.0) specified under the NPDES permit.

5.3 Estimated Removal of Carbon Tetrachloride from the Utica Aquifer

The groundwater production and carbon tetrachloride concentration data presented in Tables 4.1 and 5.1, respectively, can be used to estimate the total quantity of carbon tetrachloride extracted by wells GWEX1–GWEX4 from October 29, 2004, to November 31, 2005. The results of these calculations, summarized in Table 5.3, indicate that approximately 23 kg (3.8 gal) of carbon tetrachloride was removed from the Utica aquifer during the review period.

TABLE 5.3 Estimation of carbon tetrachloride removed from the Utica aquifer.^a

		GWEX ²	I–GWEX3			GW	EX4	
			Carbon Tetra	achloride			Carbon Tetra	achloride
		ndwater acted		Calculated Amount		ndwater racted		Calculated Amount
Month	(gal)	(L)	Concentration ^b (µg/L)	Removed (kg)	(gal)	(L)	Concentration (µg/L)	Removed (kg)
Oct 2004	_c	_	_	_	263,520	997,687	85.5	0.1
Nov 2004	928,680	3,515,982.5	115	0.4	2,687,040	10,173,133	85.5	0.9
Dec 2004	1,077,780	4,080,475.1	112	0.5	2,660,544	10,072,820	91.5	0.9
Jan 2005	149,100	564,492.6	103	0.1	2,544,480	9,633,401	81.0	0.8
Feb 2005	2,051,190	7,765,805.3	101	0.8	2,298,240	8,701,137	91.0	0.8
Mar 2005	4,155,630	15,733,215	111	1.7	2,620,368	9,920,713	90.5	0.9
Apr 2005	3,059,580	11,583,570	101	1.2	2,397,600	9,077,314	89.0	0.8
May 2005	1,829,500	6,926,487	103	0.7	2,410,560	9,126,380	71.0	0.6
Jun 2005	_	_	_	_	2,332,800	8,831,981	67.0	0.6
Jul 2005	_	_	_	_	2,332,800	8,831,981	69.0	0.6
Aug 2005	1,506,200	5702473.2	117	0.7	2,096,460	7,937,198	57.0	0.5
Sept 2005	6,749,100	25552093	115	2.9	2,273,000	8,605,578	64.5	0.6
Oct 2005	9,008,200	34105045	101	3.4	2,455,905	9,298,056	56.0	0.5
Nov 2005	4,097,000	15511242	118	1.8	2,379,375	9,008,314	53.0	0.5
TOTAL				14.2				9.0

^a Total carbon tetrachloride removed from the aquifer: 23.2 kg.

^b Concentration in untreated "mixed" samples of the combined flow from wells GWEX1–GWEX3.

^c Unit not in operation.

6 Operation, Maintenance, and System Modifications

6.1 Wells GWEX1-GWEX3 and the Spray Irrigation Treatment Units

No repairs or maintenance were required on extraction wells GWEX1–GWEX3 during the review period.

Maintenance and repairs for the spray irrigation units and the groundwater delivery system included the following:

- Periodic field inspection of the units and all operating parameters.
- Replacement (under warranty) of numerous pneumatic valves, used to selectively control the operation of the spray heads. The valves were damaged by freezing during the initial setup of the irrigation units.
- Replacement of the electronic valve actuators used to control the irrigation span drain-back system. The actuators were damaged as a result of the basin flooding that took place in May 2005.
- Repair (under warranty) of the base station remote system computer, to correct damage resulting from a lightning strike through the telephone wiring. Additional surge protection was also installed.
- Adjustment of the pump motor variable frequency drives, to reduce their sensitivity to line power quality.
- Replacement of a malfunctioning manual pipeline valve that controls the flow of groundwater to the north spray unit.
- Ongoing investigation to diagnose the cause(s) of sporadic, unexpected shutdowns of the wells and treatment units.

Several modifications of the spray irrigation and groundwater delivery systems were made during the review period. These updates include the following:

- Replacement of the radio hardware required for remote control and monitoring of the spray irrigation units, to permit the use of government-specific radio frequencies.
- Redesign and reconstruction of the drain-back valve vault at the south spray irrigation site, to prevent water damage in the event of future flooding.

6.2 Well GWEX4 and the Air Stripping Unit

Well GWEX4 required no maintenance or repairs during the review period.

Maintenance of the shallow-tray air stripper was limited to the following:

- Periodic field inspection of the unit and all operating parameters.
- Replacement of a view port on one of the aeration trays.
- Routine cleaning of the unit after approximately one year of operation.
 Inspection of the unit at that time revealed minimal silting or buildup of precipitates; these were removed by pressure washing.

6.3 Installation and Sampling of Monitoring Wells

At the beginning of the aquifer restoration program, only three permanent monitoring wells at the Utica site could be used for the sampling of groundwater for VOCs analyses. Preexisting wells SB48, SB71, and SB72 (Figure 2.1) were constructed primarily for measurement of groundwater levels and do not penetrate the more contaminated zones of the groundwater column identified in detailed vertical-profile sampling (Argonne 2000). To improve monitoring coverage, four additional permanent monitoring wells (MW1–MW4; Figure 2.1) were installed at strategic locations along the plume migration pathway in August 2005. A

proposed fifth monitoring well (Figure 2.2 of Argonne 2004) was not installed because of access issues.

Table 6.1 summarizes construction data for the new and preexisting monitoring wells, as well as the results of groundwater sampling and analyses for VOCs to date. No clear trends in the patterns of carbon tetrachloride levels at the monitoring wells were apparent during the review period. Well registration forms for the new monitoring wells (installed in 2005) are in Appendix A.

TABLE 6.1 Well construction data and analytical results for carbon tetrachloride in groundwater samples from the permanent monitoring wells.

_	Dept	h (ft BGL)	<u>-</u>					
					Carbon Tet	rachloride (բ	ıg/L)	
Well	Total	Screened Interval	Nov 04	Jan 05	Feb 05	Mar 05	Aug 05	Oct 05
SB48	98.5	83.5–93.5	ND ^a	ND	ND	ND	_b	ND
SB71	94.2	84.0-94.0	1.3	1.2	1.0	ND	_	0.3 J ^c
SB72	122.3	82.6-112.6	5.5–5.7 ^d	4.3-6.2	5.1-5.6	1.9-3.4	_	3.6
MW1	105.0	85.0-100.0	_	_	_	_	38.0	79.0
MW2	115.0	90.0-110.0	_	_	_	_	8.6-8.8	9.3
W3	125.0	100.0-120.0	_	_	_	_	57.0	36.0
dW4	125.0	100.0-120.0	_	_	_	_	34.0	33.0-34.

 $^{^{\}rm a}$ ND, not detected at a method detection limit of 0.1 $\mu g/L$.

6.4 First-Year Operating and Maintenance Costs

First-year operating and maintenance costs are summarized in Table 6.2. These costs include one-time expenses associated with installation of new monitoring wells. Other expenses were related to unexpected technical problems and spring flooding that necessitated modification and rebuilding of the actuator system to withstand future flooding. Costs in subsequent years are expected to be lower.

b Well not sampled.

 $^{^{\}rm c}$ Qualifier J indicates an estimated concentration below the quantitation limit of 1 $\mu g/L$ for the purge-and-trap method.

^d Ranges of values include quality control samples.

TABLE 6.2 Summary of first-year operating and maintenance costs for the Utica restoration project.

Item	Cost (\$)
General Management Logistics Support	18,127 64,145
Remediation Monitoring Monitoring Network Establishment	170,880 11,707
Technical Oversight	17,727
TOTAL	282,586

7 Summary

A combined total of approximately 66.4 million gallons of contaminated groundwater was extracted and treated during the first 13 months of operation of the aquifer restoration systems at Utica. Approximately 52% of the total volume treated (106 acre-feet) was used to supplement the natural water entering the North Lake Basin Wildlife Management Area.

Groundwater modeling studies performed by Argonne during the development of the aquifer restoration approach for Utica (Argonne 2000) indicated that, on average, the extraction of approximately 97 million gallons of groundwater per year would be required to achieve cleanup of the aquifer in approximately 10–15 years. The total actual groundwater produced during the review period represents approximately 68% of this average annual target.

Sampling and analysis of the effluent water from the air stripping and spray irrigation treatment units indicated that these systems functioned at a minimum efficiency of 94% during the review period. Carbon tetrachloride concentrations in all discharges of treated water at the site were below the permitted maximum target (44.2 μ g/L) by roughly an order of magnitude.

Calculations based on the volumes and measured carbon tetrachloride concentrations of the groundwater extracted during the review period indicated that approximately 23 kg (3.8 gal) of carbon tetrachloride was removed from the Utica aquifer.

The costs incurred by Argonne for operating and maintenance of the aquifer restoration effort at Utica during the review period were approximately \$283,000.

8 References

Argonne, 2000, Final Report: Stage I Investigations of the Agricultural/Environmental Enhancement Pilot Program, Utica, Nebraska, prepared for the Commodity Credit Corporation, U.S. Department of Agriculture, by Argonne National Laboratory, Argonne, Illinois, January.

Argonne, 2004, Final Monitoring Plan for the Utica Aquifer–North Lake Basin Restoration Project at Utica, Nebraska, ANL/ER/TR-04/006, prepared for the Commodity Credit Corporation, U.S. Department of Agriculture, by Argonne National Laboratory, Argonne, Illinois, November.

Appendix A:

Well Registration Forms

GWEX-1

Mail to DNR PO Box 94676 Lincoln, NE 68509-4676 Phone (402)471-2363 GNEX-1

05/72005-/60852-WWRf (2)
Department of Natural Resources

STATE OF NEBRASKA

DEPARTMENT OF NATURAL RESOURCES

WATER WELL REGISTRATION

			FOR DEPART	MENT USE ON	LY	
	Re	gistration Date 5-17-200	5 Sequence No./	60852	Registration No. 2-13367	4
	Ov	ner Code No. 51127	Receipt No.	18031	UPPER BIG BLUE	NRD
1.	a.	Well Owner's First Name	Las	t Name		
	b.	Company Name USDA / FSA				
	C.	Correspondent Name		Atte	ntion	
		Address Mail Stop 4725, Room 47 City Waschington	25, South Building State DC	Zip 20024	Talanhan	
_	_				Telephone	
2.	а.	Contractor's License No 19193				·
	h	Contractor's Email Address mmagi Drilling Firm Name Boart Longyes				-
	υ.	Address P.O. Box 355				
		City Little Falls	State MN	Zip 56345	Telephone 320-632-6552	
		Drilling Firm's Email Address sthal	acker@boartlongyear.com			
3.	a.	Well location Nw 4 of the Nw	% of Section 29 Tox	mshin 11 North	Pangel E W Seward	County.
	ъ.	Natural Resources District Upper I	Big Blue	abinp rectin	, Raige - Den W - 3	County.
	c.	The well is 600 feet from	om the (N S) see	ction line and 190	feet from the (E W)	section line
			(circle one)		(circle one)	
		or Latitude Degree Min Longitude Degree Min	uteSecond			
	đ.	Street address and subdivision, if a			and the second second	
		Block		Lot		
	e.	Location of water use, if applicable	(give legal descriptions	5-29	T-11 Range 1 E	
	ſ.	If for irrigation, the land to be irrig			•	
	g.	Well reference letter(s), if applicable	6 6NEX-1	HHSS PW	SID	 ·
		mits		Surface Water Pe	rmit Number	
		nagement Area Permit Number G-0 thermal Permit Number		Industrial Permit	Number State Permit Number	
1	Mu	nicipal Permit Number				
	We	Spacing Permit Number		Conduct Permit P		
	пп	ee .		Other Permit Nur	Jumber nber	
5.		SS		Other Permit Nur NDEQ	Number	
	Pur	pose of well (indicate one)	Aquaculture	Other Permit Nur NDEQ Commercial/Indust	Numbernber	
	Pur	pose of well (indicate one) Domestic Ground Heat	Aquaculture ExchangerGroun	Other Permit Nur NDEQ	nber Dewatering (over 90 d	ays)
	Pur	pose of well (indicate one) Domestic Ground Heat Livestock Monitor	AquacultureGroundingObservat	Other Permit Nur NDEQ	nber rial Dewatering (over 90 d at Pump Irrigation ic Water Supply (with spacing (46-635))	
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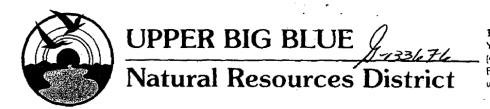
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		Will the proposed well be connected to another well(s) or be used to supplie	ement a	an ex	sw gnűsk		m another		79.
· Aver r Of		THO. IT I Ed. HISTORIE DIGITE REGISTRATION NO(8), OF OTHER WEIKS)	01	14	- F				··

Continue on other side

MAR-15-2004 MON 12:36 PM UPPER BIG BLUE NRD . FAX NO. 4023621849 P. 03	2
Well Identification: GWEX-1	
### SPECIFICATIONS OF INTENDED WELL AND PUMP: #### SPECIFICATIONS OF INTENDED WELL AND PUMP: ###################################	
Well casing diameter: 8 inches. Pump column diameter: 2 inches.	
13. ANNUAL WITHDRAWAL: (See Permit Restrictions - No. 6)	
Is the total annual ground water withdrawal of all well(s) on this parcel of land estimated to be five hundred (500) acre fe	et c
more? 🗓 YES &NO	
If the existing well(s) on this parcel of land currently withdraw five hundred (500) acre feet or more annually, will the proportion	sec
well increase the total ground water withdrawal by two hundred and fifty (250) acre feet or more? 디 YES 연 NO	
14. LANDOWNER CERTIFICATION: Please read permit restrictions listed below.	
 hereby, certify that i am familiar with the information contained in this application and, that to the best of my knowledge belief, the information is complete and accurate. I understand and will comply with the permit restrictions and the District's read regulation related to the construction and operation of this well. 	and ules
Date 3/24/04 Signature of Landowner San Dig Salling (See Permit Restrictions - No. 1	
This form must be completed in full and be accompanied by a non-refundable \$50.00 filling fee (\$250.00 for a late per	a 2)
This form must be completed in full and be accompanied by a non-retundable \$50.00 filling fee (\$250.00 for a late per payable to the Upper Big Blue NRD, 105 Lincoln Avenue, York, Nebraska 68467. An incomplete application will be returned for correction. A returned application must be resubmitted within 30 days or the filling fee is forfeited.	mit) ned
PERMIT RESTRICTIONS	
 This application must be signed by the landowner, his/her power of attorney or be accompanied by a notarized statem signed by the landowner, authorizing the another person's signature. 	ent,
2. This permit shall remain in force for one (1) year from the date approved.	7.5
3. If the well authorized by this permit has a capacity of more than fifty (50) gallons per minute, it must be constructed at less those should be constructed at less than one thousand (1000) feet from any existing well with a capacity of more than fifty (50) gallons per minute that is undifferent ownership. If a well that is less than one thousand (1000) feet from a well under separate ownership is be replaced, the replacement well may not be more than fifty (50) feet closer to the well under separate ownership than one it is replacing.	nder sino
4. When water wells are commingled, combined, clustered, or joined and have a combined total capacity of more than (50) gallons per minute, each water well shall comply with well spacing as provided in Restriction No. 3.	fifty
5. A well shall not be used to transfer ground water to a government survey section that is not adjacent to the tract of in which the well is located. Transfers of ground water from the tract on which the well is located shall be limited to acreage equal to the acreage in that tract unless such transfers occurred prior to July 1, 1990.	and Jan
6. If the total proposed annual ground water withdrawal from this parcel of land exceeds five hundred (500) acre feet (million gallons) or if existing well(s) currently withdraw five hundred (500) acre feet or more and the proposed well increase the total withdrawal by two hundred and fifty (250) acre feet (81.5 million gallons) or more, a hydrologic evaluation with this application in accordance with District Rule 5, Ch. 5.	will
7. All wells permitted by the District on or after March 1, 2004 must be equipped with a flow meter prior to operati	on.
Ground Water Management Area rules and regulations are subject to change. A copy of District Rule 5 is available up request. Prior to construction or operation, the permittee should contact the NRD office if he or she has any questions about the rules and regulations.	pon lout
NRD USE ONLY COMMENTS:	
and ORI	. }
Date Approved 3/17/05 NRD Representative Last 1/e1	-

March 2004



105 N. Lincoln Avenue York, Nebraska 68467 (402) 362-6601 Fax (402) 362-1849 www.upperbigblue.org

March 18, 2005

USDA/FSA Mail Stop 4725 Room 4725 - South Building 1400 Independence Avenue Washington, DC 20024

Subject: Late Recovery Wells Permit

Dear Sirs:

The NRD has approved the enclosed *late* well permit for the series of two wells, GWEX-1 and GWEX-3, located in Section 29-T11N-R1E, Seward County of the Upper Big Blue Natural Resources District Groundwater Management Area. It has been approved subject to all the restrictions listed on the permit and subject to the Management Area rules and regulations.

We will forward a copy of the well permit to the Nebraska Department of Natural Resources. If you have any questions feel free to call me at the NRD.

Sincerely

Rod DeBuhr

Water Department Manager

:lsh

Copy - Scott Thalacker, Boart-Longyear, Little Falls, MN
Department of Natural Resources
File

ALLUCIUEU

MAR 2 1 2005

GWEX-2

Submit to:
Department of Natural
Resources
301 Centennial Mall South
P.O. Box 94676
Lincoln, Nebraska 68509-4676

Department of Natural Resources

STATE OF NEBRASKA OF Natural Resources

DEPARTMENT OF NATURAL RESOURCES

WATER WELL REGISTRATION MODIFICATION

July 2002 DNR Form 667

	FOR DEPARTMENT USE ONLY	
Dat	re Filed: 3-38-2005 Sequence No. 113572 Registration No. G - 097200 mer Code No. 51/27 Receipt No. Upput/Big Blue NRD	
Owner Code No. 51127 Receipt No. Upper Dig Dlue NRD		
1.	Weil Owner(Required) USDA/FSA Work Telephone Number (202 720-5104	
	Home Telephone Number () Address Mail Stop 4725, Rm 4725, South Building: 1400 Independence Ave., SW City Washington, () State D.C. Zip Code 20250 + 0513	
2.	Contractor(Required) TCW Construction, Inc. Telephone Number (402) 475-5030 Address 141 M Street Pump Installer License No. 39448 City Lincoln State_NE Zip Code 68508 +	
	City IIIIC/III State No. 240 Cook Gaston	
3.	Water Well Registration No. G-097200 (GWEX-2) IDENTIFY WHAT NEEDS TO BE CORRECTED: Change use of well to recovery.	
	BEATTY WHAT WEEDS TO BE CONNECTED. CHANGE USE OF WEIT AT THE OWNER.	
4.	LOCATION OF WELL (Information in ITEMS 4A and 4B are required) LIST LEGAL:	
	A. Well location: SF // NW // of Section 29 Township 11 North, Range 1 Exw. , Seward County. B. The well is 1350 feet from the (N. S.) section line and 3400 feet from the (E. W.) section line.	
5.	LOCATION OF WELL LIST LEGAL CORRECT LEGAL AND/OR FOOTAGE:	
	A. Well location: 1/2 of Section Township North, Range E W County. B. The well is feet from the (N S section line and feet from the (E W section line.	
	C. Latitude Degree: Minute: Second: D. Longitude Degree: Minute: Second:	
	F. Block Lot	
6.	Number of acres irrigated:	
	A. Location of water use(given legal description)	
7.	Change of use(select from this category): Dewatering (over 90 days) Domestic Ground Heat Exchanger	
1	Ground Water Source Heat Pump Industrial Injection Irrigation Livestock	
ĺ	Monitoring Observation Public Water Supply (with spacing (46-638)) Recovery Other	
	A. Well was used for: Monitoring C. New use is: Recovery	
	B. New gallons per minute: 200 D. Date of Change: 3/21/05	
	Wells in a Series. A. Is this well a part of a series? Yes go to part b of this section RECEIVED	
	B. If one or more of the wells in the series is currently registered, give the well registration number (s):	

DEPARTMENT OF NATURAL RESOURCES 03/29/2005 12:41 2027204619

USDA FSA CEPD

3/2005 18:47 FAX	4024755049	TC	W CONSTRU	CTION			₩ 003/1
					G-097	1200	
Replacement and abands A. Is this well a replace Registration number Replacement well is Original well pump Location of water is	ement weil? Yos of shundened well feet from column size	No If a absendound well inches.	, D. A	bandoned well les	il was constructed a operated (m) nai well abandons		/bx
Well Construction infor A. Total well depth _ C. Fumping water fev E. Well Construction G. Casing and Screen	et feet ompleted (month)			D. Well Consum F. Bore ho <u>le d</u> ian	vel Mon began (mank) Actor in inches To Other	p Bottom	
11. Well Construction (Casi		& g mensuremen		noties to three dec	imal places		
<u>^</u>	ь		d	C .	f	*	h
Placement Depth in Foot	Casing or Screen	Inside Diameter	Outside Discreter	Wall Thickness	Type of Material	Screen Slot Size	Trade Nar
From To							
12. Grout and Gravel Pack							
Placement Dep	To To	-	out or vei Pack		Man	erial Description	en de la companya de La companya de la co
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13. Geologic Materials Logi Depth in Fret From To	ped Description						
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only. The w							
	. /	rias automiti	end on this	. romierratio	on, and to ti	he best of m	. Imaulad
in true.		3/21/05	M.	100 m	S Signature	5/2	noc

03/29/2005 12:41

2027204619

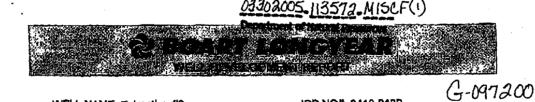
LISDA FSA CEPD

PAGE 05/05

03/23/2005 16:47 FAX 4024755048

TCW CONSTRUCTION

Ø 004/004



WELL NAME Extraction #2

WELL DIAMETER B

IMEASUREMENTS BELOW FROM TOP OF CASING)
TOTAL DEPTH 148.28

DEPTH TO WATER BEFORE DEVELOPMENT 84,34

DEPTH TO WATER AFTER DEVELOPMENT 84.68

JOB NO# 3410-2122

LOCATION LHICE. NE

DATE 5/25/2004

DEVELOPED BY M. Hansen

DESCRIPTION OF DEVELOPME	NT METHOD		
(Check One)			
☐ SURGED WIBAILER & BA ☐ SURGED WIBAILER & PU ☐ SURGED WIBLOCK & BA ☑ SURGED WIBLOCK & PU ☐ OTHER	RECEIVED		
CAN THIS WELL BE PURGED DRY? TYES YES NO			
VOLUME OF WATER IN FILTER PACK AND WELL CASING	166 Gallons		
VOLUME OF WATER REMOVED FROM WELL	58,995 Gallons		
CLARITY OF WATER BEFORE DEVELOPMENT	Dark Brown, Muddy		
CLARITY OF WATER AFTER DEVELOPMENT	Clear		
VOLUME OF WATER ADDED	300 Gallons		
SOURCE OF WATER ADDED	Utica Municipal		
TIME SPENT FOR DEVELOPMEN Minutes	START: END: A.M.		
COMMENTS:			



Nebraska Department of Natural Resources

Data Bank

Database Through: Dec 9 2005

Processed: 12/9/2005 3:44:17 PM

REGISTERED GROUNDWATER WELLS DATA RETRIEVAL

Note:

Information on Public Water Supply Wells is not available through this interface. Contact the Department of Natural Resources (Data Bank) at 402-471-2363 for more information.

Criteria: RegistrationNumber - G-097200

1 Stations met this criteria.

Completion Date Acres Irrig Pump Col Dia Owner's Name Filing Date Gallons/Min Pump Depth and Address Abandoned Date Static Level Well Depth Times Replaced Pumping Level	United States Department of Agricultu 1400 Independence Avenue SW Room 47 Washington, DC 20250
Pump Col D Pump Depth Well Depth	 148 ft
Acres Irrig Gallons/Min Static Level Pumping Level	 82 ft
Completion Date Acres Irrig Filing Date Gallons/Min Abandoned Date Static Level Times Replaced Pumping Level	6/ 22/ 1998 7/24/1998
County Name NRD Name Well Location Footage Latitude Longitude	Seward 6/1. Upper Big Blue 7/2 11N 1E 29 SENW 1350S 3400W Map It 0
Use Status	R A
Registration# Use County Nam Permit Number Status NRD Name Well Log Footage Latitude Longitude	G-097200 UBB-1-2314 Other Info Logs View as PDF

Data copy of Geo Logs for requested wells as Bar(l) delimited file. Data copy of requested wells as Bar(I) delimited file.

Data copy of Casing Screen for requested wells as Bar(l) delimited file.

Data copy of Grout Gravel for requested wells as Bar(1) delimited file. Legend and Notes

Nebraska Department of Natural Resources Data Bank

Processed: 12/9/2005 3:46:15 PM

2 Caseing and Screen records available for Registration Number G-097200

FromDepth	ToDepth	CaseOrScreen	InsideDiam	OutsideDiam	rScreen InsideDiam OutsideDiam CaseThickness Material ScrnSlotSize ScreenTname	Material	ScrnSlotSize	ScreenTname
0	110	casing	8		0.375	Steel		
110	145	screen	8	8.875		Steel	0.035	Continuous

Nebraska Department of Natural Resources Data Bank

Processed: 12/9/2005 3:47:01 PM

3 Grout Gravel information available for Registration Number G-097200

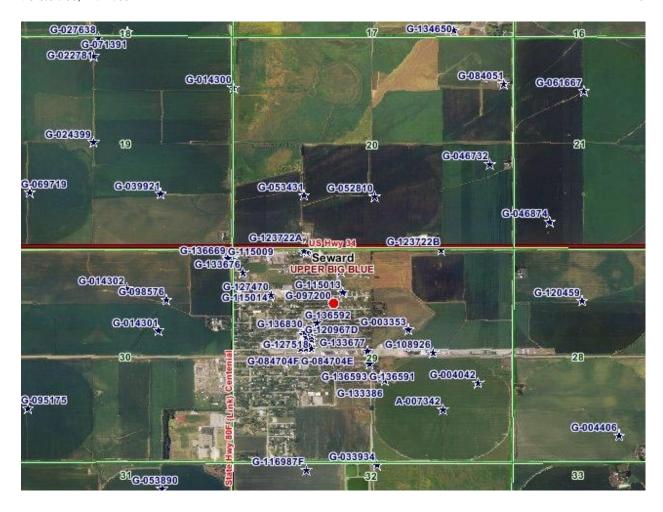
FromDepth	ToDepth	GroutOrGravel	Material
4	102	grout	Bentonite Neat Cement
102	106.8	grout	Bentonite Chips
106.8	148.3	gravel	

Nebraska Department of Natural Resources Data Bank

Processed: 12/9/2005 3:48:11 PM

13 Logs Available for Registration Number G-097200, Well ID 113572

Depth		Description				
From	To	Description				
0	4	Dark Brown Organics				
4	40	Brown Silty Clay				
40	45	Sand & Gravel				
45	50	Silty Sand with Some Gravel				
50	86	Sand, Fine, Silty with Trace Clay & Manganese				
86	101	Sand & Gravel				
102	108	Sand, Fine				
108	110	Sand & Gravel				
110	132	Sand, Fine				
132	136	Sand, Medium				
136	148	Sand, Fine				
148	150	Sand & Gray Clay				
150	152	Gray Clay				



GWEX-3

Mail to DNR PO Box 94676 Lincoln, NE 68509-4676 Phone (402)471-2363 GNEX-3

05/72005 - 160853-W WRF (2)

STATE OF NEBRASKA

Pepartment of Natural Resources

DEPARTMENT OF NATURAL RESOURCES

WATER WELL REGISTRATION

		FOR DEPARTMENT USE ONLY
	Re Ov	gistration Date 5-7-2005 Sequence No. 160853 Registration No. 11-133177 wher Code No. 51/2/7 Receipt No. 180314-632 UPPER BIG BLUE NRD
1.	a. b. c.	Well Owner's First Name Last Name Company Name USDA / FSA Correspondent Name Attention Address Mail Stop 4725, Room 4725, South Building City Waschington State DC Zip 20024 Telephone
2.		Contractor's License No 19193 Contractor's Name Michael Magnin Contractor's Email Address mmagnin@boartlongyear.com Drilling Firm Name Boart Longyear Address P.O. Box 355
		City Little Falls State MN Zip 56345 Telephone 320-632-6552 Drilling Firm's Email Address sthalacker@boartlongyear.com
3.	a. b. c.	Well location SE % of the NW% of Section 29 , Township 11 North, Range 1 E W Seward County. Natural Resources District Upper Big Blue The well is 2,550 feet from the (N S) section line and 2,550 feet from the (E W section line
	d. e. f. g	or Latitude Degree Minute Second Longitude Degree Minute Second Street address and subdivision, if applicable Block Lot Location of water use, if applicable (give legal descriptions) S29 T// Lag. Geold E If for irrigation, the land to be irrigated is 4/D 0 acres. Well reference letter(s), if applicable GNEY-S HHSS PWSID
4.	Geo Mu	Industrial Permit Number G-097200 Industrial Permit Number Transfer Out-Of-State Permit Number Conduct Permit Number Conduct Permit Number Other Permit Number Other Permit Number Other Permit Number Conduct Permit Number Other
5.		pose of well (indicate one) Aquaculture Commercial/Industrial Dewatering (over 90 days) Domestic Ground Heat Exchanger Groundwater Source Heat Pump Irrigation Injection Livestock Monitoring Observation Public Water Supply (with spacing (46-638)) Public Water Supply (without spacing) Recovery Other (indicate use)
6.	We a. b. c.	Ils in a Series. Is this well a part of a series? Yes go to part b of this section If one or more of the wells in the series is currently registered, give the well registration number G-097200 How many wells in the series are you registering at this time? 2
7.	Repa.	Is this well a replacement well? Yes No Registration number of abandoned well If not registered, date abandoned well was constructed (m) /(a /(y) Replacement well is feet from abandoned well. d. Abandoned well last operated (m) /(a /(y) Consignal well pump column size inches. f. Completion of original well abandonment on (m) /(a /(y) Location of water use of abandoned well

AUG 0 2 2004

								G-	133677	
8. Pump In	formation.						<u> </u>			
a. Is p	ump instal	led at t	his time	Yes 1	No					
Is pump	installed b	y well	owner in sect	tion 1?Y	es No I	s pump installed	l by contractor in	section 2?	Yes No	
				ease fill out lice						
	-									
	•									
			n Address				:::::::::_			
-				-	Zip		Tele	phone	-	
c. Pun	np installe	r's Firn	n Email Addr	ess	- M	easured	Estimated			
d Dro	n nine dist	meter		inches		Lenoth of di	rop pipe	fee	+	
				_/(d/(y)		. Pump Branc			•	
h. This	well is de	signed	and construc	ted to pump les		n (es 🔀				
9. Well Con										
	well dept			feet.		b. Static water	r level 82.0	feet.		
c. Pumi	ning water	level		feet		d. Well Const	ruction began	5 /a-) 22 / (year 2004	
e. Well	Construct	ion cor	npleted (month).	5 / _(day) 25	/ _{(year_2004}	f. Bore hole d	liameter in inches	Top16.00 E	lottom_16.00	
g. Casir	ng and Scr	een Joi	ints are Weld	ed Glu	ed	Threaded	Othe	r	·	
10 Well Con	etmostics (Casina	& Coronn) A	d o & a maa	curamante che	wld be in inches	s to three decimal	nlaces		
	a	Casing	b	c c	d d	e e	f f	g	h	
	ement		Casing or	Inside	Outside	Wall	Screen Slot	Type of	Trade Name	
	in Feet		Screen	Diameter	Diameter	Thickness	Size	Material	Trade realic	
<u>-</u> _	To		Beleen	Diameter	Diamicce	Tinckness	Size	Material		
From		-	- •		0.50-				1	
0.0	105.0		Casing	7.981	8.625	3.220		Low Carbon		
105.0	140.0		Screen	7.900	8.700	0.040	0.020	Stainless	Johnson Screen	
140.0	146.0		Casing	7.981	8.625	3.220	4	Low Carbon	A53-B	
	<u> </u>			<u></u>		<u> </u>		<u> </u>		
			,,							
11. Grout and										
Plac	ement Dep	pth in F	eet	1	out or		Mater	ial Description		
From		To		Grav	el Pack					
0.0		97.0		Grout		Neat Cement				
97.0		101.0		Bentonite		Baroid 3/8"	Baroid 3/8" Chips			
101.0		146.0		Gravel Pack		12/20 Sand	12/20 Sand			
12. Geo	logic Mate	erials L	.ogged		1					
Depth in Feet		I	Description			Depth in Feet	De	scription		
From To	0		_			From 7	Го	-		
0.0 146.	0 Glaci	al Dri	ft	_						
				/A 33:	tional charter	nov ho sub-sitte	d)			
				(Addı	nonat sneets i	nay be submitte	u)			
13. I am fai	miliar with	the in	formation sub	mitted on this	registration a	nd to the best of	f my knowledge it	is true.		
ran ranita		111	ATTEMPTION BUT	THE HOLD THE	autou, a		, morrouge it			
M	u		-	7-30-04						
Water V	Velleonti	actor's	Signature	Date		Well	Owner's Signatur	e e	Date	
	_					if Contracto	r is unknown or D	eceased		

MAR-15-2004 MON 12:36 PM UPPER BIG BLUE NRD

1. TYPE OF PERMIT REQUESTED: (Check appropriate item(s)

FAX NO. 4023621849

NRD USE ONLY PERMIT No. UBB-1-

P. 01

Department of Natural Resources

APPLICATION FOR A PERMIT TO CONSTRUCT A WATER WELL IN THE UPPER BIG BLUE NATURAL RESOURCES DISTRICT

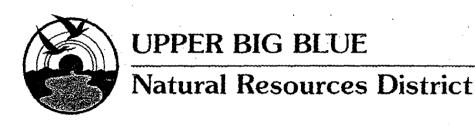
1-15

	New Late D Supplemental withdrawal (See Permit Restrictions - No. 6) Is this application for a series of wells? YES: NO. If YES, How many wells?	DATE	RECEIVE	3.	2-0	5_
2.	NAME AND ADDRESS OF LANDOWNER: 3. NAME AT		RESS OF		ILLER:	
	Mail Stop 4725, Rm 4725, South Building 101 A	lderso	n Stree	t	-	
		ield,	WI 5447	6		
Pho	one (202) 720 - 5104 20024 Phone (800) <u>23</u>	6 -	4983		_
4.	PURPOSED USE OF WELL: (Check one) ODomestic OIndustrial Olinigatio			Public W	ater Supp	xly
5.	IDENTIFY THE LOCATION OF THE PROPOSED WELL: (See Permit Restriction	ns - Nos.	3 & 4)			
	Section 29 Township 11 North, Range 1 East/Wesk Seward	•		County	1-	
	State Registration No(Required for replacement well and late of	or supple	mental per	mits).		
	The well will be located 600 feet from the North/South section line and will be	190 -	feet from t	he £as ¥V	est secti	on line.
6.	スモラン REPLACEMENT AND ABANDONED INFORMATION: (See Permit Restrictions - N	\$\$C ~	3 ,		."	
	Will this well replace a well that is or will be permanently abandoned? DYES CINC	0.	, to 1970	1.3		
	Date that the original well was last operated on20		**			
	The replacement well will be feet from the original well.					
	Will the replacement well provide water to the same tract of land as the			•		
	original well? YES NO.		THE WOLLD	LAVA VECT	N. Die Ver	
7.	WELL AND LAND APPLICATION SKETCH:	MANA	NEW	MANNE	NENE	
	The box at the right represents one square mile, (1 section). Indicate with an "X", the proposed location of the well(s), outline and cross-hatch the proposed water use area.	ZIVIVI.	EW.	SWNH = X-1	EENE	
8.	IRRIGATION OR OTHER LAND APPLICATION OF WATER:		XC	UEX	-2	1
•	#	WASA	RESW	NWSE !	NESE	N
	Type of irrigation (water distribution) system is proposed?					13
	[6]	2020.	SHSW	\$W\$E	STATE	
	PREVIOUS IRRIGATION OR OTHER LAND APPLICATION: Are any of the acres identified in question 8 served by another well now?					
	EIYES MNO. If YES, How many acres?	15207		i		
	What is the current distribution system?	. 2				
٦^	ther(specify)		528	<u> </u>		
	GROUND WATER TRANSFER: (See Permit Restrictions - No. 5)					
	is the proposed well to be used to transfer water outside of the legal description listed	i ahove?	M VES T	I NO		
	If YES, enter the legal description of the water use area. NWSW Quarter, Section 20, 7			Ranne	1 Eas	-+/ XDC X6
	SWSW 17	. essisasish	11 1014	11 1 4001 (P) Q		ist ist
11.	COMMINGLED, COMBINED, CLUSTERED, OR JOINED WELLS: (See Permit F	Restrictio	ns - No. 4)			
	Will the proposed well be connected to another well(s) or be used to supplement an ex	dsting wa	ter use fro	m anoline	well(s)?	Ø YES
	INO. If YES, list the State Registration No(s), of other welks) G - 0972	00 PE	CEIVED			
	Continue on other side	MAY	16 2005	,		

Continue on other side

-	MAR-15-2004 MON 12:36 PM UPPER BIG BLUE NRD FAX NO. 4023621849 P. 02
	Well Identification: GWEX-1
12	SPECIFICATIONS OF INTENDED WELLIAND PUMP DOCUMENTS
-	Estimated outpoing capacity: 50 gallons per minute. Estimated total well depth: 131 feet.
	Well casing diameter: 8 Inches. Pump column diameter: 2 inches.
13.	ANNUAL WITHDRAWAL: (See Permit Restrictions - No. 5)
	is the total annual ground water withdrawal of all well(s) on this parcel of land estimated to be five hundred (500) acre feet of
	more? DYES XXNO
	If the existing well(s) on this parcel of land currently withdraw five hundred (500) acre feet or more annually, will the proposed
	well increase the total ground water withdrawal by two hundred and fifty (250) acre feet or more? ☐ YES ☐ NO
14.	LANDOWNER CERTIFICATION: Please read permit restrictions listed below.
	 hereby, certify that I am familiar with the information contained in this application and, that to the best of my knowledge and belief, the information is complete and accurate. I understand and will comply with the permit restrictions and the District's rules and regulations related to the construction and operation of this well.
Da	ta 3/24/04 Signature of Landowner Sau Dea Salland (See Permit Restrictions - No. 1 & 2)
_	CONTRACTING OFFICER, USDA (\$250.00 for a late permit) is form must be completed in full and be accompanied by a non-refundable \$50.00 filling fee (\$250.00 for a late permit)
pa	is form must be completed in full and be accompanied by a non-refundable \$50.00 filing fee (\$250.00 for a late permit) yable to the Upper Big Blue NRD, 105 Lincoln Avenue, York, Nebraska 68467. An incomplete application will be returned correction. A returned application must be resubmitted within 30 days or the filing fee is forfeited.
_	PERMIT RESTRICTIONS
1.	This application must be signed by the landowner, his/her power of attorney or be accompanied by a notarized statement, signed by the landowner, authorizing the another person's signature.
2.	This permit shall remain in force for one (1) year from the date approved.
3.	if the well authorized by this permit has a capacity of more than fifty (50) gallons per minute, it must be constructed at least one thousand (1000) feet from any existing well with a capacity of more than fifty (50) gallons per minute that is under different ownership. If a well that is less than one thousand (1000) feet from a well under separate ownership is being replaced, the replacement well may not be more than fifty (50) feet closer to the well under separate ownership than the one it is replacing.
4.	When water wells are commingled, combined, clustered, or joined and have a combined total capacity of more than fifty (50) gallons per minute, each water well shall comply with well spacing as provided in Restriction No. 3.
5.	A well shall not be used to transfer ground water to a government survey section that is not adjacent to the tract of land in which the well is located. Transfers of ground water from the tract on which the well is located shall be limited to an acreage equal to the acreage in that tract unless such transfers occurred prior to July 1, 1990.
6.	If the total proposed annual ground water withdrawal from this parcel of land exceeds five hundred (500) acre feet (163 million gallons) or if existing well(s) currently withdraw five hundred (500) acre feet or more and the proposed well will increase the total withdrawal by two hundred and fifty (250) acre feet (81.5 million gallons) or more, a hydrologic evaluation must be submitted with this application in accordance with District Rule 5, Ch. 5.
7.	All wells permitted by the District on or after March 1, 2004 must be equipped with a flow meter prior to operation.
req	ound Water Management Area rules and regulations are subject to change. A copy of District Rule 5 is available upon uest. Prior to construction or operation, the permittee should contact the NRD office if he or she has any questions about rules and regulations.
N	RD USE ONLY
C	DMMENTS:
Di	ate Approved 3/17/04 NRO Representative Take

March 2004



133/17 105 N. Lincoln Avenue York, Nebraska 68467 (402) 362-6601 Fax (402) 362-1849 www.upperbigblue.org

March 18, 2005

USDA/FSA Mail Stop 4725 Room 4725 - South Building 1400 Independence Avenue Washington, DC 20024

Subject: Late Recovery Wells Permit

Dear Sirs:

The NRD has approved the enclosed *late* well permit for the series of two wells, GWEX-1 and GWEX-3, located in Section 29-T11N-R1E, Seward County of the Upper Big Blue Natural Resources District Groundwater Management Area. It has been approved subject to all the restrictions listed on the permit and subject to the Management Area rules and regulations.

We will forward a copy of the well permit to the Nebraska Department of Natural Resources. If you have any questions feel free to call me at the NRD.

Sincerely

Rod DeBuhr

- Water Department Manager

:lsh

Copy - Scott Thalacker, Boart-Longyear, Little Falls, MN Department of Natural Resources File

PERMIT

MAR 2 1 2005

GWEX-4

STA	ATE OF NE	BRASKA		Fee Paid	\$110.00 DN	IR Cash Fund \$18.50
DEPARTMEN	T OF NAT	URAL RESC	OURCES	HHSS Fee	\$70.00 HH	ISS-DNR Cash Fun \$0.00
		GISTRATIO				Get Billing 10242
			PARTMENT	USE ONLY		
NOL ID 111161076323	NOL Status			Δ	Pagiatration Code	G-133386
	51127 NOL Status	W. LANCE WITH HEAT PRINCIPLE AND ADDRESS OF THE PRINCIPLE AND ADDRESS OF T	Vell Status Call Up Code	A	Registration Code Registration Date	Add
	67373		Call Up Date		negistration Date	04/27/2005
Ocq Num	0,0,0					Dogo 1 of 0
		04272005 -	167373	-WWR	F	Page 1 of 2
1a Owner's Name						
b Company Name	USDA / FSA / CCC					
c Correspondent Name				on Name	··	
Address		Avenue SW, Room 4				
City: Washington	,	State DC Z	Zip Code 20)250 -	0513 Ph	one 202 - 720-5295
2a HHSS Contractor Lic ID:	434900	Contractor's Nan	ne:	Daniel L. Free	ese	
Contractor's License No:	39452	Contractor's Ema	ail Address:	dlfreese@lay	nechristensen.com	
b Drilling Firm Name	Layne-Westerr	, a division of Layne	Christensen Co.			
Address	P.O. Box 597					
City: Valley		State NE Z	Zip Code 68	3064	Ph	one 402 - 359-2042
Drilling Firms Email Addre	1072@layne	christensen.com				
3a Well Location NWS	e of Se	ection 29, Tov	vnship 11	North, Range	1 E (E/	W), Seward County
b Natural Resource District	Upper Big Blue				•	
c The well is 2041	feet from the	(N/S) section lin	ne and 2	418 f	eet from the E	E/W) section line
GPS: or Latitude: 40	53' 34.00"	Longitude:	-097 20' 21.00"			
d Street address or block, lo	-				Block	No Lot
e Location of water use, if ap						
f If for irrigation, the land to I	_		res			
g Well Reference letter(s), if	applicable	GWEX-4				
4 Permits	Permits N			ermits		s Number Date
Management Area Permi	UBB-1-35	05	04/21/2005 T	ransfer Out-Of	-State	
Surface Water	dispersion of dispersion		ا الحصال	ell Spacing		
Geothermal				onduct Water		
Industrial			N	lunicipal		
Industrial Transfer Notice			°	ther		
5 Purpose of Well Re	ecovery		Othe	r		
Notes	,					
6 Wells in a Series						
a Is this well a part of a serie						
b if one or more of the wells	_	antly registered give	o the well regio	tration number		
c How many wells in the ser		, ,	e tile well legis		¬	
O HOW Many wons in the ser	are you registeri	ng at tine title!				
7 Replacement and abandor	ned well information	Repla	acement Numbe	er 🗀		
a is this well a replacement	well?		b Reg	istration numb	er of abandoned well	
-			•		abandoned well was	constructed
c Replacement well is	feet fro	m abandoned well.	d Aba	ndoned well las	st operated	

111161076323

111161076323

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111161076323

111161076323

111161076323

50.0

86.0

101.0

108.0

110.0

132.0

136.0

148.0

e Original well pum		ine	1272005 - ches.		WRF original well abandonment on	F	Page 2 of 2
8 Pump Information	1			,			
a is pump installed	at this time?						
ls pump installed	by well owner in	section 1?		Is pump installed	by contractor in section 2?		
Else installed by	pump installer.						
b HHSS Installer's	License ID.						
Pump Installer's	License No.		Pump Instal	ler's Name			
Pump Installer's	Email Address						
Pump Installer's	Firm Name						===
Pump Installer's	Firm Address						
City:		State	Zip	Code -0000	Phone		
Pump installer's	Firm Email Addr	ess					
c Pumping Rate		gallons per minute)	п	neasured or estimated		
d Drop pipe diamet	er	inches		e Length of drop	pipe feet.		
f Pumping equipme	ent installed	/	/ 🗌	g Pump Brand			
h This well will be u	used to pump les	s than 50 gpm					
9 Well Construction	n Information						
a Total well depth	150 .0	feet.		b Static Water Lo	evel feet		
c Pumping Water L	evel	feet.		d Well construct	on began: 10 / 31	/ 1997	
e Well construction	completed:	11 / 01	1997	f Bore hole diame	eter in inches. Top 12.0	0 Bottom	12.00
g Casing and Scree	en Joints [\	Welded	Other		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
10 Well Construction	n (Casing and So	reen)			MANAGER AND A	2	-
From Depth T			utside Diam	Thickness S	ceen Slot Size Materia	l Trade na	me Ca
0.0	115.0	6.00	6.625	.313	steel	Section and Control of the Control o	
115.0	145.0	6.00	6.625	.313	.020 SST	Houston	
145.0	150.0	6.00	6.625	.313	.000 SST	Houston	
L							
11 Well Construction	on (Grout and Gr	avel)					
NOL ID	From Depth	To Depth 🗼			Material	7 4	1.1
111161076323	0.0	105.0 cer					1
111161076323	105.0		ntonite chips				
111161076323	110.0	150.0 Ce	ntral Sand C F	Pack			
12 Geolog Material i	ogged						
		To Depth	hiovala i		Description		
111161076323	0.0		k brown orgar			HART OF STREET STREET, SOUL STREET, ST	
111161076323	4.0		wn silty clay	······································			WA
111161076323	40.0		nd and gravel			Providence A Mark Physics Providence	10.0
111161076323	45.0	50 Oeilt	v sand with so	me gravel			

86.0 fine sand, silty with trace of clay

101.0 sand and gravel

110.0 sand and gravel

136.0 medium sand

150.0 sand and gray clay

108.0 fine sand

132.0 fine sand

148.0 fine sand

APR-27-2005 WED 08:49 AM UPPER BIG BLUE NRD

FAX NO. 4023621849

P. 01

Ι,							
•					MET.T.	ID: G	TOW A
•	APPLICATION FOR A PERMIT TO CONSTRUCT	ΤΑ\	VAT E I	o WELL		ID; G	VE-2-4
	UPPER BIG BLUE NATURAL RESOU						
	· · · · · · · · · · · · · · · · · · ·		~ 	114.01	101355	04	
1	. TYPE OF PERMIT REQUESTED: (Check appropriate item(s)		NRD PER	USE ON MIT No. U	LY BB-1	3505	·
	M New Late C Supplemental withdrawal (See Permit Restrictions - No. 6	i)	DAT	e pecen	ED	1-05	
	Is this application for a series of wells? DYES MO. If YES, How many wells?_		DAT	RECEN		705	
2					F WELL DR	ILLER:	
-			Wester	-n			
_	1400 Independence Ave SW, Mail Stop 4725; Rm 4725 PC						
_				68064-			
P	hone (202) 720 . 5104 Phone	40	2)	359	2042		
4		-		ivestock action		ater Sup	pły
5.							
3.	Section 29 Township 11 North, Range 1 East/Wasts Sewa		# 15 NOS	i. 3 & 4)	0		
					County	•	
	State Registration No. (Required for replacement well and						
	The well will be located 2041feet from the NSK South section line and will			_feet from	n the East/Max	est sect	ion line.
6.	REPLACEMENT AND ABANDONED INFORMATION: (See Permit Restrict	tions -	No. 3)		1.4		,
	Will this well replace a well that is or will be permanently abandoned?	MN	0.	1. 1.2			
	Date that the original well was last operated on20			:	, ,		
	The replacement well will be feet from the original well.						
	Will the replacement well provide water to the same tract of land as the						
	original well? YES NO.						_
7.	WELL AND LAND APPLICATION SKETCH:		NAVAN	MEMO	MANE	NENE	1
	The box at the right represents one square mile, (1 section). Indicate with			1			1
	an "X", the proposed location of the well(s), outline and cross-hatch the proposed water use area.		SUMP	SENN	SIVATE	SENE	į
, _					1		
8,	<u></u>			1	1 1		Ĵ.
	How many acres will this well apply water to?		VISVE4	NESW	X SIVSE	ध्याध	ily:
	Type of Irrigation (water distribution) system is proposed?			1	^		,
	□Center pivot □Gated pipe → Other(specify)	3-	SIVSIV	SESTO	KWSE	SESE	
9,	PREVIOUS IRRIGATION OR OTHER LAND APPLICATION:	7 4 1		12.00	1	-ENG	
	Are any of the acres identified in question 8 served by another well now?	M M			1	1	
	☐YES MO. If YES, How many acres?		1324	 	 		
	What is the current distribution system? □Center pivot □Gated pipe	ŀ	3	440"	≌ .].	-	-
\Box	Other(specify)	•					
10	. GROUND WATER TRANSFER: (See Permit Restrictions -No. 5)						
	Is the proposed well to be used to transfer water outside of the legal description	n listed	above?	XO YES	□ NO.	^	
	If YES, enter the legal description of the water use area. WW SW Quarter, Section	20,	ownshi	Nor	th, Range		HAGODA
	sw s ω	17		11	1	£ Eas	
11	·			ns - No. 4			
	Will the proposed well be connected to another well(s) or be used to supplement	t an ex	isting wa	iter use fr	om another i	vell(s)?	⊒ YES
	MNO. If YES, list the State Registration No(s), of other well(s)						

Continue on other side

04272005 -167373 - PERF (2)
Department of Natural Resources

Received Time Apr. 27. 8:48AM

93/:	31/2885	08:12	202720461	.9	USD	a FSA CEPI)		P. (PAGE 05
3/3	10/2005 1	1:55 FAX	4024755049	ICW	CONSTRUCT	HOI	5] 9-13338	@004/00 4
12.	. SPECIFI	CATIONS	of intended !	WELL AND PUM	P;				D: GNEX-4
	Estimated	pumping	capacity:	70gallon	ns per minuta.	Estimated tot	al well depth: _	150	feet.
		ng diam ete		inches. Pump cat		:2	_ inches.		
13		el sonnual g	round water with	Permit Restrictions Indrawal of all well		cel of land sat	imated to be f	ve hundred (5	i00) acre feet o
	more?		NO NO	ariand automate		us (cns)			All Africa marries
				of land currently wi withdrawai by two					
14.			TIFICATION:	Please read pe				, 11160 -	1110
	beli ef , the	Informatio	n is com plete an	itir the information of accurate, I under ruction and operat	erstand and wi	il com ply with	n and, that to t the parmitrest	he best of my iclions and th	knowle dge and a Districts rule:
	te 3 31	05 -		500	WOD)	mæe.			
Thi	is form mu yable to th	ist be com B'Upper Bi	ig Blue NRD, 103	nd he accompani S'Lincoln Avanua i must be asubm	ied by a son-	refundable \$	on incomplete	3 A. (\$250.00 for application i	ions - No. 1 & 2 r at later permit VIII be returnis
_				PERMI	IT RESTRICT	MONS			
1.				the landowner, hi			e accompanie	by a noteri	zed statement
2.	This pem	nitehall re	main in force fo	or one (1) year fro	om the date a	pp ro ved.	÷.	3. °	
3,	one thous	sand (1000 whership the replec	O) feet from any	has a capacity of y existing wall wit is less than one fi y not be more tha	th a capa olty housand (100	of more than (0) fact from (fifty (60) gallo a well under s	ns per minut aparate own	e that is under ership is being
4,				, combined, custo it well shall comp					
5.	in which t	he well is !	located. Transl	ground water to fers of ground w at transminer so	eter from the	tract on which	h the well is lo	csted shall t	
8.	million ga increase	lions) or if he total wil	feklisting well(s) thdrawal by two	i water withdrawa) currently withdra hundred end lifty ition in accordance	raw five hundi (250) agre fee	red (600) a hr et (61,5 million	a feight or more a gellone) of m	and the pm	paked wall will
	All wells	permitted	by the District	ton or after Marc	:h 1. 2004 mu	ist be equipp	ed with a flow	meter prio	rto operation
7.				and regulations					
Gra	ound Water	to constru	udion or operat s.	tion, the parmitter	s althor Phin				_
Gro req the	ound Weter luest, Prior	to constru regulation: NLY		ton, the parmitter					

Received Time Apr. 27. 9:56AM

To: dlfreese@laynechristensen.com; 1072@laynechristensen.com

Re: Well Registered

04272005-167373-COR(1)

April 27, 2005

CONTRACTOR: Daniel L. Freese

CONTRACTORS FIRM:

Layne-Western, a division of Layne Christensen Co.

P.O. Box 597 Valley, NE 68064

LOCATION OF WELL: NW1/4SE1/4 of Section 29 Township 11 North, Range 1 E Seward County

OWNER: USDA / FSA / CCC

NOL ID: 111161076323351 SEQUENCE NUMBER: 167373

The above well has been registered with the Nebraska Department of Natural Resources. Its registration number is G-133386. The registered well information can be reviewed at the Department website: http://dnrdata.dnr.state.ne.us/wellssql

We thank you for your cooperation. If you have any questions or comments, please let us know.

Sincerely, Christine Southwick Staff Assistant, Ground Water Nebraska Department of Natural Resources Lincoln, NE 68509 (402) 471-4084 MW1

Mail to DNR PO Box 94676 Lincoln, NE 68509-4676 Phone (402)471-2363

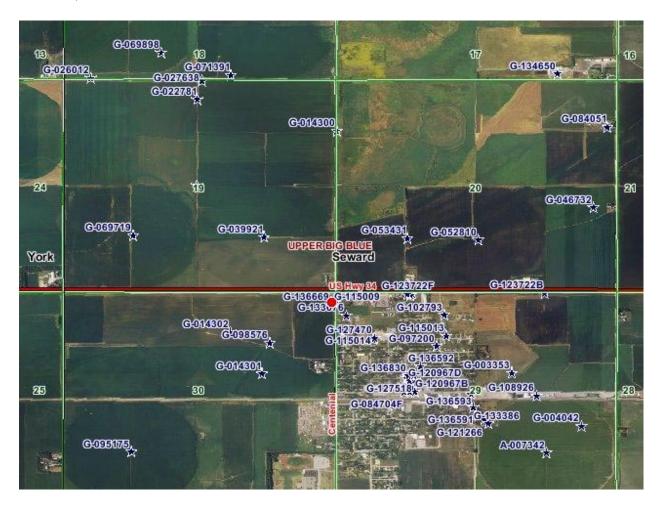
STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

January 2004 DNR Form 145

WATER WELL REGISTRATION	
FOR DEPARTMENT USE ONLY	Ý

	Registration Date 10-3-2005 Sequence No. 170488 Registration No. G-13 Owner Code No. 51127 Receipt No. UPPER BIG BLU	36669 16 NRD
1.	a. Well Owner's First Name b. Company Name USDA/CC c. Correspondent Name Steve Gilmoic Address Stop 05/3 - Room 4775 1400 Independence Ave Sw City Washington, DC State Zip 20250 Telephone 202-	
2.	2. a. Contractor's License No 19193 Contractor's Name Mike Magnin Contractor's Email Address Magnin Shoot leagues & Coch b. Drilling Firm Name Boat Longues Address 101 Alderson Street City Scholield State WI Zip 54416 Telephone 7/5-3. Drilling Firm's Email Address	
3.	b. Natural Resources District Coper By Bloc c. The well is 249 feet from the Scoond 3.96" Longitude Degree 400 Minute 50 Second 3.96" Longitude Degree 770 Minute 200 Second 59.64" d. Street address and subdivision, if applicable Block E. Location of water use, if applicable (give legal descriptions) f. If for irrigation, the land to be irrigated is	section line
	Permits	
5.	Domestic Ground Heat Exchanger Groundwater Source Heat Pump Irrigation Livestock Monitoring Observation Public Water Supply (with spacing) Recovery Other (indicate use)	r 90 days) Injection
6.	a. Is this well a part of a series? Yes go to part b of this section b. If one or more of the wells in the series is currently registered, give the well registration number c. How many wells in the series are you registering at this time?	
7.	/. Replacement and abandoned well information. a. Is this well a replacement well? Yes No b. Registration number of abandoned well If not registered, date abandoned well was constructed c. Replacement well is feet from abandoned well. d. Abandoned well last operated (m)/(d) e. Original well pump column size inches. f. Completion of original well abandonment on g. Location of water use of abandoned well	/(v)

0 D T	C	·								
8. Pump In:		at this time	Tves INSTITUTE	Jo						
					numn installed	by contractor in s	ection 27	Yes X No		
	_				-	by contactor in s	conon D. <u>III.</u>			
If pump installed by pump installer, please fill out license number below b. Pump Installer's License NoPump Installer's Name										
		Email Address		inp income o						
Pum	np Installer's l	Firm Name								
Pum	np Installer's l	Firm Address						·		
City			State	Zip	-	Tele	phone	·		
Pum	np Installer's	Firm Email Addre	SS							
c. Pum	nping rate	gallon	s per minute _	Me	asured	Estimated		,		
d. Dro	p pipe diamet	er	inches		0	op pipe	fee	t		
f. Pum	ping equipme	ent installed (m)	_(d(y)		Pump Brand					
		ned and construct	ed to pump les	s than 50 gpm	Yes L	No				
9. Well Cons	struction Info	rmation.					. t			
a. Total	well depth _	105.0 f	eet.		b. Static water	level 87.0	feet.	100		
c. Pump	oing water lev	eli	feet	101 05	d. Well Const	ruction began (mon	th) Z /(da	y) <u>10</u> 1 (year <u>0.5</u> Bottom <u>6</u> "		
e. Well g. Casin	Construction or and Screen	Joints are Welde	ed Glu	ed T	Threaded X	nameter in inches Other	10p <u>zs</u> r	souom_ <u>s</u>		
g. Cash	is and occor.	Johns are weld	<u> </u>		Timeaded 1-74	- Cuic				
10. Well Con	struction (Ca	sing & Screen)- c	, d, e, & g mea	surements sho	uld be in inche	to three decimal	places			
	a	Ъ	С	d	е	f	g	h .		
Place	ement	Casing or	Inside	Outside	Wall	Screen Slot	Type of	Trade Name		
Depth	in Feet	Screen	Diameter	Diameter	Thickness	Size	Material			
From	To	7 1				•		,		
0	85,0'	Casing	2,067	2,375	,154		PUC	Bourt Kengina		
85.0	105.0'	20,0' Screen	2,067	2.375	.154	,010	PVC	Boart Longger		
23.0	105.0	LOID SEVEEN	1,06	7:360	1127	1000	,,,,,	DOGIT LONGGEGE		
		-	<u> </u>							
				<u> </u>				<u> </u>		
11. Grout and	George Dool	•								
			-			3.5-1	-17			
	ement Depth			out or		Mater	ial Description			
From	Т			rel Pack			,			
		79.0'		nite Grout	Borard	Agya Guard	Grout 3	30% Solids		
79.	0	83,0		te Chips	Baroid	3/8 Holeplu	2			
831	0	108.0	Sand	# 20'	Red Flin	+ Sand & Gr	avel #20	well Slot Sand		
12. Geol	logic Materia	ls Logged		1						
Depth in Feet		Description			Depth in Fee	De De	scription			
From To		,			From 7	Γο . ΄				
<u>o .5</u>	6	ravel								
5' 4	9.0' Bro	5:14.	Clar		-					
		-1 /	1 6	/		· · · · · · · · · · · · · · · · · · ·				
49.0 108	10 Brow	un Medium 7	to time Sor	rd	-					
			(4.3.3)	tland disets		4)				
			(Addi	uonai sheets n	nay be submitte	a)		1		
13. I am far	niliar with th	a information sub	mitted on this	registration of	nd to the best o	f my knowledge it	is true			
*** **********************************	miai wini fil	nitormation sub	THIRD OUT OUR	rogionation, al	ad to the nest o	my Mowreage II	. до шис.			
Maria	/1//	Mod	8/26/0	5						
Water W	Vell Contract	or's Signature	Date	<u> </u>	Well	Owner's Signatur	re	Date		
						r is unknown or I		•		



MW2

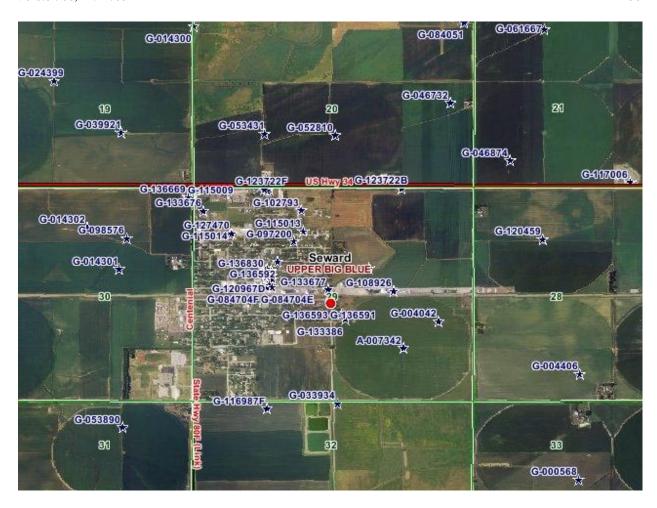
Mail to DNR PO Box 94676 Lincoln, NE 68509-4676 Phone (402)471-2363

January 2004 DNR Form 145

STATE OF NEBRASKA DEPARTMENT OF NATURAL RESOURCES WATER WELL REGISTRATION

	FOR DEPARTMENT USE ONLY
	Registration Date 10 - 3 - 2005 Sequence No. 170489 Registration No. G-136591 Owner Code No. 51127 Receipt No. UPPER BIG BLUE NRD
	a. Well Owner's First Name Last Name b. Company Name USDA / CCC c. Correspondent Name Steve Gilmen Attention Address Stop 05/3 Room 4725 1400 Independence Ave 5W City Washington; DC State Zip Telephone
2.	a. Contractor's License No. 19193 Contractor's Name Mike Mognin Contractor's Email Address Mmagnin & boot longitor of Can b. Drilling Firm Name Boot kongrear Address 101 Aldresson Street City Schofield State WI Zip 54452 Telephone 715-359-7090 Drilling Firm's Email Address
3.	a. Well location NE 1/4 of the SW 1/4 of Section 29, Township // North, Range / ED W Seward County. b. Natural Resources District Upper Big Bloc c. The well is 2451 feet from the (N SD) section line and 2592 feet from the (B W) section line or Latitude Degree 40° Minute 53' Second 38.04" Longitude Degree 97 Minute 20' Second 24.72' d. Street address and subdivision, if applicable Block Lot e. Location of water use, if applicable (give legal descriptions) f. If for irrigation, the land to be irrigated is acres. g. Well reference letter(s), if applicable M Q-2 HHSS PWSID
÷	
	Permits Surface Water Permit Number Management Area Permit Number Industrial Permit Number Geothermal Permit Number Transfer Out-Of-State Permit Number Municipal Permit Number Conduct Permit Number Well Spacing Permit Number Other Permit Number HHSS NDEQ
5.	Purpose of well (indicate one) Aquaculture Commercial/Industrial Dewatering (over 90 days) Domestic Ground Heat Exchanger Groundwater Source Heat Pump Irrigation Injection Livestock Monitoring Observation Public Water Supply (with spacing (46-638)) Public Water Supply (without spacing) Recovery Other (indicate use)
6.	Wells in a Series. a. Is this well a part of a series? Yes go to part b of this section b. If one or more of the wells in the series is currently registered, give the well registration number c. How many wells in the series are you registering at this time?
7.	Replacement and abandoned well information. a. Is this well a replacement well? Yes No b. Registration number of abandoned well If not registered, date abandoned well was constructed (m) /(d /(y) c. Replacement well is feet from abandoned well. d. Abandoned well last operated (m) /(d) /(y) e. Original well pump column size inches. f. Completion of original well abandonment on (m) /(d /(y) g. Location of water use of abandoned well

8. Pump Int	formation		,,,,,								
•		d at this time	Yes N	Vo							
Is pump installed by well owner in section 1? Yes XNo Is pump installed by contractor in section 2? Yes XNo											
If pump installed by pump installer, please fill out license number below											
b. Pump Installer's License No Pump Installer's Name											
Pump Installer's Email AddressPump Installer's Firm Name											
	•										
	Pump Installer's Firm Address City Telephone Telephone										
Pump Installer's Firm Email Address											
c. Pumping rate gallons per minute Measured Estimated											
d. Drop pipe diameter inches e. Length of drop pipe feet											
f. Pum	ping equipr	nent installed (m)_	_/(d/(y)		. Pump Brand						
		gned and construct	ed to pump les	s than 50 gpm	Yes	No					
9. Well Cons	struction Inf	ormation.				070					
a. Total	well depth	f	eet.		b. Static water	r level 87.0	feet.	91.05			
c. Pump e. Well	Construction	n completed (month)	8 /4	7 1, 05	f. Bore hole of	liameter in inches	Top 6	Bottom			
g. Casin	g and Scree	ormation. //7/0' evel on completed (month). en Joints are Weld	ed Glu	ed	Threaded 7	Other	r				
	struction (C	asing & Screen)- c	, a, e, & g mea	d d	e e	f f	g	h			
	ment	Casing or	Inside	Outside	Wall	Screen Slot	Type of	Trade Name			
	in Feet	Screen	Diameter	Diameter	Thickness	Size	Material				
From	То	-	Diminotor	Diameter	111101111000	3220					
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90,0'	115.0			2.375	154	216	PUC	Boart Longyear			
70,0	115.0	13.0 Seven	31067	2.300	1/3/	.010	100	Dogil Longy car			
				1		1					
11. Grout and	Gravel Pac	k									
Plac	ement Dept	h in Feet	Gr	out or		Mater	ial Description	1			
From		То	Grav	el Pack	- 1						
0		85.0	Rentan	ite Grout	Roseril	Acres Gual	1 Good	30% Solids			
85.	Q*	88.0'		te Chips	Boon	1 3/m Haleply	0				
88.	,	117.0'	Sand	# 20	Pil Fl	at soul + 6	Erove \$20	well Slot Sand			
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		in the fine									
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	•	•,	(Addi	tional sheets r	nay be submitte	ed)					
10 7 7		1 10 1	10. 1	1	. 1	C 1					
13. I am far	niliar with t	he information sub	mitted on this	registration, a	na to the best o	my knowledge if	is true.				
The.	m K -	Max	8/26/05	<u> </u>							
Water W	Vell Contrac	ctor's Signature	Date		Well	Owner's Signatur	re	Date			
		.				r is unknown or I					



MW3

Mail to DNR PO Box 94676 Lincoln, NE 68509-4676 Phone (402)471-2363

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

WATER WELL REGISTRATION FOR DEPARTMENT USE ONLY

	Re	gistration Date 10-3-2005 Sequence No. 170490 Registration No. G-136592 vner Code No. 51127 Receipt No. UPPER BIG BLUE NRD
		vner Code No. 51127 Receipt No. UPPER BIG BLUE NRD
1.	a. b.	Well Owner's First Name Last Name Company Name US OA / CCC
	c.	Correspondent Name Steve Gilmore Attention
		Address Stop 0513 - Room 4725 1400 Independence Ave Scer City Washington, DC State Zip 20250 Telephone 202-720-5104
-		
2.	a.	
	L.	Contractor's Email Address Magain a hoortlonggeor o Com Drilling Firm Name Boort Longgeor
	D.	Address 101 Allerson Street
		City Schoffeld State WI Zip 54476 Telephone 715-359-7090
		Drilling Firm's Email Address
_		
3.	a. b.	Well location 5 1/2 of the WW's of Section 29, Township // North, Range (ED) W Seward County. Natural Resources District Upper Big Blue
	D. C.	The well is 1854 feet from the ODD S section line and 1594 feet from the CD W D section line
	٠.	(circle one)
		or Latitude Degree 40° Minute 53' Second 48.12"
	_	Longitude Degree 77 windte 20 Second 3770
	d.	Street address and subdivision, if applicable
		Block Lot Location of water use, if applicable (give legal descriptions)
	e. f.	If for irrigation, the land to be irrigated is acres.
	g.	Well reference letter(s), if applicable MW-3 HHSS PWSID
_		
4.	Perr	mits Surface Water Permit Number Industrial Permit Number
	Geo	thermal Permit Number Transfer Out-Of-State Permit Number
		nicipal Permit Number Conduct Permit Number Conduct Permit Number
	Wel	Il Spacing Permit Number Other Permit Number NDEO
		pose of well (indicate one) Aquaculture Commercial/Industrial Dewatering (over 90 days)
٦.	T III	Domestic Ground Heat Exchanger Groundwater Source Heat Pump Irrigation Injection
		Livestock Monitoring Observation Public Water Supply (with spacing (46-638))
		Public Water Supply (without spacing) Recovery Other
		(indicate usc)
6.	We	lls in a Series.
	a.	Is this well a part of a series? Yes go to part b of this section No go to part 7 of this application
	b.	If one or more of the wells in the series is currently registered, give the well registration number
	c.	How many wells in the series are you registering at this time?
7.	•	lacement and abandoned well information.
	a.	Is this well a replacement well? Yes No
	b.	Registration number of abandoned well If not registered, date abandoned well was constructed (m)/(d/(y)
	с. e.	Replacement well is feet from abandoned well. d. Abandoned well last operated (m)/(d)/(y) Original well pump column size inches. f. Completion of original well abandonment on (m)/(d/(y)
	g.	Location of water use of abandoned well

Is pump If pump If pump b. Pum Pum Pum City Pum c. Pum d. Drog f. Pum h. This	installed by installed by installed by installer' up ping rate _ p pipe diam ping equipm well is destruction Installer up installer' up instal	s Firm Email Addre gallon eter ment installed (m) igned and construct	Statess per minuteinchesinc	Zip Zip gs than 50 gpn	easured Length of dr. Pump Brand	Tele Estimated top pipe No r level 87.0° ruction began (monthing)	phonefeefeet. ah) 8 /(da Top6'' B		
		Casing & Screen)- c,				a to three desired	-la asa		
a a		b	c c	d d	e e	f	g	h	
Place	ment	Casing or	Inside	Outside	Wall	Screen Slot	Type of	Trade Name	
Depth	in Feet	Screen	Diameter	Diameter	Thickness	Size	Material		
From	То								
. 0	100,0	Casing	2.067	2.375	154		PUC	Boart Languery	
100.01	125.0		2,067	2.375	:154	:010	PUC	Boot 1- orner	
700,0	100:0	AS SEILER	2,007	71514	:157	.010	100	posti Longigeor	
From O									
12. Geologic Materials Logged Depth in Feet Description From To Depth in Feet Description From To Jopsoil July Depth in Feet Description From To From To Additional sheets may be submitted)									
13. I am fan	niliar with	the information sub			nd to the best of	f my knowledge it	is true.		
Mari	Lift.	Mondo	8/26/0	5					
Water W	ell Contra	ctor's Signature	Date			Owner's Signatur r is unknown or D		Date	



MW4

Mail to DNR PO Box 94676 Lincoln, NE 68509-4676

Phone (402)471-2363

STATE OF NEBRASKA DEPARTMENT OF NATURAL RESOURCES

WATER WELL REGISTRATION

January 2004 DNR Form 145

	FOR DEPARTMENT USE ONLY
	Registration Date 10-3-2005 Sequence No. 170491 Registration No. G-136593 Owner Code No. 51127 Receipt No. UPPer Big Blue NRD
1.	Last Name Company Name USDA/FSA/CEPD Correspondent Name Steve Gilmore Address Stop 0513 - Room 4725 1400 Fodendere Ave. SW City Washington BC State Zip 20250 Telephone 202-770-5104
2.	Contractor's License No. 19193 Contractor's Name Mike Mognin Contractor's Email Address Mognin @ hooflongyear of Com Drilling Firm Name Boart Long year Address 101 Mderson Street City Scholield State WI Zip 54476 Telephone Drilling Firm's Email Address
3.	Well location NE% of the SW% of Section 29, Township // North; Range / EXW Seward County. Natural Resources District Opper Bio Block The well is 245/ feet from the (N Section line and 2592 feet from the (B W) section line or Latitude Degree 40° Minute 53′ Second 38,04′′ Longitude Degree 97° Minute 20′ Second 24,72′′ Street address and subdivision, if applicable Block Lot
	Location of water use, if applicable (give legal descriptions) If for irrigation, the land to be irrigated isacres. Well reference letter(s), if applicable HHSS PWSID
4.	remits Surface Water Permit Number Industrial Permit Number Feothermal Permit Number Industrial Permit Number Transfer Out-Of-State Permit Number Conduct Permit Number Vell Spacing Permit Number UHSS NDEQ
5.	Public Water Supply (without spacing) Recovery Other (indicate use)
6.	Wells in a Series. Is this well a part of a series? Yes go to part b of this section No go to part 7 of this application If one or more of the wells in the series is currently registered, give the well registration number How many wells in the series are you registering at this time?
7.	Leplacement and abandoned well information. Is this well a replacement well? Yes No Registration number of abandoned well If not registered, date abandoned well was constructed (m) /(d /(y) / (y)

	8. Pump Information.										
a. Is pump installed at this time Yes No											
Is pump	Is pump installed by well owner in section 1? Yes No Is pump installed by contractor in section 2? Yes No										
If pump	If pump installed by pump installer, please fill out license number below										
b. Pun	b. Pump Installer's License No. Pump Installer's Name										
Pun	Pump Installer's Email Address										
Pun	Pump Installer's Firm Name										
Pun	Pump Installer's Firm Address										
City	CityStateZipTelephone										
Pun	Pump Installer's Firm Email Address										
c. Pun	The state of the s										
d. Dro											
		ned and construct									
9. Well Con				81							
a. Total	situction into	125.0' 1	· 		h Ctatia wata	r level <u>82.0</u>	foot				
n		•	~ ·		1 777 17 0	ruction began	166r	12 1 05			
e. Well	Construction	completed (8 1000	21,05	f Bore hole	ruction began _{(mon} <u>li</u> ameter in inches	Top & 'I	Bottom (year			
g. Casir	ng and Screen	completed (month). Joints are Welde	ed Glu	ed	Threaded X	Other					
10. Well Con	struction (Ca	sing & Screen)- c	, d, e, & g mea	surements sho	ould be in inche	s to three decimal	places				
	a	b	С	d	е	f	g	h			
Place	ment	Casing or	Inside	Outside	Wall	Screen Slot	Type of	Trade Name			
Depth	in Feet	Screen	Diameter	Diameter	Thickness	Size	Material				
From	To	-									
		 	<u> </u>	- 22/	1.011		0.1.0	0 11			
	100.0	Casing	2.067	2.375	.154		PUC	Boart Longycar			
100.0	125.0	250' screen	2.067	2.375	.154	2010	PUC	Boart Languear			
							·	//			
11. Grout and	Gravel Pack										
Plac	ement Depth	in Feet	Gr	out or		Mater	ial Description				
From	T		l	el Pack							
	- 1	-		 	 			-81 111			
		94.0'	Ben Toni	te Grout	Baroid	Agua Good	Grout 3	50% Solids			
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1.1/10					720.7711	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	., , , , , , ,				
12. Geo	logic Materia	ls Logged									
Depth in Feet	_				Depth in Fee	. D.	scription				
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1010	1000	and The 10 /	redion J	inc_							
-			7 L L A)								
			(Addi	tional sheets i	nay be submitte	a)					
12 Tam A	المراعات والمراال	information and		maniaturaina -	nd to the best of	Famou lan accidenda = 34	ia tauxa				
13. I am far	milar with the	miormation sub	mitted on this	registration, a	nd to the best of	f my knowledge it	is true.				
Mn.	_/-	71.9	Olaria	_							
_ w	100	100	8/26/05	<u> </u>	777 11	O		Dete			
water V	Vell Contracto	ors Signature	. Date			Owner's Signatur		Date			
					n Contracto	r is unknown or D	CCCASCO				

