



## Nitrate Concentrations in Ground Water in the Henrys Fork Basin, Eastern Idaho

In 1998 and 1999, the U.S. Geological Survey (USGS) completed comprehensive studies of nitrate concentrations in ground water in the Henrys Fork Basin in eastern Idaho (fig. 1A). These studies were done in cooperation with the following agencies or groups: Idaho Division of Environmental Quality (DEQ), District 7 Health Department, Idaho Department of Water Resources (IDWR), Idaho Department of Agriculture (IDAG), Bureau of Reclamation, Henrys Fork Foundation, Fremont County, and Madison County. This Fact Sheet presents selected results of these investigations.

### Description of the Area

The Henrys Fork Basin in parts of Teton, Madison, and Fremont Counties in Idaho comprises lower Henrys Fork (Menan Buttes to about Ashton, including the Fall River drainage), Teton River, and upper Henrys Fork drainages. Detailed descriptions of climate, geographic setting, land and water uses, geology, hydrology, and generalized water quality of the area are provided in reports listed in the "Selected References" section, back of this report.

Geology and hydrology of the basin are diverse and complex. Unconsolidated sediment varies in thickness from a few feet to hundreds of feet; thicknesses are greatest in areas from Menan Buttes to St. Anthony.

Sediment overlies variable thicknesses of volcanic rocks, and ground-water yielding zones exist in sediment and volcanic rock units. Regionally, ground water moves generally southward to southwestward but, in localized areas, ground-water movement can be northwestward or southeastward (Crosthwaite and others, 1970; Whitehead, 1978; Spinazola, 1994). Total well depths vary from tens of feet to hundreds of feet below land surface. Some well casings may be perforated or screened at one or more intervals or wells may be constructed with uncased boreholes to increase well yields.

Most ground water in the Henrys Fork Basin is nonthermal (temperature less than 29 degrees Celsius, °C; 84 degrees Fahrenheit, °F), but geothermal water (temperature greater than 29°C) is present in many parts of the basin. On the basis of U.S. Environmental Protection Agency (EPA, 1996) standards for public water supplies, ground water in the Henrys Fork Basin is suitable for most public and private drinking-water uses. Ground water in this area is highly or very highly vulnerable to contamination (Rupert and others, 1991), and water in a few areas contains contaminants—components that can limit the water's suitability for use or can represent degradation of water quality.

Potential pathways of contaminant movement to ground-water zones include downward flushing of contaminants by infiltration of precipitation, floodwater, or applied irrigation water; flushing from soil and unsatur-

ated rocks by seasonal variations in ground-water levels; leakage around or into well casings or boreholes (especially important in areas with thin layers of soil and sediment overlying volcanic rock); dumping into wells; backflushing to wells through water-supply systems; and transport from upgradient ground-water zones. Contamination from land and water uses can be localized (point source) or widespread (nonpoint source).

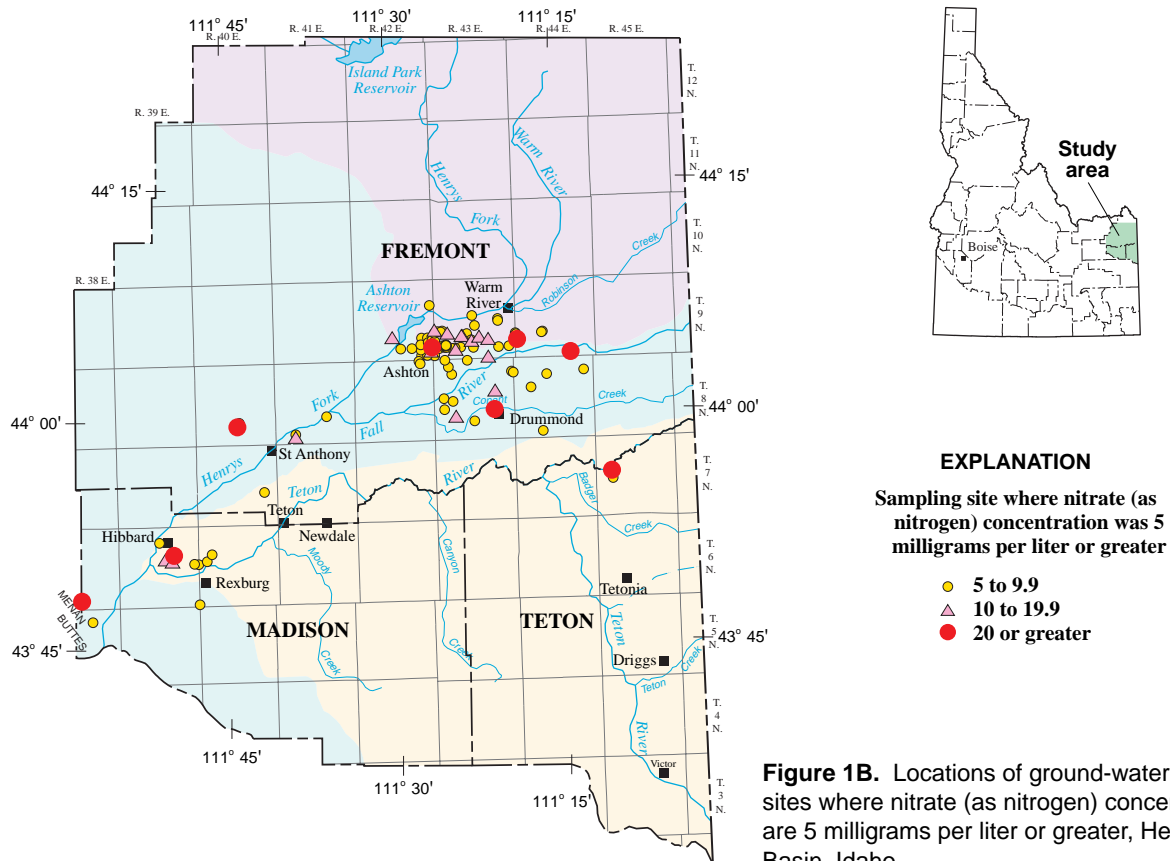
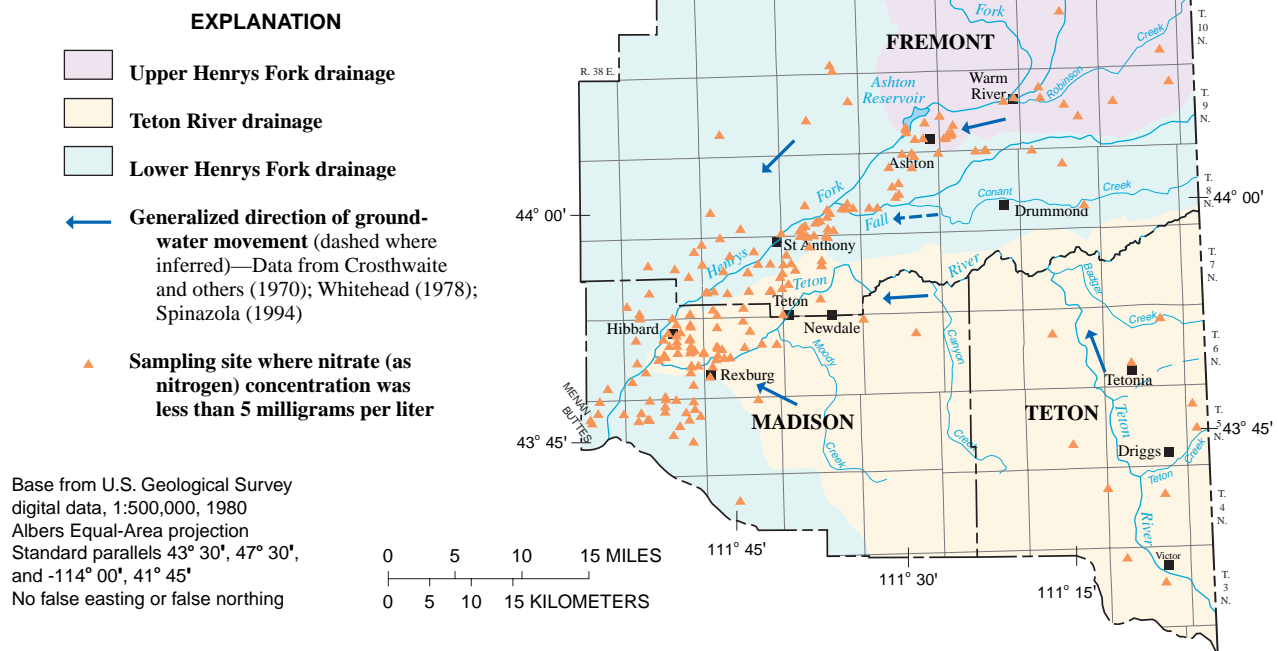
One of the most widespread contaminants in the Henrys Fork Basin is nitrate ( $\text{NO}_3$ ). In this report, nitrate is reported as nitrogen ( $\text{NO}_3\text{-N}$  or nitrate-N) in milligrams per liter (mg/L, equivalent to parts per million).

### Nitrate-N Concentrations in Ground Water

Concentrations of nitrate-N in Idaho prior to land and water development probably were less than 1 mg/L. From 1995 through 1999, the median concentration (50th percentile) of nitrate-N in Idaho ground water was about 1.4 mg/L, and the range of concentrations was <0.05 to 100 mg/L. During the same period, the median nitrate-N concentration in the Henrys Fork Basin was 3.2 mg/L, and the range of concentrations was <0.05 to 38 mg/L.

Large nitrate-N concentrations primarily are of concern as a drinking-water health risk, and the maximum EPA (1996) limit for nitrate-N concentration in public water supplies is 10 mg/L. Recommendations

**Figure 1A.** Locations of ground-water sampling sites where nitrate (as nitrogen) concentrations are less than 5 milligrams per liter, and generalized directions of ground-water movement, Henrys Fork Basin, Idaho.



**Figure 1B.** Locations of ground-water sampling sites where nitrate (as nitrogen) concentrations are 5 milligrams per liter or greater, Henrys Fork Basin, Idaho.

**Table 1.** Drinking-water recommendations for ranges of nitrate

[Modified from Mahler and others, 1990, p. 1; mg/L, milligrams per liter]

Nitrate as nitrogen (NO <sub>3</sub> -N, in mg/L) <sup>1</sup>	Nitrate as nitrate (NO <sub>3</sub> -NO <sub>3</sub> , in mg/L) <sup>2</sup>	Comments
0 to 10	0 to 44	Safe for human and livestock consumption.
11 to 20	45 to 88	Generally safe for human adult and livestock consumption. Do not use for human infants.
21 to 40	89 to 176	Short-term use acceptable for human adult and all livestock consumption unless food or feed sources are very high in nitrate. Long-term use could be risky. Do not use for human infants.
41 to 100	177 to 440	Moderate to high risk for human adult and young livestock consumption. Probably acceptable for mature livestock if feed is low in nitrate. Do not use for human infants.
Over 100	Over 440	Do not use.

<sup>1</sup> Laboratory nitrate analysis reported as nitrogen (N), in mg/L.<sup>2</sup> Laboratory nitrate analysis reported as nitrate (NO<sub>3</sub>), in mg/L.

for various ranges of nitrate-N in drinking water are shown in table 1.

Chronic, long-term health risks from consumption of water containing large nitrate concentrations are not fully understood. Short-term effects include the risk of methemoglobinemia (blue-baby syndrome, characterized by the reduced ability of blood to carry oxygen) to human infants, a small percentage of adults, and young livestock (Mahler and others, 1990, p. 1). Large concentrations of nitrate-N may be implicated with an increased incidence of non-Hodgkin's lymphoma (Weisenburger, 1991, p. 309). Anomalous nitrate-N concentrations also imply active exchange of water from land surface to ground-water zones and the potential for water contamination by microorganisms or other chemical compounds (Parlman, 1998, p. 4).

## Ground-Water Analyses and Site Descriptions

From 1995 through 1999, water samples were collected by the USGS or DEQ from 319 wells or springs in the Henrys Fork Basin and analyzed for nitrate-N concentrations<sup>1</sup>. For sites with multiple analyses, only the most recent analysis per site was used in this report. Complete site descrip-

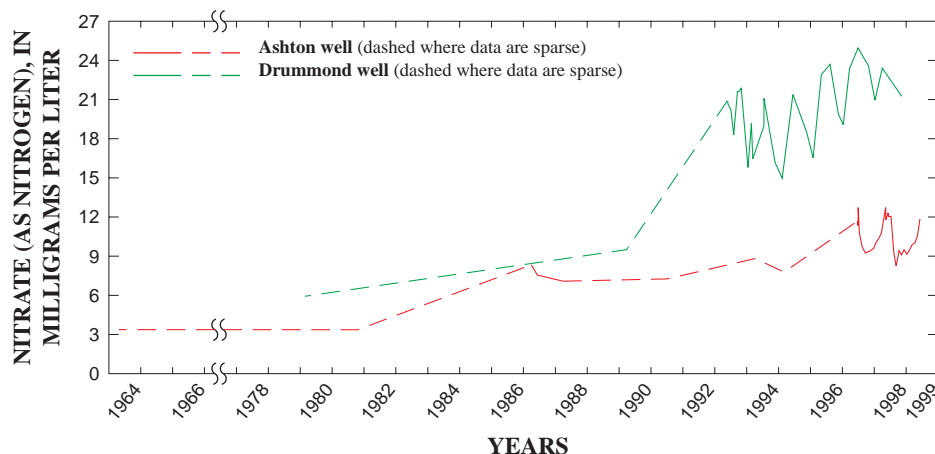
tions and water-quality data are available from the USGS District office in Boise, Idaho. Well locations, total well depth, and selected water-quality data are available in MS-EXCEL spreadsheet format at the Idaho District Web site <http://idaho.usgs.gov/> until approximately February 2001.

Locations of ground-water sites are displayed in figures 1A and 1B according to ranges of nitrate-N concentrations. Concentrations in most water samples are relatively small (less than 5 mg/L). In some parts of the study area, water contains moderately large nitrate-N concentrations (5 to 9.9 mg/L) or concentrations

exceeding the EPA (1996) maximum contaminant level of 10 mg/L, a potential health risk for some drinking-water purposes.

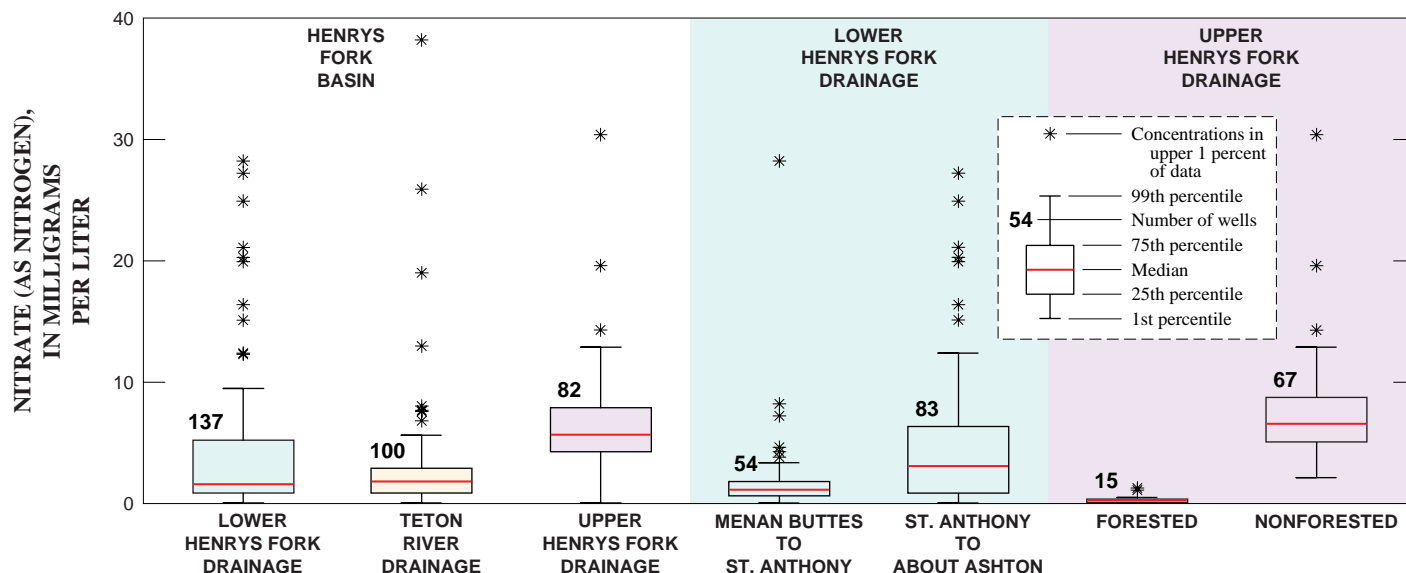
## Historical Nitrate-N Concentrations

Nitrate-N data prior to about 1990 are sparsely distributed or clustered in the Henrys Fork Basin. Most historical nitrate-N concentrations were less than 5 mg/L, but concentrations exceeding 20 mg/L were analyzed in water samples from wells east of Ashton and near Menan Buttes in the 1970's. Nitrates could have been increasing since about the 1970's in



**Figure 2.** Changes in nitrate (as nitrogen) concentrations, 1964–99, in water samples from wells at Ashton and Drummond, Henrys Fork Basin, Idaho.

<sup>1</sup>USGS laboratory analyses are reported in units of nitrite plus nitrate as nitrogen (NO<sub>2</sub>+NO<sub>3</sub> as N). DEQ laboratory analyses are reported in units of nitrate as nitrogen (NO<sub>3</sub> as N). Concentrations of nitrite in ground water generally are negligible. For purposes of this report, USGS and DEQ analyses are comparable.



**Figure 3.** Nitrate (as nitrogen) data for wells in Henrys Fork Basin, Idaho.

areas where overall nitrate-N concentrations are currently large.

Changes in nitrate-N concentrations over time for water samples from wells at Drummond and Ashton are shown in figure 2. Total depth of both wells is about 300 feet, and hydrogeologic environments and nearby land-use histories are similar. Few nitrate-N data are available for either well from 1950 to about 1980, but the patterns of increasing nitrate-N concentrations are similar—relatively low nitrate-N concentrations until about 1980, then increasing concentrations to 1999 accompanied by seasonal fluctuations in concentrations each year. Causes for increasing concentrations currently are not fully understood.

## Statistical Summary of Nitrate-N Data

Statistical summaries (boxplots) of nitrate-N concentrations for lower Henrys Fork, Teton River, and upper Henrys Fork drainages are compared in figure 3. Median (50th percentile) concentrations for lower Henrys Fork and Teton River drainages are similar (1.6 mg/L and 1.9 mg/L, respectively), but the median concentration for the upper Henrys Fork area is 5.7 mg/L. Substantial differences

are also evident in the distribution of nitrate-N concentrations within each drainage, as shown in the comparison of summaries for segments of the lower Henrys Fork drainage—Menan Buttes to St. Anthony and St. Anthony to about Ashton. From Menan Buttes to St. Anthony, the median concentration is 1.1 mg/L, and from St. Anthony to about Ashton, the median is 3.1 mg/L. In the upper Henrys Fork drainage, large differences in concentrations are evident between areas with little or no land- and water-use development (forested) and areas with extensive and varied land- and water-use development (nonforested). The median concentration for forested areas is 0.3 mg/L, and the median concentration for nonforested areas is 6.6 mg/L.

## Sources of Nitrogen

Rupert (1996) estimated the amount of total nitrogen input by cattle manure, fertilizer, legume crops (such as alfalfa and beans), precipitation, and domestic septic systems for counties in the upper Snake River Basin, eastern Idaho and western Wyoming. The estimates were used to rank the input of nitrogen by source and determine the amount of total nitrogen potentially available to

ground and surface water through leaching and runoff. Results showed that about 45 percent of the input was from fertilizers, 29 percent from cattle manure, 19 percent from legume crops, 6 percent from precipitation, and less than 1 percent from domestic septic systems. Input from cattle manure, fertilizers, and legume crops varied widely among counties, reflecting differences in land-use practices such as cropping patterns and numbers of dairies and feedlots. In the Henrys Fork Basin, Rupert indicated that fertilizers were the major source of nitrogen input. Manure and crops were secondary sources, and precipitation and domestic septic systems were minor sources of nitrogen input.

## Nitrogen Isotope Data

One method for estimating sources of nitrogen to ground water is analysis for stable isotopes of nitrogen. Stable isotopes are nonradioactive forms of an element. Nitrogen isotopes  $^{15}\text{N}$  and  $^{14}\text{N}$  constitute an isotope pair, and lab analyses determine the ratio of the abundance of the heavier isotope ( $^{15}\text{N}$ ) to that of the lighter isotope ( $^{14}\text{N}$ ) in water. The major potential sources of nitrogen contamination commonly have characteristic  $^{15}\text{N}/^{14}\text{N}$  ratios (expressed in



**Table 2.** Nitrogen isotope ratios of common sources of nitrate in water

Potential contaminant ratio source	<sup>15</sup> N/ <sup>14</sup> N (permil)
Precipitation	-3
Commercial fertilizer	-4 to +4
Organic nitrogen in soil	+4 to +9
Animal waste	Greater than +10

permil units, or parts per thousand). Typical <sup>15</sup>N/<sup>14</sup>N ratio values for nitrogen sources are presented in table 2 (Seiler, 1996, p. 12). Total well depth, nitrate-N, and nitrogen isotope ratio data for recent ground-water samples in the Henrys Fork Basin are shown in table 3.

Additional nitrogen isotope analyses are available through DEQ for areas near Ashton where intermediate nitrogen isotope ratio values in water could indicate a mixture of nitrogen sources (D. Yashan, DEQ, written commun., 1999).

## Other Sources of Nitrate-N Data

The comprehensive study of nitrate-N in ground water in the Henrys Fork Basin has been completed, but there are ongoing ground-water quality programs through several agencies and organizations, including USGS, DEQ, District 7 Health Department, IDAG, and consultants. For private wellowners, nitrate-N analyses are available through local analytical laboratories. Information on water quality, health risks, laboratory analyses for private wellowners, and water-treatment options is avail-

able through DEQ and District 7 Health Department agencies.

## Additional Information Needed

Effects of several hydrogeologic and environmental factors on ground-water quality are not well understood at this time. Additional information is needed in the following areas: (1) causes of increasing nitrate-N concentrations since about 1980; (2) effects of well construction on contamination of multiple water-yielding zones; (3) seasonal change in nitrate-N concentrations; (4) seasonal change in water levels and directions of ground-water movement in major water-yielding zones, particularly in the Fall River drainage; (5) comparative age dates of water in major water-yielding zones to help determine rates of contaminant movement; and (6) ground-water/surface-water relations in areas where nitrate-N concentrations are large. Large nitrate-N concentrations in ground water could contribute to increased nitrate-N concentrations in surface water, potentially resulting in deterioration of surface-water quality.

## Acknowledgments

Special thanks are extended to wellowners in the study area for access to property and permission to collect water samples from their wells. Additional thanks are extended to personnel from the City of Ashton, Lockheed Martin Idaho Technol-

ogies Company, Brown and Caldwell, URS Greiner Woodward Clyde, and Ricks College for information and unpublished data for the area.

—by D.J. Parlman

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**Table 3.** Total well depth, dissolved nitrate (as nitrogen), and nitrogen isotope ratio data<sup>1</sup> for selected wells, Henrys Fork Basin, Idaho

[mg/L, milligrams per liter]

Water sample source	Sample date	Depth of well, total (feet)	Nitrate, dissolved (mg/L as N)	<sup>15</sup> N/ <sup>14</sup> N stable isotope ratio (permil)
Well near Hibbard.....	06-15-99	240	25.9	2.80
Well near St. Anthony.....	06-29-99	113	27.2	.60
Well at Drummond .....	06-30-99	310	21.1	8.30
Well near Ashton .....	10-06-98	60	18.5	9.80
	06-25-99	60	30.4	10.10
Well at Ashton .....	10-06-98	289	8.33	5.40

<sup>1</sup>Analyses from the U.S. Geological Survey National Water-Quality Laboratory, Denver, Colorado. Nitrogen isotopes, <sup>15</sup>N/<sup>14</sup>N as nitrate and ammonia.

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**Banner photo:** Upper Henrys Fork Basin, Idaho.

**Photo at left:** Warm River Springs on Henrys Fork northeast of Ashton, Idaho (Photo by D.J. Parlman, 1998).

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## SELECTED WATER QUALITY DATA--HENRYS FORK BASIN, EASTERN IDAHO, 1995 through 1999

( < = less than; -- = data not available; NO2+NO3 = nitrite plus nitrate; MG/L AS N = milligrams per liter as nitrogen;  
latitude and longitude in degrees, minutes, and seconds based on North American datum of 1927 (NAD27);  
N-15/N-14 = nitrogen-15/nitrogen-14 as nitrate and ammonia; USGS = U. S. Geological Survey;  
DEQ = Idaho Division of Environmental Quality)

WELL LOCATION (township, range and section)	LAT- I- TUDE (NAD27)	LONG- I- TUDE (NAD27)	SAMPLE DATE (d/m/y)	DEPTH OF WELL, TOTAL (FEET)	USGS ANALYSES			DEQ ANALYSES	
					NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N)	N-15 / N-14 STABLE ISOTOPE RATIO (PER MIL)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N)	NITRO- GEN, NITRATE DIS- SOLVED (MG/L AS N)
03N 45E 05CAC1	43 36 40	111 10 29	07/06/95	50	0.02	<0.01	--	0.53	--
			07/27/99	50	<0.02	<0.01	--	0.43	--
03N 45E 14CBB1	43 35 02	111 07 06	07/06/95	183	<0.02	<0.01	--	0.58	--
			09/14/98	183	0.02	0.01	--	0.65	0.64
04N 44E 12ADD1	43 41 14	111 12 01	07/06/95	296	<0.02	<0.01	--	1.50	--
			08/04/99	296	<0.02	<0.01	--	2.00	--
04N 45E 11CDC1	43 40 47	111 06 54	09/14/98	80	0.02	0.01	--	0.18	0.17
05N 38E 02BAD1	43 47 49	111 57 18	08/09/95	82	0.03	<0.01	--	2.10	--
			06/29/99	82	0.03	<0.01	--	1.38	--
05N 38E 04ADA1	43 47 48	111 59 04	06/15/99	110	--	--	--	3.84	--
05N 38E 04ADA2	43 47 47	111 59 05	06/15/99	70	--	--	--	3.18	--
			06/15/99	70	--	--	--	3.18	--
05N 38E 04ADA3	43 47 46	111 59 02	06/17/99	220	--	--	--	<0.05	--
05N 38E 10DBA1	43 46 38	111 58 10	06/15/99	60	--	--	--	4.28	--
05N 38E 10DDB2	43 46 26	111 58 02	06/15/99	260	--	--	--	0.14	--
05N 38E 11BAB1	43 47 02	111 57 29	09/11/98	170	0.03	0.01	--	2.44	2.43
05N 38E 11BAB2	43 47 06	111 57 30	06/16/99	217	--	--	--	7.23	--
05N 39E 01BDD1	43 47 42	111 48 53	06/15/99	35	--	--	--	4.10	--
			06/15/99	35	--	--	--	4.10	--
05N 39E 01DCC1	43 47 12	111 48 47	06/15/99	85	--	--	--	2.47	--
05N 39E 02BBA2	43 47 49	111 50 26	06/15/99	41	--	--	--	2.02	--

05N 39E 03CDB1	43 47 25	111 51 26	06/15/99	68	--	--	--	1.98	--
			06/15/99	68	--	--	--	1.97	--
05N 39E 04BCA1	43 47 49	111 52 49	06/29/99	60	--	--	--	2.68	--
05N 39E 05DDD1	43 47 43	111 43 05	06/16/99	88	--	--	--	1.03	--
05N 39E 07BAC1	43 46 59	111 55 10	06/29/99	50	--	--	--	0.66	--
05N 39E 08ABC1	43 47 01	111 53 36	06/16/99	35	--	--	--	0.86	--
05N 39E 08CDB1	43 46 30	111 53 52	06/16/99	25	--	--	--	0.68	--
05N 39E 09CBC1	43 46 35	111 53 02	06/16/99	175	--	--	--	0.24	--
05N 39E 09CBD1	43 46 34	111 52 53	06/16/99	60	--	--	--	0.76	--
05N 39E 10BAC1	43 47 04	111 51 27	06/15/99	132	--	--	--	0.97	--
05N 39E 10BDB1	43 46 57	111 51 27	08/04/98	--	--	--	--	--	1.87
05N 39E 11AAC1	43 47 00	111 49 35	08/31/95	72	<0.02	<0.01	--	1.60	--
			06/21/99	72	<0.02	<0.01	--	1.61	--
05N 39E 12CBA1	43 46 31	111 49 18	08/31/95	60	0.02	<0.01	--	2.50	--
			06/14/99	60	<0.02	<0.01	--	2.11	--
05N 39E 12DAA1	43 46 44	111 48 17	06/15/99	81	--	--	--	3.07	--
05N 39E 14BAD1	43 46 07	111 50 10	06/15/99	100	--	--	--	2.94	--
05N 39E 14BAD2			06/15/99	--	--	--	--	2.31	--
05N 39E 15DDD1	43 45 32	111 50 45	10/17/95	61	--	--	--	--	1.50
			10/21/98	61	--	--	--	--	1.40
			06/17/99	61	--	--	--	1.55	--
05N 39E 24BDD1	43 45 05	111 49 00	08/11/97	60	<0.02	<0.01	--	2.78	--
			06/22/99	60	--	--	--	1.47	--
05N 44E 27ABC1	43 44 10	111 15 00	08/09/96	180	0.02	<0.01	--	0.38	--
05N 46E 07BDA1	43 46 35	111 04 12	08/06/97	160	0.03	<0.01	--	0.80	--
			08/06/97	160	0.02	<0.01	--	0.81	--
05N 46E 19AAB1	43 45 01	111 03 53	07/11/95	206	0.02	<0.01	--	0.73	--
			09/14/98	206	0.02	0.01	--	0.70	0.69
			07/27/99	206	<0.02	<0.01	--	0.50	--
06N 38E 34BCC1	43 48 22	111 58 35	05/14/98	--	--	--	--	--	28.20
06N 38E 35ABA1	43 48 38	111 56 33	08/30/95	303	<0.02	<0.01	--	0.18	--
			06/29/99	303	<0.02	<0.01	--	0.16	--
06N 39E 01CBB1	43 52 33	111 48 58	06/17/99	--	--	--	--	0.91	--
06N 39E 01CCC2	43 52 41	111 49 00	06/17/99	86	--	--	--	1.29	--
06N 39E 02CDC1	43 52 11	111 49 54	06/17/99	80	--	--	--	4.71	--
06N 39E 03ADD1	43 52 43	111 50 15	06/15/98	100	--	--	--	--	1.90
06N 39E 07ADD1	43 51 44	111 53 55	08/11/97	120	0.02	<0.01	--	0.91	--



			06/29/99	120	--	--	--	0.86	--
06N 39E 09ADA1	43 51 45	111 51 27	06/16/99	82	--	--	--	3.54	--
06N 39E 10AAD1	43 51 59	111 50 16	08/04/97	79	0.02	<0.01	--	3.24	--
			06/22/99	79	--	--	--	2.23	--
06N 39E 10BABA1	43 52 09	111 51 00	06/15/98	90	--	--	--	--	3.10
06N 39E 10BBB5	43 52 08	111 51 21	06/15/98	80	--	--	--	--	5.00
06N 39E 10CDD1	43 51 20	111 50 56	06/16/99	100	--	--	--	1.73	--
06N 39E 10DAAD2	43 51 36	111 50 15	06/15/99	267	--	--	--	2.26	--
			06/15/99	267	--	--	--	2.16	--
06N 39E 10DDDD1	43 51 20	111 50 15	01/23/95	79	--	--	--	--	4.56
			02/22/96	79	--	--	--	--	7.08
			02/18/97	79	--	--	--	--	6.52
			01/06/98	79	--	--	--	--	6.85
			05/07/98	79	--	--	--	--	8.24
			07/28/98	79	--	--	--	--	10.90
			08/24/98	79	--	--	--	--	6.81
06N 39E 10DDDD2			01/04/98	260	--	0.09	--	--	2.23
			11/18/98	260	--	--	--	--	2.67
			06/15/99	260	--	--	--	2.70	--
06N 39E 11ADD1	43 51 47	111 49 04	06/17/99	80	--	--	--	3.21	--
06N 39E 11DAA1	43 51 42	111 49 05	06/16/99	85	--	--	--	--	1.20
06N 39E 13BBB1	43 51 15	111 49 00	06/16/98	80	--	--	--	--	2.00
06N 39E 13BCA1	43 51 03	111 49 00	06/16/99	218	--	--	--	1.78	--
06N 39E 13BCD1	43 50 58	111 48 55	06/03/98	90	--	--	--	--	2.40
06N 39E 13BDB1	43 51 02	111 48 42	06/15/98	127	--	--	--	--	4.00
06N 39E 13DAAA1	43 50 53	111 47 52	09/23/98	70	--	--	--	--	0.11
			06/17/99	70	--	--	--	0.44	--
06N 39E 13DAAD1	43 50 48	111 47 52	06/17/99	70	--	--	--	0.55	--
06N 39E 13DADC1	43 50 43	111 48 15	06/17/99	75	--	--	--	8.05	--
06N 39E 13DADD1	43 50 41	111 47 52	04/23/98	--	--	--	--	--	6.42
			11/19/98	--	--	--	--	--	10.70
			06/17/99	--	--	--	--	8.03	--
06N 39E 14BBCC1	43 51 07	111 50 13	03/23/98	240	--	--	--	--	28.60
			03/30/98	240	--	--	--	--	28.40
			04/16/98	240	--	--	--	--	25.50
			06/23/98	240	--	--	--	--	21.20
			10/08/98	240	<0.02	<0.01	--	27.10	--

			06/15/99	240	--	--	2.80	25.90	--
06N 39E 14BCB1	43 51 03	111 50 13	06/16/99	90	--	--	--	13.00	--
06N 39E 14CBB1	43 50 52	111 50 12	06/16/98	80	--	--	--	--	1.60
06N 39E 14DAA1	43 50 52	111 49 04	06/15/98	260	--	--	--	--	2.80
06N 39E 15BAD1	43 51 12	111 50 50	06/17/99	--	--	--	--	19.00	--
06N 39E 15CBC1	43 50 45	111 51 25	06/22/99	100	--	--	--	3.41	--
06N 39E 15CCB1	43 50 37	111 51 24	12/30/98	100	--	--	--	--	3.23
06N 39E 15CCB2	43 50 38	111 51 17	04/21/98	102	--	--	--	--	2.70
06N 39E 16DCC1	43 50 27	111 51 55	08/08/97	100	0.02	<0.01	--	2.33	--
06N 39E 19AAD1	43 50 15	111 53 52	06/15/99	108	--	--	--	1.14	--
			06/15/99	108	--	--	--	1.14	--
06N 39E 20DCC1	43 49 39	111 53 06	08/30/95	89	<0.02	<0.01	--	3.10	--
			08/12/96	89	0.02	0.01	--	2.60	2.59
			08/08/97	89	0.02	<0.01	--	2.59	--
			08/19/98	89	0.03	<0.01	--	2.95	--
			06/21/99	89	<0.02	<0.01	--	2.54	--
06N 39E 23DDDD1	43 49 35	111 49 04	01/27/98	--	--	--	--	--	0.48
06N 39E 24ACC1	43 50 00	111 48 22	09/06/95	97	<0.02	<0.01	--	<0.05	--
			09/06/95	97	<0.02	<0.01	--	<0.05	--
			06/14/99	97	<0.02	<0.01	--	<0.05	--
06N 39E 24BCCC1	43 50 02	111 49 00	02/23/98	--	--	--	--	--	1.84
06N 39E 24CBB1	43 49 58	111 49 00	06/16/99	64	--	--	--	0.26	--
06N 39E 25CCD1	43 48 46	111 48 51	06/16/99	80	--	--	--	2.29	--
06N 39E 30ABB1	43 49 03	111 54 20	04/27/98	44	--	--	--	--	0.42
06N 39E 34CCBB2	43 48 03	111 51 24	06/16/99	160	--	--	--	1.59	--
			06/16/99	160	--	--	--	1.56	--
06N 39E 34CCC1	43 47 53	111 51 22	06/16/99	94	--	--	--	2.74	--
06N 39E 36DAD1	43 48 05	111 47 51	06/16/99	62	--	--	--	5.63	--
06N 40E 03CDD1	43 52 10	111 43 40	06/17/99	62	--	--	--	2.28	--
06N 40E 04AAD1	43 52 51	111 44 16	06/16/99	200	--	--	--	3.12	--
06N 40E 05CBC1	43 52 28	111 46 36	06/16/99	67	--	--	--	0.86	--
06N 40E 08AAA1	43 51 18	111 46 39	06/29/99	83	--	--	--	5.53	--
06N 40E 11CDCC1	43 51 19	111 42 37	09/11/98	52	0.02	<0.01	--	2.77	--
			06/22/99	52	--	--	--	0.87	--
06N 40E 13BAA1	43 51 16	111 41 17	06/17/99	141	--	--	--	0.74	--
06N 40E 16AAC1	43 51 08	111 44 11	06/03/98	69	--	--	--	--	1.50
06N 40E 17BBC1	43 51 07	111 46 35	08/03/98	195	--	<0.01	--	--	1.50

06N 40E 17BDB1	43 51 02	111 46 12	09/23/98	104	--	--	--	--	0.96
			06/15/99	104	--	--	--	1.15	--
06N 40E 17CBC1	43 50 39	111 46 36	03/18/98	42	--	--	--	--	1.60
06N 40E 17DCC1	43 50 28	111 46 01	06/22/99	64	--	--	--	2.18	--
06N 40E 18AAA1	43 51 14	111 46 39	08/06/97	59	0.02	<0.01	--	0.13	--
			06/22/99	59	--	--	--	0.45	--
			06/22/99	59	--	--	--	0.45	--
06N 40E 18DBB1	43 50 52	111 47 06	06/01/98	--	--	--	--	--	7.59
06N 40E 18DDD1	43 50 29	111 45 29	04/09/98	69	--	--	--	--	1.32
06N 40E 19AAB2	43 50 23	111 46 46	12/08/98	250	--	--	--	--	3.96
06N 40E 19DBA1	43 49 55	111 47 05	06/16/99	175	--	--	--	0.90	--
			06/16/99	175	--	--	--	0.91	--
06N 40E 30BDD1	43 49 16	111 47 20	06/24/99	61	--	--	--	0.96	--
06N 42E 06BCB1	43 52 44	111 33 26	08/06/97	500	0.02	<0.01	--	1.19	--
06N 42E 10ADA1	43 51 45	111 28 45	08/31/95	975	<0.02	<0.01	--	0.84	--
			06/22/99	975	<0.02	<0.01	--	0.96	--
06N 44E 09CCA2	43 51 23	111 16 32	07/11/95	700	<0.02	<0.01	--	1.00	--
			07/30/99	700	<0.02	<0.01	--	2.32	--
06N 45E 02CDB1	43 52 12	111 06 49	08/14/96	--	0.03	0.01	--	0.08	0.07
06N 45E 28BBC1	43 49 22	111 09 32	08/09/96	110	0.02	<0.01	--	0.85	--
07N 39E 01CDD1	43 57 23	111 48 29	06/22/99	110	--	--	--	1.08	--
07N 39E 08DDD1	43 56 32	111 52 40	06/17/99	124	--	--	--	0.41	--
07N 39E 12CCC1	43 56 33	111 47 47	06/22/99	72	--	--	--	1.03	--
07N 39E 14DDA1	43 55 47	111 49 02	06/22/99	144	--	--	--	3.02	--
07N 39E 15ADA1	43 56 18	111 50 16	06/29/99	160	--	--	--	0.88	--
07N 39E 29AAA1	43 54 46	111 52 37	06/16/99	200	--	--	--	0.32	--
07N 39E 30CDC1	43 53 56	111 54 39	06/17/99	160	--	--	--	0.67	--
07N 39E 32CBA1	43 53 27	111 53 32	06/17/99	159	--	--	--	3.38	--
07N 39E 32CCA1	43 53 12	111 53 32	08/30/95	55	0.06	<0.01	--	2.80	--
			06/21/99	55	<0.02	<0.01	--	4.65	--
07N 39E 32CCA2	43 53 10	111 53 30	08/11/97	120	<0.02	<0.01	--	1.78	--
			06/24/99	120	--	--	--	1.52	--
07N 39E 34DCD2	43 53 07	111 50 35	06/17/99	76	--	--	--	0.65	--
07N 39E 36CBC1	43 53 22	111 49 00	06/17/99	79	--	--	--	1.06	--
07N 40E 05BAA1	43 58 14	111 46 07	09/23/98	157	--	--	--	--	1.50
			09/23/98	157	--	--	--	--	1.10
			06/23/99	157	--	--	--	1.13	--

07N 40E 06BCC1	43 57 50	111 47 47	06/22/99	85	--	--	--	1.05	--
07N 40E 09BCB1	43 57 04	111 45 18	09/22/98	70	0.12	--	--	--	0.58
			09/22/98	70	--	--	--	--	0.09
			06/23/99	70	--	--	--	0.32	--
07N 40E 10AAA1	43 57 19	111 43 07	06/23/99	100	--	--	--	0.67	--
07N 40E 11CCD1	43 56 30	111 42 46	06/22/99	80	--	--	--	0.89	--
07N 40E 12CCD1	43 56 32	111 41 40	06/22/99	160	--	--	--	1.42	--
07N 40E 13DDC1	43 55 37	111 40 48	06/22/99	180	--	--	--	1.46	--
07N 40E 15CAA1	43 55 58	111 43 45	09/23/98	130	--	--	--	--	0.33
			06/15/99	130	--	--	--	0.39	--
07N 40E 15CAA2	43 55 59	111 43 42	06/15/99	150	--	--	--	0.97	--
07N 40E 17ACC1	43 56 05	111 45 54	09/22/98	80	--	--	--	--	0.59
			06/22/99	80	--	--	--	0.46	--
			06/22/99	80	--	--	--	0.46	--
07N 40E 19DDD1	43 54 48	111 46 48	06/22/99	60	--	--	--	0.48	--
07N 40E 22CDD1	43 54 46	111 43 40	06/23/99	140	--	--	--	0.68	--
07N 40E 24BCC1	43 55 15	111 41 47	06/23/99	80	--	--	--	8.24	--
07N 40E 24DDA1	43 54 53	111 40 40	06/17/99	130	--	--	--	1.15	--
07N 40E 25BBA1	43 54 44	111 41 39	06/23/99	100	--	--	--	1.53	--
07N 40E 25BBB1	43 54 44	111 41 46	06/29/99	90	--	--	--	1.29	--
07N 40E 29AAD1	43 54 38	111 45 35	06/29/99	130	--	--	--	2.87	--
07N 40E 30BAB1	43 54 45	111 47 25	01/21/98	50	--	--	--	--	0.96
07N 40E 30BAB2	43 54 45	111 47 31	06/16/99	50	--	--	--	0.80	--
			06/16/99	50	--	--	--	0.78	--
07N 40E 31ADB1	43 53 37	111 46 55	06/17/99	100	--	--	--	1.25	--
07N 40E 32CBCC1	43 53 16	111 46 35	09/11/98	74	0.03	<0.01	--	1.62	--
07N 40E 34BBC1	43 53 41	111 44 11	06/17/99	90	--	--	--	0.85	--
07N 40E 36DDA1	43 53 11	111 40 39	05/04/98	121	--	--	--	--	0.99
07N 41E 04CCB1	43 57 32	111 38 07	06/23/99	180	--	--	--	0.83	--
07N 41E 05AAA1	43 58 10	111 38 15	06/15/99	203	--	--	--	1.28	--
07N 41E 07BCC1	43 57 02	111 40 12	09/23/98	170	--	--	--	--	1.50
			06/17/99	170	--	--	--	1.78	--
07N 41E 10CCB1	43 56 37	111 37 02	06/29/99	65	--	--	--	0.13	--
07N 41E 15ABC1	43 56 17	111 37 02	06/29/99	78	--	--	--	1.84	--
07N 41E 16AAD1	43 56 18	111 37 05	06/29/99	60	--	--	--	2.24	--
07N 41E 18ABA1	43 56 29	111 39 47	06/23/99	152	--	--	--	0.54	--
07N 41E 18BBD1	43 56 26	111 40 29	06/24/99	170	--	--	--	1.76	--

07N 41E 18CBC1	43 55 51	111 40 35	06/22/99	100	--	--	--	0.52	--
07N 41E 18DAA1	43 56 03	111 39 27	06/23/99	200	--	--	--	1.85	--
07N 41E 19CAA1	43 55 09	111 40 05	06/23/99	120	--	--	--	1.19	--
07N 45E 17CBA1	43 55 57	111 10 34	07/11/95	220	0.02	<0.01	--	17.00	--
			09/22/95	220	<0.02	<0.01	--	0.07	--
			09/22/95	220	<0.02	<0.01	--	12.00	--
			08/27/96	220	<0.02	<0.01	--	11.00	--
			08/27/96	220	<0.02	<0.01	--	11.00	--
			08/05/97	220	0.04	<0.01	--	35.40	--
			09/16/98	220	0.04	0.02	--	38.20	38.20
07N 45E 20BAB1	43 55 30	111 10 26	08/14/96	422	0.04	0.01	--	7.70	7.69
08N 40E 27BAC1	43 59 47	111 43 53	07/19/96	165	0.03	<0.01	--	5.50	--
08N 40E 27CBB1	43 59 19	111 44 12	07/19/96	113	0.04	0.01	--	23.00	23.00
			06/24/99	113	--	--	--	27.70	--
			06/29/99	113	<0.02	<0.01	0.60	27.20	--
08N 40E 30ABA1	43 59 54	111 46 56	08/10/95	73	<0.02	<0.01	--	1.20	--
			06/24/99	73	<0.02	<0.01	--	2.96	--
08N 40E 33ADA1	43 58 48	111 44 15	09/22/98	167	0.07	--	--	--	2.60
			06/23/99	167	--	--	--	0.88	--
08N 41E 20DAC1	44 00 13	111 38 25	08/01/96	265	<0.02	<0.01	--	1.30	--
			06/29/99	265	--	--	--	2.00	--
08N 41E 22DDA1	44 00 03	111 35 57	06/29/99	75	--	--	--	3.28	--
08N 41E 22DDC1	44 00 03	111 36 01	06/29/99	42	--	--	--	8.78	--
08N 41E 23DCC1	43 59 57	111 35 06	06/23/99	--	--	--	--	0.77	--
08N 41E 24CBC1	44 00 15	111 34 36	06/24/99	65	--	--	--	0.33	--
08N 41E 24CDD1	43 59 57	111 34 05	06/15/99	59	--	--	--	0.35	--
08N 41E 26AAA1	43 59 55	111 34 42	06/23/99	57	--	--	--	0.56	--
08N 41E 27ABB1	43 59 54	111 36 25	06/17/99	55	--	--	--	0.26	--
08N 41E 27ACA1	43 59 40	111 36 10	06/29/99	92	--	--	--	2.35	--
08N 41E 27CCB1	43 59 12	111 37 04	06/23/99	258	--	--	--	1.55	--
08N 41E 27DBB1	43 59 26	111 36 27	06/30/99	240	--	--	--	0.74	--
08N 41E 28DDC1	43 54 08	111 37 15	06/23/99	240	--	--	--	0.85	--
08N 41E 28DDC2	43 59 08	111 37 20	06/23/99	59	--	--	--	3.83	--
08N 41E 31CBC1	43 58 26	111 40 36	06/22/99	190	--	--	--	0.90	--
08N 41E 32ABC1	43 58 56	111 38 50	09/01/95	148	<0.02	<0.01	--	9.50	--
			08/01/96	148	<0.02	<0.01	--	5.30	--
			08/07/97	148	<0.02	<0.01	--	11.70	--



			06/22/99	148	--	--	--	6.90	--
			07/30/99	148	<0.02	<0.01	--	5.24	--
08N 41E 32ABC2	43 58 55	111 38 50	08/07/98	50	0.04	0.11	--	22.90	22.80
			08/07/98	50	0.03	0.11	--	23.70	23.60
			06/22/99	50	<0.02	<0.01	--	19.90	--
08N 41E 32ACC1	43 58 46	111 38 43	06/22/99	220	--	--	--	1.30	--
08N 41E 32ADB1	43 58 52	111 38 25	06/24/99	75	--	--	--	1.88	--
08N 41E 32ADB2	43 58 52	111 38 30	06/24/99	240	--	--	--	1.40	--
08N 41E 32CAA1	43 58 35	111 38 56	06/24/99	250	--	--	--	1.13	--
08N 41E 32CDD1	43 58 14	111 38 55	06/24/99	195	--	--	--	0.84	--
08N 41E 32DCD1	43 58 19	111 38 38	12/13/98	--	--	--	--	--	0.84
08N 41E 32DDC1	43 58 14	111 38 25	06/22/99	240	--	--	--	0.96	--
08N 41E 33ABB2	43 59 04	111 37 31	07/14/95	--	0.02	<0.01	--	0.82	--
			06/23/99	--	<0.02	<0.01	--	0.87	--
08N 41E 33CDD1	43 58 15	111 37 40	06/24/99	--	--	--	--	1.14	--
08N 41E 34ACC1	43 58 40	111 36 25	05/27/98	--	--	--	--	--	1.07
08N 41E 34CDC1	43 58 13	111 36 36	06/24/99	60	--	--	--	0.92	--
08N 41E 34DAA1	43 58 33	111 35 54	06/24/99	102	--	--	--	0.37	--
08N 41E 34DCC1	43 58 07	111 36 26	06/24/99	155	--	--	--	0.79	--
08N 42E 01AAA1	44 03 22	111 26 16	07/18/97	60	--	--	--	--	3.68
			06/08/98	60	0.05	0.02	--	5.61	5.60
			10/07/98	60	<0.02	<0.01	--	4.12	--
08N 42E 02AAD1	44 03 18	111 27 27	07/18/97	60	--	--	--	--	5.34
			06/09/98	60	0.03	0.01	--	5.76	5.74
08N 42E 02BCA1	44 03 11	111 28 26	06/15/99	720	--	--	--	1.63	--
08N 42E 03AAA1	44 03 24	111 28 40	06/30/99	40	--	--	--	4.88	--
08N 42E 03BAB1	44 03 22	111 29 31	06/30/99	82	--	--	--	4.84	--
08N 42E 09BAB1	44 02 32	111 30 45	08/07/97	173	<0.02	<0.01	--	2.63	--
			06/24/99	173	--	--	--	3.85	--
08N 42E 10AAA1	44 02 28	111 28 41	06/29/99	420	--	--	--	4.36	--
08N 42E 16AAD1	44 01 28	111 29 55	06/29/99	114	--	--	--	3.68	--
08N 42E 16BDD1	44 01 16	111 30 30	09/30/98	92	--	--	--	--	3.58
08N 42E 19DCD1	43 59 56	111 32 38	06/23/99	100	--	--	--	0.87	--
08N 42E 20CDC1	43 59 56	111 31 54	06/23/99	125	--	--	--	0.27	--
08N 42E 21AAA1	44 00 46	111 29 55	06/29/99	182	--	--	--	3.06	--
08N 42E 21ABD1	44 00 35	111 30 14	06/24/99	145	--	--	--	1.45	--
08N 42E 30BCC1	43 59 31	111 31 26	06/23/99	132	--	--	--	1.68	--

08N 43E 01DDB1	44 02 38	111 19 15	06/30/99	266	--	--	--	5.16	--
08N 43E 01DDD1	44 02 34	111 19 05	08/12/97	340	0.03	<0.01	--	5.41	--
			06/30/99	340	--	--	--	5.55	--
08N 43E 05BCD1	44 03 02	111 24 55	06/30/99	82	--	--	--	6.08	--
08N 43E 05CDC1	44 02 33	111 24 38	06/30/99	200	--	--	--	8.98	--
08N 43E 14ABB1	44 01 35	111 20 46	07/22/97	--	--	--	--	--	11.40
			06/30/99	--	--	--	--	12.30	--
08N 43E 18DDB1	44 00 59	111 25 24	07/18/97	--	--	--	--	--	6.90
			06/30/99	--	--	--	--	8.23	--
08N 43E 19DAB1	44 00 16	111 25 22	06/30/99	162	--	--	--	8.94	--
08N 43E 20BAA1	44 00 47	111 24 35	06/30/99	102	--	--	--	9.48	--
08N 43E 20DCC1	43 59 58	111 24 21	07/22/97	320	--	--	--	--	10.30
			08/11/98	320	0.06	<0.01	--	15.10	--
08N 43E 23DBC1	44 00 10	111 20 44	01/11/95	310	--	--	--	--	18.70
			01/11/95	310	--	--	--	--	20.90
			05/23/95	310	--	--	--	--	15.80
			08/15/95	310	--	--	--	--	14.50
			12/20/95	310	--	--	--	--	21.20
			02/29/96	310	--	--	--	--	19.90
			05/30/96	310	--	--	--	--	18.20
			08/15/96	310	--	--	--	--	16.20
			11/21/96	310	--	--	--	--	22.80
			03/04/97	310	--	--	--	--	23.60
			06/10/97	310	--	--	--	--	19.70
			08/07/97	310	--	--	--	--	18.80
			10/20/97	310	--	--	--	--	23.30
			01/29/98	310	--	--	--	--	24.90
			06/01/98	310	--	--	--	--	23.50
			08/17/98	310	--	--	--	--	20.80
			11/12/98	310	--	--	--	--	23.30
			06/30/99	310	0.06	0.02	8.30	21.10	21.10
			06/30/99	310	--	--	--	19.80	--
08N 43E 28ADD1	43 59 29	111 22 42	06/23/99	255	--	--	--	8.03	--
08N 44E 01CDB1	44 02 37	111 12 45	06/30/99	165	--	--	--	7.17	--
08N 44E 05BBB1	44 03 22	111 17 50	08/09/95	232	<0.02	<0.01	--	0.97	--
			08/09/95	232	<0.02	<0.01	--	0.96	--
08N 44E 09BAA1	44 02 24	111 16 05	06/12/98	40	<0.02	0.01	--	6.38	6.37

08N 44E 10BAB1	44 02 28	111 15 08	06/30/99	260	--	--	--	0.58	--
08N 44E 17BAB1	44 01 34	111 17 32	06/30/99	400	--	--	--	5.34	--
08N 44E 26AAC1	43 59 42	111 13 17	06/30/99	346	--	--	--	3.83	--
08N 44E 33BCBD1	43 58 43	111 16 34	08/02/96	342	<0.02	<0.01	--	5.30	--
			08/18/97	342	<0.02	<0.01	--	5.31	--
			08/11/98	342	0.06	<0.01	--	5.16	--
			06/16/99	342	<0.02	<0.01	--	6.09	--
09N 40E 29ACB1	44 04 56	111 45 55	06/16/99	479	<0.02	<0.01	--	3.09	--
09N 41E 13BBA1	44 06 53	111 34 17	08/10/95	115	<0.02	<0.01	--	1.50	--
			06/23/99	115	<0.02	<0.01	--	1.01	--
09N 41E 21BCC1	44 05 43	111 38 05	08/07/97	415	<0.02	<0.01	--	1.84	--
09N 42E 12DCA2	44 07 04	111 26 28	06/09/98	330	0.05	0.02	--	5.69	5.67
			10/07/98	330	<0.02	<0.01	--	6.62	--
09N 42E 21DDC1	44 05 12	111 29 53	07/22/97	--	--	--	--	--	12.70
			06/30/99	--	--	--	--	12.40	--
09N 42E 23DDA1	44 05 21	111 27 25	06/09/98	85	0.04	0.01	--	2.17	2.16
09N 42E 25ADC1	44 04 48	111 26 19	07/18/97	80	--	--	--	--	7.82
			06/08/98	80	0.02	0.02	--	7.23	7.21
			10/06/98	80	0.02	<0.01	--	6.95	--
			07/18/97	57	--	--	--	--	4.77
09N 42E 25BAD1	44 04 58	111 26 43	06/09/98	57	<0.02	0.01	--	5.01	5.00
			10/07/98	57	<0.02	<0.01	--	5.46	--
			08/12/97	161	0.03	<0.01	--	5.64	--
09N 42E 25BBC1	44 04 58	111 27 15	06/08/98	161	0.05	0.01	--	5.33	5.32
			10/06/98	161	<0.02	<0.01	--	5.47	--
			06/09/98	80	0.04	0.01	--	4.87	4.86
09N 42E 25DBB1	44 04 40	111 26 40	10/07/98	80	0.03	<0.01	--	5.97	--
			07/18/97	57	--	--	--	--	4.32
09N 42E 26CCD1	44 04 18	111 28 20	06/09/98	57	0.02	0.01	--	4.78	4.77
			07/18/97	62	--	--	--	--	5.31
			06/09/98	62	<0.02	0.01	--	6.57	6.56
09N 42E 26CDC1	44 04 18	111 28 09	06/30/99	62	--	--	--	6.32	--
			07/18/97	50	--	--	--	--	7.44
			06/08/98	50	0.04	0.01	--	7.52	7.51
09N 42E 26DDC1	44 04 20	111 27 35	06/08/98	43	0.02	0.01	--	3.49	3.48
09N 42E 27ABB1	44 05 05	111 29 07	07/22/97	--	--	--	--	--	1.01
			06/30/99	--	--	--	--	0.78	--

09N 42E 27ABC1	44 04 58	111 29 07	07/22/97	--	--	--	--	--	1.74
09N 42E 27ACC1	44 04 45	111 29 05	07/22/97	--	--	--	--	--	4.45
			06/30/99	--	--	--	--	4.85	--
09N 42E 27CDD1	44 04 18	111 29 09	07/22/97	--	--	--	--	--	3.96
			06/30/99	--	--	--	--	5.15	--
09N 42E 35AAD1	44 04 11	111 27 20	04/15/98	--	--	--	--	--	5.27
09N 42E 35DDC1	44 03 28	111 27 33	07/18/97	105	--	--	--	--	5.16
			06/08/98	105	0.02	0.01	--	5.86	5.85
			06/30/99	105	--	--	--	6.50	--
09N 42E 36AAB1	44 04 16	111 26 13	07/18/97	60	--	--	--	--	23.50
			06/08/98	60	0.04	0.02	--	22.70	22.70
			10/06/98	60	0.02	<0.01	--	17.90	--
			10/06/98	60	0.02	<0.01	9.80	18.50	--
			06/25/99	60	0.03	<0.01	10.10	30.40	--
09N 42E 36ABA1	44 04 15	111 26 25	02/27/95	289	--	--	--	--	7.07
			06/11/97	289	--	--	--	--	11.10
			06/24/97	289	--	--	--	--	10.80
			06/24/97	289	--	--	--	--	12.20
			07/07/97	289	--	--	--	--	10.20
			08/11/97	289	--	--	--	--	9.05
			09/15/97	289	--	--	--	--	8.59
			11/04/97	289	--	--	--	--	8.74
			12/17/97	289	--	--	--	--	8.95
			01/12/98	289	--	--	--	--	9.39
			02/18/98	289	--	--	--	--	9.79
			03/19/98	289	--	--	--	--	10.20
			04/14/98	289	--	--	--	--	11.40
			05/05/98	289	--	--	--	--	12.20
			05/05/98	289	--	--	--	--	11.20
			06/02/98	289	--	--	--	--	11.80
			06/08/98	289	0.05	0.01	--	11.50	11.50
			07/06/98	289	--	--	--	--	11.50
			08/05/98	289	--	--	--	--	8.66
			09/02/98	289	--	--	--	--	7.56
			09/03/98	289	--	--	--	--	7.56
			10/06/98	289	<0.02	<0.01	5.40	8.33	--
			10/06/98	289	--	--	--	--	8.79

			11/03/98	289	--	--	--	--	8.44
			12/01/98	289	--	--	--	--	8.85
			01/05/99	289	--	--	--	--	8.50
			02/02/99	289	--	--	--	--	8.84
			03/02/99	289	--	--	--	--	9.23
			04/06/99	289	--	--	--	--	9.42
			05/04/99	289	--	--	--	--	9.98
			06/02/99	289	--	--	--	--	11.30
			06/25/99	289	<0.02	<0.01	--	11.10	--
09N 42E 36ABA2	44 04 15	111 26 25	06/11/97	321	--	--	--	--	10.00
			06/24/97	321	--	--	--	--	10.10
			06/24/97	321	--	--	--	--	10.20
			07/07/97	321	--	--	--	--	9.16
			08/11/97	321	--	--	--	--	8.01
			09/15/97	321	--	--	--	--	7.52
			10/11/97	321	--	--	--	--	7.41
			11/04/97	321	--	--	--	--	6.98
			12/17/97	321	--	--	--	--	7.53
			01/12/98	321	--	--	--	--	7.43
			02/18/98	321	--	--	--	--	8.20
			03/18/98	321	--	--	--	--	8.66
			04/14/98	321	--	--	--	--	9.68
			05/05/98	321	--	--	--	--	11.50
			05/05/98	321	--	--	--	--	10.40
			06/02/98	321	--	--	--	--	10.90
			06/08/98	321	0.02	0.02	--	11.00	11.00
			07/07/98	321	--	--	--	--	10.70
			08/05/98	321	--	--	--	--	6.96
			09/02/98	321	--	--	--	--	6.46
			09/03/98	321	--	--	--	--	6.46
			10/06/98	321	<0.02	<0.01	--	7.59	--
			10/06/98	321	--	--	--	--	6.97
			11/03/98	321	--	--	--	--	7.26
			12/01/98	321	--	--	--	--	7.04
			01/05/99	321	--	--	--	--	7.34
			02/02/99	321	--	--	--	--	7.39
			03/02/99	321	--	--	--	--	7.63



			04/06/99	321	--	--	--	--	8.12
			05/04/99	321	--	--	--	--	9.58
			06/02/99	321	--	--	--	--	9.84
			06/25/99	321	0.03	<0.01	--	10.00	--
09N 42E 36CAA1	44 03 50	111 26 46	07/18/97	50	--	--	--	--	5.89
			06/08/98	50	0.02	0.02	--	6.35	6.34
			10/07/98	50	<0.02	<0.01	--	5.91	--
09N 42E 36CBB1	44 03 50	111 27 17	07/18/97	55	--	--	--	--	5.38
			06/08/98	55	0.05	0.01	--	6.05	6.04
			06/08/98	55	--	--	--	6.04	--
09N 42E 36DAA1	44 03 47	111 26 07	06/08/98	90	0.05	0.02	--	5.42	5.40
			10/06/98	90	<0.02	<0.01	--	5.01	--
09N 43E 13ABB1	44 06 48	111 19 18	06/11/98	280	0.03	0.01	--	0.35	0.34
09N 43E 14ADA1	44 06 36	111 20 15	06/09/98	40	0.06	0.01	--	1.09	1.08
09N 43E 14DDC1	44 06 05	111 20 21	06/09/98	321	0.04	0.01	--	5.59	5.57
09N 43E 16DAB1	44 06 20	111 22 40	06/09/98	380	0.04	0.01	--	8.40	8.38
			10/07/98	380	<0.02	<0.01	--	8.97	--
09N 43E 19BCB1	44 05 45	111 26 03	06/10/98	2264	<0.02	0.01	--	0.28	0.26
09N 43E 19BCC1	44 05 36	111 26 05	07/18/97	80	--	--	--	--	11.90
			06/10/98	80	<0.02	0.01	--	9.89	9.88
			06/11/98	80	0.02	0.01	--	9.48	9.47
			10/07/98	80	<0.02	<0.01	--	13.30	--
09N 43E 19CCC1	44 05 15	111 26 05	07/18/97	--	--	--	--	--	4.65
			06/09/98	--	0.05	0.02	--	4.96	4.94
09N 43E 19CDA1	44 05 19	111 25 31	07/18/97	37	--	--	--	--	11.50
			06/08/98	37	0.05	0.01	--	11.60	11.60
			10/07/98	37	<0.02	<0.01	--	8.49	--
09N 43E 19CDB1	44 05 21	111 25 48	07/18/97	127	--	--	--	--	4.78
			06/08/98	127	0.05	0.01	--	7.08	7.06
			06/08/98	127	0.04	0.01	--	7.17	7.15
09N 43E 19DAD1	44 05 23	111 24 55	07/18/97	180	--	--	--	--	9.51
			06/09/98	180	0.06	0.01	--	11.00	10.90
			10/07/98	180	<0.02	<0.01	--	10.30	--
09N 43E 19DBC1	44 05 23	111 25 23	06/09/98	222	<0.02	0.01	--	9.09	9.08
09N 43E 21CCC1	44 05 11	111 23 34	06/11/98	156	<0.02	0.01	--	12.20	12.20
			10/05/98	156	0.06	0.01	--	13.20	13.20
			10/05/98	156	<0.02	<0.01	--	12.80	--

09N 43E 21CCC2	44 05 12	111 23 39	07/18/97	--	--	--	--	--	29.80
			06/08/98	--	0.04	0.02	--	19.60	19.60
09N 43E 21CDD1	44 05 10	111 23 10	07/18/97	237	--	--	--	--	9.56
			06/09/98	237	0.04	0.01	--	10.30	10.30
			10/05/98	237	<0.02	<0.01	--	9.72	--
09N 43E 22BCC1	44 05 41	111 22 27	06/30/99	302	--	--	--	7.74	--
09N 43E 23AAB1	44 05 57	111 20 20	08/02/96	342	<0.02	<0.01	--	7.90	--
			06/10/98	342	0.03	0.01	--	7.15	7.13
			10/06/98	342	<0.02	<0.01	4.30	7.28	--
09N 43E 25AAA1	44 05 07	111 18 48	06/11/98	170	<0.02	<0.01	--	5.11	--
09N 43E 25AAA2	44 05 03	111 18 44	07/18/97	218	--	--	--	--	8.36
			06/09/98	218	<0.02	0.01	--	7.58	7.57
			06/09/98	218	0.03	0.01	--	7.69	7.68
09N 43E 25DCC1	44 04 17	111 19 24	06/11/98	--	<0.02	0.01	--	7.77	7.76
09N 43E 26BBC1	44 04 57	111 21 15	06/09/98	400	0.02	0.01	--	10.40	10.40
09N 43E 27BAB1	44 05 07	111 22 04	06/09/98	--	<0.02	--	--	10.70	--
09N 43E 28ADB1	44 04 52	111 22 45	06/09/98	202	0.02	0.01	--	12.90	12.90
09N 43E 28DAB1	44 04 37	111 22 45	07/18/97	157	--	--	--	--	6.78
			06/09/98	157	0.05	0.01	--	6.62	6.61
09N 43E 28DAC1	44 04 31	111 22 45	08/02/96	198	<0.02	<0.01	--	6.20	--
			07/22/97	198	--	--	--	--	5.92
			06/09/98	198	0.03	0.01	--	5.76	5.75
			10/05/98	198	<0.02	<0.01	--	5.47	--
09N 43E 29BBB1	44 05 08	111 24 52	06/10/98	100	0.02	0.01	--	5.01	5.00
			10/05/98	100	<0.02	<0.01	--	4.61	--
09N 43E 29DCC1	44 04 19	111 24 12	07/18/97	122	--	--	--	--	8.56
			06/09/98	122	<0.02	0.01	--	8.24	8.23
			10/05/98	122	<0.02	<0.01	--	11.50	--
09N 43E 29DDD1	44 04 18	111 23 45	07/18/97	--	--	--	--	--	7.86
			06/09/98	--	0.03	0.01	--	7.55	7.54
09N 43E 30BCC1	44 04 44	111 26 04	06/11/98	105	0.03	<0.01	--	5.40	--
			10/06/98	105	<0.02	<0.01	--	5.54	--
09N 43E 30CCB2	44 04 26	111 26 02	02/21/96	120	--	--	--	--	5.87
			02/06/97	120	--	--	--	--	6.99
			03/09/98	120	--	--	--	--	5.37
			06/11/98	120	0.03	<0.01	--	8.90	--
			10/06/98	120	0.02	<0.01	--	8.38	--

09N 43E 30CCC2	44 04 18	111 25 59	06/08/98	73	0.05	0.01	--	14.30	14.20
			06/08/98	73	0.05	0.01	--	14.20	14.10
			10/06/98	73	0.02	<0.01	--	9.44	--
09N 43E 30CDC1	44 04 18	111 25 44	07/18/97	74	--	--	--	--	3.79
			06/10/98	74	0.03	0.01	--	3.76	3.75
09N 43E 30CDD1	44 04 20	111 25 31	07/18/97	--	--	--	--	--	3.87
			06/09/98	--	<0.02	0.01	--	4.45	4.44
09N 43E 30DAA1	44 04 37	111 24 59	06/09/98	140	<0.02	0.01	--	4.87	4.86
			10/05/98	140	0.02	<0.01	--	2.34	--
09N 43E 30DAB1	44 04 38	111 25 04	07/18/97	--	--	--	--	--	4.71
09N 43E 30DAC1	44 04 31	111 25 10	07/18/97	--	--	--	--	--	2.60
09N 43E 30DBD2	44 04 35	111 25 20	07/18/97	48	--	--	--	--	2.86
			06/11/98	48	0.03	0.01	--	4.80	4.79
09N 43E 30DCA1	44 04 25	111 25 12	07/18/97	38	--	--	--	--	6.74
			06/09/98	38	0.03	0.01	--	6.53	6.52
			10/06/98	38	<0.02	<0.01	--	6.27	--
09N 43E 30DCB3	44 04 25	111 25 28	06/11/98	50	<0.02	0.01	--	5.69	5.68
09N 43E 30DCD3	44 04 19	111 25 13	06/10/98	45	0.02	0.01	--	5.72	5.71
09N 43E 30DDA1	44 04 26	111 25 01	07/18/97	45	--	--	--	--	9.79
			06/10/98	45	0.03	0.01	--	6.61	6.60
			06/10/98	45	0.03	0.01	--	6.53	6.51
09N 43E 30DDB1	44 04 24	111 25 04	07/18/97	--	--	--	--	--	5.65
			06/10/98	--	0.02	0.01	--	5.22	5.21
09N 43E 30DDB2			07/18/97	55	--	--	--	--	6.07
09N 43E 30DDB3	44 04 29	111 25 05	06/10/98	55	<0.02	0.01	--	5.67	5.66
			07/18/97	35	--	--	--	--	8.97
			06/10/98	35	0.02	0.01	--	6.57	6.55
09N 43E 30DDB4			10/05/98	35	<0.02	<0.01	--	7.06	--
			07/18/97	65	--	--	--	--	0.98
			06/10/98	65	0.02	0.01	--	4.77	4.75
09N 43E 30DDB5	44 04 26	111 25 04	10/05/98	65	0.02	<0.01	--	3.69	--
			06/10/98	62	<0.02	0.01	--	5.83	5.82
			06/10/98	50	0.03	0.01	--	6.60	6.59
09N 43E 30DDC1	44 04 18	111 25 03	07/18/97	40	--	--	--	--	7.47
			06/09/98	40	0.02	0.01	--	8.71	8.70
			10/07/98	40	<0.02	<0.01	--	8.51	--
09N 43E 31BAB1	44 04 15	111 25 42	07/18/97	100	--	--	--	--	7.49

			06/08/98	100	0.06	0.01	--	8.92	8.91
09N 43E 31DCD1	44 03 29	111 25 13	07/18/97	58	--	--	--	--	5.66
			06/10/98	58	<0.02	0.01	--	5.41	5.40
			10/07/98	58	<0.02	<0.01	--	5.78	--
09N 43E 32ABB1	44 04 15	111 24 16	07/18/97	--	--	--	--	--	6.43
			06/08/98	--	0.02	0.02	--	7.37	7.35
09N 43E 32BAB1	44 04 15	111 24 34	07/22/97	130	--	--	--	--	8.82
			06/11/98	130	<0.02	0.01	--	8.78	8.77
09N 43E 33AAA1	44 04 15	111 22 36	07/18/97	--	--	--	--	--	5.05
			06/10/98	--	0.02	0.01	--	4.80	4.79
			06/10/98	--	0.02	0.01	--	5.17	5.16
09N 43E 33ABA1	44 04 45	111 22 47	06/30/99	205	--	--	--	5.12	--
09N 43E 33CDD1	44 03 26	111 23 12	07/18/97	180	--	--	--	--	9.21
			06/09/98	180	0.03	0.01	--	7.96	7.95
			10/06/98	180	<0.02	<0.01	--	9.01	--
			06/30/99	180	--	--	--	6.76	--
09N 43E 33DCD1	44 03 25	111 22 55	06/11/98	--	0.02	0.01	--	3.86	3.85
09N 43E 34CDC1	44 03 26	111 22 06	07/18/97	275	--	--	--	--	0.79
			06/09/98	275	<0.02	0.01	--	0.87	0.86
09N 43E 34CDD1	44 03 26	111 21 59	06/30/99	185	--	--	--	2.62	--
09N 43E 34DAA1	44 03 48	111 21 17	06/10/98	104	0.04	0.01	--	16.40	16.40
09N 43E 35AAB1	44 04 15	111 20 20	06/10/98	32	0.02	0.01	--	12.30	12.30
			10/06/98	32	<0.02	<0.01	--	6.87	--
09N 43E 35CBB1	44 03 49	111 21 15	07/18/97	114	--	--	--	--	9.39
			06/10/98	114	<0.02	0.01	--	15.40	15.40
			06/18/99	114	--	--	--	24.90	--
09N 44E 08BDA1	44 07 27	111 17 03	06/11/98	420	0.14	0.01	--	0.26	0.25
			06/11/98	420	0.14	0.01	--	0.26	0.25
			10/07/98	420	<0.02	<0.01	--	0.23	--
			10/07/98	420	<0.02	<0.01	--	0.23	--
09N 44E 15CAC1	44 06 16	111 14 48	06/11/98	360	0.03	0.01	--	0.16	0.15
09N 44E 17ABC1	44 06 45	111 16 56	06/11/98	421	0.05	0.01	--	0.29	0.28
09N 44E 21CCC1	44 05 10	111 16 20	06/10/98	100	0.04	0.01	--	7.71	7.70
09N 44E 23CAB1	44 05 29	111 13 35	07/12/95	120	--	--	--	--	0.36
			07/01/96	120	--	--	--	--	0.24
			06/10/98	120	0.03	0.01	--	0.28	0.26
			10/05/98	120	<0.02	<0.01	--	0.28	--

			06/18/99	120	--	--	--	0.29	--
09N 44E 29AAA1	44 05 07	111 16 26	06/10/98	84	0.03	0.01	--	7.22	7.21
09N 44E 30CBB1	44 04 38	111 18 46	08/12/97	180	0.03	<0.01	--	18.00	--
			06/10/98	180	0.02	0.01	--	20.50	20.50
			10/06/98	180	0.03	<0.01	--	14.30	--
			06/18/99	180	--	--	--	20.30	--
09N 45E 12BAC1S	44 07 33	111 05 17	06/10/98	--	<0.02	0.01	--	0.12	0.11
09N 45E 17CBB1	44 06 24	111 10 24	07/11/95	185	--	--	--	--	0.14
			06/10/98	185	<0.02	0.01	--	0.18	0.17
10N 41E 34ADA1	44 09 15	111 35 49	08/14/97	160	<0.02	0.01	--	<0.05	--
10N 41E 35CBD1	44 08 53	111 35 36	08/05/96	175	0.04	<0.01	--	<0.05	--
10N 44E 10CBA1S	44 12 19	111 14 57	08/14/97	--	<0.02	<0.01	--	0.14	--
			06/11/98	--	<0.02	0.01	--	0.12	0.11
10N 45E 26DCA2	44 09 38	111 06 00	06/10/98	405	0.05	0.01	--	0.07	0.06
11N 42E 12CBCA1	44 17 37	111 27 14	08/11/95	123	<0.02	<0.01	--	1.10	--
			08/08/96	123	0.02	<0.01	--	0.97	--
			08/15/97	123	<0.02	<0.01	--	1.24	--
			08/11/98	123	0.06	<0.01	--	1.09	--
			08/24/99	123	<0.02	<0.01	--	1.29	--
11N 43E 28CAA2	44 14 42	111 23 18	08/11/95	298	<0.02	<0.01	--	0.53	--
12N 43E 17DBA1	44 21 51	111 24 03	08/08/96	65	0.02	<0.01	--	0.37	--
12N 44E 17ACA1	44 22 05	111 16 42	09/14/95	140	<0.02	<0.01	--	0.08	--
			08/10/99	140	<0.02	<0.01	--	0.09	--
			08/10/99	140	<0.02	<0.01	--	0.09	--
48N 118W 10CCC1	44 07 50	111 00 50	06/11/98	20	0.02	0.01	--	0.10	0.09