WATER-QUALITY DATA FOR SELECTED SITES ON MICHAUD FLATS, FORT HALL INDIAN RESERVATION, IDAHO, DECEMBER 1982 TO JULY 1987

By N.D. Jacobson

U.S. GEOLOGICAL SURVEY
Open-File Report 89-71

Prepared in cooperation with
SHOSHONE-BANNOCK TRIBES,
FORT HALL INDIAN RESERVATION

Boise, Idaho
1989

DEPARTMENT OF THE INTERIOR
MANUEL LUJAN, JR., Secretary
U.S. GEOLOGICAL SURVEY
Dallas L. Peck, Director

For additional information
write to:

District Chief
U.S. Geological Survey, WRD
230 Collins Road
Boise, ID 83702

Copies of this report can be
purchased from:

U.S. Geological Survey
Books and Open-File Reports
Federal Center, Bldg. 810
Box 25425
Denver, CO 80225

CONTENTS

	Page
Abstract	1
Introduction	1
Purpose and scope	3
Acknowledgments	3
Well- and spring-numbering system	3
Data collection	3
Results	6
References cited	26

ILLUSTRATIONS

Figure 1.	Map showing location of study area	2
2.	Diagram showing well- and spring-numbering system	4
3.	Map showing locations of wells and springs	5

TABLES

Table 1.	Chemical analyses of water from wells and springs	7
2.	Statistical summary of selected water-quality data	20

CONVERSION FACTORS

For the convenience of readers who may prefer to use metric (International System) units rather than the inch-pound units used in this report, values may be converted by using factors listed in the table below. Constituent concentrations are given in mg/L (milligrams per liter) or µg/L (micrograms per liter), which are equal to parts per million or parts per billion, respectively. Specific conductance is reported in µS/cm (microsiemens per centimeter at 25 degrees Celsius).

Multiply inch-pound unit	By	To obtain SI unit
acre	4,047	square meter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer

Temperature in °C (degrees Celsius) can be converted to °F (degrees Fahrenheit) as follows:

$$°F = (1.8)(°C) + 32$$

Water temperatures are reported to the nearest 0.5 °C.

WATER-QUALITY DATA FOR SELECTED SITES ON MICHAUD FLATS, FORT HALL INDIAN RESERVATION, IDAHO, DECEMBER 1982 TO JULY 1987

By

N.D. Jacobson

ABSTRACT

Chemical and physical data were collected from five wells and one spring on Michaud Flats in the Fort Hall Indian Reservation, southeastern Idaho, from December 1982 to July 1987. The data were collected to monitor changes in ground-water quality and to detect any migration of contaminants.

INTRODUCTION

The Michaud Flats study area occupies about 20 mi^2 in eastern Power and northwestern Bannock Counties, Idaho (fig. 1). The area lies south of American Falls Reservoir and the Snake River, between the Portneuf River on the east and Bannock Creek on the west. Ground-water resources on the flats are substantial and are developed extensively for irrigation and industrial pumpage.

Large concentrations of some contaminants, principally arsenic, in water from wells on the flats first were detected in October 1972 (Balmer and Noble, 1979, p. 215). The Idaho Department of Health and Welfare conducted a study of selected chemical constituents in water from various domestic and industrial wells from October 1972 to October 1973. During the study, arsenic concentrations in water from several wells exceeded the U.S. Public Health Service recommended limit of 50 µg/L (Balmer and Noble, 1979, p. 215).

In 1980, the U.S. Geological Survey, in cooperation with the Shoshone-Bannock Tribes, began a two-phase study to (1) determine the occurrence and movement of ground water and describe the degree and extent of ground-water contamination, and (2) develop a monitoring program to periodically sample and analyze water from selected wells and springs to help determine the degree and fluctuation of ground-water contamination associated with industrial waste-water disposal practices.

The first phase of study described geohydrologic and water-quality conditions in the vicinity of a large industrial complex that processes phosphate ores in the eastern Michaud Flats area on and near the Fort Hall Indian Reservation (Jacobson, 1982).

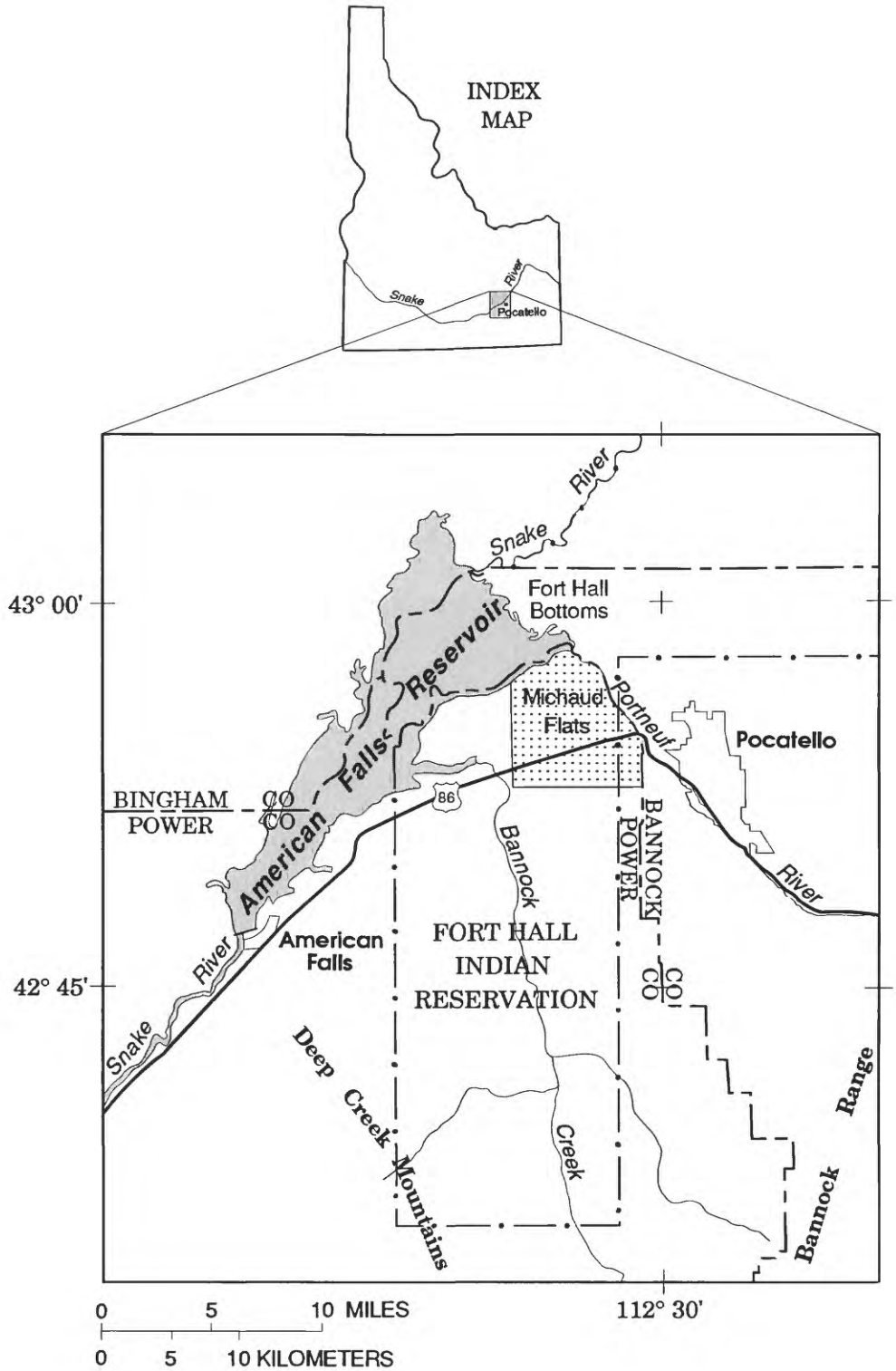


Figure 1.--Location of study area.

The second phase of study provided geophysical data, storage coefficients, specific capacities, and transmissivity values for the area; described procedures being implemented by the ore-processing plants to control ground-water contamination; and presented concentrations of selected chemical constituents, dissolved solids, stable isotopes, and tritium (Jacobson, 1984).

Purpose and Scope

The purpose of this report is to present water-quality data collected from selected wells and springs at strategic locations on Michaud Flats. Data were collected during the period December 1982 to July 1987.

Acknowledgments

The author is grateful to the Shoshone-Bannock Tribes for their cooperation in conducting this study. Thanks also are due to Mr. C.D. Holmes, FMC Corporation; Mr. Paul Evans, J.R. Simplot Company; Mr. Clint Buchanan, City of Pocatello; and Idaho Power Company.

Well- and Spring-Numbering System

The numbering system used by the U.S. Geological Survey in Idaho indicates the location of wells or springs within the official rectangular subdivision of the public lands, with reference to the Boise base line and Meridian. The first two segments of the number designate the township and range. The third segment gives the section number; three letters, which indicate the 1/4 section (160-acre tract), the 1/4-1/4 section (40-acre tract), and the 1/4-1/4-1/4 section (10-acre tract); and the serial number of the well within the tract. Quarter sections are lettered A, B, C, and D in counterclockwise order from the northeast quarter of each section (fig. 2). Within quarter sections, 40-acre and 10-acre tracts are lettered in the same manner. Well 6S-33E-12DAD1 is in the SE1/4NE1/4SE1/4, sec. 12, T. 6 S., R. 33 E., and was the first well inventoried in that tract. Springs are designated by the letter "S" following the last numeral; for example, 6S-34E-7ACA1S.

DATA COLLECTION

Water samples for chemical analyses were obtained from five wells and one spring (fig. 3). These sites were selected to provide necessary data to determine any changes in concentrations of constituents and to detect any migration of contaminants. The sites were sampled semiannually in December and July from 1982 to 1985 and annually in July from 1986 to 1987.

Site 1 is a shallow observation well drilled by the U.S. Geological Survey. It is completed in the water-table aquifer and was located to intercept contaminant

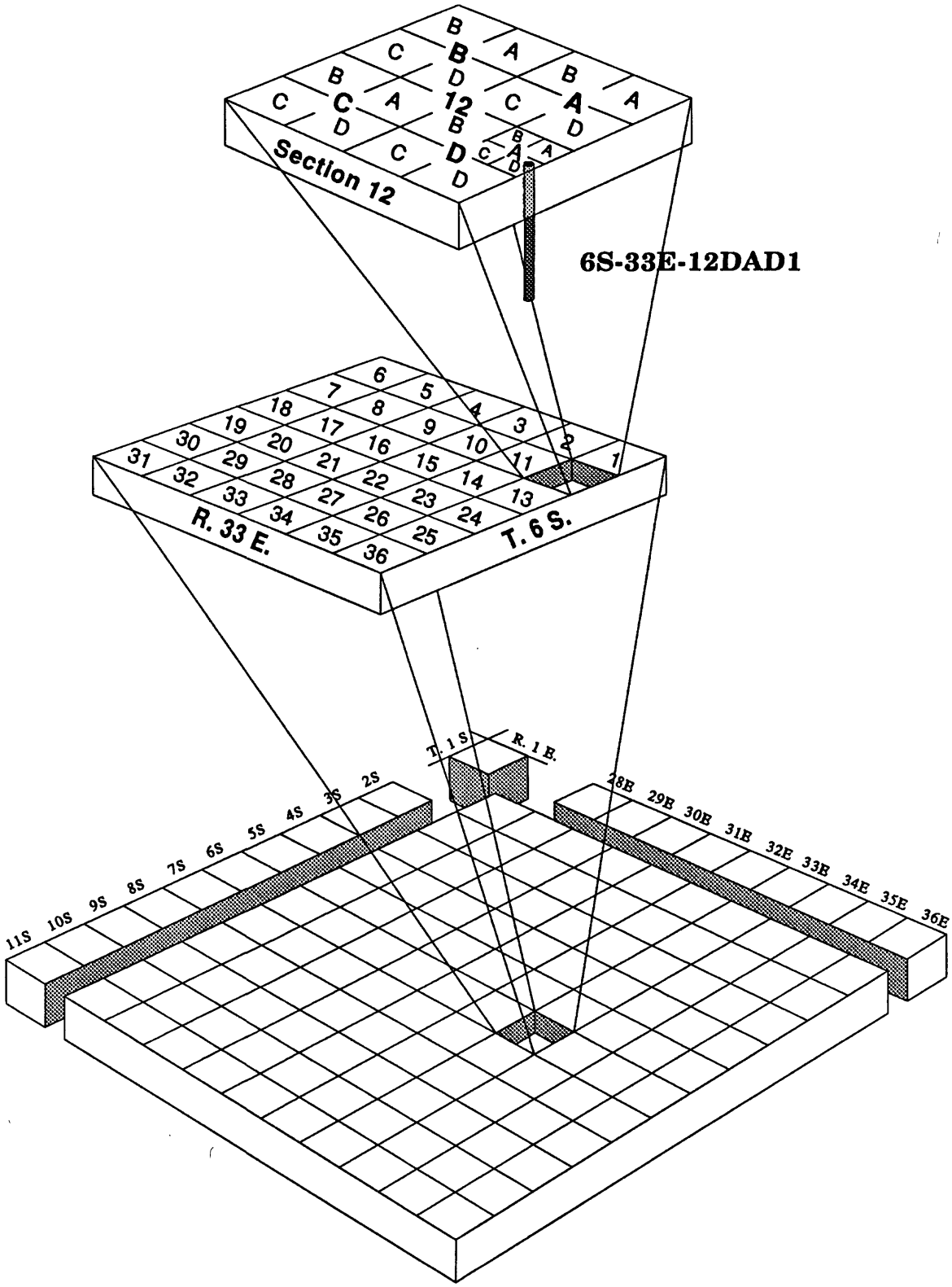
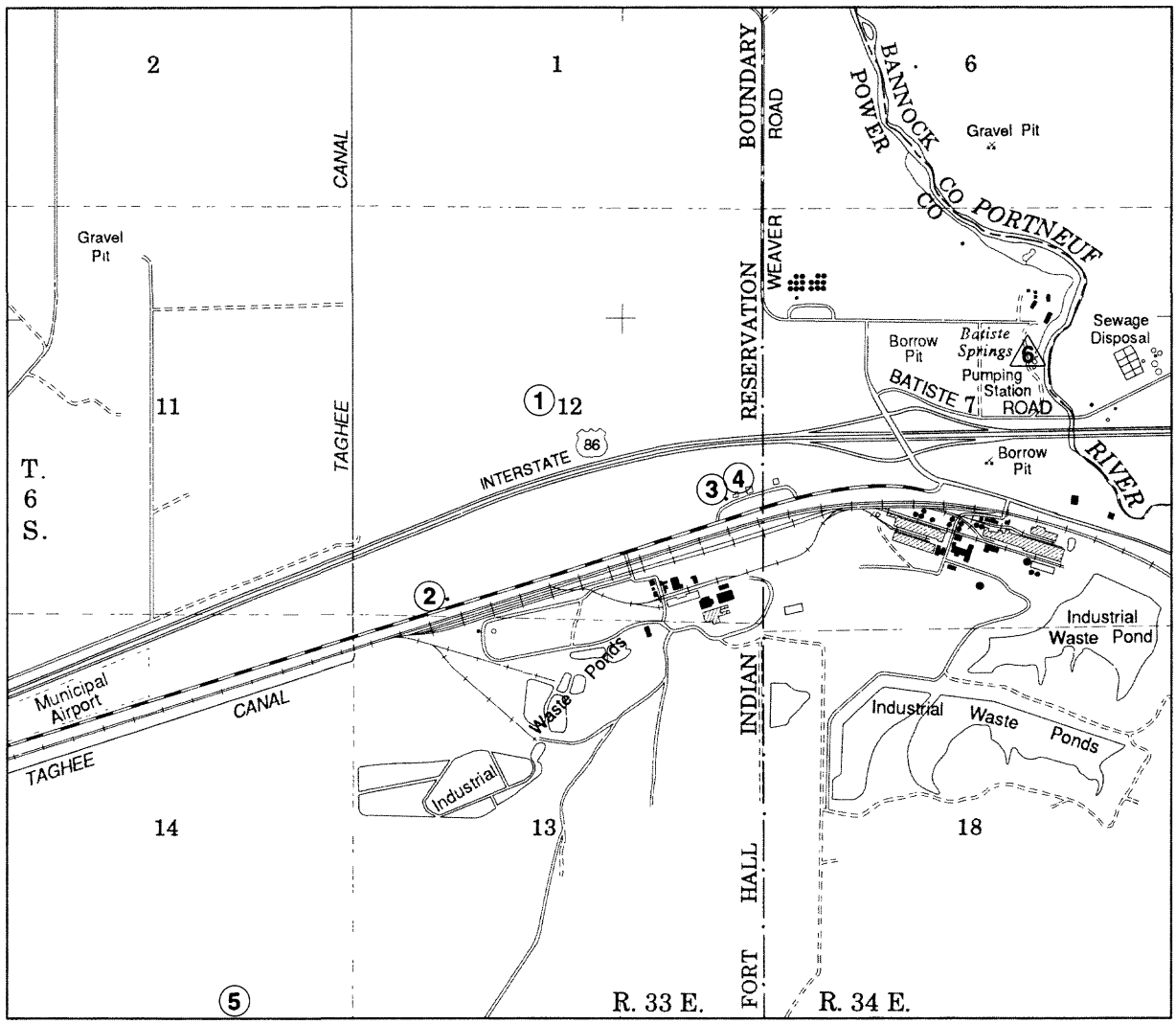


Figure 2.--Well- and spring-numbering system.



Base from U.S. Geological Survey
1:24,000, 1971

EXPLANATION

1	Michaud 1	6S-33E-12BDD1
2	Russell Lindley	6S-33E-12CCD1
3	Old Pilot House	6S-33E-DAD1
4	New Pilot House	6S-33E-12DAD2
5	Idaho Power	6S-33E-14DCD1
6	Batiste Springs	6S-34E-7ACA1S

Figure 3.--Locations of wells and springs.

migration. Site 2, a well completed in the water-table aquifer, has a history of poor water quality and is of use in determining water-quality trends. Site 3, a well also completed in the water-table aquifer, was the site first identified from chemical analysis where the concentration of arsenic in the water exceeded the U.S. Public Health Service water-quality limits. Site 4, a well completed in the deep artesian aquifer and immediately adjacent to site 3, was chosen to compare hydraulic heads between the two wells to indicate potential for leakage between aquifers, and to provide a representative water sample of the artesian aquifer. Site 5, a well completed in the artesian aquifer, is the farthest upgradient and is the only well available to determine background water quality. Batiste Springs was selected because of its proximity to the Portneuf River and industrial waste ponds. It has a long history of impaired water quality.

Water samples were analyzed for concentrations of hardness, dissolved calcium, magnesium, sodium, potassium, sulfate, chloride, fluoride, silica, solids, and nitrogen, total phosphorous, dissolved arsenic and boron, and dissolved and suspended gross alpha and gross beta. Determinations of specific conductance, pH, and air and water temperatures were made onsite.

RESULTS

Specific conductance ranged from 450 µS/cm in background well 14DCD1 to 2,270 µS/cm in well 12CCD1. Arsenic concentrations at all sites ranged from 3 to 94 µg/L and exceeded the recommended limit (U.S. Environmental Protection Agency, 1977, p. 5) of 50 µg/L in one sample from Batiste Springs and in five samples from the Old Pilot House well. Concentrations of boron ranged from 60 to 910 µg/L. Dissolved gross alpha concentrations ranged from 1.1 to 49 µg/L.

Chemical and physical data are presented in table 1. Statistical summaries of selected water-quality data for each site are presented in table 2.

Headnotes for tables 1 and 2

Time:	24-hour
U-nat:	Uranium (natural)
susp.:	Suspended
pCi/L:	Picocuries per liter (curies x 10^{-12}). One curie is 3.7 x 10^{10} disintegrations per second.
Cs-137:	Cesium-137
Sr/Y-90:	Strontium/Yttrium-90
<:	Less than
--:	No data available
*:	Onsite analysis

Table 1.--*Chemical analyses of water from wells and springs*

6S-33E-12BDD1 Michaud Well 1

Date	Time	Depth below land surface (water level) (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
12-20-82	0934	--	79.20	538	7.7	-2.5	13.5	180	50	14
7-18-83	0926	53.10	79.20	559	7.8	22.0	14.0	190	51	15
12-19-83	1152	52.30	79.20	524	7.5	-4.0	13.5	190	53	14
7-23-84	0930	52.50	79.20	545	7.6	25.0	13.5	200	52	16
12-17-84	0944	51.90	79.20	527	7.7	-10.0	13.5	200	54	15
7-10-85	0944	53.90	79.20	571	7.6	24.5	13.5	200	55	16
12-12-85	1311	52.50	79.20	556	8.1	-6.0	11.5	200	55	16
7-9-86	0922	53.55	79.20	578	7.7	20.0	13.5	190	53	15
7-21-87	0934	53.30	79.20	579	7.8	13.5	13.0	200	55	16

Date	Sodium, dissolved (mg/L as Na)	Percent sodium	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
12-20-82	35	28	1	6.9	53	43	1.2	35	330	0.56
7-18-83	35	28	1	6.7	52	40	1.1	35	340	.67
12-19-83	34	27	1	6.4	53	40	1.1	35	330	.66
7-23-84	36	28	1	6.4	57	40	1.1	36	340	.63
12-17-84	34	27	1	6.6	54	42	1.0	36	340	.71
7-10-85	35	26	1	6.9	56	40	1.0	35	340	.72
12-12-85	34	26	1	7.4	57	47	1.0	35	350	.77
7-9-86	32	26	1	6.7	58	44	1.1	34	340	.83
7-21-87	33	25	1	5.8	58	44	1.0	34	350	.79

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-33E-12BDD1 Michaud Well 1--Continued

Date	Phosphorus, total (mg/L as P)	Arsenic, dissolved (µg/L as As)	Boron, dissolved (µg/L as B)	Gross alpha, dissolved (µg/L as U-nat)	Gross alpha, susp. total (µg/L as U-nat)	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, susp. total (pCi/L as Cs-137)	Gross beta, dissolved (pCi/L as Sr/Y-90)	Gross beta, susp. total (pCi/L as Sr/Y-90)
12-20-82	0.05	5	90	8.2	0.5	7.8	0.6	7.5	0.6
7-18-83	.22	5	90	7.9	<.4	7.4	<.4	7.1	<.4
12-19-83	.01	4	90	7.0	<.4	5.5	.6	4.7	.5
7-23-84	.02	3	90	7.7	<.4	11	.5	9.1	<.4
12-17-84	.03	4	90	7.5	<.4	6.1	<.4	5.3	<.4
7-10-85	.02	4	90	7.7	<.4	6.6	<.4	5.7	<.4
12-12-85	--	6	110	3.6	.6	8.4	.6	6.2	.6
7-9-86	.05	5	90	3.3	.8	7.3	.5	5.9	.5
7-21-87	<.01	4	90	1.5	<.4	8.5	<.4	6.4	<.4

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-33E-12CCD1 Russell Lindley Well

Date	Time	Depth of (well, total (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium dissolved (mg/L as Na)
12-21-82	0934	103.00	1,650	7.4	6.0	13.0	560	140	51	140
7-19-83	0734	103.00	1,780	7.5	18.0	14.0	610	150	57	160
12-21-83	1313	103.00	2,080	7.6	-22.0	11.0	650	160	62	160
7-24-84	1014	103.00	2,230	7.3	42.0	11.0	610	150	57	170
12-18-84	0817	103.00	1,910	7.2	-6.0	10.0	600	150	54	150
7-10-85	1536	103.00	1,570	7.7	28.0	13.0	530	130	50	130
12-13-85	0818	103.00	1,870	7.4	-10.0	9.5	580	140	55	140
7- 9-86	1532	103.00	2,270	7.3	18.5	13.0	710	170	70	170
7-22-87	0914	103.00	1,920	7.5	23.0	14.0	620	150	59	140

Date	Percent sodium	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
12-21-82	34	3	15	170	310	0.5	46	1,000	6.3
7-19-83	36	3	15	200	360	.5	45	1,200	6.5
12-21-83	34	3	15	210	360	.5	42	1,200	6.5
7-24-84	37	3	18	210	350	.6	47	1,200	6.6
12-18-84	35	3	15	180	310	.4	47	1,100	5.8
7-10-85	34	3	14	180	290	.5	45	990	5.1
12-13-85	34	3	15	180	320	.5	47	1,100	6.2
7- 9-86	33	3	18	220	410	.5	47	1,300	7.0
7-22-87	32	3	15	180	340	.5	44	1,100	5.2

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-33E-12CCD1 Russell Lindley Well--Continued

Date	Phosphorus, total (mg/L as P)	Arsenic, dissolved (µg/L as As)	Boron, dissolved (µg/L as B)	Gross alpha, dissolved (µg/L as U-nat)	Gross alpha, susp. total (µg/L as U-nat)	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, susp. total (pCi/L as Cs-137)	Gross beta, dissolved (pCi/L as Sr/Y-90)	Gross beta, susp. total (pCi/L as Sr/Y-90)
12-21-82	0.05	6	210	31	<0.4	18	0.7	17	0.7
7-19-83	.21	8	260	37	<.4	19	.6	18	.6
12-21-83	.03	7	260	38	<.4	21	1.3	18	1.2
7-24-84	.04	7	290	33	<.4	24	<.4	21	<.4
12-18-84	.02	6	250	31	<.4	22	.8	19	.8
7-10-85	.06	6	240	26	<.4	15	.6	13	.6
12-13-85	.03	7	240	7.8	<.4	18	.6	13	.6
7- 9-86	.04	9	310	16	.7	28	.6	19	.6
7-22-87	.03	6	270	12	<.4	27	<.4	17	<.4

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-33E-12DAD1 Old Pilot House Well

Date	Time	Depth below land surface (water level) (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
12-20-82	1117	--	113.00	1,340	7.2	0.0	18.5	360	76	42
7-18-83	1144	--	113.00	1,830	7.3	30.0	19.0	390	82	44
12-19-83	1346	66.00	113.00	1,790	7.3	.0	18.0	410	88	45
7-23-84	1113	66.50	113.00	1,780	7.3	27.0	17.5	420	87	49
12-17-84	1115	65.40	113.00	1,940	7.2	-8.0	16.0	430	93	49
7-10-85	1311	67.20	113.00	1,830	7.3	25.5	17.0	400	83	46
12-12-85	1200	66.45	113.00	1,970	7.5	-6.0	15.0	420	87	49
7- 9-86	1124	67.01	113.00	1,890	7.3	20.0	16.5	410	86	47
7-21-87	1121	66.85	113.00	1,960	7.4	13.5	15.5	430	89	50

Date	Sodium, dissolved (mg/L as Na)	Percent sodium	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
12-20-82	130	34	3	150	150	220	<0.1	66	1,100	6.0
7-18-83	130	34	3	130	160	200	<.1	63	1,000	7.6
12-19-84	140	35	3	120	160	210	<.1	63	1,100	6.5
7-23-84	150	35	3	140	160	250	.1	62	1,100	6.9
12-17-84	150	35	3	130	170	260	<.1	64	1,100	15.0
7-10-85	130	32	3	170	170	230	<.1	61	1,100	9.5
12-12-85	150	36	3	120	190	260	<.1	59	1,200	2.1
7- 9-86	150	36	3	140	180	260	<.1	57	1,100	11.0
7-21-87	150	36	3	120	190	250	.2	58	1,100	13.0

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-33E-12DAD1 Old Pilot House Well--Continued

Date	Phosphorus, total (mg/L as P)	Arsenic, dissolved (µg/L as As)	Boron, dissolved (µg/L as B)	Gross alpha, dissolved (µg/L as U-nat)	Gross alpha, susp. total (µg/L as U-nat)	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, susp. total (pCi/L as Cs-137)	Gross beta, dissolved (pCi/L as Sr/Y-90)	Gross beta, susp. total (pCi/L as Sr/Y-90)
12-20-82	13.0	51	870	27	<0.4	150	<0.4	140	<0.4
7-18-83	12.0	47	850	28	<4	130	<4	120	<4
12-19-83	13.0	52	830	49	<4	120	.5	120	.5
7-23-84	16.0	51	810	28	<4	120	<4	120	<4
12-17-84	--	44	850	38	<4	130	<4	110	<4
7-10-85	10.0	26	770	23	.5	130	<4	110	<4
12-12-85	10.0	60	840	6.5	.6	160	.6	100	.6
7- 9-86	8.8	52	910	8.7	.7	190	.6	130	.6
7-21-87	7.5	45	870	3.9	<4	150	.6	100	.6

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-33E-12DAD2 New Pilot House Well

Date	Time	Depth below land surface (water level) (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
12-20-82	1232	--	212.00	489	7.8	0.0	13.5	180	48	14
7-18-83	1309	--	212.00	510	8.1	31.5	15.0	180	47	14
12-19-83	1448	64.90	212.00	452	7.8	-6.0	11.5	180	49	14
7-23-84	1306	65.10	212.00	485	7.9	27.0	15.0	190	50	16
12-17-84	1325	64.60	212.00	499	7.7	-8.5	12.5	190	50	15
7-10-85	1138	66.80	212.00	511	7.9	26.0	15.0	190	50	15
12-12-85	1108	67.12	212.00	515	8.0	-7.0	11.5	180	46	15
7- 9-86	1220	65.95	212.00	522	7.9	25.0	15.0	180	48	15
7-21-87	1308	65.96	212.00	511	7.9	13.5	14.5	190	50	16

Date	Sodium, dissolved (mg/L as Na)	Percent sodium	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
12-20-82	29	25	1	5.6	43	24	0.8	32	280	2.80
7-18-83	29	26	1	6.0	52	29	.9	31	300	.83
12-19-83	29	25	1	5.2	50	30	.9	31	300	.83
7-23-84	31	25	1	5.3	52	29	.9	32	310	.76
12-17-84	30	25	1	5.7	51	29	.8	33	290	.85
7-10-85	30	25	1	5.6	48	28	.8	32	300	.87
12-10-85	30	26	1	5.4	54	32	.8	30	310	.95
7- 9-86	28	24	.9	5.4	54	31	.9	31	310	.97
7-21-87	28	24	.9	4.7	54	30	.8	31	310	.99

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-33E-12DAD2 New Pilot House Well--Continued

Date	Phosphorus, total (mg/L as P)	Arsenic, dissolved (µg/L as As)	Boron, dissolved (µg/L as B)	Gross alpha, dissolved (µg/L as U-nat)	Gross alpha, susp. total (µg/L as U-nat)	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, susp. total (pCi/L as Cs-137)	Gross beta, dissolved (pCi/L as Sr/Y-90)	Gross beta, susp. total (pCi/L as Sr/Y-90)
12-20-82	0.03	3	70	8.3	<0.4	5.6	0.4	5.4	0.5
7-18-83	.62	4	90	7.8	1.4	5.5	.8	5.3	.8
12-19-83	.01	3	80	8.6	<.4	4.6	<.4	3.9	<.4
7-23-84	.08	3	80	8.2	<.4	5.9	<.4	5.1	<.4
12-17-84	.01	3	80	6.4	<.4	6.3	<.4	5.5	<.4
7-10-85	.02	3	80	5.9	<.4	4.0	.5	3.5	.5
12-12-85	.04	3	80	2.9	.5	7.5	.6	5.8	.6
7- 9-86	.03	3	90	1.8	.5	4.9	.6	4.1	.6
7-21-87	<.01	3	80	3.3	<.4	5.9	<.4	4.5	<.4

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-33E-14DCD1 Idaho Power Well

Date	Time	Depth below land surface (water level) (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
12-20-82	1519	161.82	234.00	485	7.8	6.0	12.5	180	45	16
7-18-83	1531	162.00	234.00	471	8.1	32.0	17.5	180	44	16
12-19-83	1152	161.00	234.00	450	7.8	.0	14.0	170	45	15
7-23-84	1448	161.60	234.00	483	7.8	30.0	16.5	190	48	17
12-17-84	1416	160.10	234.00	475	7.8	-11.0	13.0	180	47	16
7-10-85	1403	161.60	234.00	507	7.9	32.5	16.0	180	46	17
12-12-85	1454	160.74	234.00	482	7.9	-8.0	14.0	180	46	17
7- 9-86	1418	161.60	234.00	498	7.8	22.0	16.5	180	45	16
7-21-87	1418	162.28	234.00	501	7.9	14.5	15.5	180	45	17

Date	Sodium, dissolved (mg/L as Na)	Percent sodium	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
12-20-82	25	22	0.8	8.3	18	34	0.5	60	300	0.94
7-18-83	25	23	.8	7.9	20	39	.4	58	310	1.00
12-19-83	25	23	.9	7.8	20	35	.5	58	310	1.00
7-23-84	26	22	.8	8.4	18	35	.5	60	310	.90
12-17-84	26	23	.9	8.0	18	37	.4	62	310	1.10
7-10-85	27	23	.9	11	20	36	.4	62	320	1.10
12-12-85	26	22	.9	8.5	16	42	.4	61	320	1.20
7- 9-86	26	23	.9	8.5	22	38	.4	58	310	1.30
7-21-87	26	23	.9	8.3	21	40	.4	58	320	1.20

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-33E-14DCD1 Idaho Power Well--Continued

Date	Phosphorus, total (mg/L as P)	Arsenic, dissolved (µg/L as As)	Boron, dissolved (µg/L as B)	Gross alpha, dissolved (µg/L as U-nat)	Gross alpha, susp. total (µg/L as U-nat)	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, susp. total (pCi/L as Cs-137)	Gross beta, dissolved (pCi/L as Sr/Y-90)	Gross beta, susp. total (pCi/L as Sr/Y-90)
12-20-82	0.04	15	60	6.4	<0.4	9.8	<0.4	9.4	<0.4
7-18-83	.13	17	60	9.6	.5	9.0	.5	8.6	.5
12-19-83	.01	14	60	12	<.4	11	<.4	9.2	<.4
7-23-84	.02	15	60	6.3	<.4	6.1	.5	5.2	.5
12-17-84	.07	14	60	7.2	<.4	9.0	<.4	7.8	<.4
7-10-85	.30	18	70	8.2	<.4	12	<.4	10	<.4
12-12-85	.02	18	70	3.3	.5	12	.6	8.8	.6
7- 9-86	.03	18	60	8.4	.8	9.5	.6	7.9	.6
7-21-87	.03	15	60	9.1	<.4	14	<.4	10	<.4

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-34E-7ACA1S Batiste Springs

Date	Time	Specific conductance (µS/cm)	pH (standard units)	Temperature, air (°C)	Temperature, water (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)
12-21-82	0816	1,290	6.8	5.5	14.0	470	120	42	80
7-19-83	0952	1,510	6.9	21.0	13.5	520	130	48	89
12-20-83	1010	1,290	6.9	-12.0	14.0	510	130	44	83
7-24-84	0824	1,350	6.8	24.5	14.5	530	130	49	95
12-18-84	0926	1,360	6.9	-8.5	14.0	480	120	44	86
7-11-85	0839	1,140	6.9	20.0	14.0	410	100	39	76
12-13-85	1000	1,160	6.8	.0	13.5	410	100	38	74
7-10-86	0819	1,320	6.8	17.0	14.0	440	110	40	80
7-22-86	1042	958	7.0	19.5	13.5	340	85	31	62

Date	Percent sodium	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)
12-21-82	26	2	16	240	75	0.4	42	770	8.9
7-19-83	26	2	14	280	71	.4	41	840	9.8
12-20-83	26	2	13	240	72	.5	41	820	8.5
7-24-84	28	2	13	280	72	.4	43	880	10.0
12-18-84	27	2	13	230	79	.4	43	780	16.0
7-11-85	28	2	15	190	72	.4	42	680	6.0
12-13-85	28	2	13	200	75	.4	39	710	7.3
7-10-86	27	2	16	230	78	.4	41	770	10.0
7-22-86	27	2	13	140	65	.5	37	580	4.8

Table 1.--*Chemical analyses of water from wells and springs*--Continued

6S-34E-7ACA1S Batiste Springs--Continued

Date	Phosphorus, total (mg/L as P)	Arsenic, dissolved (µg/L as As)	Boron, dissolved (µg/L as B)	Gross alpha, dissolved (µg/L as U-nat)	Gross alpha, susp. total (µg/L as U-nat)	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, susp. total (pCi/L as Cs-137)	Gross beta, dissolved (pCi/L as Sr/Y-90)	Gross beta, susp. total (pCi/L as Sr/Y-90)
12-21-82	4.20	25	250	20	<0.4	16	<0.4	15	<.4
7-19-83	4.30	20	250	24	<.4	14	<.4	13	<.4
12-20-83	3.40	19	250	21	<.4	17	<.4	15	<.4
7-24-84	9.80	36	260	24	<.4	110	<.4	96	<.4
12-18-84	2.50	24	260	19	<.4	19	<.4	17	<.4
7-11-85	.02	36	270	15	<.4	15	<.4	13	<.4
12-13-85	3.80	31	260	7.5	.8	17	.5	11	.5
7-10-86	.16	36	290	16	.6	21	.4	16	.4
7-22-87	2.70	94	240	1.1	<.4	17	<.4	12	<.4

Table 2.--*Statistical summary of selected water-quality data*

6S-33E-12BDD1 Michaud Well 1

Water-quality constituent	Data population	Median (50 percent)	Mean	Range of values Minimum	Range of values Maximum
*Specific conductance (µS/cm)	9	556	553	524	579
*pH (standard units)	9	7.7	7.7	7.5	8.1
*Temperature (°C)	9	13.5	13.0	11.5	14.0
Hardness (mg/L as $CaCO_3$)	9	195	194	180	200
Calcium, dissolved (mg/L as Ca)	9	53	53	50	55
Magnesium, dissolved (mg/L as Mg)	9	15	15	14	16
Sodium, dissolved (mg/L as Na)	9	34	34	32	36
Potassium, dissolved (mg/L as K)	9	6.7	6.6	5.8	7.4
Chloride, dissolved (mg/L as Cl)	9	42	42	40	47
Fluoride, dissolved (mg/L as F)	9	1.1	1.1	1.0	1.2
Silica, dissolved (mg/L as SiO_2)	9	35	35	34	36
Nitrogen, nitrite + nitrate, dissolved (mg/L as N)	9	.71	.70	.56	.83
Phosphorus, total (mg/L as P)	8	.02	.05	.01	.22
Arsenic, dissolved (µg/L as As)	9	4	4.5	3	6
Boron, dissolved (µg/L as B)	9	92	92	90	110
Gross alpha, dissolved (µg/L as U-nat)	9	7.6	6.6	3.3	8.2
Gross alpha, susp. total (µg/L as U-nat)	9	.40	.49	<.40	.80
Gross beta, dissolved (pCi/L as Cs-137)	9	7.4	7.5	5.5	11.0
Gross beta, susp. total (pCi/L as Cs-137)	9	.50	.50	<.40	.60
Gross beta, dissolved (pCi/L as Sr/Y-90)	9	6.0	6.4	4.7	9.1
Gross beta, susp. total (pCi/L as Sr/Y-90)	9	.45	.48	<.40	.60

Table 2.--*Statistical summary of selected water-quality data*--Continued

6S-33E-12CCD1 Russell Lindley Well

Water-quality constituent	Data population	Median (50 percent)	Mean	Range of values Minimum	Range of values Maximum
*Specific conductance (µS/cm)	9	1,910	1,920	1,570	2,270
*pH (standard units)	9	7.4	7.4	7.2	7.7
*Temperature (°C)	9	13.0	12.0	9.5	14.0
Hardness (mg/L as $CaCO_3$)	9	610	607	530	710
Calcium, dissolved (mg/L as Ca)	9	150	149	130	170
Magnesium, dissolved (mg/L as Mg)	9	57	57	50	70
Sodium, dissolved (mg/L as Na)	9	150	151	130	170
Potassium, dissolved (mg/L as K)	9	15	16	14	18
Chloride, dissolved (mg/L as Cl)	9	340	339	290	410
Fluoride, dissolved (mg/L as F)	9	.50	.50	.40	.60
Silica, dissolved (mg/L as SiO_2)	9	46	46	42	47
Nitrogen, nitrite + nitrate, dissolved (mg/L as N)	9	6.3	6.1	5.1	7.0
Phosphorus, total (mg/L as P)	9	.04	.05	.02	.21
Arsenic, dissolved (µg/L as As)	9	7.0	6.9	6.0	9.0
Boron, dissolved (µg/L as B)	9	260	259	210	310
Gross alpha, dissolved (µg/L as U-nat)	9	31	27	7.8	38
Gross alpha, susp. total (µg/L as U-nat)	9	.40	.44	<.40	.70
Gross beta, dissolved (pCi/L as Cs-137)	9	20	20	15	28
Gross beta, susp. total (pCi/L as Cs-137)	9	.60	.70	<.40	1.30
Gross beta, dissolved (pCi/L as Sr/Y-90)	9	18	17	13	21
Gross beta, susp. total (pCi/L as Sr/Y-90)	9	.60	.69	<.40	1.20

Table 2.--*Statistical summary of selected water-quality data*--Continued

6S-33E-12DAD1 Old Pilot House Well

Water-quality constituent	Data population	Median (50 percent)	Mean	Range of values Minimum	Range of values Maximum
*Specific conductance (µS/cm)	9	1,830	1,810	1,340	1,970
*pH (standard units)	9	7.3	7.3	7.2	7.5
*Temperature (°C)	9	17.0	17.0	15.0	19.0
Hardness (mg/L as $CaCO_3$)	9	410	410	360	430
Calcium, dissolved (mg/L as Ca)	9	86	86	76	93
Magnesium, dissolved (mg/L as Mg)	9	46	47	42	50
Sodium, dissolved (mg/L as Na)	9	145	142	130	150
Potassium, dissolved (mg/L as K)	9	130	135	120	170
Chloride, dissolved (mg/L as Cl)	9	240	240	200	260
Fluoride, dissolved (mg/L as F)	9	.12	.12	<.10	.20
Silica, dissolved (mg/L as SiO_2)	9	62	61	57	66
Nitrogen, nitrite + nitrate, dissolved (mg/L as N)	9	7.2	7.9	2.1	15
Phosphorus, total (mg/L as P)	8	10	11.2	7.5	16
Arsenic, dissolved (µg/L as As)	9	49	48	26	60
Boron, dissolved (µg/L as B)	9	845	844	810	910
Gross alpha, dissolved (µg/L as U-nat)	9	27	24	3.90	49
Gross alpha, susp. total (µg/L as U-nat)	9	.42	.47	<.40	.70
Gross beta, dissolved (pCi/L as Cs-137)	9	130	140	120	190
Gross beta, susp. total (pCi/L as Cs-137)	9	.42	.46	<.40	.60
Gross beta, dissolved (pCi/L as Sr/Y-90)	9	115	120	110	140
Gross beta, susp. total (pCi/L as Sr/Y-90)	9	.42	.47	<.40	.60

Table 2.--*Statistical summary of selected water-quality data*--Continued

6S-33E-12DAD2 New Pilot House Well

Water-quality constituent	Data population	Median (50) percent)	Mean	Range of values Minimum	Maximum
*Specific conductance (µS/cm)	9	511	499	452	522
*pH (standard units)	9	7.9	7.9	7.7	8.1
*Temperature (°C)	9	14.5	13.5	11.5	15.0
Hardness (mg/L as $CaCO_3$)	9	185	185	180	190
Calcium, dissolved (mg/L as Ca)	9	49	49	46	50
Magnesium, dissolved (mg/L as Mg)	9	15	15	14	16
Sodium, dissolved (mg/L as Na)	9	29	29	28	30
Potassium, dissolved (mg/L as K)	9	5.4	5.4	4.7	6.0
Chloride, dissolved (mg/L as Cl)	9	30	29	28	32
Fluoride, dissolved (mg/L as F)	9	.80	.80	.80	.90
Silica, dissolved (mg/L as SiO_2)	9	31	31	30	33
Nitrogen, nitrite + nitrate, dissolved (mg/L as N)	9	.87	1.09	.76	2.80
Phosphorus, total (mg/L as P)	9	.03	.09	.01	.62
Arsenic, dissolved (µg/L as As)	9	3	3	3	4
Boron, dissolved (µg/L as B)	9	80	80	70	90
Gross alpha, dissolved (µg/L as U-nat)	9	6.4	5.9	1.8	8.6
Gross alpha, susp. total (µg/L as U-nat)	9	.42	.57	<.40	1.40
Gross beta, dissolved (pCi/L as Cs-137)	9	5.5	5.5	4.0	7.5
Gross beta, susp. total (pCi/L as Cs-137)	9	.50	.53	<.40	.80
Gross beta, dissolved (pCi/L as Sr/Y-90)	9	5.1	4.7	3.5	5.8
Gross beta, susp. total (pCi/L as Sr/Y-90)	9	.50	.53	<.40	.80

Table 2.--*Statistical summary of selected water-quality data*--Continued

6S-33E-14DCD1 Idaho Power Well

Water-quality constituent	Data population	Median (50 percent)	Mean	Range of values Minimum	Maximum
*Specific conductance (µS/cm)	9	483	484	450	507
*pH (standard units)	9	7.8	7.9	7.8	8.1
*Temperature (°C)	9	15.5	15.0	12.5	17.5
Hardness (mg/L as $CaCO_3$)	9	180	180	170	190
Calcium, dissolved (mg/L as Ca)	9	45	45	44	48
Magnesium, dissolved (mg/L as Mg)	9	16	16	15	17
Sodium, dissolved (mg/L as Na)	9	26	26	25	27
Potassium, dissolved (mg/L as K)	9	8.3	8.5	7.8	11
Chloride, dissolved (mg/L as Cl)	9	37	37	34	42
Fluoride, dissolved (mg/L as F)	9	.42	.43	.40	.50
Silica, dissolved (mg/L as SiO_2)	9	60	60	58	62
Nitrogen, nitrite + nitrate, dissolved (mg/L as N)	9	1.10	1.08	.90	1.30
Phosphorus, total (mg/L as P)	9	.03	.07	.01	.30
Arsenic, dissolved (µg/L as As)	9	15	16	14	18
Boron, dissolved (µg/L as B)	9	62	62	60	70
Gross alpha, dissolved (µg/L as U-nat)	9	7.7	7.7	3.3	12
Gross alpha, susp. total (µg/L as U-nat)	9	.40	.48	<.40	.80
Gross beta, dissolved (pCi/L as Cs-137)	9	9.6	9.8	6.1	12
Gross beta, susp. total (pCi/L as Cs-137)	9	.45	.48	<.40	.60
Gross beta, dissolved (pCi/L as Sr/Y-90)	9	8.7	8.4	5.2	10
Gross beta, susp. total (pCi/L as Sr/Y-90)	9	.45	.48	<.40	.60

Table 2.--*Statistical summary of selected water-quality data*--Continued

6S-34E-7ACA1S Batiste Springs

Water-quality constituent	Data population	Median (50 percent)	Mean	Range of values Minimum	Range of values Maximum
*Specific conductance (µS/cm)	9	1,160	1,150	958	1,320
*pH (standard units)	9	6.8	6.9	6.8	7.0
*Temperature (°C)	9	13.5	13.5	13.5	14.0
Hardness (mg/L as $CaCO_3$)	9	470	456	340	530
Calcium, dissolved (mg/L as Ca)	9	120	114	85	130
Magnesium, dissolved (mg/L as Mg)	9	42	42	31	49
Sodium, dissolved (mg/L as Na)	9	80	81	62	95
Potassium, dissolved (mg/L as K)	9	13	14	13	16
Chloride, dissolved (mg/L as Cl)	9	75	73	65	79
Fluoride, dissolved (mg/L as F)	9	.40	.43	.40	.50
Silica, dissolved (mg/L as SiO_2)	9	41	41	37	43
Nitrogen, nitrite + nitrate, dissolved (mg/L as N)	9	8.9	9.0	4.8	16
Phosphorus, total (mg/L as P)	9	3.40	3.43	.02	9.80
Arsenic, dissolved (mg/L as As)	9	31	36	19	94
Boron, dissolved (mg/L as B)	9	260	263	240	290
Gross alpha, dissolved (µg/L as U-nat)	9	19.0	16.4	1.1	24
Gross alpha, susp. total (µg/L as U-nat)	9	.42	.47	<.40	.80
Gross beta, dissolved (pCi/L as Cs-137)	9	17	27	14	110
Gross beta, susp. total (pCi/L as Cs-137)	9	.40	.40	<.40	.50
Gross beta, dissolved (pCi/L as Sr/Y-90)	9	15	23	11	96
Gross beta, susp. total (pCi/L as Sr/Y-90)	9	.40	.40	<.40	.50

REFERENCES CITED

Balmer, D.K., and Noble, J.B., 1979, Water resources of the Fort Hall Indian Reservation, final report: Tacoma, Wash., Robinson and Noble, Inc., 227 p.

Jacobson, N.D., 1982, Ground-water conditions in the eastern part of Michaud Flats, Fort Hall Indian Reservation, Idaho: U.S. Geological Survey Water-Resources Investigations/Open-File Report 82-570, 35 p.

------- 1984, Hydrogeology of eastern Michaud Flats, Fort Hall Indian Reservation, Idaho: U.S. Geological Survey Water-Resources Investigations Report 84-4201, 31 p.

U.S. Environmental Protection Agency, 1977, National interim primary water regulations: Washington, U.S. Government Printing Office, 159 p.