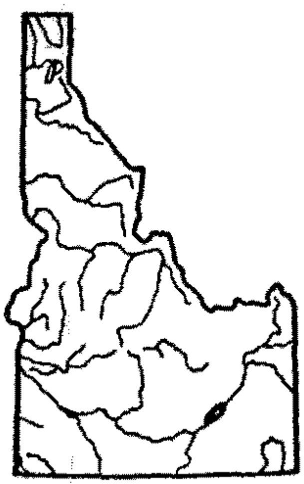
L. Campbell

GEOTHERMAL INVESTIGATIONS IN IDAHO

PART 9

POTENTIAL FOR DIRECT HEAT APPLICATION OF GEOTHERMAL RESOURCES

Drillers finish work on the first of several geothermal wells being planned for the Capitol Mall complex in Boise where it is hoped that enough hot water will be found to heat several state buildings.



IDAHO DEPARTMENT OF WATER RESOURCES
WATER INFORMATION BULLETIN NO. 30
JUNE 1980

WATER INFORMATION BULLETIN NO. 30

GEOTHERMAL INVESTIGATIONS IN IDAHO

Part 9

Potential for Direct Heat Application of Geothermal Resources

by

John C. Mitchell
Linda L. Johnson
John E. Anderson

With a section on Preliminary Environmental Assessment of Idaho Geothermal Resource Areas

by

Susan G. Spencer
Jacquelyn F. Sullivan

Work performed under U.S. Department of Energy Contract
No. DE-AS07-77ET28407
Modification No. A001
Designation UC-66-2

Idaho Department of Water Resources
Statehouse
Boise, Idaho

June 1980

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately-owned rights.

The information is the result of tax-supported research and as such is not copyrightable. It may be freely reprinted with the customary crediting of the source. The Idaho Department of Water Resources would appreciate notification of any reprinting of this information.

TABLE OF CONTENTS

Table of Contents (continued)

LIST OF TABLES

LIST OF FIGURES

List of Figures (continued)

List of Figures (continued)

List of Figures (continued)

List of Figures (continued)

List of Figures (continued)

ACKNOWLEDGMENTS

Many people have contributed to this study in the hope that the information will be of benefit to the people of the State of Idaho.

The United States Department of Energy (DOE) granted financial support, while the U.S. Geological Survey (USGS) made available personnel and laboratory facilities for water quality analyses. EG&G Idaho, Inc., a prime contractor of DOE, made available laboratory facilities, personnel, and equipment for neutron-activation analyses of trace metals from thermal water samples at the Idaho National Engineering Laboratory.

Field checking of many springs and well locations was accomplished by Andres Garcia, George Denman, Mark Von Lindern and Larry Beard of the Idaho Department of Water Resources (IDWR). Compilation of the computerized data on thermal springs and wells for the two maps was the responsibility of Sharron Chapman, IDWR. Other IDWR personnel, especially Ralph Mellin, provided review assistance and many details for the report.

National Oceanic and Atmospheric Administration (NOAA) published the map Geothermal Resources of Idaho (Plate 1 in pocket) using information on thermal springs and wells supplied by IDWR, the USGS Geotherm data bank, and many other sources.

All of these cooperative efforts are gratefully acknowledged and appreciated; without such generous support, this study could not have been accomplished.

PREFACE

Geothermal energy (the natural heat energy of the earth) is receiving nationwide attention. Increasing involvement of many parties in the exploration for and development of this energy source has been accelerated by four factors:

1. Ecologically, geothermal energy appears to be a better alternative than other methods of power generation such as nuclear, fossil fuel or hydro-electric.

2. Economically, it competes favorably with hydro-electric and fossil fuel power generation and may be less expensive than nuclear methods.

3. Enormous reserves of geothermal resources have been identified and can be developed if the effort is made to utilize them.

4. Efficient use of all energy sources is recognized as necessary if present energy shortages are to be alleviated and future shortages avoided.

Published information on the geothermal potential in Idaho consists mostly of numerous reports that briefly describe or mention thermal water occurrences in particular areas or regions of the state. Seven published reports (Stearns and others, 1937; Waring, 1956; Ross, 1971; Nichols and others, 1972; Warner, 1972 and 1975; Young and Mitchell, 1973) have been written on Idaho's geothermal potential on a statewide basis. Three of the reports are mainly compilations of pre-existing data collected by various investigators over an extended time interval of approximately 50 to 60 years. Waring (1965, p. 26-31) essentially updates the data of Stearns and others (1973, p. 136-151). Godwin and others (1971) classified approximately 6,075,000 hectares (15 million acres) of land in Idaho as being prospectively valuable for geothermal exploration. Ross (1971) published geologic and chemical information on about 380 thermal water occurrences, and presented brief evaluations of the geothermal potential of different regions of the state. Nichols and others (1972) identified nonpower uses and the economic impact of these uses on Idaho. Warner (1972 and 1975) dealt with Idaho's geothermal potential based on its regional geologic setting. Other reports deal with localized areas. Young and Whitehead (1975a, 1975b) wrote on the geothermal potential of the Bruneau-Grand View and Weiser areas. Mitchell (1976a, 1976b, 1976c) published information on the northern Cache Valley, Blackfoot, and Camas Prairie areas.

Wilson and others (1976) reported on geothermal investigations of the Cascade, Idaho, area. Mink and Graham (1977) reported on the geothermal potential of the west Boise area. In addition to the above published reports, there are seven unpublished open-file reports prepared by the U.S. Geological Survey (USFS) that are listed in the selected references. These are available for public review.

In Idaho, the prospects for early development of geothermal energy as an energy source appear excellent. The regional geologic setting appears favorable for the existence of large geothermal fields, although little is known of the full potential of this resource. A great deal more must be learned of geothermal occurrence and utilization. The Idaho Department of Water Resources (IDWR) initiated a study of geothermal potential to generate interest in development of the resources and to properly perform the department's regulatory function (Water Information Bulletin No. 30. Part 1, Young and Mitchell, 1973). The study, prepared jointly with the USGS, located 25 areas in Idaho where indications of potential power development utilizing geothermal energy were found. Parts 2, 3, and 4 of Water Information Bulletin No. 30, prepared by the USGS, studied areas in southwest Idaho. Parts 5, 6, and 7, prepared by the IDWR, studied areas in south-central and southeastern Idaho. Part 8, prepared jointly by the IDWR and the Southern Methodist University, describes the heat flow regime in and around the Snake River Plain.

There are four objectives common to each of the studies: (1) to encourage the development of the resource through public knowledge of its occurrence, characteristics, origin, and properties; (2) to develop the expertise within the IDWR to properly perform its function of regulation of the resource; (3) to protect the ground and surface waters of the state from deleterious effects that might be brought about by large-scale geothermal development efforts by public or private parties; (4) to protect the geothermal resource from waste and mismanagement because of lack of knowledge of its occurrence, characteristics, and properties.

This study (Part 9 of Water Information Bulletin No. 30), prepared by IDWR, summarizes a part of the effort to obtain additional data on the properties, origin, occurrence, and characteristics of this resource in Idaho. It contains information on 899 thermal water occurrences with surface temperatures of 20°C or higher from both springs and wells. Chemical analyses of 357 of the 899 total thermal water sites are also contained herein, as well as previously published and unpublished geophysical, geological and hydrological information.

Thirty-six of the 44 counties in Idaho are discussed in separate chapters of this report. The eight counties not discussed in the report contain no known geothermal water discharges and little is known of their geothermal potential. Six of the eight counties not discussed are in northern Idaho: Bonner, Boundary, Kootenai, Benewah, Clearwater and Lewis counties. The other two (Lincoln and Minidoka counties) are within the eastern Snake River Plain aquifer, which may mask deep thermal anomalies in these counties.

ABSTRACT

There are 899 thermal water occurrences known in Idaho, including 258 springs and 641 wells having temperatures ranging from 20 to 93°C. Fifty-one cities or towns in Idaho containing 30 percent of the state's population are within 5 km of known geothermal springs or wells. These include several of Idaho's major cities such as Lewiston, Caldwell, Nampa, Boise, Twin Falls, Poctello, and Idaho Falls.

Fourteen sites appear to have subsurface temperatures of 140°C or higher according to the several chemical geothermometers applied to thermal water discharges. These include Weiser, Big Creek, White Licks, Vulcan, Roystone, Bonneville, Crane Creek, Cove Creek, Indian Creek, and Deer Creek hot springs, and the Raft River, Preston, and Magic Reservoir areas. These sites could be industrial sites, but several are in remote areas away from major transportation and, therefore, would probably be best utilized for electrical power generation using the binary cycle or Magma Max process.

Present uses range from space heating to power generation. Six areas are known where commercial greenhouse operations are conducted for growing cut and potted flowers and vegetables. Space heating is substantial in only two places (Boise and Ketchum) although numerous individuals scattered throughout the state make use of thermal water for space heating and private swimming facilities. There are 22 operating resorts using thermal water and two commercial warm-water fish-rearing operations.

The geothermal potential in Idaho's future can be most beneficial, providing the resource is utilized in an environmental and economical manner. While some thermal waters are being used to their maximum, most heat is dissipated through irrigation practices or is discharged unused.

It appears that the greatest potential for rapid on-line industrial process heat is in the Boise, Nampa-Caldwell, Pocatello, and Weiser areas where geothermal discharges from several wells are known. Existing industry in these areas could possibly be induced to retrofit to geothermal process or space heat if sufficient temperatures and flow rates can be found.

GENERAL INTRODUCTION

PURPOSE AND SCOPE

This report was prepared in response to the many requests from Idaho's citizens and industries for authoritative information pertaining to the state's geothermal resources. The report primarily outlines the characteristics, occurrences, and uses (present and potential) of low temperature (<150°C) thermal waters, with minor emphasis on high temperature (>150°C) waters. The information presented in this report is designed to expand the IDWR data bank, enabling the IDWR to better serve the public and private sector while enhancing the department's regulatory responsiveness. In addition, computerized well and spring data were supplied to the National Oceanic and Atmospheric Administration for the development of the first state geothermal map (Plate 1 in pocket) and to the U.S. Geological Survey for supplementing the geotherm data bank.

The general objectives of the study and report are as follows: (1) describe, in a single reference, the thermal water chemistry and quality from existing and newly acquired data on thermal springs and wells; (2) evaluate the statewide geothermal potential from the standpoint of direct heat application; (3) pinpoint specific areas and general uses for direct heat application; (4) provide basic data on low temperature resources for potential uses; (5) give recommendations about areas of the state that could receive large benefits from detailed study.

Most locations were field checked to confirm the reported thermal discharge. Several occurrences reported in other publications were looked for but not found. These are not included in this report. Others in remote areas were not field checked but are included and labeled "not field checked" in the basic data tables in the appendix.

WELL- AND SPRING-NUMBERING SYSTEM

The numbering system used by the IDWR and the USGS 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, followed by three letters and a numeral, which indicate the quarter section, the 40-acre tract, the 10-acre tract, and the serial number of the well within the tract, respectively. Quarter sections are lettered a, b, c, and d in a counterclockwise order from the northeast quarter of each section (figure 1). Within the quarter sections, 40-acre and 10-acre tracts are lettered in the same manner. Well 1S-17E-23aab1 is in the *NW1/4 NE1/4 NE1/4 of Section* 23, T.1 S, R.17 E, and was the first well inventoried in that tract. Springs are designated by the letter "S" following the last numeral; for example, 1S-13E-34bcb1S.

USE OF METRIC UNITS

The metric or International System (SI) of units are used *in this report* to present water chemistry and most other data. Concentrations of chemical substances dissolved in the water are given in milligrams per liter (mg/l) rather than in parts per million (ppm) as in some previous Water Information Bulletins. Numerical values for chemical concentrations are essentially equal, whether reported in mg/l or ppm for the range of values reported in this report. Water temperatures are given in degrees Celsius (°C). Figure 2 shows the relation between degrees Celsius and degrees Fahrenheit.

Linear measurements (inches, feet, miles) are given in their corresponding metric units (millimeters, meters, kilometers). Weight and volume measurements are also given in their corresponding metric units. Area measurements are also listed in SI units. Table 1 gives conversion factors for these units.

TABLE 1
ENGLISH METRIC CONVERSION FACTORS

To Convert from	To	Multiply by
acres	hectares	0.405
inches	centimeters	2.540
feet	meters	0.305
yards	meters	0.914
miles	kilometers	1.609
sq. miles	sq. kilometers	2.589
gallons	liters	3.785
ounces	grams	28.349
hectares	acres	2.471
pounds	kilograms	0.454
tons (short)	tons (metric)	0.907
centimeters	inches	0.394
meters	feet	3.281
meters	yards	1.094
kilometers	miles	0.621
sq. kilometers	sq. miles	0.386
liters	gallons	0.264
grams	ounces	0.035
kilograms	pounds	2.205
tons (metric)	tons (short)	1.102

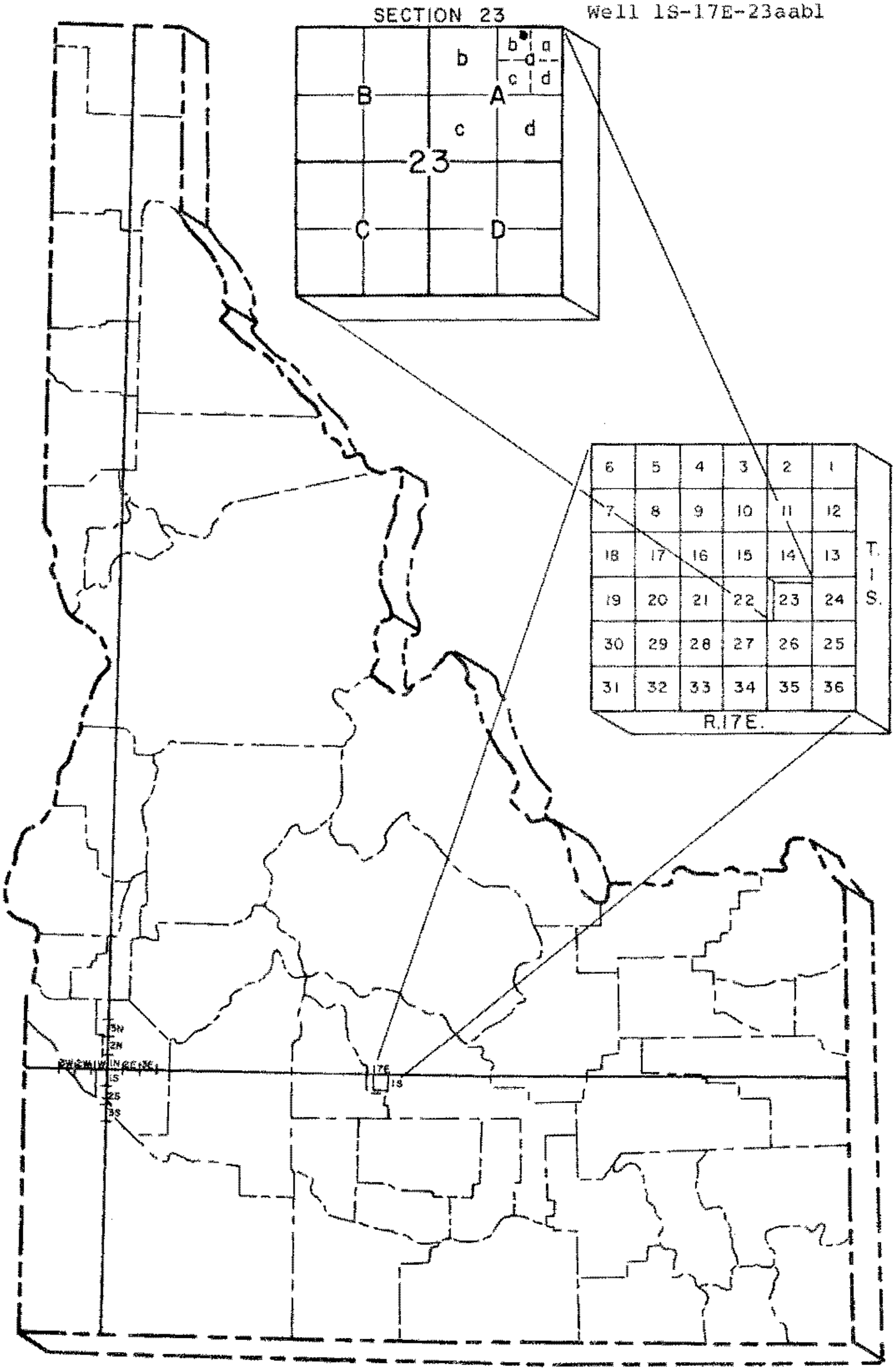


FIGURE 1. Diagram showing the well- and spring-numbering system for Idaho. (Using well 1S-17E-23aabl.)

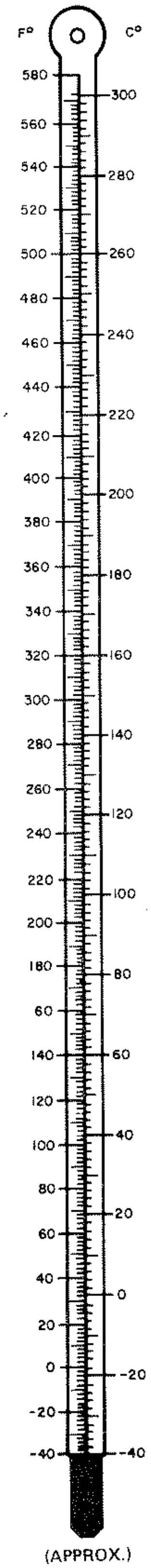


FIGURE 2. Temperature conversion graph.

CHEMICAL GEOTHERMOMETERS

In this report, the geothermal potential of various areas in Idaho has been evaluated from five factors, including several chemical geothermometers, water temperature at surface, geology, geophysical, and hydrology. As the chemical geothermometers are original interpretations, they are discussed to clarify their meaning. Much of the geology, geophysics and hydrology is from published reports and is not discussed here.

Preliminary evaluations of geothermal systems are being successfully conducted using chemical geothermometers. In the Raft River Valley of southeastern Idaho, the reliability of these chemical geothermometers has been tested by deep drilling. The quartz and sodium-potassium-calcium (Na-K-Ca) estimated aquifer temperatures (Young and Mitchell, 1973) and silica mixing model calculations (Young and Mitchell, 1973, unpublished data) agreed very closely (within 10°C) with temperatures found in depth (Kunze, 1975). This proven reliability in the Raft River Valley gives some measure of confidence in applying the same methods to other similar areas of the state.

The degree of reliance to be placed on a chemical geothermometer depends on many factors. The basic assumption is that the chemical character of the water obtained by temperature dependent equilibrium reactions in the thermal aquifer is conserved from the time the water leaves the aquifer until it reaches the surface. The concentration of certain chemical constituents dissolved in the thermal waters can, therefore, be used to estimate aquifer temperatures.

Aquifer temperatures, calculated from the quartz, Na-K-Ca chemical geothermometers and mixing models as well as the atomic ratios of selected elements found in the thermal waters of Idaho, are given in basic data table 2 in the appendix. These were calculated from values of concentration found in basic data table 1.

In basic data table 2, there are 10 columns which represent aquifer temperatures. These 10 columns of basic data table 2 were derived using different assumptions as to physical controls governing dissolved chemical constituents in thermal water. In most cases, it appears that the chalcedony (column T_4) or Na-K-Ca (column T_5) chemical geothermometers may be the most accurate for thermal water in Idaho. However, in many cases these differ by as much as 20-30°C. Chalcedony generally estimates temperatures somewhat higher than Na-K-Ca, particularly for high pH waters issuing from granitic terrains. It is not presently known which is closest to the actual aquifer temperature.

However, as drilling has confirmed the reliability of Na-K-Ca in Raft River Valley in Cassia County and for other reasons, the authors have more confidence stating that Na-K-Ca may be the more accurate. In any case, best correlation is obtained generally between Na-K-Ca and chalcedony chemical geothermometers. In several areas where high water temperatures at the surface (>65°C) have been measured, good agreement between quartz and Na-K-Ca chemical geothermometers indicates temperatures may be high enough for wet steam or binary cycle power generation.

PRESENT AND POTENTIAL GEOTHERMAL USE IN IDAHO

Geothermal energy has been used in Idaho for a long time. Figure 3 is a map of Idaho showing locations and current uses of geothermal energy in the state. Uses have been made ranging from electrical generation using pelton wheels to catfish farming. Present uses of geothermal energy are tabulated in table 2 (modified from Nichols, et. al., 1972).

Geothermal energy has been used for space heating in Boise since 1893 and in Ketchum. Currently several greenhouse operations are conducted near Boise for fresh and cut flowers. Other greenhouse operations using geothermal energy are located at Weiser, Grand View, White Arrow Ranch near Bliss, Banbury Hot Springs area in the Hagerman Valley, and on the South Fork Payette River and at Raft River.

Irrigation has been a long-standing use of thermal water in Idaho, although most irrigators consider hot water a nuisance as it must be cooled before being applied to crops. Some report heavier first and last cuttings of alfalfa as the growing seasons may be somewhat extended; however, the effect of the heat may be quite minor as opposed to the effect of the water from an extra early and a late season irrigation.

Stock watering in winter is another beneficial use which creates increases in weight gain on less feed with geothermally watered livestock compared to cold watered livestock.

The Department of Energy's Idaho Raft River Project is designed to gather information on various uses and applications of geothermal energy, including binary cycle power generation, reinjection of geothermal fluids, space heating, and cooling, potato processing, manure and cattle feed processing, irrigation, and aquaculture. In addition, environmental related studies of subsidence, microseismicity, flora and fauna, water quality, and groundwater levels are being made.

Many resorts using thermal water are operated in Idaho. These are listed in table 2 and locations shown in figure 3.

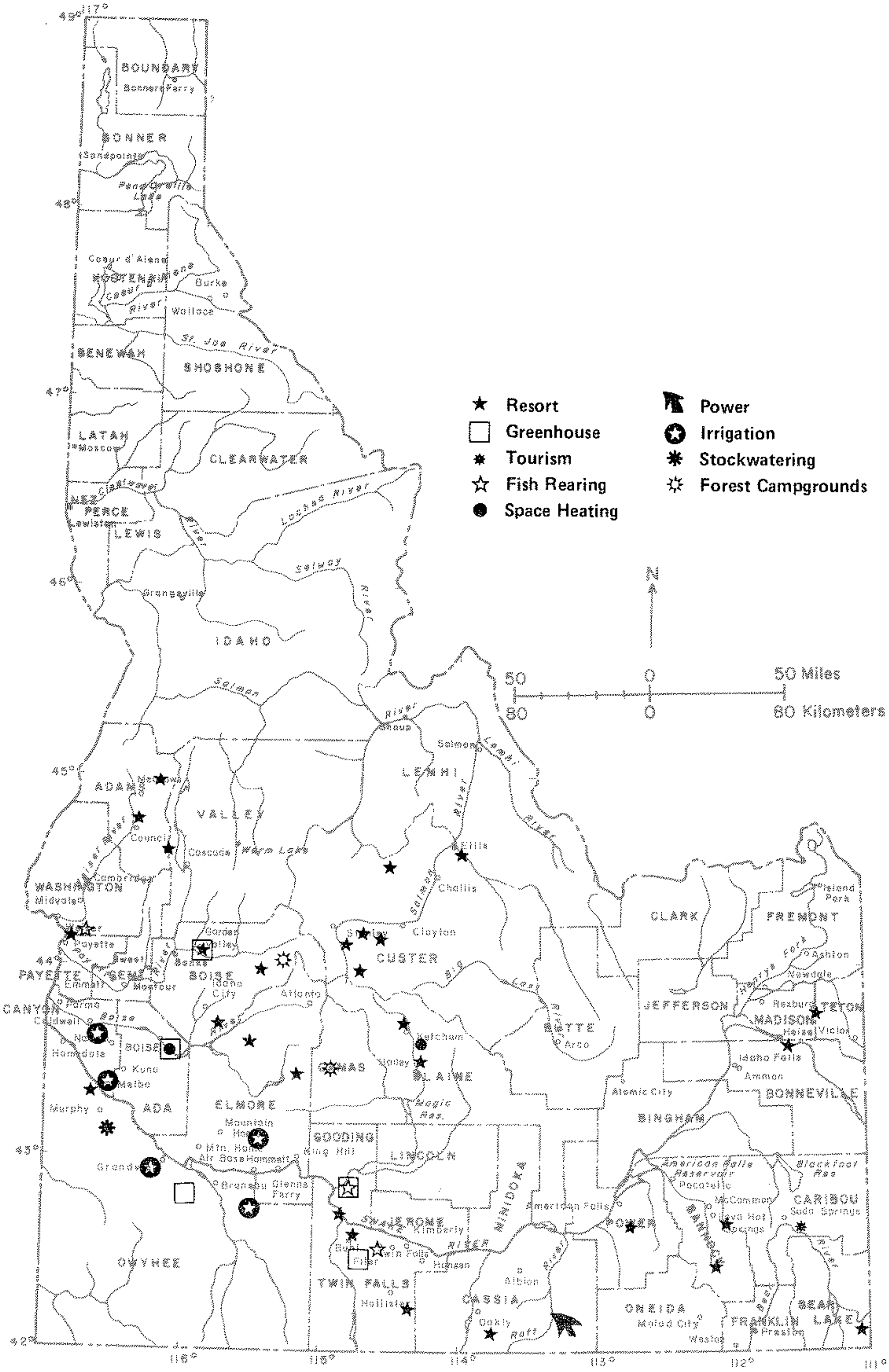


FIGURE 3. Index map of Idaho showing locations and present uses of geothermal energy.

TABLE 2
GEOTHERMAL DEVELOPMENT IN IDAHO - HOT WATER USES (1978)
(Table modified from Nichols, Brockway & Warnick, 1972)

Name of Facility	County	Type of Development	Approximate Years in Operation	Approximate Dollar Value 1973	Length of Season in Months	Approximate Number of Employees	Water Supply: Approximate Discharge	Water Supply: Temperature °C
Warm Springs Water District	Ada	Space heating	1800's	Public supply	12	5	6400 lpm @	72
Edwards Greenhouse	Ada	Greenhouse	56	100,000	12	4	1400 lpm @	47
Hunt Brothers' Floral	Ada	Greenhouse	40	120,000	12	4	1100 lpm @	47
Zim's Resort	Adams	Resort	51	120,000	4	6	380 lpm @	63-66
Starkey H.S.	Adams	Resort	1900	70,000	4	4	490 lpm @	56
White Licks H.S.	Adams	Baths & camping	--	1,000	Summer	--	110 lpm @	60-68
Downata H.S.	Bannock	Resort	20	120,000	Summer	--	1900 lpm @	43
Lava H.S.	Bannock	Resort & health spa	75	1,500,000	12	20	5700 lpm @	45
Bear Lake H.S.	Bear Lake	Resort	80-100	60,000	4-5	3	@	48
Easley Store & Plunge	Blaine	Resort & camping	30	Church prop.	3		70 lpm @	37
Brandt's H.S.	Blaine	Motel & pool space heating	1800's	180,000	12	1	3800 lpm @	70
Claredon H.S.	Blaine	Resort	40-50	100,000	12	2	380 lpm @	52
Twin Falls H.S.	Boise	Resort	40	100,000	12		1900 lpm @	67
Warm Springs Resort	Boise	Resort	1800's	120,000	Summer	4	1100 lpm @	42
Donlay lodge H.S.	Boise	Greenhouse	9	200,000	12	6	265 lpm @	55
Haven Lodge H.S.	Boise	Space heating & resort	20	300,000	12	2	75 lpm @	48-64
Wards Greenhouse	Boise	Greenhouse	9	100,000	12	4	5700 lpm @	75
Terrace Lakes Resort	Boise	Space heating & resort	13	1,500,000	12	20	1900 lpm @	75
Kirkham H.S.	Boise	Forest campground	--	U.S. Forest Ser.	Summer	--	950 lpm @	65
Bonneville H.S.	Boise	Forest campground	--	U.S. Forest Ser.	Summer	--	1375 lpm @	85
Baumgartner H.S.	Camas	Forest campground	--	U.S. Forest Ser.	Summer	--	75 lpm @	44
Oakley H.S.	Cassia	Resort & health spa	15	10,000	12	2	40 lpm @	47
Sunbeam H.S.	Custer	Bath house	--	U.S. Forest Ser.	Summer	2	1700 lpm @	61-76
Snake River Boy Scout Council	Custer	Camp & pool	--	--	3	--	40 lpm @	35
Beardsley H.S. (Challis H.S.)	Custer	Resort & pool	92	20,000	12	3	5700 lpm @	43
Campground H.S.	Custer	Forest campground	5	10,000	Summer	--	330 lpm @	56
Robinson Bar	Custer	Resort	20	60,000	Summer	--	260 lpm @	55
Middle Fork Lodge	Custer	Resort	5	270,000	Summer	--	260 lpm @	43
Idaho Rocky Mtn. Ranch	Custer	Resort	--	130,000	Summer	--	-- @	50
Sawtooth Land Corp.	Custer	Resort	--	10,000	--	--	380 lpm @	41
Paradise H.S.	Elmore	Resort & space heating	50-60	100,000	Summer	--	950 lpm @	53
White Arrow Ranch	Gooding	Greenhouse, space heating, fish farming	10	100,000	12	15	3100 lpm @	65

Table 2. Geothermal Development in Idaho - Hot Water Uses (continued)

Name of Facility	County	Type of Development	Approximate Years in Operation	Approximate Dollar Value 1973	Length of Season in Months	Approximate Number of Employees	Water Supply Approximate Discharge	Water Supply Temperature °C
Heise Hot Springs, Inc.	Jefferson	Resort & pool	80	200,000	12	12	225 lpm @	49
Green Canyon Natatorium	Madison	Pool	--	50,000		--	-- @	44
Cooke's Greenhouse	Owyhee	Greenhouse	7	30,000	12	2	1700 lpm @	83
Given's H.S.	Owyhee	Pool	80	80,000	12	2	130 lpm @	47
Jacobson's Feed Lot	Owyhee	Stock Watering	10	270,000	12	10	1700 lpm @	37
Bybee's Pool	Owyhee	Pool	20	30,000	12	2	1000 lpm @	60
Indian Springs Natatorium	Power	Resort	65	100,000	5	8	5800 lpm @	32
Sligar's Resort	Twin Falls	Resort	25	100,000	8	4	450 lpm @	63
Salmon Falls H.S.	Twin Falls	Pool	--	--	--	--	-- @	67
Miracle H.S.	Twin Falls	Health spa	--	50,000	12	2	1325 lpm @	54
Banbury H.S.	Twin Falls	Resort	60	70,000	5	5	2300 lpm @	57
Archibald's Greenhouse	Twin Falls	Greenhouses	5	20,000	12	--	1300 lpm @	45
Lunty's Tropical Fish	Twin Falls	Test project	1	--	--	--	1500 lpm @	32
Nat-Soo-Pah H.S.	Twin Falls	Resort	60	70,000	6	--	115 lpm @	36
Weiser H.S.	Washington	Resort & greenhouse	1900's	130,000	12	--	20 lpm @	70
Midvale City Well	Washington	Pool	20	City property	Summer	--	7600 lpm @	28

The most famous is probably Lava Hot Springs, a state-owned natatorium and health spa.

Potential uses for geothermal energy in Idaho are many and varied. Figure 4 shows minimum temperatures necessary for agricultural and industrial uses in which geothermal energy has been used or proposed. Many of these uses are related to agriculture, forest products, or tourism--three of Idaho's principal industries. The greatest potential, as far as present knowledge of the resource in Idaho is concerned, is for space heating and greenhouse use. In rapidly growing areas, such as Nampa, Caldwell, Boise, Pocatello, and Twin Falls, thermal water of sufficient quantity might be discovered and used for space heating large buildings and new subdivisions. Groundwater heat pumps generally would give a large energy savings over present heat sources if the water temperature was less than desirable for direct space heating use. Groundwater heat pumps used both for heating and cooling also have a large potential even in areas that have a normal cool groundwater temperature.

The area of greatest potential for greenhouse operation is the Bruneau-Grand View area where high yield irrigation wells tap thermal aquifers where water temperature ranges from 20-84°C. The area is far from markets and major transportation routes but so is most other farmland in Idaho. Winter crops could conceivably be grown in this area for use in Idaho rather than shipping crops in from states with more favorable climates.

Table 3 and figure 5 show 14 areas in Idaho where potential exists for power generation where subsurface temperatures might be greater than 140°C, based on the Na-K-Ca and quartz chemical geothermometers. The Blackfoot Reservoir area was chosen on the basis of geology. The 140°C temperature was chosen as the lower limit as it appears that technology and rapidly escalating energy costs may make this limit economically attractive in the foreseeable future. Five locations appear to have aquifer temperatures high enough for wet steam generation. The highest estimated aquifer temperature expected from any of the 14 listed areas appears to be 175°C at Big Creek and Crane Creek hot springs areas in Lemhi and Washington counties. The upper limit given for Battle Creek-Squaw Hot Springs area in Franklin County may or may not be valid, because of uncertainties in interpretation due to travertine ($CaCO_3$) deposition at some spring vents. The Crane and Cove creeks to Weiser area have received initial evaluation by the USGS. Blackfoot Reservoir area and Battle Creek-Squaw hot springs areas have received initial evaluation by IDWR. The other areas need initial assessment work to more accurately determine their thermal potential. Many of these areas are remote and in rugged terrain. Assessment will, therefore, be somewhat

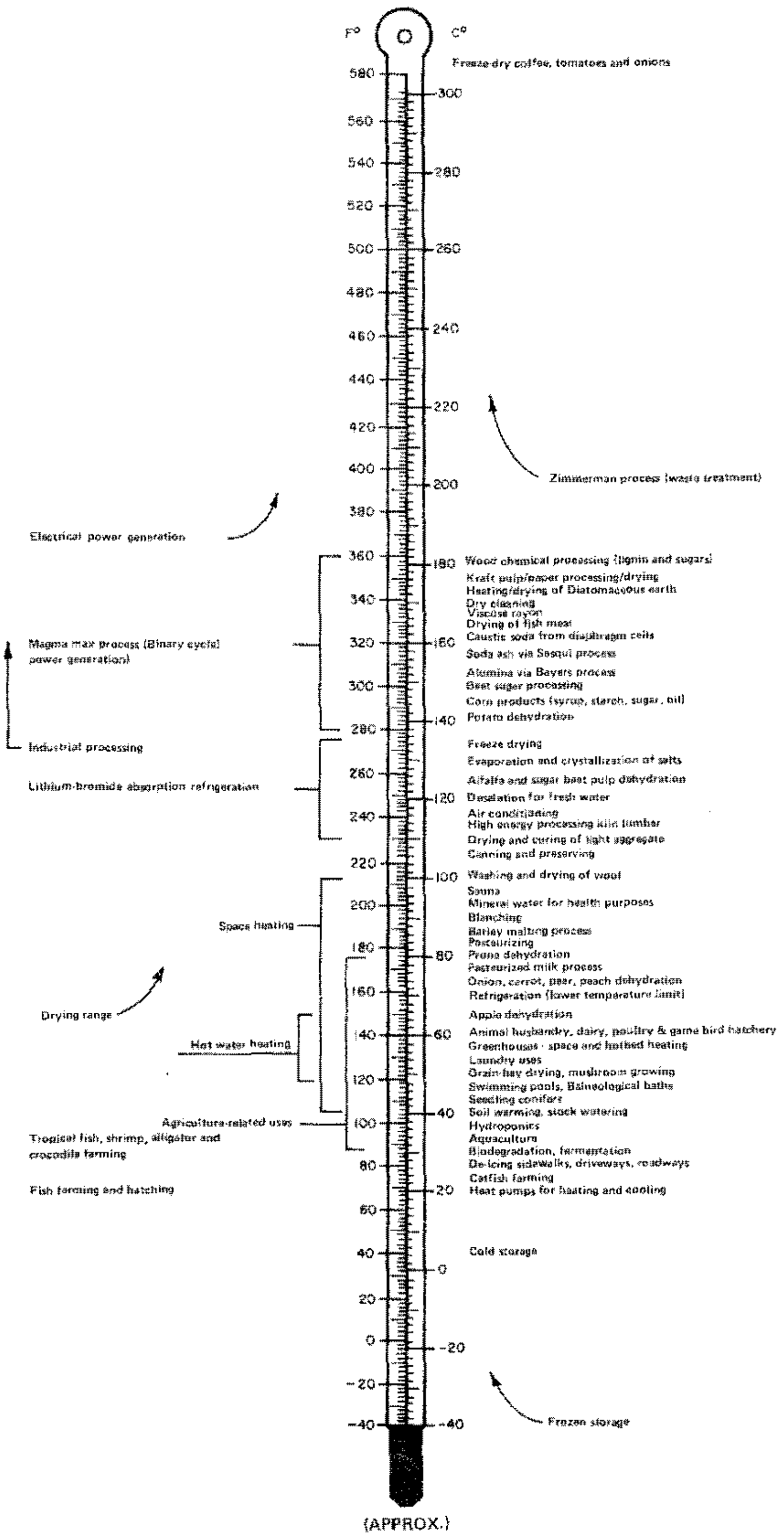


FIGURE 4. Required temperatures for geothermal fluids.

TABLE 3

AREAS IN IDAHO MOST FAVORABLE FOR POWER GENERATION BASED ON SURFACE MANIFESTATIONS, GEOLOGY AND GEOTHERMOMETERY (1978)

Area	Location	County	Measured Surface Temperature °C	*Best Estimate Subsur. Temp. °C Na-K-Ca	*Best Estimate Subsur. Temp. °C Quartz	Principal Land Owner	Type of Generation	Area Number Figure	Remarks
Battle Creek-Squaw H.S.	15S-39E-8bdc1S & 15S-39E-17bcd1S	Franklin	84	250	150	Private	Wet steam	1	Could be mixed water - geothermometers difficult to interpret.
Big Creek H.S.	23N-19E-22c1S	Lemhi	93	175	175	USFS	Wet steam	2	Ridge top discharge, silica & carbonate deposition, boiling at surface.
Blackfoot Reservoir	6S-41E-19bac1	Caribou	42	?	?	Private, BLM, BIA	?	3	Picked on basis of favorable geology & geophysics.
Bonneville H.S.	10N-10E-31c1S	Boise	85	142	137	USFS	Binary cycle	4	Used for a steam bath and bathing by campers.
Crane Creek H.S.	11N-3W-7bdb1S	Washington	92	166	176	Private	Wet steam	5	Near boiling at the surface.
Cove Creek H.S.	10N-3W-9ccc1S	Washington	74	172	152	Private	Wet steam	6	11 km southeast of Crane Creek H.S.
Deer H.S.	9N-3E-25bac1S	Boise	80	139	147	Private	Binary cycle	7	Siliceous sinter deposits.
Indian Creek H.S.	17N-11E-15acd1S	Valley	88	137	142	USFS	Binary cycle	8	In wilderness area.
Magic Reservoir	1S-17E-23aab1	Blaine-Camas	72	174	139	Private	Wet steam	9	Chemistry of waters somewhat similar to Raft River.
Raft River	15S-26E-23bbc1	Cassia	92	147	135	BLM	Binary cycle	10	Plant under construction. Geothermometers confirmed by drilling Na-K-Ca most accurate.
Roystone H.S.	7N-1E-8dda1S	Gem	54	150	147	Private	Binary cycle	11	Presently a natatorium.
Vulcan H.S.	14N-6E-11bda1S	Valley	84	147	135	USFS Private	Binary cycle	12	
White Licks H.S.	16N-2E-33bcc1S	Adams	65	145	145	USFS Private	Binary cycle	13	Bath houses for campers.
Weiser H.S.	11N-6W-10cca1	Washington	78	141	156	Private	Binary cycle	14	Presently a natatorium, with greenhouse operation.

*See first footnote in Table 4.

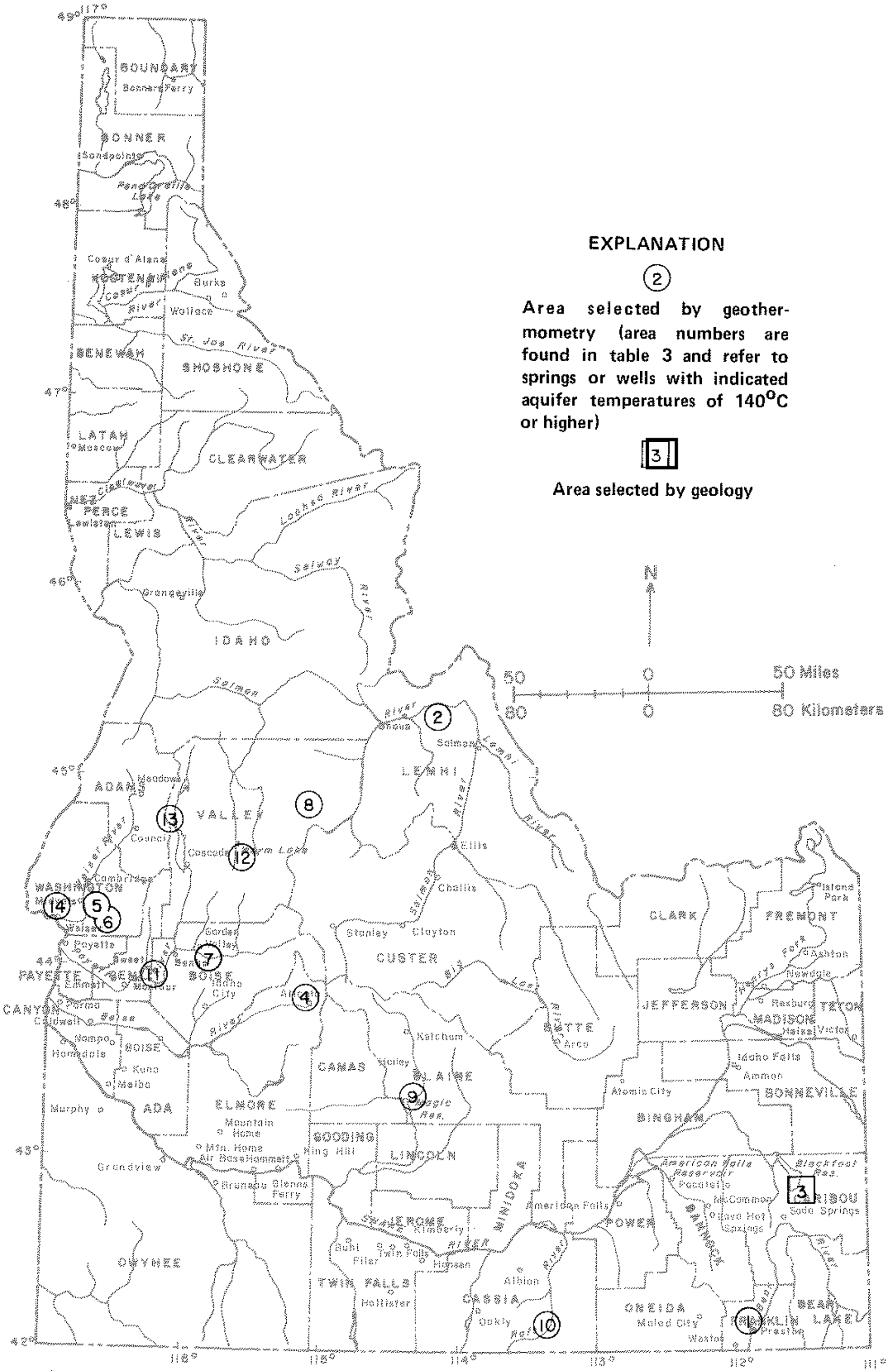


FIGURE 5. Index map of Idaho showing areas most favorable for power generation based on surface manifestation, geology and geotherometery. (Modified from Young and Mitchell, 1973.)

difficult and expensive, but if geothermal energy is going to make an impact on Idaho's electrical power base, and it appears to have potential to do so, the initial assessment will have to be made.

ORGANIZATION OF DATA

This report has been organized into four subregions within the state boundaries due to thermal waters in the separate subregions having different characteristics or modes of occurrence. Individual counties within a specific subregion are discussed in separate chapters. Figure 6 shows the approximate subregion boundaries and the counties they encompass.

Basic data tables containing information on the known springs and wells comprise a major section in the appendix of this report. The appendix also contains preliminary environmental assessments of several geothermal resource areas.

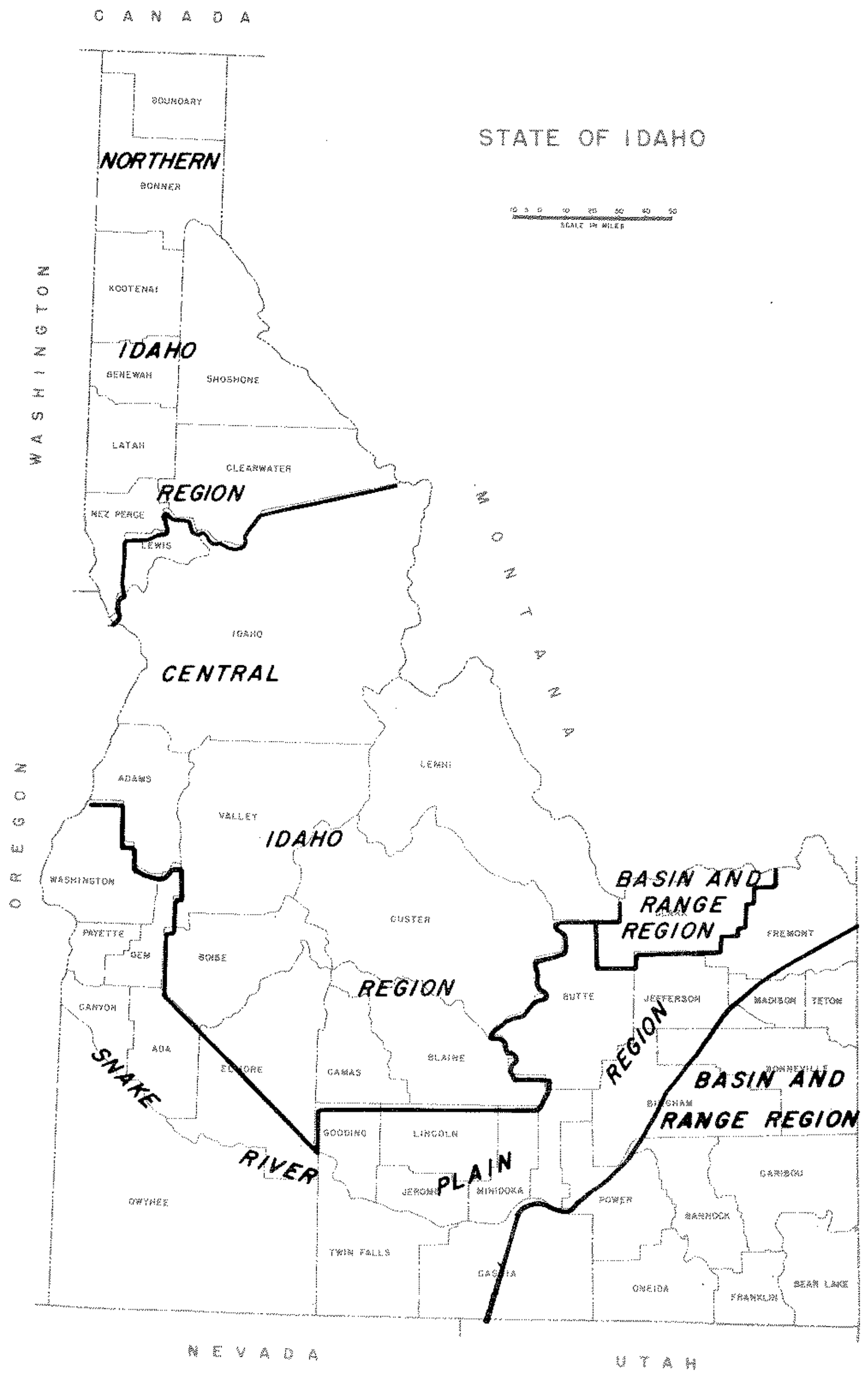


FIGURE 6. Index map of Idaho showing locations of counties and subregions covered in this report.

GEOTHERMAL POTENTIAL
OF THE NORTHERN IDAHO "PANHANDLE" REGION
INCLUDING SHOSHONE AND NEZ PERCE COUNTIES

There are no known thermal anomalies located in the eight counties that make up the Northern Idaho Panhandle area with the exception of some hot rock material deep in the mines in Shoshone County (figure 7) and one warm well in NezPerce County (figure 8). Generally very little is known of the geothermal potential of this area. Specific information known and relating to the geothermal potential in NezPerce and Shoshone counties follows.

SHOSHONE COUNTY

Shoshone County, located in the Panhandle area, is known for its silver, lead, and zinc deposits.

The generalized geologic framework of the area consists of Precambrian metasediments of the Belt Supergroup formations. These formations have undergone slight metamorphism and are composed primarily of quartzites, argillites, shales, and impure limestones.

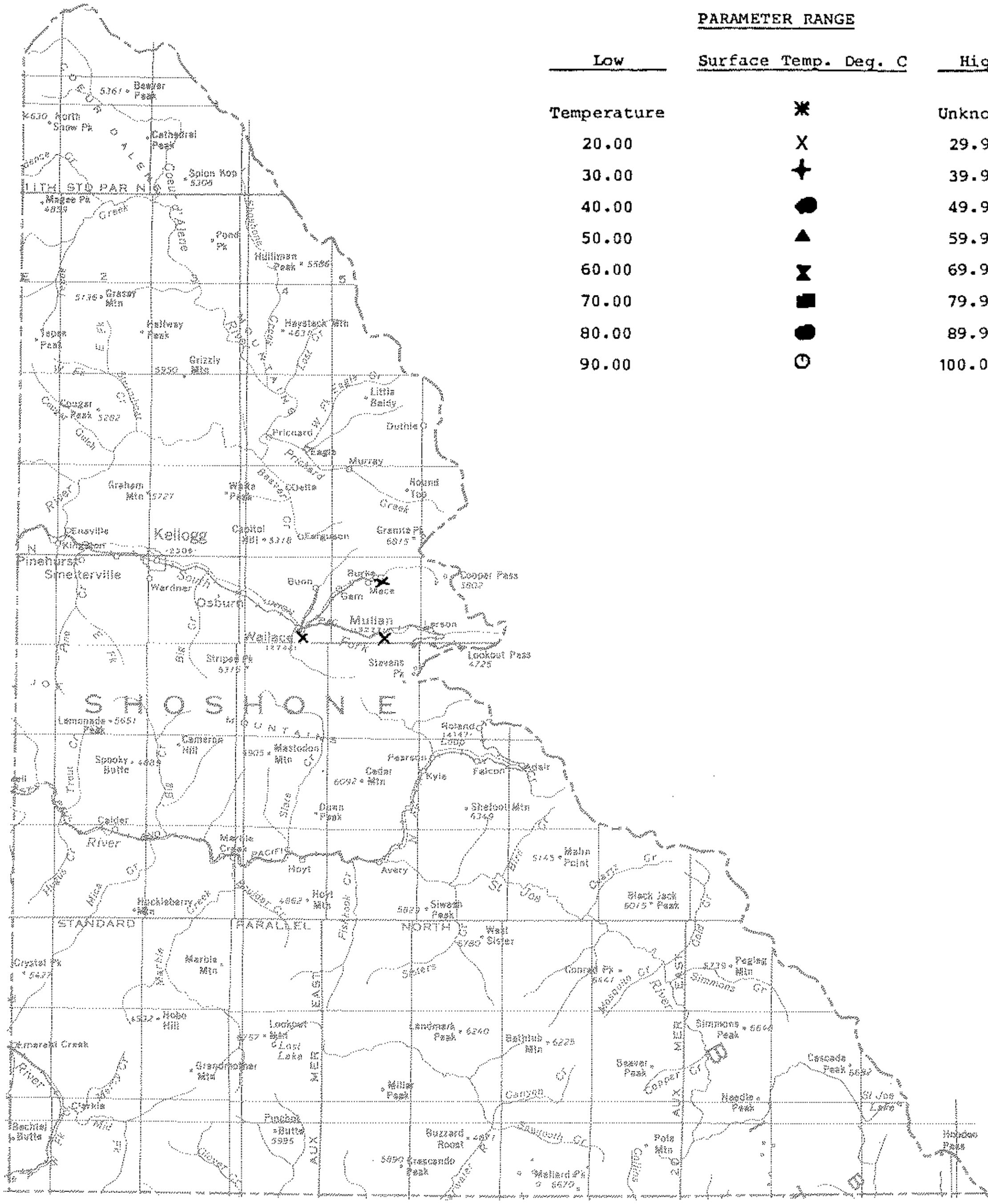
The Belt metasediments (undifferentiated) consist of the Prichard, Burke, Revett, St. Regis, Wallace, and Spruce formations with the ore being mainly contained in the lower Burke and upper Prichard formations.

The structure of the area is relatively complex with two major fault trends; one trending northwest-southeast and the other trending northeast-southwest.

Mining has taken place in the Coeur d'Alene mining district since the middle 1800's. Currently the Bunker Hill, Sunshine, Crescent, Galena, and Star Morning mines are just a few of the deeper active mines located in Shoshone County. Most of the mines in the area are relatively water barren and diamond drilling and/or mining excavation has not encountered a significant geothermal anomaly. Any water needed for drilling or mining purposes is piped into these mines from surface sources.

Thermal gradient studies of the rock temperatures in the mines show temperatures increase from a normal temperature at the surface to those exceeding 40°C at deeper levels within the mines.

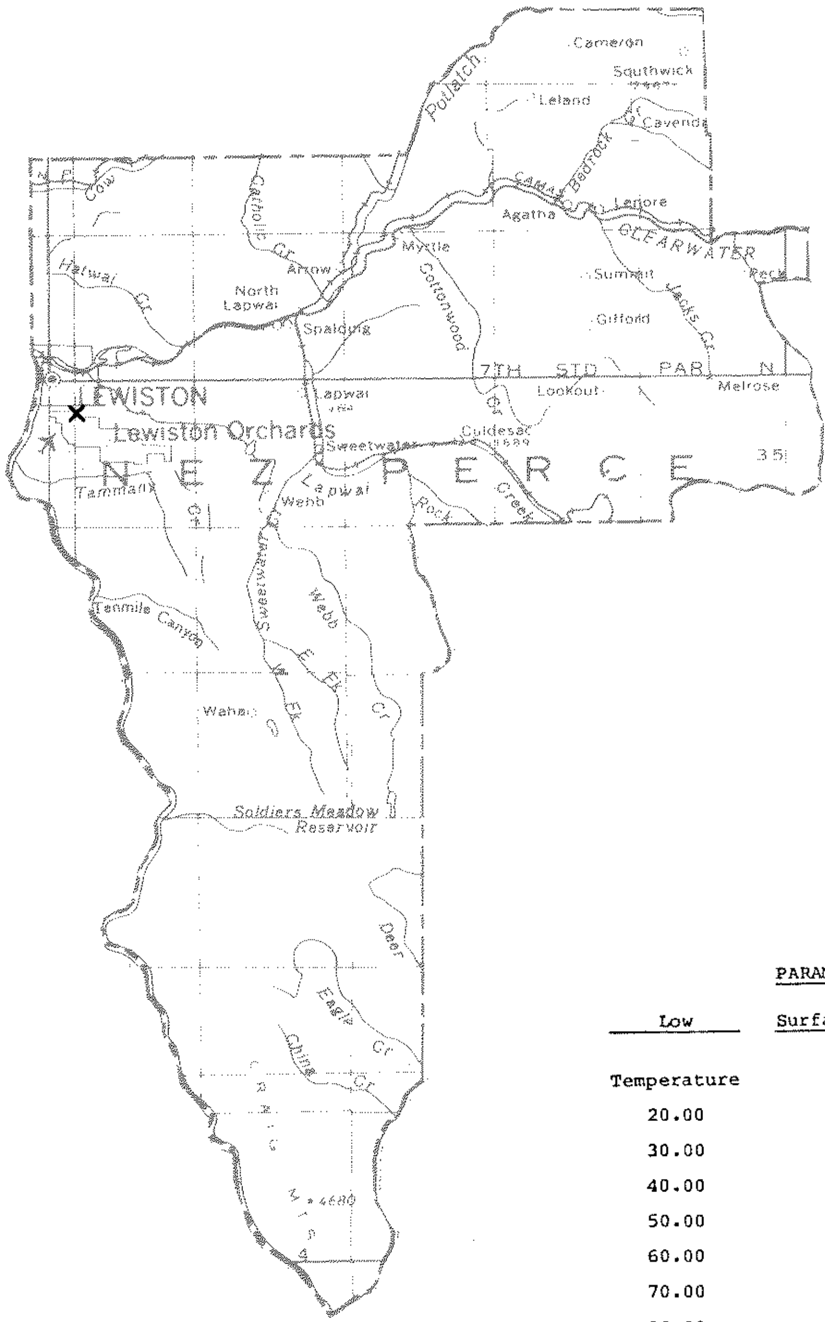
In the Star Morning Mine, rock temperatures were recorded to be 42°C at the 7300 ft level. In the Galena



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✚	39.99
40.00	●	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00

FIGURE 7. Index map of Shoshone County showing locations of known thermal water occurrences with surface temperatures above 20°C.



	PARAMETER RANGE	
Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	ʘ	100.00

FIGURE 8. Index map of Nez Perce County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Mine, rock temperature at the 1600 ft level is 22°C and increases with depth.

Surface water brought into a mine is subsequently heated through use to the existing rock temperature at the level at which it is utilized. Excess water that accumulates is then pumped out of the mine and discharged at the surface or used in a surface facility.

For the last three years, the Bunker Hill Mine has expelled excess water at the surface at rates of 4393 liters per minute (l/m) to 7153 l/m at temperatures near 22°C. The Crescent Mine expels excess water at the rate of 719 l/m at temperatures near 37°C. The Galena Mine in 1978 pumped excess water out of the mine at the rate of 397 l/m at temperatures near 24°C. Waters expelled from the Galena Mine are very low in dissolved solids, have a pH of 7.6 ± 0.2 and are reused in the beneficiating plant. See figure 7 for mine locations.

Certain areas of these mines at some future date may have the potential to store and naturally heat a sufficient amount of water to be used for large scale thermal space heating.

Presently, any excess water that is pumped out of the mines not being utilized in their surface facilities could possibly be utilized for local space heating.

NEZ PERCE COUNTY

Little interest has been expressed in the geothermal potential of Nez Perce County and nothing has been previously written on its potential. One thermal well, however, has been drilled near Lewiston by the city of Lewiston (figure 8). This well has a surface temperature of 20°C, discharges 4500 l/min and is 183 m deep. No chemical analysis is available for the well and, consequently, it is impossible to determine the possibility of hotter water at depth. This well and other wells drilled in the future could, however, be used at this temperature for space heating and cooling using groundwater heat pumps provided sufficient flow rates are available. A water sample from this well should be chemically analyzed and aquifer temperature estimates should be made. It is possible that more and hotter thermal water might be found in the Lewiston area.

GEOTHERMAL POTENTIAL OF THE CENTRAL IDAHO REGION INCLUDING IDAHO, ADAMS, VALLEY, LEMHI, BOISE, CUSTER, NORTHERN ELMORE, CAMAS AND NORTHERN BLAINE COUNTIES

The vast region of central Idaho, including the Idaho batholith, is discussed as a separate section due to similarities in geology, geochemistry, structurally related occurrences, and the depositional features thermal springs in this region have in common.

Most of the thermal water found in this region appears as springs, which range in temperature from 20-93°C. Locally, several wells have encountered thermal water. It is commonly known that these thermal springs and wells are located along the major and minor streams and rivers in the area. They thus emerge at the lowest possible elevation, although many are found in the upper reaches of drainages. An example are 18 thermal springs that occur along the Middle Fork of the Boise River along a 45 km stretch between Arrowrock Reservoir and Atlanta. However, a more detailed examination reveals that thermal springs in this region appear rather evenly spaced along narrow arcuate zones or trends, some of which cut across drainage divides (figure 9 in pocket). Other zones follow major drainages, as in the Boise and Payette river systems. In some cases, mostly along the longer zones, the spacing tends to increase regularly in one direction. In some cases, where zones intersect, as at Indian Creek and Middle Fork Salmon River, two springs occur near the zone intersections. The arcuate zones range in length from 20 to 80 km and appear to be very narrow. These arcuate zones are most numerous and well defined in the central batholith region in Idaho. Well drilling and spring locations in other regions of Idaho have revealed similar zones. The regular spacing of springs along these zones appears to result from the regular spacing of linear features associated with them. Why the springs occur at nearly the same point on separate parallel lineaments is unknown but probably is the result of another lineament or structure (not visible on Landsat images) which cross the regularly spaced linears. The springs occur at the intersections.

Springs along these arcuate zones tend to occur (1) near the confluence of streams and/or rivers, such as at Pistol Creek Hot Springs (16N-10E-14dbc1S) and Little Pistol Creek Hot Springs (16N-10E-14dbc1S); Riggins (24N-2E-14dbd1S), Loon Creek (17N-14E-19bdb1S) and Hailey Hot Springs (2N-18E-18dbb1S); or (2) near where a drainage is diverted around a large promontory or rock outcropping which projects into the stream and around which the stream was forced to make a horseshoe or U-shaped bend. Mormon Bend (11N-14E-20aab1S), Riverside (16N-12E-16cbb1S), Sheepeater (15N-10E-24bbb1S), Sunflower Flat (16N-12E-8bbb1S), Thomas Creek Ranch (16N-12E-17dad1S), Lightfoot Hot Springs (3N-13E-7dca1S) and Warfield (4N-17E-31bbc1S) Hot Springs are examples of the second type of occurrence (see figure 10). It is conceivable that many undiscovered thermal springs issue from the bottoms of river channels where the flowing water masks the thermal water.

Figure 9 (in pocket) is a superposition of linears from Day (1974) and circular features of Haskett (1974) on a spring and well location map of Idaho. This figure shows that many of the thermal springs and wells are associated (found on or very near) with large linear features that are seen on high altitude U-2 and satellite photos. Few of Day's linears are found to fit the curvilinear zones defined by the spring occurrences, but data strongly suggest structural control for most thermal water in the region. Although the exact nature of the linears is not known, they could represent joints or faults or some other type of rock fracture. One theory of the origin of these thermal springs is that they occur where ancestral joints, formed by shrinkage or contraction of deeply buried, cooling igneous or metamorphic rock complex intersects faults, or other fractures allowing circulation of meteoric (rain and snow) water to depths where the water is heated by hot rock. The hot water being less dense than the colder water rises along the same or other joints, faults or fractures to form a thermal spring. Thus, most of the thermal springs in this region of Idaho probably represent deep circulation of meteoric waters to depths where the water is heated by contact with hot rock in a region or along zones of above normal geothermal gradient or heat flow.

These types of occurrences appear typical. Perhaps the localized geothermal anomalies--those associated with high intensity shallow seated heat sources (intrusions)--might be those which are not associated with arcuate belts or zones. Alternatively, at least some of the zones could represent fractures or other structures into which magma has intruded to shallow depths producing high intensity shallow seated heat sources.

IDAHO COUNTY

Thirteen thermal springs are known to occur in Idaho County (figure 11). They are fairly uniform in temperature, ranging from 41 to 59°C. They are not limited to any one locality or rock type, but are found sparsely distributed over a large area. Four springs, Wier Creek (36N-11E-13bcc1S), Colgate Licks (36N-12E-15abd1S), Jerry Johnson

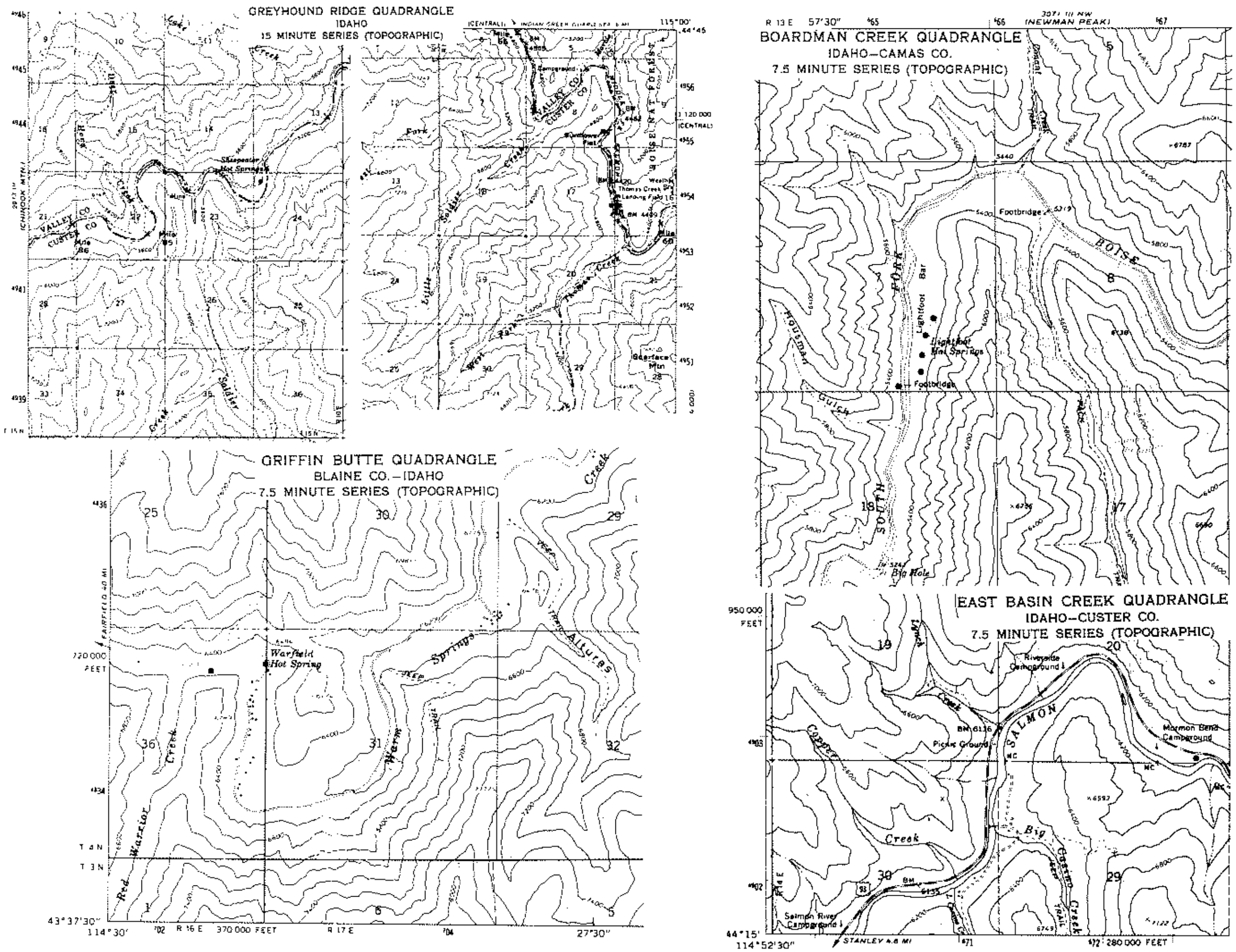
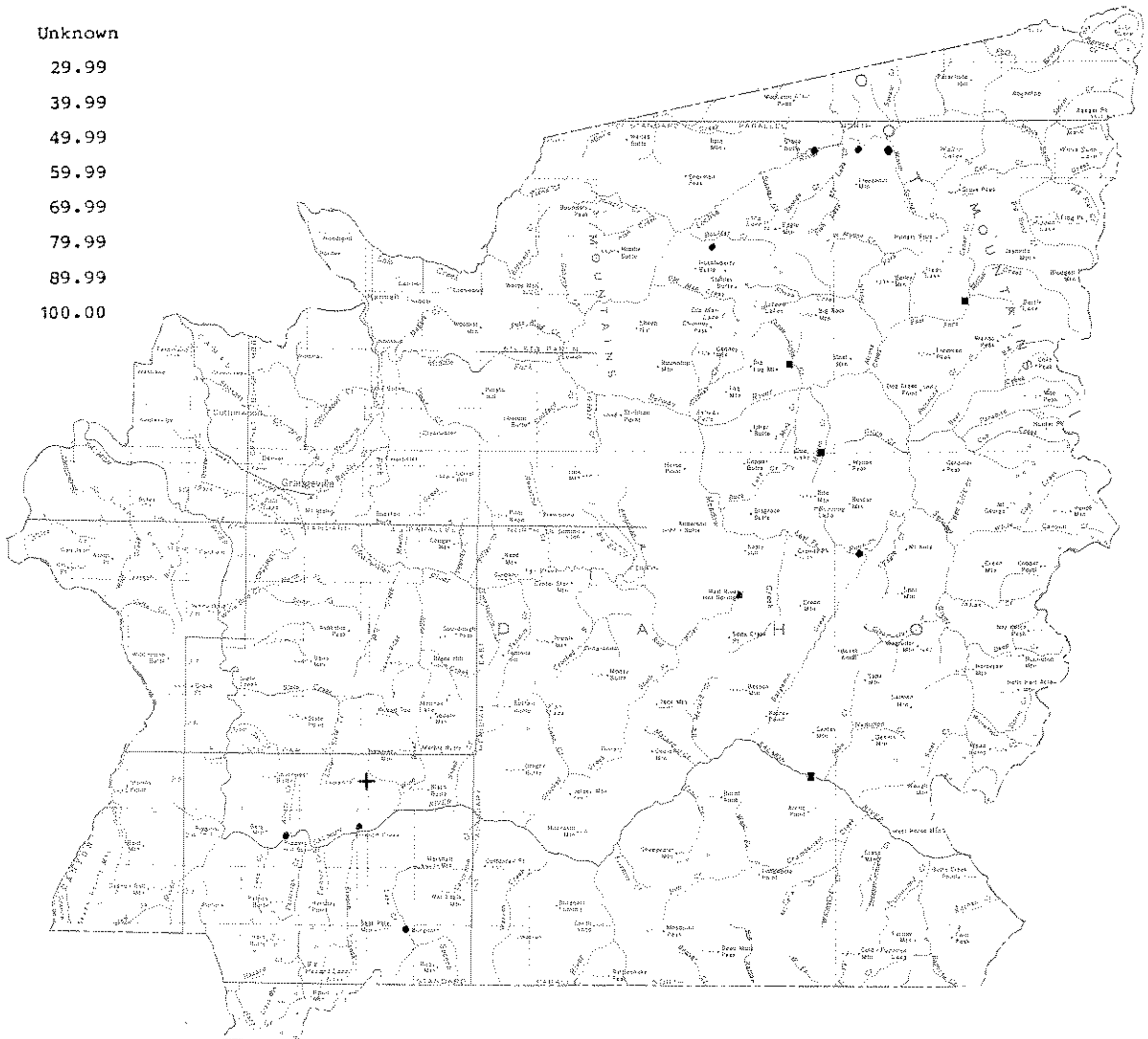


FIGURE 10. Topographic maps showing typical central Idaho thermal spring occurrences near sharp river bends. Black dots indicate spring locations.

FIGURE 11. Index map of Idaho County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏱	100.00



(36N-13E-18addlS), and an unnamed spring occur within a small area in northeastern Idaho County on or near the Lochsa River. Most of the other springs are in remote locations, wilderness or recreational areas, accessible only by pack trail. This, along with restricted use of these areas, precludes large scale development. Riggins (24N-2E-14dbdlS), Burgdorf (22N-4E-lbdclS), and Red River Hot Springs (25N-12E-3dddlS) are popular resort areas and boast improvements, although the Red River Resort recently burned down and the Burgdorf Resort pools have been officially closed by the district health officials. Jerry Johnson Hot Springs is used for informal bathing by campers and back-packers.

Most thermal springs in Idaho County occur within granitic rocks or near contacts of other rock types with granitic rocks. All are associated with known faults or linear features. The best defined arcuate trend in the region is represented by Stanley (34N-10E-6caalS), Stewart (32N-11E-4caalS), Martin (31N-11E-24dcdlS) hot springs and Running Springs (29N-12E-14abblS) in east-central Idaho County (figure 9 in pocket).

Water quality chemical data from thermal water occurrences in Idaho County are given in basic data table 1. These analyses provide a chemical comparison of thermal water in the area and were used to calculate selected chemical-constituent ratios and to estimate aquifer temperatures.

Chemical analyses are available for only six of the fourteen hot springs found in Idaho County. All of the analyzed springs are low in total dissolved solids, ranging from 582 mg/l at Riggins Hot Springs to 133 mg/l at Wier Creek Hot Springs. The pH of these waters is alkaline, ranging from 8.1 to 9.0, except for Red River Hot Springs. These springs have a flouride content of 23 mg/l whereas other sampled springs in the county have a flouride content of less than 6 mg/l. Typically, the waters in Idaho County are similar to most other thermal waters throughout central and southwestern Idaho that issue from granitic rock or areas thought to be underlain by granitic type rocks.

Aquifer temperatures calculated from the silicia and Na-K-Ca chemical geothermometers and mixing models, as well as selected atomic ratios, are given in basic data table 2. Maximum subsurface temperature expected from wells drilled in the area of springs for which chemical analyses are available probably would not exceed 100°C and may be most closely approximated by the chalcedony or Na-K-Ca temperature, columns T_4 and T_5, basic data table 2.

ADAMS COUNTY

Seven thermal springs and two wells are known in Adams County with measured surface temperatures exceeding 20°C (figure 12). The two wells are located near the town of Council. Both are fairly low temperature at 22°C. Several other wells in the Council area have above normal temperatures of up to 17°C (10°C above mean annual temperature). Well 16N-1W-15bac1 is 35 m deep and was drilled within 0.4 km of the Hornet Creek-Weiser River confluence. The other well, 16N-1W-11acd1, was drilled to a depth of 64 m near the valley-mountain boundary fault zone near Grossen Canyon. No chemical analyses are available from these wells. Samples should be collected to help determine their geothermal potential.

Starkey Hot Springs (18N-1W-34dbb1S), an attractive resort area, discharges 500 l/min of 56°C water near the confluence of Warm Springs Creek and Weiser River where the Weiser River bends north and abruptly turns south again in the steep-walled canyon surrounding Fort Hall Hill. Starkey Hot Springs appears structurally typical of the thermal spring occurrences in central Idaho. Aquifer temperatures indicated by Na-K-Ca and chalcedony chemical geothermometers are 70 and 77°C, respectively. These temperatures could have uses up to and including the lower temperature limit of refrigeration (see figure 4). Dissolved solids and flouride concentration are low, being 348 mg/l and less than 1 mg/l, respectively. The pH is 8.6. The chemistry of the water suggests a source rock not similar in chemical or mineralogical constituents to granitic rocks.

Council Mountain Hot Springs (15N-1E-2bdb1S) is located 2.5 km up Warm Springs Creek from its confluence with the Middle Fork Weiser River southeast of Council. It issues at 68°C and 190 l/min from Quaternary alluvium near granitic rock. No other information is available on this thermal spring. Its location appears atypical of most springs in central Idaho.

White Licks Hot Springs (16N-2E-33bcc1S) is located in the Middle Fork Weiser River drainage and issues from Quaternary alluvium near Miocene basalt and Cretaceous granitic rocks. Ross (1971, p. 9) reported that White Licks Hot Springs occurred on a relatively short north trending fault and had an abnormally high mineral content. Water issues from numerous spring vents at 63 to 65°C (Young and Mitchell, 1973, p. 9) and has a slight sulfur odor. The quartz and Na-K-Ca chemical geothermometers estimate aquifer temperatures of 142 to 145°C, the lower limit of binary cycle power generation, might be found in the area by deep drilling.

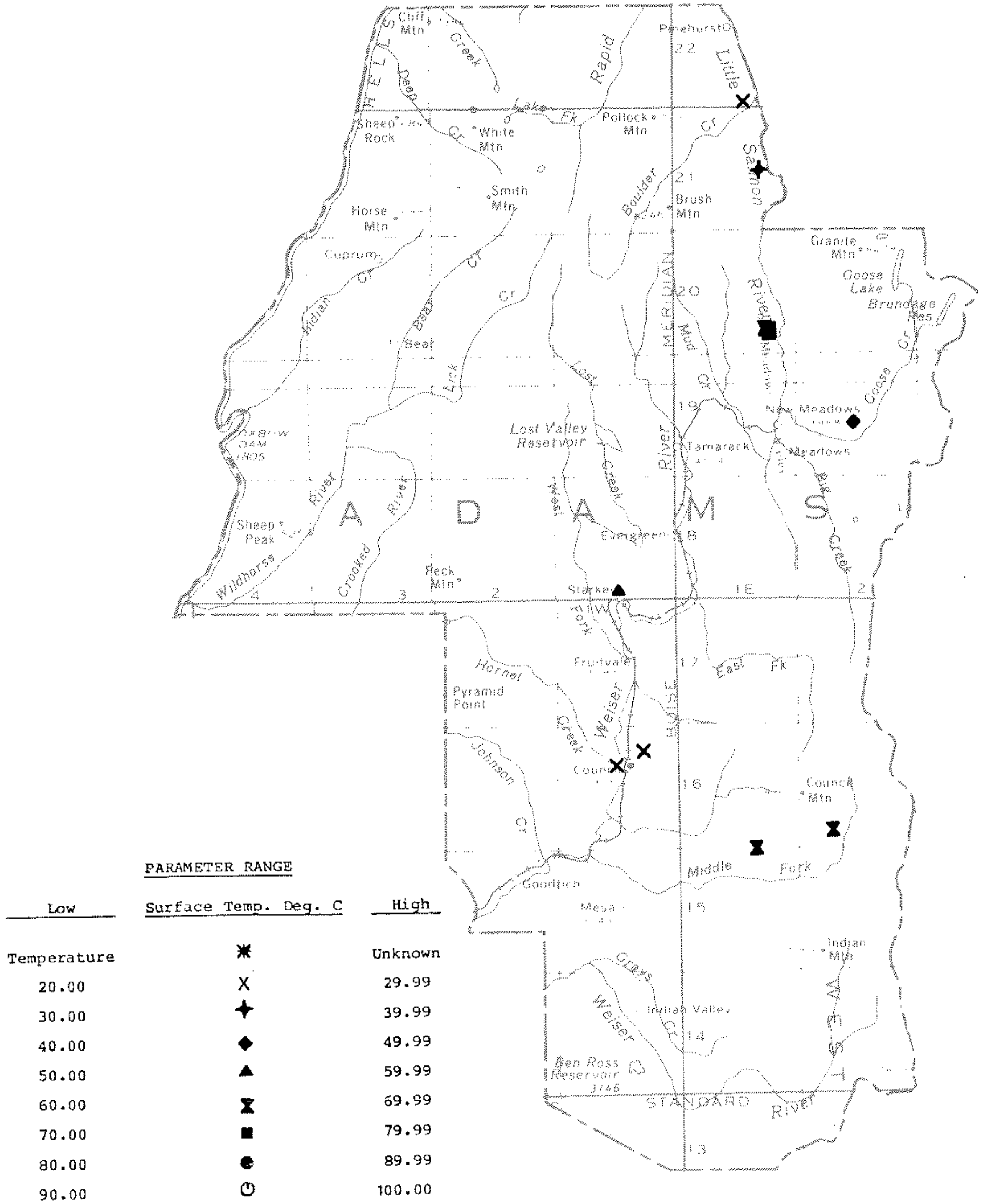


FIGURE 12. Index map of Adams County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Zims Resort (20N-1E-26ddalS) issues at 65°C and about 380 l/min from alluvial fill near the fault contact between Tertiary basalt and Cretaceous granitic rock. Dissolved solids are fairly low for this part of Idaho at 666 mg/l and the flouride content is 2.3 mg/l. Good agreement between Na-K-Ca and chalcedony chemical geothermometers indicate aquifer temperature may be about 83 to 84°C.

Krigbaum Hot Springs (19N-2E-22ccalS) near Meadows, issues from a northeast trending normal fault in Cretaceous granitic rocks near Miocene basalt from two separate spring vents at 40 and 42°C at 150 l/min. The chalcedony and Na-K-Ca chemical geothermometers indicate subsurface temperatures of 91 and 96°C, respectively.

The other springs are located on the Little Salmon River north of Meadows Valley (22N-1E-34dadlS and 21N-1E-23abalS). The springs have fairly low temperatures (26 and 30°C) and low discharges.

The chalcedony and Na-K-Ca chemical geothermometers seem to be more consistent in Adams County (at least for springs and wells for which analyses are currently available) than anywhere else in the state.

The geophysics which have been done in Adams County are reported on by Donaldson and Applegate (1979). They reported that:

> ...the preliminary map (figure 13) of southern Idaho shows the Council-Cambridge area being dominated by a distinct gravity high with a residual magnitude of nearly 40 mgal (milligal) near Council (figure 14). The gradient of the anomaly is enhanced to the east where the dense basalts lie adjacent to relatively low density intrusives. This steep gradient indicates a sharp contact between basalt and batholith rocks and a faulted contact is certainly possible. The gravity profile as a whole indicates that these plateau basalts are considerably thickened in this area. The anomaly may represent a local embayment on the plateau-basalt depositional surface or perhaps subsidence and filling during the volcanic activity.
>
> Bond (1975) shows many faults in this area and Witkind (1975) classifies several faults as active (figure 15). The faulting patterns (Bond, 1978) suggest that alluvial-filled river cut valleys in this area may be fault controlled. Unfortunately, the gravity data is very sparse and does not define the valley margins or allow any estimation of their depths or structural controls.

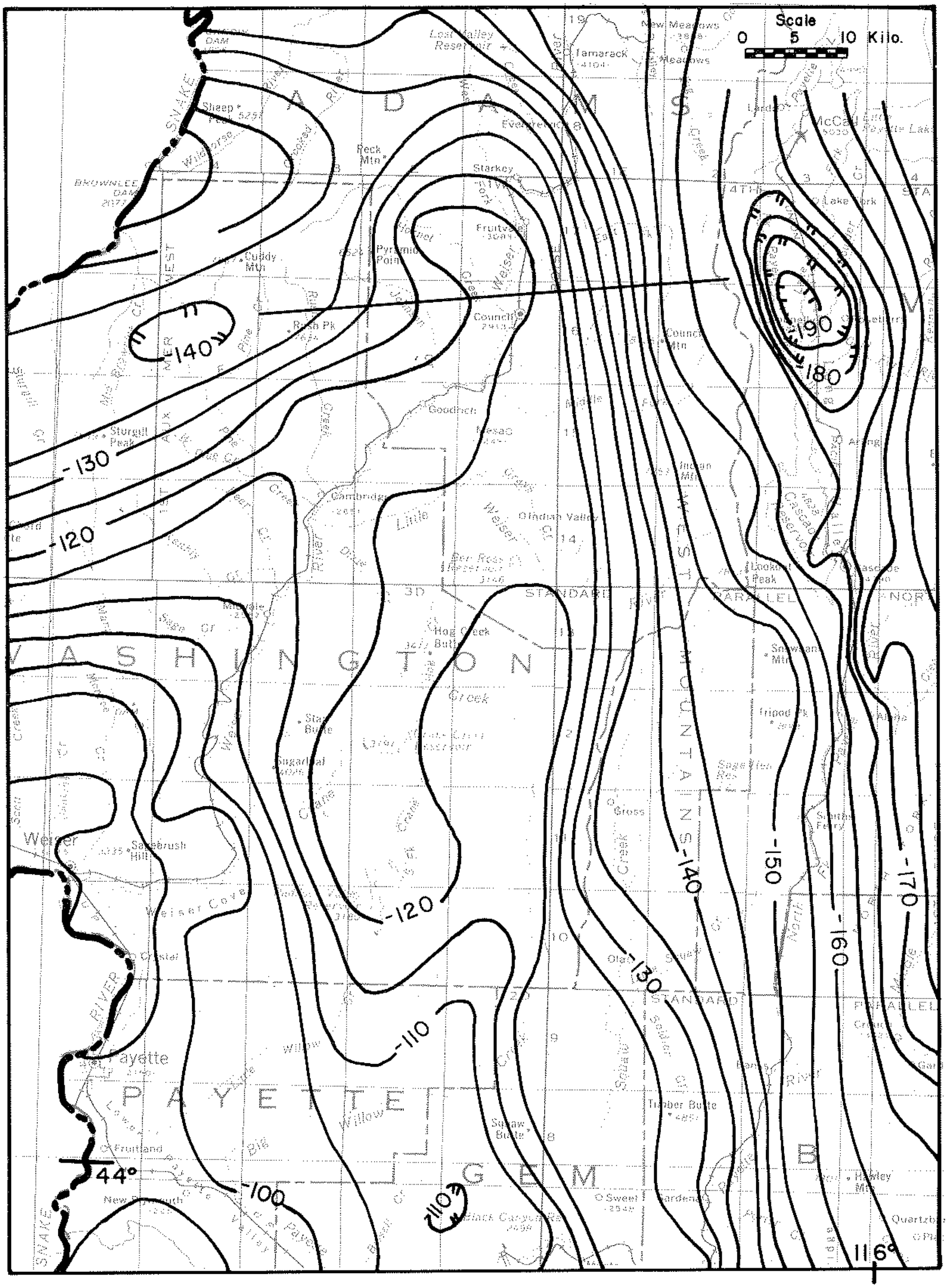


FIGURE 13. Gravity map of Council-Cambridge area, contour interval is 5 milligals. (Mabey, Peterson, and Wilson, 1974).

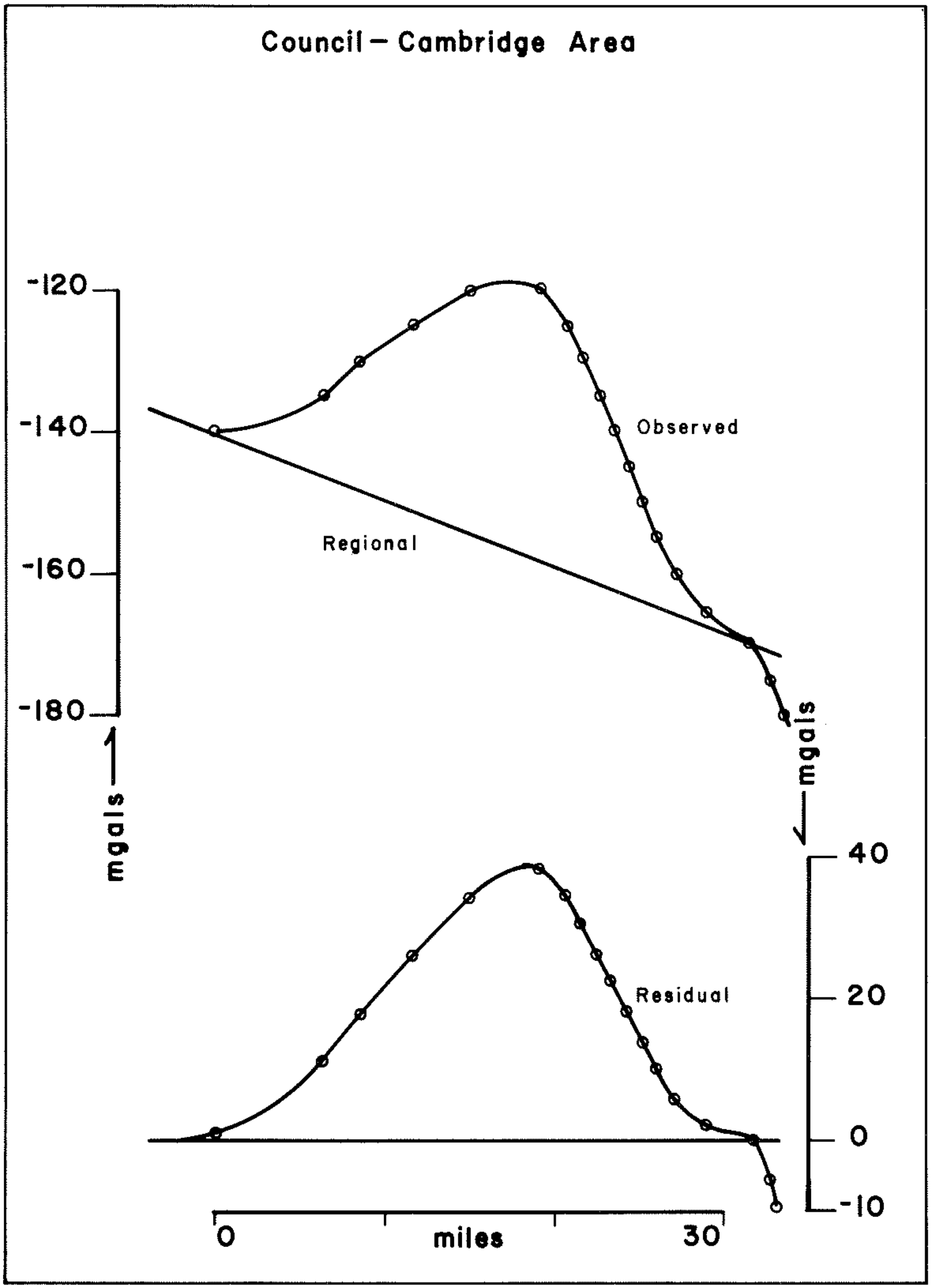


FIGURE 14. Gravity Profile near Council (from Donaldson and Applegate, 1979).

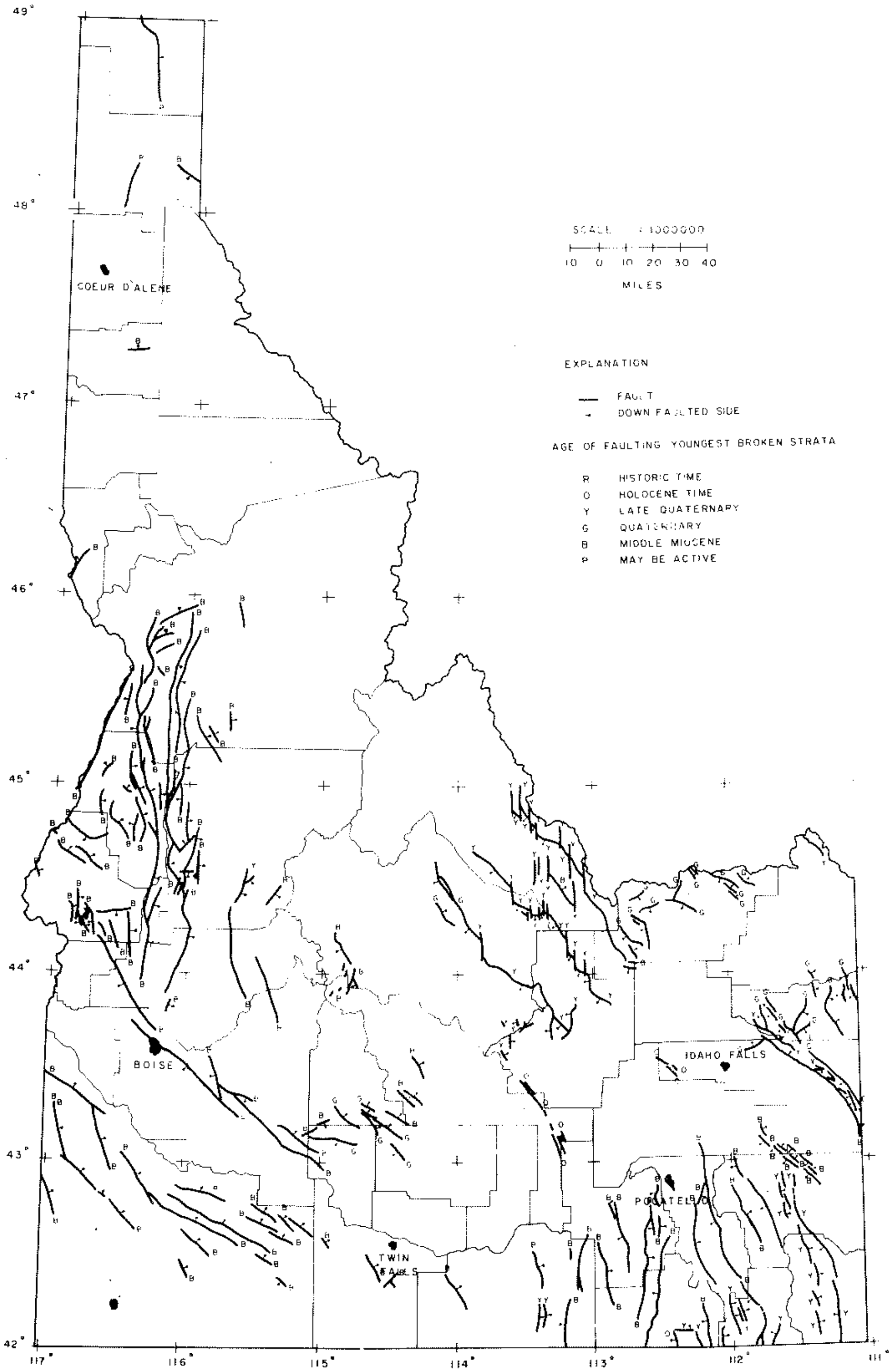


FIGURE 15. Index map of Idaho showing known and suspected active faults. (Modified from Witkind, 1975.)

VALLEY COUNTY

Occurrences of thermal springs in Valley County are similar to occurrences in Idaho County but they appear to be more numerous (figure 16). Many are accessible by graded and drained gravel roads in the more remote locations and some occur near major transportation routes. Others are in wilderness areas accessible only by pack trail or river travel. Many are used by game animals as salt licks due to minor amounts of sodium (Na) and chlorine (Cl) ions in the water.

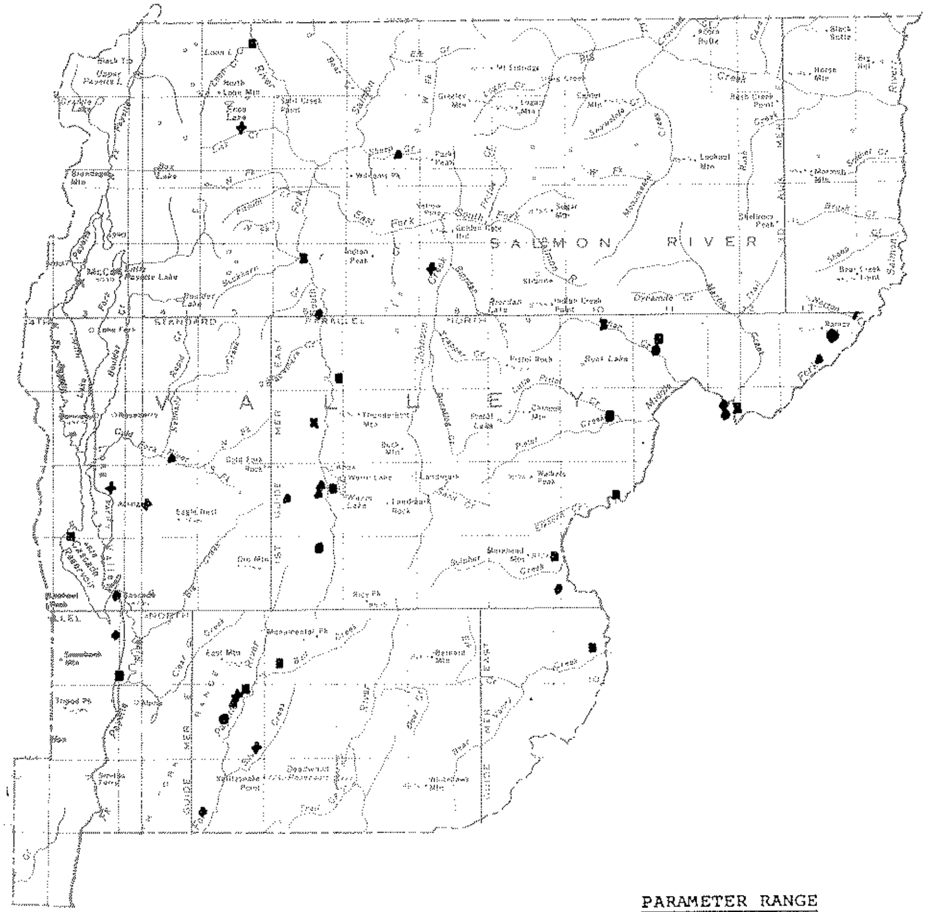
Chemical analyses are available for only 20 of the 41 known thermal water occurrences in Valley County. Temperatures range from 20°C at Dollar Creek Warm Springs (16N-6E-14ccc1S) to 88°C at Indian Creek Hot Springs (17N-11E-21b1S) in the Idaho wilderness area. Dissolved solids are very low, the highest being 412 mg/l and the lowest reported to be 192 mg/l. The waters may be classed as sodium carbonate or sodium bicarbonate type waters according to the dominant chemical species dissolved in the water.

Two areas in Valley County that might be candidates for power generation sites are Indian Creek Hot Springs and Vulcan Hot Springs (14N-6E-11bda1S), provided quartz is the mineral controlling silica content in the thermal waters. As Indian Creek Hot Springs is in the Idaho wilderness area, however, it is not likely to be developed. The two springs exhibit very similar chemical qualities. Subsurface temperatures appear to be in the 135°C range, according to the Na-K-Ca chemical geothermometer and may be as high as 145-150°C, according to the quartz chemical geothermometer (columns T_5 and T_1, basic data table 2.)

Another noteworthy thermal spring is Boiling Springs (12N-5E-22bbc1S) on the Middle Fork of the Payette River. This spring, according to Ross (1971, p. 10), is perhaps the best studied thermal spring in Idaho. The water contains several metallic ions, including mercury. Ross (1971, p. 10) stated that:

> Boiling Springs is only one of eight thermal springs in this area. All flow from granitic rocks along shear zones paralleling the river. Springs along the Middle Fork of the Payette River seem to be along an extension of the same fault that acts as a conduit for springs along the South Fork of the Salmon River.

Although called Boiling Springs, surface temperature is only 85°C. Subsurface temperatures appear to be not much higher, only 89°C according to the chemical geothermometer.



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00

FIGURE 16. Index map of Valley County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Cater and others (1973 p. 383-389) discussed the thermal springs in Valley and Custer counties along the Middle Fork of the Salmon River and stated:

> Thermal springs in the Idaho primitive area are in an area of ...volcanics and tectonic activity. Most rocks are Cretaceous Idaho batholith, Eocene Challis volcanics and Eocene granite. Rock types do not appear to influence the distribution of the springs. Tertitary mafic dikes near the thermal springs indicate a possible mutual relationship to deep-seated heat sources.
>
> The igneous rocks are not porous, but numerous surface fractures and faults are apparently extensive, providing the channel ways for convective systems that permit surface waters to reach deep-seated heat sources and return to the surface at greatly elevated temperatures. All springs are on numerous small faults and fractures within a few feet of major streams along probable faults. Most faults and fractures strike N. 45° W; dips are normally greater than 45°.

With the exception of Indian Creek Hot Springs, subsurface temperature in the Middle Fork Salmon River area probably will not exceed boiling as shown by the chalcedony and Na-K-Ca chemical geothermometers (basic data table 2, columns T_4 and T_5). Wilderness area classification precludes large scale development of any of these thermal springs.

Wilson and others (1976) studied the geothermal potential of the Cascade area in Valley County. They stated:

> Field and laboratory investigations show the existence of a geothermal resource in the Cascade area of west-central Idaho which may have development potential for non-electrical uses. Numerous high angle faults cut the Idaho batholith in this area; displacements on some of these faults are as great as 3050 m and many of them have associated alteration zones. X-ray analyses of samples collected from these zones indicate substantial hydrothermal alteration. Fault controlled hot springs have temperatures at the surface of up to 71°C.
>
> Microseismic monitoring in the area suggests that east-west trending faults are active, supporting the plausibility of an accessible geothermal resource.

FIGURE 17. EROS false color infrared Landsat EDISE image of part of west-central Idaho and eastern Oregon showing selected linear features and thermal water locations with surface temperatures above 20°C. Note: Linear features occur between the black lines.

> The domestic groundwater supply for most of the area is from very shallow wells, most of which are developed in the upper 200 feet of the valley floors and derive their water from joints rather than from fault systems. Preliminary data indicate no connection between the thermal systems and the water supply for the area.

The Na-K-Ca and chalcedony chemical geothermometers suggest aquifer temperatures may be as high as 46 to 66°C near the city of Cascade.

Thermal water is associated mostly with granitic rocks of the Idaho batholith.

Earth Resources Observation Systems (EROS) digital image enhancement system satellite image (figure 17) of the Cascade-Long Valley area shows that Cascade lies near the intersection of major linear features. These may control the occurrence of thermal water in the area. Other thermal water occurrences in west-central Idaho and selected linear features associated with them are also shown on the image.

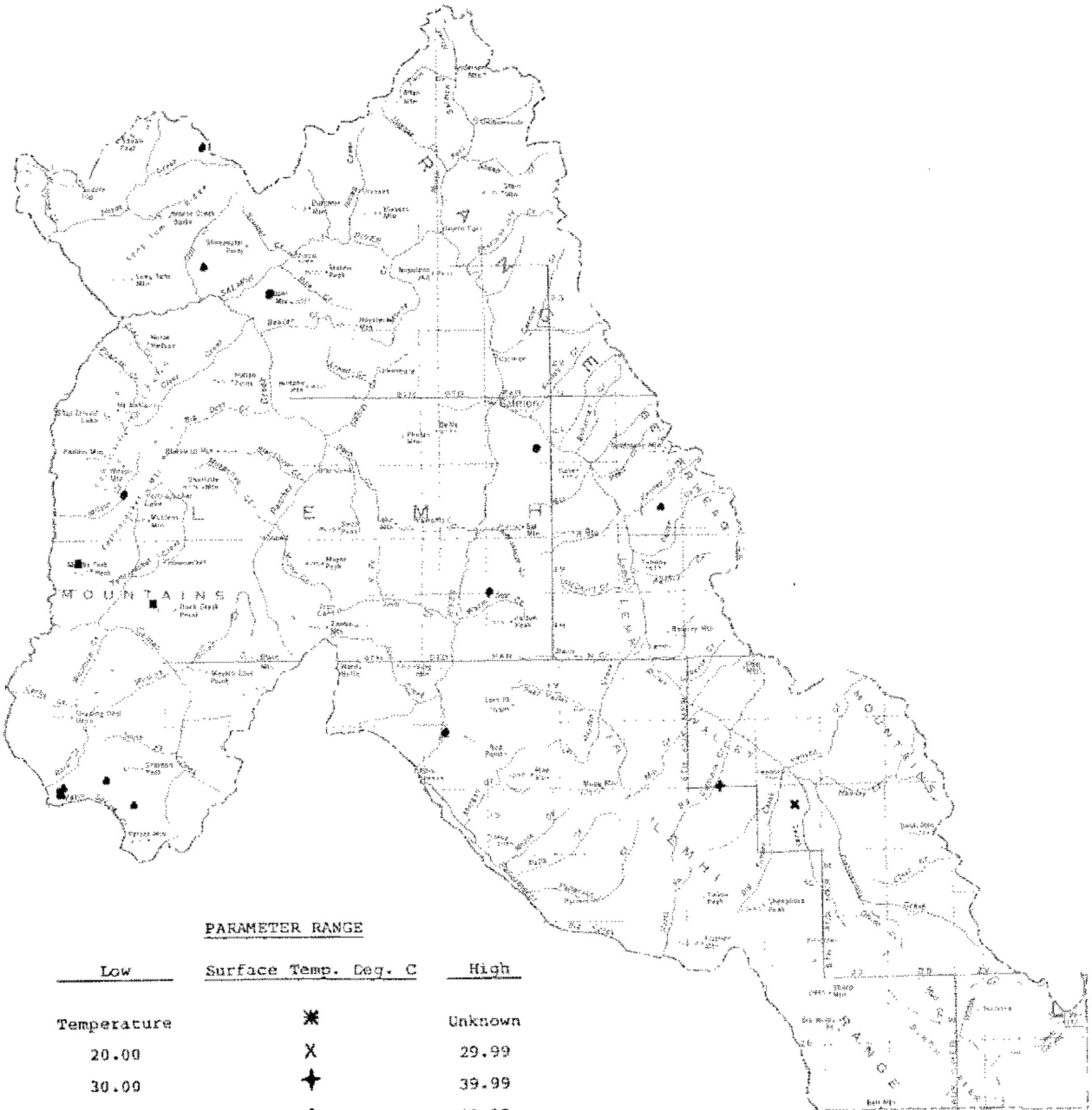
LEMHI COUNTY

Eleven thermal springs have presently been documented in Lemhi County (figure 18). About half are in remote (primitive or recreation) areas which precludes development. Chemical data have been collected for only four of the eleven thermal springs located in Lemhi County.

The hottest thermal spring in the county and one of the hottest in Idaho is Big Creek Hot Springs (23N-18E-22cad1S) which has a surface temperature of 93°C (boiling). It is located high in the Hot Springs Creek drainage (over 330 m above the Salmon River, the major drainage in the area) near Panther Creek at the top of a divide (ridge top discharge). Quartz and Na-K-Ca chemical geothermometers both indicate subsurface temperatures are 160-175°C. Both siliceous and carbonate deposition is found near active vents. Water is presently used by big game hunters as a steam bath. Big Creek Hot Springs appears from available data to date to be one of the best prospects in Idaho for power generation.

Bennett (1977) reported on the geology and geochemistry of the Blackbird Mountain-Panther Creek region in Lemhi County, Idaho. He stated (p. 4):

> The Panther Creek region is located in the Salmon River Mountains. The area is characterized by flattopped mountains and moderate to steep V-shaped canyons. This entire section of Idaho is quite striking from the air as concordant elevations give



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✳	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00

FIGURE 18. Index map of Lemhi County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

> the appearance of a flat plain stretching from the Bighorn Crags (Tertiary pluton) which rise above the general remnant surfaces. Elevations range from 976 m in the Salmon River Canyon to over 2,700 m in the western part of the study area.

Bennett further stated (p. 8):

> The rocks in the Blackbird Mountain quadrangle are, for the most part, Precambrian metasediments and intrusives which have undergone several episodes of folding and faulting. Large scale thrust faulting, block faulting, and Tertiary igneous activity (both intrusive and extrusive) have added to the complexity. Lack of good stratigraphic control greatly complicates the interpretation of the geology; indeed, even the gross ages of the main units remains questionable.

Bennett's linear map of the area is included here as figure 19. He noted five major trends:

a. There are three prominent sets of linears, a northwest set, a northeast set and a north-northwest set.

b. A set of linears which outlines the eastern edge of the Crags pluton may represent a curvilinear fracture system associated with emplacement of the pluton. These linears trend northwest along Roaring Creek, north-south just east of Cathedral Rock and north-northeast along Yellowjacket Creek.

c. Many of the major drainages appear to coincide with linear segments such as the Panther Creek-Napias Creek lineament.

d. Linears appear more concentrated in the area of Blackbird Creek, Musgrove Creek and Porphyry Creek. In this area, the intersection of northeast and northwest linears forms a boxwork pattern. Several of the northeast linears are confined to a belt bordered by the Panther Creek-Napias lineament to the east and the headwaters of Blackbird Creek, Musgrove Creek and Porphyry Creek to the west.

e. Comparison of figures 20 and 21 shows that the -150 gamma contour, which may represent the western limit of the Leesburg stock, coincides with linear segments just east of

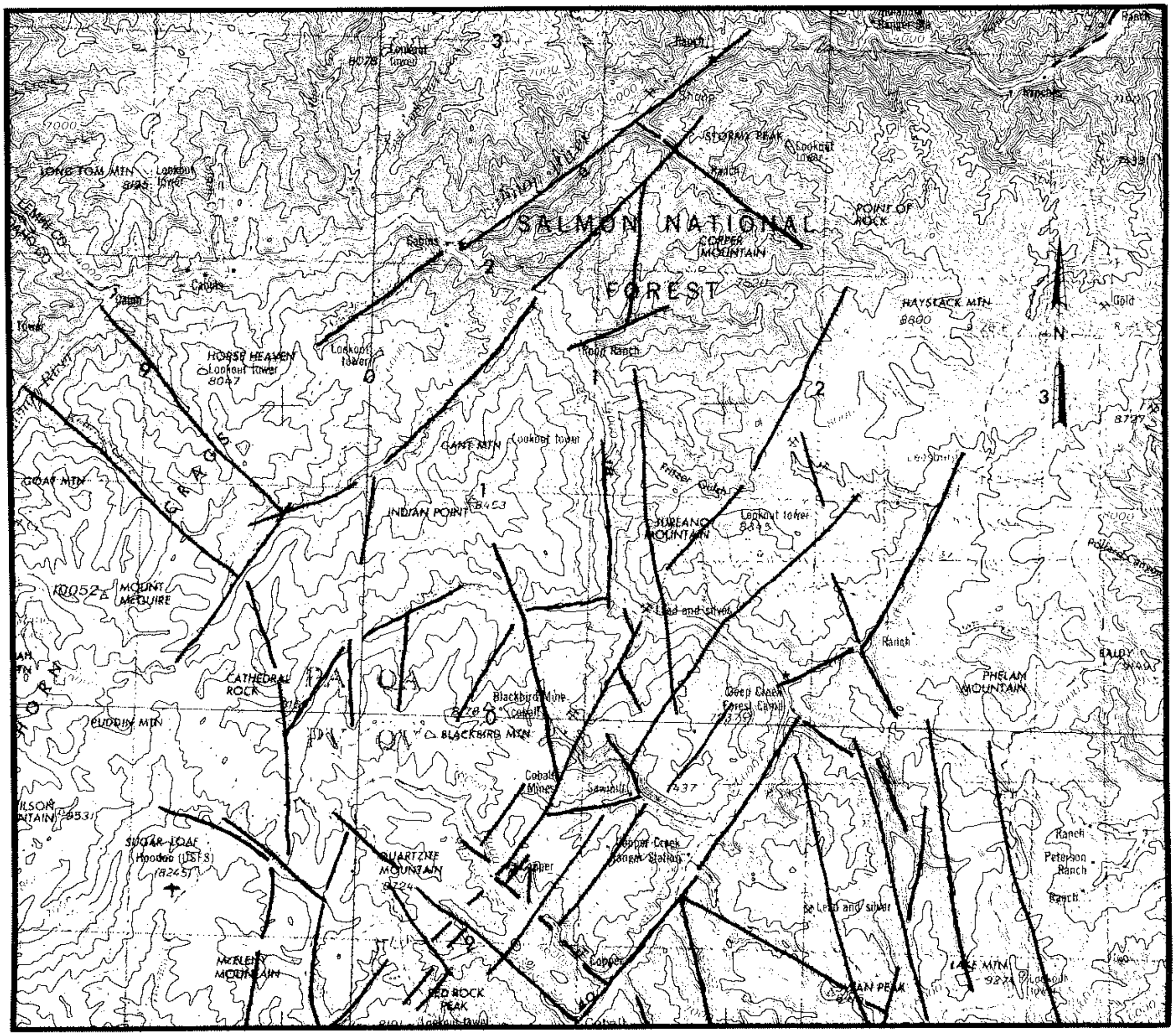


FIGURE 19. Linear map compiled from Landsat, false color, infrared imagery. Topographic base is from Elk City AMS map (scale 1:250,000). From Bennett, 1977, p. 33.

the Panther Creek and along Napias Creek and Moccasin Creek.

Of interest to this study are the linears that intersect in the vicinity of Big Creek Hot Springs. The Hot Springs Creek part of the Clear Creek-Hot Springs Creek lineament has been mapped as a fault (figure 19). The north trending lineament approximately follows the Augen-Greiss-Yellow-jacket Formation (figures 19 and 20).

Of interest to this report is Bennett's aeromagnetic map of the area as shown in figure 21. Bennett reported that:

> A positive magnetic anomaly (maximum +150 gamma) is expressed northwest of Leesburg on Camp Creek.

Bennett believed this represented the magnetic expression of the Leesburg Stock. Bennett reported that:

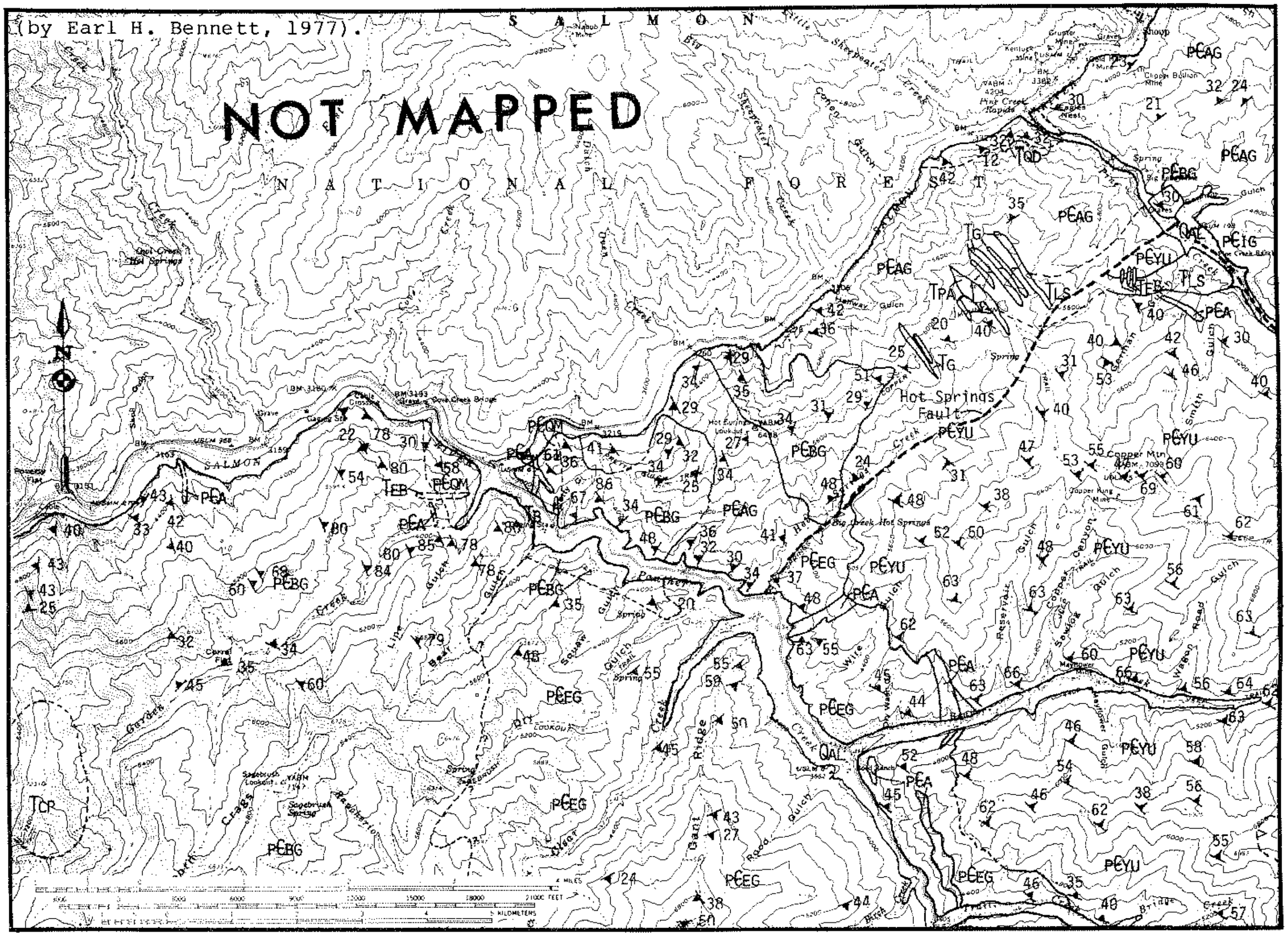
> The small part of the stock exposed along Arnett Creek extends from the +50 gamma contour across the 0 gamma contour. The -100 gamma line which surrounds the +150 line (south of Haystack Mountain) marks the western limit of silver, lead and molybdenum anomalies which are probably related to the stock. The -150 gamma contour near Jureano Mountain extends along the Leesburg fault and may mark the western limit of the stock in the subsurface.
>
> The area enclosed by the -210 gamma line over Gant Mountain and the surrounding -200 gamma line are most likely expressions of the augen/ellipsoidal gneiss unit and its subsurface extension to the northwest beneath the undifferentiated metamorphic rocks. In fact, most of the area which is less than -150 gammas, within the study area, appears to be related to the outcrop patterns of the augen gneiss.

Big Creek Hot Springs lies on the -170 to -200 gamma trough. This trough follows the general trend of the Hot Springs fault.

The land is administered by the U.S. Forest Service (USFS). Until leases are issued, prospects such as Big Creek Hot Springs cannot contribute to our energy supply. The area is remote but not roadless. The nearest sizable market for electricity would be Missoula, Montana; however, recent electric wheeling legislation could allow development by utilities located out of the area.

Salmon Hot Springs (20N-22E-3abdlS), 10 km south of Salmon, has a surface temperature of 45°C, and is the

FIGURE 20. Geologic map of the Big Creek Hot Spring area in Lemhi County, Idaho



— EXPLANATION —

TERTIARY	QAL	Alluvium
	QLS	Landslide deposits
	QGL	Glacial terrace deposits
	QT	Terrace gravels
QUATERNARY	TA	Later Tertiary ash
	TI	Interbeds
	TCV	Undifferentiated Challis Volcanics
	TPA	Porphyritic andesite
	TED	Undifferentiated Tertiary dikes
	TEB	Basalt dikes
	TG	Gabbroic dikes
	TQD	Orbicular quartz diorite
	TCP	Crags pluton
	TLS	Late Cretaceous - Tertiary Leesburg stock

PRECAMBRIAN (Y)	pЄQM	Quartz monzonite orthogneiss
		Augen Gneiss Complex:
	pЄAF pЄIG pЄEG	Augen gneiss (pЄAG)/Ellipsoidal gneiss (pЄEG)/gneiss intermediate between pЄAG and pЄEG = pЄIG
	pЄA	Amphibolite dikes
	pЄHU pЄHL	Hoodoo Quartzite pЄHU, upper unit may be equivalent to Ruppel's (1975) Apple Creek Formation. pЄHL, lower unit is probably equal to Ruppel's (1975) Big Creek Formation.
	pЄYU pЄYL	Yellowjacket Formation pЄYU-upper dark gray, impure quartzite member and pЄYL-lower phyllite member.
	pЄQB	"Mixed unit" consists of quartzites, schists, phyllites and argillites, which are probably Yellowjacket Formation at a higher metamorphic grade.
	pЄGS	Garnet schist. Probably Yellowjacket Formation units at a higher metamorphic grade.
	pЄBG	Undifferentiated schists and other metamorphic rocks - Probably Yellowjacket Formation units at a higher metamorphic grade.

Symbol	Explanation
45	Strike and dip of bedding
	Vertical beds
	Strike and dip of foliation
	Vertical foliation
30	Strike and dip where foliation parallels bedding
--------- -?-?-?-?-	Contact - dashed where approximate, queried where uncertain or inferred
— Δ Δ Δ —	Thrust fault, teeth on upper plate
—?—?—?—	Fault - dashed where approximate, queried where inferred. May in part be thrust faults

Note: *The Shoup and Ulysses Mtn. quadrangles (area north of 45° 15′ north latitude) have a contour interval of 80 feet. The Blackbird Mtn. and Leesburg quadrangles (area south of 45° 15′ north latitude) have a contour interval of 100 feet.*

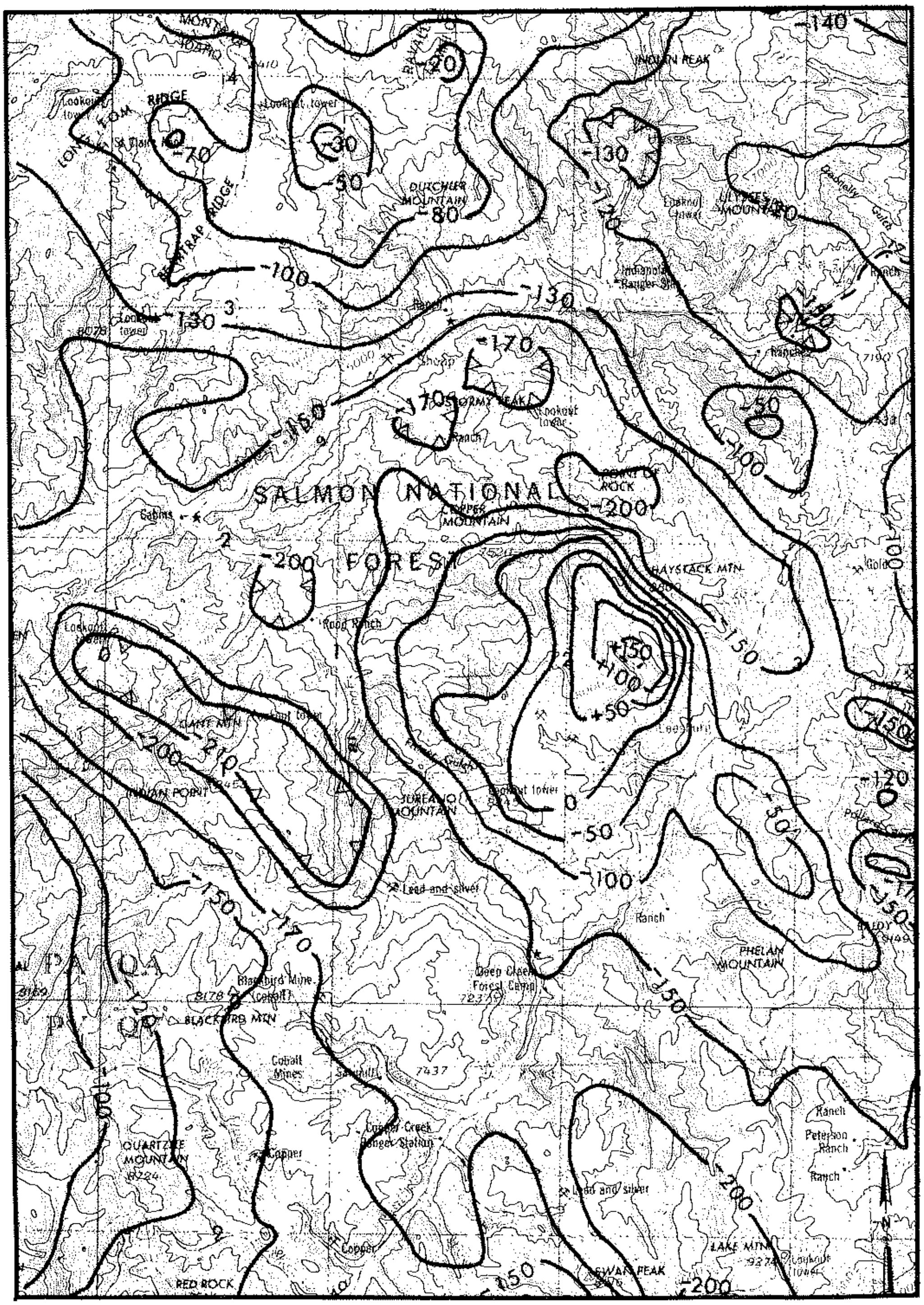


FIGURE 21. Aeromagnetic map of the study area (modified from U.S.G.S., 1975). Map is drawn with a 6.17 gamma/mile north and a 3.92 gamma/mile east regional trend removed. Magnetic contours are overlain on topography from the Elk City AMS map (scale 1:250,000). From Bennett, 1977, p.28.

nearest of any thermal springs in Lemhi County to a meaningful population center. Aquifer temperatures at Salmon Hot Springs appear to be only 50°C by the chalcedony chemical geothermometers (basic data table 2) although the Na-K-Ca chemical geothermometer indicated temperatures may be as high as 204°C. This discrepancy could be caused by mixing of hot and cold water or precipitation of calcium in the subsurface. There is excess travertine deposition by the spring. This site might have potential for space heating in or near Salmon.

Sharkey Hot Springs (20N-24E-34ccc1S) issues from Oligocene silicic volcanic rocks along a northwest trending fault. It is actively depositing small quantities of carbonate material and apparently formerly deposited silica. It discharges 30 l/min. Measured surface temperature is 52°C. Maximum subsurface temperature is thought to be best represented by the chalcedony chemical geothermometers at 104°C. Sharkey Hot Springs is somewhat removed from population centers but is accessible by an improved road.

A spring (16N-21E-18adc1S) located on the Salmon River discharges 25 l/min and has a surface temperature of 46°C. It issues from the alluvial material probably overlying Precambrian quartzite. This spring deposits small quantities of carbonate material locally. Subsurface temperatures may best be represented by the chalcedony chemical geothermometer at 57°C.

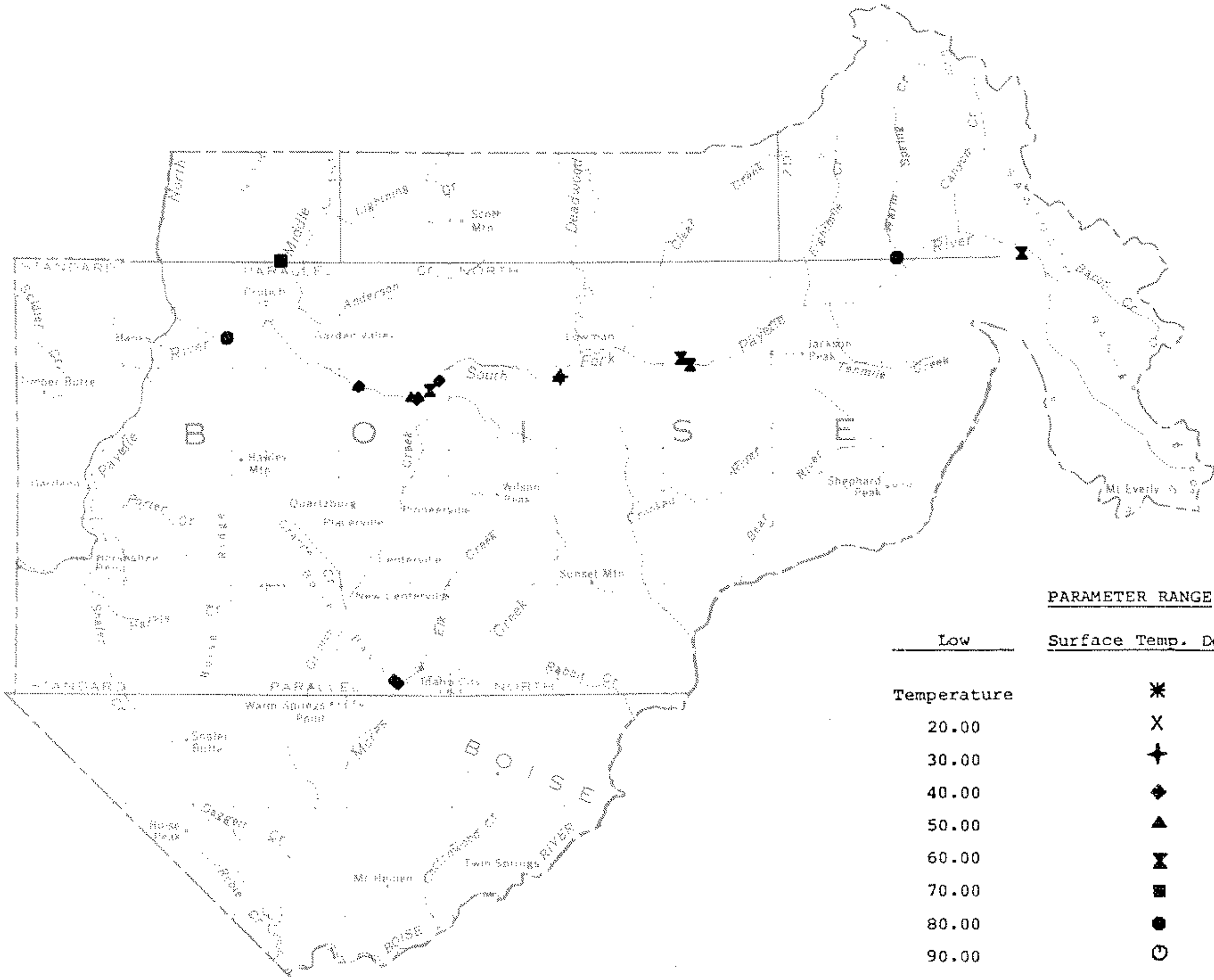
BOISE COUNTY

Thermal springs in Boise County are most numerous along the South Fork of the Payette River (figure 22). Garden Valley lies at the confluence of the South and Middle Forks of the Payette River and is popular as a summer home resort area. Several thermal springs and at least one thermal well are in the Garden Valley area. Two thermal springs exist near Idaho City. One, Stope Warm Springs (6N-5E-33abc1S), occurs in an abandoned mine adit. The other, Warm Springs (6N-5E-33adc1S), has been developed into a popular resort. Idaho City is also a popular summer home area where use could be made of thermal water for space heating.

Little is known of the characteristics of thermal water as only six chemical analyses are available from 19 known thermal occurrences in Boise County. More sampling of thermal water occurrences should be undertaken to more fully assess the area's geothermal potential.

In general, the dissolved solids are low except for flouride and sulfate concentrations in those thermal waters sampled; generally, the water is a sodium bicarbonate type.

FIGURE 22. Index map of Boise County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00

Bonneville Hot Springs (10N-10E-31bcc1S) is the hottest thermal water in Boise County at 85°C and has a 1400 l/m discharge issuing from a fault in granite (Ross 1971). Bonneville Hot Springs may have potential for binary cycle power generation, as the quartz and Na-K-Ca chemical geothermometers estimate temperatures of 137 and 142°C.

Deer Hot Springs (9N-3E-25bac1S) might also have potential for binary cycle power, as quartz and Na-K-Ca chemical geothermometers estimate temperatures of 147 and 134°C. Deer Hot Springs has a surface temperature of 80°C and discharges 76 l/min.

Other thermal springs are much cooler having surface temperatures between 46 and 67°C and subsurface temperatures between 60 and 104°C, according to the Na-K-Ca and chalcedony chemical geothermometers. The Na-K-Ca chemical geothermometer indicates subsurface temperatures cool in a fairly systematic way from a high of 142°C at Bonneville Hot Springs in the upper reaches of the South Fork Payette River to a low of 63°C near Danskin Creek Hot Springs (8N-5E-1bcc1S).

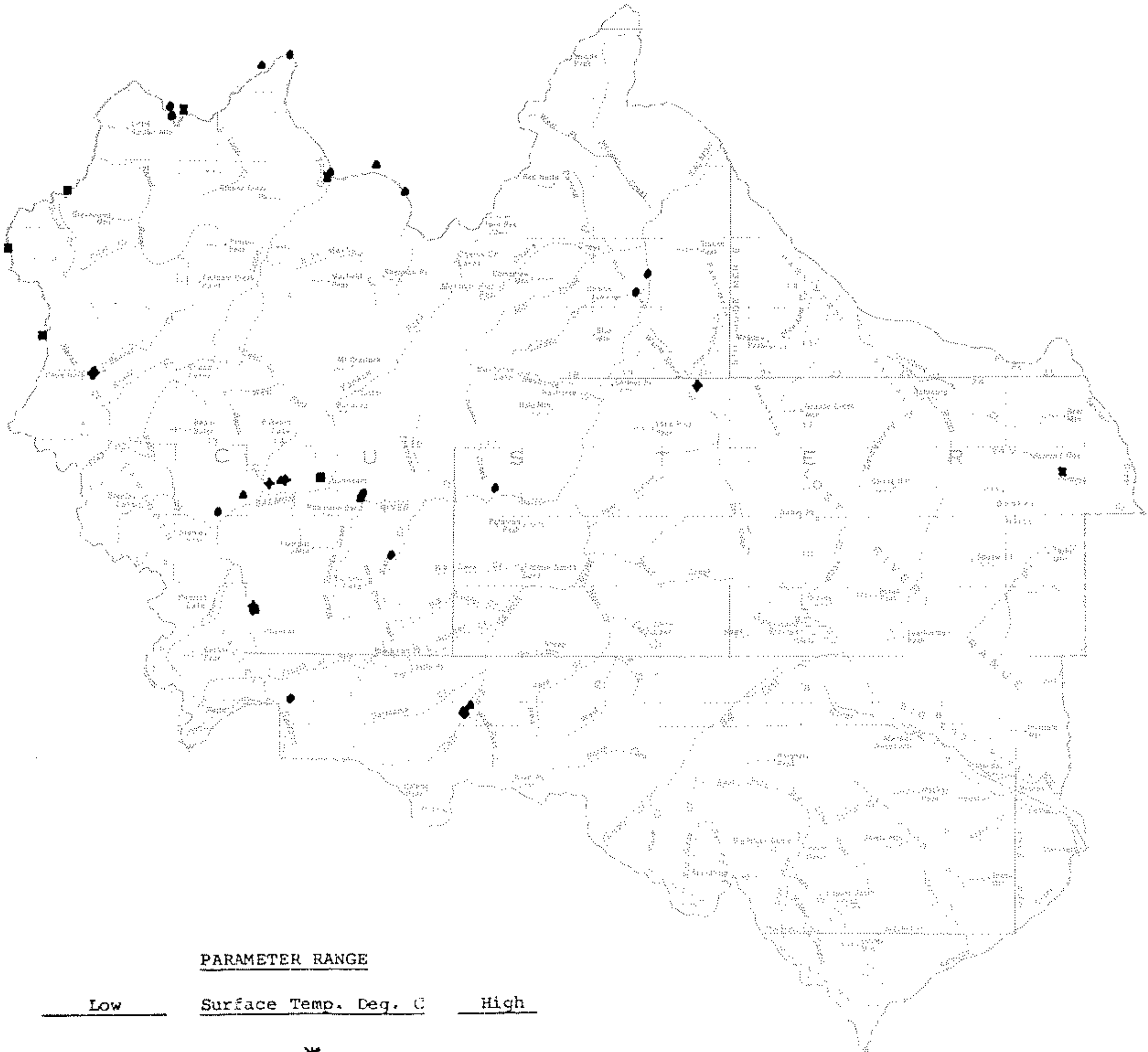
Sacajawea Hot Springs (10N-11E-31aad1S) in the upper reaches of the South Fork Payette River drainage has not been sampled, but has a surface temperature of 68°C and reported discharge of 380 l/min.

Twin Springs (4N-6E-24bcb1S), a developed resort, is so named because a thermal and nonthermal spring occur in close proximity and is located in the lower reaches of the Middle Fork of the Boise River above Arrowrock Reservoir. The thermal spring discharges water at 67°C. Subsurface temperatures may be as high as 104°C, according to the chalcedony chemical geothermometer. The Na-K-Ca chemical geothermometer predicts 60°C, unexplainedly 7°C below measured surface temperatures.

CUSTER COUNTY

Thermal springs in Custer County (figure 23) are similar in occurrence to springs in most of the rest of north-central Idaho occurring near drainage confluences or near ridge points that protrude into the stream. The thermal waters are generally low in dissolved solids and have high pH values. About half are on lands administered by the USFS and many could be developed for recreational uses. One, Stanley Hot Springs (10N-13E-3cab1S), has now been covered over.

Generalities on thermal spring occurrences along the Middle Fork of the Salmon River were given earlier in the section on Valley County. These are in remote areas, so



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✚	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	○	100.00

FIGURE 23. Index map of Custer County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

FIGURE 24. EROS false color infrared Landsat EDISE image of central Idaho showing selected linear features and thermal water locations with surface temperatures above 20°C.

large scale development for industrial purposes is not likely. Springs along the main Salmon River between Smiley Creek and Salmon generally lie within recreation area boundaries on both private land and land administered by the USFS. Some of these springs have potential for recreational uses. Several are presently used as such and others have been previously used for such purposes. In areas that are being developed for recreational home sites, springs could be utilized for space heating. Some of these springs might be used similar to the way springs in Boise County are used by the Idaho Department of Fish and Game as a heat source for game bird production, particularly wild turkeys and grouse. As most of the area is far from markets and few good transportation facilities exist, most other uses appear to be excluded, although locally small scale uses, such as greenhouse operations, might be feasible.

Figure 24 is an enhanced Landsat false color infrared image of part of Central Idaho showing locations of selected thermal water discharges and linear features. The common occurrence of springs and lineaments is not striking on the figure. Nevertheless, several major linear features are shown near the thermal springs or wells. The chemical geothermometers are highly variable for Custer County. Highest aquifer temperatures appear to be near 104°C in the area of Basin Creek, Mormon Bend and Sunbeam Hot Springs.

NORTHERN ELMORE COUNTY

Thermal springs in northern Elmore County (figure 25) are distributed along the major drainages -- the North, Middle, and South Forks of the Boise River. These occurrences along the drainages are similar to other springs in central Idaho.

Ross (1971, p. 13 and 14) states that:

> More than a dozen thermal springs occur along the lineament that marks the main Boise River and its Middle Fork tributary. All the springs issue from granite, in areas transected by granitic and mafic dikes. Between Twin Springs (4N-6E-24bcb1S) in Boise County and Weatherby Mill well (6N-9E-35aca1) springs average one every 2 miles. A single spring (6N-11E-35dca1S) is northeast of Altanta along the same lineament.
>
> The 29°C water from the flowing well at Weatherby Mill is considered by local residents too mineralized to drink, although total dissolved solids are similar to those in the other springs.
>
> Approximately a dozen thermal anomalies (figure 25) occur along the upper reaches of the South Fork of

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	x	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00

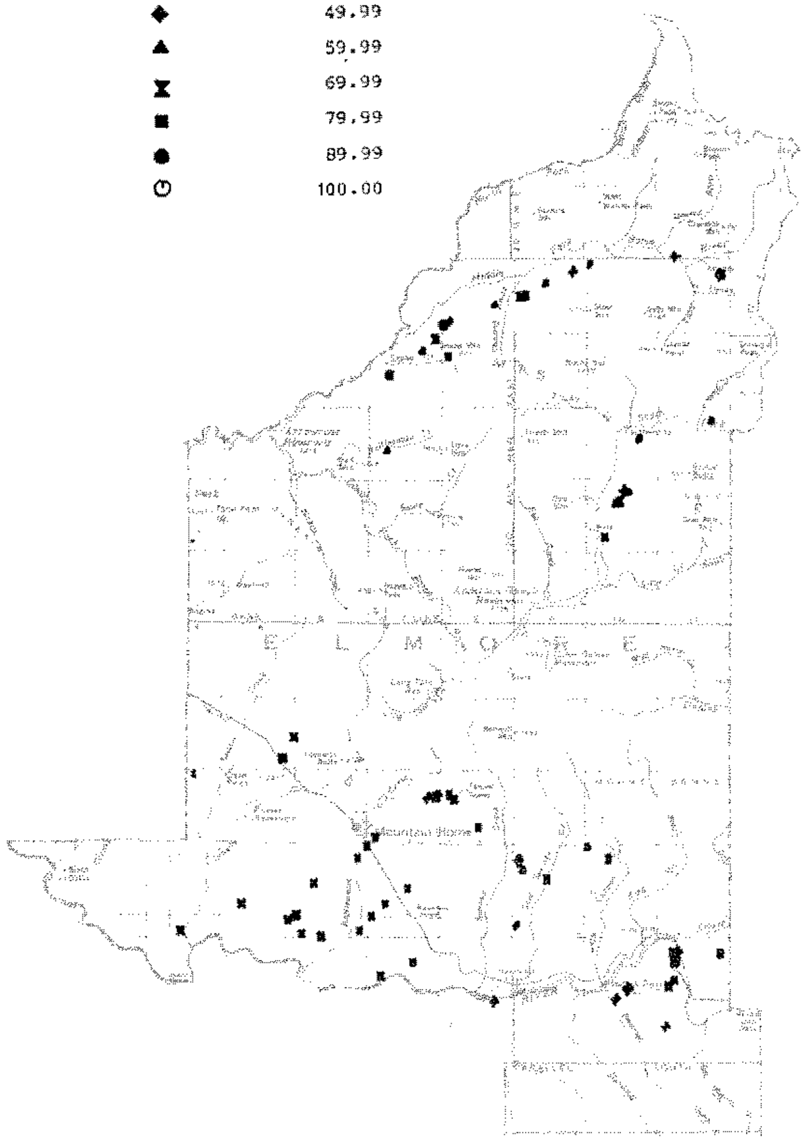


FIGURE 25. Index map of Elmore County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

the Boise River and its tributaries. All are in granitic rock, much of which is cut by mafic and pegmatitic dikes.

Paradise Hot Springs (3N-10E-33bdb1S) utilizes 60°C water in a swimming pool at a resort. A mile south, Bridge Hot Spring (2N-10E-5aca1S) and related seeps flow more than 150 gpm, also at 60°C. A warm spring (3N-10E-10aba1S) and several warm wells are at Featherville. The 46°C water at Baumgartner Hot Spring (3N-12E-7dcd1S) is used for bathing facilities at a Forest Service campground. Lightfoot Hot Spring (3N-13E-7dca1S) apparently was used at one time for domestic heating and for irrigation of a small meadow. Maximum temperature is 62°C.

Highest temperatures along the South Fork of the Boise River are at the east and west extremities of the regions.

The chemical geothermometers indicate some of the hotter of the low temperature thermal water in Idaho might be found in northern Elmore County. The Na-K-Ca and quartz chemical geothermometers indicate temperatures as high as 126°C might be found by drilling at Neinmeyer Hot Springs (5N-7E-24bdd1S). At Latty Hot Springs (3S-10E-31ddb1S), temperatures might be as high as 137°C. Most of the other springs in the area show subsurface temperatures below 80°C, according to the Na-K-Ca chemical geothermometer.

Most of these thermal springs are on lands administered by the USFS and several more probably could be developed by the USFS for recreation purposes. Those that occur near vacation homesites (table 4) could probably be developed for space heating, provided flows could be augmented by drilling. Some of them could be used by the Idaho Department of Fish and Game as a heat source for game bird production.

CAMAS COUNTY

Camas County (figure 26) contains several thermal springs and wells. Many are in the unpopulated Soldier Mountain area to the north of Camas Prairie. These occurrences are similar to the rest of the thermal springs in central Idaho. They are limited to the South Fork of the Boise River and its tributaries in northern Camas County. Located here are Worswick (3N-14E-28caa1S), Preis (3N-14E-19dac1S), Wardrop (1N-13E-32abb1S) and Lightfoot (3N-13E-7dca1S) hot springs. Worswick Hot Springs is probably the most extensive thermal spring in Idaho covering more than 10 acres and having dozens of vents, according to Ross (1971).

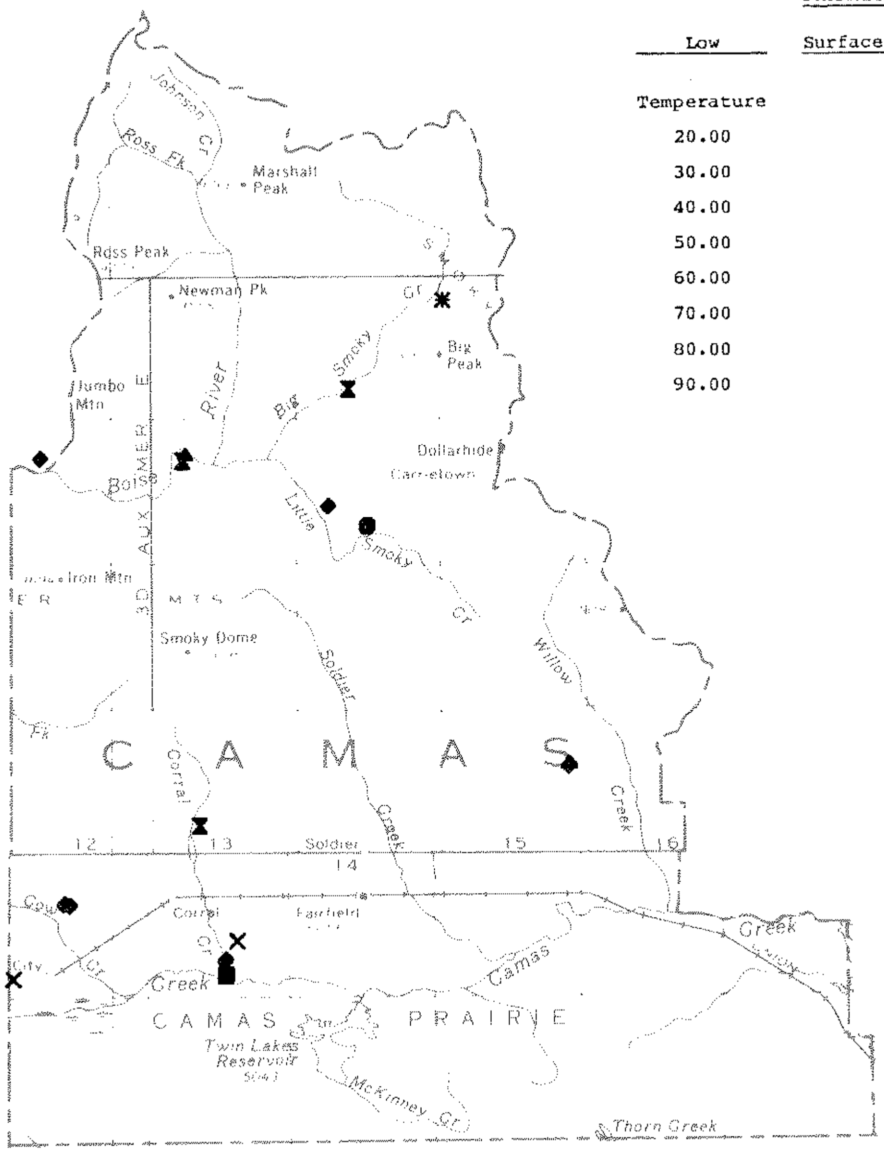
TABLE 4

TOWNS AND RECREATIONAL HOME AREAS IN CENTRAL IDAHO WITHIN 5 KM (3 MI) OF A 20°C OR HIGHER THERMAL SPRING OR WELL (1978)

Town	County	Location	Spring or Well Surface Temperature °C	*Best Estimated Subsurface Temperature °C Min. Na-K-Ca	Max. Chalcedony	Total Dissolved Solids	Present Water Use	Population	Surface Owner	Remarks
Atlanta	Elmore	5N-11E-3	--	--	--	--	--	--	--	No chemical analyses available, summer home sites.
Cascade	Valley	14N-3E-36abd1	43	46	66	193	Municipal pool	916	City of Cascade	--
Challis	Custer	14N-19E-23ddd1S	40	60	68		Natatorium	850	Private	Summer home sites.
Clayton	Custer	11N-17E-27bdd1S	41	58	99**	640	Natatorium Recreation	41	Private	Summer home sites.
Council	Adams	16N-1W-15bac1	22	--	--	--	Irrigation	923	Private	--
Ellis	Custer	16N-2E-18adc1S	46	--	--	--	--	--	--	Springs in Lemhi County.
Featherville	Elmore	3N-10E-10aba1	43	--	--	--	Space heating	--	Private	Summer home sites.
Garden Valley	Boise	8N-5E-10bdd1S	55	74	80	237	Space heating, private swimming	--	Private	Summer home sites.
Hailey	Blaine	2N-18E-18dbb1S	59	83	100	272	Space heating	1,840	Private	Heated Hiawatha Hotel.
Idaho City	Boise	6N-5E-30acd1S	41	--	--	--	Natatorium	194	Private	No chemical analyses available, summer home sites.
Ketchum	Blaine	4N-17E-15aac1S	71	88	101	324	Space heating	1,780	Private	Heats several condominiums.
Meadows	Adams	19N-2E-22cca1S	43	91	96**	489	Unused	--	--	Public water supply.
Stanley	Custer	10N-13E-3cab1S	41	47	76	210	Unused	52	Private	Bath house & pool.
Warm Lake	Valley	15N-6E-14cdb1S	55	62	83	258	Unused	--	--	Near summer home sites.

*Minimum and maximum subsurface temperatures are based on the chemical geothermometers from basic data table 2. Both are given to call the reader's attention to the uncertainties involved in their interpretation. Maximum temperatures should be viewed with some skepticism. The geothermometers are useful in initial assessment of geothermal areas to establish priorities for further work in these areas.

**Minimum temperature is chalcedony temperature. Maximum temperature is Na-K-Ca temperature.



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	ʘ	100.00

FIGURE 26. Index map of Camas County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Most flow at temperatures near 76°C. Total discharge from the entire spring is over 1500 l/min. Ross (1971, p. 14) reported that the entire area, which is brecciated, bleached, and silicified, was the probable intersection of several fault zones.

Mitchell (1976c) reported on the geothermal potential of southern Camas County and described the geochemistry of the thermal springs in this area. He reported (p. 15) that:

> Thermal water occurrences in the Camas Prairie area are not limited to any one locality or rock type but are found sparsely distributed over a large area (figure 26). The occurrences seem more abundant, however, in the western reaches where Hot Springs Ranch (1N-13E-32abc1S), Barron's Hot Springs (1S-13E-34bcb1S), Spring No. (1S-12E-16cba1S-cab1S) and several warm artesian wells are located. These springs issue from alluvial valley fill deposits. The wells were drilled into valley fill alluvium.
>
> Elk Creek Hot Springs (1N-15E-14ada1S) are located in the eastern part of the study area and issue from fractures in Cretaceous granitic rocks near Eocene(?) to Miocene(?) Challis volcanic rocks.
>
> Several other reported thermal waters (notably warm artesian wells) were not flowing at the time they were visited and samples could not be collected for analysis. Thermal water deposits were absent at all visited springs and wells except for very minor evaporative incrustations around discharge pipes of some of the wells. Discharges of the various sampled springs and most wells were low. Measured surface temperatures range from 26 to 72°C and average 53°C. In general, groundwaters in this area are about 10°C above mean annual temperature.

Mitchell further stated (p. 17):

> In general, the thermal waters of the Camas Prairie area can be classified as sodium bicarbonate ($NaHCO_3$) type waters although the dominant element found in Hot Springs Ranch (1N-13E-32abc1S) water is silica rather than sodium. With the exception of Magic Hot Springs well (1S-17E-23aab1) these thermal waters are typified by:
>
> 1. High silica contents (50-90 mg/l) compared to low total dissolved solids of less than 365 mg/l;

2. High pH (7.8-9.2);

3. High carbonate compared to most thermal water in Idaho;

4. High fluoride contents compared to most thermal and cold groundwaters in Idaho;

5. Low calcium (Ca), magnesium (Mg), potassium (K), and chloride (Cl) contents.

Typically, these thermal waters are chemically similar to thermal waters found discharging from Cretaceous granitic rocks, or areas believed to be underlain by these type rocks elsewhere in Idaho (Ross, 1971, p. 23), (Young and Mitchell, 1972, unpublished data, and Young and Whitehead, 1975a, p. 30).

The cause of this chemical "fingerprint" for these waters is not well understood. At least three hypotheses might explain some of the observations.

1. Abundance of certain elements may reflect the availability of the elements in various minerals found in the granitic rocks and the minerals' solubility in heated water or steam. For example, the high fluoride content might be traced to the abundance of fluorite or fluorapatite, and its solubility at reservoir temperature, and pH, or to fluoride, concealed in interlattice silicate structures of hydroxyl bearing minerals such as the micas or amphiboles, which are found in the granitic rocks.

2. High fluoride waters may reflect an appreciable quantity of magmatic waters or volcanic gasses. Observations of gasses from volcanoes indicate magmatic waters should generally be high in volatiles such as fluoride, ammonia and boron.

3. High fluoride waters might be explained by enrichment of fluoride in a steam phase separated from water having a lower fluoride content (volatile enrichment).

The first explanation of the high fluoride content is considered by this author to be the best hypothesis because of:

1. The widespread occurrence of fluoride-rich thermal waters in Idaho;

2. Their close association with granitic rocks or areas believed to be underlain by granitic rocks;

3. Lack of fumarolic, geyser, and related geothermal activity (which would indicate volatile enrichment processes are actively taking place);

4. Low concentrations of other volatiles, i.e., ammonia and boron, chemical constituents found in volcanic gasses, and which are also capable of enrichment in separated steam. In nearly all geothermal systems investigated to date, isotopic studies have not revealed any magmatic or juvenile water contributions to these systems.

5. Thermodynamic calculations indicate that thermal waters from Elk Creek Hot Springs (1N-15E14ada1S), which issue directly from fractures in granitic rocks, are in equilibrium with fluorite at the measured spring temperatures. Fluorite is known as an accessory mineral in certain granitic rocks in Idaho.

6. In general, granitic rocks are known to contain relatively much fluoride, mostly in fluroapatite, but, in some cases, a fluoride concealed in interlattice spaces of hydroxyl bearing minerals such as the micas or amphiboles where it substitues for hydroxide due to size and charge similarities.

The geochemical data suggested to Mitchell (1976c, p. 22) that the thermal waters in the Camas Prairie area are from low temperature systems.

The chalcedony equilibrium chemical geothermometer (T_4, basic data table 2) or Na-K-Ca chemical geothermometer (T_5, basic data table 2) are considered the most reliable and representative of actual aquifer temperatures in most cases because of these considerations:

1. Thermal waters issuing from granitic terrains are generally considered to be supersaturated with silica with respect to quartz (Holland 1967, p. 393). Therefore, the quartz equilibrium chemical geothermometer (T_1 and T_2) and mixing models (T_9 and T_{10}) may not be valid because of excess silica in many of these springs and wells.

2. In no case does amorphous silica control silica concentration in the thermal water. The below-measured surface temperatures and in some cases below-zero temperatures predicted by the amorphous silica chemical geothermometer indicate that the thermal waters are considerably undersaturated with silica with respect to this phase. No exceptions to this generalization were noted from basic data table 2 in the Camas Prairie area.

3. No unusual conditions are suggestive of mixed hot and cold waters, such as cold spring seeps in the vicinity of the hot springs or wells, were observed.

4. Discharges were, in general, very low throughout the area, indicating little, if any, mixing of hot and cold waters. Exceptions to the low discharges are found only in drilled holes.

5. The low Na-K-Ca predicted aquifer temperatures are in general agreement with measured surface temperatures, indicating little mixing of hot and cold water, or that equilibrium conditions have been maintained since the waters have left the thermal aquifer. The low predicted Na-K-Ca aquifer temperatures show fair agreement with the chalcedony equilibrium aquifer temperatures.

6. The low chloride and certain other element concentrations found in these thermal waters could be the result of mixing. However, mixing would dilute certain other chemical constituents found in relatively high concentrations such as fluoride and carbonate.

7. Walton (1962, table 2, p. 35) reported higher calcium concentrations in cold groundwaters in the area than were found in the thermal waters. Dilution of thermal waters with cold groundwaters would mean the premixed thermal waters would have to be nearly devoid of calcium in order for the mixed water to show the calcium concentration found in the thermal waters. Thermal water devoid of calcium from granitic rocks is considered unlikely.

8. The extremely widespread geographical area in which these type waters are found would make it highly unlikely that such uniform mixing conditions could exist as to recognize these

waters by merely looking at unsynthesized geochemical data.

9. Arnórsson (1970, p. 537, 1975, p. 763) found that chalcedony generally controls silica concentration in Icelandic thermal waters when aquifer temperatures are below 100-110°C. Chalcedony equilibrium aquifer temperatures are below Arnórsson's upper limit. Chalcedony equilibrium is, therefore, indicated if this criterion is applicable to the Camas Prairie.

10. The depths postulated as necessary to give rise to the measured surface temperature are reasonable for the origin of these waters.

Mitchell (1976c, p. 25) concluded:

> The Camas Prairie thermal waters are probably meteroic waters circulating to shallow (approximately 1,200 m) depths along fractures or fissures within the granitic rocks underlying and along the margins of the Prairie. Heated waters are discharging upward into the sediments of the Prairie, perhaps through faults or fissures within the underlying granite concealed by valley fill. Some water subsequently discharges to the surface, forming springs. The source of the heat related to the granitic rocks is unknown.
>
> The possibility of a large thermal aquifer or reservoir within the sediments filling the basin is negligible due to the apparent shallow depth of the valley fill materials as shown by the two wells penetrating the entire thickness of sediments near the basin center. Any possibility of a large thermal reservoir could lie in large faults in highly fractured granitic rock underlying the Prairie. Fracture permeability may allow sufficient circulation and recharge to allow large volumes of water to be withdrawn if the fault system could be penetrated by drilling. Hot and cold groundwaters at depth probably are not mixing to any apparent degree. The thermal waters ascending from shallow depths could be cooling by conduction during their ascent to the surface.
>
> Maximum temperatures encountered in drilling to 900 to 1,500 m are probably only about 100°C. Temperatures of this magnitude would be sufficient to have some industrial applications. These industrial applications and approximate temperatures necessary for them are shown in figure 4.

NORTHERN BLAINE COUNTY

Northern Blaine County (figure 27) is another region in Idaho where geothermal resources have been an energy source of long standing. Fifteen thermal springs are known in northern Blaine County. Several wells have been drilled near some of the thermal springs that yield hot water as at Magic Hot Springs (1S-17E-23aab1), Hailey Hot Springs (2N-18E-18dbb1S), Clarendon Hot Springs (3N-17E-27dcb1S), Guyer Hot Springs (4N-17E-15aac1S) and Easley Hot Springs (5N-16E-10dbc1S).

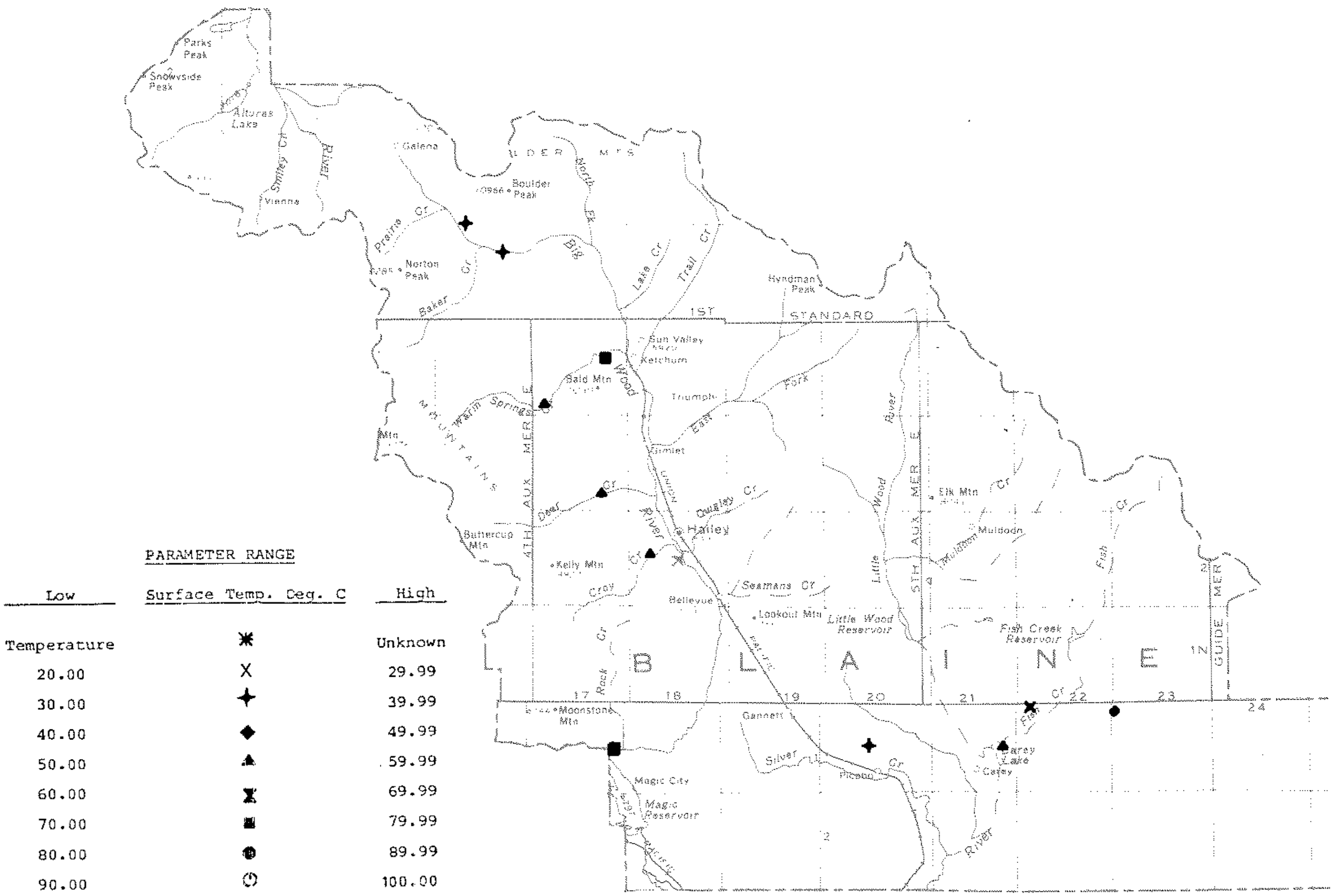
Easley Hot Springs is being used as a natatorium. The drilling of a well at Magic Hot Springs increased the temperature by 36°C from 38 to 74°C. These waters have been used to space heat small cabins. At Magic Hot Springs Landing, chemical geothermometers indicate aquifer temperature could be near 175°C, which would make this area a candidate for power generation using methods similar to those planned for Raft River in Cassia County. Even a small power plant at this site could furnish much of the power needs for this rural area of Idaho. Cascading uses could be made of the power plant effluent.

In Blaine County three warm water wells occur near the northern margin of the eastern Snake River Plain near Carey, and three more occur 3 km northwest of Picabo. Condie Hot Springs (1S-21E-14ddc1S) occurs near Carey Lake.

The Hailey area is located in south-central Idaho on the Big Wood River drainage. The geologic framework of the area consists of undifferentiated Paleozoic and Mesozoic marine sedimentary rocks. Hailey Hot Springs is located about 3 km from Hailey (population 1,840, 1976) on Democrat Gulch, a tributary to Croy Creek which in turn is a tributary to the Big Wood River with confluence at Hailey (figure 28). Sufficient thermal water might possibly be withdrawn from near Hailey Hot Springs to space heat the entire town of Hailey. The surface temperature of the spring is 59°C. The chemical geothermometers suggest a temperature of 78 to 97°C might be encountered by deeper drilling. It is not known at what depth this temperature might be encountered, but it may be as deep as 900 to 1200 m.

Hailey Hot Springs' structural setting is typical of the hot springs in central Idaho; that is, many do occur near the confluence of streams, indicating fault or similar structural control. Fault controlled geothermal systems may provide a significant resource in Idaho for local use, as has been found at Raft River and Boise. Hailey Hot Springs occurs on the curvilinear zone connecting Clarendon Hot Springs, Warfield Hot Springs, and Easley Hot Springs (see

FIGURE 27. Index map of Blaine County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.



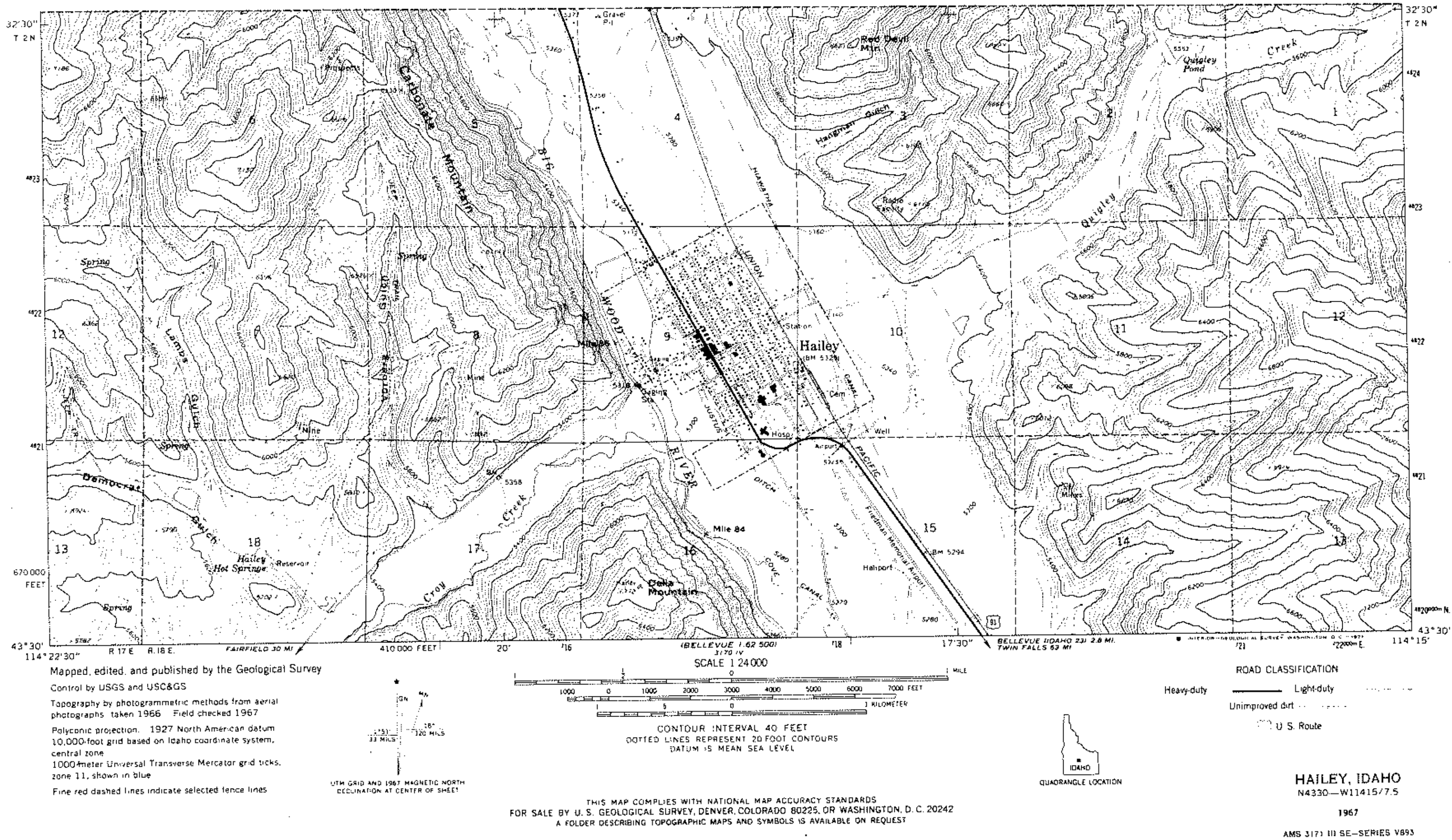


FIGURE 28. Topographic map of Hailey area showing location of Hailey Hot Springs with respect to the City of Hailey.

figure 9 in pocket and figure 29). Hailey Hot Springs was formerly used to heat the Hailey Hiawatha Hotel, an approximately 560 m^2 (square meter) structure which recently burned.

It is not known at present which structure or structures control the occurrence of thermal water at Hailey Hot Springs (Big Wood structure, Croy Creek-Quigley Creek structure, or Democrat Gulch structure). To confirm the size and exact location of the geothermal reservoir for space heating the town's buildings and residences, it will be advisable to evaluate, in some detail, reservoir characteristics and determine the amount and characteristics of geothermal water which could be withdrawn for use. This would be done by drilling observation wells, running well tests and perhaps drilling exploration holes to see if existing water flows could be augmented, or a new source found closer to Hailey.

Donaldson and Applegate (1979), reporting on geophysics in the Hailey-Ketchum area, stated:

> Gravity in the Ketchum-Hailey area is dominated by a strong regional gradient controlled by the transition from the Snake River Plain gravity high to the gravity low over the Idaho batholith. Any detailed interpretation from gravity in this area would necessarily involve increasing the amount of data and carefully removing the strong regional gradient.
>
> Witkind (1975) (figure 15) has identified an active fault in the lower Wood River Valley which is terminated about 7 km north of Hailey. Distortions in the regional gradient contours are, however, suggestive of faulting further up the valley and faults are indicated on the Idaho State Geologic Map (Bond, 1978).
>
> A relatively small-amplitude, low-frequency magnetic high roughly centered over Bald Mountain and an associated low to the north may be indicative of a buried igneous unit (see figure 30). A strong elongate high and associated low centered about 15 miles NE of Sun Valley appears to be a near surface phenomena.

Guyer Hot Springs (4N-17E-15aac1S) near Ketchum on Warm Springs Creek is another area where thermal water is presently being used for space heating. Guyer Hot Springs occurrence is very similar to that at Hailey Hot Springs and lies along a suspected curvilinear zone connecting Hailey, Clarendon, Guyer and Easley hot springs. Warfield Hot

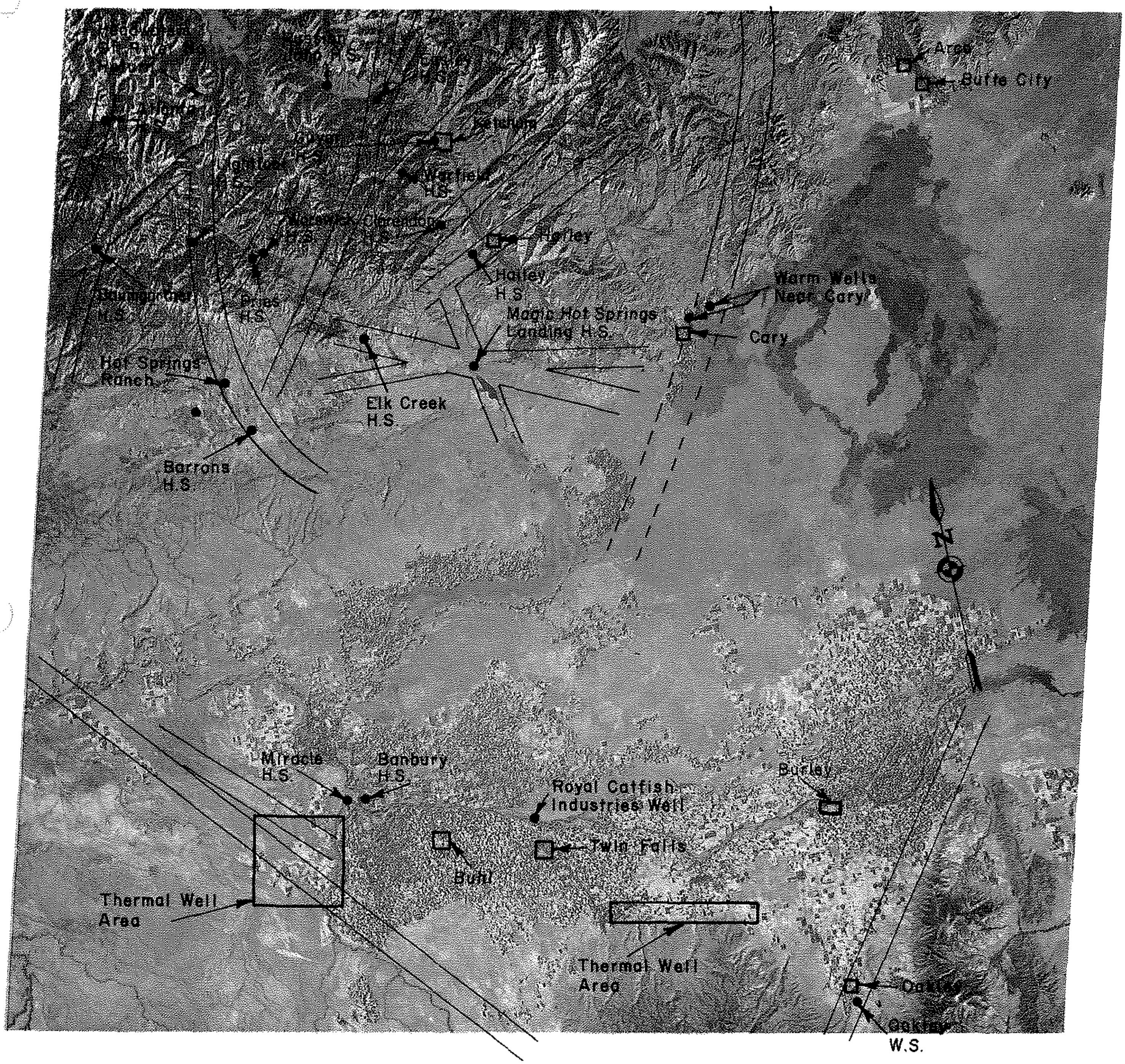


FIGURE 29. EROS false color infrared Landsat EDISE image of south-central Idaho showing selected linear features and thermal water locations with surface temperature above 20°C.

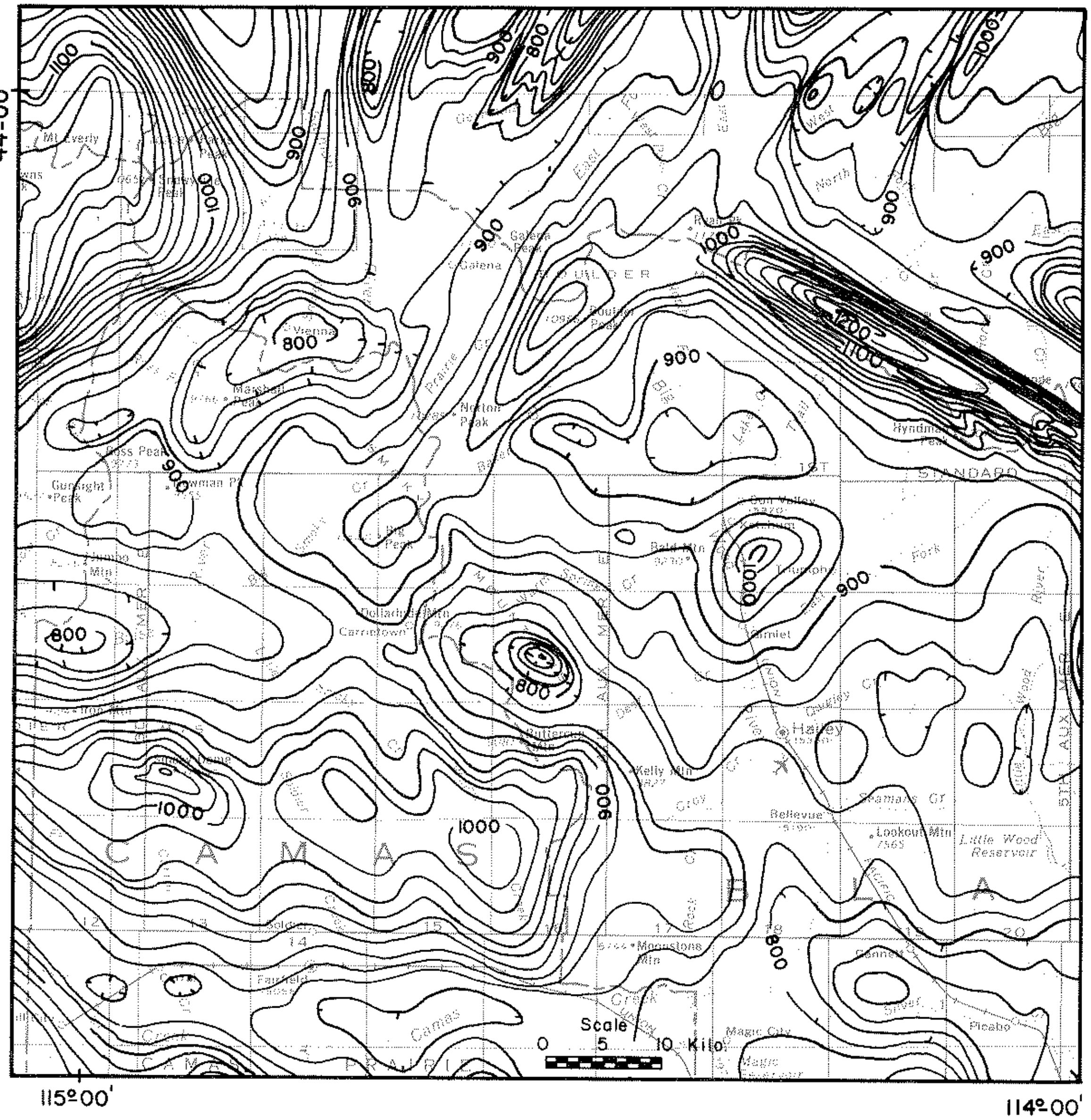


FIGURE 30. Magnetic anomalies near Bald Mountain (right of center) and NE of Sun Valley (upper right) (U.S. Geological Survey, 1971).

Springs is further up Warm Springs Creek from Guyer and will probably be used to heat vacation homes near Ketchum in the future.

Magic Hot Springs Landing was reported on by Mitchell (1977) who stated that water from Magic Hot Springs well (1S-17E-23aab1) near the north shore of Magic Reservoir contained 978 mg/l dissolved solids, 105 mg/l silica, and was higher in chloride than other thermal water in the area. Mitchell stated (p. 23):

> This well was drilled in 1965 above the site of a warm spring which subsequently ceased to flow. Surface temperature of the spring water before drilling of the well was 36°C (Ross 1971, p. 56). When measured in the fall of 1973 the well had a surface temperature of 72°C. In 1975, during attempts to cap this well, artesian pressures reached 30 psig (pounds per square inch gauge), then started dropping. The owners were in fear of losing the well and removed the newly installed valve. These efforts increased surface temperature by 2°C to 74°C and discharge to approximately 250 liters per min.
>
> The indicated disequilibrium conditions (Na-K-Ca chemical geothermometer differs from measured surface temperatures by more than 20°C) could mean a possibility of mixing of the thermal with nonthermal groundwaters. The proximity of the well to Magic Reservoir leads one to suspect that cold water leakage from Magic Reservoir could be entering the thermal water conduit system that supplies Magic Hot Springs well. Mixing model calculations indicate that the hot water component of this mixed (?) water may have reached temperatures as high as 200°C with cold water making up about 70% of total water. Even if mixing is not taking place the 150-175°C temperatures predicted by the other chemical geothermometers are close to that temperature now considered necessary for a binary cycle geothermal power plant. The high chloride content (greater than 50 mg/l) would indicate that this system would probably be a hot water rather than a dry steam system.
>
> The marked difference in chemistry between Magic Hot Springs well waters and other thermal waters in the Camas Prairie area would indicate: (1) Magic Hot Springs well waters have been at higher temperatures than the other thermal waters in the area, and/or (2) the aquifer or reservoir rocks for Magic Hot Springs well waters are mineralogically

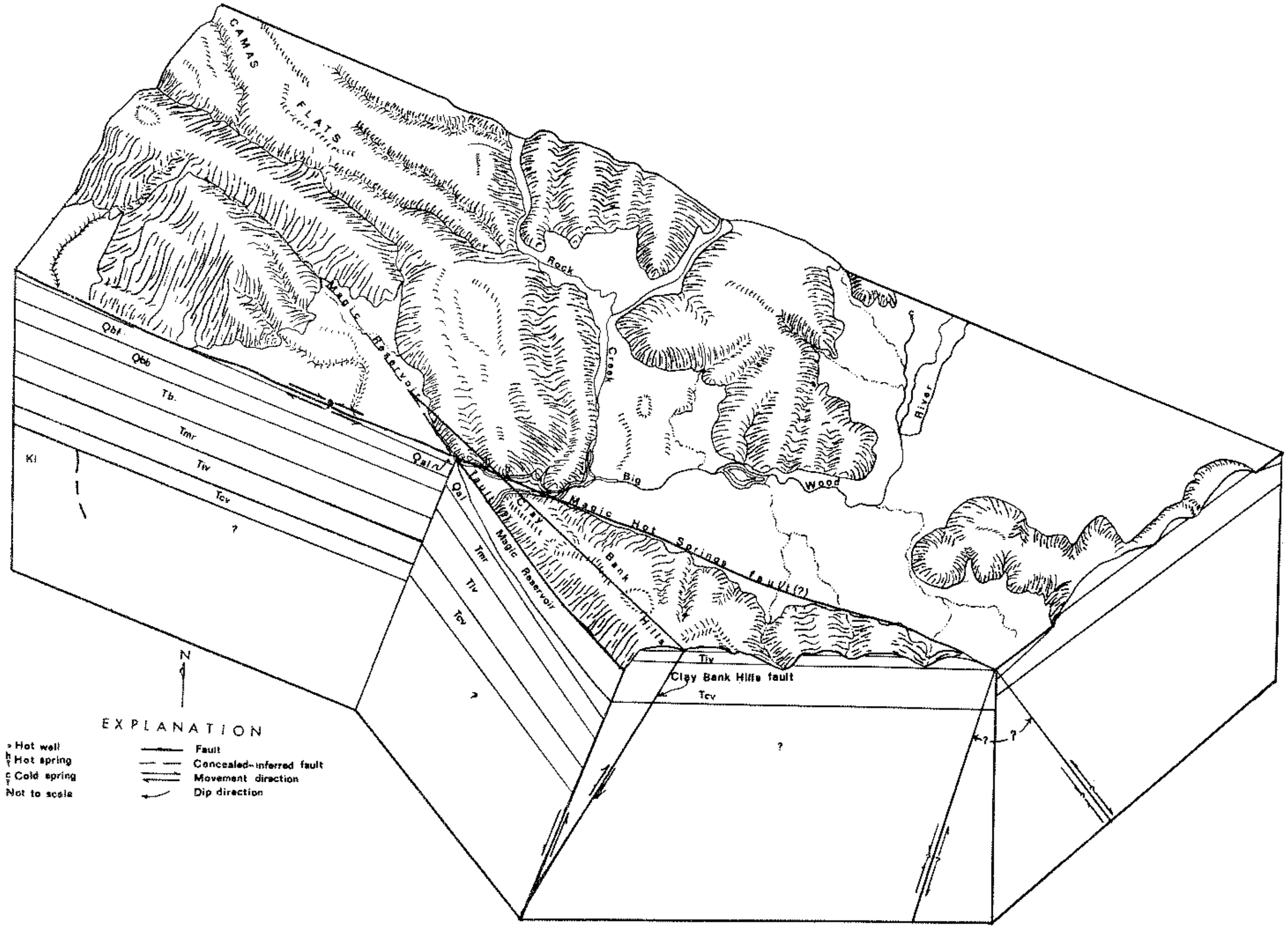
and/or chemically different from the aquifer or reservoir rock for the rest of the Prairie area. Although in many instances it is possible, using geochemical methods, to determine the aquifer or rock type from which thermal waters are in equilibrium, available data does not indicate which rock type could constitute an aquifer. The geology of the area would, however, suggest the aquifer to be either Quaternary alluvium, Middle Pliocene basalts of the Idaho Group, Lower Pliocene Idavada volcanic rocks, Eocene or Miocene Challis volcanic rocks, Cretaceous granitic rocks, or perhaps a combination of two or more of these.

The heat source for these waters could either be (1) an intruded sill or stock, related perhaps to the Holocene basalt flows found south of Magic Reservoir, or (2) a regionally high geothermal gradient and heat flow. Brott and others (1976) have determined that geothermal gradients and heat flow along the margins of the Snake River Plain are higher (about 3 HFU) than the regional norm which would indicate a regional heat source rather than a localized anomaly.

Mitchell (1976) further stated (p. 15) that Magic Hot Springs:

> ...well was drilled near the intersection of two curvilinear features that are probably faults. These faults may represent the controlling structure for the occurrence of thermal water in this particular part of the study area. Landsat false color infrared satellite imagery shows one of these lineaments as extending northwesterly, from near the southern tip of Magic Reservoir, along its eastern shoreline, and into the Soldier Mountains as the northern margin of the study area. The other feature extends at a slight northwesterly angle along the northern margin of the Claybank Hills and into the Soldier Mountains. (Malde and others, 1963, show a fault lying somewhat east of and nearly parallel to the Magic Reservoir (?) fault. Their mapped fault passes through the Claybank Hills and lies very near Magic Hot Springs well.) A hypothetical block diagram showing the possible control of Magic Hot Springs well is shown in figure 31.

FIGURE 31. Idealized block diagram of Magic Reservoir Area in Camas and Blaine counties depicting theoretical structural control for Magic Hot Springs well. In reality, the faults depicted may represent more broadly defined zones of faulting rather than single plane surfaces as represented on paper. The trend of these features are fairly well known, but the direction of movement of the Magic Hot Springs fault is unknown. (From Mitchell, 1976c.)



SUMMARY OF CENTRAL IDAHO REGION

Most thermal water in central Idaho occurs as springs, although several well drillers have accidentally discovered thermal water while drilling for cold water. Most of these springs appear to be fault controlled, therefore, prospecting for new thermal water areas would probably be most profitable along the major drainages near large river bends, near stream confluences, near gaps in suspected curvilinear zones connecting existing known thermal springs or along major lineaments. Significant amounts of thermal water may yet be undiscovered as it may be discharging directly into river bottoms where it cannot be observed. A thermal scanner could conceivably be used for river bottom prospecting.

Several of the larger towns, notably Cascade, Hailey, Ketchum and Council, occur within 5 km of a thermal water discharge. These towns should probably receive first priority in initial assessment surveys, as they contain the greater population concentration (see table 4 for a complete listing). Many of these and smaller communities could heat public buildings and schools with geothermal water. Some may have small industries that could utilize geothermal fluids. Geothermal water could also be used for space heating in recreational home areas. Recreational uses could be increased, particularly by the USFS. Game bird hatcheries might be established at some sites by the Idaho Department of Fish and Game.

GEOTHERMAL POTENTIAL OF THE SNAKE RIVER PLAIN REGION INCLUDING WASHINGTON, PAYETTE, GEM, CANYON, ADA, SOUTHERN ELMORE, GOODING, JEROME, MINIDOKA, OWYHEE, TWIN FALLS, NORTHERN FREMONT, BUTTE AND WESTERN CASSIA COUNTIES

The Snake River Plain region of Idaho is endowed with certain geologic features that favor the occurrence of geothermal energy. The Snake River Plain is one of the largest and possibly least studied (in terms of origin) structural features of the North American continent. It extends some 480 km in a broad arcuate plain from Weiser near the west-central border of Idaho, southeastward to Burley, thence northeastward to its abrupt termination with the western rim of the Island Park caldera in eastern Idaho adjacent to Yellowstone Park. In width, the plain varies from 32 km in the west to 90 km in the east (see figure 32).

The Snake River Plain is generally divided according to surface and shallow subsurface geology into the northwestward-trending western Snake River Plain and a northeastern-trending eastern Snake River Plain for purposes of discussion. The dividing line between the two subregions, is approximated by the Salmon Falls Creek-Snake River area in western Twin Falls and Gooding counties. Elevations vary uniformly from a low of 700 m near Weiser to a high of 1,830 m near the Island Park caldera rim. The gently undulating plain is flanked on the east, southeast, and northeast by transverse mountain ranges and valleys. Other structural features, faulting, lineament, and joint patterns surrounding the plain are generally parallel to (in the western Snake River Plain) or transverse to (in eastern Snake River Plain) the borders of the plain.

The Snake River enters the plain from the southeast through a mountain valley in the eastern part of Idaho. The Snake River flows along the southern margin of the plain until it reaches the western border of Idaho, then abruptly swings across the plain, exiting through Hells Canyon. Smaller streams and rivers enter the plain from adjacent mountains and valleys.

The plain proper represents the surface of a thick sequence of silicic, andesitic, and basaltic lava flows interlayered with volcanic ash, tuff and sedimentary material. Estimates of the thickness of this sequence varies from 3,000 to 9,000 m. Volcanic cinder cones and buttes puncture the thick pile of volcanic and sedimentary material throughout the entire plain in many places. Many of these volcanic and sedimentary units are water saturated.

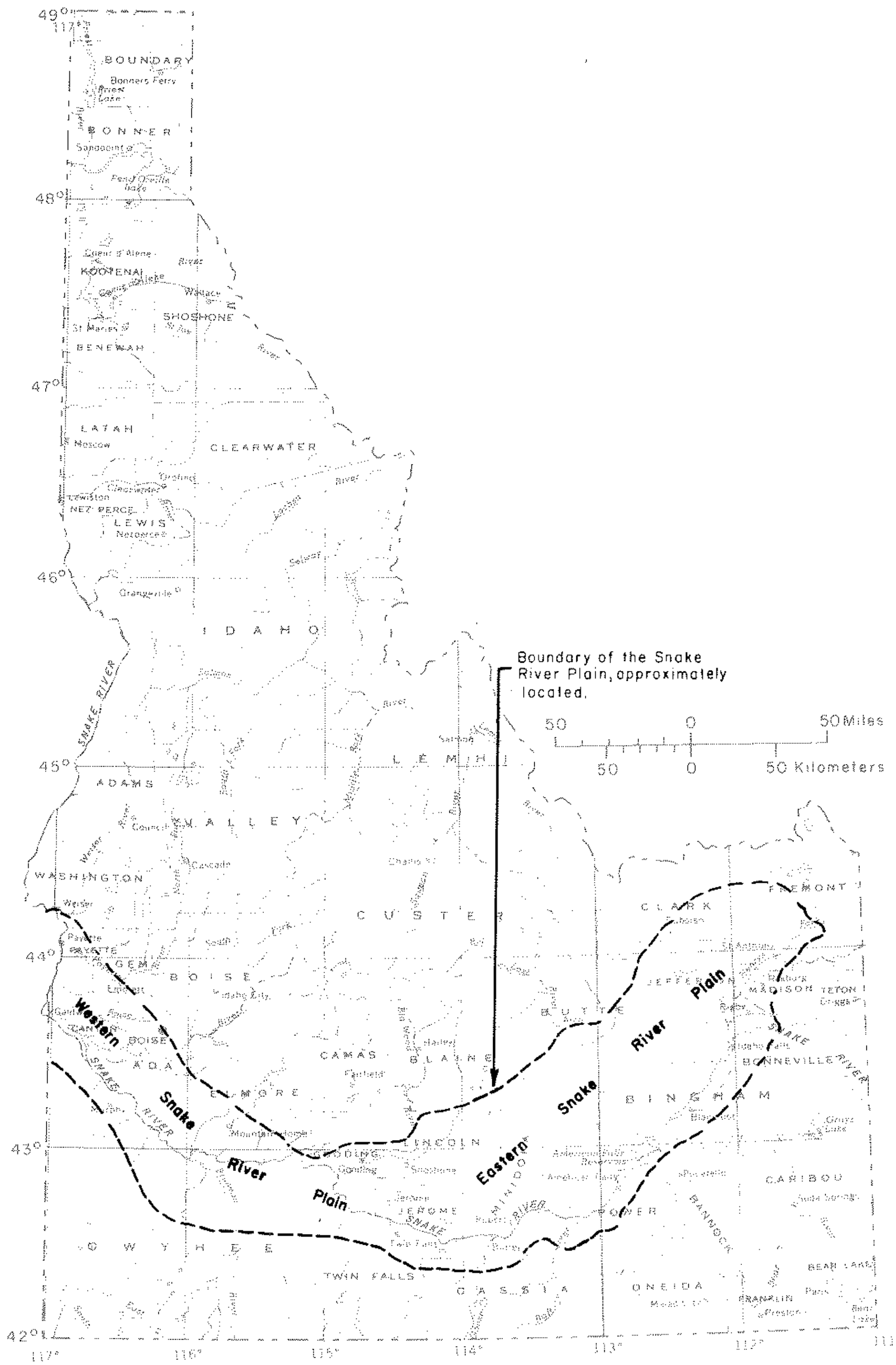


FIGURE 32. Index map of Idaho showing the Snake River Plain and its subdivisions.

One of the largest fresh groundwater bodies known, the Snake Plain aquifer with more than 1.2 x 10^9 cubic meters of water withdrawn annually, underlies a large portion of the eastern Snake River Plain.

The Snake River Plain is also one of the more youthful geologic features in Idaho. It apparently had its inception in Pliocene time some 3-15 million years ago. Volcanism has continued sporadically through Holocene time (the present epoch). This volcanism and associated deformation has apparently migrated from west to east, as age dating of volcanic rocks by Armstrong and others (1975) has shown decreasing ages of rocks from west to east. This widespread deformation and volcanism, both rhyolitic and basaltic, are fundamental features of geothermal provinces.

Brott and others (1976) determined that heat flow throughout the Snake River Plain is consistently 0.5 to 3 HFU (heat flow units) higher than in areas of normal heat flow. The higher values are found along the margins of the plain. Although few heat flow measurements could be obtained above the Snake Plain aquifer due to the aquifer's masking effect, Brott and others (1978) showed that elevation changes from west to east in the plain could be due to thermal expansion of underlying hot rocks. Consequently, the rocks beneath the eastern Snake River Plain where elevations are highest should be much hotter than those beneath the western Snake River Plain. This concept is strengthened by Armstrong's rock age dates.

Although the eastern Snake River Plain may ultimately have higher geothermal potential than the western Snake River Plain, most thermal water wells have been drilled in the western Snake River Plain. These wells extend in a belt some 65 km wide and 270 km long, which stretches from Raft River in the extreme south-central part of Idaho, northwestward to Weiser in the west-central part of Idaho (Plate 1 in pocket). Another, shorter and narrower belt, about 80 km long and 15 km wide, extends northwestward from Weiser through the Council-Cambridge area to Meadows. This belt contains numerous wells with surface water temperatures exceeding mean annual temperature by 5-10°C and several up to 20°C (see map, Plate 1). Thermal springs generally seem confined to the margins of the Snake River Plain as do thermal wells in the eastern Snake River Plain, or are found along the Snake River.

Three areas in Idaho where thermal aquifers may exist are located within the large western Snake River Plain thermal zone. These are the Lake Lowell-Nampa-Caldwell area, the Blue Gulch area west of Buhl, and the Bruneau-Grand View area in northern Owyhee County. Others may exist, but well drilling has not revealed their extent to date. Some evidence indicates these aquifers may be recharged through large faults in the subsurface.

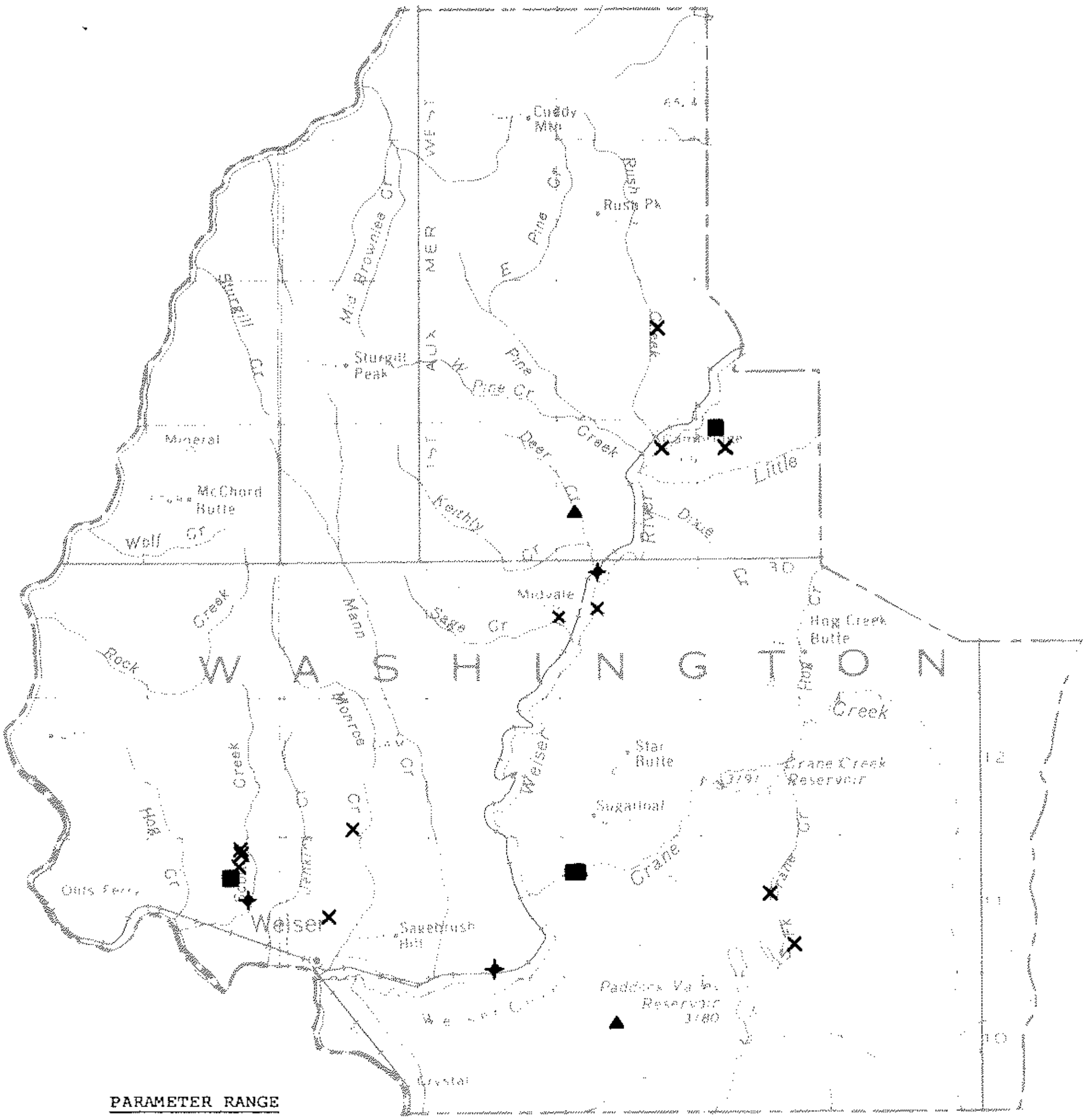
Discussion of the geothermal resources in the western Snake River Plain region follows on a county basis. No geothermal resource was found in Lincoln County.

WASHINGTON COUNTY

Washington County contains several areas where there are thermal water discharges (see figure 33). Weiser Hot Springs (11N-6W-10acb1S), northwest of Weiser, has long been utilized for swimming, balneological bathing, and greenhouse operations as well as small scale space heating. Several small diameter wells yield enough water at the site of a former hot spring to carry on the above operations. Another location which indicates promise of electrical generation capability is the Crane Creek Hot Springs (11N-3W-7bcb1S) area northeast of Weiser.

Young and Whitehead (1975, p. 31-32) summarized the geothermal potential of these areas.

> The Weiser area comprises about 518 sq km in southwestern Washington County and includes two subareas having thermal water: the Crane Creek subarea, which is about 19 km east of Weiser, and the Weiser Hot Springs subarea, which is about 8 km northwest of Weiser.
>
> Although the surficial geology of the Crane Creek and Weiser Hot Springs geothermal subareas is somewhat different, the general stratigraphy is similar. Volcanic and sedimentary rocks of Permian and younger age, granite of Cretaceous age, or the older basalts of the Columbia River Group of Miocene and Pliocene age may underlie the Weiser area. However, the scant data available indicate that the reservoir rock is most likely composed of the older basalts of the Columbia River Group. Miocene and Pliocene (?) sedimentary rocks, termed the Payette Formation, overlie older basalts and are, in turn, overlain by a younger sequence of basalts of the Columbia River Group. For the most part, sedimentary rocks of the Idaho Group of Pliocene and Pleistocene age overlie the younger basalts. Alluvium and colluvium of Pleistocene and Holocene age cover much of the older rock units, particularly in the lowlands and valleys.
>
> Gravity surveys indicate that the Weiser area is at the northwest end of a large regional gravity high that is associated with the western Snake River



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00

FIGURE 33. Index map of Washington County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Plain. The Crane Creek subarea is characterized by an extensive gravity low. A low-amplitude gravity high indicates that a dense, anomalous, near-surface mass may underlie the Weiser Hot Springs subarea. Magnetic lows are found in both the Crane Creek and Weiser Hot Springs subareas. Preliminary audio-magnetotelluric soundings suggest that an anomalous conductive zone is present at shallow depths in both subareas.

Hoover and Long (1975) reported on these audio-magnetotelluric (AMT) soundings and stated:

> A small region near Vale, Oregon, has been classed as a KGRA (known geothermal resource area). Hot-spring activity occurs at the town of Vale and at two locations near the neighboring town of Weiser, Idaho. This area is in the Snake River basin (Newton and Corcoran, 1963) which is on the western edge of the Snake River Plain. The basin is underlain by a section, at least 1.5 km and possibly 4.6 km thick, of principally nonmarine Cenozoic sediments. The area shown in figures 34 and 35 is covered almost completely by the Idaho group of Pliocene and Pleistocene age made up of gravel, sand, silt, clay, and ash. In the middle of the basin, which is centered in the mapped area, the Idaho group is at least 1.2 km to 1.5 km (5000 ft) thick, as shown by a number of gas wells drilled within the basin. Older Tertiary rocks crop out around the edges of this region with the principal one being the Columbia River basalt group. Structural trends south of Vale are principally north-south, bending more to the northwest in the vicinity of Weiser.
>
> Figures 34 and 35 show the two 27-Hz AMT maps obtained in the basin. At the Crane Creek Hot Springs northeast of Weiser, one of the lowest apparent resistivities was measured, 0.5 ohm-m, at 8 Hz. The maps in the Weiser region show rather complex structures and evidence of much lateral change. The higher resistivities in the northern part of the area are associated with older rocks at the edge of the Idaho batholith.
>
> Within the basin proper, the principal trend in the electrical data is northeast. A resistivity low runs through Vale and extends about 20 km to the southwest. Extension of this trend northeast runs into the low at Crane Creek about 20 km northeast of Weiser. A local high of about 16 ohm-m just northeast of Vale, apparent only in figure 34 is

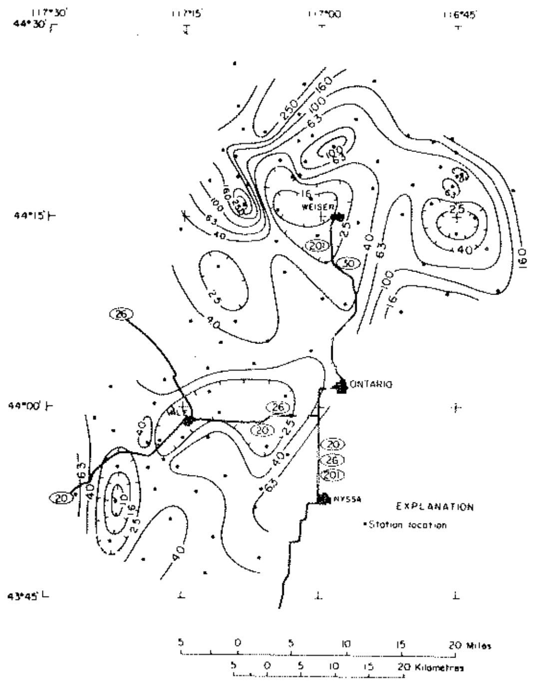


FIGURE 34. 27-Hz apparent-resistivity map (telluric line north-south), Weiser, Idaho–Vale, Oregon. Contours in ohm·meters.

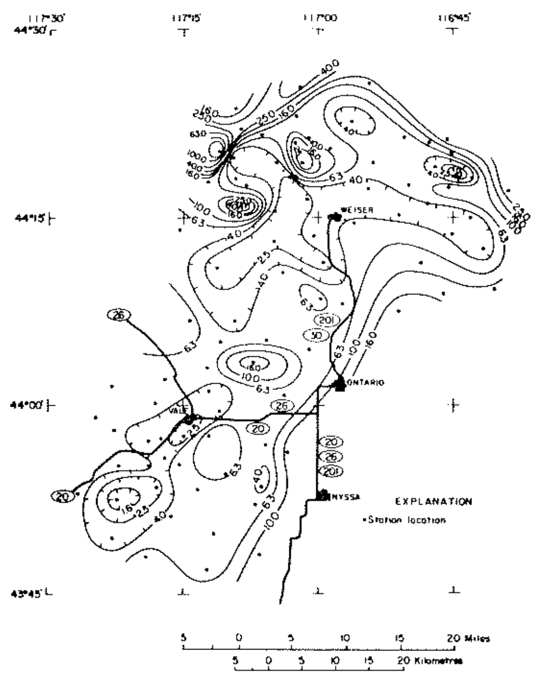


FIGURE 35. Map of 27-Hz apparent resistivity (telluric line east-west), Weiser, Idaho–Vale, Oregon. Contours in ohm·meters.

(Hoover and Long, 1975.)

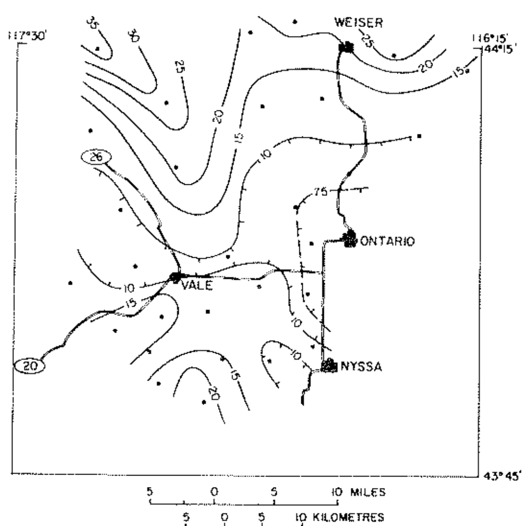


FIGURE 36. Telluric anomaly map at 20- to 30-sec period, Vale, Oregon–Weiser, Idaho. Contour interval $2K = 10\sqrt{J}$.

also on the same trend. This high is related to the rocks comprising Malheur Butte, next to which the sounding was made. This is a small prominent plug whose emplacement may be structurally related to this same northeast trend.

Because of the low resistivities in the basin, the depth of AMT exploration does not extend below the sediments in most places. We attribute the anomalies to hot, saline waters and alteration within the sedimentary section. It is interesting that the electrical trends do not coincide with the surface structural trends. Leakage of the geothermal system to the surface, however, is probably along faults in the sedimentary section. This same observation has been made in other regions - most clearly in the Surprise Valley, California KGRA where north-trending basin-and-range faulting is prominent, yet the trend of the data relating to the geothermal system implies a northwest direction.

A telluric survey was made in the Vale, Oregon, area and the data are shown in figure 36. The correlation of this map with the AMT data is not as direct as in Island Park, which might be expected. The AMT survey is sampling principally the young basin sediments, while the telluric data sample a larger part of the crust and may be reflecting basement topography. A low saddle in the telluric data, however, is seen just north of Vale with a trend to the east and northeast. The lowest values on the telluric map are on the eastern edge near the towns of Ontario and Nyssa.

Young and Whitehead (1975, p. 31-32) stated further that:

A ground-temperature survey made in the Weiser Hot Springs subarea apparently outlines an area of high heat flow centered or near the Weiser Hot Springs, and it also correlates very well with high boron concentrations measured in water samples collected in the area of the survey.

Most of the thermal waters sampled in the Weiser area are of a sodium chloride sulfate or sodium sulfate type. Dissolved-solids concentrations ranged from 1,070 to 1,140 mg/l for thermal water in the Crane Creek subarea and from 225 to 852 mg/l in the Weiser Hot Springs subarea. Thermal water sampled in the Crane Creek subarea had noticeably higher concentrations of chloride and boron than did thermal water sampled in the Weiser Hot Springs subarea.

Measured groundwater temperatures ranged from 13.0 to 92.0°C, and were highest at a spring in the Crane Creek subarea. Estimated aquifer temperatures, using the silica and the sodium-potassium-calcium chemical geothermometers, ranged from 153 to 177°C in the Crane Creek subarea and from 3 to 157°C in the Weiser Hot Springs subarea. Estimated aquifer temperatures for samples from wells at the Weiser Hot Springs ranged from 141 to 157°C. In the Crane Creek and Weiser hot springs subareas, respectively, estimated maximum temperatures at depth, using the mixed water method, ranged from 212 to 270°C and from 200 to 242°C with percentages of cold water ranging from 67 to 76 percent from 70 to 97 percent.

Analyses of hot-spring deposits from active and inactive-spring vents indicated that, although the mineral constituents in samples from both subareas are similar, the deposits in the Crane Creek subarea contain much greater amounts of sinter than those from the Weiser Hot Springs subarea. This indicates that the water depositing this material was at temperatures in excess of 180°C at depth.

The source of the heat for the thermal water in the Weiser area is believed to be a cooling young intrusive implanted at shallow depth in late Miocene or early Pleistocene time, or above-normal heat flow caused by the high temperatures at relatively shallow depth resulting from a general thinning of the earth's upper crust in this area.

Aside from the power generation possibilities in the Crane Creek area, the Weiser and Crane Creek hot springs represent areas where geothermal energy could be harnessed for agricultural use as well. The Weiser area is on the Union Pacific Railroad Mainline with a spur branch extending into the Crane Creek subarea to very near the springs. The entire Vale, Ontario-Weiser area is a rich, agricultural area where approximately one-third of the nation's onions are grown. Much of Idaho's fruit and sugar beets are also grown in this area. Uses such as onion, beet pulp, and fruit drying suggest themselves. Meat packers could make use of the thermal water for refrigeration.

Thermal waters also extend northeastward, in a belt from Vale, Oregon, through Weiser to Council-Cambridge in Washington County to the Meadows area in Adams County (see Plate 1 in pocket). Little is known about the Council-Cambridge area geothermally except that there are approximately eight wells ranging in temperatures from 20 to 30°C and one hot spring at 69°C. Discharge of wells ranges from

379 to 1500 l/m. The wells range in depth from 56 to 283 meters. Chemical analyses of discharge water from these wells should be made to establish priorities for further work in this area.

PAYETTE COUNTY

Little is known of the geothermal potential of Payette County. Nine thermal wells are known to have been drilled there and all are relatively cool, between 20 to 29°C (figure 37). Four are in the southwestern corner of Payette County north of Parma. Two more are up Little Willow Creek about 13 km northeast of Fruitland. Two occur about 5 km east of Fruitland and one occurs .4 km east of Payette.

Highest surface temperatures were measured up Little Willow Creek at 25 and 29°C from wells 9N-3W-21bdcl and 9N-3W-19ddal. Well head temperatures of 20°C have been measured from wells 9N-5W-35ccbl near Payette and 8N-4W-7ccdl near Fruitland.

No chemical analyses are available from any thermal wells in Payette County. Assessment of the resource should begin with sampling the hottest ones and those near Fruitland and Payette. It is possible that more and hotter water could be found in the Fruitland-Payette-Ontario area where several food processing plants are located.

GEM COUNTY

Four thermal anomalies are known in Gem County (see figure 37). Roystone Hot Springs (7N-1E-8ddalS) may have potential for binary cycle power generation. Roystone occurs near the intersection of a prominent north trending lineament that connects with the Dry Valley thermal anomaly north of Boise and a less pronounced northeast trending lineament (figure 17). These are visible on enhanced false color composite satellite images of the area. Surface temperature at Roystone Hot Springs is 55°C and discharge is 75 l/m. As estimated by the quartz and Na-K-Ca chemical geothermometers, subsurface temperature is 147 and 150°C, respectively.

A spring (7N-1E-9cdclS) about .4 km from Roystone Hot Springs has a 45°C surface temperature and may have an aquifer temperature between 84 and 106°C according to the Na-K-Ca and chalcedony chemical geothermometers.

A well 9.5 m deep has been drilled recently near Emmett in Gem County. This well has a surface temperature of 24°C which is sufficient for space heating if groundwater heat pumps are used. No other data are presently available for this well, but its presence suggests that the Emmett area

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✚	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	◴	100.00

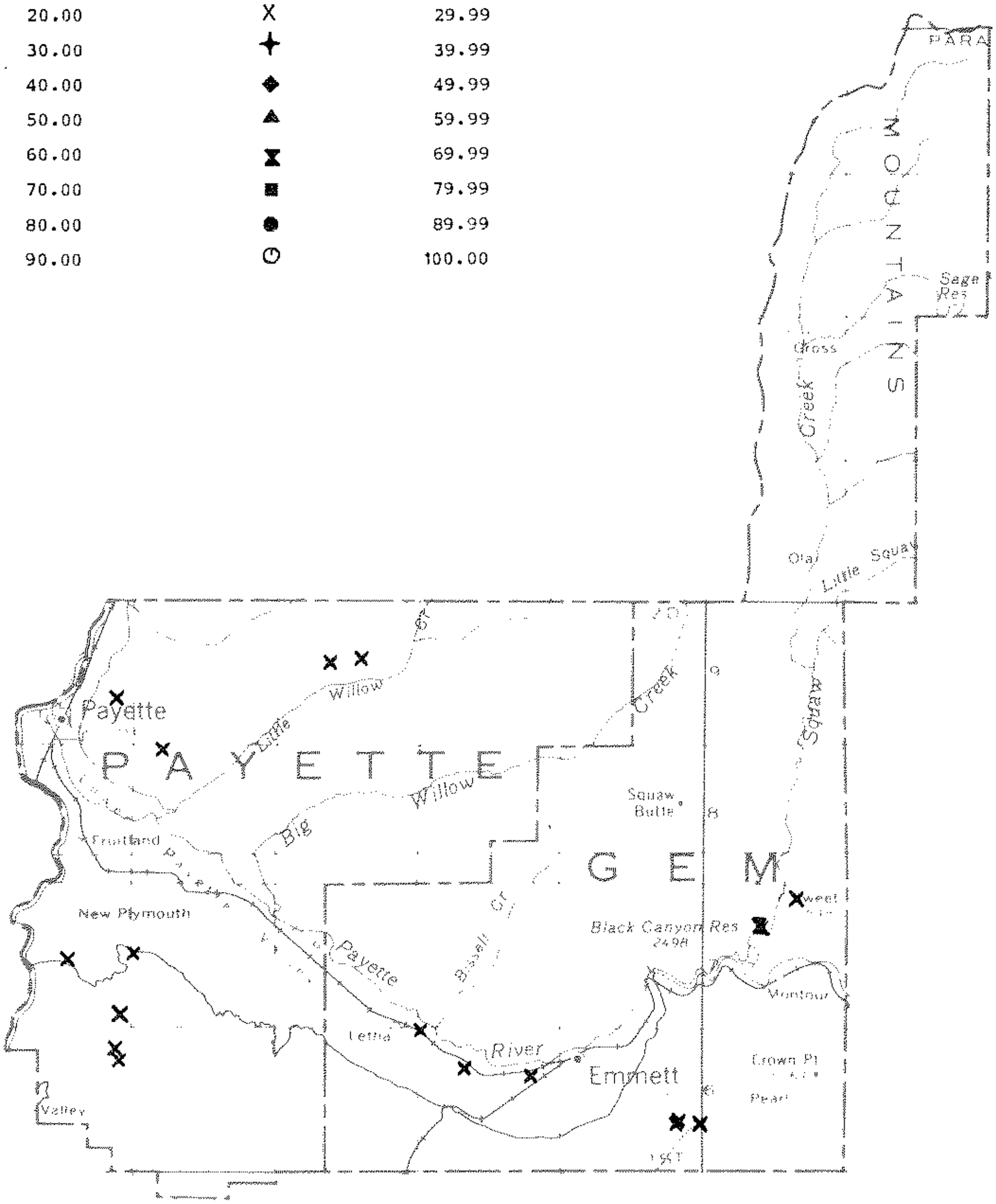


FIGURE 37. Index map of Payette and Gem counties showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

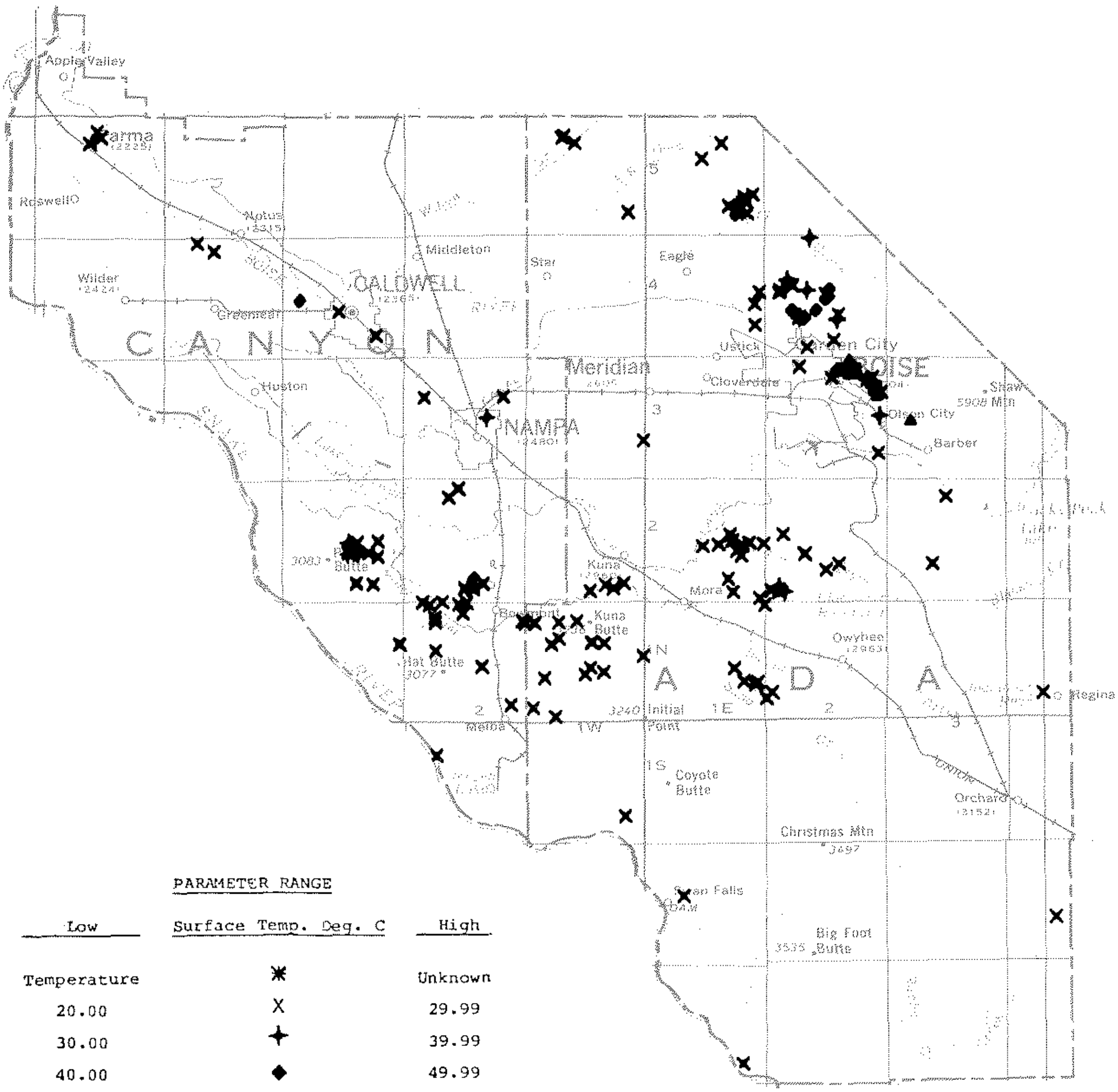
may have potential for low temperature geothermal energy. A chemical analysis should be obtained from the well to see if subsurface temperatures might be substantially higher before other work is undertaken in this area.

CANYON COUNTY

Little is known of the potential in Canyon County for low temperature geothermal use. Numerous low temperature (20-41°C) thermal wells occur in Canyon County. In a large area south and southeast of Lake Lowell, numerous 20-30°C wells have been drilled (figure 38) and are mostly used for irrigation. Water for the municipal swimming pool in Nampa is 31°C. A thermal well exists near the municipal pool in Caldwell (4N-3W-28aabl presently flowing and unused). The city of Caldwell owns at least one more well (4N-3W-35abdl) which provides 20°C water. A warm well (41°C) near the Simplot feedlot (4N-3W-19adcl) 3 km south of Caldwell provides water for cattle. This well was drilled as an oil and gas exploration well and reportedly produced "very hot water," but was perforated at 900 m to provide cooler drinking water for cattle. Other warm wells exist near Parma (5N-5W-9adbl and 5N-5W-4dcdlS) and Melba (1N-2W-36caal) (24°C) owned by the respective cities and operated as municipal wells.

Figure 38 shows northeast-southwest alignment of thermal wells stretching from Parma to Nampa, passing through Caldwell, which might indicate a geologic structure of some length. This linear trend of wells has been mapped as a fault between Nampa and Caldwell (Bond, 1978). Due to obscuring cultural features, it is difficult to identify a lineament from the satellite photos, although one might possibly exist on or near the wells (figure 39). Several closely spaced wells in central Ada County fall along this trend (Plate 1, figure 9 and figure 38).

As Canyon County is a hub of industrial activity, primarily food processing, this area should be assessed early for low temperature geothermal resources. As the thermal water appears to be related to faulting in the area, structures that might control distribution of thermal water should be sought. Geologic mapping, gravity and magnetic surveys, and hydrologic studies of the area should be accomplished first to determine gross structural patterns. Reflective seismic and resistivity surveys could be designed and run from the previously mentioned data base to site several drill holes in promising areas near Nampa or Caldwell. (This has been started through the purchase of oil exploration survey data as part of the IDWR-DOE Nampa-Caldwell area study.) From here, stepout surveys or drilling should be undertaken in other parts of the western Snake River Plain to uncover other favorable geologic struc-



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00

FIGURE 38. Index map of Canyon and Ada counties showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

tures where thermal water may be found. These types of exploration could lead to discovery of many valuable energy resources in this section of Idaho.

ADA COUNTY

People in Ada County have long used geothermal energy. Several geothermal installations of note are currently operating in Boise. The Idaho Department of Transportation heats and air conditions its main office building on State Street using a groundwater heat pump system. The Idaho State Health Laboratory is currently using geothermal energy obtained from the Warm Springs Water District wells. Approximately 185 homes on and near Warm Springs Avenue have used geothermal energy (well head temperature 74°C) for their heat source since the turn of the century. Several greenhouses for cut and potted plants derive their heat from geothermal wells (well head temperature 47°C). Several domestic wells provide heat throughout the Boise Front area to individual homes. Plans for expansion of geothermal heating by the city of Boise are being made. The Capital Mall Complex is being looked at for possible conversion of state and federal buildings to geothermal energy for space heating and cooling.

There are 119 wells (well head temperatures greater than 20°C) known in Ada County (figure 38). The hottest ones are near the Boise Front, where they are associated with extensive, large displacement faulting. Wells drilled by Boise State University Geology Department, funded by DOE for the Boise City Project, were sited to hit the intersection of several known faults and lineaments at depth. These wells were highly successful. Preliminary tests by DOE indicate a sufficient resource for the anticipated development in downtown Boise. Another area of thermal water also lies near fault and lineament intersections. This is the Spring Valley-Dry Valley area northwest of Boise where several thermal wells are located. Here, the Dry Valley-Roystone Hot Springs lineament intersects the Dry Valley fault system. Other wells are located in the several gulches which cut the Boise Front at nearly right angles. Mink and Graham, 1977, in their study of the geothermal potential of the west Boise area, sited five areas along the Boise Front that they considered to have potential for low temperature geothermal use. These areas are shown in figure 40. In addition to these areas, others where thermal water is found near Boise are: Strawberry Glen Road area, Garden City area, Capitol Mall area, Old State Penitentary area, and Glenwood Street-Chinden Boulevard area.

Donaldson and Applegate (1979) have conducted reconnaissance level resistivity surveys along the Boise Front to determine thermal water locations. They state:

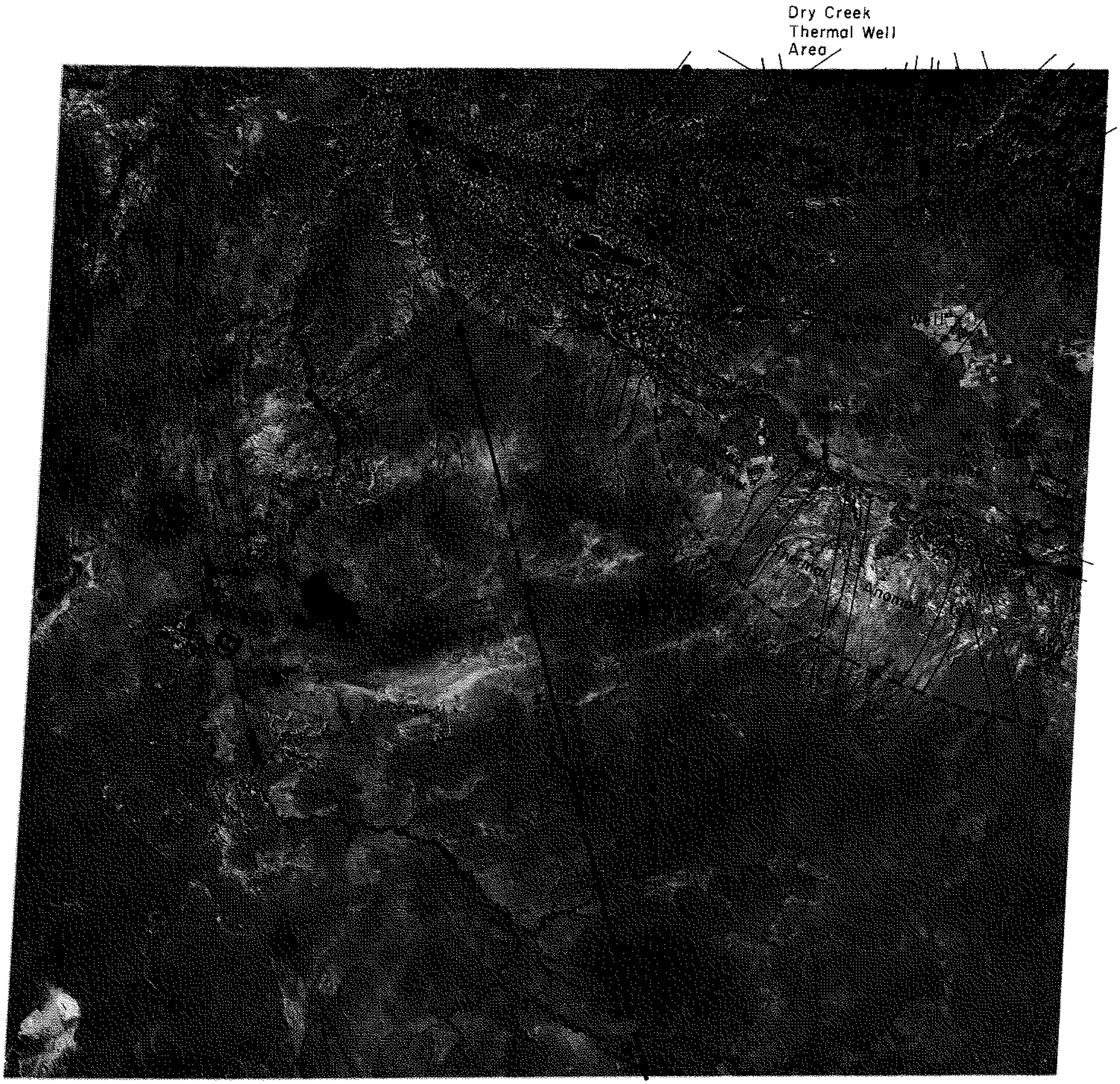


FIGURE 39. EROS false color infrared Landsat EDISE image of part of southwestern Idaho and southeastern Oregon showing selected linear features and thermal water locations with surface temperatures above 20°C.

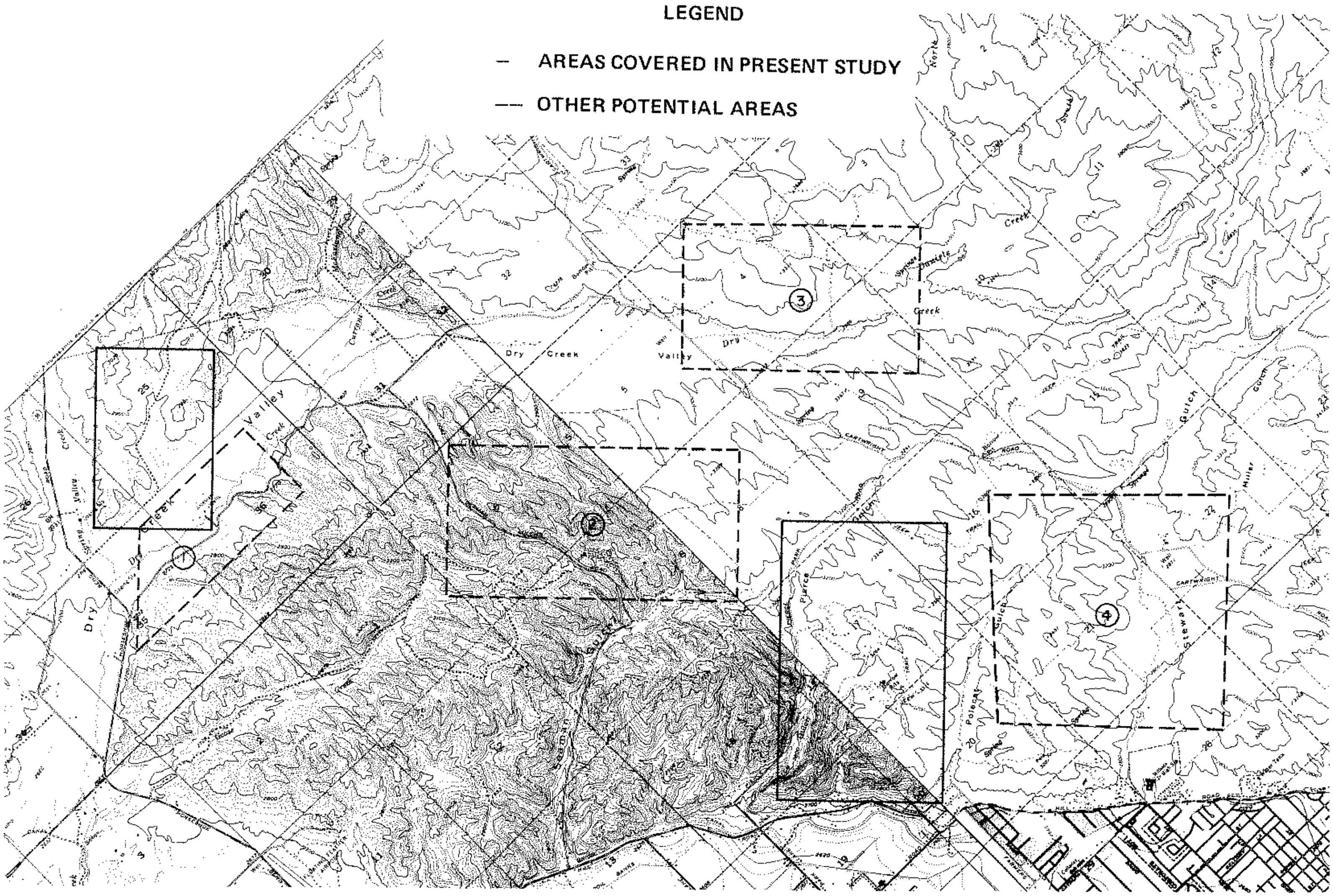


FIGURE 40. Topographic map of west Boise Front area showing locations of potential geothermal sites. (Modified from Mink and Graham, 1977.)

Of direct interest are the resistivity surveys (figures 41, 42, 43, and 44) which have outlined several anomalously conductive areas. The steep resistivity gradients associated with these anomalies probably reflect the presence of faults intersecting the major Boise Front fault at high angles. Such fault intersections, where they are proven to exist, offer very attractive geothermal prospects.

A large number of irrigation wells occur in central Ada County in the vicinity of Eight and Ten Mile creeks where well head temperatures in this part of Ada County are between 20 and 25°C. Another group occurs near Kuna in west central Ada County. There are several large linears that apparently extend from the Middle Fork Boise River drainage and appear to cross the Snake River Plain in the Eight and Tenmile creeks area. A long, more pronounced linear runs northwest-southeast up the axis of the western Snake River Plain and intersects the other linears south of Tenmile Creek. Knowledge of the type of geologic features these linears represent appears to be fundamental to obtaining much more information on geothermal occurrences in the western Snake River Plain region. A speculation is that they represent surface expressions of basement or other faults or rock fractures. They may act as conduits for thermal water. Recharge of these systems could be anywhere along them. There could even be interbasin transfer of groundwater along some of the regional linears and transfer could take place anywhere from one kilometer or less to tens of kilometers or more. Any holes drilled for the purpose of obtaining thermal water would have to be very carefully targeted to intersect faults or rock fractures where thermal water may be circulating. In the alluvium and valley fill sediments away from the mountain front faults, thermal water conduits would be difficult to locate. Analysis of large scale enhanced false color Landsat images may allow some of these faults to be found. A systematic program of reflective seismic profiling across the western Snake River Plain is highly recommended to determine the location and depth of any faulting in the area.

SOUTHERN ELMORE COUNTY

Numerous thermal wells and several thermal springs are known in southern Elmore County. Springs are scattered widely but are principally located along the northern margin of the western Snake River Plain northeast and east of Mountain Home. Some wells are located just west of Mountain Home and Mountain Home Air Force Base and several kilometers to the east of Mountain Home Air Force Base (see figure 25). The wells near Mountain Home and the Air Base are the coolest, being 20 to 25°C at the surface. Several wells in southern Elmore County are located near the Snake River.

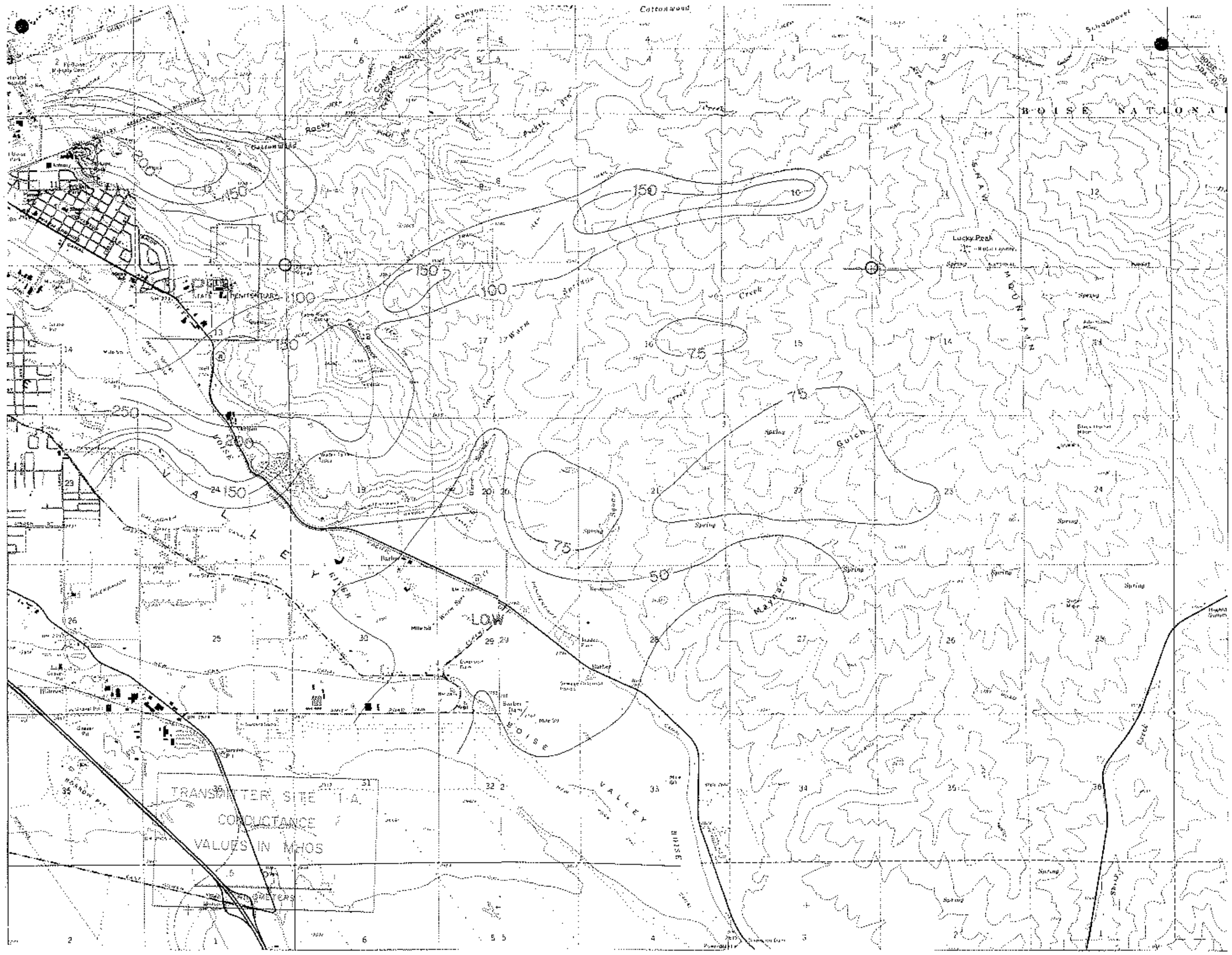
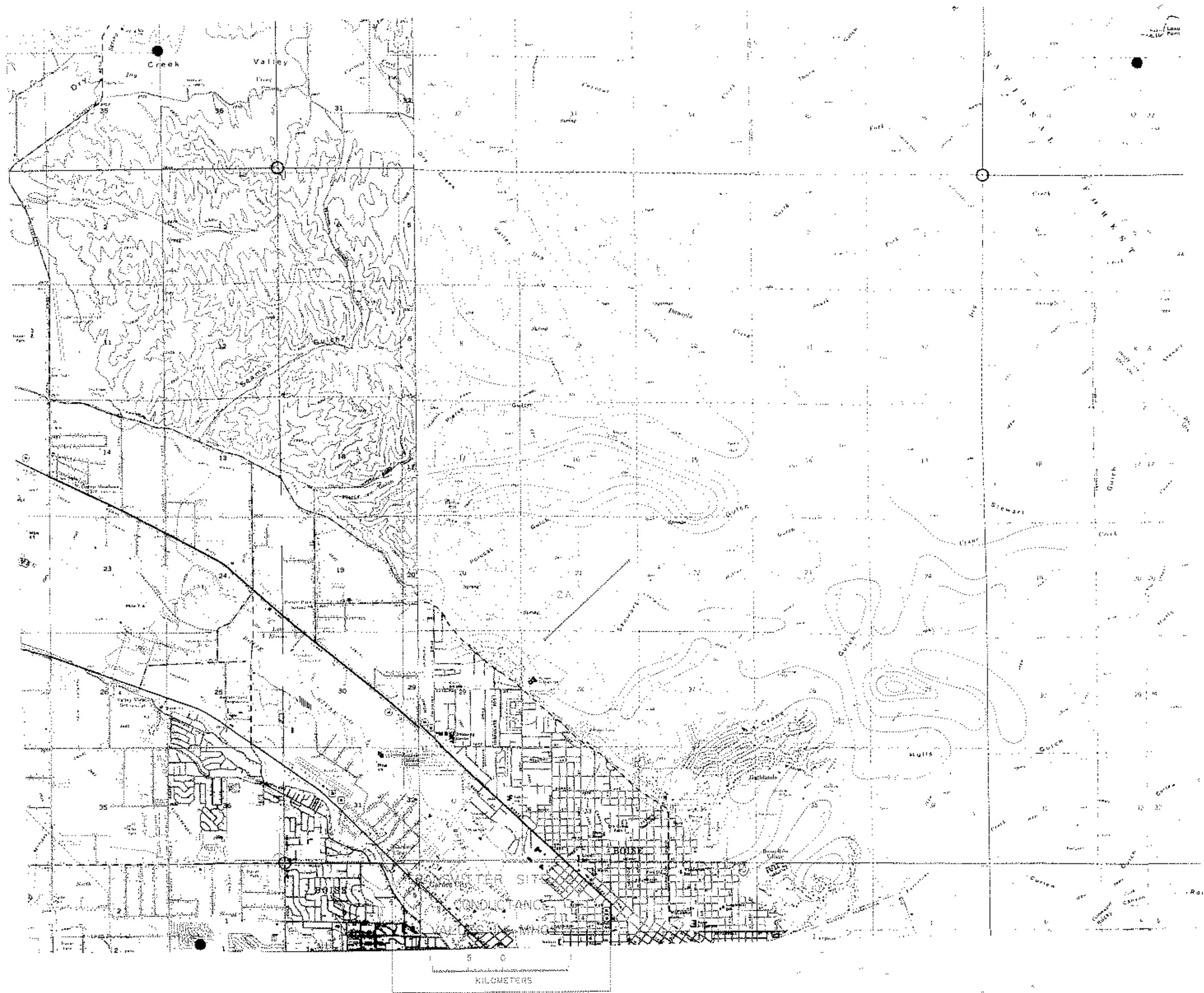


FIGURE 41. Map of Boise Front area showing total conductance for transmitter 1 A array (Donaldson and Applegate, 1979, modified).

FIGURE 42. Map of Boise Front area showing total conductance for transmitter 2 A array (Donaldson and Applegate, 1979, modified).



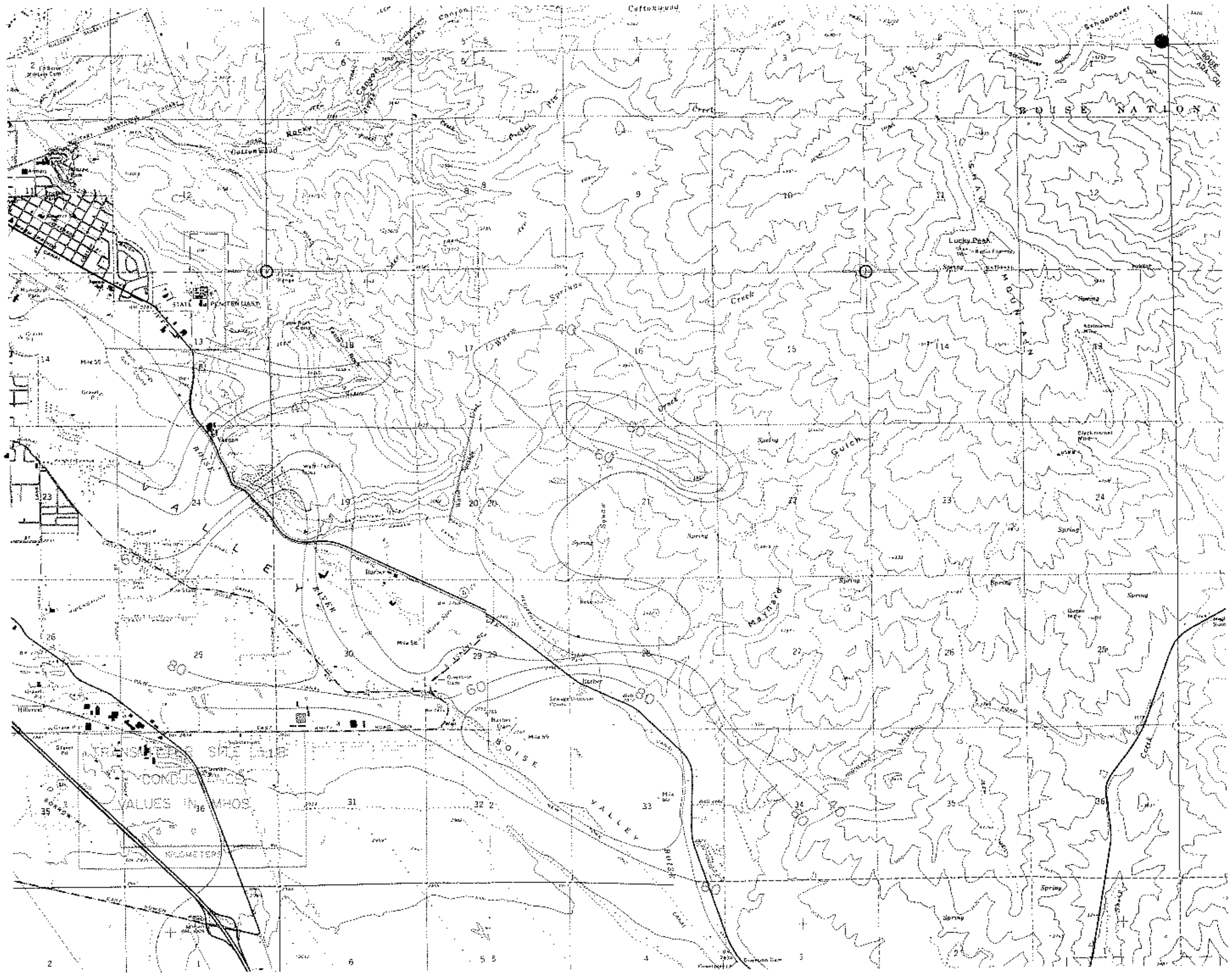
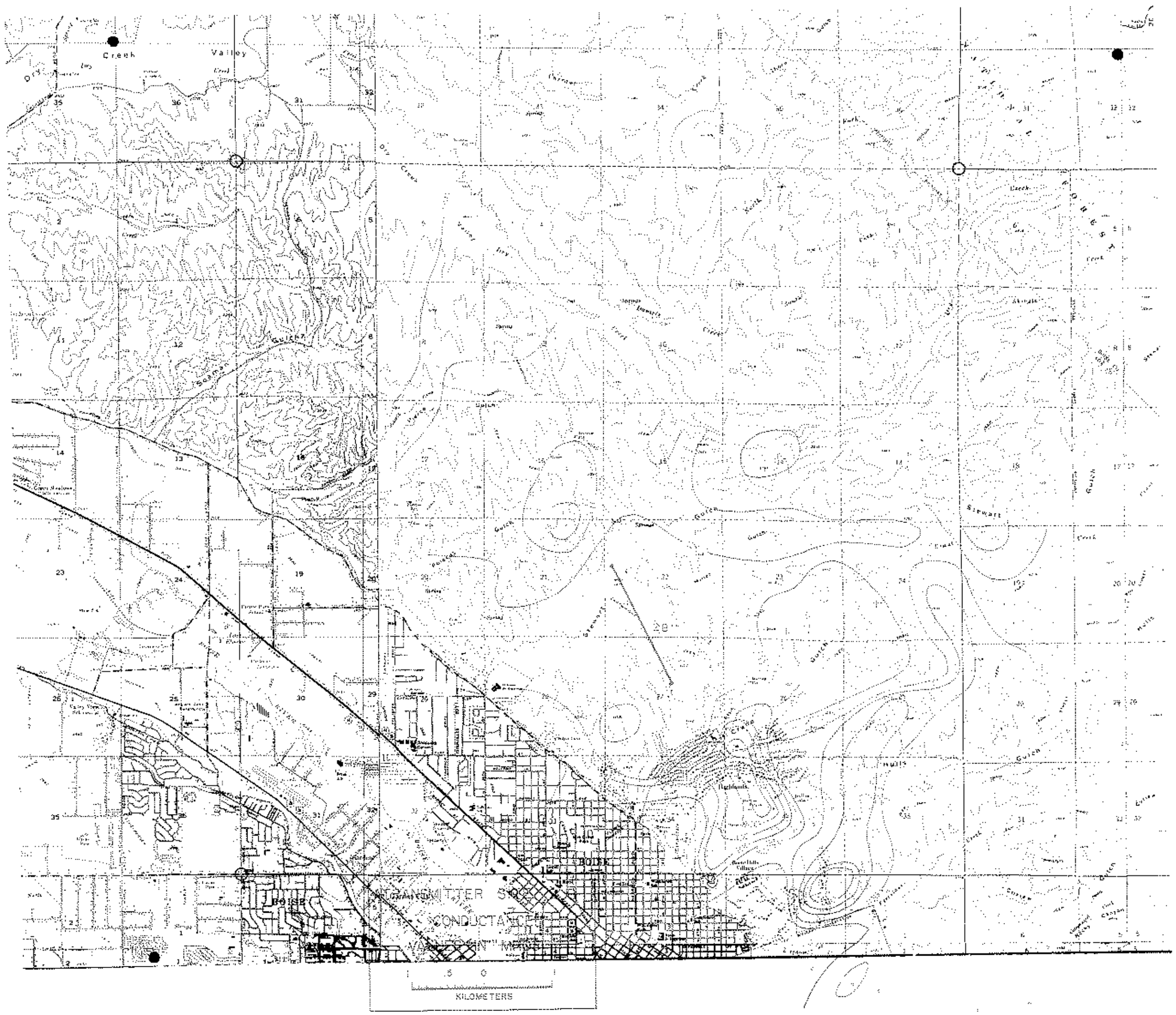


FIGURE 43. Map of Boise Front area showing total conductance for transmitter 1 B array (Donaldson and Applegate, 1979, modified).

FIGURE 44. Map of Boise Front area showing total conductance for transmitter 2 B array (Donaldson and Applegate, 1979, modified).



Some of the wells drilled near Mountain Home and east of the Air Base form linear patterns that could reveal structural control for the thermal water occurrence. The alignment is transverse to the western Snake Plain axis and, as in Ada and Canyon counties, thermal water occurrences could be at least partially controlled by faulting running across the plain. However, the springs and wells that occur along the plain margin seem to be influenced by structures running parallel to the western Snake Plain axis or northwest-southeast.

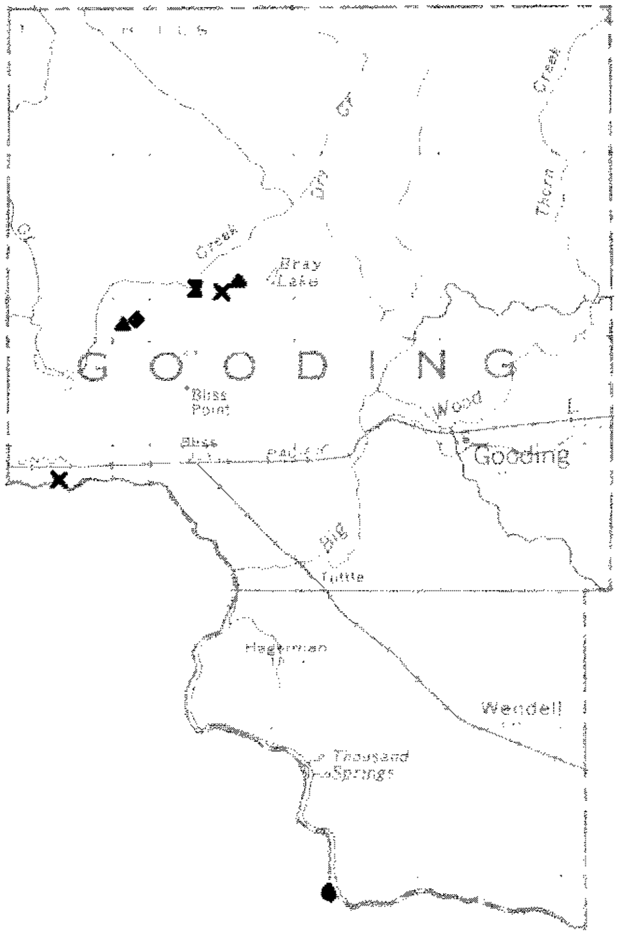
Mountain Home and Mountain Home Air Force Base are the two principal population centers in southern Elmore County where thermal water occurs and where greatest use could probably be made for it. Other towns are King Hill and Glenns Ferry. Low temperature (20 - 30°C) thermal wells are located within 5 km of the above sites. Prospecting for more thermal water in each of these areas might prove fruitful, and the prospect of hotter water at depth is possible. These areas should be further investigated to determine their full potential, beginning with chemical analyses of existing thermal well waters so an estimate can be made of the maximum water temperature through the use of chemical geothermometers.

GOODING COUNTY

Seven thermal anomalies occur in Gooding County (figure 45). Four wells and a spring occur along Clover Creek near the foot of the Mount Bennett Hills and another occurs near the Snake River. All are in western Gooding County and far removed from most population centers.

Chemical analyses are available on three of the seven thermal sites in Gooding County. White Arrow Hot Springs (4S-13E-30adb1S) is the hottest at 65°C. Agreement between the chalcedony and Na-K-Ca chemical geothermometers (108°C and 112°C, respectively) indicates subsurface temperatures are probably in this range. However, in drilling the well at White Arrow Hot Springs, the owner reports blue quartz was found in the hole. The quartz chemical geothermometer predicts temperature of 135°C. White Arrow is presently the scene of private agricultural research and commercial production of tomatoes in geothermally heated greenhouses. Idaho Image (May-June, 1975) reported the following activities at White Arrow Ranch by Bob Erkins:

> Tomatoes are harvested at the White Arrow Ranch at Bliss from September through July, when temperatures range from 38 to -2°C.
>
> Tomato plants are very sensitive to extremes of temperatures; however, the secret at White Arrow



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✚	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	▟	79.99
80.00	●	89.99
90.00	⏀	100.00

FIGURE 45. Index map of Gooding County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Ranch is that they use a large natural hot spring to maintain optimum growing temperature during the winter in their two 12 by 40 m hothouses.

The water which comes from the ground at a temperature of 65°C flows into heat exchangers at the end of the building. Air is blown across them and through large plastic pipes and carried the length of the building. Hot water is also carried through some 3 km of black plastic pipe which provides further radiant heat.

In hot weather, the south end of the building can be opened and ventilation provided by six large exhaust fans. The temperature is further controlled by blowing air through large cooling pads through which cold water is dripped.

Throughout the year, according to owner Robert A. Erkins, the temperature can easily be maintained at between 18° and 28°C. Production is stopped in the summer months not by the weather, but because that is the season when there are plenty of tomatoes already on the market from growers using more conventional methods.

Just getting out of the experimental stage and into full production, White Arrow Ranch has been shipping about 600 pounds of tomatoes per week but, within the next month or two, expects to be shipping around 4,000 pounds per week. Erkins projects a crop of up to 30 tons of tomatoes annually from a quarter acre of space.

Some 3,000 Manapal tomato plants were planted for the first crop. Erkins said it was one of several hothouse varieties that could have been used.

Future plans include cucumbers and potted house plants. Land is already cleared and piping in for 12 more hothouse buildings, although their construction will not be completed until they are needed.

The key to the system is a free-flowing hot spring which provides heated water at a rate of 3800 l/min, much more than needed for any projected expansion. Erkins said his electric bill is not high, but dependable power supply is important to proper operation of the system. In the two existing buildings some 18 electric fans are used for heating and cooling. In addition, three electric pumps move the well and spring water used to water the tomato plants. (Water from the hot spring is not used for this purpose.)

Erkins requires only one employee to operate the first building. One of his most important functions is to walk through the structure three times a day with a gasoline-powered blower strapped on his back to pollinate the plants. Tomatoes are normally pollinated by wind, but there is none in the buildings.

One of the biggest problems, according to Erkins, was a lack of data. There have been other hothouses using natural hot water, but no one seemed to be able to provide much really expert information, so much had to be learned by experimentation.

Erkins and his wife have been in the trout farming business in Idaho for 23 years, but it is their first venture in tomato growing. White Arrow Ranch was originally settled in the 1800's, but had been deserted for some time before being purchased by the Erkins. It was named for an Indian tribe that had camped at the site and which was noted for making white arrowheads.

A well in Gooding County (4S-13E-28abbl) is 47°C at the surface, with the Na-K-Ca and chalcedony chemical geothermometers indicating temperatures of 98-105°C at depth. Uses similar to that of White Arrow could probably be made with this water. Another well (5S-12E-3aaal) is 57°C at the well head; the Na-K-Ca and chalcedony chemical geothermometers predict maximum subsurface temperatures from 70-83°C might be found in this area.

Little information is available from the other wells in Gooding County.

JEROME COUNTY

Royal Catfish Industries has used geothermal water to raise catfish in Jerome County (figure 46). The operation is now closed. Thermal water at 43°C is discharged from a thermal well (9S-17E-29dbbl) located along the Snake River north of Twin Falls to supply water to the facility which had 30 fish rearing ponds. Subsurface temperatures predicted by the chalcedony and Na-K-Ca chemical geothermometers are 89 and 93°C respectively. No other thermal water is known in Jerome County and the potential for further prospects is unknown.

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00

FIGURE 46. Index map of Jerome and southern Minidoka counties showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

MINIDOKA COUNTY

Little information on the geothermal potential of Minidoka County is available. The area is underlain by the Snake Plain aquifer, which may mask thermal occurrences throughout the eastern Snake River Plain. A single thermal well (9S-23E-28ccal) (figure 46), drilled for the city of Paul, encountered Pliocene and Pleistocene basaltic lava flows to a total depth of 137 m, discharges 22°C at 7570 l/min. Its occurrence suggests more and possibly hotter water might be found in the area. No chemical analysis is available, therefore, speculation about possible subsurface temperatures cannot be made. Uses up to and including groundwater heat pump space heating and cooling could be made of the thermal water at existing discharge temperatures. A chemical analysis of the well waters should be made to ascertain the possibilities of obtaining hotter water in the area through deeper drilling.

OWYHEE COUNTY

The Bruneau-Grand View thermal anomaly zone (figure 47) in southwest Idaho is the largest geothermal area in the western United States, rivaled in size only by the geopressured zones in the Texas-Louisiana Gulf Coast region. Renner and others (1975, p. 39) estimate that 1100 x 10^{18} joules of heat (above 15°C to 10 km of depth) are contained in rocks and water beneath an estimated 2250 sq. km of land area. Thermal water ranging in temperature from 20 to 84°C is extracted from more than 100 domestic, stock, and irrigation wells from two different types of aquifers - sedimentary and volcanic rock. Many of the wells are artesian and range from 150 to nearly 1100 m deep. They are concentrated mostly in four areas - Bruneau River Valley, Little Valley, Grand View, and Oreana where farmland is available for agricultural use. Young and Whitehead's (1975, p. 44-45) assessment of the resource in this area is summarized.

> The rocks in the Bruneau-Grand View area range in age from Late Cretaceous to Holocene. Rocks of the Cenozoic Era have been subdivided in four groups: (1) an unnamed sequence of rhyolitic and related rocks, (2) the Idavada Volcanics, (3) the Idaho Group, and (4) the Snake River Group. For convenience, these rocks units have been divided into two major groups according to their hydrologic properties: (1) the volcanic-rock aquifers that include the Idavada Volcanics, the Banbury Basalt of the Idaho Group and undifferentiated silicic volcanic rocks; (2) the sedimentary-rock aquifers, which include chiefly sedimentary units of the Idaho and Snake River Groups.

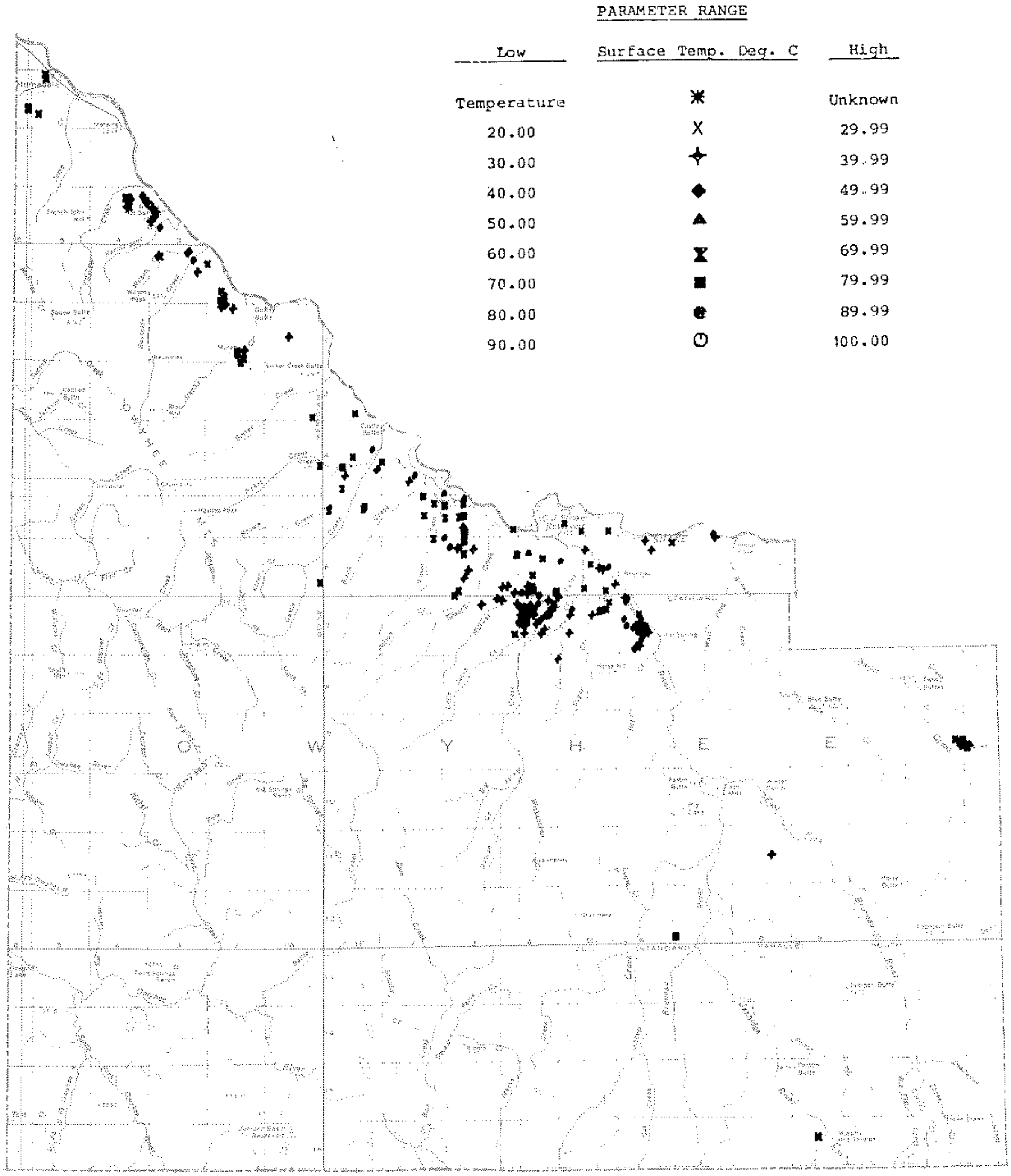


FIGURE 47. Index map of Owyhee County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Recharge to the volcanic-rock aquifer (except the Banbury Basalt) is thought to be chiefly from precipitation in the higher altitudes to the south and southwest of the study area where the rock units are exposed at the surface. Recharge to the sedimentary-rock aquifers and the Banbury Basalt is believed to be mainly by the upward movement of water from the underlying volcanic-rock aquifers.

The Idavada Volcanics or underlying rock units are believed to be the reservoir rocks for the thermal water in the Bruneau-Grand View area.

A system of northwest-trending faults has probably fractured and displaced rocks ranging in age from Pliocene to Pleistocene. Most of the faulting probably occurred in early Pliocene time, with progressively diminishing movements through Pleistocene time. Gravity and aeromagnetic surveys support the theory of a northwestward-trending subsurface structure.

An AMT (audio-magnetotelluric) survey of the Bruneau-Grand View area has revealed a large conductive anomaly in the region between Oreana and Grand View. The low resistivities observed, approaching 2 ohm-meters, imply a hot-water reservoir in which the reservoir rocks have been altered.

Sampled thermal water in the Bruneau-Grand View area is generally of a sodium bicarbonate type. In the study area, thermal water from the sedimentary-rock aquifers generally contains dissolved solids concentrations greater than 600 mg/l, is nearly neutral in pH, and usually contains less than 2 mg/l flouride. Water from the volcanic-rock aquifers generally contains less than 500 mg/l dissolved solids, has pH values higher than 8.0, and has flouride concentrations in excess of 8 mg/l. Chloride concentrations range from 2.7 to 79 mg/l for all sampled water with the values from the volcanic-rock aquifers usually less than 20 mg/l. Sulfate concentrations are much higher for water from the volcanic rock than for the water from the overlying sedimentary-rock aquifers. The chemistry of the thermal water from the volcanic-rock aquifers is very similar to that of thermal water flowing from the granitic rocks of the Idaho batholith.

(Note: Recent deep drilling in the area has revealed the existence of granitic rock underlying the silicic volcanic rock aquifers.)

Ratios of concentration of selected chemical constituents are used to distinguish water from the volcanic-rock and sedimentary-rock aquifers. The chloride-fluoride ratio is probably the best indicator with ratios generally less than 0.6 for water from the volcanic-rock aquifers. Chloride-boron ratios of the hotter water aquifers showed a marked decrease near Bruneau and Grand View because of increased boron concentrations.

Measured groundwater temperatures at the surface in the Bruneau-Grand View area range from 9.5 to 83°C with the higher temperatures (40 to 83°C) found in the water from the volcanic-rock aquifers. Temperatures of the water from the sedimentary-rock aquifers seldom exceed 35°C. The observed groundwater temperatures in the volcanic-rock aquifers seem to be related to the depth to the aquifers.

The gas in samples collected from water in the Bruneau-Grand View area consists primarily of nitrogen, oxygen, and methane. Methane was found primarily in samples from the sedimentary rock aquifers. Analysis of the gas in water from the volcanic-rock aquifers indicates that the gas is essentially that contained in meteroic water recharging the system.

Mineral deposition at wells and springs in the Bruneau-Grand View area is noticeably absent, largely because of the low dissolved-solids concentration in the water.

The source of heat for the deeply circulating thermal waters in the Bruneau-Grand View area is believed to be an above normal geothermal gradient. This above normal gradient could be related to a thinning of the earth's upper crust in this area.

The Bruneau-Grand View area represents a complex geothermal system consisting of several aquifers that may be interconnected by faulting and by wells that have been drilled through the overlying sedimentary rock aquifers into the volcanic rock aquifers. The complexity and intermingling of water from wells drilled into the various aquifers precludes accurate subsurface determinations for every well. Consequently, only aquifer temperatures are given in basic data table 4 (in basic data table 2 all available aquifer temperatures are given) for wells cased at least two thirds of their total depth and to those with surface temperatures of 40°C or above. These estimated aquifer temperatures suggest that the waters in the Bruneau-Grand View area have never been very hot (100 to 110°C) and in some cases may have come from depths where temperatures are even cooler (70 to 100°C). Deep drilling in the area has given conflicting results, although the most accurate seems to come from Phillips Petroleum's Lawrence D. No. 1 well (5S-1E-24ad1) with a reported bottom hole temperature of 108°C at a depth of 2,672 m.

Young and Whitehead's study was limited to an area south of the Snake River. It is not known whether the aquifer systems extend north of the Snake River. Warner (1975) postulated the existence of a large northwest striking left lateral rift system near the present course of the Snake River, with clockwise or northwestward rotation of about 80 km of the northern block relative to the southern block. Rifting postdates formation of the sedimentary and volcanic rock aquifers of the Bruneau-Grand View area. If this rifting hypothesis is correct, the sedimentary and volcanic rock aquifers in the Bruneau-Grand View area have been rifted also, and the other "half" of this thermal anomaly may have been subsequently shifted northwestward to now lie somewhere between Boise and Weiser. Indeed, much thermal water has been found by well drillers in Ada, Canyon, Payette and Washington counties.

TWIN FALLS COUNTY

Thermal water in Twin Falls County (figure 48) is widely scattered occurring principally in the northeastern and eastern part of the county. There are 56 thermal water occurrences with surface temperatures of 20°C or above.

Miracle (8S-14E-31acb1S) and Banbury (8S-4E-33cba1S) hot springs are resorts located along the Snake River in north-western Twin Falls County. Several wells are also located along the Snake River north and west of Buhl.

A number of wells have encountered warm water in the Blue Gulch area northwest of Balanced Rock and west of Salmon Falls Creek. A fairly large warm water aquifer may exist here, judging from the number and spacing of thermal wells. A general alignment of wells and springs along the eastern margin of the thermal anomaly may indicate faulting or other geologic structure that may control thermal water here. A large northwest-trending linear feature (figure 29), which stretches from Mountain Home to Salmon Falls Creek (90 km), may also control thermal water here and feed the aquifer system. Wells generally average 190 m deep and well head temperatures average about 27°C.

A well 0.8 km east of Buhl may indicate some potential for low temperature geothermal use in the Buhl area. No other information is available on this well except that the well head temperature is 26°C.

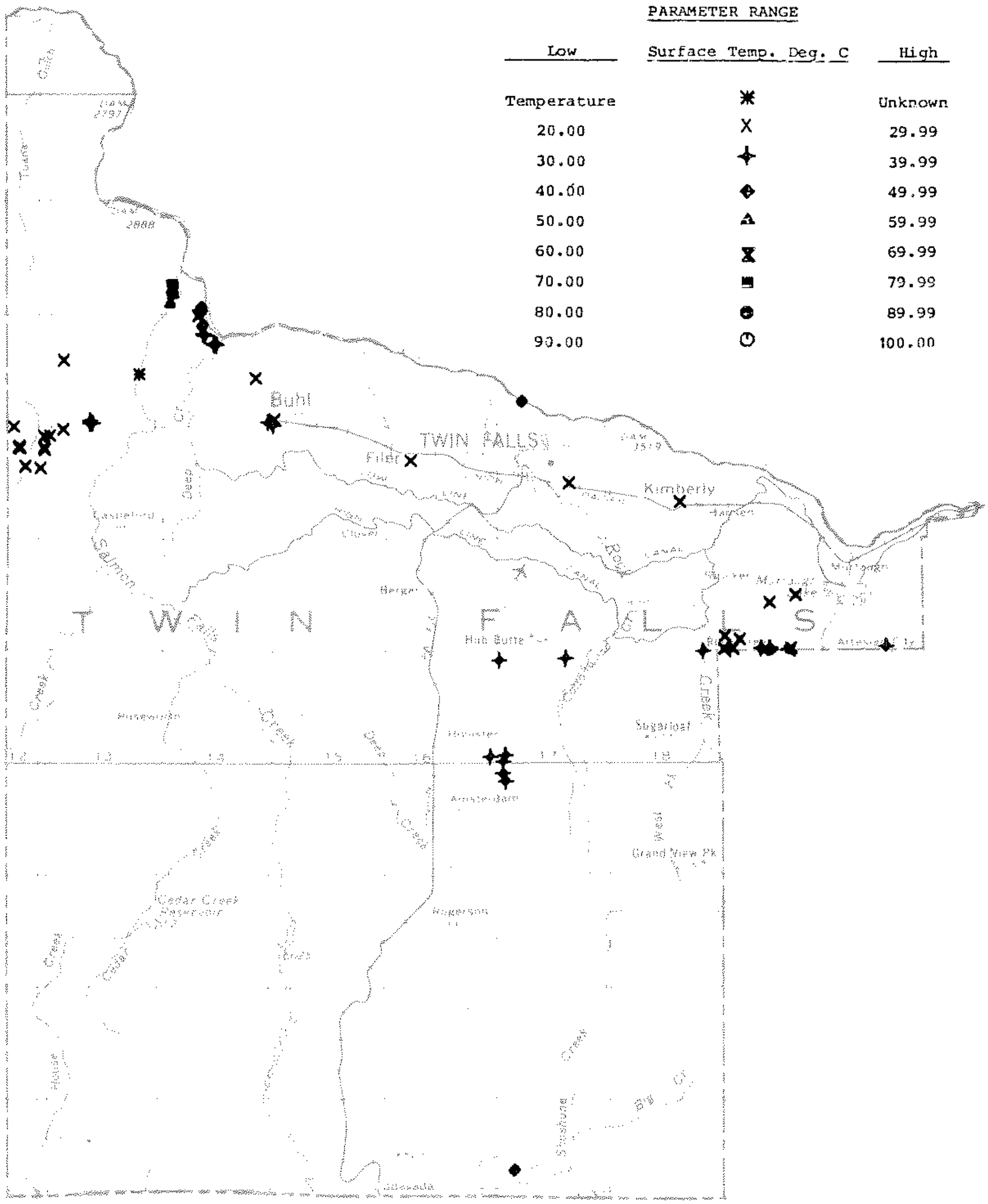


FIGURE 48. Index map of Twin Falls County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

The city of Filer owns a well (10S-16E-8cdal) having a well head temperature of 27°C. Another well temperature of 29°C exists on the outskirts of Twin Falls (10S-17E-14ccdl) and indicates a possible thermal source may exist in this area also. A well (10S-18E-26bbal) between Hansen and Kimberly is also 20°C and a large concentration of wells (10 in Twin Falls County and 20 in western Cassia County) exists east of Cedar Hill and southwest of Murtaugh Lake near Artesian City. These wells are aligned in a nearly east-west direction and occur near the foot of the South Hills. This may indicate a large fault could exist here. Most of the wells are in the 27 to 37°C range and range in depth from 150 to 365 meters.

Perhaps the first or only geothermally heated dog house in the world exists at Magic Hot Springs (16S-17E-30acalS) in southern Twin Falls County near a small private resort close to the Idaho-Nevada border. Here thermal water is used for recreation, balneological purposes and for space heating a number of cabins.

Nat-Soo-Paw Warm Springs (12S-17E-31bablS) is located 5 km east of Hollister and flows at 36°C surface temperature from Quaternary alluvium near Tertiary silicic volcanic rocks along a possible concealed fault. Nat-Soo-Paw has been a resort for many years. Several other thermal springs existed in the Hollister area but are now dry due to well drilling. Several wells in the area discharge thermal water of low temperature (from 20 to 38°C).

Donaldson and Applegate (1979) reported that:

> The Twin Falls area lies on the boundary of the subdivision of the Snake River Plain into its eastern and western components. This may be significant if the division reflects a crustal break as has been suggested by Malde (1959) based on gravity and earthquake epicenters.
>
> In this area gravity does not suggest any sharp structural features. The regional gradient toward the axis of the plain is dominant with the exception of a broad 5-10 mgal low centered about 23 km due east of Jerome (figure 49). A corresponding local magnetic low (figure 50) enhances the possibility that a structural depression exists. There are no active faults documented by Witkind (1975) in this subarea but Day (1974) has mapped lineaments from ERTS imagery which approximate the trend of the western plain in direction (figure 10).
>
> A series of warm wells in the southern portion of this area match quite closely the trends of 3 active faults reported by Witkind (1975).

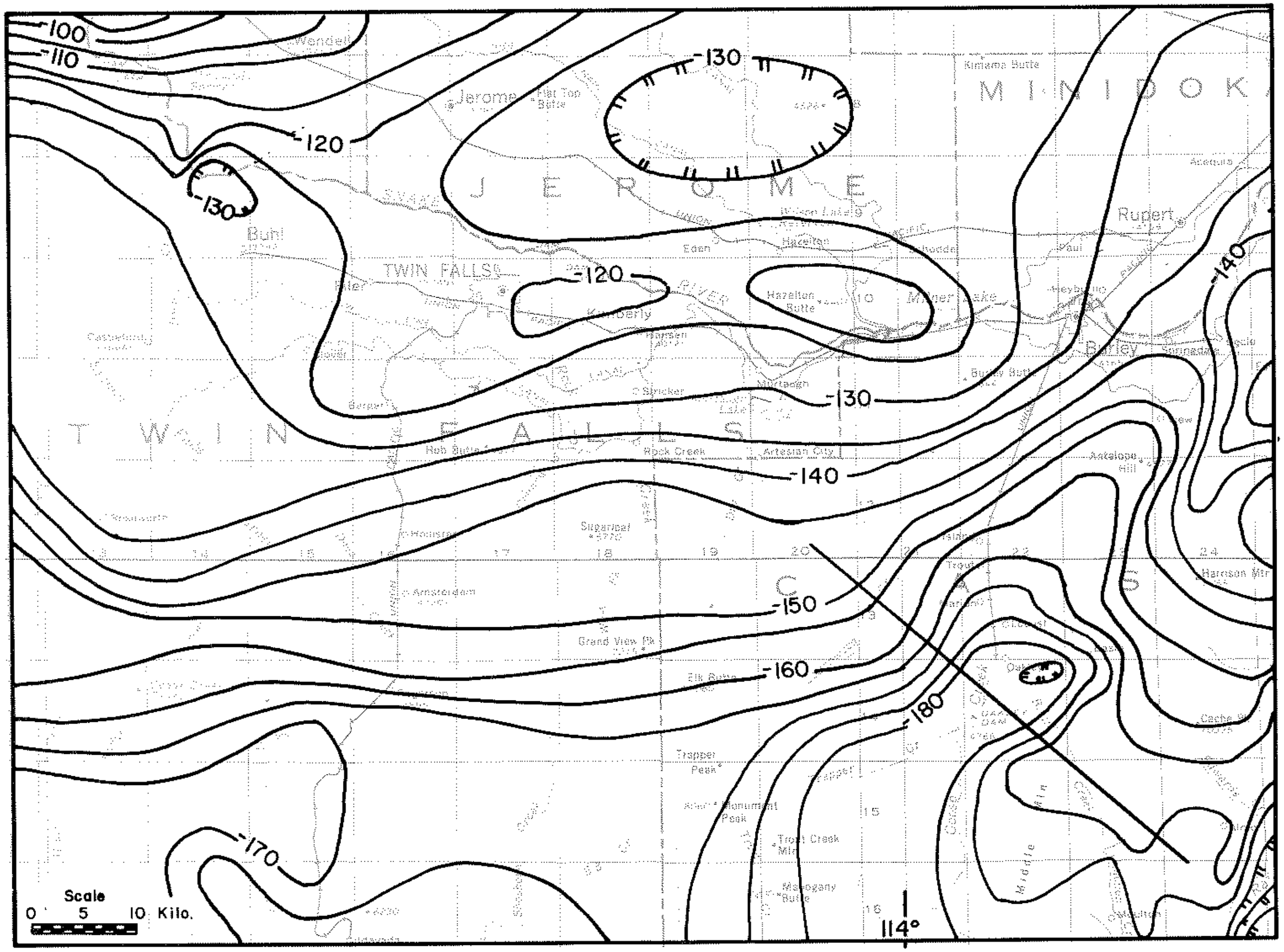


FIGURE 49. Gravity map showing lows near Buhl (upper left), east of Jerome (upper center) and near Oakley (lower right). (Mabey, Peterson and Wilson, 1974.)

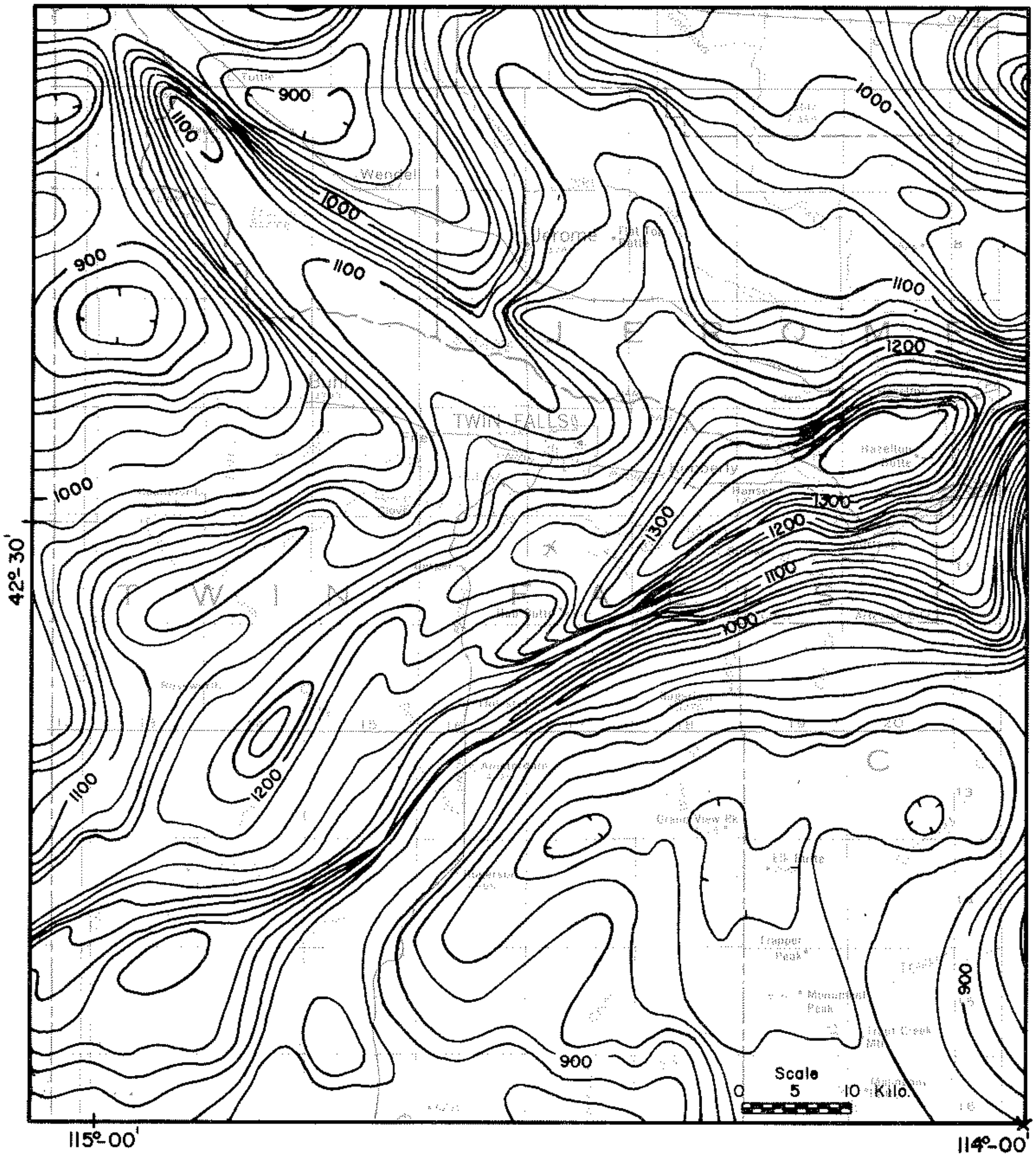


FIGURE 50. Aeromagnetic map showing low west of Jerome (upper right) (U.S. Geological Survey, 1971).

NORTHERN FREMONT COUNTY

Extensive geothermal leasing activity is ongoing in the Island Park basin in east-central Fremont County near Yellowstone Park (figure 51). Stearns and others, (1939, p. 28-29) recognized this basin as a caldera. Hamilton (1965, p. C1) described the "Island Park caldera" as "an elliptical collapse structure 29 by 37 km in diameter that was dropped from the center of a shield volcano composed of rhyolite ash flows." Hamilton further described the caldera as:

> ...part of the Snake River-Yellowstone province of intense Pliocene and Quaternary volcanism of olivine basalt and rhyolite. In this province, as in other bimodal volcanic provinces, rhyolite and basalt erupted from vents interspersed in both time and space, and simultaneous eruptions of both liquids from the same or nearby vents are known to have occurred. In the Island Park caldera the eruptive sequence and geometry suggest that the large magma chamber contains liquid rhyolite overlying liquid olivine basalt.

Hoover and Long (1975, p. 1,062) stated:

> Current geologic evidence suggests that a Yellowstone-type system does not exist at Island Park because the last major rhyolite body was emplaced about one million years ago and subsequent eruptions were of basaltic composition coming from the mantle along fractures in the older caldera (R.L. Christiansen, oral commun., 1975). The general absence of hot springs also suggests an old system. AMT and telluric surveys were made in August 1974 to study the possible existence of concealed hydrothermal activity.
>
> The generalized geology of rock types in the caldera is shown in figure 52 with the 7.6 Hz north-south AMT data. The caldera stands out as an area of high resistivity, generally above 100 ohm-m surrounded by a region of intermediate values. Within the caldera local highs around 1000 ohm-m are associated with small rhyolite domes on the surface, and most hidden by later basalt flows. The AMT data shows the possibility of another rhyolite body on the western rim of the caldera which has been covered by tuff and rhyolite flows and may represent a source for some of these materials.
>
> An east-west cross section is shown in figure 53. Included in the figure is a skin-depth

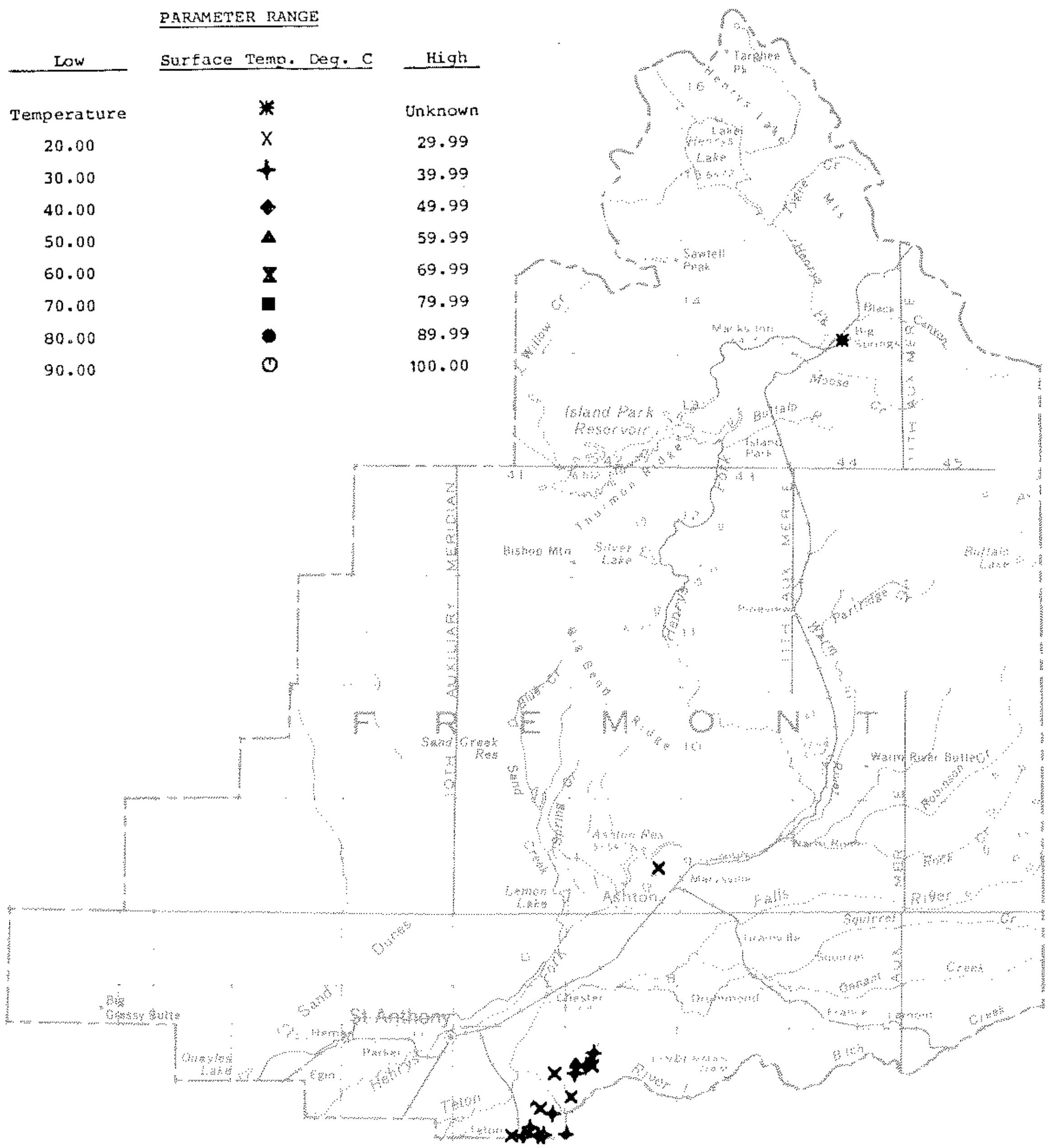


FIGURE 51. Index map of Fremont County showing the locations of thermal water occurrences with surface temperatures of 20°C or higher.

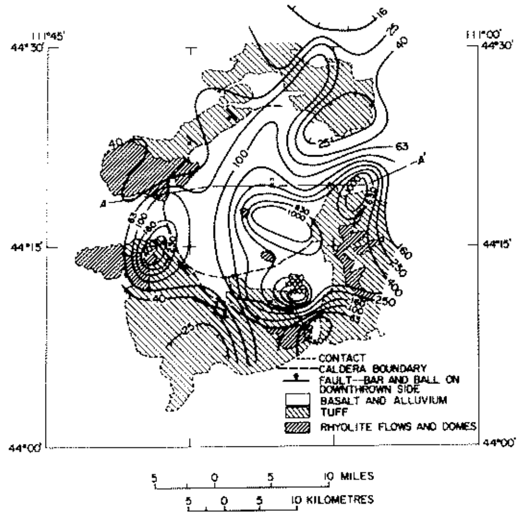


FIGURE 52. Map of rock types and 26 Hz apparent-resistivity (telluric line north-south), Island Park, Idaho. Contours in ohm·meters and logarithmic basis.

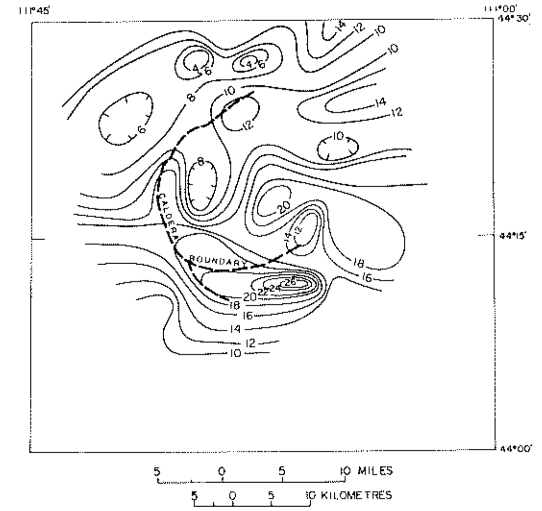


FIGURE 54. Telluric anomaly map at 20- to 30-sec period, Island Park, Idaho. Contour interval $2K = 10\sqrt{J}$.

(Hoover and Long, 1975.)

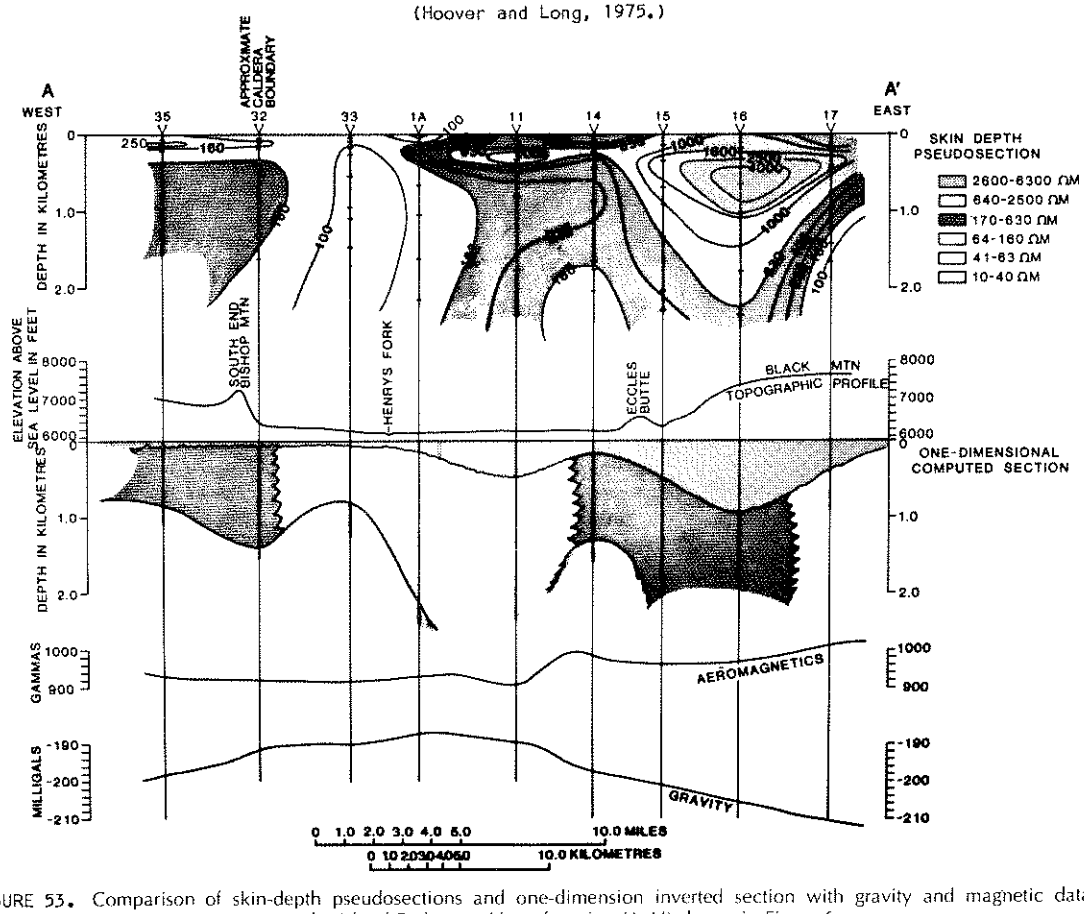


FIGURE 53. Comparison of skin-depth pseudosections and one-dimension inverted section with gravity and magnetic data across the Island Park area. Line of section (A-A') shown in Figure 6.

pseudosection obtained by contouring the apparent resistivities at their corresponding skin depths on the section, and a second section obtained by one-dimensional inversion of the same sounding curves. The corresponding gravity and magnetic data show an edge of the body near station 11. The gravity data show a high associated with the caldera partly masked by the flanks of the extreme low associated with the Yellowstone region.

The telluric survey data appears in figure 54 which shows a high degree of correlation with the AMT data. Telluric data was obtained in the 20 to 30 second period range, which would give a skin depth around 25 km in 1000 ohm-m material. The high-resistivity material in the southeast part of the caldera is present at depth as indicated on the telluric map, and even the smallest high on the western edge can be seen as well. The telluric data also clearly shows the caldera as a region of high resistivity. This implies that the caldera has cooled, that there is little rock alteration, and that the area is not now a very promising exploration target. The high resistivities in Island Park basin clearly support Christiansen's inferences.

BUTTE COUNTY

Four warm wells are known in Butte County (figure 55) and are located near the northern margin of the Snake River Plain. Three are in Butte City, 5 km south of Arco, and another is between Arco and the Craters of the Moon National Monument.

One Butte City well (3N-27E-9abbl) (35°C) was originally drilled to a depth of 259 m in search of cold water. There was an increase in the temperature as the drilling went deeper so the well was backfilled to 145 m. Subsurface temperatures may be as high as 76°C at this location. Another Butte City well (3N-27E-9abb2) is 33°C and was drilled to a depth of 152.5 m. The chalcedony and Na-K-Ca chemical geothermometers indicate temperatures between 52 and 54°C might be encountered by deepening the well.

The oldest warm water well in this area (3N-27E-9aabl) was drilled in 1919 to a depth of 183 m and produced water in the 40°C temperature range. Another well (3N-25E-32cdcl) is 110 m deep and has a surface temperature of 43.5°C.

Butte City-Arco might be an area where use of thermal water for space heating could prove feasible. As other wells in the area have not encountered thermal water, it

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	⬢	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00

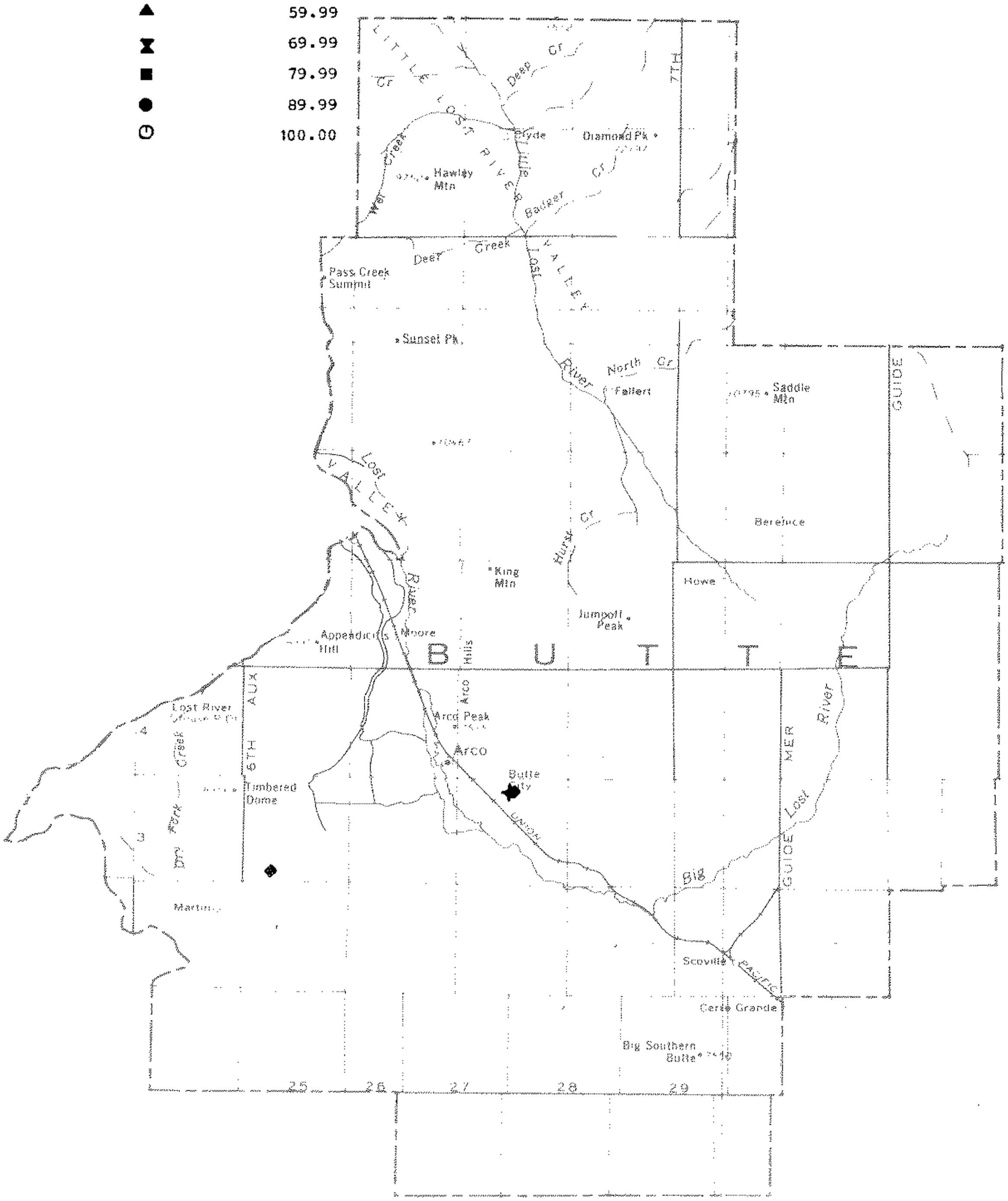


FIGURE 55. Index map of Butte County showing locations of thermal occurrences with surface temperatures of 20°C or higher.

appears these thermal occurrences are structurally controlled (maybe drilled into faults along which the thermal water is rising). Any studies should be designed to delineate the faults and determine the extent of the resource along them. This could be accomplished by geophysical techniques, coupled with detailed geologic mapping, of the area around Butte City and Arco. Hydrologic and geochemical studies should be pursued in order to determine developmental effects on already existing groundwater supplies.

WESTERN CASSIA COUNTY

Several warm irrigation wells are located between Oakley and Burley west of the Albion Range in western Cassia County (figure 56). Measured surface temperatures range from 21 to 39°C and known well depths range from 76 to 585 m.

The largest concentration of wells in western Cassia County occurs near Artesian City. Drilling of irrigation wells in this area indicates the existence of a fairly large thermal zone, possibly fault fed at the base of the South Hills. Temperatures are fairly low, ranging from 24 to 38°C. This area might prove suitable for some type of large scale low temperature geothermal development, possibly related to agricultural use in the area.

Oakley Warm Springs (14S-22E-27dcb1S), 5 km south of Oakley, is used as a small natatorium. Warm waters issue from a fault in Paleozoic quartzite at 48°C and 40 l/min from two springs and a well. Subsurface temperatures predicted by chalcedony and Na-K-Ca chemical geothermometers are 89 and 92°C, respectively.

Donaldson and Applegate (1979) reported:

> A gravity map compiled by the USGS (Mabey, Peterson and Wilson, 1974) reveals an anomaly in the vicinity of Oakley, Idaho. The anomaly is a relatively small amplitude low which trends basically north-south, broadens near the Utah-Idaho Border and narrows and shifts eastward north of Trapper Creek (figure 49). A southeast trending gravity profile was taken from map values (figure 57). Computations based on a 21 mgal anomaly and a density contrast of 0.4 g/cc (gram per cubic centimeter) results in a basin depth estimate of about 1250 m near Oakley. The profile indicates a regional gradient with gravity increasing toward the Snake River Plain and decreasing toward a neighboring gravity low southeast of Almo, Idaho.
>
> The Oakley anomaly is not strongly definitive of structure and Witkind (1975) does not document

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00

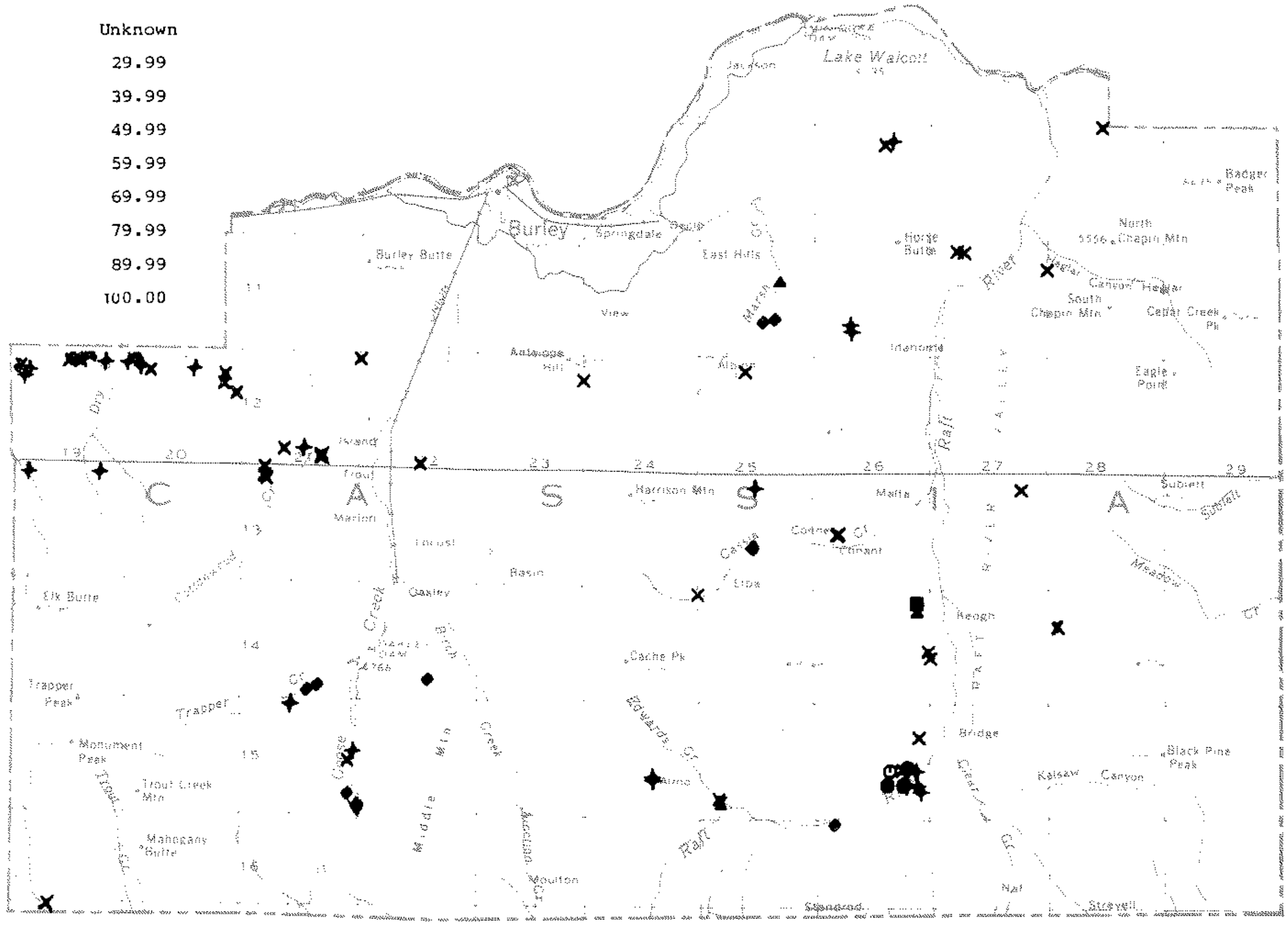


FIGURE 56. Index map of Cassia County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

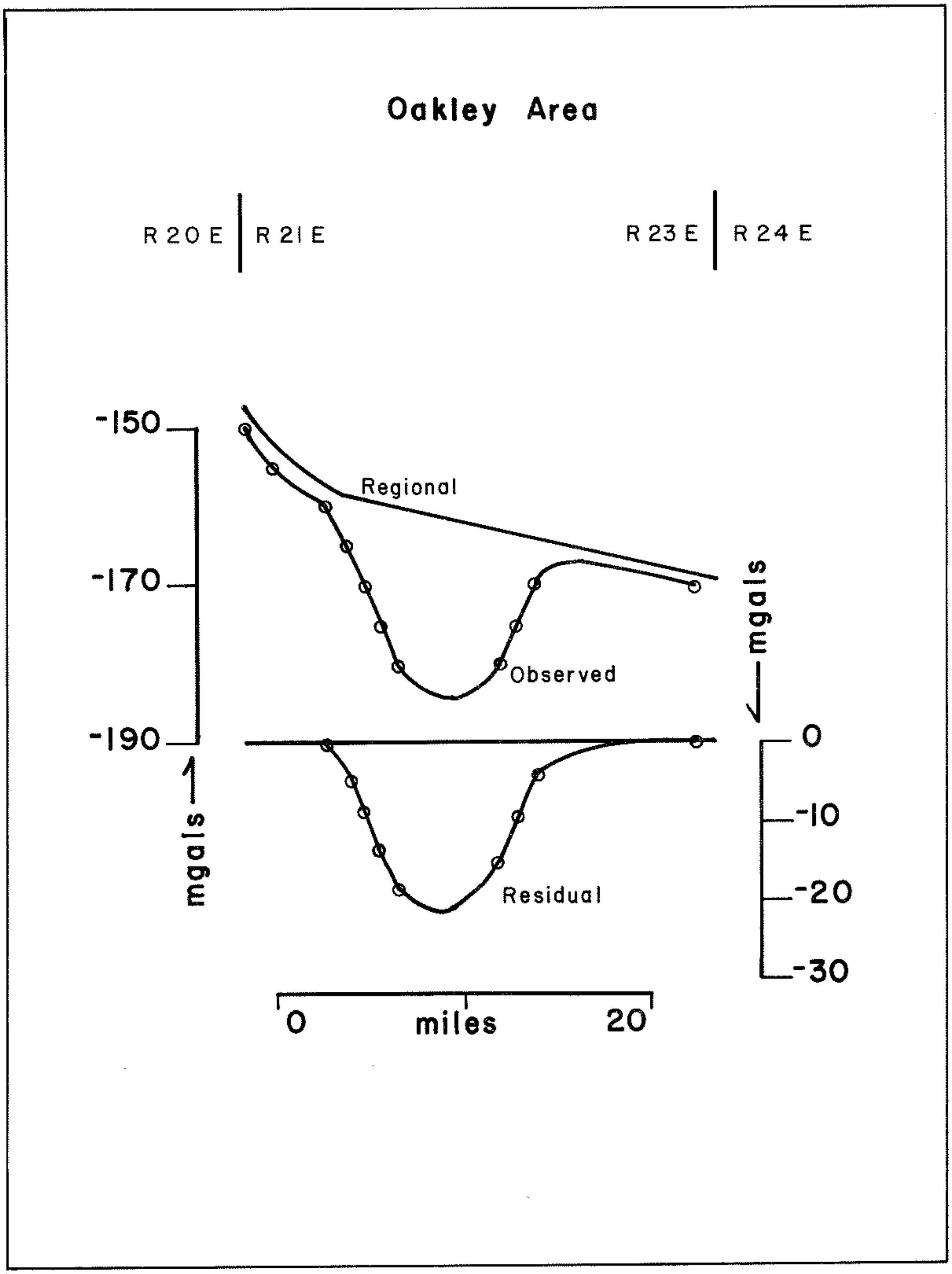


FIGURE 57. Gravity profile near Oakley (from Donaldson and Applegate, 1979).

known or suspected active faults which would control the nose of the anomaly to the northeast. He does identify a fault suspected of being active since mid-Miocene which lies about 11 km west of Oakley, trends northwest and appears to control a rather linear topographic break. The position of this fault does correlate very well with a coherent distortion of gravity contours as expected for movement downward toward the basin.

While faults are not documented to define the gravity suggested structure, Day (1974) has mapped lineaments from ERTS imagery which correspond very well to the location, shape and trend of the gravity anomaly (figure 9).

The basin depth estimate of about 1250 m near Oakley is a very conservative estimate based on calculations using a Bouger approximation. This approximation is generally quite accurate where basin width is several times the basin depth and results in increasingly conservative estimates as the width to depth ratio decreases.

Assuming a 1250 m deep basin structure with a basement rock thermal conductivity of 6.0 mcal/cm/^{o}C, a basin fill thermal conductivity of 3.0 mcal/ cm/^{o}C, and a heat flow of 3.0 HFU (see Brott, et al., 1976), one can calculate a predicted temperature of about 90^{o}C at maximum depth (Diment, et al., 1975). This maximum temperature estimate is conservative in the same sense that the depth estimate is considered conservative.

SUMMARY - SNAKE RIVER PLAIN REGION

Table 5 shows cities, towns, and recreational home areas in central Idaho that are near known thermal water. These towns probably could make use of thermal water for space heating of schools and public buildings if sufficient flow rates and temperatures could be obtained by drilling. The subsequent reuse of the warm water effluent through water-source heat pumps would give a greater and more economic use of a limited heat source. The hot springs near transportation lines might be used to establish small industries suitable to thermal water found in the area. In certain places (see basic data table 1) fluoride concentrations in the thermal water that exceed EPA's drinking water standard (to 2.4 mg/l depending on temperature) might lead to disposal problems. The areas near these towns would probably be evaluated without large capital outlays for exploration as the target areas are limited in size. In this area, those with the potential for the highest return in conventional energy savings should be evaluated first. These would include areas of largest population or of greatest industrial potential. Initial evaluations of the geothermal resource in the Boise Front area has already been conducted. Several successful exploration holes have been drilled. Other areas needing initial assessment work are Nampa-Caldwell, Twin Falls, Mountain Home, and Mountain Home Air Base. Weiser has received an initial assessment, but no drill sites have been selected. More work is needed there and near Payette to select possible drill sites.

Exploration programs including detailed geophysical studies, such as gravity, magnetic, resistivity, and reflective seismic surveys, as well as hydrologic studies including isotope and additional geochemical work should be pursued in areas near known thermal water to determine structure and select drill sites. These surveys probably should be conducted by federal or state people or by private entities with federal or state assistance as these studies are expensive and small private companies have little capital to invest in such programs. Large corporations with exploration money presently are not interested in what they feel are minor energy users and will not invest money to supply energy to one or even several users. However, combined users switching to a geothermal source in several of these areas could significantly affect the present energy consumption pattern in Idaho and help Idaho toward becoming more energy self-sufficient.

TABLE 5

CITIES AND TOWNS IN THE SNAKE RIVER PLAIN REGION WITHIN 5 KM (3 MI) OF A 20°C OR HIGHER THERMAL SPRING OR WELL (1978)

Town	County	Location	Spring or Well Surface Temperature °C	*Best Estimated Subsurface Temperature °C Min. Na-K-Ca	*Best Estimated Subsurface Temperature °C Max. Chalcedony	Total Dissolved Solids	Present Water Use	Population	Surface Owner	Remarks
Boise	Ada	3N-2E-12cdd1	71	80	96	286	Space Heating	92,901	Private	One of several wells in Boise area. Depth range 122-430 m.
Buhl	Twin Falls	9S-14E-36d	--	--	--	--	--	3,382	Private	No chemical analyses available.
Caldwell	Canyon	4N-3W-28aab1	28	54	70	203	Irrigation Recreation	15,643	City of Caldwell	Flowing well.
Cambridge	Washington	14N-3W-19cbd1S	26	65	76	312	Unused	451	--	
Emmett	Gem	6N-2W-14acc1	20	--	--	--	Domestic	3,943	Private	Plans are for space heating a shop. No chemical analyses available.
Filer	Twin Falls	--	--	--	--	--	--	1,420	Private	--
Glenns Ferry	Elmore	5S-10E-32bdb1	38	67	68*	364	Natatorium	1,387	Private	--
Hanson	Twin Falls	10S-18E-26bba1	20				Irrigation	450	--	--
Hollister	Twin Falls	12S-17E-31bab1S	36	81	29	279	Natatorium	63	City of Hollister	Well located halfway between Hanson and Kimberly.
Homedale	Owyhee	--	--	--	--	--	--	1,601	Private	--
Kimberly	Twin Falls	10S-18E-26bba1	--	--	--	--	Irrigation	1,780	Private	Well located halfway between Hanson and Kimberly.
King Hill	Elmore	5S-11E-7acd	32	63	65*	235	Domestic	--	Private	--
Kuna	Ada	2N-1W-35caa1	25	--	--	--	Irrigation	941	Private	96 meters deep 3,595 lpm.
Melba	Canyon	--	--	--	--	--	--	221	Private	--
Midvale	Washington	13N-3W-8ccc1	23	46	68*	318	Public supply	447	--	Municipal well.
Mountain Home	Elmore	3S-6E-26adc1	23	--	--	--	Municipal water supply	6,755	City of Mountain Home	City well 305 m deep.
Mountain Home Air-base	Elmore	4S-5E-25bbc1	24	47	62	114	Irrigation	6,000	Private	Well 162 m deep.
Murphy	Owyhee	--	--	--	--	--	--	--	Private	--
Nampa	Canyon	--	--	--	--	--	Recreation	23,584	City of Nampa	Well No chemical analyses available.

Table 5. Cities and Towns in the Snake River Plain Region within 5 km (3 mi) of a 20°C or Higher Thermal Spring or Well (continued)

Town	County	Location	Spring or Well Surface Temperature °C	*Best Estimated Subsurface Temperature °C Min. Na-K-Ca	Max. Chalcedony	Total Dissolved Solids	Present Water Use	Population	Surface Owner	Remarks
Parma	Canyon	4N-3W-35abc1	28	54	70	--	Municipal water use	1,879	City of Parma	Well 46 m deep.
Paul	Minidoka	9S-23E-28cca1	22	--	--	--	Municipal water use	911	City of Paul	Well 137 m deep.
Twin Falls	Twin Falls	10S-17E-14cdd1	29	--	--	--	Irrigation	23,616	Municipal well	--
Weiser	Washington	11N-6W-10cca1	70	145	152***	197	Natatorium, greenhouse	4,607	Private	Several small diameter wells.
Oakley	Cassia	14S-22E-7dcb1S	47	90	90	295	Natatorium	698	Private	Warm spring.

*See first footnote, Table 4.
**Minimum temperature is chalcedony temperature. Maximum temperature is Na-K-Ca temperature.
***Minimum temperature is quartz temperature. Maximum temperature is Na-K-Ca temperature.

GEOTHERMAL POTENTIAL OF THE BASIN AND RANGE
OF SOUTHEASTERN IDAHO
INCLUDING EASTERN CASSIA, ONEIDA, FRANKLIN, BEAR LAKE
CARIBOU, BANNOCK, POWER, BINGHAM, BONNEVILLE, MADISON,
JEFFERSON, SOUTHERN FREMONT, CLARK
AND TETON COUNTIES

Thermal springs and wells in the Basin and Range-Central Rocky Mountain Region (figure 6) generally share several characteristics - including high dissolved solids, high HCO_3 content and generally precipitation of $CaCO_3$ in the form of travertine. This area also is endowed with certain geologic characteristics that favor the occurrence of geothermal energy.

The eastern margin of the Basin and Range Province is within a long narrow curvilinear zone of earthquake activity stretching from Las Vegas, Nevada, on the south to Flathead Lake, Montana, on the north, known as the Intermountain Seismic Belt (Smith and Sbar, 1974). This zone is interpreted to be a boundary between subplates of the greater North American crustal plate, where differential movements between the Basin and Range and Colorado Plateau-Rocky Mountain provinces are taking place (Sbar and others, 1972). Plate and subplate boundaries are considered to be excellent areas for prospecting for geothermal resources. Youthful magmatic activity, areas of high heat flow, and thermal spring activity are known to occur along the Intermountain Seismic Belt. In Idaho, the approximate axis of the belt passes near Preston, in Cache Valley, through the Soda Springs area in Caribou County to Driggs in Teton County and into the Yellowstone Park area.

The Basin and Range Province in Idaho consists predominantly of block faulted mountain ranges separated by Intermontane basins arranged in an echelon pattern. Mountain front faults are considered to be normal faults by most authorities. Most of the block fault ranges tilt eastward, and valleys have been partially filled with eroded waste rock from adjacent mountains. Rock types here differ from most of the rest of the state, since they are mostly marine limestones, dolomites, shales, siltstones, and sandstones ranging in age from Precambrian through Permian, and Cretaceous, and younger land derived sediments. The rocks in general are older in the central part of the area and become increasingly younger toward the edges of the Province.

Thermal spring activity is widely distributed through the Basin and Range Province, and wells have encountered thermal water locally. Most springs are associated with known faulting or lineaments but not necessarily with valley-mountain range boundary faults. Most springs are near drainages and are therefore at low elevations. Thermal springs and wells in southeast Idaho exhibit the highest dissolved solids of any found in Idaho, presumably reflecting the soluble nature of the marine sedimentary bedrock. Thermal springs and wells are found in areas of no known adjacent igneous activity.

Thermal springs and wells in southeastern Idaho seem to occur along suspected curvilinear zones (figure 9) similar to springs in the central part of the state. The curvilinear zones may not be quite so well defined here as in the crystalline granitic terrain of central Idaho. One zone, stretching from Bear Lake Hot Springs to Blackfoot River Hot Springs near the north end of Blackfoot Reservoir, has an apparent gap between Georgetown and Soda Springs where no thermal springs appear. Actually, a cold water spring associated with voluminous travertine deposits does exist near the center of the gap. It is thought that this spring was once thermal.

The largest curvilinear zone, stretching from the southern Idaho border up to Big Springs in Island Park (near Yellowstone National Park), coincides with a lineament that stretches from the northern part of the Great Salt Lake, somewhat discontinuously, up to at least Brockman Creek warm springs.

Discussion of the geothermal potential of this region follows on a county basis.

EASTERN CASSIA COUNTY

The best known and most studied geothermal anomaly in Idaho is in the Raft River Valley (figure 56), a north trending basin and range valley in southern Idaho immediately south of the Snake River Plain. The Raft River KGRA (known geothermal resource area), was formerly known as the Frazier KGRA after C.W. Frazier who drilled the first hot water well there for irrigation and stock watering purposes. This well was drilled to a depth of 122 m and issued 95°C water. Later, another hot well (92°C), was drilled on the Crank property and is presently used for greenhouse heating. Many other thermal wells exist in the Raft River Valley ranging from 20 to 148°C.

The largest variety of geothermal testing and experimentation at any single location in the world is presently underway or developing (Chappell and others, 1978, p. 83) at the Raft River site. The principal experiments have been summarized by the above authors (p. 85) as follows:

Soil Cooling
Soil Heating Agriculture
Aquaculture
Agriculture
Fluidized Bed Drying
Gas Air Conditioning
Component Testing
Tube & Shell Heat Exchanger
Direct Contact Heat Exchanger
60-KW Turbine-Generator
Environmental
Reservoir Engineering
Heat Dissipation (Pond Cooling)
Supply Well Mixing Tests
Injection Testing
Aerated Geothermal Water Corrosion
Cooling Tower Chemistry of Brine as Makeup Water
Sulfide Oxygen Scavenge Test
Asbestos Cement Pipe
Downhole Pump Test
500-KW Turbine-Generator Direct Contact

Many reports describing results of these experiments are available and listed as the ANCR & TREE reports in the Selected References.

Geophysical studies (Mabey and others, 1978, p. 1,470-1,478) have been conducted to infer the structure and general lithology underlying the valley (figures 58-60).

The thermal waters are believed to be derived from a deep fault and may be similar to other basin and range occurrences in Idaho. From several deep well tests in the Raft River Valley, a certain degree of reliability has been proven relating to the chemical geothermometers. The quartz and Na-K-Ca predicted aquifer temperatures (Young & Mitchell, 1973 and mixing models in unpublished data) agreed very closely (within 10°C) with temperatures found at depth (Kunze, 1975). Indeed, the Na-K-Ca chemical geothermometer predicted temperatures almost exactly as were found. This proven reliability in the Raft River Valley gives some measure of confidence in applying the same methods to other similar areas of the state.

To date, seven deep wells have been drilled to depths of 1,525 m into indicated fault zones, and large quantities of thermal water near 150°C have been encountered. From further well tests, it appears that the geothermal system is capable of sustained production of sufficient water to run a 50 megawatt power plant, although present plans are limited to 10 megawatts. The power generation system will be a binary cycle system.

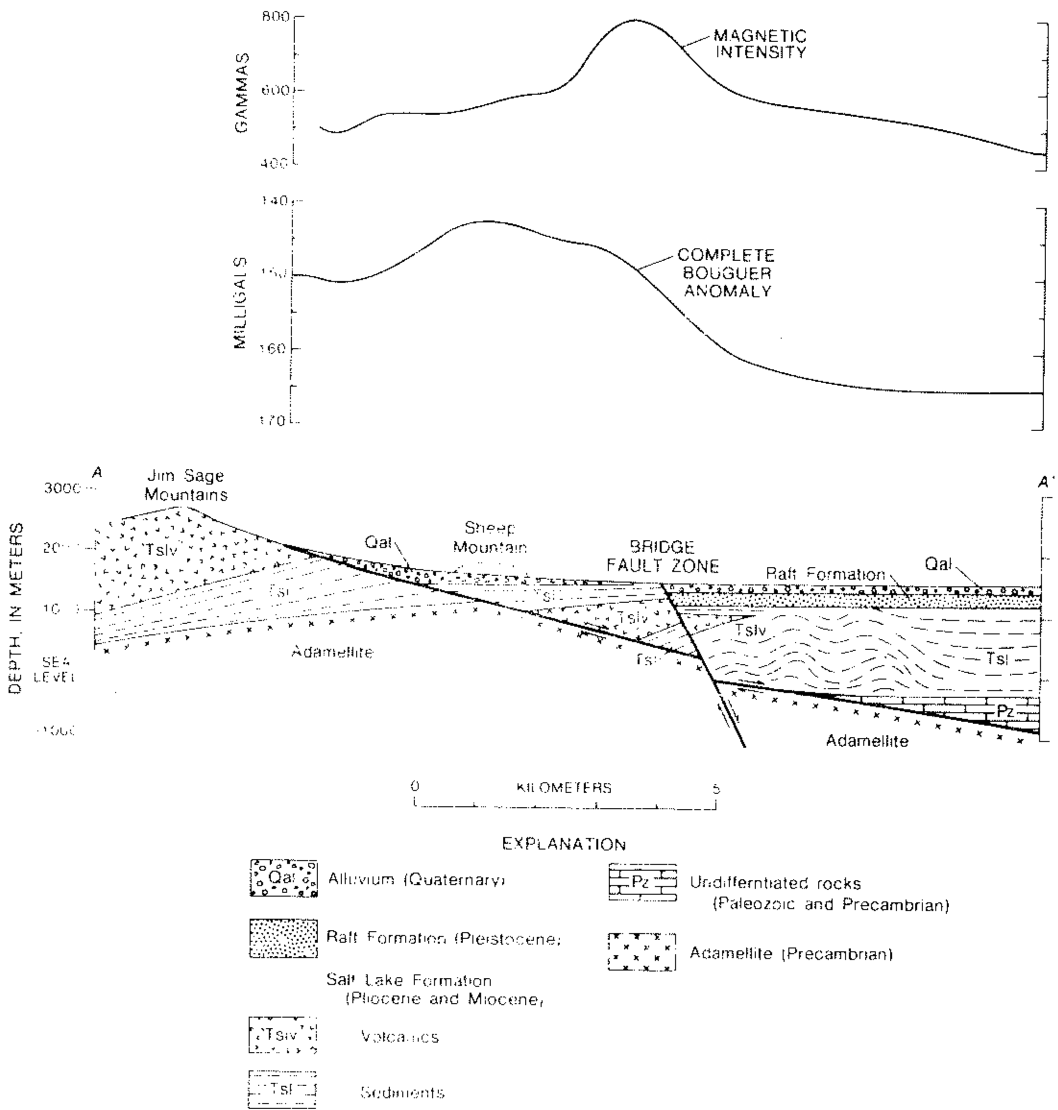


FIGURE 58. Interpreted section across the west side of the southern Raft River Valley. (From Mabey and others, 1978.)

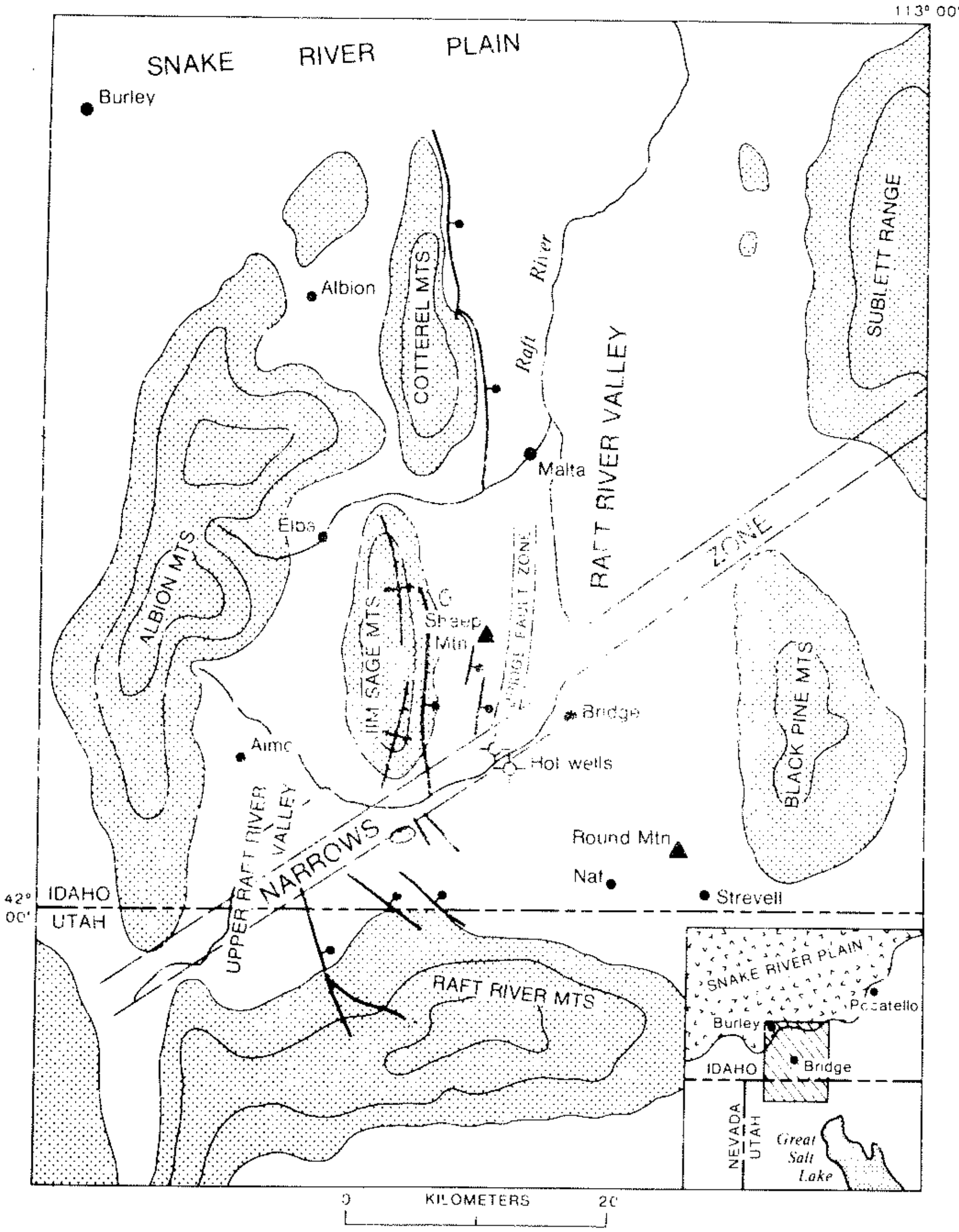


FIGURE 59. Map of the Raft River Valley region, Utah and Idaho, showing major topographic features and faults. (From Mabey and others, 1978.)

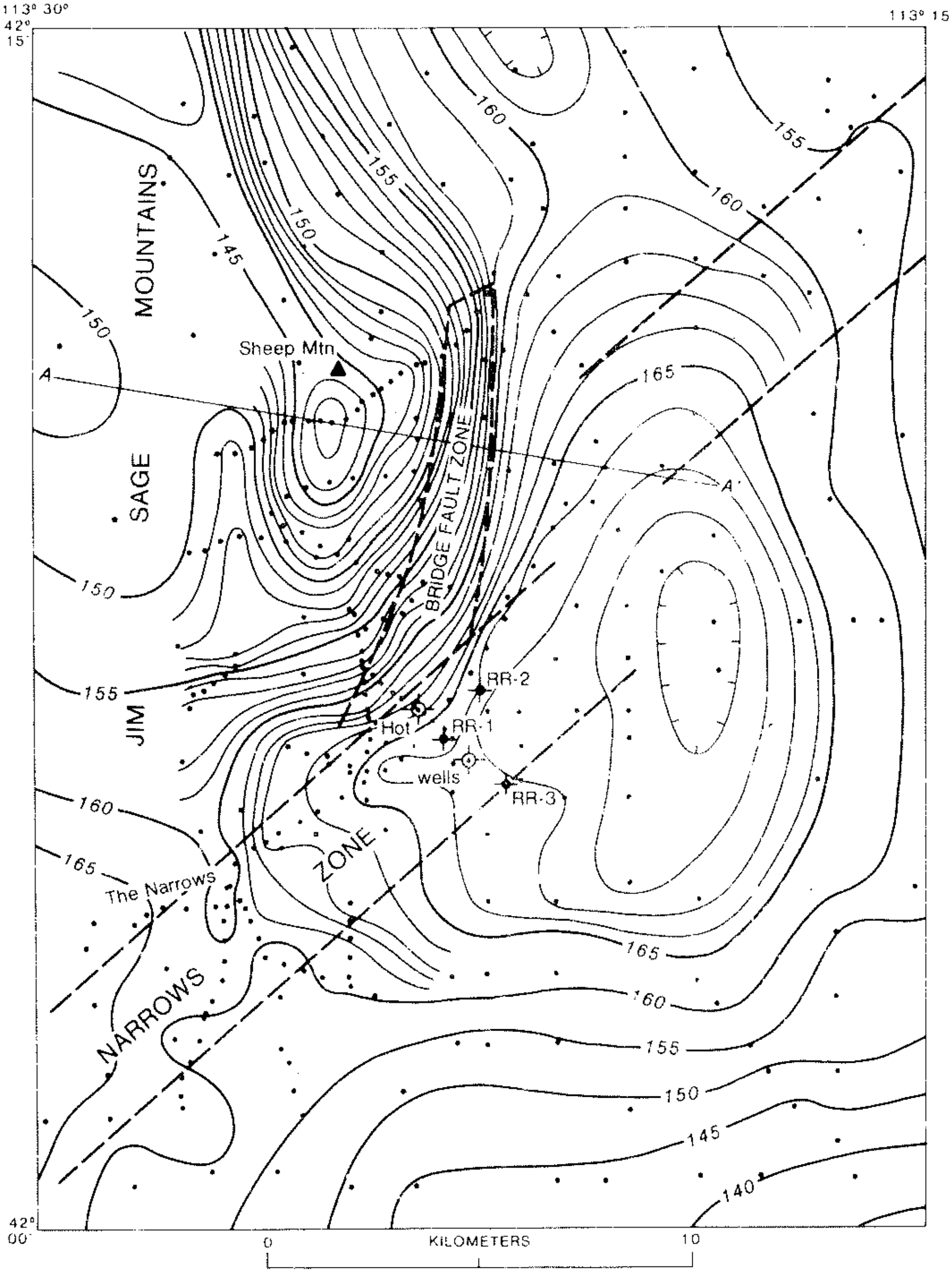


FIGURE 60. Complete Bouguer gravity anomaly map of the southern Raft River Valley. Contour interval is 1 and 5 milligals. Deep drill holes are shown and numbered. Dots are gravimeter stations. (From Mabey and others, 1978.)

Other springs and wells exist in the Raft River Valley and Cassia County, some of which are located along arcuate trends, as in north-central Idaho.

Oakley Warm Springs (14S-22E-27dcbl) located near Oakley in an adjoining valley west of Raft River issues at 47°C from Paleozoic quartzite and is developed as a small resort. The other wells documented in Cassia County are for irrigation or domestic uses and are in rural locations as are the springs.

ONEIDA COUNTY

Five thermal springs are located in Oneida County (figure 61) in the Malad Valley. All are fairly low in surface temperature and most occur near surface drainages. Pleasantview Warm Springs (15S-35E-3aablS) issues at 25°C from Precambrian quartzite and presently is unused. Woodruff Warm Springs (16S-38E-10bbclS) is the warmest spring at 27°C. Price's Hot Spring (16S-38E-23bbdlS) reported by Ross (1971) could not be found. An unnamed spring (12S-34E-36bcblS) exists near the upper end of Malad Valley. Its surface temperature is 24°C. Malad Warm Springs (14S-36E-27cdalS) issues at 25°C from a travertine mound in the fairgrounds area near Malad City. This spring, being in close proximity to Malad City, appears to have the most potential for development, due to its proximity to a population center.

In addition to the thermal springs, Burnham and others (1969, p. 33) report three areas of saline groundwater in Malad Valley. These saline groundwaters were: "(1) small in volume compared to recharge and groundwater in storage, (2) associated directly with deep circulation along or on the bedrock side of the boundary faults of the valley, and (3) localized in only three small areas." These saline waters might indicate that mineral rich thermal water is mixing with cold groundwaters. Indeed, the cold saline groundwaters are all found near thermal springs - one area near the eastern margin of the Malad Valley from Malad City to Cherry Creek, one area near Pleasantview Warm Springs, and one near Woodruff Warm Springs. If mixing is occurring, there is a good possibility that hotter water could be found by drilling near the warm springs. Careful targeting of drill holes to intersect faults at depth should be undertaken before any drilling commences. However, the chalcedony chemical geothermometer indicates aquifer temperature only a few degrees above surface temperature except at Woodruff Warm Springs where aquifer temperature may be as high as 46°C.

None of the mixing models applied to these three thermal springs in these areas are definitive (basic data table 2, columns $T_{8, 9, 11}$).

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	ʘ	100.00

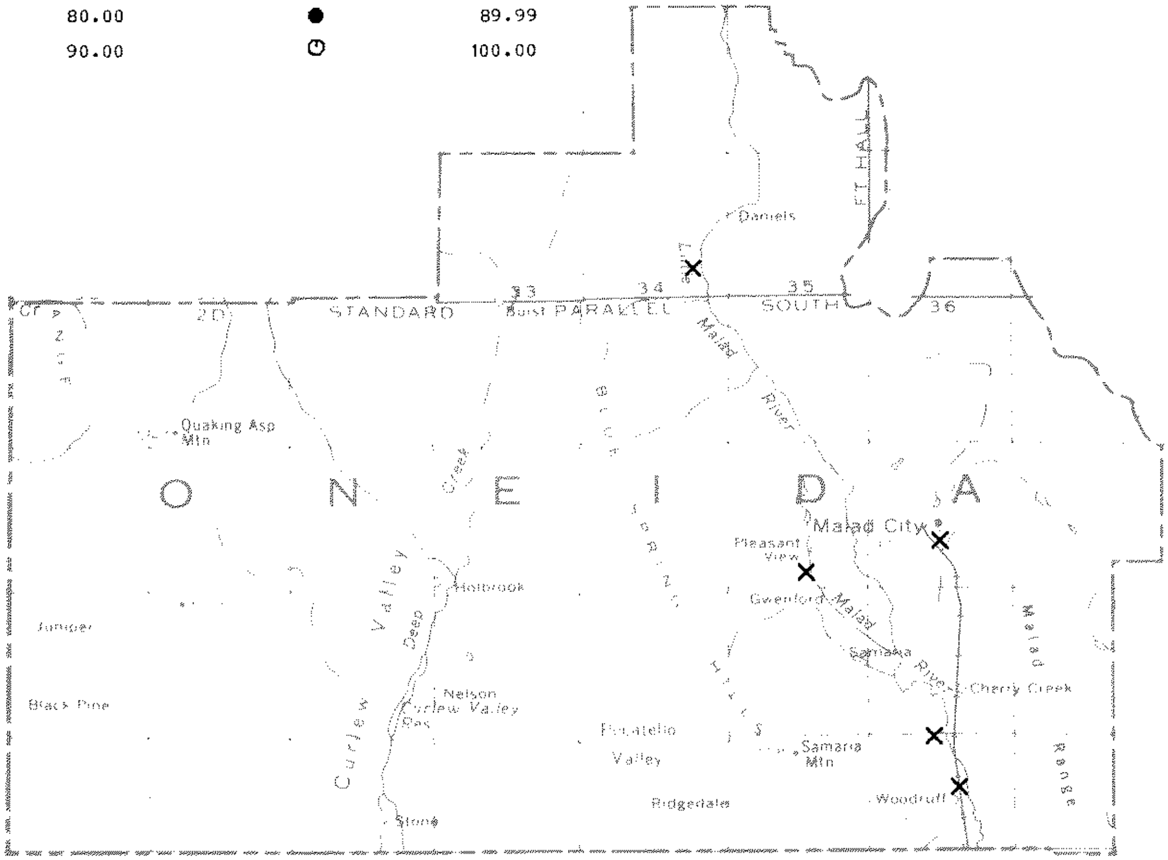


FIGURE 61. Index map of Oneida County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

FRANKLIN COUNTY

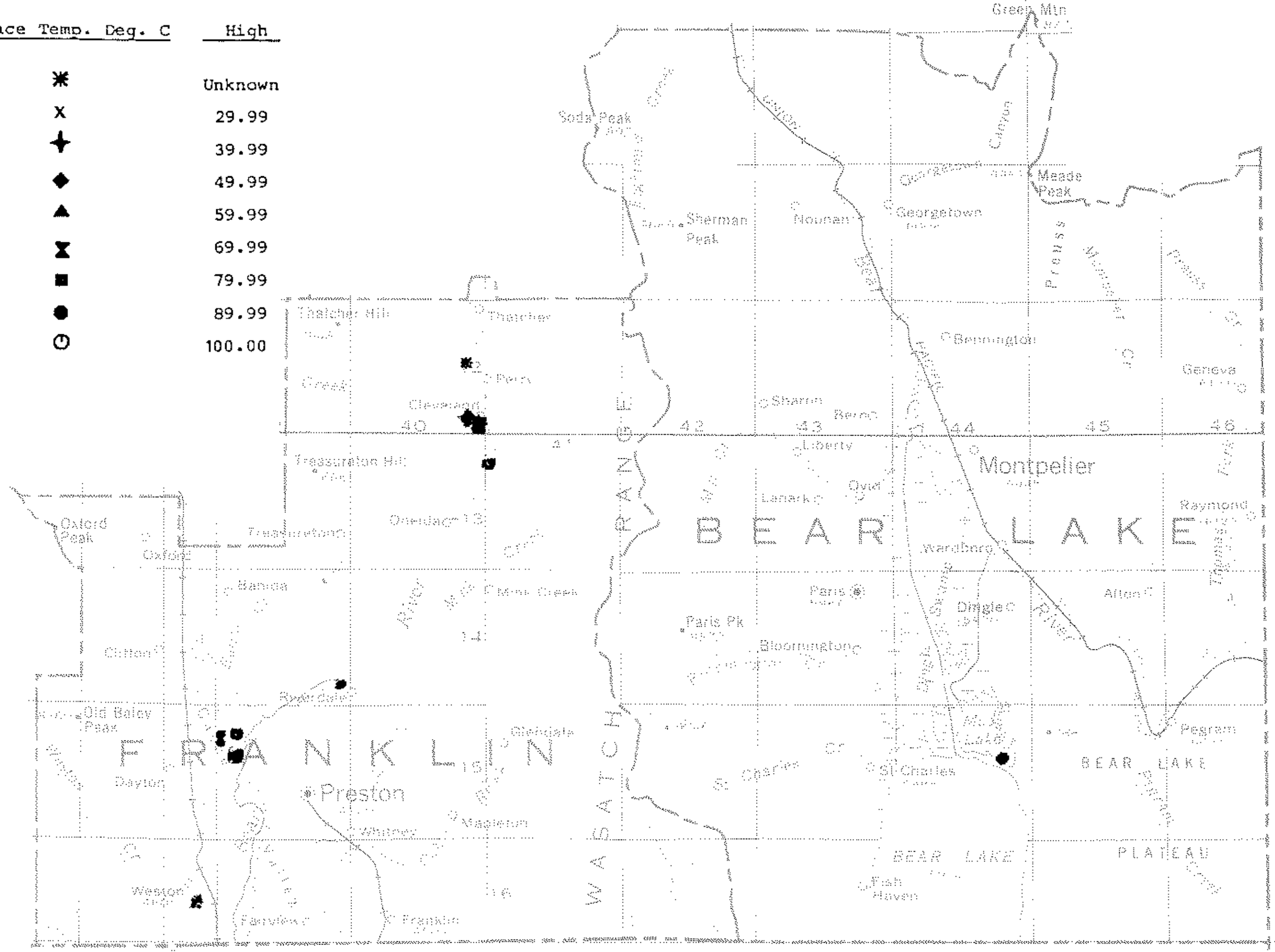
Mitchell, 1976, p. 17-19, summarized the thermal water occurrences in the northern Cache Valley area as follows:

> Thermal springs and wells are scattered at irregular intervals along the Bear River (figure 62). They occur in conjunction with various types of consolidated and unconsolidated sedimentary rocks including travertine, limestone, quartzite, and alluvial deposits. Thermal wells penetrate only alluvial deposits.
>
> Most springs in the area appear to be fault related. The springs near Cleveland are situated along a northwest linear trend on both sides of Bear River. On the west side, spring vents (12S-41E-30caa1S) issue from the bottom of circular pools 6 to 9 m in diameter within travertine formations. Numerous seeps and many small pools occur near the river edge. Numerous seeps and spring vents issue from a travertine bluff overlooking Bear River on the east. Much gas, thought to consist mostly of CO_2, escapes from the riverbed, audible for some tens of meters.
>
> No fresh deposits of travertine were forming near Cleveland. The springs on the west side issuing from pools may even be dissolving the existing travertine deposits. The waters on the west side are much cooler (35°C) than the waters from the east bluff (66°C). Waters from the vents on the west side have been used for recreational purposes. Samples were taken for chemical analyses from the large pools on the west side and from several vents on the east side.
>
> Maple Grove Hot Springs (13S-41E-7aca1S) are located in an area of intense local faulting near the shore of Oneida Narrows Reservoir. The numerous vents and seeps and the one large pool that make up the spring system are more or less aligned with each other. Unlike the Cleveland springs, Maple Grove waters are depositing much travertine. Gas, probably CO_2, is also being evolved. Several small, cold (10°C) mud pots near the smaller vents at Maple Grove evolve small quantities of gas which bubbles up through the mud. The bubbling might be interpreted by a casual observer as evidence of boiling. These waters have been used for recreational purposes and also for power generation as evidenced by an old Pelton wheel found below the spring on the shore of Oneida

FIGURE 62. Index map of Franklin and Bear Lake counties showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	*	Unknown
20.00	x	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00



Narrows Reservoir. This may have been the first use of geothermal water for power generation in Idaho; even though the wheel was designed to make use of kinetic energy of the flowing water, rather than its enthalpy or heat content. Total installed capacity probably did not exceed 5 kilowatts (kw).

Well 14S-39E-36adal, on the Bear River flood plain at Riverdale, has a surface water temperature of 40°C and was reportedly drilled to a depth of 12.1 m. For years, water from this well has been used for beneficial purposes in a dairy operation. Rulon F. Mitchell, a resident of the area for 40 years, reports that snow in a 40-acre tract around the well would melt much more quickly than in surrounding areas.

The Clifton Hill high angle boundary faults may exist at Battle Creek Hot Springs (Wayland) (15S-38E-8bdclS) and Squaw Hot Springs (15S-39E-17bcdlS) (Oriel and Platt, 1967; Peterson and Oriel, 1970; and Mabey, 1974, unpublished data). These faults may intersect the Mink Creek-Bear River lineament near these two hot springs (figure 63). The structural implications of this transverse lineament are unknown but it could represent a strike-slip or normal fault. The controlling structure for these two hot springs could be the intersection of the Clifton Hill high angle boundary faults with the Mink Creek-Bear River(?) fault.

Battle Creek Hot Springs consists of one large pool about 6 m in diameter, a smaller pool (probably a collapsed travertine structure), numerous vents and seeps. This spring system is located on the western edge of Bear River. Numerous vents are marked by gas bubbles in the riverbed. Travertine is actively being deposited around the pool and vents of this spring system. These waters have been used for hog carcass scalding and recreation. Samples were taken from the two pools and two smaller vents. Cold water seeps (temperature 6°C and total discharge 5-10 l/m) were issuing from a clay bank just above the spring vents at Battle Creek Hot Springs. Other cold water seeps were issuing at approximately the same elevations as the thermal vents about 40 m down river from the thermal vents. The cold water may be seepage along impermeable clay layers from an irrigation canal which runs along the bottom edge of the uppermost terrace level of the river valley above the hot springs, or from irrigation water applied on farmlands above the canal. Significant quantities of cold water could be mixing with the thermal water.

Squaw Hot Springs (15S-39E-17bcd1S) are located about 1 km south of Battle Creek Hot Springs near the confluence of Deep Creek and Bear River. This system consists of one well, reportedly 6.7 m deep, four other vents and several seeps. Discharge from the well (15S-39E-17bcd1) is depositing travertine at the end of the discharge pipe some 30 m from the well head, and a small mound of travertine 1.5 m high and 3 m across the base has been formed on the edge of Deep Creek. Only minor travertine deposition or evaporative incrustation was evident at the well head itself, where water samples were taken. The other vents are now only very minor depositors of travertine with small incrustations and a few travertine-coated pebbles along discharge channels. Older travertine deposits crop out in the immediate spring area, indicating prior deposition by the springs. Samples were taken from the well, from a vent situated near the road, and from another vent located near the Bear River-Deep Creek confluence. All spring vents were evolving minor quantities of gas, probably CO_2. The well being the most prolific gas evolver, gave a false appearance of vigorous boiling. These spring waters were formerly used for recreational purposes, and for heating hot houses.

Basic data table 2 lists apparent subsurface temperatures in Franklin County. Mitchell (1976) listed reasons for believing that at Squaw and Battle Creek hot springs, subsurface temperatures would approach 150°C provided quartz controlled silica in these waters. If mixing of thermal and non-thermal groundwater were taking place, temperatures could be as high as 235-245°C. In other areas of Franklin County the chalcedony chemical geothermometer (T_4, basic data table 2) probably gives good subsurface temperature estimates.

BEAR LAKE COUNTY

In Bear Lake County (figure 62), located in the central Rocky Mountain Province, there are only two known thermal springs presently active. Extensive travertine deposits, particularly on the west side of Bear Lake Valley north of Bern, attest to much greater thermal spring activity in the past. It is not known whether the springs here ceased flowing because of cooling or to self sealing because of travertine deposition, or both. Prospecting for thermal water might prove fruitful in areas of extensive travertine deposition near known faults.

Pescadero Warm Spring (12S-44E-7bdalS) (26°C) is located two miles south of the Nounan-Georgetown Road near the

FIGURE 63. EROS false color infrared Landsat EDISE image of part of southeastern Idaho and northern Utah showing selected thermal water locations with surface temperatures above 20°C.

Bern-Pescadero Road on a travertine-covered bluff overlooking the Bear River. It issues at about 40 l/min. It is presently used for stock water.

Bear Lake Hot Springs (15S-44E-13bcalS) is a popular resort area and has been for many years. Formerly known as Joe Rich's Spring, vents issue from limestone along a fault scarp at the base of the steep slope, which forms the western edge of the Bear Lake Plateau. The water issues at 48°C. Bear Lake Hot Springs and Pescadero Warm Springs are remote from population centers in Bear Lake Valley. Maximum subsurface temperatures expected at depth may be best represented by the chalcedony equilibrium temperature at about 54°C (see basic data table 2, column T_5). Bear Lake Hot Springs could probably support a natatorium and a greenhouse provided additional flow could be found by drilling.

Donaldson and Applegate (1979) reported that:

> Gravity mapping (Mabey, Peterson and Wilson, 1974) in the Bear Lake-Montpelier area of southeastern Idaho reveals steep east-west gradients suggesting a north-south striking basin and range type graben valley (figure 64). An east-west profile taken from the aforementioned map along the Idaho Standard Parallel south through the Bear Lake anomaly (figure 65) defines a 21 mgal residual low. Calculations made assuming a 0.4 gm/cm^3 density contrast between valley fill and flanking bedrock result in an estimated basin depth of about 1250 m. Witkind (1975) defines faults along both margins of the gravity inferred graben (figure 15) which are presumed active with late Quaternary beds broken. Day (1974) has mapped linears from band 5m MSS-ERTS imagery which also coincide very well with the gravity inferred graben (figure 9).
>
> The basin depth estimate must be considered very conservative. A similar depth estimate was calculated in the Oakley area where a maximum temperature-at-depth of about 90°C was calculated. Given similar assumption, similar temperature estimates would be appropriate for this area.

CARIBOU COUNTY

Six thermal springs and four thermal wells are known in Caribou County. They are widely scattered but principally located around the margins of the Blackfoot lava field and near the principal drainages of the Blackfoot, Bear, and Portneuf rivers (figure 66).

The best known thermal occurrence in Caribou County is located within the town of Soda Springs and is known as Soda

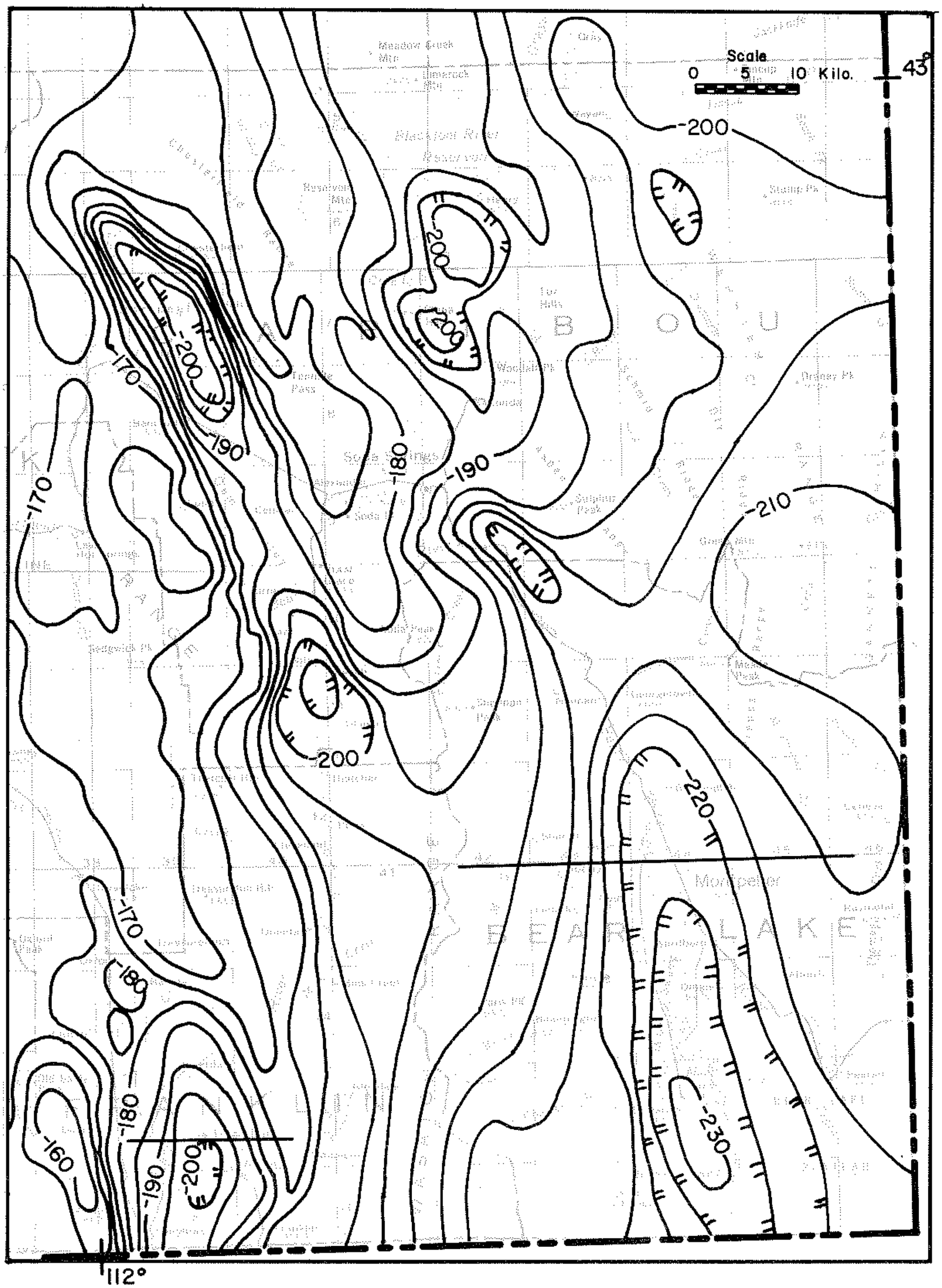


FIGURE 64. Gravity lows from Gem Valley (upper left), near Preston in Cache Valley (lower left), and near Bear Lake (lower right) (Mabey, Peterson and Wilson, 1974.) Contour interval = 5 milligals.

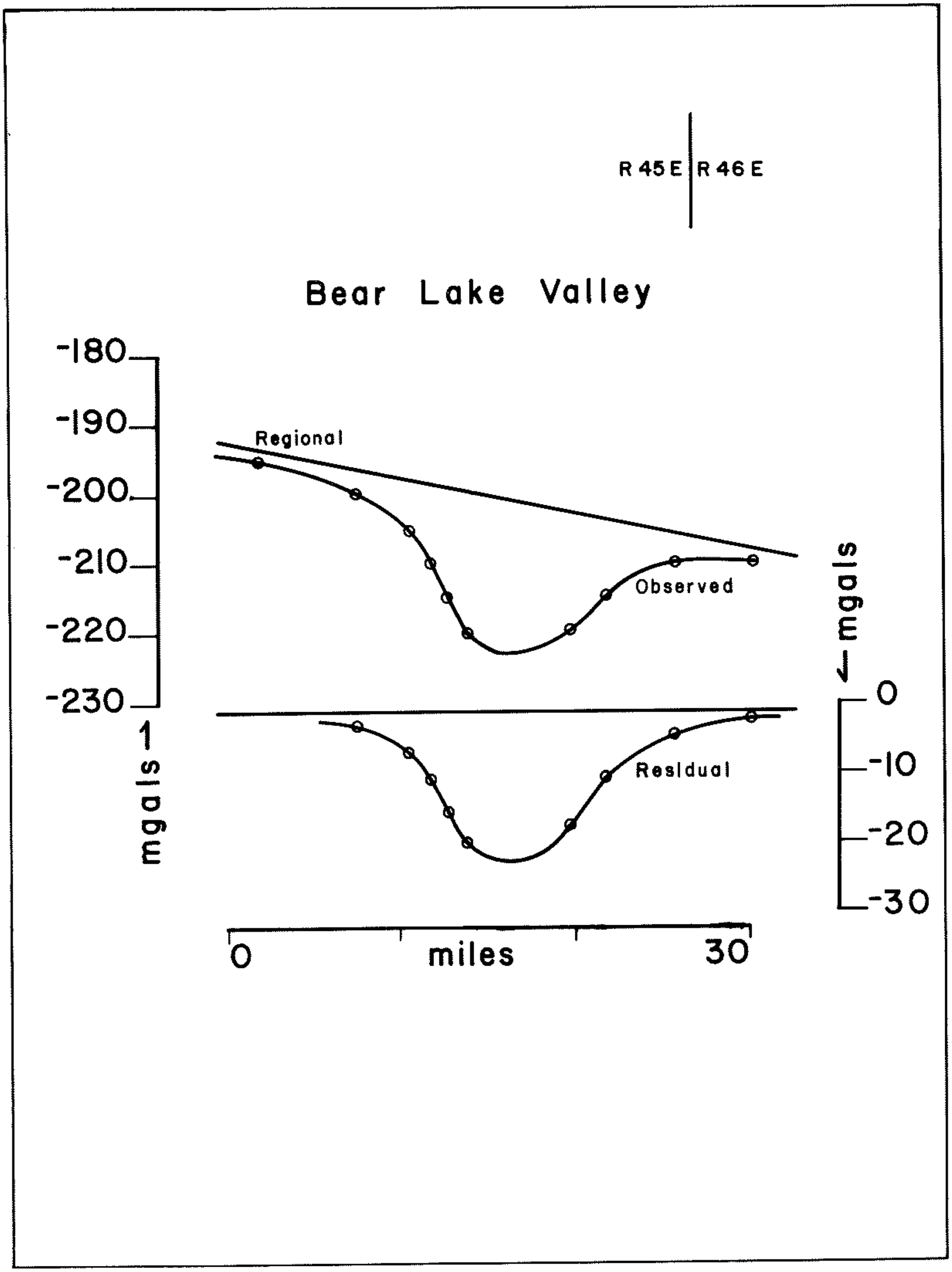
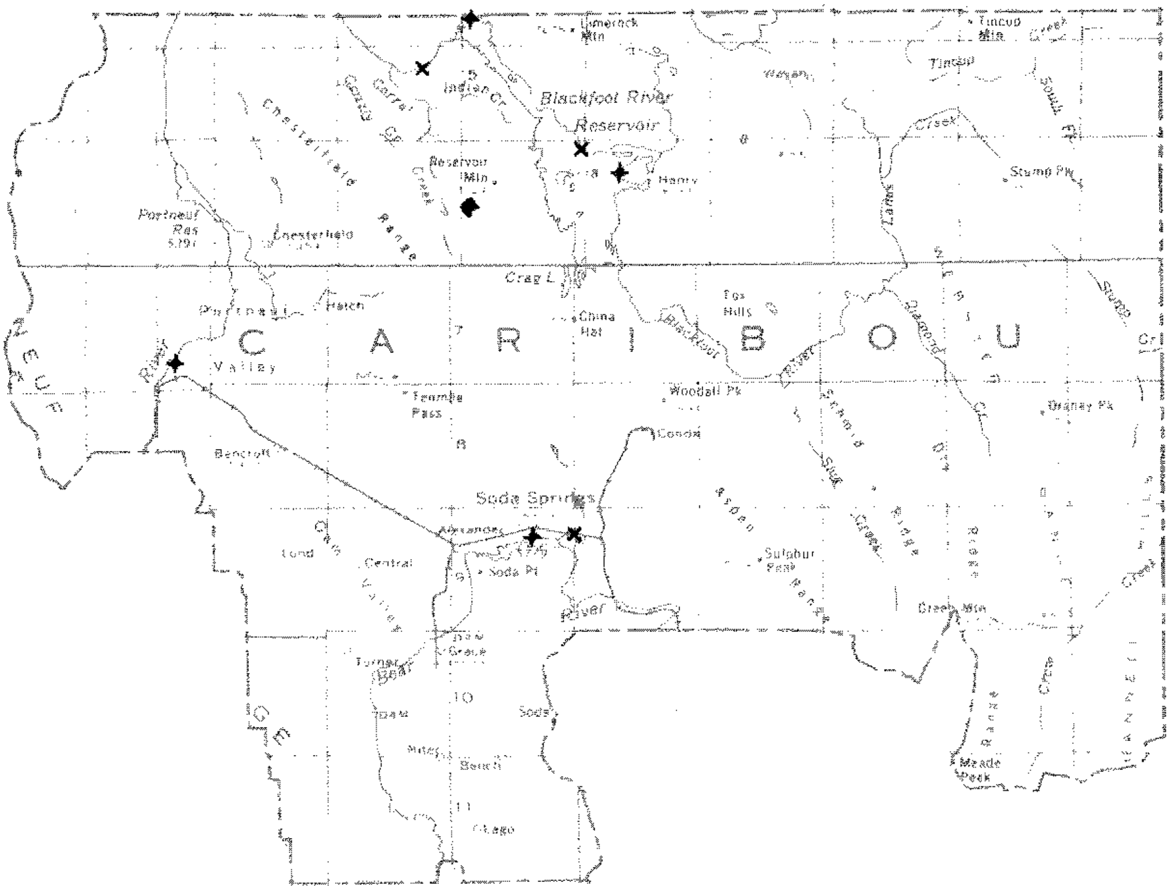


FIGURE 65. Gravity profile near Bear Lake. (From Donaldson and Applegate, 1979.)



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✳	Unknown
20.00	x	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00

FIGURE 66. Index map of Caribou County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Springs Geyser (9S-41E-12addl). It is actually a well drilled near a former hot spring, and geysering is caused by high pressure carbon dioxide gas rather than steam pressure generated by superheated water. Soda Springs Gyeser is now a tourist attraction erupting through automatic valves every hour (at the will of the city police) when the wind is right. It is 28°C at the wellhead.

A spring (6S-42E-8dbalS) with a surface temperature of 21°C issues from a large circular travertine mound west of Henry near the shore of Blackfoot Reservoir, and another (6S-41E-ladclS) issues at 22°C across the Meadow Creek arm of the reservoir. Steamboat Springs (9S-41E-10daalS) issues from travertine beneath the waters of Soda Point Reservoir. Blackfoot River Warm Springs (5S-40E-14bcdlS) issues from travertine overlying basalt on the edge of the Blackfoot River. Its temperature is 26°C. Another spring (7S-38E-26cbdlS) known in the area is on the bank of the Portneuf River on the west side of the Portneuf Valley. It has a temperature of 41°C.

The Corral Creek wells (6S-41E-19ba, temperature 36 to 41°C) are located in an extremely faulted area. Strike-slip, normal, and reverse faults were encountered when Food Machinery Corporation (FMC) drilled for phosphate in the area. The thermal water was encountered when drilling reached the Mead Peak member of the phosphoria formation. The wells were drilled near an old geyser cone.

Mitchell (1976) summarized the geothermal potential of Caribou County as follows:

> Geologic evidence of geothermal activity is abundant in Caribou County. The Intermountain Seismic Belt, related to plate and subplate boundaries, passes through the area. A known zone of high heat flow coincides with the seismic zone, and is manifested by numerous thermal springs. Mansfield (1927) reports a high geothermal gradient. The Pleistocene basalt flows, thought to be less than 700,000 years old, exist west and south of the Blackfoot Reservoir. Possibly present is a geologically young volcanic collapse structure (caldera) or low density granitic intrusive (heat source ?). The extremely young (less than 100,000 years old) rhyolite structures (China Hat, North Cone and South Cone) exist near the center of the area surrounded by the somewhat younger basalts. Thermal spring deposits, warm springs and geyser activities are evident. All are strong geologic evidence of large-scale geothermal potential.
>
> The audio-magnetotelluric (AMT) survey indicates that no shallow, low-conductive zone (typical of

geothermal systems) exists to depths approaching 2 km. This indicates the absence of geothermal reservoirs to 2 km depths in the survey area.

The chemical geothermometers indicate that the thermal waters of the Blackfoot Reservoir area probably have never reached high temperatures (above 50°C).

Published estimates of temperature gradients suggest that the thermal springs could emerge from depths as shallow as 1,000 m. The close association of these springs and wells with normal faults indicates that the waters are probably meteoric waters circulating to shallow depths along faults and re-emerging as thermal springs or wells. Water ascending from shallow depths may provide little information concerning any deep thermal system, which in this area would be the real exploration target.

The geochemistry of the thermal waters, the results of the AMT survey, and the speculative geothermal gradient and heat flow estimates from the Blackfoot Reservoir area indicate little potential for geothermal power generation from shallow depths (less than 2 km). The possibility of deeper geothermal resources is, however, attested to by the favorable geologic framework. The possible deep reservoirs would not be accessible to exploration or development except by very expensive techniques such as deep resistivity, heat flow, or deep test drilling.

Heat flow measurements taken from three or four strategically placed 300 m deep drill holes would indicate the approximate intensity of any deep heat source in the area, and consequently may be the better and less expensive method of exploration. This activity should be deferred until other, more accessible geothermal systems in Idaho have been assessed.

Caribou County does, however, represent a unique region where prospecting for geothermal water for low temperature use might be successfully conducted by local individuals, small businessmen, or corporations who wish to make use of low temperature geothermal energy but who lack large amounts of speculative investment capital. Local water well drillers might locate hot water in areas of obvious faulting where surface deposits of travertine are found. If the extinct springs have ceased to flow

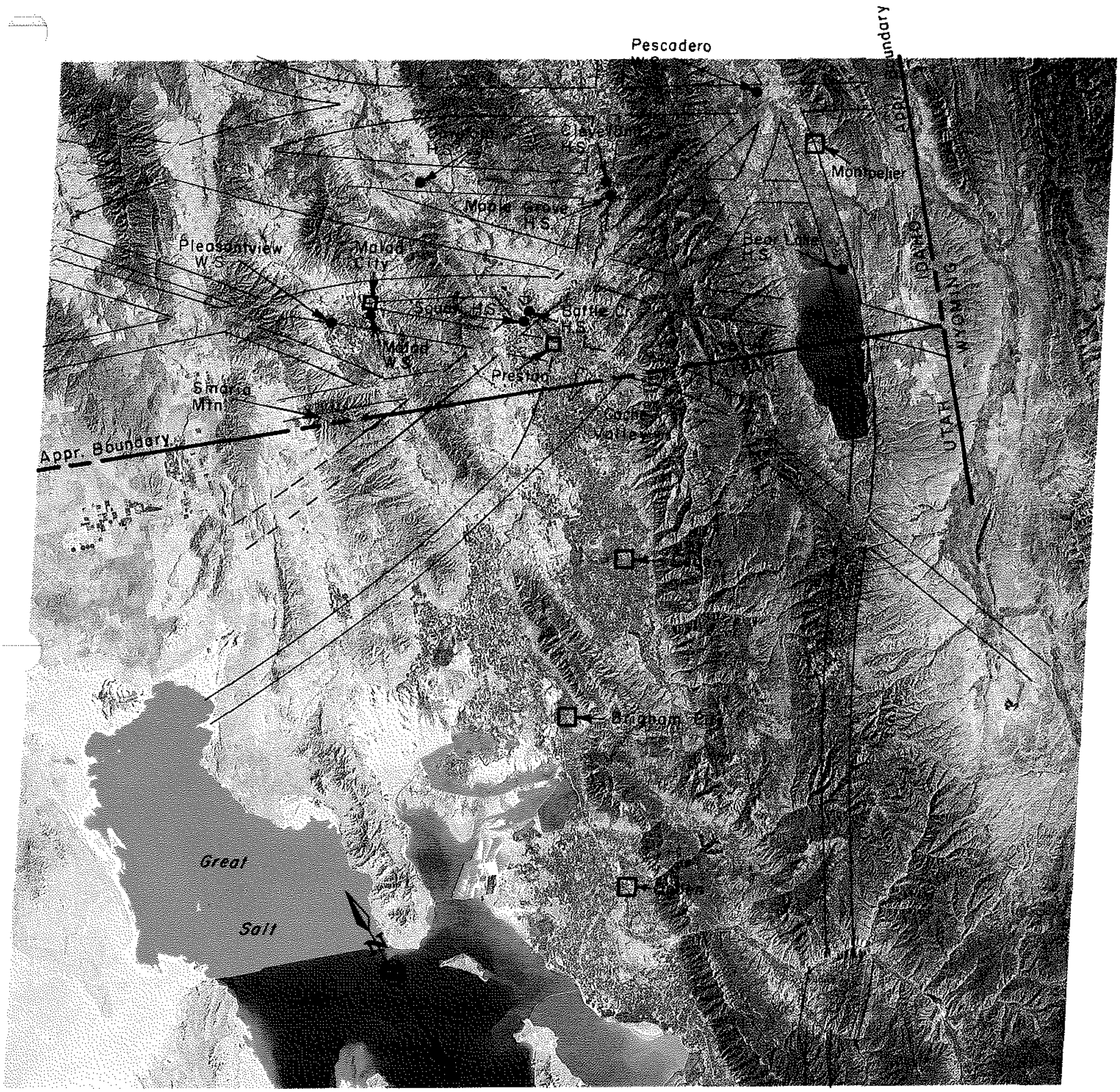


FIGURE 67. EROS false color infrared Landsat EDISE image of part of southeastern Idaho showing selected linear features and thermal water locations with surface temperatures above 20°C.

because of self-sealing due to $CaCO_3$ deposition, rather than regional cooling or more arid conditions than formerly existed, substantial amounts of low temperature water (less than 75°C) might be found by drilling into fault zones associated with travertine deposits. Self-reliant, enterprising individuals may even devise methods of scaling control, a potential hazard in geothermal water utilization in this area.

The moderately high dissolved solids in these waters preclude their use for irrigation purposes or stockwatering. Their low temperatures suggest uses such as mushroom growing, balneological baths, soil warming, recreational usages, warm water for winter mining operations or de-icing. Space heating for vegetable greenhouses or animal husbandry may be practical if efficient heat pumps were utilized.

The saline waters may challenge engineers who work toward their utilization. Activities related to the large-scale withdrawal and use of these waters must be very carefully monitored. Cooperation between those individuals making use of the water, as well as state and local officials, is necessary to avoid potential thermal and saline pollution, which could be a danger due to the higher temperature and salinity of these waters should large-scale withdrawal be attempted.

Figure 67 is an enhanced false-color infrared satellite image of part of southeastern Idaho showing major linear features and thermal water occurrences. Many of the thermal springs and wells are near the intersection of these major linear features. The exact nature of these features is not known but the features may represent some type of crustal fracture along which meteoric water circulates to depths where it is heated by hot rock.

An irregular, somewhat discontinuous and curved lineament can be traced on satellite images (figures 63 and 67) from the north end of the Great Salt Lake in northern Utah through Woodruff Hot Springs south of Malad, near Squaw Hot Springs west of Preston, through Cleveland Hot Springs, through Soda Springs, through Henry Warm Springs, through Brockman Creek Warm Springs, through Fall Creek Mineral Springs, and further north, perhaps to Ashton Warm Springs. This lineament coincides with the suspected curvilinear zone revealed by thermal spring activity as shown on figure 9. Springs along this zone appear near where east-west trending lineaments intersect the curvilinear lineament or zone.

The geothermal potential of the Blackfoot Reservoir area indicates that much of the energy requirements for the growing phosphate industry, as well as space heating for the expanding population, might be supplied by geothermal energy.

BANNOCK COUNTY

Four thermal spring areas and seven thermal wells are located in Bannock County (figure 68). The most promising areas for development are north of Pocatello near Tyhee and Lava Hot Springs.

In the Tyhee area the warm water wells, drilled to depths of 177 m, are used for irrigation, domestic, and stock water. The wells range from 20 to 41°C in temperature. They are more or less aligned in a northeast-southwest direction approximately following an inferred fault through the area (Trimbel, 1976). A faint linear feature can be seen in enhanced false color satellite images of the area. The feature is consistent with the warm water well alignment and inferred fault. A magnetic high similar to one found near Heise Hot Springs also exists near the wells (Corbett, 1978, oral commun.). These facts are evidence of both structural control for thermal water in the area and possible deep circulation of meteoric water along faults. Chalcedony and Na-K-Ca chemical geothermometers give 63 and 47°C respectively in one well (5S-34E-26dabl) in the Tyhee area. Quartz predicts 63°C for the subsurface temperature in another well (basic data 2, columns T_1, T_4, T_5). Further work in the area should be considered to determine the attitude and exact position of the controlling structures to target drill holes to intersect the structure at predetermined depth. Gravity, magnetic, and hydrologic studies should be performed first to best determine the type of followup approaches to use in further reservoir assessment in the Pocatello-Tyhee area. This area is currently being studied in greater detail. Any thermal water discovered here could be utilized for space heating and industrial uses in Pocatello.

Another area of thermal water occurrence is Lava Hot Springs where two groups of thermal springs and several wells of above normal temperatures are known. Lava Hot Springs has been a popular resort area for years boasting a state-owned health spa. Before renovation, the swimming pool contained natural thermal water; now, the water must be heated by natural gas to give a comfortable swimming temperature. The city is interested in further development of the resource, particularly for space heating.

McClain (1978) reported on the geothermal occurrences near Lava Hot Springs and stated:

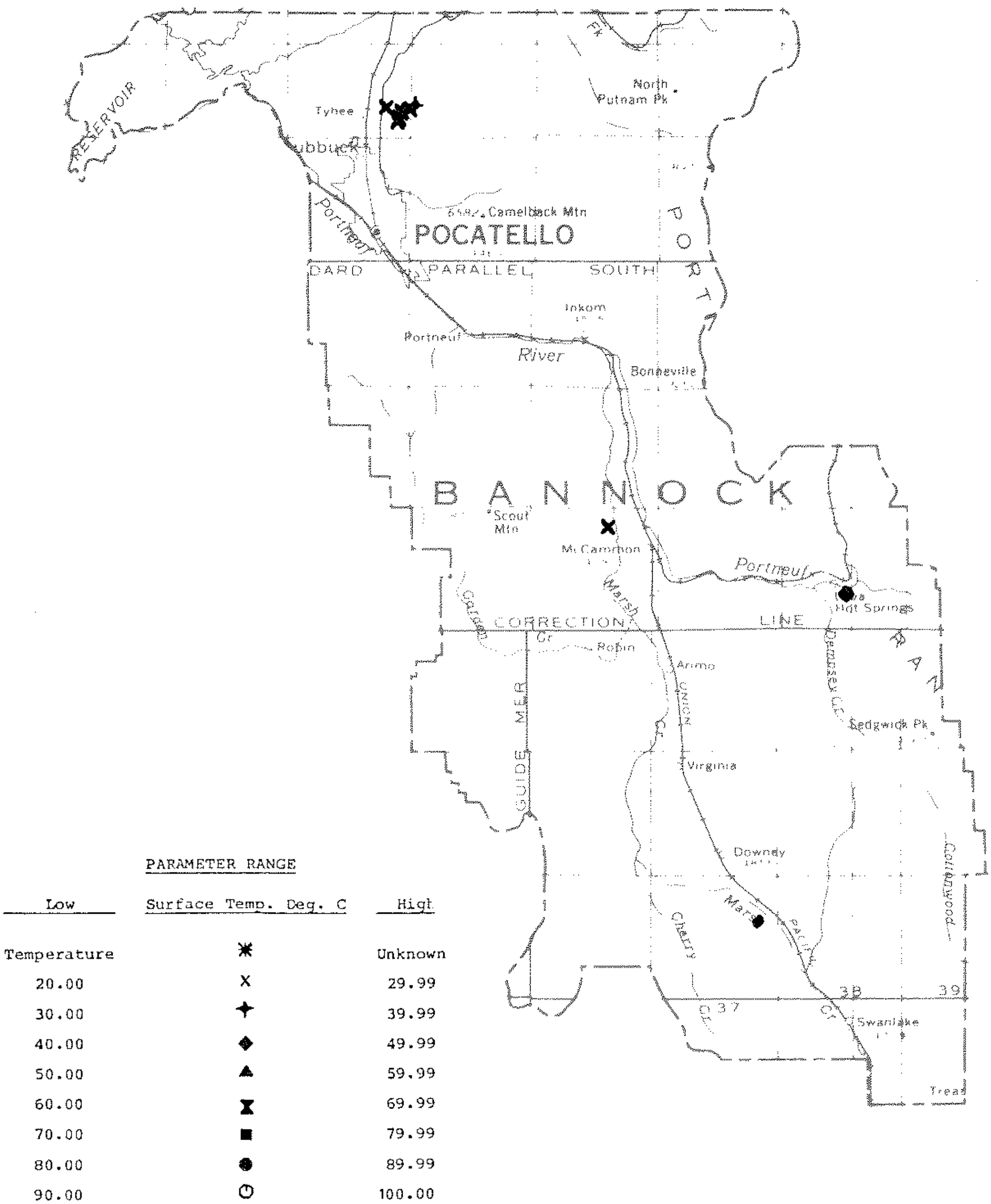


FIGURE 68. Index map of Bannock County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Geologically, the Lava Hot Springs area is a complicated stratigraphic and structural location. The oldest rocks in the area are Precambrian and lower Cambrian quartzite. Units representing Cambrian through Pennsylvanian systems are present in the area. Most of the rocks in this section are carbonates. A major unconformity exists between the upper Paleozoic units and Tertiary units of the area. Pliocene units are present in the area and consist of sedimentary and volcanic breccias, tuffs, ash, and lava flows. Most of these rocks are valley fill materials which have been largely removed by erosion. The final stratigraphic unit deposited in the area are Pleistocene lava flows. Most of the Portneuf River Valley is underlain by this intervalley basalt flow.

During the Cretaceous and early Tertiary, major thrust faulting displaced the Precambrian and Paleozoic units eastward. The area experienced a period of structural quiescence during the early and middle Miocene which was followed by extensive high angle faulting during the Pliocene. This last period of tectonic uplift created the present fault block mountain range of the area.

Physiographically, the Lava Hot Springs area is in the northeasternmost corner of the Basin and Range Province. The occurrence of thermal springs in the area appears to be related to the location of fault zones. The brecciated fault zones serve as permeable conduits leading the thermal water up from depth.

In the city of Lava Hot Springs, two major fault linears intersect. The Lava Hot Springs fault is a major north-south trending linear that is typical of the Basin and Range Province. Vertical displacement along this fault is several thousand feet creating the fault block mountain which dominates the relief of the area. A second fault cuts east-west through the Lava Hot Springs area offsetting the Lava Hot Springs fault to the east several hundred feet. It is at the intersection of these two faults that the thermal waters of the area are manifested. The relationship of the thermal waters to the thrust plain of the region is unclear.

The hot waters of the Lava Hot Springs area range in temperature from 21-68°C. The major springs which feed the Foundation Spa are 38°C. The presence of fault zones can be easily determined in the area by extensive travertine deposits. These thermal waters are most logically associated with deeper sources of thermal fluids which are circulating up through the Paleozoic units along the fault intersection.

Most of the thermal springs and wells in the area occur from the basaltic rocks which underlie the Portneuf River Valley. Several shallow wells have been dug with backhoes to depths of less than 20 feet. Hot fluids are intersected along the bottom contact of the basalts. This may indicate that thermal water of the area is rising along the fault zones and spreading horizontally along the basalt contact.

Using the sodium-potassium-calcium geothermometer, a reservoir temperature of 211°C has been predicted, and using silica, a temperature of 80°C. In either case, the temperature would be sufficient for space heating. A surface temperature of 71°C has been reported on the bank of the Portneuf River just west of the spa. Investigations are presently being undertaken to determine the feasibility of designing a district heating project. The reported flow (over 1500 l/min.) and the location appears to favor this project. A district heating project would also avoid the present apparent interference between the very shallow individual wells in towns.

Downata Hot Springs (12S-37E-12ccd1S), a popular resort area of long standing, rises from Quaternary alluvium near Tertiary sediments. It is associated with an east-west lineament (see figure 67). It is 43°C at the surface. Subsurface temperatures here probably are not much higher than 46°C, as estimated by the Na-K-Ca chemical geothermometer. These hot springs are remote enough from a large population center to exclude large scale development. Greenhouses or other agricultural uses could be made of excess water over and above the resort's needs.

One warm domestic well (22°C) exists near Marsh Creek between McCammon and Inkom. It has not been sampled.

POWER COUNTY

Power County has one popular resort area, Indian Springs (8S-31E-18dab1S) (figure 69), which has been in existence for many years. It is located a few kilometers south of American Falls. Indian Springs is 32°C and discharges 5,830 l/min. Maximum subsurface temperatures expected are best represented by the Na-K-Ca chemical geothermometer at 71°C with the quartz chemical geothermometer indicating 63°C.

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	x	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00

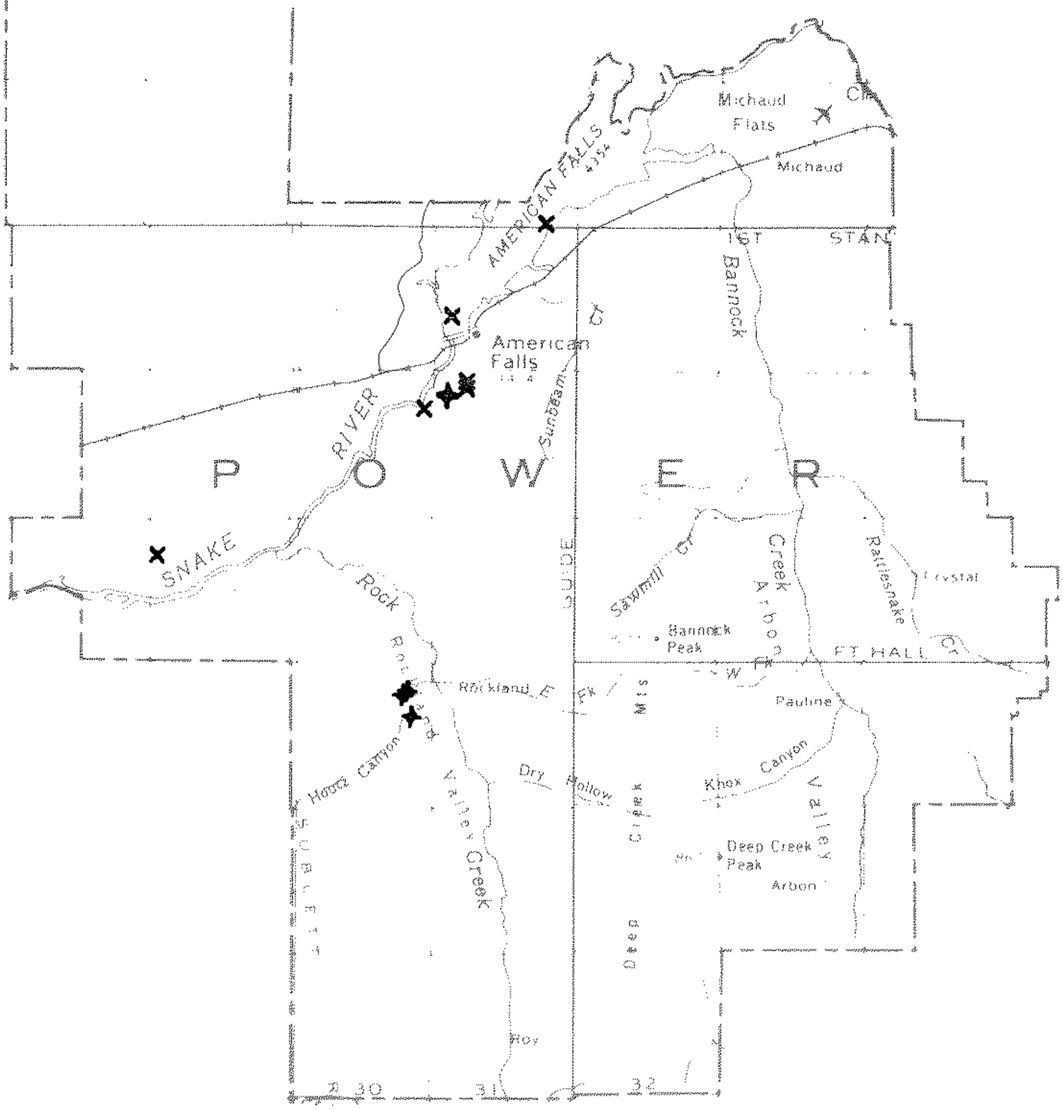


FIGURE 69. Index map of Power County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Two other springs, Rockland Warm Springs (10S-30E-13cdc1S) and an unnamed spring (9S-28E-19acd1S) located west of Massacre Rocks State Park on the shore of Lake Walcott, are undeveloped. Rockland Warm Springs has a chemistry and surface temperature similar to Indian Springs.

Several large travertine deposits occur in Power County (figure 70). Past flows of thermal water may have deposited them. If the thermal springs ceased flowing due to self sealing from travertine deposition in spring vents, thermal water might be found by prospecting along known faults near the travertine deposits. Trimble and Carr (1976, p. 62-64) reported on the geology in the Rockland and Arbon quadrangles, Power County. They stated:

> Travertine and travertine-cemented conglomerate and breccia occur at several localities in the Rockland and Arbon quadrangles. Yellowish-white travertine as much as 1.83 m thick overlies the Little Creek Formation in the valley of Warm Creek from a point near Indian Springs to a point near the community of Neeley. An isolated exposure of travertine apparently overlies basalt of the Massacre Volcanics on the east side of the valley of Rock Creek, in the SW1/4 NE1/4 sec. 13, T.9S., R.31E. Several outcrops of travertine overlie alluvial pebbly silt or gravel that, in turn, rests on the Starlight Formation (1) on the north side of Rocky Hollow east of the highway between American Falls and Rockland (State Highway 37), (2) in secs. 28 and 29, T.9S., R.31E., between Rocky Hollow and Spring Creek and (3) along the valley of Spring Creek.
>
> Travertine and travertine-cemented conglomerate and breccia are exposed in the valley of East Fork Rock Creek and in Sand Hollow and Dry Hollow in the Rockland quadrangle and are exposed in the area of Pete Lish Canyon, Howard Flat, and Warner Flat in the Arbon quadrangle. The thickest travertine deposits are adjacent to the frontal fault of the Deep Creek Mountains and to a normal fault of large displacement in the Arbon quadrangle. In Sand Hollow, travertine-cemented conglomerate immediately adjacent to the frontal fault is about 68 m thick and ends abruptly on the east at a breccia zone. In the valley of East Fork Rock Creek, it is more than 15 m thick. Travertine is found down-valley from the fault for as much as 5 km in some places and appears to be younger than the coarse pediment gravel in this area.
>
> The volume of travertine-cemented breccia at the locality in the Arbon quadrangle is notable. An

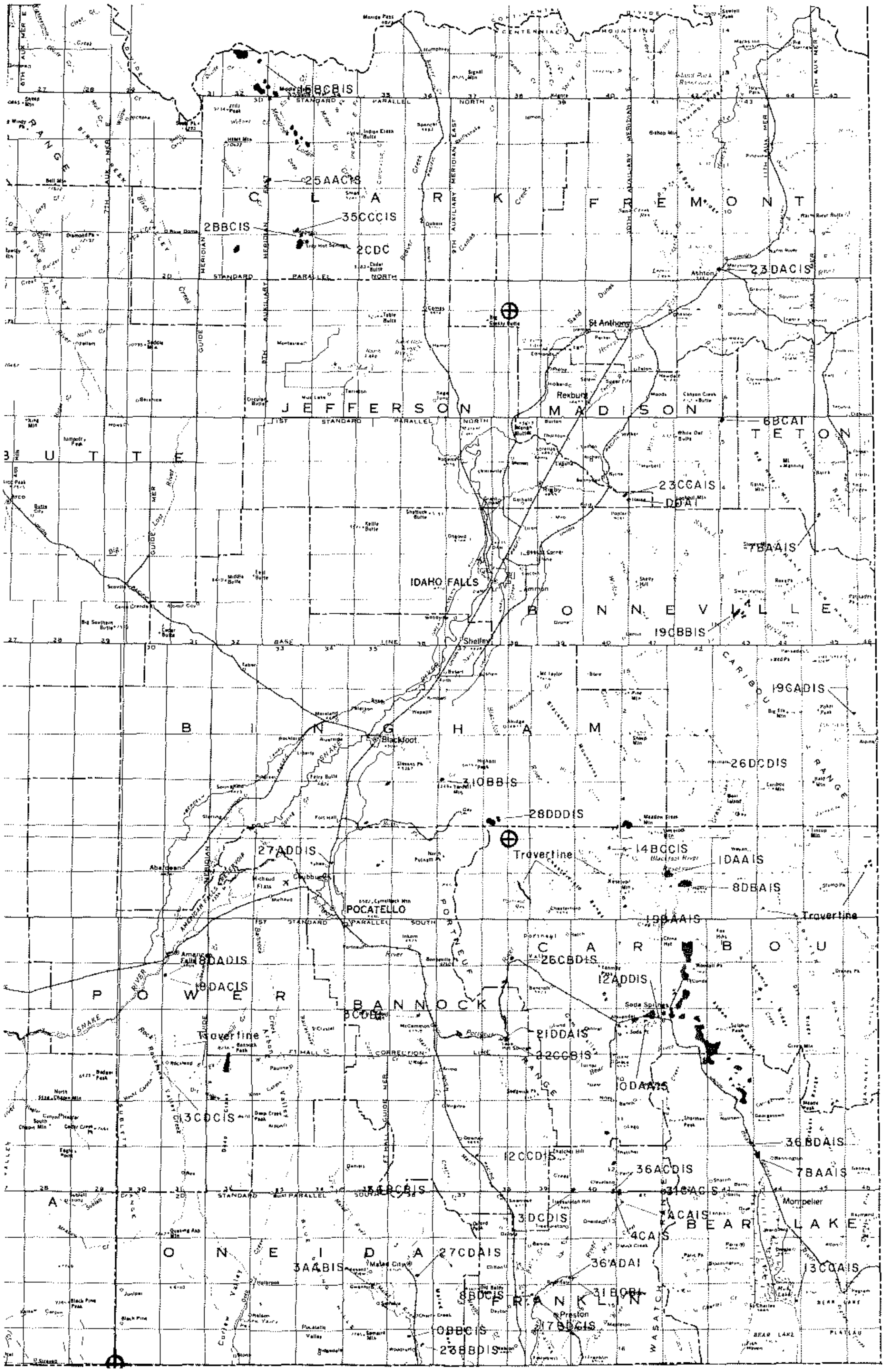


FIGURE 70. Travertine deposits and associated known springs in southeastern Idaho (modified from Bodnar and Bush, 1978).

area more than 4 km long and locally more than half a mile wide between Pete Lish Canyon and Warner Flat is completely covered. Locally, this deposit probably is more than 150 m thick. The breccia is composed mainly of fragments 0.65 - 1.25 m across of Paleozoic rocks in a travertine matrix. Travertine-cemented sandstone and tuffaceous sandstone is locally interbedded with the breccia.

The common occurrences of travertine-cemented conglomerate and breccia adjacent to major faults, and the abundance of travertine near Indian Springs, a hot spring apparently on a fault line, indicate that the travertine was deposited by water containing a high percentage of calcium carbonate that issued from artesian springs along the faults.

A late Pleistocene age for most of the travertine is suggested by two lines of evidence. First, the isolated exposure of travertine overlying basalt east of Rock Creek, in the SE1/4 NW1/4 sec. 13, T.9S, R.30E., contains mollusks of possible Pleistocene age (USGS Cenozoic loc. 21644). According to D.W. Taylor (written commun., 1959) the absence of extinct species tends to suggest a late Pleistocene age, but the small number of species makes even this age uncertain. The stratigraphic position, in several localities, of the travertine above gravel that probably is generally equivalent to the Sunbeam Formation also suggests a late Pleistocene age for much of the deposit. Eastward dips in the travertine cemented breccia and sandstone in the Arbon quadrangle indicate that there has been renewed tectonic movement along the major fault after deposition of the travertine. This suggests that these deposits are somewhat older than flat-lying deposits west of the frontal fault of the Deep Creek Mountains.

BINGHAM COUNTY

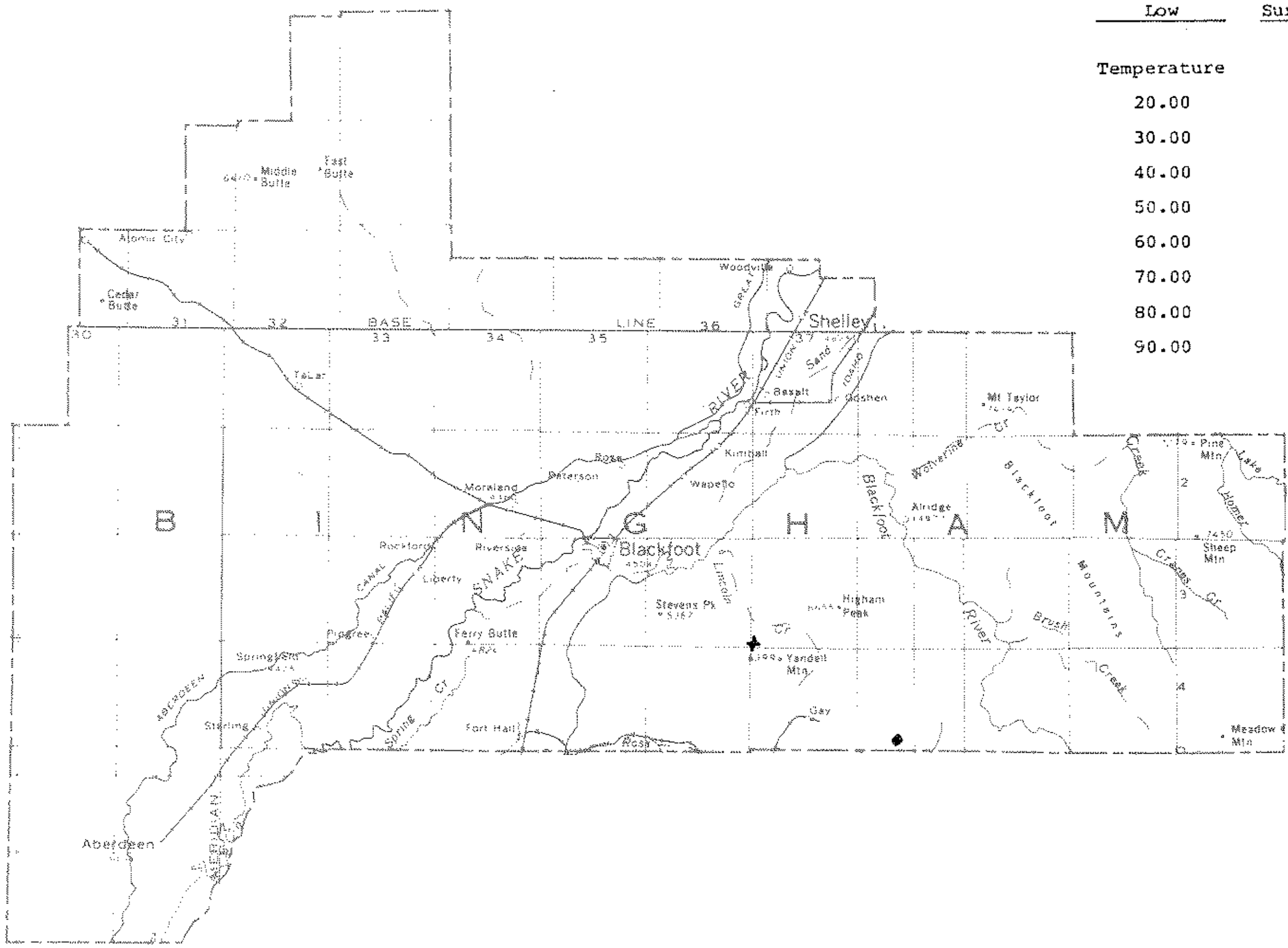
Only two thermal springs are known in Bingham County (figure 71). Both are of low temperature. Yandall Springs (3S-37E-31dbb1S) is located at the base of Yandall Mountain along a fault in Paleozoic limestone. It issues from several vents at 22 - 32°C. This is a fairly large spring, discharging 5,700 l/min and is used for irrigation. Dissolved solids are only 197 mg/l. Subsurface temperature probably will not exceed 35°C, as predicted by the chalcedony chemical geothermometer.

Alkali Flat Warm Springs (4S-38E-28ddd1S) is a small seep situated in a bowl in travertine and closely resembles

FIGURE 71. Index map of Bingham County showing locations of thermal water occurrences with surface temperatures of 20°C of higher.

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	x	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00



springs found in Caribou County. It has a surface temperature of 34°C, discharges about 75 l/min and is located in the Gay Mine (phosphate) area. Thermal water in this area could possibly be used in winter mining operations. The spring is presently used for stock water. Subsurface temperatures are predicted to be about 58°C by the chalcedony chemical geothermometer.

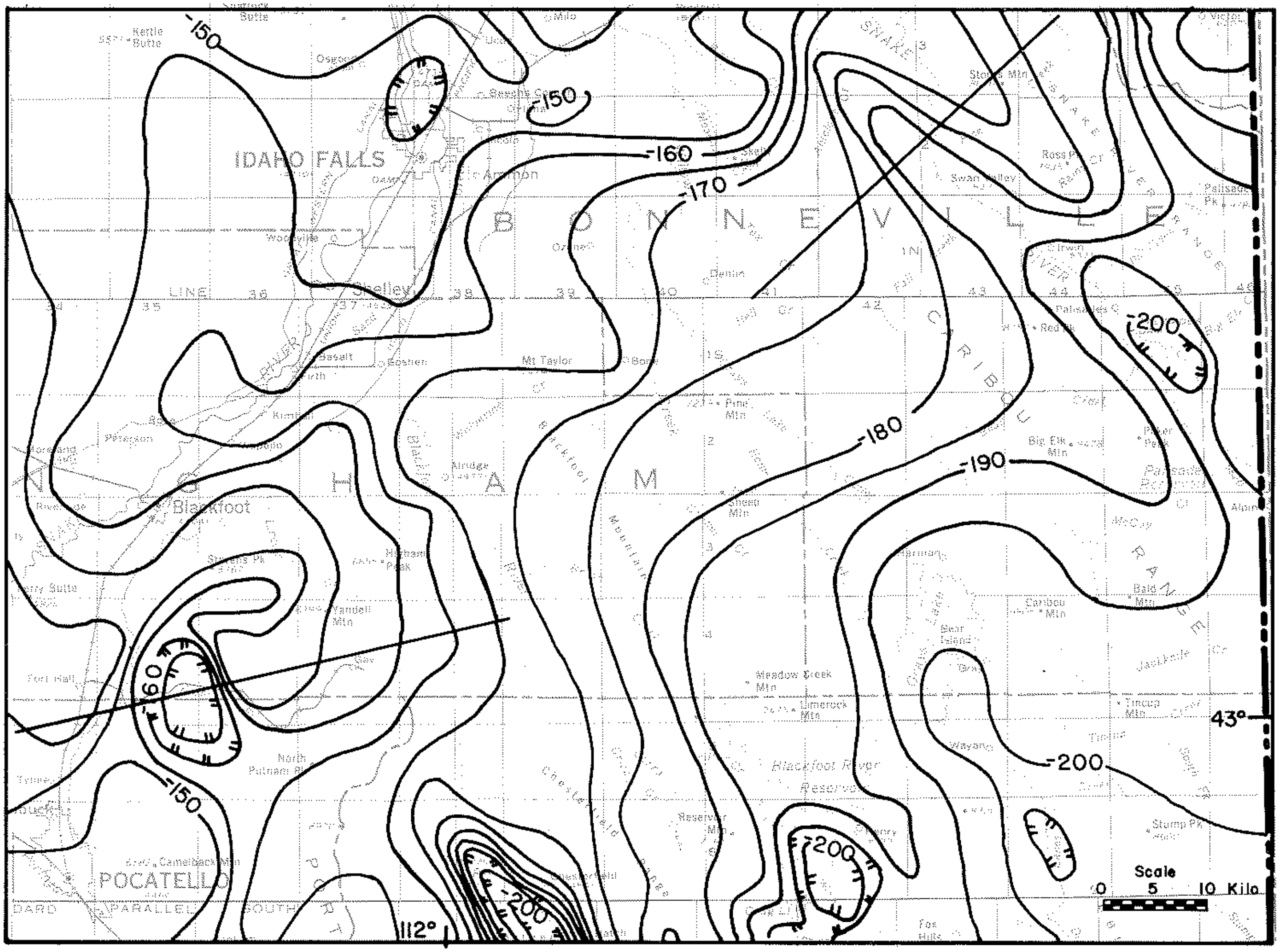
Donaldson and Applegate (1979) reported that:

> The preliminary Gravity Map of southern Idaho (Mabey, Peterson and Wilson, 1974) defines a prominent low about 12 miles south of Blackfoot (figure 72). An east-northeast profile through this anomaly (figure 73) defines a 22.5 mgal low which, assuming a 0.4 gm/cm^3 density contrast, results in calculations estimating a basin depth of about 1,342 m. A steep gravity gradient on the east side of the anomaly is very suggestive of a fault but the equi-dimensional nature of the main part of the anomaly does not suggest a preferred direction of valley strike. Witkind (1975) defines a 105 km long active fault which is terminated in the vicinity of the east flank of the gravity anomaly (figure 15). This fault has been recurrently active since Middle Miocene time. East of this anomaly, gravity is quite featureless and exhibits only a regional gradient of about -.64 mgal/km eastward. Day (1974) has mapped a lineament from ERTS imagery (figure 9) which approximates a portion of the Witkind fault but terminates before reaching the gravity anomaly. In the vicinity of the gravity anomaly, Day has mapped several northeast trending linears which parallel the trend of the eastern Snake River Plain, only a short distance northward (figure 9). It is probably significant that gravity contours enclosing the main portion of the previously mentioned anomaly are distorted toward the northeast (figure 72). Gravity, mapped lineaments and a prominent fault interruption all indicate effects of the force or forces responsible for the presence of the eastern Snake River Plain and the complexity expected in the transition into this dominating structural feature.

BONNEVILLE COUNTY

Three thermal spring areas are located in Bonneville County and warm water of 20°C has been encountered by well drilling near Ammon west of Idaho Falls (figure 74). Alpine Warm Springs (2S-46E-19cad1S), the hottest at 37°C, is now covered by the waters of Palisades Reservoir. A sample of

FIGURE 72. Gravity lows south of Blackfoot (lower right) and Swan Valley (upper left) (Mabey, Peterson and Wilson, 1974).



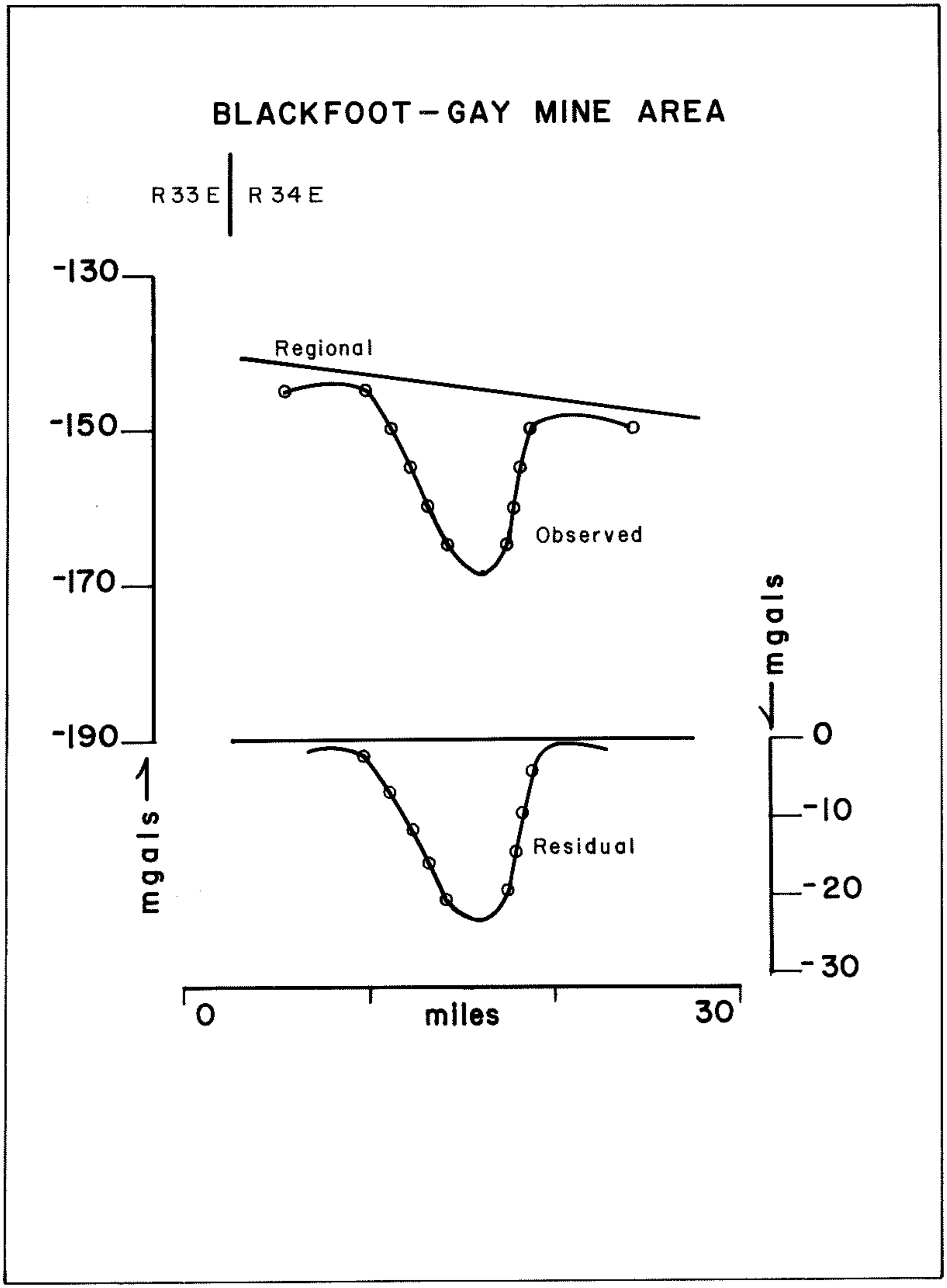
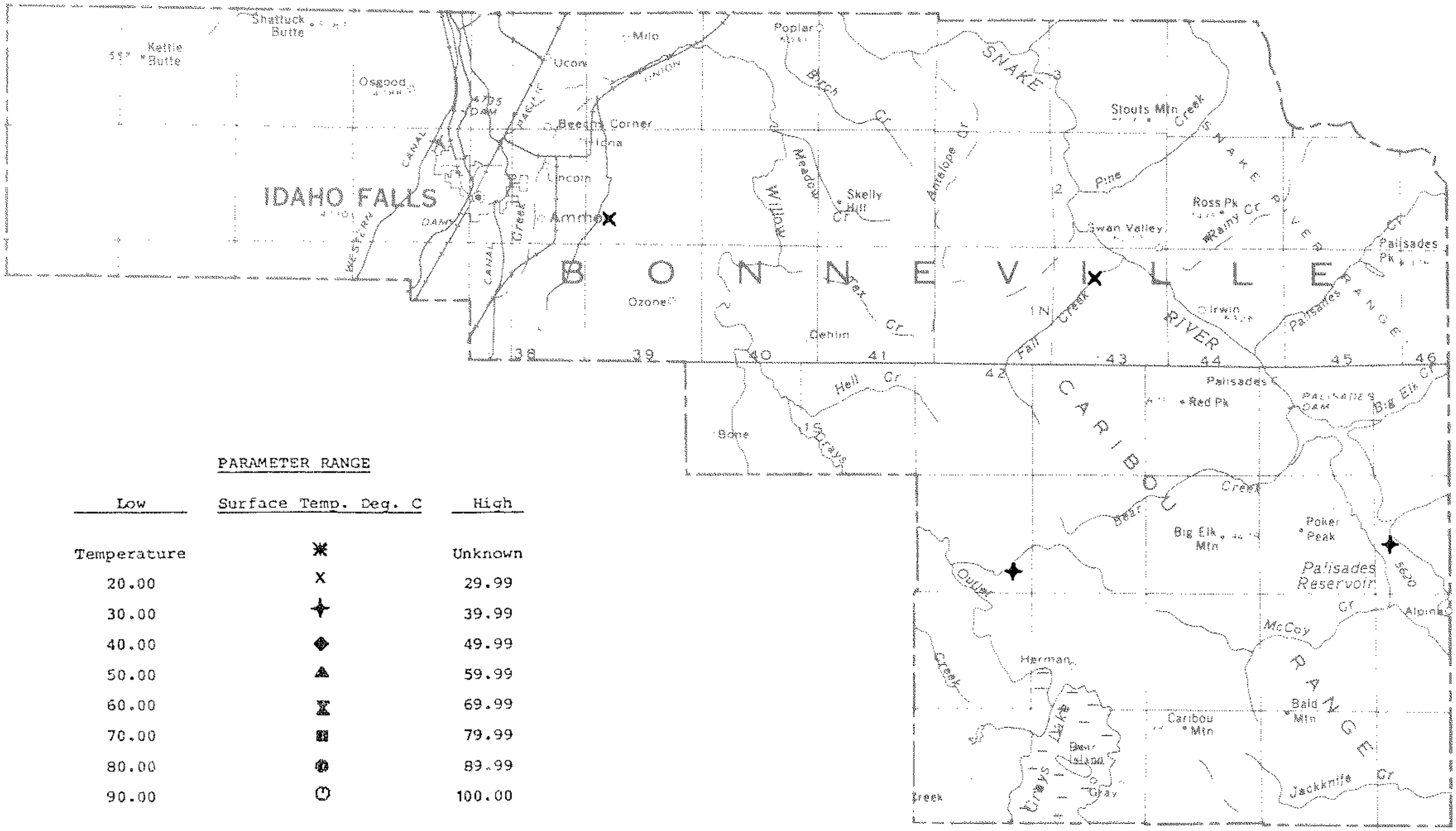


FIGURE 73. Gravity profile near Blackfoot. (From Donaldson and Applegate, 1979.)

FIGURE 74. Index map of Bonneville County showing locations of thermal water occurrences with surface temperatures of 20° or higher.



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	x	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	○	100.00

this group of springs was obtained during low water caused by the drought of 1977. Subsurface temperature here might be 61°C as predicted by the chalcedony chemical geothermometer.

Brockman Creek Hot Springs (2S-42E-26dcd1S) is 35°C, discharges 49 l/min and bubbles gas.

Fall Creek Mineral Springs (1N-43E-9cbb1S) is the coolest thermal spring at 25°C. It discharges water along a three-fourths mile long stretch of Fall Creek and deposits travertine in several locations. The spring appears to be fault controlled.

Subsurface temperatures in these areas are best represented by the chalcedony (T_4, basic data table 2) temperature, with the exception of Fall Creek Mineral Spring, where quartz (T_1) may be the best estimated subsurface temperature. At Fall Creek, subsurface temperatures may approach 40°C, while at Brockman Creek and Alpine Warm Springs, subsurface temperatures might be as high as 38 and 61°C, respectively.

This area lies along what is locally known geologically as the Heise Alpine Trend.

MADISON COUNTY

Madison County near Rexburg and Fremont County near Newdale have been scenes of intense geothermal research activity by the DOE and the USGS. Since the destruction of Sugar City by the Teton Dam failure and flood of 1976, efforts have been aimed at finding a thermal source to heat the rebuilt town of Sugar City. The area lies along the southern margin of the eastern Snake River Plain in a zone of high heat flow recognized by Brott and others, 1976. Heat flow values in excess of 5 HFU extend in a northeast-southwest zone from Rexburg to Newdale. Several thermal wells are also known here (figure 75). The Na-K-Ca chemical geothermometer predicts a shallow warm water system with temperatures that might range between 30 and 81°C.

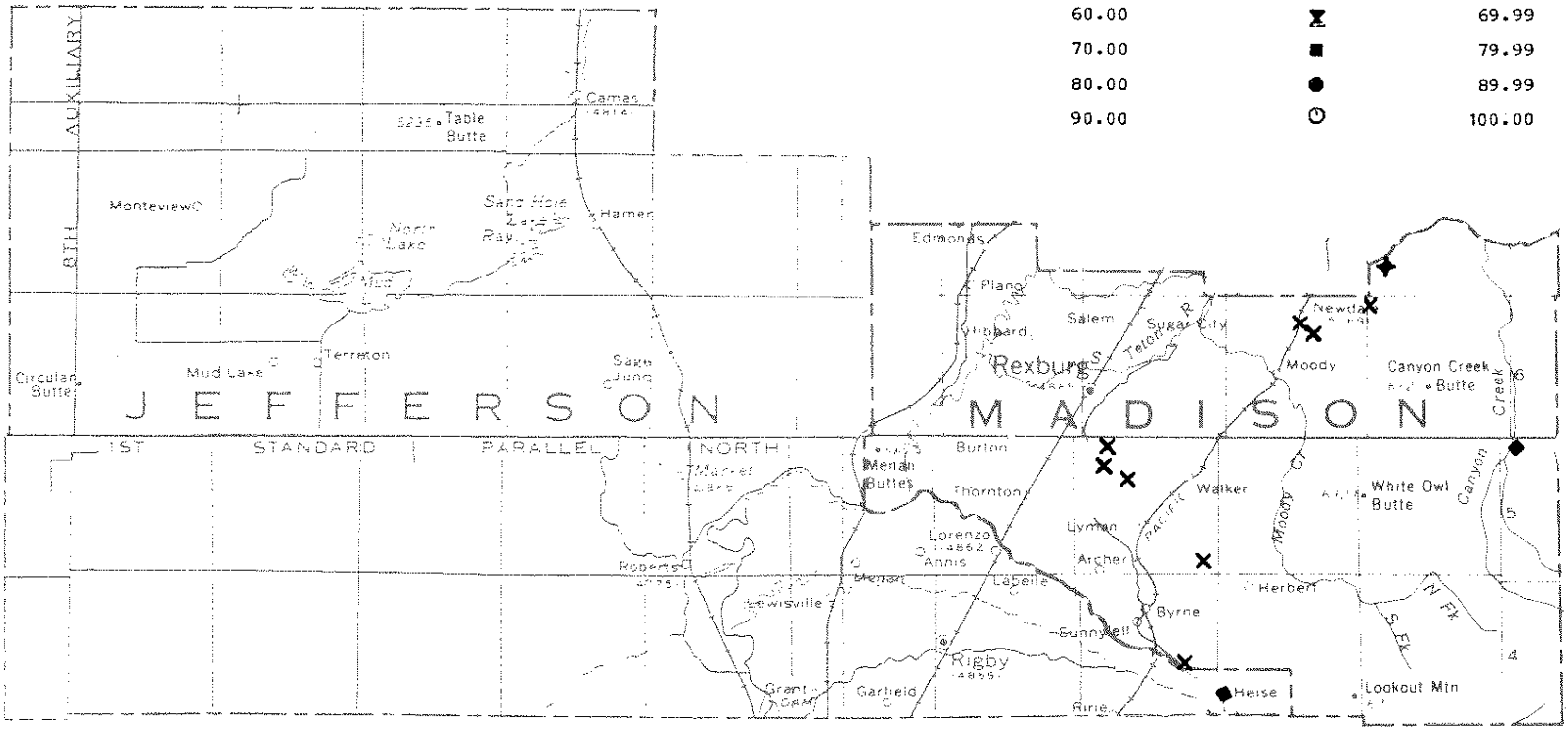
Mabey (1978) reports:

> A caldera complex in the Rexburg area of the eastern Snake River Plain has been defined on the basis of geologic evidence provided by H.J. Prostka and G.F. Embree (written communication, 1977) and named the Rexburg caldera complex (figure 76). Geothermal resources in the Rexburg area are likely to be related directly or indirectly by this caldera complex.

FIGURE 75. Index map of Madison and Jefferson counties showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	x	29.99
30.00	✚	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00



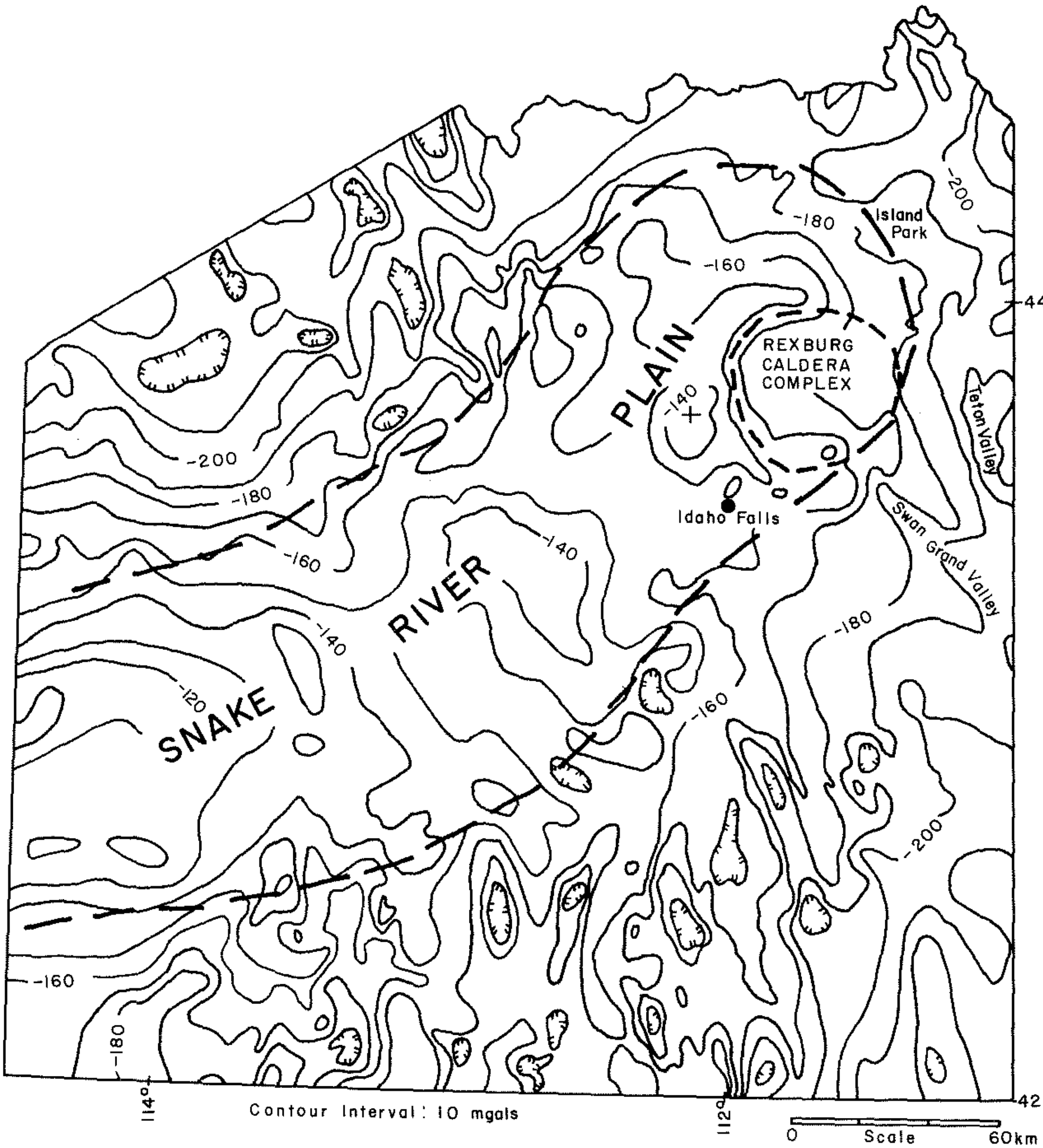


FIGURE 76. Bouguer gravity anomaly map of southeastern Idaho showing the location of the Rexburg caldera complex (from Mabey, 1978).

A gravity map of the caldera complex (Mabey, 1978) is shown in figure 77.

Mabey (1978) further reports:

The boundary of the Rexburg caldera complex is best defined by the surface geology in the southeastern quadrant, and here there is very good correlation between the boundary of the Rexburg gravity low and the caldera complex boundary. On the west and north the gravity data may be the best information available on the boundary of the caldera complex, and the inferred boundary of the caldera complex shown in figure 77 coincides with the edge of the negative mass anomaly indicated by the gravity data. To the northeast the caldera complex appears to overlap another depression, and the margin here is not well defined by either the geology or the gravity data. The inferred boundary here is primarily a connection of the better defined segments. The lowest gravity values occur in the eastern and western parts of the caldera complex, near Menan Buttes and east of Rexburg. The subdued high between these lows appears to be a northwestward-trending gravity high centered over Heise Hot Springs and a southwest-trending high west of Sugar City.

Gravity lows associated with calderas in the western United States usually result from two sources: low density fill within the caldera or an underlying body of intrusive rock that is less dense than the enclosing basement. The coincidence of the southwestern boundary of the Rexburg caldera complex with steep gravity gradients suggests a near-surface source, caldera fill. Except in the vicinity of the gravity high at Heise Hot Springs, the rocks exposed or penetrated by drill holes as deep as 420 m in the area of the gravity low are stream gravels, basalt and welded tuff of Quaternary age, and Pliocene rhyolite. No attempt has been made to determine the density of these rocks in the area of the Rexburg caldera complex, but the average bulk density of similar rocks in the region ranges from about 2.0 to 2.65 g per cm^3. The average bulk density of pre-Tertiary rocks in the region is about 2.65 g per cm^3. Thus a mass of the low-density Quaternary and Tertiary sedimentary and volcanic rock enclosed by pre-Tertiary rock would produce a gravity low, and this seems a probable cause of a major part of the low. Nowhere does the gravity anomaly require a deep source, although the existence of such a source smaller in

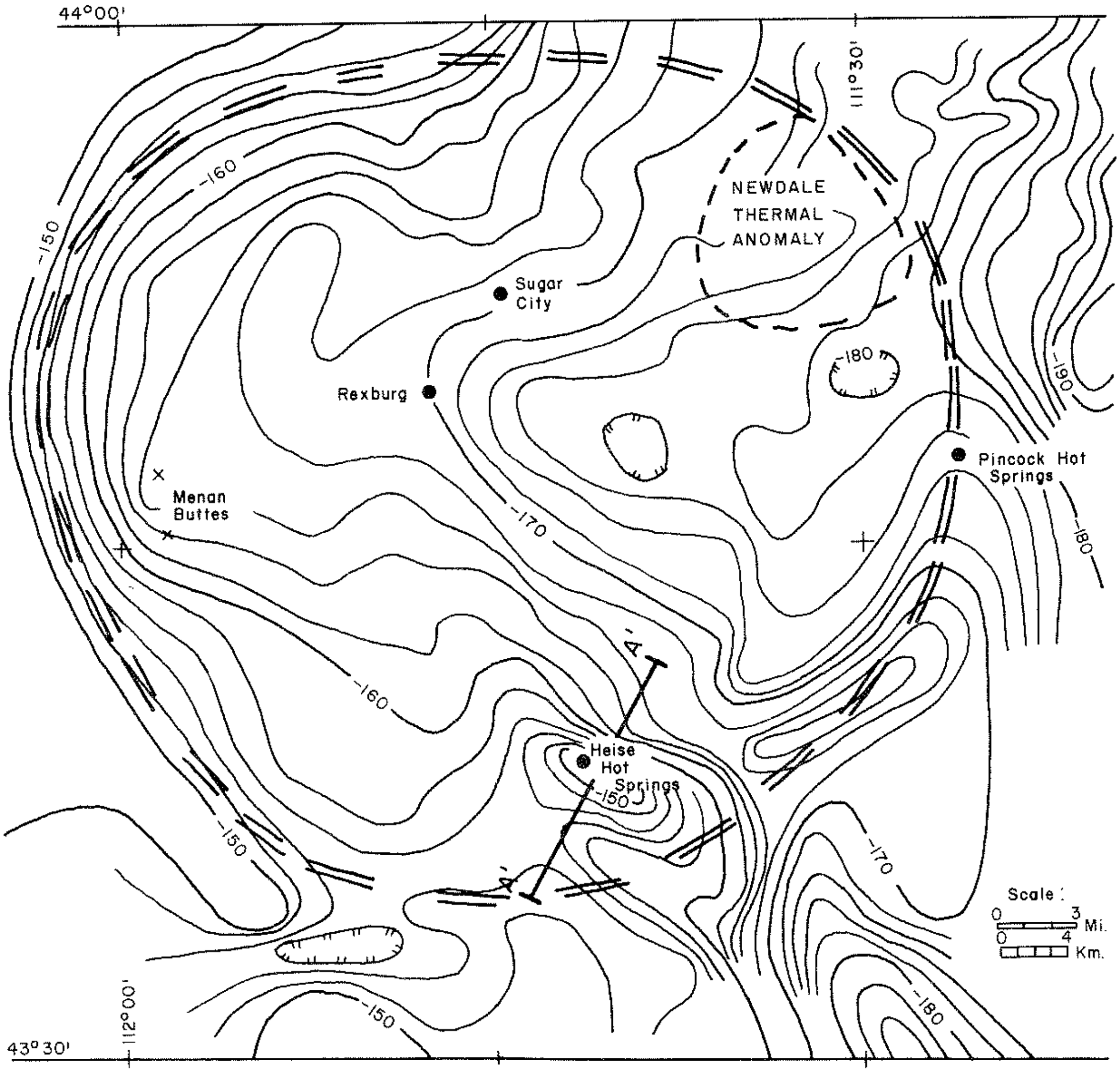


FIGURE 77. Bouguer gravity anomaly map of the Rexburg area showing the outline of the Rexburg caldera complex as inferred from the gravity data. Contour interval is 2 milligals (from Mabey, 1978).

extent than the inferred caldera complex is not inconsistent with the gravity data.

Although the Rexburg gravity low appears in large part to reflect fill within the Rexburg caldera complex, a precise quantitative interpretation of the anomaly is not justified. The amplitude of the gravity low cannot be accurately determined because of uncertainties in isolating the anomaly from the more regional high associated with the eastern Snake River Plain. No approximation of the regional gravity anomaly over the Snake River Plain can be computed by assuming that a linear relationship exists between the gravity anomaly and topography (Mabey, 1966). However, in the northeast part of the Snake River Plain, the area over which the elevations are averaged strongly affects the regional determined and thus the amplitude of the computed residual. Even if the local low could be isolated from the regional high, the fill and the enclosing rock cannot be accurately estimated. Also the possibility of a significant contribution to the gravity anomaly by an underlying intrusive body cannot be discounted. The residual amplitude of gravity is estimated to be about 20 mgals. The average density contrast between the fill and the enclosing rock is likely to be between 0.2 and 0.5 g per cm^3. A 20-mgal anomaly could be produced by a thickness of 1 to 2.5 km of rocks having this density contrast.

Green Canyon (Pincock) Hot Spring (5N-43E-6bcalS) lies on the caldera margin (figure 77). The quartz chemical geothermometer (T_1, basic data table 2) gives an estimate that thermal water feeding the Green Canyon Hot Springs may only have been as hot as 72°C.

JEFFERSON COUNTY

Only one thermal water occurrence is known in Jefferson County (figure 75). Heise Hot Springs (4N-40E-25ddalS), an established popular resort area located near the South Fork of the Snake River near the edge of the Snake River Plain, is in the extreme southeastern part of the county. Surface temperature is 49°C. The quartz chemical geothermometer gives an estimate of a subsurface temperature of 79°C. This spring deposits free sulfur and travertine and has a distinct sulfur odor. It issues from Tertiary silicic volcanic rocks along a northwest-trending fault. Heise lies within and near the southern margin of the Rexburg caldera on a large gravity high.

Mabey (1978) reports:

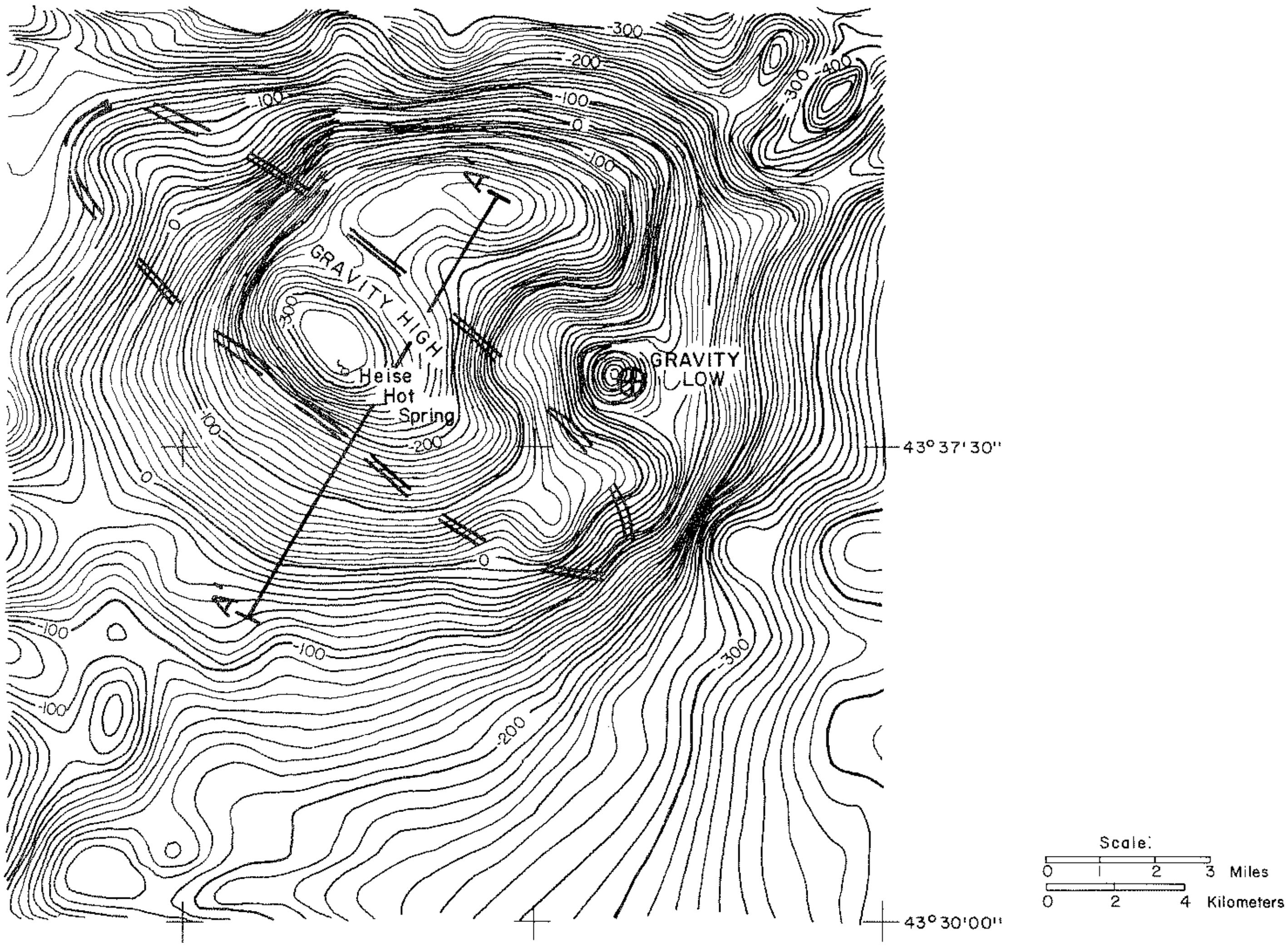
The most prominent local gravity and magnetic anomalies are highs within the Rexburg caldera complex in the area of Heise Hot Springs (figure 77.) Although the crests of the anomalies are coincident, the extent of the anomalies are different and they cannot reflect entirely the same mass. Mesozoic sedimentary rocks overlain by Pliocene rhyolite flows and welded tuffs are exposed in the area of the anomalies. Rhyolite dikes are locally abundant. The northwest-trending Heise fault (Prostka and Hackman, 1974), which forms a southwest-facing scarp locally 300 m high, is parallel to and near the crest of the anomalies. The correlation between the gravity high and outcropping Mesozoic sedimentary rock suggests that the gravity anomaly reflects in large part a structural high elevating the more dense pre-Tertiary rocks. The shape and extent of the magnetic anomaly, the abundant rhyolite dikes in the area, and the indication by the magnetic gradients that the source lies below the surface all suggest that a major part of the magnetic high is produced by a large buried intrusive body. Some features of the magnetic anomaly reflect the near-surface volcanic rocks.

Heise Hot Springs and the warm springs to the northwest occur along the crest of the gravity and magnetic highs. The springs are in a structurally complex area where northwest-trending faults, probably related to the Basin and Range structure of Swan and Grand valleys, displace a structural high over the inferred intrusive body. Although the Heise fault forms a prominent southwest-facing scarp and the presence of the Snake River against this scarp attests to recent movement of the fault, the geophysical data indicate that the Heise fault is near the crest of the structural high.

The north side of the magnetic high is an east-trending zone that coincides with a subtle east trend in the gravity anomaly contours. The zone coincides with west-trending segments of major canyons and is north of the northernmost outcrops of rhyolite. Another east-trending gravity feature is apparent about 5 km farther north.

About 8 km east of Heise Hot Springs are coincident gravity and magnetic lows (figure 78). The cause of the lows is not apparent on the geologic map of Prostka and Hackman (1974). The anomalies appear to reflect a zone in which both the density and magnetization of the underlying rocks are lower than those of the enclosing rocks.

FIGURE 78. Residual aeromagnetic map of the area of Heise Hot Springs showing the location of the gravity high at Heise Hot Springs and a gravity low to the east.



Pincock Hot Spring, on the east edge of the Rexburg caldera, lies midway betwen two flight lines about 9 km apart on the regional map (figure 78). Along both flight lines a magnetic high was measured opposite the hot spring. Although existing data are not adequate to define this anomaly, the data suggest a magnetic high in the area of Pincock Hot Spring.

A profile (figure 79) normal to the trend of the gravity high shows a section that would produce the major features of the gravity and magnetic fields in the vicinity of Heise Hot Springs. The gravity anomaly is attributed to a high on the surface of the pre-Cenozoic rocks at Heise Hot Springs and to an area of thicker Cenozoic rocks under the valley of the Snake River to the southwest. The depression containing the thicker Cenozoic rocks is parallel to and within a northwestward projection of the Swan-Grand Valley trend into the Rexburg caldera complex. The magnetic anomaly has two major components: a local high at Heise Hot Springs superimposed on broader, more deeply buried source. Both components probably reflect a large body of intrusive rock with the apex near Heise Hot Springs. The intrusive mass, which may be the same age as the rhyolite dikes, lies within the Rexburg caldera complex where the Swan-Grand Valley trend intersects the caldera. Magnetic anomalies suggesting a similar intrusive body occur elsewhere along the southeastern margin of the Snake River Plain, where major Basin and Range structures intersect the plain (Mabey, in press). Along the northeastern part of the profile, the magnetic anomaly appears to reflect both Cenozoic volcanic rock and the underlying intrusive body.

SOUTHERN FREMONT COUNTY

One thermal spring in southern Fremont County referred to as Ashton Warm Springs (9N-42E-23dac1S) is located outside the Rexburg caldera boundaries near the community of Ashton (figure 51). It seeps into a nearby creek at 41°C. Silica content is quite high, indicating superheated water could be obtained here. The Na-K-Ca chemical geothermometer indicates that a maximum subsurface temperature of 91°C may be obtained. Ashton Warm Springs is close enough to Ashton to represent a significant energy source for low temperature space heating, and uses up to low temperature blanching (figure 4) might be possible if increased flow rates and temperatures could be found through deep drilling. Geophysical and geological studies to determine structure should be pursued before any drilling in the area begins to best site a target prior to any contemplated deep holes.

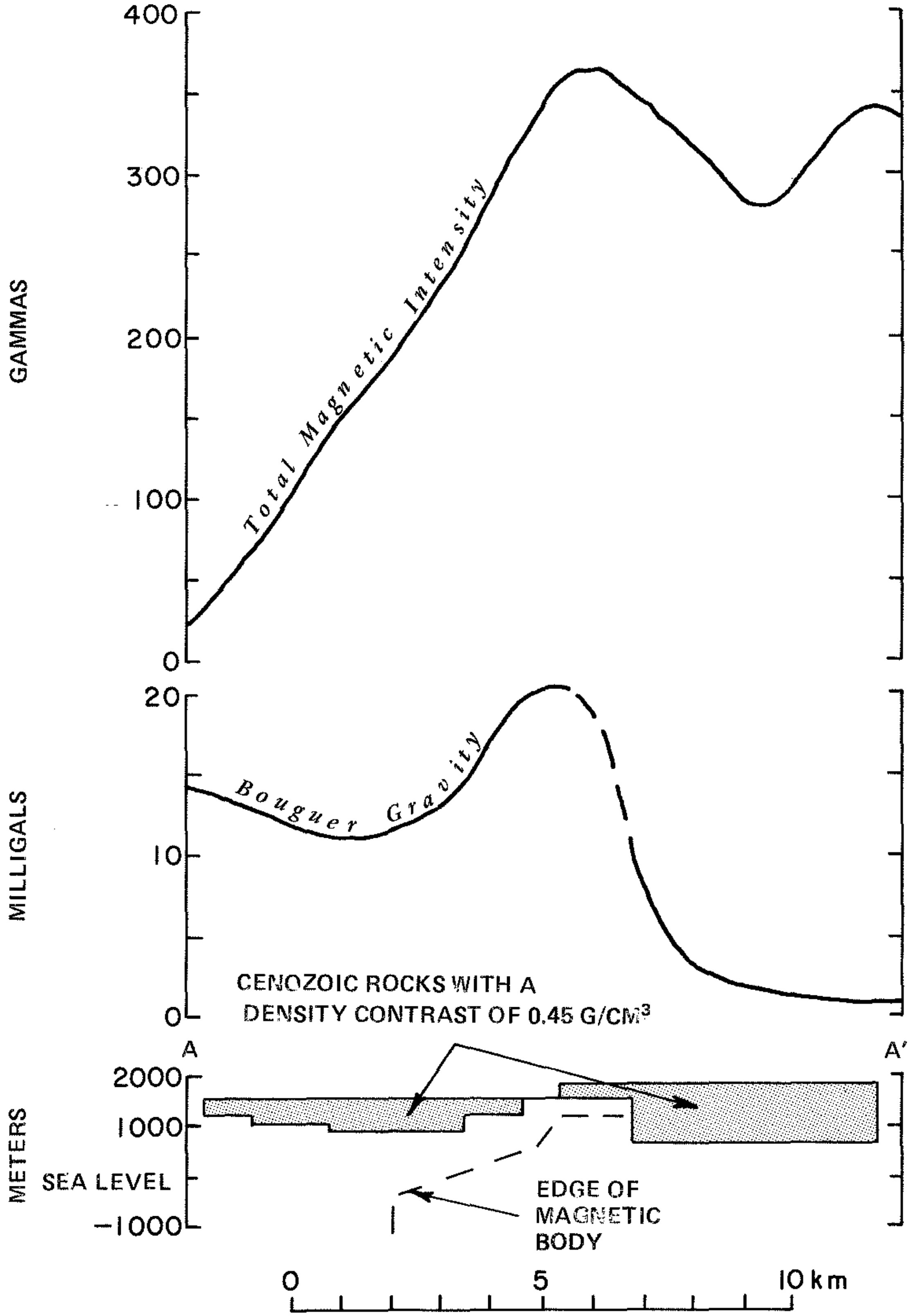


FIGURE 79. Magnetic and gravity profiles and interpreted section across the anomalies at Heise Hot Springs (from Mabey, 1978).

Seventeen thermal wells ranging from 22 to 51°C exist in southern Fremont County in and around the city of Newdale (10 km southeast of St. Anthony). This thermal anomaly seems to be related to the Rexburg caldera previously discussed in the sections on Madison and Jefferson counties. Further work in this area might be oriented toward determining if thermal water could possibly extend further to the northwest, toward St. Anthony.

CLARK COUNTY

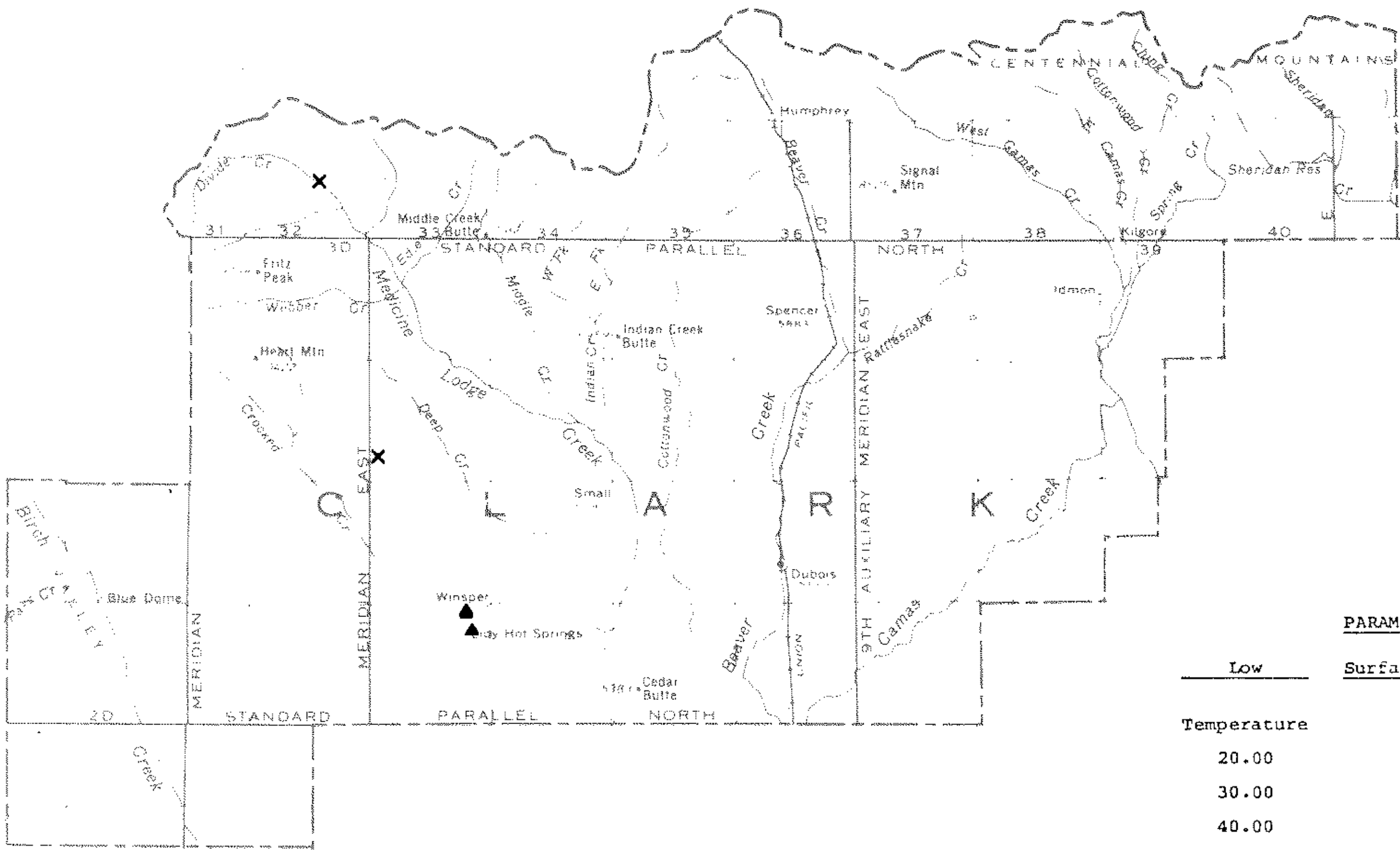
Three thermal spring areas are known in Clark County (figure 80). Liddy Hot Springs (10N-33E-35ccc1S) is located near where the mountain front meets the northern margin of the eastern Snake River Plain. Liddy is located on an active fault and is used presently for phosphate fertilizer processing and in a domestic laundry room. It was formerly used at the Liddy Hot Springs natatorium, which has been closed for several years. Discharge is near a ridgecrest several tens of meters above the Snake River Plain. It is one of the two ridgetop discharges known in Idaho. A well has been drilled near the spring site and the owner reports that water shot to the top of the 12 m drilling mast, so the well apparently is under some degree of shut-in pressure. Surface temperature is 51°C. Best estimated subsurface temperature is 54°C by the chalcedony chemical geothermometer. The Na-K-Ca chemical geothermometer gives an estimate of 65°C as the probable highest temperature that might be obtained from the well.

Big Springs (13N-32E-15bcb1S) is located on Warm Springs Creek, a tributary to Medicine Lodge Creek in the Beaverhead Mountain Range. It is 23°C and is not used. It discharges 140 l/min. No chemical analysis is available.

Warm Springs (11N-32E-25aac1S) is 29°C, discharging 3400 l/m and is currently used for stock water. Chalcedony and Na-K-Ca chemical geothermometers give an estimate of subsurface temperatures of 25 and 23°C, 4 and 6°C, respectively, below surface temperatures. The quartz chemical geothermometer gives an estimated subsurface temperature of 51°C.

Clark County thermal areas apparently lie on the same thermal water structure or issue from deep rocks similar to those found on the south side of the Snake River Plain, judging from the travertine deposits found in both areas (figure 70). Clark County is the only area north of the Snake River Plain where travertine deposits of large areal extent are known. Commercial quarrying operations for onyx occur here. Water quality appears to be good; dissolved solids are less than 500 mg/l. Flouride content at Liddy Hot Springs is 6 mg/l; however, as maximum subsurface temperatures appear to be not greater than 68°C, limited use

FIGURE 80. Index map of Clark County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.



PARAMETER RANGE

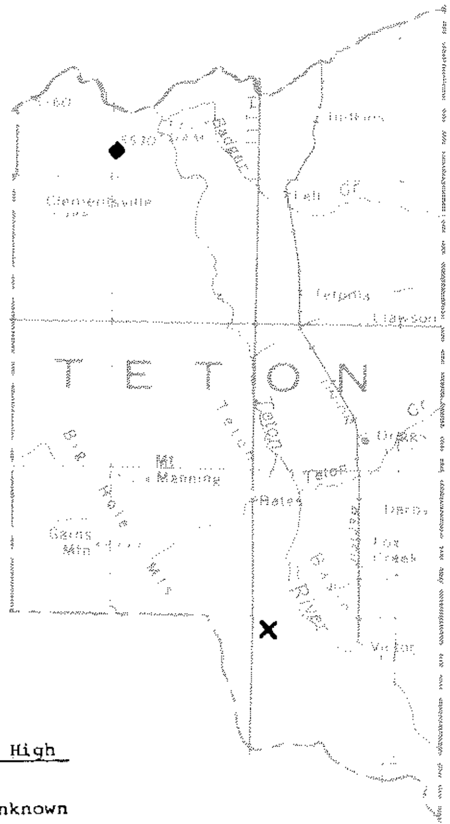
Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	x	29.99
30.00	✦	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⏀	100.00

could be made of the thermal water. Uses such as animal husbandry, greenhouse, space heating, and hay and grain drying are suggested in figure 4. Other thermal water might be discovered in Clark County in areas of obvious faulting near travertine deposits provided extinct springs have ceased flowing caused by self sealing from travertine deposition in the thermal water conduits.

TETON COUNTY

Only one thermal spring (13N-45E-7baa1S) is known in Teton County (figure 81). It is located east of Victor near the western flank of the Big Hole range in the Teton Basin. It is 20°C at the surface. Chemical analysis is not available, so speculation on the subsurface temperature cannot be made. It discharges 950 l/min and is used for swimming. This spring is located near a thrust fault in Triassic marine sedimentary rocks near the nose of an anticline.

A thermal well (7N-43E-36aac1), 353 m deep, has been reported in northwestern Teton County. The reported surface temperature is 49°C. The well was not field checked, but the well location seems to "fit" the suspected curvilinear zone outlined on figure 9.



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	x	29.99
30.00	✦	39.99
40.00	●	49.99
50.00	▲	59.99
60.00	⧗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	ʘ	100.00

FIGURE 81. Index map of Teton County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

SUMMARY
BASIN AND RANGE
CENTRAL ROCKY MOUNTAIN PROVINCE
SOUTHEASTERN IDAHO

Table 6 shows towns in southeastern Idaho that are near thermal water. These towns probably could be heated by geothermal water if sufficient flow rates and temperatures could be obtained by drilling. School districts could perhaps lower heating costs by developing geothermal heating. New schools or other public buildings planned could be built near thermal water locations. In certain places, as at Preston, Malad, and Soda Springs, $CaCO_3$ deposition and high dissolved solids may lead to scaling and disposal problems. In other areas, heat dissipation and objectionable gasses may pose environmental problems. Areas near towns in southeastern Idaho could be evaluated without large capital outlays for exploration as the target areas are limited in size.

Pocatello, due to its large population and industrial base, shows the most promise of the largest impact upon conventional energy supply savings by converting to geothermal energy; the potential in this area should be studied first. Gravity, magnetic, seismic refraction or resistivity studies should be able to pinpoint controlling structure and thermal water occurrence in a limited area near Tyhee, north of Pocatello. Pump tests on existing wells should be conducted to determine aquifer characteristics.

Preston may show promise of power generation. If such is the case, cascading uses could be made of thermal water effluent from the power plant. These uses range from steam electric generation to fish farming (see figure 4).

Malad, Soda Springs, Lava Hot Springs, Rexburg, and Ashton represent towns where an economical assessment of geothermal resources for space heating of business establishments and area subdivisions could be made. Rexburg also has potential to use geothermal heat in food processing plants, as well as to heat large buildings at Ricks College. Other areas may have potential and could see development as well, but assessment might be a little more difficult and costly. The engineering and economic feasibility of retrofitting the above communities for space heating could also be studied.

Wells to tap the geothermal resource would have to be carefully targeted to intersect thermal water bearing structures which, in most cases, appear to be faults.

TABLE 6

CITIES AND TOWNS IN SOUTHEAST IDAHO WITHIN 5 KM (3 MI) OF A 20°C OR HIGHER THERMAL SPRING OR WELL (1978)

Town	County	Location	Spring or Well Surface Temperature °C	*Best Estimated Subsurface Temperature °C Min. Na-K-Ca	Max. Chalcedony	Total Dissolved Solids	Present Water Use	Population	Surface Owner	Remarks
Albion	Cassia	11S-25E-11cca1	60	81	89****	372	Irrigation	243	--	--
Ammon	Bonneville	3N-39E-30adc1	20	--	--	--	Domestic	3,360	Private	No chemical analyses available.
Ashton	Fremont	9S-42E-23dab1S	41	91	116	204	Unused	1,181	Private	Thermal spring just north of town.
Lava Hot Springs	Bannock	9S-38E-21dda1S	45	50	82***	960	Natatorium balneological baths	512	State of Idaho	Recreational area.
Malad	Oneida	14S-36E-27cda1S	25	29	61***	--	Unused	1,848	Private	Spring in travertine bowl near fairgrounds.
McCammon	Bannock	9S-36E-3cdb1	20	--	--	--	Domestic	619	Private	No chemical analyses available.
Newdale	Fremont	7N-41E-35cdd1	32	84	93	377	Irrigation	285	City	Several wells in vicinity of Newdale.
Pocatello	Bannock	5S-34E-26dab11	41	47	62	718	Domestic & irrigation	42,565	Private	Several wells aligned in a NE direction.
Preston	Franklin	15S-39E-17bcd1	84	125	250**	9,830	Unused	3,284	Private	Geothermometers difficult to interpret.
Rexburg	Madison	5N-40E-36ddb1	26	--	--	--	Irrigation	9,761	Private	No chemical analyses available, not field checked.
Soda Springs	Caribou	9S-41E-12add1S	28	30	54	3,207	Tourism	3,487	City	Really a well drilled near a former spring.
Victor	Teton	3N-45E-7abb1	20	--	--	--	Private swimming	254	Private	No chemical analyses available.
Weston	Franklin	16S-38E-24acd1	23	84	92	566	Irrigation	229	Private	Well 3 km SE of Weston.

*See first footnote of Table 4.

**Maximum temperature is from Na-K-Ca chemical geothermometer, minimum temperature is from quartz chemical geothermometer.

***Maximum temperature is from quartz chemical geothermometer, minimum temperature is from the chalcedony chemical geothermometer.

****Maximum temperature is from Na-K-Ca chemical geothermometer, minimum temperature is from the chalcedony chemical geothermometer.

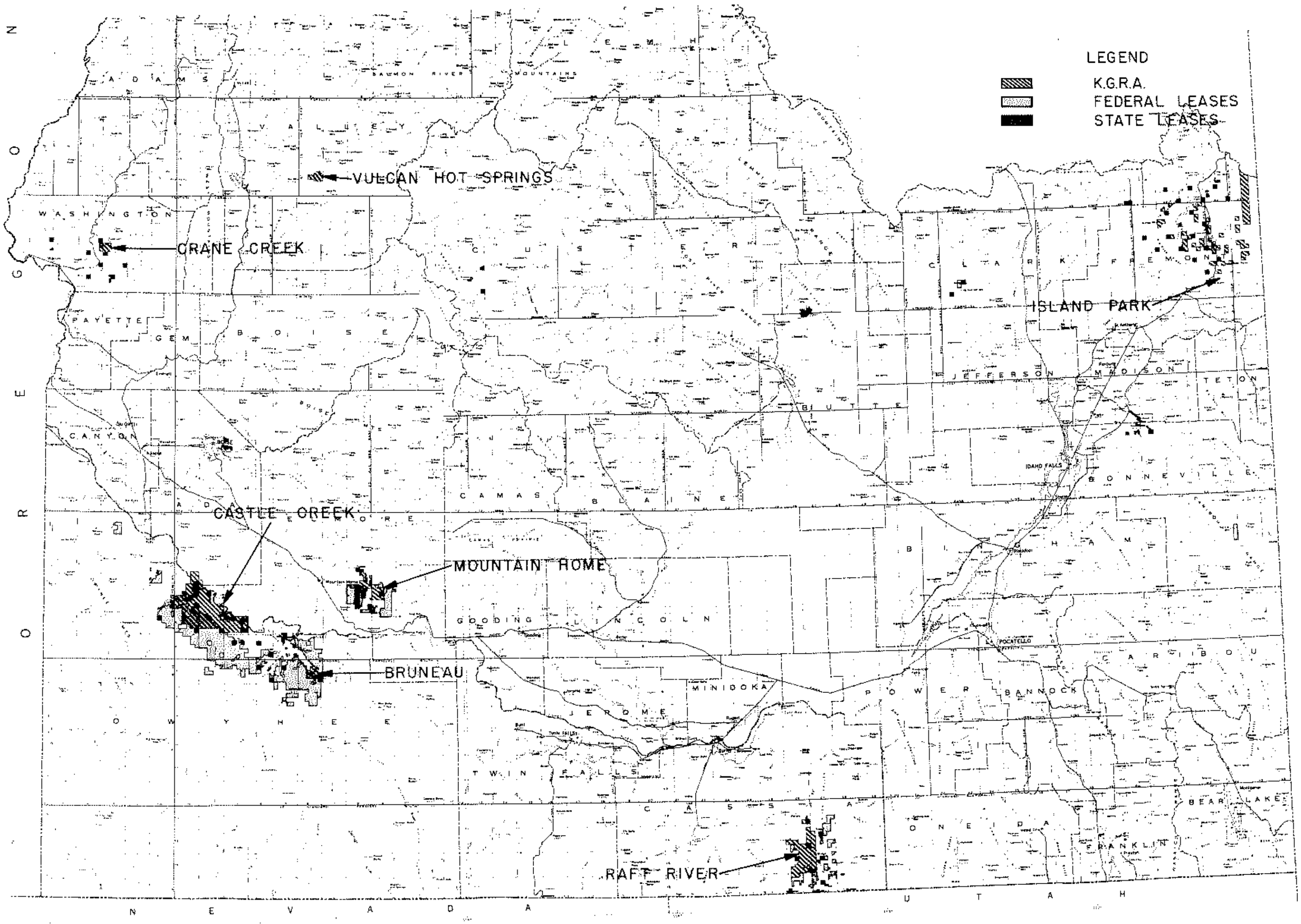
CONCLUSIONS AND RECOMMENDATIONS

It has become apparent that much of the thermal water discharged through wells and springs is probably of low temperature (<100°C). Much of it discharges near small towns and cities throughout southern Idaho where it could reasonably be used for space heating. Figure 82 shows locations of towns and cities in Idaho within 5 km of a thermal water discharge. In these areas, and to some extent in favorable rural areas, the federal 1978 Energy Tax Act has provided significant incentives for private development. These cities and towns near thermal water discharges represent approximately 30 percent of Idaho's present population.

Prior to the development of any geothermal resource, the prospective developer/user should be sure there is a necessary amount of water appropriated and a drilling permit secured from the IDWR. The subsurface ownership should be checked for ownership of the mineral rights. If not, the developer/user will need to secure a geothermal lease from the appropriate party or agency.

As found in the statewide study done for this report, most of the thermal water is associated with known faults or linear features thought to represent some type of rock fracture. Even the three main thermal aquifers presently known to have thermal water are widespread--Bruneau-Grand View, Blue Gulch-Artesian City, and Nampa-Caldwell areas may ultimately be fed through deep-seated regional fractures. Recharge to the fracture controlled systems could be anywhere along their length and interbasin groundwater transfer may be associated with those that are regional in length. More and perhaps hotter water might be discovered by exploration along faults and fractures throughout the Snake River Plain region. (Drill holes would have to be targeted carefully to intersect the water bearing structure at predetermined depth. Detailed knowledge of the dip, strike, and throw of faults would be needed to site the drill holes.) Reflective seismic profiling and deep electrical resistivity methods appear to be the best methods of delineating fractures containing thermal water in much of the western Snake River Plain region. A systematic program for seismic and resistivity profiling should be initiated in the Western Snake River Plain region and in areas of heavy population density in eastern Idaho, such as Pocatello, Twin Falls, and Idaho Falls, to map fracture patterns, provided geologic conditions are conducive to seismic techniques in these areas.

FIGURE 82. Index map showing known geothermal resource areas (KGRAs) and federal and state leased lands in Idaho (current to October, 1978).



In the Western Snake River Plain region, the faults and linear features associated with thermal water appear to be regional in character, some stretching the length and breadth of the plain. In the Western Snake River Plain, a systematic seismic reflection profiling program should be initiated to cover most of the plain proper where geologic conditions are favorable to seismic reflection techniques. This could be in the Nampa-Caldwell-Boise region and be extended into other areas later on. The seismic profiling could be followed by resistivity surveys of faulted and fractured areas discovered by the seismic profiling. This would provide information on deep water movement, recharge, and discharge areas. It would leave well-defined target areas for large-scale energy users to explore in greater depth.

The small towns and cities outside the Western Snake River Plain could be assessed at relatively small cost as surveys could be concentrated in smaller areas.

The preceding three regional summaries give specific conclusions regarding towns that could receive the most significant and the greatest benefits from further study.

SELECTED REFERENCES

Ackerman, H.D., 1975, abs., Seismic refraction study in the Raft River geothermal area, Idaho: Soc. Explor. Geophys. Annual Int. Meeting, Abs. no. 45, p. 28.

_________, 1975, Velocity section in Raft River, Idaho, geothermal area from seismic refractions: U.S. Geol. Survey open file report no. 75-106.

Anderson, W.L., 1977, Interpretation of electromagnetic soundings in the Raft River geothermal area, Idaho: U.S. Geol. Survey open file report no. 77-557.

Applegate, J.K. and Donaldson, P.R., 1975, abs., Passive and active seismic studies and the geologic structure of the Boise front, Idaho: Soc. Explor. Geophys. Annual Int. Meeting, abs. no. 45, p. 29.

__________, 1977, Characteristics of selected geothermal systems in Idaho, in The earth's crust, its nature and physical properties: Am. Geophys. Union, Geophysical monograph 20.

Applegate, J.K., Donaldson, P.R., Hinkley, D., and others, 1976, abs., Borehole geophysics evaluation of the Raft River geothermal reservoir, Idaho: Soc. Explor. Geophys., Annual Int. Meeting, abs. no. 45, p. 94-95.

Applegate, J.K., Donaldson, P.R. and Mink, L.L., 1976, abs., Geologic and seismic studies of the Boise front, Idaho, for geothermal resource evaluation: Am. Assoc. Petroleum Geologists Bull., v. 60, p. 1389.

Applegate, J.K., Donaldson, P.R., Mink, L.L., and others, 1977, An investigation of the geothermal potential of the Boise, Idaho area: U.S. Dept. of Energy, open file report 1537, Idaho Falls, Idaho.

Armstrong, F.C., 1953 Generalized composite stratigraphic section for the Soda Springs quadrangle and adjacent areas in southeastern Idaho: in Intermountain Assoc. Petroleum Geologists 4th Ann. Field Conf., 1953: chart in pocket.

__________, 1969, Geologic map of the Soda Springs quadrangle, southeastern Idaho: U.S. Geol. Survey Misc. Geol. Inv. Map 1-557, 2 sheets.

Armstrong, F.C. and Cressman, E.R., 1963, the Bannock thrust zone, southeastern Idaho: U.S. Geol. Survey Prof. Paper 374-J, 22 p.

Armstrong, R.L., Leeman, W.P. and Malde, H.E., 1975, K-Ar dating, Quaternary and Neogene volcanic rocks of the Snake River Plain, Idaho: Amer. Jour. Sci., v. 275, p. 225-251.

Arnórsson, Stefán, 1970, Underground temperatures in hydrothermal areas in Iceland as deduced from the silica content of the thermal water: in Proceedings United Nations Symp. on the Development and Utilization of Geothermal Resources, Pisa, 1970, v. 2, Part 1, Geothermics, Spec. Issue 2, p. 537-541.

__________, 1975, Application of silica geothermometer in low temperature hydrothermal areas in Iceland: Amer. Jour. Sci., v. 275, no. 7, p. 763-784.

Austin, C.F. and Wheland, J.A., 1978, Geothermal potential at U.S. Air Force Bases: Geothermal Technology Div. Naval Weapons Center, China Lake, Ca. Civil and Environmental Engineering Development Div., Air Force Systems Command, Tyndall Air Force Base CEEDO-TR-78-47, 55 p.

Barnes, H.L., ed., 1967, Geochemistry of hydrothermal ore deposits: New York; Holt, Rinehart, and Winston, Inc., 670 p.

Bennett, E.H., 1976, Reconnaissance geology and geochemistry of the South Mountain-Juniper Mountain region, Owyhee County, Idaho: Idaho Bur. of Mines and Geology Pamph. no. 166, 110 p.

__________, 1977, Reconnaissance geology and geochemistry of the Blackbird Mountain-Panther Creek region, Lemhi County, Idaho: Idaho Bur. of Mines and Geology Pamph. no. 167, 108 p.

Bishop, A.A., 1975, Use of geothermal water for agriculture: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1221.

Bjorklund, L.J. and McGreevy, L.J., 1971, Groundwater resources of Cache Valley, Utah and Idaho: State of Utah, Dept. of Natural Resources, tech. pub. no. 36, 72 p.

Bodnar, Theodore and Bush, Richard, 1978, Hot springs in the state of Idaho and associated deposits: ISU Geology Research Dept., open file report.

Bodvarsson, Gunnar, 1970, Evaluation of geothermal prospects and the objectives of geothermal exploration: Geoexploration, 8,7.

Bond, J.G., 1963, Geology of the Clearwater embayment: Idaho Bur. of Mines and Geology Pamph. no. 128, 83 p.

__________, 1978, Geologic map of Idaho: Idaho Dept. of Lands, Bur. of Mines and Geology, 1 map.

Bonini, W.E., 1963, Gravity anomalies in Idaho: Idaho Bur. of Mines and Geology Pamph. no. 132, 10 p.

Bonini, W.E. and Lavin, P.M., 1957, abs., Gravity anomalies in southern Idaho and southwestern Montana: Geol. Soc. America Bull., v. 68, p. 1702.

Braile, L.W., Keller, G.R., Martin, W.R., et. al., 1977, abs., Crustal structure of the Columbia Plateau and Snake River Plain: Geol. Soc. America, abs. programs, vol. 9, no. 7, p. 908-909.

Bright, R.W., 1963, Pleistocene Lakes Thatcher and Bonneville, southeastern Idaho: Minnesota Univ. (Minneapolis) Ph.D. thesis; available from University Microfilms, Inc., Ann Arbor, Mich.

Brook, C.A., Mariner, R.H., Mabey, D.R., and Swanson, J.S., 1979, Hydrothermal convection systems with reservoir temperature $\geq$ 90°C, in Assessment of geothermal resources of the United States - 1978, L.J.B. Muffler, ed., U.S. Geol. Survey Circ. 790, 163 p.

Brott, C.A., Blackwell, D.D. and Mitchell, J.C., 1975, abs., Heat flow studies of the Snake River Plain: Geol. Soc. America, abs. programs, v. 7, no. 5, p. 590-591.

__________, 1976, Geothermal Investigations in Idaho, Part 8, Heat flow studies of the Snake River Plain, Idaho: Idaho Dept. of Water Resources, Water Inf. Bull. no. 30, 195 p.

__________, 1976, abs., Heat flow study of Snake River Plain, Idaho: Amer. Assoc. Petroleum Geologists Bull., v. 60, p. 1392.

__________, 1978, Tectonic implications of the heat flow of the western Snake River Plain, Idaho: Geol. Soc. America Bull., v. 89 p. 1697-1701.

Burnham, W.L., Harder, A.H. and Dion, N.P., 1969, Availability of groundwater for large-scale use in the Malad Valley-Bear River Basin areas of southeastern Idaho - an initial assessment: U.S. Geol. Survey open file report, 40 p.

Castelin, P.M. and Chapman, Sherl, 1972, Water resources of the Big Wood River-Silver Creek area, Blaine County, Idaho: Idaho Dept. of Water Adm., Water Inf. Bull. no. 28.

Castelin, P.M. and Winner, J.E., 1976, Effects of urbanization on the water resources of the Sun Valley-Ketchum area, Blaine County, Idaho: Idaho Dept. of Water Resources, Water Inf. Bull. no. 40.

Cater, F.W., Pinckney, D.M., Hamilton, W.B., Parker, R.L., Weldin, R.D., Close, T.J. and Zilka, N.T., 1973, Mineral resources of the Idaho Primitive Area and vicinity, Idaho: U.S. Geol. Survey Bull. 1304, 431 p.

Chappel, R.N., Griffith, J.L., Knowles, W.R. and Schulta, R.J., 1978, The multipurpose geothermal test and experimental activities at Raft

River, Idaho: Geothermal Energy: A Novelty becomes a Resource, transactions v. 2, sec. 1, p. 83-87, Geothermal Resources Council Annu. Meeting, 25-27 July 1978.

Choate, Raoul, 1962, Geology and ore deposits of the Stanley area: Idaho Bur. of Mines and Geology Pamph. no. 126, 122 p.

Cook, K.L., Halverson, M.O., Stepp, J.C. and Bery, J.W., Jr., 1964, Regional gravity survey of the northern Great Salt Lake Desert and adjacent areas in Utah, Nevada and Idaho: Geol. Soc. America Bull., v. 75, p. 715-740.

Coulter, H.W., 1956, Geology of the southeast portion of the Preston quadrangle, Idaho: Idaho Bur. of Mines and Geology Pamph. no. 107, 47 p.

Covington, H.R., Deep drilling data, Raft River geothermal area, Idaho (well no. 3, sidetract-C): U.S. Geol. Survey open file report no. 77-883.

__________, 1977, Deep drilling data, Raft River geothermal area, Idaho (well no. 1): U.S. Geol. Survey open file report No. 77-226.

__________, 1977, Deep drilling data, Raft River geothermal area, Idaho (well no. 2): U.S. Geol. Survey open file report no. 77-243.

__________, 1977, Deep drilling data, Raft River geothermal area, Idaho (well no. 3): U.S. Geol. Survey open file report no. 77-616.

__________, 1977, Deep drilling data, Raft River geothermal area, Idaho (well no. 4): U.S. Geol. Survey open file report no. 78-91.

Cox, Allan, Dalrymple, G.B. and Doell, R.R., 1967, Reversals of the earth's magnetic field: Sci. American, v. 216, no. 2, p. 44-54.

Crosthwaite, E.G., 1957 (1958), Ground-water possibilities south of the Snake River between Twin Falls and Pocatello, Idaho: U.S. Geol. Survey Water-Supply Paper 1460 C, p. 99-145.

Crosthwaite, E.G., Mundorff, M.J. and Walker, D.H., 1970, Ground water aspects of the Lower Henry Fork region, eastern Idaho: U.S. Geol. Survey Water Supply Paper 1879 C.

Crosthwaite, E.G. and Scott, R.C., 1956, Ground-water in the North Side Pumping Division, Minidoka County, Idaho: U.S. Geol. Survey Circ. 371, 19 p.

Dart, R.H., Neill, D.T. and Whitbeck, J.F., 1975, Conceptual design and cost evaluation of organic rankine cycle electric generating plant powered by medium temperature geothermal water: Aerojet Nuclear Corp., Idaho Operations Office, ANCR report 1226.

Davis, W.E., 1972, Mineral resources of the Salmon River breaks primitive area, Idaho, aeromagnetic survey: U.S. Geol. Survey Bull. 1353-C, p. 18-20.

Day, N.F., 1974, Linears Map, Band 5, MSS-ERTS, Northern and Southern Idaho: Idaho Bur. of Mines and Geology open file map, 2 maps.

Diment, W.H., Urban, T.C., Sass, J.H., et al., 1975, Temperatures and heat contents based on conductive transport of heat, in Assessment of geothermal resources of the United States, 1975: U.S. Geol. Survey Cir. 726.

Dion, N.P., 1969, Hydrologic reconnaissance of the Bear River Basin in southeastern Idaho: Idaho Dept. of Water Resources, Water Inf. Bull. No. 13, 66 p.

_________, 1974, An estimate of leakage from the Blackfoot Reservoir to Bear River Basin, southeastern Idaho: Idaho Dept. of Water Resources, Water Inf. Bull. No. 34, 24 p.

Doherty, D.M. and Nash, K.G., 1977, abs., Remote sensing identification of caldera related geologic features in the eastern Snake River Plain: Geol. Soc. America, abs. programs, v. 9, no. 6, p. 719-720.

Donaldson, P.R. and Applegate, J.K., 1975, abs., Evaluation of the geothermal potential of the Boise front, Idaho: Soc. Explor. Geophys. Annual Int. Meeting, abs., no. 45, p. 29.

_________, 1976, abs., Geoelectrical investigations of Boise, Idaho geothermal system: Amer. Assoc. Petroleum Geologists Bull., v. 60, p. 1397.

_________, 1979, Geophysical review of selected geothermal areas in southern Idaho: Geotechniques, Inc. open file report.

Donovan, L. E., 1975, Feasibility/conceptual design study for Boise geothermal space heating demonstration project distribution and disposal system: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1258.

Donovan, L.E. and Richardson, A.S., 1975, Feasibility/conceptual design study for Boise geothermal space heating demonstration project building modifications: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1246.

Eldridge, G. H., 1895, A geologic reconnaissance across Idaho: U.S. Geol. Survey Sixteenth Ann. report, pt. 2, 211-276.

Ellis, A. J., 1970, Quantitative interpretation of chemical characteristics of hydrothermal systems: in Proceedings United Nations Symp.

on the Development and Utilization of Geothermal Resources, Pisa, 1970, v. 2, Part 1, Geothermics, Spec. Issue 2, p. 516-528.

Fenneman, N.M., 1917, Physiographic division of the United States: Assoc. Am. Geographers Annals 6, p. 19-98.

_________, 1931, Physiography of Western United States: New York, McGraw-Hill Book Co., 534 p.

Forrester, J.D., 1956, Geology and mineral resources of the Salmon Quadrangle, Lemhi county, Idaho: Idaho Bur. of Mines and Geology Pamph. no. 106, 102 p.

Fournier, R.O., 1977. Chemical geothermometers and mixing models for geothermal systems: Geothermics, v. 5, no. 1-4, p. 41-50.

Fournier, R.O. and Potter, R.W., II, 1978, A magnesium correction for the Na-K-Ca chemical geothermometer: U.S. Geol. Survey open file report 78-986, 24 p.

Fournier, R.O. and Rowe, J.J., 1966, Estimation of underground temperatures from the silica content of water from hot springs and wet steam wells: Am. Jour. Sci., v. 264, p. 685-695.

Fournier, R.O., and Truesdell A.H., 1970, Chemical indicators of subsurface temperature applied to hot waters of Yellowstone National Park, Wyo., U.S.A.: in Proceedings United Nations Symp. on the Development and Utilization of Geothermal Energy, Pisa, 1970, v. 2, Part 1, Geothermics, Spec. Issue 2; p. 529-535.

_________, 1973, An empirical Na-K-Ca geochemical thermometer for natural waters: Geochim, et. Cosmochim, Acta., v. 73, p. 1255-1275.

_________, 1974, Geochemical indicators of subsurface temperature, Part 2, Estimation of temperature and fracture of hot water mixed with cold: U.S. Geol. Survey Jour. of Research, v. 2, no. 3, p. 264-270.

Fournier, R.O., White, D.E. and Truesdell, A.H., 1974, Geochemical indicators of subsurface temperature, Part 1, Basic Assumptions: U.S. Geol. Survey Jour. of Research, v. 2, no. 3, p. 259-263.

Geothermal Task Force, 1975, Idaho Geothermal R&D project report for period 1-1-75 to 3-31-75: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1222.

_________, 1975, Geothermal R&D project report for period 4-1-75 to 6-30-75: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1247.

_________, 1975, Geothermal R&D project report for period 7-1-75 to 9-30-75: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1281.

_________, 1975, Geothermal R&D project report for period 10-1-75 to 12-30-75: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1283.

_________, 1976, Geothermal R&D project report for period 1-1-76 to 3-31-76: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1319.

_________, 1976, Geothermal R&D project report for period 4-1-76 to 6-30-76: EG&G Idaho, Inc., Idaho National Engineering Laboratory, Energy Research and Development Administration, Idaho Operations Office, TREE report 1008.

Gerick, J.A. and Simmons, George, 1977, Idaho potential for industrial utilization of geothermal energy: M.S. thesis, University of Idaho, Chem. Eng. Dept., 169 p.

Gilbert, G.K., 1875, Lake Bonneville, in report upon the geographic and geologic exploration and survey west of the 100th meridian: Washington U.S Gov't. Printing Office, v. 3.

_________, 1890. Lake Bonneville: U.S. Geol. Survey Mon. 1, 438 p.

Godwin, L.H., Haigler, L.B., Rioux, R.L., White, D.E., Muffler, L.J.P. Wayland, R.G., 1971, Classification of public lands valuable for geothermal resources: U.S. Geol. Survey Circ. 647, 17 p.

Godwin, L.H. and Oberlindacher, Peter, 1967, Rev. July 1976, State of Idaho geothermal and classification map: Menlo Park, Calif., U.S. Geol. Survey Conserv. Div., Pacific Area.

Greenberg, S.A. and Price, E.W., 1957, The solubility of silica in solutions and electrolytes: Jour. Phys. Chem. 61, p. 1539-1541.

Grose, L.T., 1971, Geothermal energy: geology, exploration, and developments; Part 1: Colorado School Mines Research Inst. Min. Industries Bull. v. 14, no. 6, 14 p.

Hale, L.A., 1969, abs., Phosphate exploration using gamma-radiation logs, Dry Valley, Idaho: Mining Eng., v. 21, no. 8, p. 35.

Hamilton, W.S., 1965, Geology and petrogenesis of the Island Park caldera of rhyolite and basalt eastern Idaho: U.S. Geol. Survey Prof. Paper 504 C, p. C1-C37.

_________, 1976, abs., Tectonic history of west-central Idaho: Geol. Soc. America, abs. programs, v. 8, no. 3, p. 378-379.

Hardy, C.T. and Williams, J.S., 1953, Geologic map of the northern Wasatch Mountains, Utah and Idaho: in Intermountain Assoc. Petroleum Geologists Guidebook 4th Ann. Field Conf., Geology of northern Utah and southeastern Idaho, 1953, pl. 1.

Harrison, J.E., Greggs, A.B. and Wells, J.D., 1974, Tectonic features of the Precambrian belt basin and their influence on post-belt structures: U.S. Geol. Survey Prof. Paper 866.

Haskett, G.R., 1976, Thermal springs and wells, lineaments and circular feature map for Idaho, U.S. Bur of Rec. map, open file.

Healy, J., 1970, Pre-investigation geological appraisal of geothermal fields: in Proceedings United Nations Symp. on the Development and Utilization of Geothermal Resources, Pisa, 1970, v. 2, Part 1, Geothermics, Spec. Issue 2, p. 571-577.

Hill, D.P., 1963, Gravity and crustal structure in the western Snake River Plain, Idaho: Jour. Geophys. Research, v. 68, no. 20, p. 5807-5819.

Hill, D.P., Baldwin, H.L. and Pakiser, L.C., 1961, Gravity, volcanism and deformation in the Snake River Plain, Idaho: U.S. Geol. Survey Prof. Paper 424-B, p. 248-250.

Hill, D.P. and Pakiser, L.C., 1967, Seismic-refraction study of crustal structure between the Nevada test site and Boise, Idaho: Geol. Soc. America Bull., v. 78, p. 685-704.

Holland, H.D., 1965, Some application of thermochemical data to problems of ore deposits, II. Mineral assemblages and the composition of ore-forming fluids: Econ. Geology v. 60, no. 6, p. 1101-1165.

_________, 1967, Gangue minerals in hydrothermal deposits: in Geochemistry of Hydrothermal Ore Deposits, H.L. Barnes, ed., Holt, Rinehart, and Winston, Inc.

Hollenbaugh, K.M. and Nichols, C.R., 1975, Geological aspects of the national potential for non-electrical utilization of geothermal resources: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1213.

Hoover, D.B. and Long, C.L., 1975, Audio-magnetotelluric methods in reconnaissance geothermal explorations: Proceedings, 2nd United Nations Symp. on the Development and Use of Geothermal Resources, San Francisco, v. 2, p. 1059-1064.

Hoover, D.B. and Tippens, C.L., 1975, Geothermal Investigations in Idaho, Part 2, A reconnaissance audio-magnetotelluric survey: Idaho Dept. of Water Resources, Water Inf. Bull. no. 30, p. 53-79.

Hoover, D.B., Brougham, G.W. and Clark, J.C., 1976, Station and traverse location map, audio-magnetotelluric data log and telluric profiles for Crane Creek known geothermal resource area, Idaho: U.S. Geol. Survey open file report no. 76-409.

Hubbard, C.R., 1956, Geology and mineral resources of Nez Perce County, Idaho: Bur. of Mines and Geology, County report no. 1, 17 p.

Huttrer, G. W. and Tamm, A.H., 1977, abs., Geothermal potential of three areas in southeastern Idaho and western Wyoming: Am. Assoc. Petroleum Geologists Bull., v. 61, p. 798.

Hyde, Jay and Whelan, J.A., 1978, Field report, geothermal potential of the Mountain Home Air Force Base and Sailor Creek Air Force Range, Idaho. Appendix B, Item 8 to Air Force report CEEDO 78-47, Geothermal potential at U.S. Air Force Bases, 55 p.

Jackson, D.B., 1974, Report on direct current soundings over a geothermal prospect in the Bruneau-Grandview area, Idaho: U.S. Geol. Survey open file report no. 74-240.

Jobin, D.A. and Schroeder, M.L., 1964. Geology of the Conant Valley quadrangle, Bonneville County, Idaho: U.S. Geol. Survey Mineral Inv. Field Studies Map MF-277, 1 sheet.

Karlo, J.F. and Koswor, P.R., 1975, abs., Thermal overprint as a possible effect on the gravity relations of the eastern Snake River Plain, Idaho: Geol. Soc. America, abs. programs, v. 7, no. 5, p. 615-616.

Keller, A.S., 1963, Structure and stratigraphy behind the Bannock thrust in parts of the Preston and Montpelier quadrangles, Idaho: Unpublished Columbia Univ., Ph.D. dissertation, 204 p.

Keller, J.G., Miller, L.G., Miners, G.L. and Richardson, A.S., 1975, Geothermal space heating of a geothermal drilling rig: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission Idaho Operations Office, ANCR report 1241.

Kettenacker, W.C., 1977, Two dimensional simulation of the Raft River geothermal reservoir and wells: EG&G Idaho, Inc., Idaho National Engineering Laboratory, Energy Research and Development Administration, Idaho Operations Office, TREE report 1085.

Kharaka, Y.K. and Barns, Ivan, 1973, SOLMNEQ: Solution-mineral equilibrium computations: National Tech. Inf. Service pub. PB-215 899.82 p.

Khattab, M.M.M., 1969, abs., Gravity and magnetic surveys of the Grouse Creek Mountains and the Raft River Mountains area and vicinity, Utah and Idaho: Diss. abs. v. 29, no. 12, part 1, p. 4720 B.

Killsgaard, T.H., Freeman, V.L. and Coffman, J.S., 1970, Mineral resources of the Sawtooth primitive area, Idaho: U.S. Geol. Survey Bull. 1319-D.

King, Clarence, 1878, Systematic geology: U.S. Geol. Explor. 40th Parallel, v. 1, p. 127-227.

Kirkham, V.R.D., 1924, Geology and oil possibilities of Bingham, Bonneville, and Caribou Counties, Idaho: Idaho Bur. of Mines and Geology Bull. 8, 108 p.

Kummell, Bernhard, 1954, Triassic stratigraphy of southeastern Idaho and adjacent areas: U.S. Geol. Survey Prof. Paper 254-H, p. 165-194.

Kunze, J.F., 1974, Program plan for FY 1974: Aerojet Nuclear Corp., National Reactor Testing Station, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1139.

_________, 1975, Idaho geothermal R&D project report for period 1-1-75 to 3-31-75: Idaho National Engineering Laboratory, ANCR report 1222, p. 17.

Kunze, J.F. and Miller, L.G., 1974, Idaho geothermal R&D project report for period 12-16-73 to 3-15-74: Aerojet Nuclear Corp., National Reactor Testing Station, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1155.

_________, 1974, Idaho geothermal R&D project report for period 7-16-74 to 9-30-74: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1190.

_________, 1974, Geothermal R&D project report for period 10-1-74 to 12-31-74: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1208.

_________, 1974, Idaho geothermal R&D project report for 3-16-74 to 7-15-74: Aerojet Nuclear Corp., National Reactor Testing Station, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1175.

Kunze, J.F., Miller, L.G. and Whitbeck, J.F., 1975, Moderate temperature utilization project in the Raft River Valley, Proceedings 2nd United Nations Symp. on the Development and Use of Geothermal Resources, San Francisco, v. 3, p. 1241-1245.

Kunze, J.F. and Richardson, A.S., 1975, National program definition study for the non-electrical utilization of geothermal energy:

Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1214.

Kunze, J.F., Richardson, A.S., Nichols, C.R. and Mink, L.L., 1975, Geothermal space heating project involving state owned buildings in Boise, Idaho: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1211.

Kunze, J.F., Richardson, A.S., Hollenbaugh, K.M., Nichols, C.R. and Mink, L.L., 1975, Non-electric utilization project, Boise, Idaho: Proceedings 2nd United Nations Symp. on the Development and Use of Geothermal Resources, San Francisco, v. 3, p. 2141-2145.

Kunze, J.F., Miller, L.G., Neill, D.T. and Nichols, C.R., 1974, Proposal for a demonstration geothermal power plant in the Raft River Valley: Aerojet Nuclear Corp., National Reactor Testing Station, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1138.

Kunze, J.F. and Whitbeck, J.F., 1976, A plan for developing moderate temperature low salinity geothermal resources: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1318.

La Fehr, T.R., 1963, abs., Gravity and crustal structure in eastern Snake River Plain, Idaho: Am. Assoc. Petroleum Geologists Bull., v. 47, p. 1772.

La Fehr, T.R. and Pakiser, L.C., 1962, Gravity, volcanism and crustal deformation in the eastern Snake River Plain, Idaho: U.S. Geol. Survey Prof. Paper 450D, p. 76-78.

Lindal, Baldur, 1973, Industrial and other applications of geothermal energy: in Earth Sciences 12, Geothermal Energy, A Review of Research and Development, The Unesco Press, H.C. Armstead, ed., p. 135-147.

Lindgren, Waldemar, 1900, The gold and silver veins of Silver city, DeLamar, and other mining districts in Idaho: U.S. Geol. Survey Twentieth Ann. report p. 3, p. 65-256.

Livingston, D.C. and Laney, F.G., 1920, The copper deposits of the Seven Devils and adjacent districts including Heath, Hornet Creek, Hoodoo, and Deer Creek: Idaho Bur. of Mines and Geology Pamph. no. 1, 105 p.

Long, C.L., O'Donnell, J.E. and Smith, B.D., 1975, abs., Geophysical studies in the Island Park caldera, Idaho: Geol. Soc. America, abs. programs, v. 7, no. 5, p. 623.

Long, C.L., et. al., 1976, AMT station location map, Island Park KGRA, Idaho: U.S. Geol. Survey open file report no. 76-700-E.

Mabey, D.R., 1966, Relation between Bouguer gravity anamalies and regional topography in Nevada and the eastern Snake River Plain, Idaho: U.S. Geol. Survey Prof. Paper 550-B, p. 105-110.

__________, 1971, Geophysical data relating to a possible Pleistocene overflow of Lake Bonneville at Gem Valley, southeastern Idaho: U.S. Geol. Survey Prof. Paper 750-B, p. 122-127.

__________, 1974, abs., Regional gravity and magnetic anomalies in southeastern Idaho and western Wyoming: Geol. Soc. Am. Spec. Paper 76, p. 212.

__________, 1976, Interpretation of a gravity profile across the western Snake River Plain, Idaho: Geology, v. 4, no. 1, p. 53-55.

__________, 1978, Gravity and aeromagnetic anomalies in the Rexburg area of eastern Idaho: U.S. Geol. Survey open file report no. 78-382.

Mabey, D.R., Ackerman, H., Zohdy, A.A.R., and others, 1975, abs., Geophysical studies of a geothermal area in the southern Raft River Valley, Idaho: Geol. Soc. America, abs. programs, v. 7, no. 5, p. 624.

Mabey, D.R. and Armstrong, F.C., 1962, Gravity and magnetic anomalies in Gem Valley, Caribou County, Idaho: U.S. Geol. Survey Prof. Paper 450-D, p. 73-75.

Mabey, D.R., Peterson, D.L. and Wilson, C.W., 1973, abs., Regional gravity and aeromagnetic studies in southern Idaho: Geol. Soc. America, abs., v. 5, no. 6, p. 494.

__________, 1974, Preliminary gravity map of southern Idaho: U.S. Geol. Survey open file report no. 74-78, 1 map, scale 1:250,000.

__________, 1975, abs., Regional gravity and magnetic studies of the Snake River Plain: Geol. Soc. America, abs. programs, v. 7, no 5, p. 624-625.

Mabey, D.R. and Oriel, S.S., 1970, Gravity and magnetic anomalies in the Soda Springs region, southeastern Idaho: U.S. Geol. Survey Prof. Paper 646-E.

Mabey, D.R., Hoover, D.B., O'Donnell, J.E., and Wilson, C.W., 1978, Reconnaissance geophysical studies of the geothermal system in southern Raft River Valley, Idaho, Geophysics, v. 43, no. 7, p. 1470-1484.

Madsen, W.W. and Ingvarsson, I.J., 1975, Analysis of the binary cycle for geothermal power generation: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1245.

Mahon, W.A.J., 1970, Chemistry in the exploration and exploitation of hydrothermal systems: in Proceedings United Nations Symp. on the Development and Utilization of Geothermal Resources, Pisa, 1970, v. 2, Part 2, Geothermics, Spec. Issue 2, p. 1310-1322.

Malde, H.E., 1959, Fault zone along northern boundary of western Snake River Plain, Idaho: Science, v. 130, no. 3370, p. 272.

Malde, H.E., 1965, Snake River Plain: in the Quaternary of the United States: Princeton, N.M., Princeton Univ. Press, p. 255-263, illus., tables, geol. map.

Malde, H.E., Powers, H.A. and Marshall, C.H., 1963, Reconnaissance geologic map of west-central Snake River Plain, Idaho: U.S. Geol. Survey, Misc. Geol. Inv. Map 1-373.

Maley, S.T., 1973, Handbook of mineral law (1977): Idaho Dept. of Lands Adm. & Div. of Earth Resources, MMRC Publication, Boise, Idaho, 293 p.

Mansfield, G.R., 1927, Geography, geology and mineral resources of part of southeastern Idaho: U.S. Geol. Survey Prof. Paper 152, 453 p.

McGreevy, L.L. and Bjorklund, L.J., 1970, Selected hydrologic data, Cache Valley, Utah and Idaho: U.S. Geol. Survey open file release (duplicated as Utah Basic-Data Release 21), 51 p.

McLain, David, 1978, Lava Hot Springs, Idaho: Geo-heat utilization center Bull. v. 14, no. 1, p. 3.

Meinzer, O.E., 1924, Origin of the thermal springs of Nevada, Utah, and southern Idaho: Jour. Geology v. 32, no. 4, p. 295-303.

Meuschke, J.L. and Long, C.L., 1965, Aeromagnetic map of part of the Lanes Creek quadrangle, Caribou County, Idaho: U.S. Geol. Survey Geophys. Inv. Map GP-490, 1:62,500.

Miller, R.L., 1976, Corrosion Engineering in the utilization of the Raft River geothermal resource: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1342.

Mink, L.L. and Graham, D.L., 1977, Geothermal potential of the west Boise area: EG&G Idaho, Inc., Idaho National Engineering Laboratory, Dept. of Energy, Idaho Operations Office, TREE report 1162, 34 p.

Mitchell, C.M., Knowles, F.F. and Petrafeso, F.A., 1965, Aeromagnetic map of the Pocatello-Soda Springs area, Bannock and Caribou Counties, Idaho: U.S. Geol. Survey Geophys. Inv. Map GP-521.

Mitchell, J.C., 1976a, Geothermal Investigations in Idaho, Part 5, Geochemistry and geologic setting of the thermal waters of the

Northern Cache Valley area, Franklin County, Idaho: Idaho Dept. of Water Resources, Water Inf. Bull. no. 30, 47 p.

_________, 1976b, Geothermal Investigations in Idaho, Part 6, Geochemistry and geologic setting of the thermal and mineral waters of the Blackfoot Reservoir area, Caribou County, Idaho: Idaho Dept. of Water Resources, Water Inf. Bull. no. 30, 47 p.

_________, 1976c, Geothermal Investigations in Idaho, Part 7, Geochemistry and geologic setting of the thermal waters of the Camas Prairie area, Blaine and Camas Counties, Idaho: Dept. of Water Resources, Water Inf. Bull. no. 30, 44 p.

_________, 1978, Idaho Dept. of Water Resources unpublished data.

Mundorff, M.J., 1967, Ground-water in the vicinity of American Falls Reservoir, Idaho: Prepared in cooperation with the U.S. Bureau of Reclamation, Geol. Survey Water-Supply Paper 1846.

Nace, R.L., et. al., 1961, Water resources of the Raft River Basin, Idaho-Utah: U.S. Geol. Survey Water-Supply Paper 1582, 138 p.

Newcomb, R.C., 1970, Tectonic structure of the main part of the basalt of the Columbia River Group, Washington, Oregon and Idaho: U.S. Geol. Survey Misc. Inv. Map 1-587, 1 sheet.

Newton, N.C. and Corcoran, R.E., 1963, Petroleum geology of the western Snake River Basin, Oregon-Idaho: Oil and Gas Investigations no. 1, Oregon Dept. of Geology and Min. Industries, 67 p.

Nichols, C.R., Brockway, C.E. and Warnick, C.C., 1972, Geothermal water and power resource exploration and development for Idaho: Water Resource Research Inst. Tech. Completion Prep. Project NSF-Geothermal 47-517, 48 p.

Norvitch, R.F. and Larson, A.L., 1970, A reconnaissance of water resources in the Portneuf River Basin, Idaho: Idaho Dept. of Reclamation, Water Inf. Bull. no. 16, 58 p.

Oriel, S.S. and Platt, L.B., 1968, Reconnaissance geologic map of the Preston quadrangle, southeastern Idaho: U.S. Geol. Survey open file map, 2 sheets.

Pakiser, L.C., 1960, abs., Gravity in volcanic areas, California and Idaho: Jour. Geophys. Research v. 65, no. 8, p. 2515.

Pakiser, L.C. and Baldwin, H.L., 1961, Gravity, volcanism and crustal deformation in and near Yellowstone National Park: U.S. Geol. Survey Prof. Paper 424-B, p. 246-248.

Pakiser, L.C. and Hill, D.P., 1963, Crustal structure in Nevada and southern Idaho from nuclear explosions: Jour. Geophys. Research, v. 68, no. 20, p. 5757-5766.

Pennington, W.D., Smith, R.B. and Trimble, H.B., 1974, A microearthquake survey of parts of the Snake River Plain and Central Idaho: Seismological Soc. Amer. Bull., v. 64, p. 307-312.

Peterson, D.L., 1974, Bouguer gravity map of part of the northern Lake Bonneville Basin, Utah and Idaho: U.S. Geol. Survey, Misc. Field Study Map, no. MF-627, gravity survey map 1:250,000.

_________, 1977, Principal facts for a gravity survey of Battle Creek-Squaw Creek Hot Springs and vicinity, northern Cache Valley, Idaho: U.S. Geol. Survey open file report no. 77-670.

Peterson, D.L. and Oriel, S.S., 1970, Gravity anomalies in Cache Valley, Cache and Box Elder Counties, Utah, and Bannock and Franklin Counties, Idaho: U.S. Geol. Survey Prof. Paper 700-C, pp. C114-C118.

Peterson, D.L. and Witkind, I.J., 1975, Preliminary results of a gravity survey of the Henry's Lake quadrangle, Idaho and Montana: Jour. Research, U.S. Geol. Survey, v. 3, no. 3, p. 223-228.

Piper, A.M., 1923, Geology and water resources of the Goose Creek Basin, Cassia County, Idaho: Idaho Bur. of Mines and Geology Bull. no. 6, 48 p.

_________, 1925, Ground Water for irrigation on Camas Prairie, Camas and Elmore Counties, Idaho: Idaho Bur. of Mines and Geology Pamph. no. 15, 46 p.

Presser, T.S. and Barnes, Ivan, 1974, Special techniques for determining chemical properties of geothermal water: U.S. Geol. Survey Water Resource Investigations 22-74, 11 p.

Prostka, H.J. and Embree, G.F., 1978, Geology and geothermal potential of the Rexburg area, southeastern Idaho, U.S. Geol. Survey open file report no. 78-1009.

Prostka, H.J., Hackman R.J., 1974, Preliminary geologic map of the northwest 1/4, Driggs 1 and 2° quadrangle, southeastern Idaho: U.S. Geol. Survey open file geologic map 74-105.

Prostka, H.J. and Oriel, S.S., 1975, abs., Genetic models for Snake River Plain, Idaho: Geol. Soc. America, abs. programs, v. 7, no. 7, p. 1236.

Ralston, D.R. and Chapman, S.L., 1968, Ground-water resources of the Mountain Home area, Elmore County, Idaho: Idaho Dept. of Reclamation, Water Inf. Bull. no. 4, 63 p.

Rambo, W.L. and Blank, H.R., Jr., 1969, abs., Gravity survey of the Island Park caldera and vicinity, eastern Idaho: Geol. Soc. America Spec. Paper 121, p. 625.

Renner, J.L., White, D.E. and Williams, D.L., 1975, Hydrothermal convection systems: in Assessment of Geothermal Resources of the United States - 1975, U.S. Geol. Survey Circ. 726, D.E. White and D.L. Williams, ed., 155 p.

Richards, R.W., 1911, Notes on lead and copper deposits in the Bear River Range, Idaho and Utah: U.S. Geol. Survey Bull. no. 470, p. 117-187.

Richards, R.W. and Mansfield, C.R., 1912, The Bannock overthrust, a major fault in southeastern Idaho and northeastern Utah: Jour. Geology, v. 20, p. 681-701.

Rightmire, C.T., Young, H.W. and Whitehead, R.L., 1976, Geothermal Investigations in Idaho, Part 4, Isotopic and geochemical analysis of water from the Bruneau-Grand View and Weiser areas, southwest Idaho: Idaho Dept. of Water Resources, Water Inf. Bull. no. 30, 28 p.

Roberts, P.A., 1975, Fish culture utilization of geothermal energy: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations, ANCR report 1220.

Ross, S.H., 1971, Geothermal potential of Idaho: Idaho Bur. of Mines and Geology Pamph. no. 150, 72 p., also in Proceedings, United Nations Symp. on the Development and Utilization of Geothermal Resources, Pisa, v. 2, Part 2, Geothermic Spec. Issue 2, p. 975-1008.

Russell, I.C., 1902, Geology and water resources of the Snake River Plain of Idaho: U.S. Geol. Survey Bull. no. 199, p. 192.

Sacarto, D.M., 1976, State policies for geothermal development: National Conference of State Legislatures, Denver, Renewable Energy Resources Project, Patrick Binns, Dir., 94 p.

Savage, C.N., 1958, Geology and mineral resources of Ada and Canyon Counties: Idaho Bur. of Mines and Geology, County report 3, 94 p.

__________, 1962, Geomagnetics and geologic interpretation of a map of Eastern Bonner County: Idaho Bur. of Mines and Geol. Info. Circ. no. 15, 16 p.

Sbar, M.L., Barazangi, Muawia, Dorman, James, Christopher, H.S. and Smith, R.B., 1972, Tectonics of the Intermountain Seismic Belt, Western United States Micro-earthquake seismicity and composite fault plane solution: Geol. Soc. American Bull. v. 83, no. 1.

Schmidt, D.L. and Makin, J.H., 1962, Quaternary geology of the Bellevue area in Blaine and Camas Counties, Idaho: U.S. Geol. Survey open file report no. 625.

Schmitt, R.C. and Spencer, S.G., 1977, Beneficial uses of geothermal energy, description and preliminary results for phase I of the Raft River irrigation experiment, TREE report 1048.

Shaffer, C.J., 1975, Geothermal steam plant modeling and power tradeoff studies: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1295.

Siever, Raymond, 1962, Silica solubility, 0-200°C and diagenesis of siliceous sediments: Jour. Geol. v. 70, p. 127-150.

Smith, C.L., 1966, Geology of the eastern Mount Bennett Hills, Camas, Gooding and Lincoln Counties, Idaho: Ph.D. dissertation, Univ. of Idaho, Moscow, 129 p.

Smith, R.B. and Sbar, M.L., 1974, Contemporary tectonics and seismicity of the Western United States: Geol. Soc. America Bull., v. 85, p. 1205-1218.

Smith, R.O., 1959, Ground water resources of the middle Big Wood River-Silver Creek area, Blaine County, Idaho: U.S. Geol. Survey Water-Supply Paper 1478, 64 p.

Spencer, S.G., 1975, Environmental Report - Deep geothermal test wells in the Raft River Valley: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1204.

Staley, W.W. and Prater, L.S., 1945, Sulphur in Idaho: Idaho Bur. of Mines and Geology, Min. Resources report no. 2, 7 p.

Stanley, W.D., 1972, Geophysical study of unconsolidated sediments and basin structure in Cache Valley, Utah and Idaho: Geol. Soc. America Bull, v. 83, no. 6, p. 1817-1830.

Stearns, H.T. and Bryan, L.L., 1925, Preliminary report on the geology and water resources of the Mud Lake Basin, Idaho: U.S. Geol. Survey Water-Supply Paper 560-D, 134 p.

Stearns, H.T., Crandall, Lynn and Steward, W.G., 1936, Records of wells on the Snake River Plain, southwestern Idaho: Water Supply Paper 775, 139 p.

__________, 1938, Geology and ground-water resources of the Snake River Plain in southeastern Idaho: U.S. Geol. Survey Water Supply Paper 774, 268 p.

Stearns, N.D., Stearns, H.T. and Waring G.A., 1937, Thermal springs in the United States: U.S. Geol. Survey Water-Supply Paper 679-B, p. 59-206.

Stephenson, G.R. and Zugel, J.F., 1967, Seismic refraction studies in watershed hydrology: Proceedings of the Fifth Annual Engineering Geology and Soils Engineering Symp., Idaho Dept. of Highways.

Stoker, R.C., 1975, Drilling plan Boise slim (2-3/8 in. diameter) holes demonstration space heating project 1975: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1261.

Stoker, R.C., 1977, unpublished data, EG&G Idaho, Inc., Idaho Falls.

Stott, L.R., 1974, A gravity survey of a late Cenozoic graben in the Wyoming-Idaho thrust belt: Masters thesis, Univ. of Michigan.

Swanberg, C.A., 1972, Vertical distribution of heat generation in the Idaho batholith: Jour. Geophys. Res., v. 77, p. 2508-2513.

Swanson, J.R., 1977, Data file geotherm: U.S. Geol. Survey open file data, Menlo Park, CA.

Swink, D.G. and Schultz, R.J., 1975, Conceptual study for utilization of an intermediate temperature geothermal resource: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1260.

Torgerson, L.D. and Richardson, A.S., 1975, Feasibility review for geothermal conversion of existing H&V systems on the Boise geothermal space heating project: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1256.

Trimble, D.E., 1976, Geology of the Michaud and Pocatello quadrangles, Bannock and Power Counties, Idaho: U.S. Geol. Survey Bull. 1400, p. 88.

Trimble, D.E. and Carr, W.J., 1961, Late Quaternary history of the Snake River in the American Falls region, Idaho: Geol. Soc. America Bull, v. 72, no. p. 1739-1748.

Truesdell, A.H. and Jones, B.F., 1974, WATEQ, a computer program for calculating chemical equilibia of natural waters: Jour. Research, U.S. Geol. Survey, v. 2, no. 2, March-April, 1974, p. 233-248.

Tschanz, Charles, et. al., 1974, Mineral resources of the eastern part of the Sawtooth National Recreation Area, Custer and Blaine Counties, Idaho: U.S. Geol. Survey open file report.

Umpleby, J.B., 1915, Ore deposits in the Sawtooth quadrangle, Blaine and Custer Counties, Idaho: in Contribution to Economic Geology: U.S. Geol. Survey Bull. 580, p. 221-249.

Umpleby, J.B., Westgate, L.G. and Ross, C.P., 1930, Geology and ore deposits of the Wood River region, Idaho: U.S. Geol. Survey Bull. 814.

Urbin, T.C. and Diment, W.H., 1975, abs., Heat flow on the south flank of the Snake River rift: Geol. Soc. America, abs. programs, v. 7, no. 5, p. 648.

U.S. Geological Survey, 1971, Aeromagnetic map of southwestern Idaho, scale 1;500,000: U.S. Geol. Survey open file report.

Vincent, K.R. and Applegate, J.K., 1978, A preliminary evaluation of the seismicity of southwestern Idaho and eastern Oregon: Implications for geologic engineering studies: Idaho Trans. Dept., Div. of Highways, Proc, Sixteenth Annual Eng. Geol. and Soils Eng. Symp.

Walker, E.H., Dutcher, L.C., Decker S.O. and Dyer, K.L., 1979, The Raft River Basin, Idaho, Utah, As of 1966: A re-appraisal of the water resources and effects of ground-water development: U.S. Geol. Survey open file report, 116 p.

Wallace, R.W., 1972, A finite-element planer flow model of Camas Prairie, Idaho: Univ. of Idaho Ph.D. dissertation.

Walton, W.C., 1962, Ground-water resources of Camas Prairie, Camas and Elmore Counties, Idaho: U.S. Geol. Survey Water-Supply Paper 1609, 57 p.

Waring, G.H. (revised by R.R. Blankenship and Ray Bentall), 1965, Thermal springs of the United States and other countries of the world - a summary: U.S. Geol. Survey Prof. Paper 492, 383 p.

Warner, M.M., 1972, Geothermal resources of Idaho: in Geothermal Overviews of the Western United States, Geothermal Resources Council Special report no. 1, p. 92-98.

__________, 1975, Special aspects of Cenozoic history of southern Idaho and their geothermal implications: in Proceedings 13th Annu. Eng. Geol. and Soils Eng. Symp. p. 247-270.

__________, 1975, abs., Special aspects of Cenozoic history of southern Idaho and their geothermal implications: Geol. Soc. America, abs. programs, v. 7, no. 5, p. 649-650.

Watson, K., 1975, abs., Reconnaissance geothermal explorations at Raft River, Idaho, from thermal infrared scanning: Soc. Explor. Geophys., Annu. Int. Meeting, abs. no. 45, p. 66-67.

Wells, M.W., 1971, Heat from the earth's surface: Early development of western geothermal resources: Jour. of the West, v. 10, p. 53-71.

Whitbeck, J.R., 1974, Design concepts for flash steam systems for use with medium temperature geothermal water: Aerojet Nuclear Corp., National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1210.

_________, 1975, Review and tentative selection of a working fluid use with a medium temperature (300°F) geothermal resource: Aerojet Nuclear Corp., Idaho National Engineering Laboratory, U.S. Atomic Energy Commission, Idaho Operations Office, ANCR report 1224.

White, D.E., 1970, Geochemistry applied to the discovery, evaluation, and exploitation of geothermal energy resources, in Proceedings United Nations Symp. on the Development and Utilization of Geothermal Energy, Pisa, v. 1, Part 2, Geothermics, Spec. Issue 2, p. 58-80.

White, D.E., Muffler, L.J.P. and Truesdell, A.H., 1971, Vapor-dominated hydrothermal systems compared with hot water systems: Econ. Geology, v. 66, no. 1, p. 75-97.

White D.E. and Williams, D.L., ed., 1975, Assessment of geothermal resources of the United States - 1975: U.S. Geol. Survey Circ. 726.

Willden, R., 1965, Seismic-refraction measurements of crustal structure between American Falls Reservoir, Idaho, and Flaming Gorge, Utah: U.S. Geol. Survey Prof. Paper 525-C, p. 44-50.

Williams, P.L., Mabey, D.R., Zohdy, A.A.R., Ackermann, Hans, Hoover, D.B., Pierce, K.L. and Oriel, S.S., 1975, Geology and geophysics of the southern Raft River Valley geothermal area, Idaho, U.S.A.: Proceedings, 2nd United Nations Symp. on the Development and Use of Geothermal Resources, San Francisco, v. 2, p. 1273-1282.

Wilson, M.D., Applegate, J.K., Chapman, S.L. and Donaldson, P.R., 1976, Geothermal investigations of the Cascade, Idaho area: Dept. of Geology and Geophysics, Boise State University report, 44 p.

Witkind, I.J., 1975, Preliminary map showing known and suspected active faults in Idaho: U.S. Geol. Survey open file report no. 75-278.

Woolard, G.P., 1958, Areas of tectonic activity in the United States as indicated by earthquake epicenter: Trans. Am. Geophys. Union, v. 39, no. 6, p. 1135-1149.

Young, H.W., 1977, Reconnaissance of ground-water resources in the Mountain Home plateau area, southwest Idaho: U.S. Geol. Survey water resources investigations 77-108 open file report, 40 p.

Young, H.W., Harenburg, W.A. and Seitz, H.R., 1977, Water resources of the Weiser River Basin, west-central Idaho: Idaho Dept. of Water Resources, Water Inf. Bull. no. 44.

Young, H.W. and Mitchell, J.C., 1973, Geothermal Investigations in Idaho, Part 1, Geochemistry and geologic setting of selected thermal waters: Idaho Dept. of Water Resource, Water Inf. Bull. no. 30, 43 p.

Young, H.W. and Whitehead, R.L, 1975a, Geothermal Investigations in Idaho, Part 2, An evaluation of thermal water in the Bruneau-Grand View area, southwest Idaho: Idaho Dept. of Water Resources, Water Inf. Bull. no. 30, 126 p.

__________, 1975b, Geothermal Investigations in Idaho, Part 3, An evaluation of thermal water in the Weiser area, Idaho: Idaho Dept. of Water Resources, Water Inf. Bull. no. 30, 35 p.

Zohdy, A.A.R., 1970, abs., mapping basaltic aquifers in southern Idaho by deep electrical soundings: Geophysics, v. 35, p. 1166.

Zohdy, A.A.R. and Bisdorf, R.J., 1976, Schlumberger soundings in the Upper Raft River and Raft River Valleys, Idaho and Utah: U.S. Geol. Survey open file report no. 76-92.

Zohdy, A.A.R., Bisdorf, R.J. and Jackson, D.B., 1978, Simple total field and Schlumberger soundings near Sugar City, Idaho: U.S. Geol. Survey open file report no. 78.

Zohdy, A.A.R., Jackson, D.B. and Bisdorf, R.J., 1975, Schlumberger soundings and total field measurements in the Raft River geothermal area, Idaho: U.S. Geol. Survey open file report no. 75-130.

__________, 1975, abs., Exploring the Raft River geothermal area, Idaho, with the D.C. resistivity method: Soc. Explor. Geophys. Annual Int. Meeting, abs. no. 45, p. 27-28.

Zohdy, A.A.R. and Stanley, W.D., 1972, abs., Profiles of deep electrical soundings on the Snake River Plain, Idaho: Geol. Soc. America, abs., v. 4, no. 6, p. 423-424.

APPENDIX

The basic data tables list information on thermal springs and wells so far as is presently known. In some instances the spring number given in the basic data tables may differ slightly from that found on the map, Geothermal Resources of Idaho, Plate 1, in pocket. The location given in the basic data tables represents a sample location while that given on the map represents that of the main discharge points. When a spring location is given in the text, it refers to the basic data tables.

BASIC DATA TABLE 1

BASIC DATA TABLE 1

CHEMICAL ANALYSES OF THERMAL WATER FROM SELECTED SPRINGS AND WELLS IN IDAHO
(Chemical constitutents in milligrams per liter)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
Ada County																												
LILLIE COLLIAS WELL 1N 1E 1ADC1	8/12/76	25	146.	0.	31	22.0	5.80	48	2.60	149.	0.0	33.00	0.02	17.0	0.70	1.00	0.0	0.0	342	0.1	234	79.	0.	122.	56.0	2.4	-0.198	12
NICHOLSON WELL 1N 1E 25DBA1	8/ 2/76	25	162.	0.	38	17.0	2.60	30	2.30	119.	0.0	15.00	0.01	6.8	0.40	0.76	0.0	0.0	287	7.9	171	53.	0.	98.	53.8	1.8	-2.209	12
AGRI-CON WELL #4 1N 1E 36AAD1	0/ 0/ 0	22	0.	0.	46	377.0	105.00	444	124.00	0.	0.0	528.00	0.0	291.0	0.27	0.0	0.0	0.0	248	7.8	1915	1372.	1372.	0.	38.7	5.2	44.406	12
IDU LAND AND BEEF 1N 2E 6ABA1	5/ 6/54	25	123.	0.	29	14.0	2.90	49	2.10	134.	0.0	22.00	0.0	16.0	1.10	0.0	0.0	0.0	299	8.3	201	47.	0.	110.	68.3	3.1	-1.900	9
TOM BEVINS WELL 2N 1E 22DDB1	0/ 0/ 0	31	0.	0.	26	224.0	6.10	889	99.00	5992.	0.0	1013.00	0.0	227.0	1.60	0.0	0.0	0.0	237	8.1	5431	584.	0.	4910.	73.1	16.0	-40.813	12
GEORGE WHITMORE WELL 2N 1E 24DAD1	0/ 0/ 0	27	0.	0.	30	377.0	44.00	841	99.00	6784.	0.0	1383.00	0.0	390.0	0.56	0.0	0.0	0.0	294	7.6	6500	1122.	0.	5559.	59.4	10.9	-42.094	12
WARREN TOZER WELL 2N 3E 10BCB1	8/ 3/76	20	144.	0.	32	17.0	4.20	14	1.10	77.	0.0	16.00	0.01	7.3	0.30	1.30	0.0	0.0	193	7.9	131	60.	0.	63.	33.3	0.8	-0.592	12
ST. TRANS. DEPT. WELL 2N 3E 28CAC1	8/ 3/76	22	297.	0.	44	23.0	4.90	19	1.60	119.	0.0	7.60	0.05	4.6	0.30	2.00	0.0	0.0	232	7.4	165	78.	0.	98.	34.2	0.9	0.883	12
FERD KOCH WELL 3N 2E 2CBD1	8/10/77	49	0.	76.	39	3.0	0.10	720	0.60	89.	15.00	25.00	0.0	7.3	3.10	0.0	0.0	0.0	320	9.0	856	8.	0.	98.	99.4	111.5	83.400	10
BEARD WELL 3N 2E 11ABC1	10/21/77	76	0.	568.	80	5.5	0.0	89	1.40	120.	19.00	21.00	0.01	3.1	17.00	0.02	0.0	0.09	420	8.5	295	14.	0.	130.	92.6	10.5	1.851	10
WARM SPRINGS WATER DIST 3N 2E 12CDD1	5/31/72	75	122.	727.	78	2.0	0.0	75	1.30	141.	4.00	23.00	0.01	9.3	24.00	0.08	0.0	0.0	386	7.3	286	5.	0.	122.	96.1	14.6	-13.543	3
OLD PENITENTIARY WELL #1 3N 2E 13ACB1	11/ 6/76	59	266.	2649.	42	1.6	0.01	77	0.78	100.	20.00	0.0	0.32	8.9	18.00	0.0	0.05	0.50	402	8.7	217	4.	0.	115.	97.1	16.7	-1.219	10
BOISE WATER CORP. WELL 3N 2E 36ABC1	7/29/77	21	0.	0.	25	19.0	0.80	22	1.10	97.	0.0	14.00	0.0	5.9	0.50	0.28	0.0	0.03	204	7.3	134	51.	0.	79.	47.9	1.3	-3.582	12
DENNIS FLAKE WELL 4N 1E 24DCC1	8/ 9/77	27	310.	95.	60	22.0	2.10	42	5.40	200.	0.0	3.10	0.12	2.6	0.60	0.0	0.0	0.11	310	7.6	236	64.	0.	164.	56.5	2.3	-3.507	10
CARL RUSH WELL 4N 2E 4BDC1	8/ 9/77	29	0.	0.	27	34.0	3.10	30	1.20	150.	0.0	36.00	0.0	3.9	2.00	0.0	0.0	0.02	290	7.3	210	98.	0.	123.	39.7	1.3	-2.235	10
EDWARDS GREENHOUSE WELL 4N 2E 29ACD1	5/31/72	47	364.	0.	46	4.5	0.30	55	2.40	145.	2.00	21.00	0.02	4.4	10.00	0.06	0.0	0.0	311	7.1	216	12.	0.	122.	88.5	6.8	-13.927	3

SHADOW VALLEY WELL 5N 1E 25BCC1	8/ 8/77	28	92.	1703.	38	38.0	4.30	28	3.60	150.	0.0	54.00	0.0	4.1	1.80	0.0	0.0	0.04	340	8.6	245	112.	0.	123.	34.2	1.1	-3.744	10
BEN STADLER WELL 5N 1E 26DCD1	8/ 9/77	29	210.	3406.	32	22.0	1.90	37	3.50	110.	0.0	47.00	0.0	4.8	3.50	0.0	0.0	0.00	2799	7.9	205	63.	0.	90.	54.5	2.0	-3.943	10
JULIUS JEKER WELL 5N 1E 35ACA1	5/31/72	40	0.	83.	33	4.3	0.0	49	3.20	112.	1.00	23.00	0.03	4.9	11.00	0.05,	0.0	0.0	285	7.5	184	11.	0.	93.	87.8	6.5	-11.722	3
JERRY DAVIS WELL #1 1N 1W 7ACC1	8/12/76	21	180.	0.	45	52.0	20.00	50	6.80	171.	0.0	100.00	0.0	43.0	0.20	4.20	0.0	0.0	656	8.0	405	212.	72.	140.	33.0	1.5	3.093	14
CLATER FORSGREN WELL 1N 1W 7BCC1	8/25/75	20	38.	0.	43	45.0	18.00	60	6.10	264.	0.0	110.00	0.0	27.0	0.30	0.0	0.0	0.0	643	7.4	439	186.	0.	216.	40.2	1.9	-6.529	9
IRVIN BOEHLKE WELL 1N 1W 8DBA1	10/ 6/77	22	0.	3028.	35	70.0	8.80	46	4.70	110.	0.0	130.00	0.04	55.0	0.20	1.20	0.0	0.07	610	7.5	405	211.	121.	90.	31.6	1.4	1.326	10
SHANE BUES WELL 1N 1W 15DAA1	8/12/76	23	165.	0.	47	20.0	7.00	39	4.90	130.	0.0	37.00	0.01	15.0	0.30	1.20	0.0	0.0	331	8.1	235	79.	0.	107.	50.0	1.9	0.233	12
TERRY TLUCEK WELL #1 1N 1W 22DDD1	0/ 0/ 0	23	0.	0.	37	429.0	56.00	591	99.00	6589.	0.0	970.00	0.0	340.0	0.23	0.0	0.0	0.0	270	7.4	5762	1301.	0.	5400.	47.4	7.1	-43.501	12
BISCHOF REALTY WELL 3N 1W 25ADD1	8/25/77	21	0.	0.	32	89.0	20.00	58	2.70	310.	0.0	140.00	0.0	26.0	0.30	3.10	0.0	0.07	808	7.0	523	304.	50.	254.	29.1	1.4	-0.772	12
LETHA FISHER WELL 5N 1W 16CAB1	10/ 7/75	20	58.	0.	62	34.0	8.10	25	9.30	237.	0.0	16.00	0.0	4.2	0.50	0.0	0.0	0.0	360	7.9	275	118.	0.	194.	29.5	1.0	-8.588	9
HARRY CHARTERS WELL 1S 1W 5ABC1	8/13/76	26	113.	0.	43	16.0	6.90	48	4.70	133.	0.0	41.00	0.01	15.0	0.50	1.40	0.0	0.0	346	8.2	241	68.	0.	109.	58.4	2.5	-0.253	12
INITAL BUTTE WELL 1S 1W 36BBC1	8/ 4/76	23	168.	0.	32	19.0	5.70	54	4.60	114.	0.0	62.00	0.01	20.0	0.50	3.20	0.0	0.0	386	8.1	257	71.	0.	93.	60.5	2.8	0.149	12
Adams County																												
WHITE LICKS H S 16N 2E 33BCC1S	6/29/72	65	0.	114.	110	39.0	0.30	420	17.00	71.	0.0	660.00	0.05	150.0	8.80	0.07	0.0	0.0	502	7.6	1440	99.	40.	58.	88.4	18.4	2.584	3
KRIGBAUM H S 19N 2E 22CCA1S	6/29/72	43	0.	151.	73	5.3	0.20	140	3.30	81.	9.00	190.00	0.03	26.0	2.80	0.05	0.0	0.0	668	8.8	489	14.	0.	81.	94.3	16.2	-0.284	3
ZIM'S RESORT 20N 1E 26DDA1S	6/29/72	65	0.	0.	64	12.0	0.10	190	3.60	47.	9.00	330.00	0.03	32.0	2.30	0.07	0.0	0.0	940	8.5	666	30.	0.	54.	92.2	15.0	-0.167	3
STINKY W S 21N 1E 23ABA1S	10/19/77	30	0.	38.	55	10.0	1.70	130	3.80	81.	1.00	230.00	0.02	24.0	1.80	0.0	0.0	0.88	680	8.4	497	32.	0.	68.	88.5	10.0	-4.625	10
BOULDER CREEK RESORT 22N 1E 34DAD1S	10/19/77	26	0.	19.	43	17.0	0.0	50	0.40	46.	34.00	40.00	0.02	5.0	1.00	0.03	0.0	0.0	240	9.4	213	42.	0.	94.	71.7	3.3	1.831	10
STARKEY H S 18N 1W 34DBB1S	6/27/72	56	0.	492.	56	4.5	0.0	86	1.60	60.	6.00	150.00	0.03	14.0	0.90	0.05	0.0	0.0	502	8.6	348	11.	0.	59.	93.4	11.2	-8.700	3

*DATA REFERENCE:
1= ROSS, 1971
2= CATER, ET. AL., 1973
3= YOUNG AND MITCHELL, 1973
4= YOUNG AND WHITEHEAD, 1975A
5= YOUNG AND WHITEHEAD, 1975B
6= MITCHELL, 1976A
7= MITCHELL, 1976B
8= MITCHELL, 1976C
9= SWANSON, 1977
10= MITCHELL, UNPUBLISHED, 1978
11= TSCHANG, ET. AL., 1974
12= USGS WRD FILE
13= STOKER, UNPUBLISHED, 1977
14= YOUNG, 1977

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
Bannock County																												
SHOAL SUBDIVISION WELL 5S 34E 26DBA1	6/20/79	26	72.	378.	38	93.0	39.00	176	25.00	425.	0.0	156.00	0.0	228.0	2.70	6.90	0.0	0.0	0	0.0	973	392.	44.	348.	47.4	3.9	-2.248	10
ROBERT BROWN WELL #1 5S 34E 26DAB1	7/27/72	41	177.	57.	20	70.0	25.00	150	21.00	478.	0.0	95.00	0.0	87.0	3.20	0.02	0.0	0.0	1170	7.7	706	277.	0.	392.	51.7	3.9	0.700	3
DEAN MORRIS WELL 9S 36E 3CDB1	8/ 7/76	22	8.	0.	25	44.0	9.20	13	1.90	143.	0.0	13.00	0.0	24.0	0.10	0.0	0.0	0.0	349	7.2	200	148.	30.	117.	15.9	0.5	3.373	9
LAVA H S 9S 38E 21DDA1S	8/15/72	45	0.	0.	32	120.0	32.00	170	39.00	542.	0.0	110.00	0.04	190.0	0.70	0.38	0.0	0.0	1579	6.6	960	431.	0.	444.	43.5	3.6	1.310	3
DOWNATA H S 12S 37E 12CCD1S	5/17/72	43	0.	1855.	29	43.0	15.00	20	9.10	214.	0.0	18.00	0.0	20.0	0.40	0.50	0.0	0.0	413	6.7	260	169.	0.	175.	19.4	0.7	0.135	3
Bear Lake County																												
PESCADERO W S 11S 43E 36BDA1S	9/12/73	26	0.	38.	31	188.0	65.00	63	14.00	658.	0.0	225.00	0.0	83.0	1.80	0.14	0.01	0.26	169	6.4	994	736.	197.	539.	15.4	1.0	-0.229	10
BEAR LAKE H S 15S 44E 13CCA1S	5/ 9/72	48	0.	0.	35	210.0	55.00	180	61.00	256.	0.0	800.00	0.01	79.0	7.10	0.56	0.0	0.0	2039	6.6	1553	750.	540.	210.	32.1	2.9	1.937	3
Bingham County																												
YANDELL SPRINGS 3S 37E 31DBB1S	8/18/77	32	0.	568.	22	150.0	35.00	22	7.20	240.	0.0	330.00	0.02	29.0	0.90	0.0	0.0	0.05	950	7.1	714	518.	321.	197.	8.3	0.4	-0.755	10
ALKALI FLAT W S 4S 38E 28DDD1S	8/18/77	34	0.	0.	19	210.0	68.00	34	37.00	640.	0.0	340.00	0.03	17.0	0.90	0.0	0.0	1.10	1529	6.6	1040	804.	279.	524.	8.0	0.5	1.084	10
Blaine County																												
HAILEY H S 2N 18E 18DBB1S	7/11/72	59	0.	265.	85	2.0	0.0	68	1.50	88.	0.0	51.00	0.02	10.0	12.00	0.07	0.0	0.0	337	9.7	272	5.	0.	72.	95.5	13.2	-5.164	3
CLARENDON H S 3N 17E 27DCB1S	7/11/72	47	0.	378.	80	2.2	0.10	81	1.70	29.	30.00	68.00	0.01	11.0	15.00	0.06	0.0	0.0	400	8.2	303	6.	0.	74.	95.6	14.5	-4.353	3
GUYER H S 4N 17E 15AAC1S	7/11/72	71	0.	3785.	86	2.9	0.0	84	2.10	51.	25.00	72.00	0.02	11.0	16.00	0.06	0.0	0.0	421	8.0	324	7.	0.	83.	94.8	13.6	-5.779	3
WARFIELD H S 4N 17E 31BBC1S	10/13/77	62	0.	378.	97	2.6	0.0	67	1.90	55.	37.00	35.00	0.01	8.1	14.00	0.0	0.0	0.01	370	8.7	289	6.	0.	107.	94.2	11.4	-11.009	10
EASLEY H S 5N 16E 10DBC1S	0/ 0/ 0	37	0.	68.	54	3.8	0.10	69	0.60	24.	28.00	46.00	0.0	5.9	21.00	0.0	0.0	0.0	0	9.2	240	10.	0.	66.	93.4	9.5	-5.416	11
RUSSIAN JOHN H S 6N 16E 33CCA1S	0/ 0/ 0	35	0.	4.	54	2.3	0.10	70	0.60	25.	29.00	46.00	0.0	6.5	19.00	0.0	0.0	0.0	0	8.8	239	6.	0.	69.	95.7	12.3	-5.364	11
MAGIC H S LANDING WELL 1S 17E 23AAB1	6/21/72	71	79.	57.	100	22.0	1.30	330	19.00	766.	0.0	60.00	0.04	83.0	13.00	0.06	0.0	0.0	1499	6.4	1005	60.	0.	628.	89.5	18.5	-2.466	8

MAGIC H S LANDING WELL	1S 17E 23AAB1	10/29/73	72	79.	38.	105	20.0	0.15	321	23.00	735.	0.0	52.00	0.01	85.0	10.00	0.56	0.06	0.08	1149	6.9	978	51.	0.	602.	89.7	19.6	-1.595	3
CONDIE H S	1S 21E 14DDC1S	8/ 8/72	52	0.	1310.	28	56.0	11.00	63	17.00	360.	0.0	28.00	0.01	14.0	1.70	0.05	0.0	0.0	653	7.3	395	185.	0.	295.	39.9	2.0	-0.676	1
MILFORD SWEAT H S	1S 22E 1DAB1S	8/ 8/72	44	0.	76.	26	60.0	12.00	48	8.90	294.	0.0	63.00	0.03	6.5	2.30	0.0	0.0	0.0	591	7.3	371	199.	0.	241.	33.2	1.5	-1.280	3

Boise County

TWIN SPRINGS	4N 6E 24BCB1S	7/ 0/55	67	0.	0.	90	2.0	0.0	52	0.80	22.	37.00	22.00	0.0	2.0	4.80	0.0	0.0	0.0	230	9.4	221	5.	0.	80.	95.0	10.1	0.017	1
DANSKIN CREEK H S	8N 5E 1BCC1S	6/ 8/72	40	0.	8.	48	2.4	0.10	66	0.90	85.	1.00	42.00	0.01	5.1	3.10	0.25	0.0	0.0	317	8.8	210	6.	0.	71.	95.0	11.3	6.821	3
HOT SPRINGS CAMPGROUND	8N 5E 6DCB1	10/20/77	48	0.	19.	64	3.9	0.0	73	1.30	71.	26.00	24.00	0.01	7.3	15.00	0.01	0.0	0.10	370	8.9	249	10.	0.	102.	93.3	10.2	-1.881	10
DONLAY RANCH H S	8N 5E 10BDD1S	8/18/72	55	0.	265.	59	1.9	0.0	68	1.10	40.	30.00	38.00	0.02	5.6	14.00	0.04	0.0	0.0	336	8.6	237	5.	0.	83.	96.0	13.6	-4.113	3
DEER H S	9N 3E 25BAC1S	8/ 4/72	80	0.	76.	120	4.5	0.0	130	4.80	160.	0.0	79.00	0.02	34.0	13.00	0.04	0.0	0.0	600	8.1	464	11.	0.	131.	94.2	16.9	0.585	3
KIRKHAM H S	9N 8E 32CAB1S	7/14/72	65	0.	946.	69	1.9	0.10	66	1.30	46.	21.00	45.00	0.02	3.0	15.00	0.06	0.0	0.0	322	7.8	244	5.	0.	73.	95.5	12.6	-4.389	3
BONNEVILLE H S	10N 10E 31BCC1S	8/18/72	85	0.	1374.	100	2.2	0.10	67	2.90	58.	21.00	52.00	0.03	7.2	17.00	0.02	0.0	0.0	377	8.1	297	6.	0.	83.	93.8	12.0	-10.961	3

Bonneville County

FALL CREEK MINERAL SPG	1N 43E 9CBB1S	8/10/72	25	0.	265.	11	440.0	96.00	1110	120.00	1200.	0.0	390.00	0.04	1900.0	1.70	0.05	0.0	0.0	7949	6.3	4658	1493.	509.	983.	59.5	12.5	-0.170	3
BROCKMAN CREEK W S	2S 42E 26DCD1S	10/19/76	35	0.	49.	24	150.0	41.00	2100	34.00	1900.	0.0	2502.00	0.0	590.0	2.60	0.0	0.0	0.0	8649	6.4	6377	543.	0.	1557.	88.6	39.2	1.491	9
ALPINE W S	2S 46E 19CAD1S	9/27/77	37	0.	38.	40	560.0	100.00	1500	180.00	880.	0.0	1000.00	0.53	2800.0	2.70	0.05	0.0	5.20	10499	6.5	6615	1808.	1087.	721.	61.5	15.3	-3.802	10

Butte County

LEWIS ROTHWELL WELL	3N 25E 32CDC1	8/ 9/72	41	110.	45.	55	74.0	24.00	72	21.00	322.	0.0	170.00	0.02	21.0	3.20	0.12	0.0	0.0	898	6.3	598	283.	19.	264.	33.5	1.9	-1.295	3
BUTTE CITY WELL #1	3N 27E 9ABB1	8/ 9/72	35	145.	0.	33	64.0	24.00	31	7.70	315.	0.0	56.00	0.02	22.0	0.80	0.98	0.0	0.0	648	7.2	394	258.	0.	258.	20.1	0.8	-2.174	3

Camas County

WARDROP H S	1N 13E 32ABB1S	6/20/72	66	0.	731.	73	1.4	0.0	54	3.00	51.	37.00	12.00	0.03	5.1	4.10	0.07	0.0	0.0	252	8.0	214	3.	0.	103.	94.1	12.6	-3.553	3
HOT SPRINGS RANCH	1N 13E 32ABC1S	10/31/73	60	0.	0.	81	1.0	0.0	56	0.78	45.	36.00	11.00	0.0	5.7	3.70	0.03	0.0	0.00	226	9.2	217	2.	0.	97.	97.2	15.4	-0.719	8
HOT SPRINGS RANCH	1N 13E 32ABC2S	10/31/73	67	0.	95.	78	1.0	0.0	56	2.00	58.	30.00	12.00	0.0	5.7	3.30	0.70	0.0	0.0	215	9.2	217	2.	0.	98.	96.0	15.4	0.044	8
HOT SPRING RANCH	1N 13E 32ABC3S	10/31/73	64	0.	0.	78	1.2	0.12	55	1.20	54.	32.00	11.00	0.0	5.7	3.20	0.09	0.0	0.0	220	9.2	214	3.	0.	98.	96.0	12.8	-0.638	8
ELK CREEK H S	1N 15E 14ADA1S	10/30/73	55	0.	95.	82	2.2	0.12	91	2.00	65.	2.40	44.00	0.0	23.0	18.00	0.10	0.0	0.01	333	8.9	296	6.	0.	57.	95.9	16.2	5.929	8
ELK CREEK H S	1N 15E 14ADA2S	10/30/73	55	0.	8.	83	2.4	0.12	92	1.60	96.	1.20	44.00	0.0	23.0	16.00	0.10	0.08	0.01	376	8.9	310	6.	0.	81.	95.9	15.7	1.546	8

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
Camas County (cont'd.)																												
ELK CREEK H S 1N 15E 14ADA3S	10/30/73	45	0.	8.	78	2.2	0.0	92	1.60	96.	2.40	48.00	0.01	24.0	17.00	0.86	0.03	0.01	418	8.9	313	5.	0.	83.	96.4	17.1	-1.055	8
LIGHTFOOT H S 3N 13E 7DCA1S	10/14/77	56	0.	38.	72	1.7	0.0	82	2.00	110.	16.00	26.00	0.01	16.0	13.00	0.03	0.0	0.11	460	8.7	282	4.	0.	117.	96.3	17.3	-4.026	10
BAUMGARTNER H S 3N 12E 7DCD1S	10/14/77	44	0.	76.	44	2.5	0.0	54	0.80	80.	11.00	22.00	0.01	15.0	6.50	0.27	0.0	0.07	270	8.5	195	6.	0.	84.	94.2	9.4	-7.960	10
WORSWICK H S 3N 14E 28CAA1S	7/10/72	81	0.	1764.	96	1.8	0.0	69	1.90	51.	28.00	35.00	0.02	5.0	15.00	0.07	0.0	0.0	328	7.3	276	4.	0.	88.	95.6	14.2	-4.773	3
SHEEP H S 1S 12E 16CAB1S	10/31/73	49	0.	0.	68	1.0	0.0	49	0.78	0.	57.00	7.70	0.0	4.2	2.00	0.04	0.0	0.00	208	9.9	189	2.	0.	95.	96.8	13.5	-2.290	8
WOLF H S 1S 12E 16CBA1S	10/31/73	45	0.	0.	68	0.8	0.0	49	0.39	5.	51.00	8.20	0.0	3.2	1.90	0.06	0.0	0.00	206	9.9	184	2.	0.	89.	97.7	15.1	0.706	8
KEITH STROM WELL 1S 12E 31CBC1	6/20/72	31	122.	57.	36	0.6	0.0	32	0.30	31.	26.00	3.30	0.04	2.1	0.80	0.03	0.0	0.0	150	9.2	116	1.	0.	69.	97.4	11.4	-4.176	3
LEE BARRON WELL #1 1S 13E 22CCC1	11/ 1/73	26	58.	4.	78	3.0	0.61	86	2.40	193.	0.0	5.30	0.03	10.0	9.80	0.0	1.30	0.02	460	7.8	290	10.	0.	158.	93.5	11.8	-0.888	8
LEE BARRON WELL #2 1S 13E 27CCB1	11/ 1/73	35	58.	303.	83	3.0	0.12	94	1.60	205.	0.0	5.80	0.02	11.0	11.00	0.02	0.48	0.02	491	8.0	310	8.	0.	168.	95.3	14.5	-1.231	8
LEE BARRON WELL #3 1S 13E 27CCB2	11/ 1/73	45	120.	0.	64	2.2	0.12	99	2.00	215.	0.0	9.10	0.03	12.0	10.00	0.02	0.06	0.0	411	8.5	304	6.	0.	176.	96.2	17.6	-1.234	8
BARRON H S 1S 13E 34BCB1S	11/ 1/73	72	0.	38.	84	3.6	0.12	108	3.10	227.	0.0	13.00	0.01	13.0	13.00	0.0	0.06	0.02	335	8.2	349	9.	0.	186.	94.6	15.3	-0.881	8
LEE BARRON WELL #4 1S 13E 34BCC1	11/ 1/73	49	0.	0.	84	3.4	0.12	106	2.70	211.	0.0	12.00	0.0	14.0	13.00	0.19	0.02	0.02	347	8.3	339	9.	0.	173.	94.9	15.4	0.463	8
FAIRFIELD CITY WELL 1S 14E 9DAA1	8/ 9/77	21	0.	814.	26	5.6	1.10	35	0.60	88.	0.0	6.30	0.0	2.6	2.40	0.0	0.0	0.0	172	8.0	122	18.	0.	72.	79.8	3.5	3.036	12
Canyon County																												
LEONARD TIEGS WELL #1 1N 2W 5ADD1	8/27/75	22	223.	0.	28	45.0	7.80	37	3.40	146.	0.0	72.00	0.0	30.0	0.30	0.0	0.0	0.0	483	8.0	295	144.	25.	120.	35.1	1.3	-2.671	9
DON TIEGS WELL #2 1N 2W 8ACC1	10/ 6/77	22	0.	0.	35	70.0	8.80	46	6.70	110.	0.0	130.00	0.04	55.0	0.20	1.20	0.0	0.07	610	7.5	407	211.	121.	90.	31.3	1.4	1.733	10
MELBA CITY WELL 1N 2W 36CAA1	10/ 6/77	25	0.	757.	42	9.1	2.30	88	3.80	200.	0.0	34.00	0.04	17.0	1.40	0.40	0.0	0.0	420	8.2	296	32.	0.	164.	83.8	6.7	-0.192	10

WESLEY SCHOBER WELL 2N 2W 34BDA1	6/ 4/79	48	97.	2271.	38	3.3	0.20	131	1.00	227.	16.00	68.00	0.03	28.0	4.10	0.02	0.0	0.0	650	8.7	401	9.	0.	213.	96.5	18.9	-6.272	10
CANNON FARMS WELL #4 2N 3W 22DCC1	5/ 6/54	30	0.	2952.	59	40.0	11.00	55	6.40	242.	0.0	62.00	0.0	7.9	0.50	0.0	0.0	0.0	509	8.2	360	145.	0.	198.	43.8	2.0	-0.551	9
CALDWELL MUNC. PARK WELL 4N 3W 28AAB1	10/ 5/77	28	67.	568.	49	11.0	0.10	53	2.00	160.	0.0	2.60	0.04	5.4	1.50	0.04	0.0	0.09	280	7.7	203	28.	0.	131.	79.1	4.4	-0.058	10
CALDWELL CITY WELL 4N 3W 35ABD1	10/ 5/77	20	131.	3028.	29	19.0	1.80	37	1.60	140.	0.0	11.00	0.04	6.9	0.80	0.30	0.0	0.05	250	7.6	176	55.	0.	115.	58.6	2.2	-1.773	10

Caribou County

BLACKFOOT RIVER W S 5S 40E 14BCD1S	9/27/73	26	0.	4.	33	674.0	245.00	147	217.00	2357.	0.0	1132.00	0.0	110.0	3.70	0.06	1.30	0.42	470	6.2	3720	2689.	758.	1932.	9.7	1.2	0.210	8
BLACKFOOT RESERVOIR W S 6S 41E 1ADC1S	10/11/73	23	0.	568.	25	232.0	58.00	26	14.00	956.	0.0	70.00	0.0	28.0	2.30	0.03	0.01	0.04	146	6.2	925	817.	34.	783.	6.3	0.4	-0.559	7
CORRAL CREEK WELL #1 6S 41E 19BAA1	9/12/73	42	40.	598.	28	701.0	263.00	101	237.00	2845.	0.0	898.00	0.0	41.0	2.30	0.16	1.20	0.52	4519	6.5	3670	2830.	499.	2331.	6.6	0.8	0.383	7
CORRAL CREEK WELL #2 6S 41E 19BAB1	9/12/73	41	37.	397.	30	620.0	246.00	97	242.00	2763.	0.0	908.00	0.01	43.0	3.50	0.24	1.90	0.47	4519	6.8	3548	2558.	294.	2264.	6.9	0.8	-3.111	7
CORRAL CREEK WELL #3 6S 41E 19BAC1	9/12/73	41	56.	79.	30	697.0	263.00	101	233.00	2723.	0.0	896.00	0.0	40.0	2.40	0.14	1.30	0.52	4589	6.6	3601	2820.	589.	2231.	6.6	0.8	1.731	7
CORRAL CREEK WELL #4 6S 41E 19BAD2	9/12/73	36	64.	42.	30	649.0	253.00	99	233.00	2803.	0.0	884.00	0.0	40.0	2.50	0.15	1.20	0.53	4399	6.6	3568	2660.	363.	2297.	6.8	0.8	-1.624	7
PORTNEUF RIVER W S 7S 38E 26CBD1S	8/23/77	34	0.	189.	38	280.0	64.00	81	62.00	1060.	0.0	270.00	0.06	62.0	0.80	0.0	0.0	0.31	2399	6.2	1379	962.	93.	869.	14.5	1.1	-0.906	10
SODA SPRINGS GEYSER 9S 41E 12ADD1S	9/ 2/73	28	0.	4.	35	851.0	193.00	12	23.00	2613.	0.0	801.00	0.0	5.7	1.60	0.21	0.06	0.05	1959	6.5	3207	2917.	776.	2141.	0.9	0.1	-0.258	7

Cassia County

SIX S RANCH WELL #1 11S 25E 11CCA1	7/26/72	60	136.	7911.	60	8.2	0.50	110	3.90	125.	0.0	59.00	0.0	55.0	14.00	0.0	0.0	0.0	574	7.7	372	23.	0.	102.	89.7	10.1	-2.726	3
SIX S RANCH WELL #2 11S 26E 20DDD1	8/ 5/75	32	0.	5095.	46	31.0	0.50	34	3.80	143.	0.0	29.00	0.0	5.9	1.60	0.0	0.0	0.0	310	7.9	222	79.	0.	117.	46.7	1.7	-1.520	9
CRITCHFIELD WELL 11S 26E 28BCB1	7/25/75	35	0.	5095.	47	31.0	0.40	34	4.10	141.	0.0	13.00	0.0	20.0	1.40	0.0	0.0	0.0	0	7.6	220	79.	0.	116.	46.7	1.7	-1.438	9
C & Y RANCH WELL #2 11S 27E 5BAB1	9/ 0/66	29	0.	0.	78	26.0	7.20	100	0.0	230.	0.0	14.00	0.0	90.0	3.40	0.90	0.0	0.0	655	7.6	432	94.	0.	188.	69.7	4.5	-4.275	1
LYLE DURFEE WELL 13S 25E 22BCB1	9/ 0/66	30	0.	0.	18	22.0	5.40	19	0.0	94.	0.0	13.00	0.0	22.0	1.40	0.80	0.0	0.0	238	7.3	147	77.	0.	77.	34.9	0.9	-3.515	1
WARD SPRINGS 13S 26E 17CCD1S	8/ 8/75	21	0.	322.	45	34.0	0.60	14	3.00	92.	0.0	9.50	0.0	25.0	0.50	0.0	0.0	0.0	217	8.2	176	87.	12.	75.	25.0	0.7	-1.138	9
14S 21E 34BDC1	7/26/72	43	0.	189.	47	14.0	1.10	44	9.60	144.	0.0	15.00	0.01	7.0	1.30	0.01	0.0	0.0	282	8.0	209	39.	0.	118.	64.9	3.0	-0.233	3
OAKLEY H S 14S 22E 27DCB1S	10/26/72	47	0.	38.	70	2.7	0.0	87	2.20	43.	29.00	22.00	0.03	53.0	8.00	0.04	0.0	0.0	421	9.6	295	7.	0.	84.	95.2	14.6	-0.952	3

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
Cassia County (cont'd.)																												
SEARS SPRING 14S 25E 6BBB1S	8/ 5/75	28	0.	662.	22	29.0	7.50	15	3.30	120.	0.0	10.00	0.0	19.0	0.40	0.0	0.0	0.0	270	8.2	165	103.	5.	98.	23.3	0.6	0.365	9
GRIFFETH-WIGHT WELL 14S 26E 1BDD1	0/ 0/ 0	77	1982.	378.	64	5.0	12.00	14	2.50	116.	124.00	27.00	0.01	62.0	0.0	1.20	1.00	0.0	10000	8.4	368	62.	0.	302.	31.9	0.8	-62.093	10
HAROLD WIGHT WELL 14S 26E 1CDA1	6/14/77	63	0.	0.	83	1.0	0.20	170	2.90	240.	36.00	25.00	0.0	72.0	7.30	0.50	0.0	0.08	600	9.3	515	3.	0.	257.	98.1	40.6	-3.683	12
HAROLD WARD WELL #1 14S 27E 18CCC1	7/24/75	24	0.	3399.	90	55.0	2.20	170	29.00	131.	0.0	23.00	0.0	300.0	1.10	0.0	0.0	0.0	960	7.6	734	146.	39.	107.	66.8	6.1	-0.457	9
MORRIS MITCHELL WELL #2 15S 21E 25DCC1	9/22/77	46	0.	38.	28	2.0	0.10	110	1.80	230.	11.00	21.00	0.02	17.0	2.40	0.03	0.0	0.08	475	8.7	306	5.	0.	207.	96.9	20.6	-2.673	10
HAROLD WARD WELL #2 15S 24E 22DDB1	7/25/72	38	152.	378.	44	37.0	9.30	70	3.10	169.	0.0	33.00	0.03	80.0	2.90	0.56	0.0	0.0	606	7.4	362	131.	0.	138.	53.1	2.7	-1.377	3
BLM 15S 25E 29CDC1	10/ 7/76	60	0.	0.	68	3.6	0.10	120	3.40	65.	20.00	40.00	0.0	82.0	7.60	0.0	0.0	0.0	540	8.9	376	9.	0.	87.	95.0	17.0	1.840	9
BLM 15S 26E 12ACC1	12/ 5/74	26	0.	0.	88	300.0	1.40	2000	270.00	58.	0.0	45.00	0.0	3900.0	3.90	0.0	0.0	0.88	998	7.8	6636	754.	707.	48.	79.8	31.7	-1.427	9
BLM 15S 26E 22DDD1	12/ 6/74	82	0.	189.	56	56.0	0.50	1300	14.00	63.	0.0	52.00	0.0	2000.0	5.00	0.0	0.0	0.04	6609	8.0	3514	142.	90.	52.	94.7	47.5	0.762	9
IVAN DARRINGTON WELL #1 15S 26E 23AAA1	10/23/75	85	0.	15.	140	43.0	1.00	400	37.00	63.	0.0	40.00	0.0	680.0	9.10	0.0	0.0	0.0	1879	8.1	1381	111.	60.	52.	84.6	15.5	-2.265	9
FRAZIER H S WELL 15S 26E 23BBC1	5/18/72	95	126.	220.	90	53.0	0.40	560	22.00	55.	0.0	57.00	0.0	900.0	5.70	0.54	0.0	0.0	3049	7.4	1715	134.	89.	45.	88.3	21.1	-0.381	3
HARRIAT CRANK WELL 15S 26E 23DDC1	5/18/72	90	165.	227.	97	130.0	0.40	1110	35.00	36.	0.0	61.00	0.01	1900.0	14.00	0.57	0.0	0.0	6089	7.7	3365	326.	296.	30.	86.7	26.7	-0.474	3
IVAN DARRINGTON WELL #3 15S 26E 23DDD1	7/30/75	33	0.	0.	53	140.0	8.30	450	19.00	174.	0.0	69.00	0.0	820.0	2.30	1.10	0.0	0.0	2459	7.0	1648	383.	241.	143.	70.6	10.0	0.265	12
REID STEWART WELL 15S 26E 24BAD1	7/24/75	32	0.	3399.	47	100.0	6.30	380	16.00	177.	0.0	65.00	0.0	650.0	1.90	0.0	0.0	0.0	2179	7.3	1353	275.	130.	145.	73.6	10.0	-0.596	9
IVAN DARRINGTON WELL #4 15S 26E 24DCC1	7/29/75	31	0.	3399.	55	88.0	7.10	340	16.00	161.	0.0	52.00	0.0	560.0	2.50	0.0	0.0	0.0	1839	7.5	1199	249.	117.	132.	73.3	9.4	1.293	9
BLM 15S 26E 25ACA1	1/14/75	30	0.	83.	88	35.0	3.90	370	34.00	176.	0.0	32.00	0.0	570.0	2.80	0.0	0.0	0.21	1949	7.7	1222	103.	0.	144.	84.6	15.8	-2.119	9
BLM 16S 26E 5BBA1	3/28/75	40	0.	151.	37	58.0	9.00	240	13.00	138.	0.0	44.00	0.0	380.0	4.40	0.0	0.0	0.14	1539	6.8	853	182.	69.	113.	72.5	7.7	0.971	9

Clark County

LIDY H S #1 9N 33E 2BBC1S	8/25/72	50	0.	946.	34	87.0	16.00	27	15.00	179.	0.0	190.00	0.03	8.0	6.00	0.02	0.0	0.0	691	6.3	471	283.	136.	147.	16.3	0.7	-1.495	3
LIDY H S WELL 10N 33E 35CCC1	8/22/77	59	149.	6813.	37	55.0	14.00	24	12.00	180.	0.0	100.00	0.03	7.1	4.40	0.0	0.0	0.09	490	7.6	342	195.	47.	148.	19.9	0.7	-2.047	10
WARM SPRINGS 11N 32E 25AAC1S	8/28/72	29	0.	7267.	17	54.0	19.00	9	2.90	209.	0.0	62.00	0.02	5.3	1.00	0.12	0.0	0.0	457	7.0	274	213.	42.	171.	9.0	0.3	-2.285	3

Custer County

BOWERY H S 7N 17E 6ABA1S	8/17/72	43	0.	76.	62	22.0	4.50	84	6.40	139.	0.0	110.00	0.0	12.0	12.00	0.0	0.0	0.0	549	7.3	383	73.	0.	114.	68.5	4.3	-2.352	11
PIERSON H S 8N 14E 27DBD1S	7/ 3/72	60	0.	49.	70	1.8	0.10	73	1.00	31.	35.00	31.00	0.0	7.8	19.00	0.0	0.0	0.0	331	9.0	253	5.	0.	84.	96.3	14.3	-3.652	11
WEST PASS H S 8N 17E 32BCA1S	7/12/72	51	0.	95.	43	21.0	5.50	100	13.00	234.	0.0	94.00	0.02	26.0	8.40	0.06	0.0	0.0	651	6.7	426	75.	0.	192.	70.4	5.0	-6.316	3
STANLEY H S 10N 13E 3CAB1S	7/12/72	41	0.	416.	55	2.2	0.10	60	0.50	30.	28.00	31.00	0.01	5.0	14.00	0.05	0.0	0.0	293	8.8	210	6.	0.	71.	95.2	10.7	-4.042	3
SLATE CREEK H S 10N 16E 30BAD1S	7/11/72	50	0.	700.	86	8.1	0.10	83	4.50	110.	0.0	110.00	0.02	7.0	8.70	0.03	0.0	0.0	437	8.0	361	21.	0.	90.	87.3	8.0	-7.145	3
ELKHORN H S 11N 13E 36BAA1S	9/ 0/54	57	0.	0.	75	1.0	0.30	72	2.40	20.	38.00	32.00	0.0	6.0	16.00	0.0	0.0	0.0	328	9.6	252	4.	0.	80.	95.8	16.2	-0.602	1
BASIN CREEK W S 11N 14E 21DDB1S	7/ 3/72	38	0.	0.	88	2.1	0.0	62	1.20	23.	35.00	38.00	0.0	4.3	14.00	0.0	0.0	0.0	304	8.8	255	5.	0.	77.	95.2	11.8	-6.077	9
MORMON BEND H S 11N 14E 29AAB1S	0/ 0/ 0	38	0.	4.	89	2.2	0.10	62	1.30	23.	35.00	38.00	0.0	4.4	14.00	0.0	0.0	0.0	0	8.8	257	6.	0.	77.	94.7	11.1	-6.033	11
SUNBEAM H S 11N 15E 19CAB1S	7/12/72	76	0.	1681.	91	1.5	0.0	85	2.40	119.	0.0	54.00	0.02	12.0	15.00	0.06	0.0	0.0	413	8.5	319	4.	0.	98.	96.4	19.1	-4.741	3
ROBINSON BAR H S 11N 15E 27DDC1S	0/ 0/ 0	49	0.	151.	80	2.0	0.40	77	3.60	28.	41.00	57.00	0.0	6.0	12.00	0.0	0.0	0.0	0	9.3	292	7.	0.	91.	93.7	13.0	-3.919	11
SULLIVAN H S 11N 17E 27BDD1S	7/12/72	41	0.	265.	38	49.0	11.00	170	15.00	554.	0.0	26.00	0.02	57.0	1.80	0.06	0.0	0.0	1069	7.0	640	167.	0.	454.	66.5	5.7	-0.873	3
BARNEY W S 11N 25E 23CAB1S	7/13/72	29	0.	643.	18	37.0	20.00	9	1.50	181.	0.0	35.00	0.03	4.0	0.50	0.25	0.0	0.0	364	7.8	214	175.	26.	148.	10.0	0.3	0.937	3
BILL JOHNSTON WELL 14N 19E 34DAA1	7/12/72	40	915.	189.	23	55.0	21.00	45	7.60	226.	0.0	130.00	0.01	4.0	1.10	0.10	0.0	0.0	623	7.3	397	224.	38.	185.	29.6	1.3	0.188	3
SUNFLOWER FLAT H S 16N 12E 8DDB1S	0/ 0/ 0	43	0.	16.	59	4.5	0.0	91	1.60	79.	0.0	100.00	0.0	13.0	12.00	0.0	0.0	0.0	0	7.4	319	11.	0.	65.	93.7	11.8	-1.956	2
THOMAS CREEK RANCH H S 16N 12E 17DAD1S	7/ 4/71	43	0.	257.	81	2.1	0.0	82	1.80	54.	28.00	63.00	0.0	10.0	12.00	0.0	0.0	0.0	377	9.0	306	5.	0.	91.	95.9	15.6	-4.483	2
LOWER LOON CREEK H S 17N 14E 19BDB1S	7/ 4/71	49	0.	30.	72	2.9	0.0	93	1.30	114.	38.00	51.00	0.0	12.0	12.00	0.0	0.0	0.0	433	8.7	318	7.	0.	123.	95.8	15.0	-3.271	2

Elmore County

CHARLES BAKER WELL 3N 10E 10ABA1	10/14/77	41	90.	19.	67	7.4	0.0	55	0.60	65.	52.00	18.00	0.05	1.9	2.40	0.06	0.0	0.05	260	9.7	236	18.	0.	140.	86.2	5.6	-9.694	10
PARADISE H S 3N 10E 33ACD1S	10/14/77	53	0.	946.	73	9.2	0.0	48	1.10	66.	34.00	15.00	0.01	3.2	3.30	0.01	0.0	0.03	230	9.2	219	23.	0.	111.	81.1	4.4	-4.079	10

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Elmore County (cont'd.)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
PARADISE H S WELL 3N 10E 33BDB1	8/29/72	38	0.	0.	69	1.5	0.10	50	1.00	45.	35.00	17.00	0.03	2.6	3.10	0.04	0.0	0.0	232	9.2	201	4.	0.	95.	95.2	10.7	-4.613	3
NINEMEYER H S 5N 7E 24BDD1S	8/17/72	76	0.	1321.	100	1.1	0.10	67	1.80	5.	51.00	31.00	0.03	2.9	10.00	0.02	0.0	0.0	295	8.5	267	3.	0.	89.	96.4	16.4	-0.688	3
DUTCH FRANK'S H S 5N 9E 7BBA1S	8/17/72	65	0.	1135.	72	2.2	0.20	57	1.20	17.	40.00	30.00	0.03	2.4	10.00	0.02	0.0	0.0	268	8.6	223	6.	0.	81.	94.0	9.9	-3.980	3
ATLANTA H S 6N 11E 35DAD1S	7/ 0/55	38	0.	0.	78	3.0	0.40	65	1.60	41.	21.00	39.00	0.0	6.0	14.00	0.10	0.0	0.0	300	9.6	248	9.	0.	69.	92.7	9.4	-1.439	1
JOHN MALOTA WELL 2S 5E 23BBC1	8/10/76	22	128.	0.	48	17.0	6.90	34	6.50	139.	0.0	19.00	0.01	8.3	0.80	1.30	0.0	0.0	272	8.0	210	71.	0.	114.	48.3	1.8	0.128	12
LONG TOM RANCH WELL #1 3S 7E 1ACA1	8/13/76	20	53.	0.	59	26.0	5.60	18	5.80	108.	0.0	15.00	0.01	14.0	0.70	2.60	0.0	0.0	273	7.5	199	88.	0.	89.	29.1	0.8	1.406	12
LESLIE BEAM WELL 3S 8E 36CAD1	8/14/72	68	183.	2649.	86	1.5	0.0	87	0.80	74.	50.00	14.00	0.04	4.5	17.00	0.06	0.0	0.0	382	8.5	297	4.	0.	144.	97.5	19.6	-4.152	3
LATTY H S 3S 10E 31DDB1S	7/ 5/72	55	0.	0.	100	0.4	0.0	54	1.70	90.	33.00	10.00	0.04	2.7	7.00	0.07	0.0	0.0	243	8.4	253	1.	0.	129.	97.4	23.5	-14.838	3
ROBERT BRUCE WELL 4S 5E 25BBC1	8/16/76	24	162.	0.	41	13.0	2.80	9	3.00	72.	0.0	6.60	0.20	2.3	0.20	0.63	0.0	0.0	128	8.2	114	44.	0.	59.	30.0	0.6	-4.394	12
BEVERLY OLSON WELL 4S 7E 19BDB1	8/10/76	26	184.	0.	65	23.0	8.10	27	5.60	144.	0.0	19.00	0.01	9.3	1.00	0.78	0.0	0.0	306	8.0	229	91.	0.	118.	37.5	1.2	0.597	12
NORTHWEST PIPELINE WELL 4S 8E 36BBA1	6/ 6/72	38	579.	30.	86	3.2	0.20	160	3.70	447.	0.0	5.40	0.05	10.0	3.00	0.06	0.0	0.0	703	7.8	491	9.	0.	366.	96.3	23.5	-4.534	3
BILL DAVIS WELL 4S 9E 8ACA1	8/29/72	62	358.	0.	85	0.9	0.0	82	0.80	81.	41.00	14.00	0.03	3.2	16.00	0.05	0.0	0.0	387	9.2	282	2.	0.	135.	98.2	23.8	-4.076	3
GARY LAWSON WELL 5S 3E 14CBB1	7/23/73	59	701.	238.	81	2.4	0.0	91	0.80	66.	42.00	10.00	0.05	18.0	23.00	0.0	0.0	0.10	419	9.6	300	6.	0.	124.	96.6	16.2	-3.904	5
MIKE WISSEL WELL 5S 7E 16ABD1	8/10/76	21	137.	0.	73	51.0	14.00	33	7.80	202.	0.0	77.00	0.02	12.0	1.10	0.15	0.0	0.0	515	7.8	368	185.	19.	166.	26.9	1.1	-0.009	12
CHARLES BOYD WELL 5S 8E 34BDC1	7/ 5/72	34	402.	8.	58	9.1	1.00	320	11.00	797.	0.0	6.50	0.04	59.0	2.20	0.04	0.0	0.0	1339	7.7	858	27.	0.	653.	94.5	26.9	-0.812	3
MAGIC WEST CO. WELL 5S 10E 32BDB1	6/22/72	38	285.	204.	46	2.5	0.20	130	0.90	270.	8.00	2.50	0.03	29.0	13.00	0.06	0.0	0.0	590	7.9	364	7.	0.	235.	97.2	21.3	-3.885	3
CHARLES ANDERSON WELL 5S 11E 7ACC1	6/19/72	32	396.	0.	42	2.5	0.0	79	0.90	115.	16.00	12.00	0.03	6.1	20.00	0.03	0.0	0.0	367	8.5	235	6.	0.	121.	95.9	13.8	-4.459	3

Franklin County

TREASURTON W S #1	12S 40E 36ACD1S	9/ 6/73	35	0.	38.	54	265.0	68.00	563	127.00	704.	0.0	788.00	0.01	632.0	2.20	0.93	1.30	3.40	4149	6.6	2846	941.	364.	577.	52.6	8.0	0.771	6
TREASURTON W S #2	12S 40E 36ADB1S	9/ 6/73	33	0.	38.	52	259.0	64.00	517	137.00	704.	0.0	755.00	0.01	633.0	1.90	0.37	1.20	3.40	4199	6.6	2765	909.	332.	577.	50.9	7.5	-1.101	6
CLEVELAND H S #1	12S 41E 31CAC1S	9/ 6/73	66	0.	76.	60	208.0	50.00	458	98.00	718.	0.0	533.00	0.01	532.0	1.90	0.11	1.60	2.80	3229	6.4	2294	725.	136.	588.	54.0	7.4	-1.334	6
CLEVELAND H S #2	12S 41E 31CCA1S	9/ 6/73	56	0.	38.	63	172.0	50.00	460	100.00	583.	0.0	538.00	0.01	532.0	1.90	0.76	0.80	2.80	3189	6.5	2204	635.	157.	478.	56.7	7.9	-0.856	6
CLEVELAND H S #3	12S 41E 31CDB1S	9/ 6/73	61	0.	189.	64	178.0	50.00	460	102.00	576.	0.0	530.00	0.01	530.0	1.90	0.21	1.50	2.90	3379	6.5	2199	650.	178.	472.	56.2	7.9	0.194	6
MAPLE GROVE H S	13S 41E 7ACA1S	9/ 5/73	78	0.	76.	84	85.0	30.00	492	82.00	494.	0.0	256.00	0.01	596.0	1.10	0.07	1.40	2.30	2909	6.6	1869	335.	0.	405.	70.8	11.7	-0.057	6
MAPLE GROVE H S	13S 41E 7ACA2S	9/ 5/73	72	0.	378.	85	93.0	29.00	501	82.00	495.	0.0	261.00	0.02	601.0	1.10	0.12	1.30	2.30	2979	6.8	1896	351.	0.	406.	70.5	11.6	0.670	5
MAPLE GROVE H S	13S 41E 7ACA3S	9/ 5/73	60	0.	3539.	86	93.0	25.00	492	80.00	494.	0.0	251.00	0.01	584.0	1.00	0.06	0.90	2.30	2899	6.8	1854	335.	0.	405.	71.0	11.7	0.486	6
BEN MEEK WELL	14S 39E 36ADA1	9/ 5/73	40	4.	0.	89	24.0	6.60	368	22.00	513.	0.0	13.00	0.01	322.0	9.60	0.10	1.10	0.58	1809	6.9	1106	87.	0.	420.	87.4	17.2	0.144	6
ELDIN BINGHAM	15S 39E 7DBC1	8/24/77	63	0.	38.	68	320.0	36.00	4600	770.00	930.	0.0	48.00	0.12	7800.0	3.90	0.0	0.0	4.40	27999	6.2	14103	946.	184.	762.	83.8	65.0	0.469	10
BATTLE CREEK H S	15S 39E 8BDC1S	9/ 5/73	82	0.	189.	109	174.0	19.00	3161	552.00	696.	0.0	35.00	0.01	5241.0	6.00	0.11	7.60	3.50	16619	6.7	9639	512.	0.	570.	84.9	60.8	0.613	6
BATTLE CREEK H S	15S 39E 8BDC2S	9/ 5/73	43	0.	8176.	107	166.0	15.00	3071	535.00	697.	0.0	29.00	0.01	5048.0	6.00	0.42	7.30	3.40	15439	6.5	9320	476.	0.	571.	85.2	61.2	0.786	6
BATTLE CREEK H S	15S 39E 8BDC3S	9/ 5/73	81	0.	0.	109	162.0	19.00	3053	533.00	757.	0.0	37.00	0.01	5034.0	6.00	0.28	7.20	3.60	15949	6.5	9325	482.	0.	620.	85.1	60.5	0.318	6
BATTLE CREEK H S	15S 39E 8BDC4S	9/ 5/73	84	0.	19.	97	215.0	24.00	4184	686.00	610.	0.0	33.00	0.01	6967.0	6.40	0.06	10.00	5.30	18479	6.8	12512	635.	135.	500.	85.7	72.2	1.255	6
SQUAW H S WELL	15S 39E 17BCD1	9/ 4/73	84	2.	435.	124	279.0	24.00	4368	782.00	791.	0.0	35.00	0.02	7398.0	4.30	0.12	8.10	4.30	20459	6.5	13403	795.	147.	648.	84.1	67.4	0.836	6
SQUAW H S	15S 39E 17BDC1S	8/22/73	69	0.	140.	126	271.0	23.00	4184	708.00	816.	0.0	27.00	0.03	6877.0	4.30	0.16	7.30	4.20	20519	6.5	12621	771.	102.	669.	84.4	65.6	1.833	6
SQUAW H S	15S 39E 17BDC2S	9/11/73	73	0.	450.	126	241.0	26.00	3844	533.00	866.	0.0	23.00	0.02	6396.0	4.80	0.06	9.70	4.60	16859	6.6	11619	708.	0.	710.	85.7	62.8	0.046	6
MYRON FONNESBECK WELL	16S 38E 24ABC1	9/ 3/73	23	48.	*****	74	78.0	27.00	68	18.00	418.	0.0	4.30	0.03	91.0	0.50	0.08	0.10	0.42	889	6.8	566	306.	0.	343.	31.0	1.7	-0.017	6

Fremont County

DONALD TRUPP WELL	7N 41E 25CBD1	7/20/76	32	0.	0.	76	23.0	3.30	88	12.00	181.	0.0	26.00	0.0	25.0	6.20	0.0	0.0	0.0	524	7.8	348	71.	0.	148.	68.9	4.5	9.829	9
WAYNE LARSEN WELL	7N 41E 26ACC1	0/ 0/ 0	22	0.	0.	94	19.0	2.70	93	12.00	243.	0.0	23.00	0.0	28.0	7.10	0.0	0.0	0.10	531	8.1	398	59.	0.	199.	73.3	5.3	-1.445	13
HENRY HARRIS WELL	7N 41E 34ADD1	6/16/77	33	0.	0.	64	25.0	5.90	69	6.90	204.	0.0	26.00	0.0	22.0	5.70	0.83	0.0	0.15	450	7.6	325	87.	0.	167.	61.1	3.2	0.083	12
NEWDALE CITY WELL	7N 41E 34DCD1	0/ 0/ 0	32	99.	0.	71	31.0	6.40	73	8.60	236.	0.0	0.0	0.0	29.0	4.70	0.0	0.0	0.10	535	8.0	339	104.	0.	193.	58.1	3.1	4.706	13
WALLACE LITTLE WELL	7N 41E 35CDD1	8/ 9/72	36	122.	0.	75	28.0	6.30	78	8.60	240.	0.0	33.00	0.02	24.0	5.40	0.79	0.0	0.0	538	7.9	377	96.	0.	197.	61.4	3.5	-0.853	3

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
Fremont County (cont'd.)																												
CLAUDE HAWS WELL 7N 41E 36DDA1	6/24/76	32	0.	0.	68	24.0	7.30	44	4.90	188.	0.0	16.00	0.0	12.0	3.00	0.0	0.0	0.0	375	7.5	271	90.	0.	154.	49.9	2.0	-1.575	9
DEAN SWINDELMAN WELL 7N 42E 8CAA1	6/22/76	32	0.	0.	65	38.0	14.00	22	4.80	205.	0.0	8.80	0.0	14.0	2.00	0.0	0.0	0.0	388	7.6	269	152.	0.	168.	23.2	0.8	0.782	9
REMINGTON PRODUCE WELL 7N 42E 19CCA1	7/19/76	26	0.	0.	33	35.0	17.00	15	2.20	144.	0.0	22.00	0.0	24.0	2.20	0.0	0.0	0.0	383	7.9	221	157.	39.	118.	16.9	0.5	3.179	9
ASHTON H S 9N 42E 23DAC1S	8/28/72	41	0.	8.	110	1.1	0.10	36	1.60	92.	0.0	4.70	0.05	2.9	2.20	0.24	0.0	0.0	166	7.6	204	3.	0.	75.	93.8	8.8	-4.591	3
BIG SPRINGS 14N 44E 34BBC1S	8/28/72	12	0.	*****	47	5.6	0.60	14	3.00	46.	0.0	3.20	0.03	2.5	3.10	0.05	0.0	0.0	102	6.4	101	16.	0.	38.	60.0	1.5	-4.456	3
Gem County																												
ROYSTONE H S 7N 1E 8DDA1S	11/24/72	55	0.	76.	120	8.7	0.60	160	7.70	187.	0.0	110.00	0.04	62.0	16.00	0.0	0.0	0.0	799	7.5	576	24.	0.	153.	91.1	14.2	-2.421	3
EAST ROYSTONE H S 7N 1E 9CDC1S	8/ 4/72	45	0.	0.	94	15.0	2.40	99	5.30	169.	0.0	57.00	0.02	30.0	8.00	0.67	0.0	0.0	529	7.6	394	47.	0.	138.	79.9	6.3	1.154	3
Gooding County																												
J. SHANNON WELL 4S 13E 28ABB1	6/21/72	47	49.	0.	92	9.8	1.20	100	5.90	278.	0.0	19.00	0.05	8.2	12.00	0.49	0.0	0.0	497	7.0	385	29.	0.	228.	85.5	8.0	-7.062	3
WHITE ARROW H S 4S 13E 30ADB1S	5/26/72	65	0.	3126.	97	1.2	0.0	91	1.60	141.	22.00	15.00	0.03	6.6	12.00	0.11	0.0	0.0	407	7.5	315	3.	0.	152.	97.5	22.9	-1.598	3
DAVE ARCHER WELL 5S 12E 3AAA1	6/19/72	57	211.	0.	62	1.6	0.10	90	0.80	83.	42.00	19.00	0.03	8.4	19.00	0.17	0.0	0.0	413	8.6	283	4.	0.	138.	97.3	18.7	-4.755	3
Idaho County																												
BURGDORF H S 22N 4E 1BDC1S	8/ 1/72	45	0.	613.	73	2.3	0.0	49	0.80	19.	41.00	18.00	0.02	3.0	2.00	0.03	0.0	0.0	218	8.1	198	6.	0.	84.	94.0	8.9	0.067	3
RIGGINS H S 24N 2E 14DBD1S	8/ 1/72	42	0.	189.	72	6.2	0.10	160	3.40	11.	25.00	300.00	0.02	8.0	2.10	0.02	0.0	0.0	812	8.6	582	16.	0.	51.	94.5	17.5	-1.703	3
BARTH H S 25N 12E 18DD 1S	0/ 0/ 0	61	0.	742.	70	1.6	0.0	50	0.50	51.	29.00	5.30	0.0	3.6	5.70	0.0	0.0	0.0	0	9.0	190	4.	0.	90.	95.9	10.9	-1.300	2
RED RIVER H S 28N 10E 30DD1S	8/21/72	55	0.	132.	76	2.7	0.0	81	1.60	36.	36.00	44.00	0.01	4.4	23.00	0.04	0.0	0.0	380	8.6	286	7.	0.	89.	95.3	13.6	-4.630	3
WEIR CREEK H S 36N 11E 13BCC1S	8/23/72	48	0.	151.	49	3.3	0.0	29	0.50	21.	22.00	15.00	0.03	2.1	2.20	0.03	0.0	0.0	148	8.5	133	8.	0.	54.	87.7	4.4	-4.667	3
JERRY JOHNSON H S 36N 13E 18ADD1S	8/23/72	48	0.	1135.	49	2.7	0.20	37	0.40	24.	25.00	25.00	0.04	1.9	1.60	0.03	0.0	0.0	186	8.7	154	8.	0.	61.	90.9	5.9	-3.915	3

Jefferson County																												
HEISE H S 4N 40E 25DDA1S	7/27/72	49	0.	227.	30	450.0	82.00	1500	190.00	1100.	0.0	740.00	0.04	2400.0	3.10	0.10	0.0	0.0	8839	6.7	5936	1460.	558.	901.	65.7	17.1	-1.000	3
Jerome County																												
ROYAL CATFISH INDUSTRY 9S 17E 29DBB1	5/24/73	43	0.	*****	74	2.2	0.0	98	1.90	108.	42.00	17.00	0.10	16.0	11.00	0.0	0.0	0.0	454	9.0	315	5.	0.	158.	96.4	18.2	-1.775	9
Lemhi County																												
CRONKS CANYON H S 16N 21E 18ADC1S	8/24/72	46	0.	76.	37	11.0	1.40	160	11.00	339.	0.0	66.00	0.04	26.0	7.00	0.06	0.0	0.0	757	7.4	486	33.	0.	278.	88.0	12.1	-1.016	3
SALMON H S 20N 22E 3ABD1S	8/24/72	45	0.	549.	33	23.0	11.00	190	28.00	565.	0.0	34.00	0.04	50.0	1.80	0.03	0.0	0.0	1059	6.3	648	103.	0.	463.	74.9	8.2	-1.960	3
SHARKEY H S 20N 24E 34CCC1S	8/24/72	52	0.	30.	91	7.3	0.60	270	17.00	470.	0.0	160.00	0.02	51.0	12.00	0.08	0.0	0.0	1269	7.4	840	21.	0.	385.	93.3	25.8	-2.196	3
BIG CREEK H S 23N 18E 22CAD1S	7/13/72	93	0.	284.	150	5.3	0.20	220	14.00	488.	0.0	53.00	0.05	29.0	15.00	0.07	0.0	0.0	1009	7.5	726	14.	0.	400.	93.7	25.5	-2.482	3
Madison County																												
LAVERE RICKS WELL 5N 40E 5CBA1	0/ 0/ 0	21	98.	0.	42	34.0	12.00	18	3.10	174.	0.0	11.00	0.0	20.0	1.30	0.0	0.0	0.0	341	7.9	226	134.	0.	143.	22.1	0.7	-2.345	4
MARK RICKS WELL 5N 40E 8BCC1	6/15/77	26	0.	0.	50	33.0	11.00	20	3.90	170.	0.0	12.00	0.0	12.0	1.70	0.81	0.0	0.03	0	7.6	227	128.	0.	139.	24.7	0.8	0.489	4
PAULINE SMITH WELL 5N 40E 9CCC1	0/ 0/ 0	21	140.	0.	40	37.0	15.00	14	2.70	189.	0.0	11.00	0.0	16.0	0.60	0.0	0.0	0.0	365	8.0	229	154.	0.	155.	16.2	0.5	-0.920	13
GREEN CANYON H S 5N 43E 6BCA1S	8/ 9/72	44	0.	0.	25	140.0	32.00	3	3.60	167.	0.0	330.00	0.01	1.7	1.60	0.13	0.0	0.0	846	6.8	620	481.	344.	137.	1.7	0.1	0.412	3
WALZ ENTER. INC. WELL 6N 41E 10ACC1	0/ 0/ 0	26	0.	0.	65	31.0	6.90	65	9.00	232.	0.0	26.00	0.0	27.0	3.70	0.0	0.0	0.10	492	7.7	347	106.	0.	190.	54.7	2.7	-1.945	13
WANDA WOOD WELL #1 6N 41E 10BBB1	0/ 0/ 0	24	81.	0.	66	33.0	7.20	64	8.60	240.	0.0	0.0	0.0	24.0	3.50	0.0	0.0	0.10	493	8.0	324	112.	0.	197.	53.1	2.6	4.162	13
WANDA WOOD WELL #2 6N 41E 10DBB1	6/16/77	27	0.	0.	80	31.0	7.60	70	8.50	217.	0.0	26.00	0.0	25.0	4.50	1.10	0.0	0.13	470	7.6	360	109.	0.	178.	56.0	2.9	3.029	12
Oneida County																												
KENT H S 12S 34E 36BCB1S	5/17/72	24	0.	715.	33	56.0	19.00	15	4.30	226.	0.0	18.00	0.0	35.0	0.30	0.73	0.0	0.0	479	6.7	292	218.	33.	185.	12.7	0.4	0.293	3
MALAD W S 14S 36E 27CDA1S	5/16/72	25	0.	167.	19	240.0	79.00	1200	210.00	958.	0.0	25.00	0.0	2100.0	0.40	0.95	0.0	0.0	7589	6.5	4345	924.	139.	785.	68.6	17.2	0.370	3
PLEASANTVIEW W S 15S 35E 3AAB1S	5/16/72	25	0.	*****	21	110.0	33.00	280	29.00	331.	0.0	110.00	0.0	470.0	0.70	1.50	0.0	0.0	2189	6.8	1217	410.	139.	271.	57.7	6.0	0.229	3
WOODRUFF H S 16S 36E 10BBC1S	5/11/72	27	0.	0.	29	130.0	45.00	910	87.00	454.	0.0	58.00	0.03	1600.0	0.60	1.40	0.0	0.0	5369	7.3	3084	509.	137.	372.	76.1	17.5	-1.735	3
Owyhee County																												
GIVENS H S 1N 3W 21BBD1S	5/ 0/57	49	0.	0.	75	1.0	0.0	126	1.40	150.	35.00	31.00	0.0	23.0	14.00	0.20	0.0	0.0	582	9.2	380	2.	0.	181.	98.5	34.7	-0.890	1

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
Owyhee County (cont'd.)																												
WESLEY HIGGINS WELL 1N 4W 12DBB1	6/13/72	36	195.	1552.	40	2.2	0.0	110	0.30	214.	0.0	8.60	0.01	28.0	7.90	0.04	0.0	0.0	483	7.2	302	5.	0.	175.	97.6	20.4	0.024	3
EARL FOOTE WELL 1S 2W 7CCB1	6/ 5/72	46	518.	640.	32	1.9	0.0	120	1.20	187.	12.00	45.00	0.01	19.0	11.00	0.04	0.0	0.0	545	8.7	334	5.	0.	173.	97.7	24.0	-1.631	3
ALFRED HEYWOOD WELL 3S 1E 35DAC1	7/24/73	20	91.	0.	55	43.0	9.90	35	6.00	246.	0.0	25.00	0.07	7.7	2.10	0.01	0.0	0.06	440	7.8	304	148.	0.	202.	32.8	1.3	-3.394	5
WILLIAM COX WELL #1 4S 1E 25CCD1	7/24/73	30	0.	19.	120	25.0	2.90	310	29.00	952.	0.0	5.50	0.25	25.0	0.60	0.02	0.0	0.0	1419	7.3	986	74.	0.	780.	65.8	15.6	-2.564	5
WILLIAM COX WELL #2 4S 1E 26ABC1	6/ 8/73	27	518.	189.	96	13.0	2.80	250	29.00	763.	0.0	3.60	0.16	13.0	0.60	0.01	0.0	0.78	1159	7.3	785	44.	0.	625.	87.0	16.4	-2.177	5
T. ADCOCK WELL 4S 1E 29CCD1	6/ 5/73	70	927.	5602.	83	1.2	0.0	100	0.80	69.	51.00	39.00	0.01	12.0	12.00	0.0	0.0	0.15	476	9.2	332	3.	0.	142.	98.2	25.1	-2.256	5
GEORGE KING WELL 4S 1E 34BAD1	6/ 6/72	75	902.	0.	83	1.1	0.20	98	0.70	108.	33.00	40.00	0.03	12.0	12.00	0.05	0.0	0.0	454	7.9	333	4.	0.	144.	97.9	22.6	-3.963	3
G. CHRISTENSEN WELL 4S 2E 29DBC1	7/27/73	28	305.	38.	100	21.0	6.90	330	24.00	1010.	0.0	4.50	0.0	31.0	0.30	0.0	0.0	0.62	1389	7.4	1014	81.	0.	828.	86.6	16.0	-3.016	5
R. KETTERLING WELL 4S 2E 32BCC1	7/ 9/73	43	824.	95.	110	5.8	0.70	150	8.50	383.	0.0	5.20	0.07	17.0	8.70	0.70	0.0	0.0	699	8.8	494	17.	0.	314.	92.0	15.7	-2.134	5
C. STEINER WELL 5S 1E 3AAB1	7/24/73	32	579.	0.	120	27.0	1.30	260	29.00	787.	0.0	7.20	0.22	18.0	0.50	0.0	0.0	0.80	1229	7.8	850	73.	0.	645.	83.7	13.3	-0.399	5
E. LAWRENCE WELL #1 5S 1E 10BDD1	6/ 5/73	64	902.	4542.	83	2.2	0.0	100	0.70	63.	49.00	42.00	0.01	13.0	15.00	0.0	0.0	0.16	514	9.3	335	5.	0.	133.	97.1	18.6	-2.591	5
E. JOHNSTON WELL #2 5S 1E 21CBC1	6/ 6/73	65	201.	1382.	77	1.3	0.0	100	0.70	57.	50.00	42.00	0.02	13.0	15.00	0.05	0.0	0.17	468	9.2	327	3.	0.	130.	98.1	24.2	-2.404	5
E. LAWRENCE WELL #2 5S 1E 24ACD1	7/ 9/73	65	756.	7646.	89	1.1	0.0	100	1.30	82.	39.00	41.00	0.01	14.0	15.00	0.78	0.0	0.15	463	9.3	341	3.	0.	132.	98.0	26.3	-2.766	5
E. LAWRENCE WELL #3 5S 1E 24ADB1	7/24/72	66	951.	4012.	82	1.2	0.10	100	0.80	105.	31.00	45.00	0.23	13.0	14.00	0.04	0.0	0.0	459	7.9	338	3.	0.	138.	98.0	23.6	-4.260	3
OSCAR FIELDS WELL 5S 2E 1BBC1	7/ 9/73	50	549.	95.	77	1.7	0.0	86	0.60	46.	59.00	7.10	0.0	16.0	15.00	0.36	0.0	0.0	423	9.8	285	4.	0.	136.	97.4	18.2	-3.567	5
CLARENCE HOPKINS WELL 5S 2E 2CDA1	6/ 7/73	37	750.	38.	89	9.9	2.00	250	22.00	675.	0.0	3.40	0.06	25.0	6.40	0.01	0.0	0.20	1099	7.5	739	33.	0.	555.	89.9	19.0	-0.335	5

COX AND LAWRENCE WELL	5S 2E 5BCD1	6/ 5/73	43	613.	284.	110	5.2	1.10	150	6.70	223.	75.00	8.10	0.04	20.0	8.60	0.0	0.0	0.99	648	9.3	494	17.	0.	308.	92.6	15.6	-2.234	5
H. DRISKELL WELL #1	5S 2E 13ADA1	6/22/73	23	533.	19.	110	13.0	2.60	260	28.00	767.	0.0	3.20	0.10	30.0	1.50	0.0	0.0	0.0	1259	7.6	825	43.	0.	629.	87.8	17.2	-2.750	5
N. MCKEETH WELL	5S 3E 20ADA1	7/13/73	60	738.	0.	110	1.1	0.10	85	0.70	27.	61.00	6.40	0.01	15.0	19.00	0.09	0.0	0.78	396	9.6	311	3.	0.	124.	97.9	20.8	-3.594	5
BURGHARDT CO. WELL	5S 3E 20BBB1	7/23/73	27	738.	19.	110	42.0	3.90	230	19.00	703.	0.0	6.70	0.13	30.0	0.50	3.60	0.0	0.79	1129	7.2	791	121.	0.	576.	77.5	9.1	0.973	5
LEROY BEAMAN WELL	5S 3E 22AAD1	6/22/73	25	396.	19.	140	19.0	3.40	250	18.00	683.	0.0	4.00	0.70	38.0	0.70	0.02	0.0	0.20	1279	7.3	809	61.	0.	560.	86.6	13.9	0.490	5
COOK'S GREENHOUSE WELL #	5S 3E 26BCB1	6/ 7/73	83	905.	0.	110	2.1	0.0	110	1.70	22.	64.00	62.00	0.02	15.0	15.00	0.01	0.0	0.57	530	9.3	390	5.	0.	125.	97.0	20.9	-0.837	105
COOK'S GREENHOUSE WELL #	5S 3E 26BCB2	6/ 8/73	67	905.	0.	100	1.5	0.10	110	1.50	35.	55.00	64.00	0.01	15.0	14.00	0.03	0.0	0.55	529	9.3	378	4.	0.	120.	97.5	23.5	-0.151	205
D. BYBEE WELL #1	5S 3E 27BDD1	7/13/73	60	884.	0.	69	1.4	0.10	81	0.90	63.	39.00	12.00	0.0	17.0	20.00	0.25	0.0	0.83	405	9.4	271	4.	0.	117.	97.2	17.8	-6.761	5
A. WHITTED WELL	5S 3E 28BCC1	5/31/73	65	774.	0.	98	0.8	0.0	97	1.30	27.	67.00	9.80	0.02	15.0	21.00	0.0	0.0	0.62	437	9.4	323	2.	0.	134.	98.3	29.9	-1.421	5
D. BYBEE WELL #2	5S 3E 35CCC1	5/31/73	72	784.	0.	100	2.2	0.0	100	1.10	54.	49.00	72.00	0.03	16.0	15.00	0.01	0.0	0.56	551	9.3	381	5.	0.	126.	96.9	18.6	-7.947	5
IDAHO POWER CO WELL	5S 4E 34CCB1	7/20/73	27	111.	0.	94	85.0	7.80	83	12.00	227.	0.0	240.00	0.03	18.0	1.70	0.0	0.0	0.13	845	8.3	653	244.	58.	186.	41.0	2.3	-3.235	5
CHESTER TINDALL WELL	5S 5E 33BBD1	7/31/73	22	76.	0.	40	86.0	66.00	170	6.90	425.	0.0	450.00	0.0	50.0	0.60	5.30	0.0	0.30	1649	7.2	1083	486.	138.	348.	42.8	3.4	-1.695	5
CLAY ATKINS WELL	5S 5E 34DDD1	7/31/73	25	270.	0.	87	29.0	12.00	190	26.00	625.	0.0	12.00	0.0	24.0	0.60	0.33	0.0	0.70	1099	7.5	688	122.	0.	512.	72.7	7.5	0.719	5
LOWER BIRCH SPRING	6S 1E 32BBA1S	7/12/73	25	0.	0.	45	37.0	8.50	22	1.60	126.	0.0	35.00	0.01	21.0	0.50	0.56	0.0	0.03	344	7.2	233	127.	24.	103.	27.0	0.8	1.067	5
L. POST WELL #1	6S 3E 2CBB1	5/31/73	62	930.	0.	99	1.2	0.0	120	2.80	86.	52.00	45.00	0.02	19.0	17.00	0.01	0.0	0.85	599	9.1	398	3.	0.	157.	97.5	30.2	-1.663	5
L. POST WELL #2	6S 3E 2CCC1	7/ 6/73	53	591.	2725.	100	1.2	0.10	110	4.00	120.	37.00	27.00	0.02	18.0	17.00	0.03	0.0	0.76	504	9.2	373	3.	0.	160.	96.6	25.9	-2.158	5
W. BUNT WELL	6S 3E 4BCC1	6/ 4/73	48	512.	0.	110	1.6	0.0	110	6.40	58.	74.00	42.00	0.02	11.0	12.00	0.0	0.0	0.44	534	9.4	395	4.	0.	171.	95.2	23.9	-2.106	5
J. AGENBROAD WELL	6S 3E 5CAC1	6/ 4/73	61	1098.	0.	94	4.6	0.0	59	3.40	78.	12.00	20.00	0.01	9.7	11.00	0.08	0.0	0.15	320	8.6	252	11.	0.	84.	89.0	7.6	-1.290	5
NIELSON & CAROTHERS WELL	6S 3E 9ACC1	6/ 4/73	39	434.	6283.	130	3.6	0.10	97	8.10	157.	25.00	42.00	0.06	11.0	9.10	0.0	0.0	0.42	516	8.8	403	9.	0.	170.	91.4	13.8	-4.844	5
TRIANGLE DAIRY WELL #1	6S 3E 11DAD1	7/25/73	34	427.	0.	120	5.6	0.30	86	6.10	155.	0.0	33.00	0.12	11.0	11.00	0.03	0.0	0.40	433	8.9	349	15.	0.	127.	89.0	9.6	0.639	5
LITTLE VALLEY IRR. WELL	6S 4E 14ABC1	5/30/73	54	581.	5602.	140	5.0	0.10	110	4.70	20.	74.00	65.00	0.06	19.0	24.00	0.02	0.0	0.54	583	9.4	451	13.	0.	140.	92.7	13.3	-7.328	5
KENT KOHRING WELL #1	6S 4E 25BCC1	6/26/73	20	534.	341.	73	41.0	2.30	95	13.00	129.	0.0	190.00	0.03	14.0	3.90	0.23	0.0	0.13	702	7.8	495	112.	6.	106.	61.7	3.9	0.012	5

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
Owyhee County (cont'd.)																												
DICK WARD WELL 6S 4E 35CDA1	6/26/73	33	303.	0.	96	4.6	0.10	47	8.90	96.	0.0	24.00	0.04	9.0	8.00	0.0	0.0	0.10	273	8.5	244	12.	0.	79.	81.5	5.9	-5.182	5
COLYER CATTLE CO. WELL 6S 5E 10DDD1	7/ 5/73	39	508.	19.	78	2.6	0.30	120	4.30	159.	19.00	24.00	0.02	15.0	29.00	0.04	0.0	0.69	508	8.4	370	8.	0.	162.	95.2	18.8	-2.129	5
J.R.SIMPLOT WELL #1 6S 5E 18CCB1	6/26/73	27	902.	0.	120	3.9	0.10	100	7.30	93.	25.00	52.00	0.03	20.0	13.00	0.13	0.0	0.54	520	7.6	387	10.	0.	118.	91.8	13.7	0.356	5
J.R.SIMPLOT WELL #2 6S 5E 20AAB1	5/30/73	44	0.	19.	59	4.7	0.10	110	5.60	198.	18.00	3.70	0.04	17.0	24.00	0.0	0.0	0.95	562	8.8	339	12.	0.	192.	92.5	13.7	-4.796	5
GEORGE HUTCHINSON WELL 6S 5E 24BCA1	6/25/73	34	334.	19.	89	3.6	0.0	120	4.60	149.	21.00	28.00	0.02	13.0	27.00	0.0	0.0	0.57	509	9.1	379	9.	0.	157.	94.6	17.4	-0.106	5
BRUNEAU CITY WELL 6S 5E 24DDB1	7/25/73	33	591.	0.	79	2.8	0.0	99	2.30	127.	10.00	35.00	0.05	11.0	25.00	0.0	0.0	0.38	418	9.0	326	7.	0.	121.	95.6	16.3	-2.959	5
DON DAVIS WELL #1 6S 5E 29DCC1	7/ 5/73	33	476.	19.	120	7.1	0.30	87	6.30	117.	4.00	42.00	0.04	15.0	19.00	0.05	0.0	0.40	435	8.8	358	19.	0.	103.	87.5	8.7	-0.672	5
CARL & HARRY LOOS WELL 6S 5E 35CCA1	7/19/73	22	140.	0.	73	38.0	3.30	54	8.60	166.	0.0	66.00	0.02	11.0	6.90	0.17	0.0	0.10	462	9.1	342	108.	0.	136.	49.6	2.3	-0.773	5
IDAHO PARKS DEPT. WELL 6S 6E 12CCD1	7/ 6/73	37	302.	0.	120	10.0	0.60	180	15.00	493.	0.0	3.60	0.07	19.0	5.90	3.00	0.0	0.10	843	8.2	599	27.	0.	404.	89.4	15.0	-1.910	5
MILDRED BACHMAN WELL 6S 6E 19CCD1	5/22/73	38	278.	19.	88	3.0	0.0	93	3.10	94.	19.00	38.00	0.01	10.0	26.00	0.01	0.0	0.34	457	9.0	326	7.	0.	109.	94.6	14.8	-3.875	5
BRUNEAU CEMENTARY WELL 6S 6E 19DBD1	7/18/73	42	333.	0.	84	2.3	0.0	94	1.90	87.	24.00	28.00	0.0	10.0	26.00	0.02	0.0	0.34	421	9.2	312	6.	0.	111.	96.2	17.1	-2.650	5
ACE BLACK WELL 6S 6E 32BDD1	6/25/73	35	427.	95.	87	3.1	0.10	94	3.10	132.	8.00	28.00	0.02	11.0	27.00	0.01	0.0	0.35	413	9.3	326	8.	0.	122.	94.4	14.3	-4.688	5
WILBUR WILSON WELL #1 6S 7E 1ACB1	8/ 1/73	41	305.	19.	73	7.0	0.60	260	8.00	614.	0.0	3.40	0.0	62.0	4.40	0.0	0.0	0.50	239	8.0	720	20.	0.	503.	94.9	25.3	-1.045	5
WILBUR WILSON WELL #2 6S 7E 1DBD1	8/ 1/73	33	320.	38.	72	8.1	1.20	250	8.20	585.	0.0	3.60	0.0	79.0	3.20	0.02	0.0	0.90	169	8.0	712	25.	0.	479.	93.9	21.7	-2.089	5
CARL JOHNSON WELL 6S 7E 2CDD1	6/25/73	35	412.	19.	75	5.8	0.50	210	7.60	524.	0.0	2.80	0.01	56.0	7.60	0.30	0.0	0.70	951	8.0	623	17.	0.	429.	94.6	22.5	-5.056	5
SAND DUNES FARMS WELL 6S 7E 8BBA1	7/26/73	23	111.	0.	87	26.0	17.00	240	31.00	530.	0.0	250.00	0.04	17.0	0.70	0.01	0.0	0.28	209	7.0	929	135.	0.	434.	75.0	9.0	-1.708	5

BILL BURGHARDT WELL #2	7S 3E 4ACD1	6/ 8/73	34	245.	2725.	94	51.0	2.80	31	15.00	214.	0.0	36.00	0.02	7.2	1.70	0.02	0.0	0.08	437	7.4	343	139.	0.	175.	29.9	1.1	-1.210	5
KEITH THOMAS WELL	7S 4E 1ACC1	5/21/73	40	549.	2896.	83	6.9	0.20	53	6.70	79.	100.00	17.00	0.02	8.6	9.70	0.29	0.0	0.10	278	8.6	324	18.	0.	231.	81.2	5.4	-34.337	5
PETE MERRICK WELL #1	7S 4E 3ABD1	6/28/73	42	348.	6283.	95	5.8	0.10	46	7.40	88.	5.00	20.00	0.01	8.7	8.90	0.12	0.0	0.12	272	8.4	240	15.	0.	80.	80.4	5.2	-5.188	5
PETE MERRICK WELL #2	7S 4E 10BDB1	6/11/73	38	349.	1874.	99	7.2	0.10	47	8.30	106.	0.0	24.00	0.04	8.6	9.40	0.26	0.0	0.11	284	8.6	256	18.	0.	87.	77.9	4.8	-6.581	5
FRANK MILLETT WELL #1	7S 4E 11CBC1	6/12/73	36	457.	7475.	99	16.0	0.30	45	9.00	113.	0.0	30.00	0.03	9.3	8.20	1.30	0.0	0.10	312	8.3	273	41.	0.	93.	65.0	3.1	-3.270	5
FARIA BROTHERS WELL	7S 4E 12BDD1	5/21/73	43	337.	0.	96	7.0	0.10	51	7.00	97.	0.0	17.00	0.02	8.4	8.70	0.29	0.0	0.10	293	8.7	243	18.	0.	79.	80.5	5.2	1.994	5
CLARENCE COOK WELL	7S 4E 13BCC1	7/26/73	39	323.	5602.	95	7.3	0.20	49	7.80	89.	6.00	20.00	0.06	8.0	9.00	0.26	0.0	0.10	289	9.0	246	19.	0.	83.	78.6	4.9	-1.866	5
DAVE LATHINEN WELL	7S 4E 13DCD1	5/30/73	40	305.	4750.	97	8.7	0.10	53	7.50	80.	11.00	19.00	0.02	9.0	11.00	0.25	0.0	0.09	261	8.7	255	22.	0.	84.	78.4	4.9	0.200	5
FRANK MILLETT WELL #2	7S 4E 14ABC1	6/12/73	39	349.	6283.	96	7.2	0.10	45	7.80	104.	0.0	18.00	0.04	8.1	6.00	1.20	0.0	0.11	275	8.6	240	18.	0.	85.	77.5	4.6	-2.830	5
ROBERT BLACK WELL	7S 4E 15ACD1	6/12/73	33	325.	*****	100	23.0	0.80	48	9.90	123.	0.0	54.00	0.04	9.9	14.00	0.80	0.0	0.11	359	8.0	320	61.	0.	101.	58.7	2.7	-9.081	5
BLAINE RAWLINS WELL #3	7S 4E 23CBB2	6/13/73	39	247.	*****	96	12.0	0.20	56	8.70	108.	6.00	36.00	0.0	11.0	10.00	1.10	0.0	0.0	352	8.4	292	31.	0.	99.	75.1	4.5	-3.571	5
BELL BRAND RANCHES WELL	7S 4E 25ADC1	5/24/73	37	224.	*****	100	6.8	0.10	25	6.40	108.	0.0	29.00	0.04	11.0	15.00	0.58	0.0	0.12	364	8.9	247	17.	0.	89.	68.0	2.6	-37.484	5
GUTHERIES RANCH WELL	7S 4E 26BCB1	7/10/73	31	264.	4920.	91	13.0	0.40	45	8.30	103.	0.0	22.00	0.05	12.0	8.20	0.82	0.0	0.11	300	8.2	251	34.	0.	84.	68.7	3.4	-1.873	5
DAVE LATHINEN WELL	7S 4E 27BCC1	7/10/73	27	424.	5261.	76	16.0	1.30	46	7.70	109.	0.0	28.00	0.06	14.0	6.60	1.90	0.0	0.11	292	8.0	251	45.	0.	89.	64.5	3.0	-1.121	5
ACE BLACK WELL #2	7S 5E 5DBC1	6/25/73	32	733.	95.	75	4.4	0.10	63	6.10	87.	4.00	48.00	0.02	9.5	8.20	0.0	0.0	0.17	332	9.0	261	11.	0.	78.	87.7	8.1	-2.290	5
DAVIS BROTHERS WELL #1	7S 5E 7ABB1	7/ 6/73	39	495.	*****	91	8.5	0.20	51	7.40	96.	0.0	17.00	0.04	9.8	9.70	0.95	0.0	0.09	279	8.5	242	22.	0.	79.	77.9	4.7	1.912	5
DAVIS BROTHERS WELL #2	7S 5E 8CCC1	5/21/73	40	457.	3066.	90	5.9	0.10	55	6.90	81.	11.00	19.00	0.01	9.3	11.00	0.25	0.0	0.11	291	8.7	248	15.	0.	85.	83.3	6.2	-1.580	5
HARRY LOOS WELL	7S 5E 9DDD1	6/14/73	40	630.	3406.	89	12.0	0.50	50	6.80	85.	9.00	18.00	0.0	9.0	11.00	0.71	0.0	0.06	290	8.6	247	32.	0.	85.	72.8	3.8	0.453	5
ROY DAVIS WELL #2	7S 5E 13AAC1	7/17/73	25	46.	1325.	93	18.0	2.30	51	9.20	100.	0.0	50.00	0.04	10.0	10.00	0.15	0.0	0.12	361	8.4	292	54.	0.	82.	62.6	3.0	0.301	5
CARL STEINER WELL	7S 5E 13CBB1	6/21/73	36	596.	0.	83	6.7	0.0	50	7.10	86.	5.00	19.00	0.04	9.0	11.00	0.13	0.0	0.13	284	8.7	233	17.	0.	79.	80.8	5.3	-2.142	5
ROBERT TINDALL WELL	7S 5E 16ACD1	5/30/73	40	462.	0.	90	6.7	0.10	53	6.50	101.	0.0	20.00	0.02	9.8	16.00	0.26	0.0	0.09	278	8.7	252	17.	0.	83.	81.9	5.6	-6.649	5

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Owyhee County (cont'd.)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
BELL BRAND INC. WELL 7S 5E 19CCC1	7/23/73	37	232.	4428.	95	7.7	0.10	55	7.60	103.	0.0	24.00	0.0	11.0	12.00	0.24	0.0	0.11	309	8.4	263	20.	0.	84.	80.3	5.4	-2.863	5
GENE TINDALL WELL 7S 5E 28ACD1	5/24/73	34	306.	4239.	94	8.3	0.30	52	9.20	97.	0.0	24.00	0.01	9.5	11.00	0.23	0.0	0.11	297	8.6	256	22.	0.	79.	77.0	4.8	-0.525	5
GEORGE TURNER WELL 7S 6E 7AAC1	7/19/73	25	331.	0.	100	2.8	0.10	61	6.80	80.	16.00	23.00	0.03	10.0	10.00	0.01	0.0	0.14	310	9.2	269	7.	0.	92.	89.2	9.8	-3.063	5
COLYER CATTLE CO. WELL 3 7S 6E 9BAD1	7/ 5/73	51	277.	0.	100	1.6	0.30	100	2.80	59.	43.00	27.00	0.04	10.0	24.00	0.06	0.0	0.21	461	9.4	337	5.	0.	120.	96.1	19.0	-0.312	0
R.L. OWENS WELL #2 7S 6E 16CDC1	6/14/73	43	156.	0.	81	7.4	0.40	49	5.10	99.	3.00	18.00	0.0	9.0	8.90	0.33	0.0	0.06	287	8.5	230	20.	0.	86.	80.0	4.8	-3.509	5
HOT SPRINGS RANCH WELL 7S 6E 21DBC1	6/14/73	43	232.	0.	82	5.9	0.30	54	4.60	91.	7.00	18.00	0.0	9.0	12.00	0.28	0.0	0.07	287	8.5	237	16.	0.	86.	84.3	5.9	-4.179	5
R.L.OWENS WELL #4 7S 6E 23BBB1	11/ 0/53	47	0.	0.	75	9.0	1.20	51	6.10	110.	0.0	17.00	0.0	9.0	10.00	1.30	0.0	0.0	287	7.2	233	27.	0.	90.	75.9	4.2	-0.854	1
ROSE WILLIAMS WELL 7S 6E 23CAD1	5/22/73	44	396.	0.	100	12.0	1.10	53	7.20	126.	0.0	17.00	0.01	8.7	8.20	0.54	0.0	0.12	327	8.3	269	34.	0.	103.	72.5	3.9	1.103	5
R.L. OWENS WELL #7 7S 6E 26ADA1	5/22/73	38	305.	3899.	82	16.0	2.80	36	6.90	134.	0.0	15.00	0.02	8.6	3.10	0.66	0.0	0.10	288	8.0	236	51.	0.	110.	56.5	2.2	-4.157	5
JAMES PRESCOTT WELL 7S 6E 27ADB1	6/19/73	43	122.	2044.	84	12.0	1.10	48	6.20	129.	0.0	17.00	0.03	8.6	5.40	0.59	0.0	0.08	287	9.2	246	34.	0.	106.	71.1	3.6	-1.244	5
JEAN PRESCOTT H S 7S 6E 34DCB1S	6/19/73	41	0.	1703.	83	6.2	0.30	55	5.50	103.	6.00	18.00	0.03	8.8	8.50	0.46	0.0	0.01	288	9.1	242	17.	0.	94.	83.4	5.9	-2.243	5
PRESOTT W S 7S 6E 35BBB1S	7/18/73	40	0.	0.	89	13.0	1.80	43	6.70	126.	0.0	15.00	0.03	8.8	4.50	0.60	0.0	0.11	287	8.5	244	40.	0.	103.	65.9	3.0	-1.934	5
INDIAN BATHTUB H S 8S 6E 3BDD1S	7/ 5/73	39	0.	1699.	87	6.5	0.60	53	6.70	113.	5.00	15.00	0.06	9.1	6.00	0.66	0.0	0.08	300	8.3	245	19.	0.	101.	80.9	5.3	-2.148	0
INDIAN H S 12S 7E 33C 1S	6/ 2/72	69	0.	6548.	75	1.5	0.0	75	0.60	67.	30.00	24.00	0.04	8.4	14.00	0.06	0.0	0.0	360	8.0	261	4.	0.	105.	97.3	16.9	-3.409	3
MURPHY H S 16S 9E 24BBB1S	5/23/72	51	0.	265.	83	0.6	0.0	30	2.00	67.	1.00	4.70	0.10	2.3	3.60	0.64	0.0	0.0	137	7.1	160	1.	0.	57.	94.1	10.7	-3.507	3

Power County

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
INDIAN SPRINGS 8S 31E 18DAB1S	7/27/72	32	0.	5829.	20	76.0	19.00	110	10.00	254.	0.0	19.00	0.02	220.0	0.70	0.13	0.0	0.0	1099	7.5	599	268.	60.	208.	46.0	2.9	-1.917	3

ROCKLAND WARM SPRINGS	10S 30E 13CDC1S	7/27/72	38	0.	1582.	22	92.0	33.00	62	14.00	160.	0.0	23.00	0.02	250.0	0.80	0.02	0.0	0.0	1109	7.6	575	365.	234.	131.	26.0	1.4	0.795	3
Twin Falls County																													
MIRACLE H S	8S 14E 31ACB1S	5/24/72	54	0.	1325.	93	2.2	0.0	120	1.50	63.	54.00	29.00	0.03	35.0	20.00	0.50	0.0	0.0	560	9.0	386	5.	0.	142.	97.2	22.3	-1.125	3
HARRY HUTTANUS WELL #2	8S 14E 33CBA1	5/24/72	59	64.	227.	97	1.1	0.0	100	1.50	88.	38.00	26.00	0.03	27.0	15.00	0.54	0.0	0.0	479	8.5	349	3.	0.	135.	97.9	26.3	-4.029	3
ED KERPA WELL	9S 14E 9ADD1	10/ 8/76	31	0.	1699.	51	7.3	0.30	61	3.20	120.	6.00	27.00	0.0	16.0	3.20	0.0	0.0	0.10	300	9.3	234	19.	0.	108.	84.9	6.0	-3.949	9
SAM HIGH AND SONS WELL	11S 19E 33DDD1	5/25/72	33	189.	7305.	63	27.0	3.90	17	8.60	118.	0.0	12.00	0.04	15.0	0.30	1.00	0.0	0.0	266	6.6	205	83.	0.	97.	28.1	0.8	-1.971	3
T. STURGILL WELL	11S 20E 34CCC1	9/ 0/52	32	0.	0.	28	43.0	8.90	11	7.40	186.	0.0	13.00	0.0	5.0	0.70	0.60	0.0	0.0	326	7.5	209	144.	0.	152.	13.5	0.4	-0.515	1
	12S 17E 6CBB1	9/28/77	37	0.	7570.	28	37.0	9.90	46	11.00	250.	0.0	20.00	0.01	5.8	2.20	0.09	0.0	0.14	430	7.3	282	133.	0.	205.	40.5	1.7	0.779	10
NAT-SOO-PAH W S	12S 17E 31BAB1S	7/25/72	36	0.	114.	19	34.0	14.00	43	11.00	266.	0.0	18.00	0.01	8.0	1.90	0.02	0.0	0.0	469	7.6	279	142.	0.	218.	37.4	1.6	-0.602	3
IDAHO STATE WELL	12S 18E 1BBA1	7/25/72	38	236.	2055.	67	18.0	2.00	16	6.00	95.	0.0	9.30	0.26	8.0	0.60	0.63	0.0	0.0	198	7.6	174	53.	0.	78.	36.4	1.0	-2.647	3
HOLLISTER VILLAGE WELL	13S 17E 7BAB1	9/28/77	35	0.	946.	22	34.0	10.00	44	12.00	250.	0.0	15.00	0.0	5.5	2.20	0.04	0.0	0.13	450	7.2	267	126.	0.	205.	40.4	1.7	0.630	10
MAGIC H S	16S 17E 30ACA1S	5/23/72	46	0.	1457.	23	30.0	8.90	13	4.50	162.	0.0	15.00	0.03	3.8	0.30	0.42	0.0	0.0	261	6.4	178	111.	0.	133.	19.4	0.5	-4.542	3
Valley County																													
BOILING SPRINGS	12N 5E 22BBC1S	8/ 3/72	85	0.	625.	94	1.9	0.10	71	1.70	81.	24.00	12.00	0.02	12.0	13.00	0.04	0.0	0.0	331	8.8	269	5.	0.	106.	95.5	13.6	-2.902	3
SILVER CREEK PLUNGE	12N 5E 36DBA1S	10/ 0/55	39	0.	0.	53	2.0	0.40	52	5.10	70.	12.00	20.00	0.0	6.0	7.50	0.20	0.0	0.0	254	9.0	192	7.	0.	77.	89.6	8.8	-0.760	1
CABARTON H S	13N 4E 31CAB1S	8/ 3/72	71	0.	265.	78	1.7	0.0	100	1.90	70.	26.00	46.00	0.02	49.0	11.00	0.05	0.0	0.0	511	7.7	348	4.	0.	101.	97.0	21.1	-5.041	3
CASCADE CITY WELL	14N 3E 36ABD1	8/ 3/72	43	15.	0.	45	1.6	0.0	58	0.40	62.	22.00	17.00	0.04	15.0	3.80	0.09	0.0	0.0	275	9.2	193	4.	0.	87.	96.6	12.6	-2.346	3
VULCAN H S	14N 6E 11BDA1S	8/ 2/72	87	0.	1892.	120	1.8	0.10	94	3.00	120.	0.0	43.00	0.02	17.0	24.00	0.05	0.0	0.0	451	8.5	361	5.	0.	98.	95.9	18.5	-3.955	3
ARLING W S	15N 3E 13BBC1S	8/ 2/72	34	0.	3020.	60	1.3	0.10	60	0.60	17.	45.00	16.00	0.02	16.0	2.60	0.0	0.0	0.0	279	9.8	209	4.	0.	89.	96.7	13.7	-0.475	3
MOLLY'S H S	15N 6E 14ABB1S	8/ 2/72	59	0.	76.	87	2.0	0.0	70	1.50	48.	30.00	17.00	0.02	10.0	17.00	0.03	0.0	0.0	326	7.7	258	5.	0.	89.	95.7	13.6	-2.277	3
SOUTH FORK PLUNGE	15N 6E 14CDB1S	8/ 0/55	55	0.	0.	62	4.0	0.30	60	1.30	59.	22.00	14.00	0.0	9.0	12.00	0.20	0.0	0.0	284	9.3	213	11.	0.	85.	91.0	7.8	-0.737	1
PISTOL CREEK H S	16N 10E 14DBC2S	0/ 0/ 0	46	0.	13.	67	5.0	0.0	83	1.40	98.	0.0	67.00	0.0	12.0	10.00	0.0	0.0	0.0	0	6.3	293	12.	0.	80.	92.7	10.2	0.241	2
SUNFLOWER FLAT HS	16N 12E 15BBB1S	7/ 3/71	65	0.	136.	82	3.0	0.10	77	1.60	51.	30.00	41.00	0.0	9.0	109.00	0.0	0.0	0.0	369	8.8	377	8.	0.	92.	94.4	11.9	-42.244	12
RIVERSIDE H S	16N 12E 16CBB1S	7/ 4/71	43	0.	0.	75	3.2	0.0	79	1.80	62.	19.00	56.00	0.0	8.9	9.90	0.0	0.0	0.0	377	8.8	283	8.	0.	82.	94.4	12.2	0.466	2

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Phosphate (PO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Boron (B)	Ammonia (NH_3)	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness: Carbonate	Hardness: Non-Carbonate	Alkalinity as $CaCO_3$	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
Valley County (cont'd.)																												
HOLDOVER H S 17N 6E 2BAA1S	10/18/77	46	0.	95.	67	1.6	0.0	60	1.00	62.	34.00	9.90	0.01	9.8	8.90	0.02	0.0	0.05	280	9.0	222	4.	0.	107.	96.1	13.1	-6.623	10
KWISKWIS H S 17N 10E 11BBA1S	0/ 0/ 0	69	0.	57.	77	2.3	0.0	110	2.00	87.	22.00	73.00	0.0	19.0	17.00	0.0	0.0	0.0	0	8.7	365	6.	0.	108.	96.6	20.0	-1.588	2
MID FK INDIAN CRK HS 17N 11E 16ACB1S	0/ 0/ 0	72	0.	6.	110	2.1	0.0	120	3.70	116.	25.00	64.00	0.0	14.0	17.00	0.0	0.0	0.0	0	8.7	412	5.	0.	137.	96.3	22.8	0.410	0
INDIAN CREEK H S 17N 11E 21B 1S	0/ 0/ 0	88	0.	151.	110	2.0	0.0	110	3.60	131.	14.00	62.00	0.0	14.0	18.00	0.0	0.0	0.0	0	8.6	398	5.	0.	131.	96.1	21.4	-2.802	2
COX H S 17N 13E 27AAC1S	0/ 0/ 0	55	0.	68.	69	1.9	0.0	84	1.00	83.	20.00	42.00	0.0	9.0	15.00	0.0	0.0	0.0	0	8.8	282	5.	0.	101.	96.8	16.8	-2.213	2
HOSPITAL H S 17N 14E 5CBC1S	0/ 0/ 0	0	0.	8.	55	3.4	0.0	87	1.30	149.	0.0	43.00	0.0	14.0	13.00	0.0	0.0	0.0	0	8.3	289	8.	0.	122.	94.9	13.0	-5.208	2
TEAPOT H S 18N 6E 9ADC1S	10/18/77	60	0.	95.	69	2.3	0.0	63	1.20	66.	31.00	12.00	0.01	6.2	9.90	0.0	0.0	0.07	360	8.9	227	6.	0.	106.	95.0	11.4	-3.033	10
HOT CREEK W S 18N 8E 17BDA1S	9/ 0/58	35	0.	0.	60	3.0	0.0	63	1.80	58.	12.00	45.00	0.0	10.0	6.40	0.0	0.0	0.0	343	8.7	229	7.	0.	68.	93.3	10.0	0.151	1
Washington County																												
COVE CREEK H S 10N 3W 9CCC1S	8/ 9/73	74	0.	19.	130	20.0	0.20	320	22.00	107.	0.0	310.00	0.12	310.0	4.70	0.0	0.0	7.50	1939	7.4	1169	51.	0.	88.	89.8	19.5	-5.286	4
ELVIN CRAIG WELL 11N 2W 16AAB1	8/14/75	20	41.	0.	81	31.0	19.00	26	13.00	283.	0.0	11.00	0.0	2.2	0.30	0.0	0.0	0.0	440	8.0	322	155.	0.	232.	24.7	0.9	-3.909	9
CRANE CREEK H S 11N 3W 7BDB1S	8/ 2/73	92	0.	19.	180	29.0	0.50	280	18.00	201.	0.0	250.00	0.0	200.0	3.20	0.01	0.0	10.00	1629	7.8	1059	74.	0.	165.	86.2	14.1	-0.795	4
CRANE CREEK H S 11N 3W 7BDB2S	8/ 2/73	57	0.	19.	190	29.0	0.60	280	19.00	202.	0.0	250.00	0.0	200.0	3.20	0.03	0.0	10.00	1569	8.0	1071	75.	0.	166.	86.0	14.1	-0.762	4
DOUGLAS MCGINNIS WELL 11N 5W 20BDD1	8/ 9/73	21	59.	0.	54	31.0	5.30	21	6.90	136.	0.0	25.00	0.0	6.8	0.50	1.80	0.0	0.00	271	7.2	219	99.	0.	111.	29.7	0.9	0.684	4
11N 6W 3DBB1	8/ 8/73	24	183.	0.	542	4.4	0.0	120	0.60	67.	0.0	180.00	0.03	28.0	1.90	0.01	0.0	2.00	624	8.6	909	11.	0.	55.	95.7	15.8	-2.680	4
GLENN HILL WELL 11N 6W 3DCB1	8/ 7/73	25	66.	0.	577	4.0	0.10	130	1.20	15.	36.00	150.00	0.0	55.0	0.60	0.0	0.0	2.40	579	7.4	961	10.	0.	72.	96.0	17.5	-2.274	4
WEISER H S 11N 6W 10ACB1S	8/ 6/73	22	0.	19.	31	12.0	1.80	50	1.40	44.	0.0	53.00	0.08	17.0	1.20	8.00	0.0	0.82	335	7.3	197	37.	1.	36.	73.5	3.6	7.097	4
GEOSOLAR GROWERS WELL #1 11N 6W 10CCA1	8/ 2/73	78	28.	0.	140	2.6	0.0	140	4.80	32.	37.00	150.00	0.0	56.0	2.90	0.01	0.0	2.10	734	9.2	549	6.	0.	88.	96.0	23.9	-2.265	4

GEOSOLAR GROWERS WELL #2 11N 6W 10CCA2	8/23/73	77	31.	0.	130	2.7	0.10	140	5.30	33.	41.00	150.00	0.01	52.0	3.90	0.01	0.0	2.20	683	9.1	541	7.	0.	95.	95.6	22.8	-2.698	4
GEOSOLAR GROWERS WELL #3 11N 6W 10CCA3	8/ 2/72	70	122.	0.	140	2.9	0.0	140	5.00	35.	38.00	150.00	0.06	56.0	3.30	1.00	0.0	2.20	7259	9.3	553	7.	0.	92.	95.7	22.6	-2.856	4
MIDVALE CITY WELL 13N 3W 8CCC1	6/28/72	28	294.	0.	84	8.7	0.80	73	25.00	225.	0.0	14.00	0.04	3.1	0.70	0.04	0.0	0.0	338	8.3	318	25.	0.	184.	74.5	6.4	1.122	3
FAIRCHILD LUMBER CO. 13N 4W 13BAC1	6/28/72	28	412.	0.	73	3.5	0.20	86	0.70	188.	20.00	14.00	0.03	3.2	0.70	0.04	0.0	0.0	375	8.5	293	10.	0.	187.	94.7	12.1	-3.114	3
LAKEY H S 14N 2W 6BBA1S	6/28/72	70	0.	1631.	72	17.0	0.10	200	3.80	24.	20.00	200.00	0.09	140.0	1.90	0.06	0.0	0.0	999	7.8	666	43.	0.	53.	90.1	13.3	1.830	3
CAMBRIDGE CITY WELL 14N 3W 30DC1	6/28/72	26	282.	0.	70	2.6	0.20	73	6.60	157.	16.00	15.00	0.04	3.8	1.00	0.04	0.0	0.0	309	8.7	263	7.	0.	155.	90.8	11.7	-1.722	3
FAIRCHILD H S 14N 3W 19CBD1S	6/27/72	50	0.	220.	55	8.0	0.80	80	1.90	81.	1.00	110.00	0.05	15.0	0.80	0.30	0.0	0.0	406	8.5	312	23.	0.	68.	87.1	7.2	-2.676	3

BASIC DATA TABLE 2

BASIC DATA TABLE 2

ESTIMATED AQUIFER TEMPERATURES, ATOMIC AND MOLAR RATIOS OF SELECTED CHEMICAL CONSTITUENTS, FREE ENERGIES OF FORMATION OF SELECTED MINERALS, PARTIAL PRESSURES OF CO_2 GAS AND R VALUES FROM SELECTED THERMAL SPRINGS AND WELLS IN IDAHO

Ada County

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes) T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	%9	%11
LILLIE COLLIAS WELL 1N 1E 1ADC1	0.	25	80	84	-31	49	48	48	122	113	97	91	999	86	0
NICHOLSON WELL 1N 1E 25DBA1	0.	25	89	91	-24	58	45	45	154	120	154	128	103	92	88
AGRI-CON WELL #4 1N 1E 36AAD1	0.	22	97	99	-17	67	232	232	346	232	265	167	229	96	96
IDU LAND AND BEEF 1N 2E 6ABA1	0.	25	78	81	-34	46	50	50	102	50	999	72	999	0	0
TOM BEVINS WELL 2N 1E 22DDB1	0.	31	73	77	-37	41	195	185	196	129	999	47	999	0	0
GEORGE WHITMORE WELL 2N 1E 24DAD1	0.	27	79	83	-32	48	192	177	203	114	999	83	999	0	0
WARREN TOZER WELL 2N 3E 10BCB1	0.	20	82	85	-30	50	21	21	157	21	117	108	999	94	0
ST. TRANS. DEPT. WELL 2N 3E 28CAC1	0.	22	95	97	-19	65	27	27	164	105	243	161	224	96	96
FERD KOCH WELL 3N 2E 2CBD1	76.	49	90	92	-23	59	34	34	-67	34	109	103	999	62	0
BEARD WELL 3N 2E 11ABC1	568.	76	125	122	6	97	62	62	37	62	164	131	75	58	0
WARM SPRINGS WATER DIST 3N 2E 12CDD1	727.	75	123	121	5	95	79	79	42	69	162	130	75	58	0
OLD PENITENTIARY WELL #1 3N 2E 13ACB1	2649.	59	93	95	-20	63	68	68	15	68	111	104	999	53	0
BOISE WATER CORP. WELL 3N 2E 36ABC1	0.	21	68	73	-41	36	22	22	115	89	999	999	999	0	0
DENNIS FLAKE WELL 4N 1E 24DCC1	95.	27	110	110	-6	81	68	68	215	131	999	174	282	0	95
CARL RUSH WELL 4N 2E 4BDC1	0.	29	75	79	-36	43	18	18	97	77	999	55	999	0	0
EDWARDS GREENHOUSE WELL 4N 2E 29ACD1	0.	47	97	99	-17	67	78	78	104	91	126	117	91	70	56

Spring/Well Identification Number & Name	Atomic Ratios: Sodium/Potassium Na/K	Sodium/Calcium Na/Ca	Magnesium/Calcium Mg/Ca	Calcium/Fluoride Ca/F	Chloride/Boron Cl/B	Chloride/Fluoride Cl/F	Calcium/Sodium Ca/Na	Molar Ratios: Calcium/Bicarbonate Ca/HCO_3	Chloride/Carbonate & Bicarbonate Cl/(CO_3 + HCO_3)	Ammonia/Chloride NH_4/Cl	Ammonia/Fluoride NH_4/F	Chloride/Sulfate Cl/SO_4	$\sqrt{Calcium}$/Sodium $\sqrt{Ca}$/Na	Free Energies of Formation of: Quartz △G Quartz	Chalcedony △G Chalcedony	Amorphous Silica △G Amorphous	Partial Pressure of CO_2 Gas (atmospheres) PCO_2	R= Magnesium/(Magnesium + Calcium + Potassium) Mg/(Mg+Ca+K) **
LILLIE COLLIAS WELL 1N 1E 1ADC1	31.4	3.80	0.43	13.02	0.0	14.90	0.26	0.22	0.19	0.0	0.0	1.40	11.22	0.93	0.34	-0.38	0.00119	0.0
NICHOLSON WELL 1N 1E 25DBA1	22.2	3.08	0.25	9.11	0.0	20.15	0.33	0.22	0.10	0.0	0.0	1.23	15.78	1.05	0.47	-0.26	0.00155	0.0
AGRI-CON WELL #4 1N 1E 36AAD1	6.1	2.05	0.46	577.65	0.0	661.92	0.49	0.0	0.0	0.0	0.0	1.49	5.02	1.23	0.63	-0.08	0.0	28.2
IDU LAND AND BEEF 1N 2E 6ABA1	39.7	6.10	0.34	7.80	0.0	6.03	0.16	0.16	0.20	0.0	0.0	1.97	8.77	0.88	0.29	-0.43	0.00067	0.0
TOM BEVINS WELL 2N 1E 22DDB1	15.3	6.92	0.04	76.04	0.0	66.37	0.14	0.06	0.06	0.0	0.0	0.61	1.93	0.73	0.16	-0.58	0.04476	3.5
GEORGE WHITMORE WELL 2N 1E 24DAD1	14.4	3.89	0.19	373.26	0.0	319.14	0.26	0.08	0.10	0.0	0.0	0.76	2.65	0.91	0.33	-0.40	0.15199	14.5
WARREN TOZER WELL 2N 3E 10BCB1	21.6	1.44	0.41	13.04	0.0	26.86	0.70	0.34	0.16	0.0	0.0	1.24	33.82	1.04	0.44	-0.27	0.00093	0.0
ST. TRANS. DEPT. WELL 2N 3E 28CAC1	20.2	1.44	0.35	8.22	0.0	36.34	0.69	0.29	0.07	0.0	0.0	1.64	28.99	1.20	0.60	-0.11	0.00471	0.0
FERD KOCH WELL 3N 2E 2CBD1	2040.9	418.41	0.05	1.26	0.0	0.46	0.00	0.05	0.12	0.0	0.0	0.79	0.28	0.42	-0.10	-0.88	0.00009	0.0
BEARD WELL 3N 2E 11ABC1	108.1	28.21	0.0	0.10	10.49	0.15	0.04	0.07	0.04	0.0	0.0	0.40	3.05	0.56	0.12	-0.70	0.00065	0.0
WARM SPRINGS WATER DIST 3N 2E 12CDD1	98.1	65.38	0.0	0.21	0.0	0.04	0.02	0.02	0.11	0.0	0.0	1.09	2.17	0.71	0.27	-0.55	0.01609	0.0
OLD PENITENTIARY WELL #1 3N 2E 13ACB1	167.9	83.90	0.01	0.27	5.42	0.04	0.01	0.02	0.13	0.01	0.00	0.0	1.89	0.38	-0.11	-0.91	0.00028	0.0
BOISE WATER CORP. WELL 3N 2E 36ABC1	34.0	2.02	0.07	6.32	59.92	18.01	0.50	0.30	0.10	0.0	0.0	1.14	22.75	0.84	0.24	-0.48	0.00480	0.0
DENNIS FLAKE WELL 4N 1E 24DCC1	13.2	3.33	0.16	2.32	7.20	17.38	0.30	0.17	0.02	0.0	0.0	2.27	12.82	1.30	0.72	-0.01	0.00538	0.0
CARL RUSH WELL 4N 2E 4BDC1	42.5	1.54	0.15	1.05	59.41	8.06	0.65	0.35	0.04	0.0	0.0	0.29	22.32	0.79	0.22	-0.52	0.00829	0.0
EDWARDS GREENHOUSE WELL 4N 2E 29ACD1	39.0	21.31	0.11	0.24	0.0	0.21	0.05	0.05	0.05	0.0	0.0	0.57	4.43	0.82	0.29	-0.48	0.01732	7.9

SHADOW VALLEY WELL	5N 1E 25BCC1	1703.	28	89	91	-24	58	42	42	215	42	139	121	97	88	83	13.2	1.28	0.19	1.22	31.23	10.01	0.78	0.39	0.05	0.0	0.0	0.21	25.28	0.95	0.37	-0.36	0.00036	0.0
BEN STADLER WELL	5N 1E 26DCD1	3406.	29	82	85	-30	50	54	54	177	130	98	94	999	82	0	18.0	2.93	0.14	0.74	292.47	2.98	0.34	0.30	0.07	0.0	0.0	0.28	14.56	0.88	0.31	-0.42	0.00151	0.0
JULIUS JEKER WELL	5N 1E 35ACA1	83.	40	83	86	-29	52	87	87	139	118	95	93	999	67	0	26.0	19.87	0.0	0.24	0.0	0.19	0.05	0.06	0.07	0.0	0.0	0.58	4.86	0.72	0.18	-0.58	0.00476	0.0
JERRY DAVIS WELL #1	1N 1W 7ACC1	0.	21	96	98	-18	66	59	59	223	144	999	170	260	0	97	12.5	1.68	0.63	115.23	0.0	123.25	0.60	0.46	0.43	0.0	0.0	1.16	16.56	1.22	0.62	-0.09	0.00156	0.0
CLATER FORSGREN WELL	1N 1W 7BCC1	0.	20	94	96	-19	64	61	61	185	115	999	171	262	0	97	16.7	2.32	0.66	48.24	0.0	71.11	0.43	0.26	0.17	0.0	0.0	0.66	12.84	1.22	0.62	-0.09	0.00970	0.0
IRVIN BOEHLKE WELL	1N 1W 8DBA1	3028.	22	85	88	-27	54	43	43	186	120	144	123	100	93	90	16.6	1.15	0.21	147.39	239.37	165.92	0.87	0.97	0.85	0.0	0.0	1.15	20.89	1.06	0.47	-0.25	0.00330	0.0
SHANE BUES WELL	1N 1W 15DAA1	0.	23	98	100	-16	68	66	66	212	149	255	164	227	96	95	13.5	3.40	0.58	26.80	0.0	31.60	0.29	0.23	0.20	0.0	0.0	1.10	13.17	1.21	0.62	-0.10	0.00101	0.0
TERRY TLUCEK WELL #1	1N 1W 22DDD1	0.	23	88	90	-25	57	205	194	253	119	161	130	105	93	90	10.2	2.40	0.22	792.30	0.0	884.21	0.42	0.10	0.09	0.0	0.0	0.95	4.02	1.10	0.51	-0.21	0.22100	16.1
BISCHOF REALTY WELL	3N 1W 25ADD1	0.	21	82	85	-30	50	27	27	109	73	113	105	999	92	0	36.5	1.14	0.37	46.45	113.16	140.64	0.88	0.44	0.14	0.0	0.0	0.50	18.68	1.03	0.44	-0.28	0.02867	0.0
LETHA FISHER WELL	5N 1W 16CAB1	0.	20	112	111	-5	83	70	70	415	179	999	222	999	0	0	4.6	1.28	0.39	4.50	0.0	32.24	0.78	0.22	0.03	0.0	0.0	0.71	26.78	1.42	0.83	0.11	0.00278	25.6
HARRY CHARTERS WELL	1S 1W 5ABC1	0.	26	94	96	-19	64	71	71	181	71	189	141	134	93	90	17.4	5.23	0.71	16.08	0.0	15.17	0.19	0.18	0.19	0.0	0.0	0.99	9.57	1.10	0.52	-0.21	0.00085	38.2
INITAL BUTTE WELL	1S 1W 36BBC1	0.	23	82	85	-30	50	68	68	166	68	103	101	999	89	0	20.0	4.95	0.49	21.44	0.0	18.01	0.20	0.25	0.30	0.0	0.0	0.87	9.27	0.98	0.39	-0.33	0.00088	0.0
Adams County																																		
WHITE LICKS H S	16N 2E 33BCC1S	114.	65	142	137	21	116	145	145	98	117	201	150	186	73	71	42.0	18.77	0.01	9.14	0.0	2.10	0.05	0.84	3.58	0.0	0.0	0.62	1.71	1.10	0.62	-0.18	0.00296	1.0
KRIGBAUM H S	19N 2E 22CCA1S	151.	43	120	118	2	91	96	96	60	96	169	137	127	81	74	72.2	46.05	0.06	4.98	0.0	0.90	0.02	0.10	0.49	0.0	0.0	0.37	1.89	1.02	0.48	-0.29	0.00012	4.5
ZIM'S RESORT	20N 1E 26DDA1S	0.	65	113	112	-3	84	83	83	47	83	121	117	86	52	27	89.8	27.60	0.01	7.46	0.0	2.47	0.04	0.39	0.97	0.0	0.0	0.26	2.09	0.61	0.13	-0.67	0.00017	1.2
STINKY W S	21N 1E 23ABA1S	38.	30	106	106	-10	76	85	85	74	85	123	114	97	85	80	58.2	22.66	0.28	7.15	8.31	2.63	0.04	0.19	0.50	0.0	0.0	0.28	2.79	1.16	0.59	-0.14	0.0	19.0
BOULDER CREEK RESORT	22N 1E 34DAD1S	19.	26	94	96	-19	64	8	8	4	8	999	999	999	0	0	212.6	5.13	0.0	2.68	0.0	8.06	0.20	0.56	0.11	0.0	0.0	0.34	9.47	0.84	0.25	-0.47	0.0	0.0
STARKEY H S	16N 1W 34DBB1S	492.	56	107	107	-9	77	70	70	46	70	116	109	86	58	40	91.4	33.32	0.0	8.34	0.0	2.37	0.03	0.11	0.36	0.0	0.0	0.25	2.83	0.66	0.16	-0.63	0.00018	0.0
Bannock County																																		
SHOAL SUBDIVISION WELL	5S 34E 26DBA1	378.	26	89	91	-24	58	187	187	229	131	118	108	999	86	0	12.0	3.30	0.69	45.26	0.0	16.33	0.30	0.33	0.91	0.0	0.0	3.96	6.29	1.05	0.47	-0.26	0.02061	37.9
ROBERT BROWN WELL #1	5S 34E 26DAB1	57.	41	63	68	-46	31	185	185	227	136	999	999	999	0	0	12.1	3.74	0.59	14.57	0.0	10.37	0.27	0.22	0.31	0.0	0.0	2.48	6.41	0.39	-0.15	-0.91	0.01166	33.8

T1=SILICA TEMP ASSUMING QUARTZ EQUILIBRIUM AND CONDUCTIVE COOLING (NO STEAM LOSS)
T2=SILICA TEMP ASSUMING QUARTZ EQUILIBRIUM AND ADIABATIC EXPANSION AT CONSTANT ENTHALPY (MAX STEAM LOSS)
T3=SILICA TEMP ASSUMING EQUILIBRIUM WITH AMORPHOUS SILICA
T4=SILICA TEMPERATURE ASSUMING EQUILIBRIUM WITH CHALCEDONY AND CONDUCTIVE COOLING (NO STEAM LOSS)
T5=NA-K-CA TEMP
T6=NA-K-CA TEMP CORRECTED FOR MG. IF $T_5 = T_6$, THERE WAS NO CORRECTION
T7=NA-K TEMP
T8=NA-K-CA TEMP CORRECTED FOR PCO_2
T9=FOURNIER-TRUESDELL MIXING MODEL 1 TEMP (QUARTZ-NO STEAM LOSS)
T10=FOURNIER-TRUESDELL MIXING MODEL 2 TEMP (QUARTZ-STEAM LOSS)
T11=FOURNIER-TRUESDELL MIXING MODEL 1 TEMP (CHALCEDONY-NO STEAM LOSS)
%9=PERCENTAGE OF COLD WATER IN T9 CALCULATION
%11=PERCENTAGE OF COLD WATER IN T11 CALCULATION
* =999 MEANS HOT WATER CALCULATION NOT POSSIBLE
** =R NOT CALCULATED IF T_5 <70°C

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO_2 Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)													Atomic Ratios							Molar Ratios						Free Energies of Formation of			Partial Pressure of CO_2 Gas (atmospheres)	R= Magnesium / Magnesium + Calcium + Potassium
			T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	%9	%11	Sodium/Potassium $\frac{Na}{K}$	Sodium/Calcium $\frac{Na}{Ca}$	Magnesium/Calcium $\frac{Mg}{Ca}$	Calcium/Fluoride $\frac{Ca}{F}$	Chloride/Boron $\frac{Cl}{B}$	Chloride/Fluoride $\frac{Cl}{F}$	Calcium/Sodium $\frac{Ca}{Na}$	Calcium/Bicarbonate $\frac{Ca}{HCO_3}$	Chloride/Carbonate & Bicarbonate $\frac{Cl}{CO_3 + HCO_3}$	Ammonia/Chloride $\frac{NH_4}{Cl}$	Ammonia/Fluoride $\frac{NH_4}{F}$	Chloride/Sulfate $\frac{Cl}{SO_4}$	$\sqrt{Calcium}$/Sodium $\frac{\sqrt{Ca}}{Na}$	Quartz ΔG Quartz	Chalcedony ΔG Chalcedony	Amorphous Silica ΔG Amorphous	PCO_2	$\frac{Mg}{Mg+Ca+K}$ **
Bannock County (cont'd.)																																	
DEAN MORRIS WELL 9S 36E 3CUB1	0.	22	72	76	-39	40	18	18	233	111	999	999	999	0	0	11.6	0.52	0.34	128.63	0.0	208.58	1.94	0.47	0.28	0.0	0.0	5.00	58.59	0.87	0.27	-0.44	0.00884	0.0
LAVA H S 9S 38E 210DA1S	0.	45	82	85	-30	50	211	211	307	126	82	81	999	51	0	7.4	2.47	0.44	145.48	0.0	81.27	0.40	0.34	0.59	0.0	0.0	4.68	7.40	0.63	0.10	-0.67	0.17410	27.4
DOWNATA H S 12S 37E 12CCD1S	1855.	43	78	81	-34	46	63	63	472	145	999	69	999	0	0	3.7	0.81	0.57	26.80	0.0	50.96	1.23	0.31	0.16	0.0	0.0	3.01	37.65	0.60	0.06	-0.71	0.05768	0.0
Bear Lake County																																	
PESCADERO W S 11S 43E 36BDA1S	38.	26	80	84	-31	49	58	58	301	105	145	120	99	88	81	7.7	0.58	0.57	24.71	97.26	49.51	1.71	0.43	0.21	0.00	0.01	1.00	24.99	0.93	0.35	-0.38	0.24883	0.0
BEAR LAKE H S 15S 44E 13CCA1S	0.	48	85	88	-27	54	232	232	391	149	113	104	999	62	0	5.0	1.49	0.43	5.96	0.0	14.02	0.67	1.25	0.52	0.0	0.0	0.27	9.25	0.64	0.11	-0.66	0.08206	27.3
Bingham County																																	
YANDELL SPRINGS 3S 37E 31DBB1S	568.	32	67	72	-43	35	34	34	382	134	999	80	999	0	0	5.2	0.26	0.38	17.27	176.70	79.01	3.91	0.95	0.20	0.0	0.0	0.24	63.93	0.62	0.05	-0.69	0.02025	0.0
ALKALI FLAT W S 4S 38E 28DDD1S	0.	34	61	67	-47	29	79	79	899	170	999	62	999	0	0	1.6	0.28	0.53	10.12	4.71	110.61	3.54	0.50	0.04	0.0	0.0	0.14	48.94	0.50	-0.06	-0.81	0.17022	[illegible]2.9
Blaine County																																	
HAILEY H S 2N 18E 18DBB1S	265.	59	128	125	9	100	83	83	56	83	189	142	151	71	63	77.1	59.27	0.0	0.45	0.0	0.08	0.02	0.03	0.19	0.0	0.0	0.53	2.39	0.85	0.35	-0.44	0.00021	0.0
CLARENDON H S 3N 17E 27DCB1S	378.	47	125	122	6	97	87	45	53	87	203	148	160	79	74	81.0	64.19	0.07	0.39	0.0	0.07	0.02	0.12	0.32	0.0	0.0	0.44	2.10	1.13	0.60	-0.17	0.00021	5.1
GUYER H S 4N 17E 15AAC1S	3785.	71	128	125	9	101	88	88	64	88	172	135	129	61	48	68.0	50.50	0.0	0.37	0.0	0.09	0.02	0.09	0.25	0.0	0.0	0.41	2.33	0.80	0.34	-0.47	0.00092	0.0
WARFIELD H S 4N 17E 31BBC1S	378.	62	135	131	15	108	85	85	72	85	200	147	159	71	64	60.0	44.93	0.0	0.31	246.77	0.09	0.02	0.07	0.15	0.0	0.0	0.63	2.76	0.88	0.39	-0.41	0.00009	0.0
EASLEY H S 5N 16E 10DBC1S	68.	37	105	105	-10	75	43	43	8	43	164	131	123	80	73	195.6	31.66	0.04	0.15	0.0	0.09	0.03	0.24	0.19	0.0	0.0	0.35	3.24	0.79	0.24	-0.51	0.00000	0.0
RUSSIAN JOHN H S 6N 16E 33CCA1S	4.	35	105	105	-10	75	52	52	7	52	169	134	126	82	76	198.4	53.06	0.07	0.18	0.0	0.06	0.02	0.14	0.20	0.0	0.0	0.38	2.49	0.99	0.43	-0.31	0.00003	0.0
MAGIC H S LANDING WELL 1S 17E 23AAB1	57.	71	137	132	16	110	162	96	127	81	192	143	153	65	56	29.5	26.15	0.10	3.42	0.0	0.80	0.04	0.04	0.18	0.0	0.0	3.75	1.63	0.96	0.50	-0.31	0.61434	6.3
MAGIC H S LANDING WELL 1S 17E 23AAB1	38.	72	139	135	19	113	174	172	148	99	196	145	157	65	57	23.7	27.98	0.01	4.56	323.70	0.95	0.04	0.04	0.20	0.00	0.01	4.43	1.60	0.97	0.52	-0.29	0.18928	0.8

CONDIE H S 1S 21E 14DDC1S1310.	52	76	80	-35	45	89	89	339	145	78	78	999	36	0	6.3	1.96	0.32	4.41	0.0	15.62	0.51	0.24	0.07	0.0	0.0	1.35	13.64	0.42	-0.10	-0.88	0.02715	21.9
MILFORD SWEAT H S 1S 22E 10AB1S 76.	44	73	77	-37	41	64	64	269	128	999	70	999	0	0	9.2	1.39	0.33	1.51	0.0	12.37	0.72	0.31	0.04	0.0	0.0	0.28	18.53	0.51	-0.03	-0.80	0.01972	0.0
Boise County																																
TWIN SPRINGS 4N 6E 24BCB1S 0.	67	131	127	11	104	60	60	36	60	189	141	151	69	60	110.5	45.33	0.0	0.22	0.0	0.20	0.02	0.14	0.06	0.0	0.0	0.25	3.12	0.23	-0.24	-1.04	0.0	0.0
DANSKIN CREEK H S 8N 5E 1BCC1S 8.	40	99	100	-15	69	63	63	29	63	144	123	100	78	68	124.7	47.94	0.07	0.88	0.0	0.37	0.02	0.04	0.10	0.0	0.0	0.33	2.70	0.82	0.27	-0.49	0.00014	0.0
HOT SPRINGS CAMPGROUND 8N 5E 6DCB1 19.	48	113	112	-3	84	65	65	44	65	173	135	129	78	69	95.5	32.63	0.0	0.26	22.24	0.12	0.03	0.08	0.13	0.0	0.0	0.82	3.11	0.81	0.29	-0.49	0.0	0.0
DONLAY RANCH H S 8N 5E 10BDD1S 265.	55	109	109	-7	80	74	74	38	74	148	125	104	68	54	105.1	62.39	0.0	0.21	0.0	0.06	0.02	0.07	0.14	0.0	0.0	0.40	2.33	0.72	0.21	-0.58	0.00011	0.0
DEER H S 9N 3E 25BAC1S 76.	80	147	141	26	122	139	139	91	139	209	149	196	66	65	46.1	50.36	0.0	1.40	0.0	0.16	0.02	0.04	0.36	0.0	0.0	1.17	1.87	0.87	0.44	-0.38	0.00267	0.0
KIRKHAM H S 9N 8E 32CAB1S 946.	65	117	115	0	68	79	56	49	93	155	128	197	63	133	86.3	60.56	0.09	0.11	0.0	0.06	0.02	0.06	0.08	0.0	0.0	0.18	2.40	0.77	0.30	-0.51	0.00133	6.0
BONNEVILLE H S 10N 10E 31BCC1S1374.	85	137	132	16	110	142	142	103	142	176	137	152	56	56	39.3	53.09	0.07	0.23	0.0	0.06	0.02	0.06	0.15	0.0	0.0	0.37	2.54	0.65	0.24	-0.58	0.00091	4.3
Bonneville County																																
FALL CREEK MINERAL SPG 1N 43E 9CBB1S 265.	25	42	50	-63	9	191	191	193	102	999	999	999	0	0	15.7	4.40	0.36	599.02	0.0	122.70	0.23	0.56	2.68	0.0	0.0	13.19	2.17	0.35	-0.23	-0.96	0.50716	24.0
BROCKMAN CREEK W S 2S 42E 26DCD1S 49.	35	70	75	-40	38	119	119	38	50	89	86	999	66	0	105.0	24.41	0.45	121.62	0.0	27.35	0.04	0.12	0.53	0.0	0.0	0.64	0.67	0.64	0.08	-0.66	0.77384	28.8
ALPINE W S 2S 46E 19CAB1S 38.	37	91	93	-22	61	200	200	206	114	146	122	100	79	68	14.2	4.67	0.29	555.82	164.04	98.32	0.21	0.97	5.39	0.0	0.0	7.58	1.81	0.93	0.37	-0.38	0.26729	20.2
Butte County																																
LEWIS ROTHWELL WELL 3N 25E 32CDC1 45.	41	106	106	-10	76	91	91	356	126	171	134	127	82	75	5.8	1.70	0.53	3.52	0.0	10.96	0.59	0.35	0.11	0.0	0.0	0.33	13.72	1.03	0.49	-0.27	0.20374	31.8
BUTTE CITY WELL #1 3N 27E 9ABB1 0.	35	83	86	-29	52	54	54	322	132	97	94	999	73	0	6.8	0.84	0.62	14.74	0.0	37.92	1.18	0.31	0.12	0.0	0.0	1.06	29.63	0.81	0.25	-0.49	0.02306	0.0
Camas County																																
WARDROP H S 1N 13E 32ABB1S 731.	66	120	118	2	91	154	154	124	154	150	128	-467	62***		30.6	67.24	0.0	0.67	0.0	0.16	0.01	0.04	0.10	0.0	0.0	1.15	2.52	0.77	0.30	-0.50	0.00091	0.0
HOT SPRINGS RANCH 1N 13E 32ABC1S 0.	60	125	123	6	97	74	74	30	74	174	137	129	71	60	122.1	97.63	0.0	0.83	434.13	0.13	0.01	0.03	0.12	0.0	0.0	1.40	2.05	0.51	0.02	-0.78	0.0	0.0
HOT SPRINGS RANCH 1N 13E 32ABC2S 95.	67	123	121	5	95	136	136	88	136	161	131	122	64	50	47.6	97.63	0.0	0.93	0.0	0.14	0.01	0.03	0.11	0.0	0.0	1.29	2.05	0.32	-0.15	-0.95	0.00000	0.0
HOT SPRING RANCH 1N 13E 32ABC3S 0.	64	123	121	5	95	84	84	55	84	165	133	124	67	54	78.0	79.90	0.16	0.95	0.0	0.18	0.01	0.03	0.11	0.0	0.0	1.40	2.29	0.39	-0.08	-0.89	0.0	9.8
ELK CREEK H S 1N 15E 14ADA1S 95.	55	126	123	7	98	94	57	56	94	187	142	150	76	70	77.4	72.11	0.09	0.68	700.71	0.06	0.01	0.05	0.58	0.0	0.0	1.42	1.87	0.81	0.31	-0.48	0.00006	5.8
ELK CREEK H S 1N 15E 14ADA2S 8.	55	127	124	7	99	84	54	42	84	189	143	151	76	70	97.8	66.83	0.08	0.77	500.50	0.07	0.01	0.04	0.40	0.01	0.01	1.42	1.93	0.82	0.32	-0.47	0.00012	5.8
ELK CREEK H S 1N 15E 14ADA3S 8.	45	123	121	5	95	86	86	42	86	201	148	159	83	79	97.8	72.90	0.0	0.76	522.26	0.06	0.01	0.03	0.41	0.00	0.00	1.35	1.85	0.99	0.45	-0.32	0.00011	0.0
LIGHTFOOT H S 3N 13E 7DCA1S 38.	56	119	117	1	91	99	99	62	99	164	133	124	72	61	69.7	84.09	0.0	0.66	44.31	0.06	0.01	0.02	0.21	0.0	0.0	1.67	1.83	0.80	0.30	-0.49	0.0	0.0
BAUMGARTNER H S 3N 12E 7DCD1S 76.	44	95	97	-19	65	56	56	34	56	107	101	999	67	0	114.8	37.66	0.0	1.24	65.28	0.18	0.03	0.05	0.28	0.0	0.0	1.85	3.36	0.80	0.27	-0.50	0.0	0.0

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO_2 Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes): T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	%9	%11	Atomic Ratios: Sodium/Potassium (Na/K)	Sodium/Calcium (Na/Ca)	Magnesium/Calcium (Mg/Ca)	Calcium/Fluoride (Ca/F)	Chloride/Boron (Cl/B)	Chloride/Fluoride (Cl/F)	Calcium/Sodium (Ca/Na)	Molar Ratios: Calcium/Bicarbonate (Ca/HCO_3)	Chloride/Carbonate & Bicarbonate ($Cl/(CO_3+HCO_3)$)	Ammonia/Chloride (NH_4/Cl)	Ammonia/Fluoride (NH_4/F)	Chloride/Sulfate (Cl/SO_4)	$\sqrt{Calcium}$/Sodium ($\sqrt{Ca}/Na$)	Free Energies of Formation of: Quartz (ΔG Quartz)	Chalcedony (ΔG Chalcedony)	Amorphous Silica (ΔG Amorphous)	Partial Pressure of CO_2 Gas (atmospheres) (PCO_2)	R = Magnesium/(Magnesium + Calcium + Potassium) ($Mg/(Mg+Ca+K)$ **)
Camas County (cont'd.)																																	
WORSWICK H S 3N 14E 28CAA1S	1764.	81	134	130	14	107	93	93	70	93	171	136	132	57	45	61.8	66.83	0.0	0.18	0.0	0.06	0.01	0.05	0.11	0.0	0.0	0.39	2.23	0.76	0.33	-0.49	0.00620	0.0
SHEEP H S 1S 12E 16CAB1S	0.	49	116	115	-1	88	73	73	37	73	167	134	125	77	68	106.8	85.42	0.0	1.13	639.77	0.24	0.01	0.0	0.12	0.0	0.0	1.48	2.34	-0.02	-0.55	-1.33	0.0	0.0
WOLF H S 1S 12E 16CBA1S	0.	45	116	115	-1	88	57	57	4	57	174	137	129	80	73	213.7	106.78	0.0	0.90	243.72	0.20	0.01	0.25	0.10	0.0	0.0	1.06	2.10	0.11	-0.42	-1.20	0.0	0.0
KEITH STROM WELL 1S 12E 31CBC1	57.	31	87	89	-26	56	51	51	11	51	999	63	999	0	0	181.4	92.98	0.0	1.41	0.0	0.36	0.01	0.03	0.06	0.0	0.0	1.72	2.78	0.70	0.12	-0.61	0.00001	0.0
LEE BARRON WELL #1 1S 13E 22CCC1	4.	26	123	121	5	95	92	92	71	98	999	189	999	0	0	60.9	49.98	0.34	0.55	190.41	0.15	0.02	0.02	0.09	0.27	0.15	5.11	2.31	1.47	0.88	0.16	0.00322	19.2
LEE BARRON WELL #2 1S 13E 27CCB1	303.	35	127	124	7	99	79	79	41	79	269	168	253	92	91	99.9	54.63	0.07	0.54	197.13	0.13	0.02	0.02	0.09	0.09	0.05	5.14	2.12	1.36	0.80	0.05	0.00022	4.9
LEE BARRON WELL #3 1S 13E 27CCB2	0.	45	113	112	-3	84	95	58	51	95	165	133	124	79	71	84.2	78.45	0.09	0.64	0.0	0.10	0.01	0.02	0.09	0.01	0.01	3.57	1.72	0.98	0.44	-0.33	0.00089	5.8
BARRON H S 1S 13E 34BCB1S	38.	72	127	124	8	99	127	127	73	102	165	133	124	61	47	59.3	52.30	0.05	0.54	198.03	0.13	0.02	0.02	0.10	0.01	0.01	2.71	2.02	0.72	0.27	-0.54	0.00286	3.7
LEE BARRON WELL #4 1S 13E 34BCC1	0.	49	127	124	8	99	96	96	65	104	205	149	160	82	76	66.8	54.35	0.06	0.58	236.95	0.12	0.02	0.02	0.11	0.00	0.00	3.16	2.00	1.11	0.59	-0.19	0.00150	4.0
FAIRFIELD CITY WELL 1S 14E 9DAA1	814.	21	73	77	-37	41	31	31	42	31	999	999	999	0	0	99.2	10.90	0.32	0.58	0.0	1.11	0.09	0.10	0.05	0.0	0.0	1.12	7.76	0.90	0.30	-0.41	0.00086	0.0
Canyon County																																	
LEONARD TIEGS WELL #1 1N 2W 5ADD1	0.	22	76	80	-35	45	40	40	174	125	999	999	999	0	0	18.5	1.43	0.29	53.60	0.0	71.11	0.70	0.47	0.35	0.0	0.0	1.13	20.82	0.92	0.33	-0.39	0.00138	0.0
DON TIEGS WELL #2 1N 2W 8ACC1	0.	22	85	88	-27	54	52	52	232	135	999	999	999	0	0	11.7	1.15	0.21	147.39	239.37	165.92	0.87	0.97	0.85	0.0	0.0	1.15	20.89	1.06	0.47	-0.25	0.00330	0.0
MELBA CITY WELL 1N 2W 36CAA1	757.	25	93	95	-20	63	83	83	103	117	999	999	999	0	0	39.4	16.86	0.42	6.51	0.0	3.08	0.06	0.07	0.14	0.0	0.0	1.35	3.94	1.10	0.52	-0.21	0.00127	25.6
WESLEY SCHOBER WELL 2N 2W 34BDA1	2271.	48	89	91	-24	58	66	66	2	66	999	999	999	0	0	222.8	69.21	0.10	3.66	0.0	0.38	0.01	0.02	0.20	0.0	0.0	1.12	1.59	0.54	0.01	-0.76	0.00059	0.0
CANNON FARMS WELL #4 2N 3W 22DCC1	2952.	30	109	109	-7	80	63	63	202	141	999	999	999	0	0	14.6	2.40	0.45	8.47	0.0	37.92	0.42	0.25	0.06	0.0	0.0	0.35	13.21	1.29	0.70	-0.02	0.00150	0.0

CALDWELL MUNC. PARK WELL	4N 3W 28AAB1	568.	28	100	101	-14	70	54	54	92	95	999	999	999	0	0	45.1	8.40	0.01	1.93	18.28	3.48	0.12	0.10	0.06	0.0	0.0	5.62	7.19	1.16	0.58	-0.15	0.00350	0.0
CALDWELL CITY WELL	4N 3W 35ABD1	3028.	20	78	81	-34	46	36	36	103	93	999	999	999	0	0	39.3	3.39	0.16	4.62	42.04	11.26	0.29	0.21	0.08	0.0	0.0	1.70	13.53	0.99	0.39	-0.33	0.00338	0.0
Caribou County																																		
BLACKFOOT RIVER W S	5S 40E 14BCD1S	4.	26	83	86	-29	52	329	329	1191	175	999	70	999	0	0	1.2	0.38	0.60	15.93	79.79	86.35	2.63	0.44	0.08	0.02	0.39	0.26	20.28	0.98	0.40	-0.33	1.25606	34.0
BLACKFOOT RESERVOIR W S	6S 41E 1ADC1S	568.	23	72	76	-39	40	46	46	529	119	999	999	999	0	0	3.2	0.20	0.41	6.52	213.26	47.82	5.12	0.37	0.05	0.00	0.00	1.08	67.27	0.86	0.27	-0.45	0.54346	0.0
CORRAL CREEK WELL #1	6S 41E 19BAA1	598.	42	76	80	-35	45	362	362	2087	198	999	59	999	0	0	0.7	0.25	0.62	9.55	24.02	144.48	3.98	0.38	0.02	0.06	0.58	0.12	30.10	0.61	0.07	-0.69	0.91403	34.5
CORRAL CREEK WELL #2	6S 41E 19BAB1	397.	41	79	83	-32	48	369	369	2295	213	999	68	999	0	0	0.7	0.27	0.65	6.58	27.87	83.97	3.67	0.34	0.03	0.09	0.61	0.13	29.48	0.67	0.12	-0.64	0.44635	35.3
CORRAL CREEK WELL #3	6S 41E 19BAC1	79.	41	79	83	-32	48	360	360	2036	201	999	68	999	0	0	0.7	0.25	0.62	8.93	23.43	137.67	3.96	0.39	0.02	0.07	0.60	0.12	30.02	0.67	0.13	-0.64	0.68542	34.7
CORRAL CREEK WELL #4	6S 41E 19BAD2	42.	36	79	83	-32	48	363	363	2097	203	999	62	999	0	0	0.7	0.27	0.64	8.58	22.99	123.06	3.76	0.35	0.02	0.06	0.54	0.12	29.55	0.75	0.20	-0.55	0.67343	35.2
PORTNEUF RIVER W S	7S 38E 26CBD1S	189.	34	89	91	-24	58	268	268	679	147	101	100	999	78	0	2.2	0.50	0.38	41.54	60.93	165.92	1.98	0.40	0.10	0.0	0.0	0.62	23.72	0.92	0.36	-0.38	0.69332	25.3
SODA SPRINGS GEYSER	9S 41E 12ADD1S	4.	28	85	88	-27	54	30	30	1590	152	999	88	999	0	0	0.9	0.02	0.37	1.91	34.73	252.14	40.68	0.50	0.00	0.02	0.04	0.02	279.16	0.98	0.40	-0.33	0.70521	0.0
Cassia County																																		
SIX S RANCH WELL #1	11S 25E 11CCA1	7911.	60	110	110	-6	81	89	79	88	101	136	120	95	61	42	48.0	23.39	0.10	2.11	0.0	0.28	0.04	0.10	0.74	0.0	0.0	2.52	2.99	0.77	0.28	-0.52	0.00436	7.5
SIX S RANCH WELL #2	11S 26E 20DDD1	5095.	32	97	99	-17	67	49	49	197	130	129	117	96	83	76	15.2	1.91	0.03	1.98	0.0	9.18	0.52	0.33	0.07	0.0	0.0	0.55	18.81	1.05	0.48	-0.26	0.00205	0.0
CRITCHFIELD WELL	11S 26E 28BCB1	5095.	35	98	100	-16	68	51	51	207	126	126	117	95	80	72	14.1	1.91	0.02	7.66	0.0	10.50	0.52	0.33	0.24	0.0	0.0	4.17	18.81	1.02	0.46	-0.28	0.00428	0.0
C & Y RANCH WELL #2	11S 27E 5BAB1	0.	29	123	121	5	95	0	0	0	0	999	178	999	0	0	0.0	6.71	0.46	14.19	0.0	3.63	0.15	0.17	0.66	0.0	0.0	17.41	5.86	1.43	0.85	0.12	0.00621	35.3
LYLE DURFEE WELL	13S 25E 22BCB1	0.	30	59	65	-49	27	0	0	0	0	999	999	999	0	0	0.0	1.51	0.40	8.42	0.0	7.45	0.66	0.36	0.40	0.0	0.0	4.58	28.35	0.53	-0.04	-0.78	0.00534	34.7
WARD SPRINGS	13S 26E 17CCD1S	322.	21	96	98	-18	66	34	34	294	34	173	136	129	95	93	7.9	0.72	0.03	26.80	0.0	32.24	1.39	0.56	0.46	0.0	0.0	7.13	47.83	1.21	0.62	-0.10	0.00054	0.0
	14S 21E 34BDC1	189.	43	98	100	-16	68	97	97	297	173	122	111	86	72	57	7.8	5.48	0.13	2.89	0.0	5.11	0.18	0.15	0.08	0.0	0.0	1.26	9.77	0.88	0.34	-0.43	0.00195	8.8
OAKLEY H S	14S 22E 27DCB1S	38.	47	118	116	0	89	92	92	65	92	180	139	131	79	72	67.3	56.18	0.0	3.55	0.0	0.16	0.02	0.10	1.25	0.0	0.0	6.52	2.17	0.38	-0.14	-0.92	0.0	0.0
SEARS SPRING	14S 25E 6BBB1S	662.	28	67	72	-43	35	39	39	299	39	999	999	999	0	0	7.7	0.90	0.43	25.46	0.0	34.37	1.11	0.37	0.27	0.0	0.0	5.15	41.23	0.66	0.08	-0.64	0.00079	0.0
GRIFFETH-WIGHT WELL	14S 26E 1BDD1	378.	77	113	112	-3	84	63	63	263	63	126	117	75	43	0	9.5	4.88	3.96	0.0	0.0	0.0	0.20	0.07	0.44	0.03	0.0	6.22	18.34	0.42	-0.02	-0.84	0.00084	0.0
HAROLD WIGHT WELL	14S 26E 1CDA1	0.	63	127	124	7	99	121	121	41	121	175	137	130	69	58	99.7	296.37	0.33	5.29	274.19	0.06	0.00	0.01	0.44	0.0	0.0	7.80	0.68	0.35	-0.13	-0.93	0.00010	11.7

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO_2 Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes) T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	%9	%11	Atomic Ratios: Sodium/Potassium $\frac{Na}{K}$	Sodium/Calcium $\frac{Na}{Ca}$	Magnesium/Calcium $\frac{Mg}{Ca}$	Calcium/Fluoride $\frac{Ca}{F}$	Chloride/Boron $\frac{Cl}{B}$	Chloride/Fluoride $\frac{Cl}{F}$	Calcium/Sodium $\frac{Ca}{Na}$	Molar Ratios: Calcium/Bicarbonate $\frac{Ca}{HCO_3}$	Chloride/Carbonate & Bicarbonate $\frac{Cl}{CO_3 + HCO_3}$	Ammonia/Chloride $\frac{NH_4}{Cl}$	Ammonia/Fluoride $\frac{NH_4}{F}$	Chloride/Sulfate $\frac{Cl}{SO_4}$	$\frac{\sqrt{Ca}}{Na}$	Free Energies of Formation of: Quartz ΔG Quartz	Chalcedony ΔG Chalcedony	Amorphous Silica ΔG Amorphous	Partial Pressure of CO_2 Gas (atmospheres) PCO_2	R = Magnesium / (Magnesium + Calcium + Potassium) $\frac{Mg}{Mg+Ca+K}$ **
Cassia County (cont'd.)																																		
HAROLD WARD WELL #1 14S 27E 18CCC1	3399.	24	131	127	11	104	201	180	256	165	999	213	999	0	0	10.0	5.39	0.07	146.17	0.0	23.70	0.19	0.64	3.88	0.0	0.0	35.32	5.01	1.59	1.00	0.28	0.00317	4.9
MORRIS MITCHELL WELL #2 15S 21E 25DCC1	38.	46	76	80	-35	45	94	52	39	94	999	56	999	0	0	103.9	95.89	0.08	3.80	64.74	0.40	0.01	0.01	0.12	0.0	0.0	2.19	1.48	0.39	-0.14	-0.92	0.00059	5.3
HAROLD WARD WELL #2 15S 24E 22DDB1	378.	38	95	97	-19	65	47	47	105	89	119	108	999	76	0	38.4	3.30	0.41	14.79	0.0	6.05	0.30	0.33	0.80	0.0	0.0	6.56	9.98	0.94	0.39	-0.37	0.00834	0.0
BLM 15S 25E 29CDC1	0.	60	116	115	-1	88	128	128	72	128	151	127	126	66	69	60.0	58.11	0.05	5.78	0.0	0.22	0.02	0.08	1.63	0.0	0.0	5.55	1.82	0.59	0.10	-0.70	0.00007	3.0
BLM 15S 26E 12ACC1	0.	26	130	126	10	102	220	213	222	220	999	201	999	0	0	12.6	11.62	0.01	535.97	1351.71	36.47	0.09	7.87	113.85	0.0	0.0	234.70	0.99	1.56	0.98	0.25	0.00074	0.5
BLM 15S 26E 22DDD1	189.	82	107	107	-9	77	103	103	18	103	112	109	75	29	0	157.9	40.47	0.01	214.39	*******	5.31	0.02	1.35	53.75	0.0	0.0	104.16	0.66	0.31	-0.11	-0.93	0.00092	1.3
IVAN DARRINGTON WELL #1 15S 26E 23AAA1	15.	85	156	149	34	132	185	183	175	185	219	153	216	65	65	18.4	16.22	0.04	40.05	0.0	2.24	0.06	1.04	18.27	0.0	0.0	46.04	1.88	0.89	0.47	-0.35	0.00069	2.6
FRAZIER H S WELL 15S 26E 23BBC1	220.	95	131	127	11	104	146	146	95	146	150	127	107	40	12	43.3	18.42	0.01	84.63	0.0	4.41	0.05	1.47	27.71	0.0	0.0	42.76	1.49	0.51	0.11	-0.71	0.00476	1.0
HARRIAT CRANK WELL 15S 26E 23DDC1	227.	90	135	131	15	108	139	120	79	139	165	132	123	49	30	53.9	14.89	0.01	72.74	0.0	4.40	0.07	5.50	89.36	0.0	0.0	84.35	1.18	0.60	0.20	-0.62	0.00102	0.4
IVAN DARRINGTON WELL #3 15S 26E 25DDD1	0.	33	104	104	-11	74	94	92	101	94	164	132	123	86	81	40.3	5.60	0.10	191.08	0.0	28.86	0.18	1.22	7.98	0.0	0.0	32.18	3.02	1.14	0.58	-0.17	0.01823	8.4
REID STEWART WELL 15S 26E 24BAD1	3399.	32	98	100	-16	68	94	94	101	100	136	120	98	84	77	40.4	6.62	0.10	183.36	0.0	24.95	0.15	0.86	6.22	0.0	0.0	27.08	3.02	1.08	0.51	-0.23	0.00931	8.8
IVAN DARRINGTON WELL #4 15S 26E 24DCC1	3399.	31	106	106	-10	76	96	96	110	109	180	139	131	89	85	36.1	6.74	0.13	120.06	0.0	16.69	0.15	0.83	5.89	0.0	0.0	29.16	3.17	1.19	0.62	-0.12	0.00528	10.9
BLM 15S 26E 25ACA1	83.	30	130	126	10	102	185	145	174	149	999	186	999	0	0	18.5	18.43	0.18	109.11	830.88	5.93	0.05	0.30	5.48	0.0	0.0	48.24	1.84	1.48	0.91	0.18	0.00364	10.9
BLM 16S 26E 5BBA1	151.	40	88	90	-25	57	94	94	122	97	83	88	999	60	0	31.4	7.21	0.26	46.29	832.87	6.25	0.14	0.64	4.66	0.0	0.0	23.39	3.64	0.80	0.26	-0.50	0.02705	18.7
Clark County																																		
LIDY H S #1 9N 33E 2BBC1S	946.	50	84	87	-28	53	66	66	540	144	89	91	999	46	0	3.1	0.54	0.30	0.71	0.0	6.87	1.85	0.74	0.08	0.0	0.0	0.11	39.67	0.58	0.06	-0.72	0.12949	0.0
LIDY H S WELL 10N 33E 35CCC1	6813.	59	88	90	-25	57	68	68	503	176	89	95	999	34	0	3.4	0.76	0.42	0.86	24.03	5.93	1.31	0.47	0.07	0.0	0.0	0.19	35.49	0.47	-0.02	-0.82	0.00738	0.0

WARM SPRINGS 11N 32E 25AAC1S	7267.	29	57	63	-50	25	23	23	357	124	999	999	999	0	0	5.8	0.32	0.58	2.84	0.0	25.60	3.13	0.39	0.04	0.0	0.0	0.23	85.24	0.52	-0.06	-0.79	0.02253	0.0
Custer County																																	
BOWERY H S 7N 17E 6ABA1S	76.	43	112	111	-5	83	89	89	184	124	193	143	153	84	80	17.0	6.66	0.34	0.54	0.0	0.87	0.15	0.24	0.15	0.0	0.0	0.30	6.41	1.07	0.53	-0.23	0.00945	22.0
PIERSON H S 8N 14E 27DBD1S	49.	60	118	116	0	89	73	64	30	73	170	134	126	71	60	124.2	70.70	0.09	0.22	0.0	0.04	0.01	0.09	0.20	0.0	0.0	0.68	2.11	0.55	0.06	-0.74	0.0	6.7
WEST PASS H S 8N 17E 32BCA1S	95.	51	94	96	-19	64	185	185	216	117	119	110	999	65	0	13.1	8.30	0.43	1.66	0.0	1.19	0.12	0.14	0.19	0.0	0.0	0.75	5.26	0.71	0.20	-0.59	0.07181	24.7
STANLEY H S 10N 13E 3CAB1S	416.	41	106	106	-10	76	47	47	6	47	175	137	130	84	77	204.1	47.55	0.07	0.19	0.0	0.07	0.02	0.11	0.15	0.0	0.0	0.44	2.84	0.88	0.34	-0.42	0.00003	0.0
SLATE CREEK H S 10N 16E 30BAD1S	700.	50	128	125	9	101	91	91	122	124	230	156	220	84	83	31.4	17.86	0.02	0.43	0.0	0.44	0.06	0.11	0.11	0.0	0.0	0.17	3.94	1.14	0.63	-0.16	0.00160	1.6
ELKHORN H S 11N 13E 36BAA1S	0.	57	121	119	3	93	137	137	83	137	187	141	133	75	66	51.0	125.52	0.49	0.20	0.0	0.03	0.01	0.08	0.18	0.0	0.0	0.51	1.59	0.15	-0.35	-1.14	0.0	18.2
BASIN CREEK W S 11N 14E 21DDB1S	0.	38	130	126	10	102	73	73	48	73	999	178	999	0	0	87.9	51.47	0.0	0.16	0.0	0.07	0.02	0.14	0.13	0.0	0.0	0.31	2.68	1.23	0.68	-0.07	0.00001	0.0
MORMON BEND H S 11N 14E 29AAB1S	4.	38	130	127	11	103	75	46	53	75	999	179	999	0	0	81.1	49.13	0.07	0.17	0.0	0.07	0.02	0.15	0.13	0.0	0.0	0.31	2.75	1.24	0.69	-0.06	0.00001	5.4
SUNBEAM H S 11N 15E 19CAB1S	1681.	76	131	128	12	104	129	129	72	129	180	138	136	63	52	60.2	98.79	0.0	0.43	0.0	0.05	0.01	0.02	0.17	0.0	0.0	0.60	1.65	0.65	0.20	-0.61	0.00064	0.0
ROBINSON BAR H S 11N 15E 27DDC1S	151.	49	125	122	6	97	148	148	109	148	219	153	216	83	83	36.4	67.12	0.33	0.27	0.0	0.08	0.01	0.11	0.15	0.0	0.0	0.29	2.11	0.68	0.16	-0.62	0.0	14.6
SULLIVAN H S 11N 17E 27BDD1S	265.	41	89	91	-24	58	99	99	169	103	115	106	999	73	0	19.3	6.05	0.37	16.97	0.0	12.90	0.17	0.13	0.17	0.0	0.0	5.94	4.73	0.80	0.26	-0.50	0.07063	24.2
BARNEY W S 11N 25E 23CAB1S	643.	29	59	65	-49	27	13	13	252	123	999	999	999	0	0	10.2	0.42	0.89	4.29	0.0	35.08	2.36	0.31	0.04	0.0	0.0	0.31	77.61	0.54	-0.04	-0.77	0.00307	0.0
BILL JOHNSTON WELL 14N 19E 34DAA1	189.	40	68	73	-41	36	60	60	254	127	999	36	999	0	0	10.1	1.43	0.63	1.95	0.0	23.70	0.70	0.37	0.03	0.0	0.0	0.08	18.93	0.50	-0.04	-0.80	0.01423	0.0
SUNFLOWER FLAT H S 16N 12E 8DDB1S	16.	43	109	109	-7	80	71	71	43	78	184	139	132	83	77	96.7	35.25	0.0	0.58	0.0	0.18	0.03	0.09	0.28	0.0	0.0	0.35	2.68	1.04	0.50	-0.27	0.00434	0.0
THOMAS CREEK RANCH H S 16N 12E 17DAD1S	257.	43	125	123	6	97	90	90	56	90	248	162	225	88	87	77.5	68.07	0.0	0.45	0.0	0.08	0.01	0.06	0.21	0.0	0.0	0.43	2.03	1.01	0.47	-0.30	0.00003	0.0
LOWER LOON CREEK H S 17N 14E 19BDB1S	30.	49	119	117	1	91	73	73	31	73	199	146	158	81	76	121.7	55.91	0.0	0.54	0.0	0.11	0.02	0.04	0.15	0.0	0.0	0.64	2.10	0.93	0.41	-0.37	0.00027	0.0
Elmore County																																	
CHARLES BAKER WELL 3N 10E 10ABA1	19.	41	115	114	-1	87	30	30	18	30	198	146	158	83	79	155.9	12.96	0.0	0.42	11.58	1.46	0.08	0.17	0.03	0.0	0.0	0.29	5.68	0.47	-0.07	-0.83	0.0	0.0
PARADISE H S 3N 10E 33ACD1S	946.	53	120	118	2	91	40	40	58	40	183	140	132	75	66	74.2	9.10	0.0	0.52	32.50	1.32	0.11	0.21	0.05	0.0	0.0	0.58	7.26	0.62	0.11	-0.67	0.0	0.0
PARADISE H S WELL 3N 10E 33BDB1	0.	38	117	115	0	88	73	73	50	73	216	153	214	86	86	85.0	58.11	0.11	0.45	0.0	0.23	0.02	0.05	0.06	0.0	0.0	0.41	2.81	0.50	-0.00	-0.79	0.00000	7.6
NINEMEYER H S 5N 7E 24BDD1S	1321.	76	137	132	16	110	126	91	69	126	189	142	150	63	53	63.3	106.19	0.15	0.16	0.0	0.05	0.01	0.33	0.09	0.0	0.0	0.25	1.80	0.72	0.27	-0.54	0.0	7.5
DUTCH FRANK'S H S 5N 9E 7BBA1S	1135.	65	119	117	1	91	72	72	53	72	161	131	-77	63***		80.8	45.17	0.15	0.13	0.0	0.10	0.02	0.20	0.07	0.0	0.0	0.22	2.99	0.66	0.18	-0.62	0.0	10.5
ATLANTA H S 6N 11E 35DAD1S	0.	38	123	121	5	95	76	76	63	76	243	162	224	88	87	69.1	37.77	0.22	0.23	0.0	0.10	0.03	0.11	0.16	0.0	0.0	0.42	3.06	0.71	0.16	-0.60	0.0	14.7
JOHN MALOTA WELL 2S 5E 23BBC1	0.	22	99	100	-15	69	77	77	274	165	224	156	218	94	94	8.9	3.49	0.67	5.56	0.0	10.07	0.29	0.19	0.10	0.0	0.0	1.18	13.93	1.24	0.65	-0.07	0.00135	35.9

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO_2 Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)													Atomic Ratios							Molar Ratios						Free Energies of Formation of			Partial Pressure of CO_2 Gas (atmospheres)	R= Magnesium / (Magnesium + Calcium + Potassium)
																Sodium/Potassium	Sodium/Calcium	Magnesium/Calcium	Calcium/Fluoride	Chloride/Boron	Chloride/Fluoride	Calcium/Sodium	Calcium/Bicarbonate	Chloride/Carbonate & Bicarbonate	Ammonia/Chloride	Ammonia/Fluoride	Chloride/Sulfate	√Calcium/Sodium	Quartz	Chalcedony	Amorphous Silica		
			T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	$\%_9$	$\%_{11}$	Na/K	Na/Ca	Mg/Ca	Ca/F	Cl/B	Cl/F	Ca/Na	Ca/HCO_3	Cl/(CO_3 + HCO_3)	NH_4/Cl	NH_4/F	Cl/SO_4	√Ca/Na	ΔG Quartz	ΔG Chalcedony	ΔG Amorphous	PCO_2	Mg/(Mg+Ca+K) **
Elmore County (cont'd.)																																	
LONG TOM RANCH WELL #1 3S 7E 1ACA1	0.	20	109	109	-7	80	58	58	379	166	999	188	999	0	0	5.3	1.21	0.35	10.72	0.0	17.61	0.83	0.37	0.22	0.0	0.0	2.53	32.53	1.40	0.80	0.09	0.00327	0.0
LESLIE BEAM WELL 3S 8E 36CAD1	2649.	68	128	125	9	101	71	71	10	71	179	138	133	66	54	185.0	101.12	0.0	0.14	0.0	0.04	0.01	0.03	0.06	0.0	0.0	0.87	1.62	0.76	0.29	-0.52	0.00033	0.0
LATTY H S 3S 10E 31DDB1S	0.	55	137	132	16	110	137	137	79	137	229	157	220	80	79	54.0	235.35	0.0	0.21	0.0	0.03	0.00	0.01	0.04	0.0	0.0	0.73	1.34	1.11	0.61	-0.19	0.00050	0.0
ROBERT BRUCE WELL 4S 5E 25BBC1	0.	24	92	94	-21	62	47	47	376	47	164	131	106	90	85	5.3	1.26	0.35	6.16	0.0	30.81	0.79	0.27	0.05	0.0	0.0	0.94	44.05	1.11	0.52	-0.20	0.00046	0.0
BEVERLY OLSON WELL 4S 7E 19BDB1	0.	26	114	113	-3	85	63	63	288	161	999	173	265	0	94	8.2	2.05	0.58	4.98	0.0	10.90	0.49	0.24	0.11	0.0	0.0	1.33	20.40	1.35	0.77	0.04	0.00148	0.0
NORTHWEST PIPELINE WELL 4S 8E 36BBA1	30.	38	128	125	9	101	124	74	59	89	268	169	252	89	88	73.5	87.17	0.10	1.79	0.0	0.51	0.01	0.01	0.04	0.0	0.0	5.01	1.28	1.34	0.79	0.04	0.00887	6.1
BILL DAVIS WELL 4S 9E 8ACA1	0.	62	128	125	9	100	82	82	13	82	188	142	150	71	63	174.3	158.84	0.0	0.11	0.0	0.03	0.01	0.02	0.04	0.0	0.0	0.62	1.33	0.49	0.01	-0.79	0.00002	0.0
GARY LAWSON WELL 5S 3E 14CBB1	238.	59	125	123	6	97	62	62	8	62	187	141	134	72	61	193.5	66.10	0.0	0.42	55.39	0.05	0.02	0.06	0.28	0.0	0.0	4.87	1.95	0.14	-0.35	-1.15	0.0	0.0
MIKE WISSEL WELL 5S 7E 16ABD1	0.	21	120	118	2	91	60	60	312	156	999	205	999	0	0	7.2	1.13	0.45	5.85	0.0	21.98	0.89	0.38	0.10	0.0	0.0	0.42	24.85	1.51	0.91	0.19	0.00298	0.0
CHARLES BOYD WELL 5S 8E 34BDC1	8.	34	108	108	-7	79	144	124	86	99	197	146	157	87	84	49.5	61.31	0.18	14.37	0.0	1.96	0.02	0.02	0.13	0.0	0.0	24.58	1.08	1.17	0.60	-0.14	0.01817	10.1
MAGIC WEST CO. WELL 5S 10E 32BDB1	204.	38	97	99	-17	67	68	68	-1	56	141	122	99	78	68	245.7	90.66	0.13	1.20	0.0	0.09	0.01	0.01	0.18	0.0	0.0	31.41	1.40	0.95	0.40	-0.35	0.00428	0.0
CHARLES ANDERSON WELL 5S 11E 7ACC1	0.	32	93	95	-20	63	64	64	20	64	138	121	97	82	74	149.3	55.09	0.0	0.16	0.0	0.06	0.02	0.03	0.08	0.0	0.0	1.38	2.30	0.95	0.38	-0.35	0.00040	0.0
Franklin County																																	
TREASURTON W S #1 12S 40E 36ACD1S	38.	35	105	105	-10	75	227	227	304	136	197	145	156	89	86	7.5	3.70	0.42	153.97	56.63	57.10	0.27	0.57	1.52	0.00	0.66	2.17	3.32	1.13	0.57	-0.18	0.18195	25.4
TREASURTON W S #2 12S 40E 36ADB1S	38.	33	103	104	-12	73	236	236	335	143	198	145	157	90	87	6.4	3.48	0.41	178.56	56.72	64.62	0.29	0.56	1.52	0.00	0.70	2.27	3.57	1.14	0.57	-0.17	0.17751	24.3
CLEVELAND H S #1 12S 41E 31CAC1S	76.	66	110	110	-6	81	222	222	294	123	140	121	95	59	35	7.9	3.84	0.40	150.07	57.88	51.90	0.26	0.44	1.25	0.01	0.94	2.70	3.62	0.70	0.23	-0.58	0.44521	24.2
CLEVELAND H S #2 12S 41E 31CCA1S	38.	56	112	112	-4	83	225	225	297	131	163	131	119	72	67	7.8	4.66	0.48	150.07	57.88	42.91	0.21	0.45	1.54	0.00	0.47	2.68	3.27	0.89	0.39	-0.40	0.25944	27.0

CLEVELAND H S #3	12S 41E 31CDB1S	189.	61	113	112	-3	84	226	226	300	131	155	128	118	67	62	7.7	4.51	0.46	149.51	55.68	44.41	0.22	0.47	1.56	0.01	0.88	2.71	3.33	0.82	0.33	-0.47	0.27131	26.4
MAPLE GROVE H S	13S 41E 7ACA1S	76.	78	127	124	8	99	217	217	252	217	168	133	124	59	42	10.2	10.09	0.58	290.40	78.95	36.63	0.10	0.26	2.04	0.00	1.42	6.30	2.15	0.73	0.29	-0.52	0.23960	28.0
MAPLE GROVE H S	13S 41E 7ACA2S	378.	72	128	125	9	100	215	215	249	131	176	137	130	65	51	10.4	9.39	0.51	292.83	79.61	40.08	0.11	0.29	2.06	0.00	1.32	6.24	2.21	0.83	0.38	-0.43	0.14033	26.2
MAPLE GROVE H S	13S 41E 7ACA3S	3539.	60	128	125	9	101	214	214	248	132	199	146	158	76	69	10.5	9.22	0.44	313.00	77.36	44.09	0.11	0.29	2.00	0.00	1.00	6.30	2.25	1.03	0.54	-0.26	0.12159	23.5
BEN MEEK WELL	14S 39E 36ADA1	0.	40	130	127	11	103	165	165	130	101	999	175	285	0	91	28.4	26.73	0.45	17.98	169.14	1.19	0.04	0.07	1.06	0.01	0.13	67.08	1.53	1.35	0.80	0.04	0.08032	23.6
ELDIN BINGHAM	15S 39E 7OBC1	38.	63	116	115	-1	88	252	159	253	136	161	130	175	67	114	10.2	25.06	0.19	1071.93	540.07	38.90	0.04	0.52	14.20	0.0	0.0	440.06	0.45	0.88	0.40	-0.41	0.79178	7.7
BATTLE CREEK H S	15S 39E 8BDC1S	189.	82	142	136	21	115	254	154	259	254	195	144	155	63	53	9.7	31.67	0.18	468.17	456.20	13.75	0.03	0.38	12.75	0.00	1.41	405.51	0.48	0.88	0.45	-0.37	0.24452	6.4
BATTLE CREEK H S	15S 39E 8BDC2S	8176.	43	141	135	20	114	253	150	259	150	999	182	999	0	0	9.8	32.25	0.15	450.93	452.32	13.12	0.03	0.36	12.26	0.00	1.36	471.39	0.48	1.46	0.92	0.15	0.24464	5.3
BATTLE CREEK H S	15S 39E 8BDC3S	0.	81	142	136	21	115	254	155	259	254	197	145	156	64	54	9.7	32.85	0.19	449.68	426.01	12.80	0.03	0.33	11.26	0.00	1.34	368.44	0.48	0.89	0.46	-0.35	0.42626	6.7
BATTLE CREEK H S	15S 39E 8BDC4S	19.	84	135	131	15	108	253	154	250	253	176	137	143	57	51	10.4	33.93	0.18	583.45	400.48	15.93	0.03	0.54	19.34	0.00	1.74	571.72	0.40	0.77	0.35	-0.47	0.16304	6.5
SQUAW H S WELL	15S 39E 17BCD1	435.	84	149	143	28	124	258	153	263	258	211	150	199	65	65	9.5	27.29	0.14	922.11	524.15	30.76	0.04	0.54	15.83	0.00	2.10	572.40	0.44	0.95	0.53	-0.29	0.41959	5.5
SQUAW H S	15S 39E 17BDC1S	140.	69	150	143	28	125	253	150	255	144	245	161	224	77	74	10.1	26.92	0.14	857.17	498.84	29.88	0.04	0.51	14.27	0.00	1.89	689.75	0.45	1.19	0.73	-0.08	0.40100	5.6
SQUAW H S	15S 39E 17BDC2S	450.	73	150	143	28	125	238	150	225	137	235	158	222	74	72	12.3	27.81	0.18	714.18	423.60	23.80	0.04	0.42	12.50	0.00	2.25	753.07	0.46	1.13	0.68	-0.13	0.33000	7.7
MYRON FONNESBECK WELL	16S 38E 24ABC1	*****	23	121	119	2	92	84	84	335	133	999	223	999	0	0	6.4	1.52	0.57	97.55	66.01	73.95	0.66	0.28	0.37	0.00	0.22	57.31	14.91	1.49	0.90	0.18	0.06322	33.8

Fremont County

DONALD TRUPP WELL	7N 41E 25CBD1	0.	32	122	120	3	94	184	184	223	150	999	169	262	0	92	12.5	6.67	0.24	2.16	0.0	1.76	0.15	0.19	0.23	0.0	0.0	2.60	6.26	1.36	0.79	0.05	0.00324	15.7
WAYNE LARSEN WELL	7N 41E 26ACC1	0.	22	133	129	13	106	184	179	215	157	999	225	999	0	0	13.2	8.53	0.23	2.11	85.30	1.27	0.12	0.12	0.20	0.0	0.0	3.30	5.38	1.63	1.04	0.32	0.00184	15.0
HENRY HARRIS WELL	7N 41E 34ADD1	0.	33	113	112	-3	84	78	78	184	126	223	154	218	89	89	17.0	4.81	0.39	2.07	44.68	2.08	0.21	0.19	0.18	0.0	0.0	2.29	8.32	1.24	0.68	-0.06	0.00593	25.4
NEWDALE CITY WELL	7N 41E 34DCD1	0.	32	118	117	0	90	81	81	204	141	259	164	228	91	90	14.4	4.11	0.34	3.31	88.35	3.13	0.24	0.20	0.21	0.0	0.0	0.0	8.76	1.31	0.74	0.00	0.00262	23.0
WALLACE LITTLE WELL	7N 41E 35CDD1	0.	36	121	119	3	93	84	84	195	136	246	160	225	89	88	15.4	4.86	0.37	2.38	0.0	2.46	0.21	0.18	0.17	0.0	0.0	1.97	7.79	1.29	0.73	-0.02	0.00359	24.3
CLAUDE HAWS WELL	7N 41E 36DDA1	0.	32	116	115	-1	88	63	63	196	123	246	160	225	91	90	15.3	3.20	0.50	2.14	0.0	3.79	0.31	0.19	0.11	0.0	0.0	2.03	12.79	1.30	0.73	-0.01	0.00683	0.0
DEAN SWINDELMAN WELL	7N 42E 8CAA1	0.	32	114	113	-3	85	48	48	297	140	235	157	222	90	90	7.8	1.01	0.61	3.75	0.0	9.01	0.99	0.28	0.12	0.0	0.0	4.31	32.18	1.27	0.70	-0.04	0.00582	0.0
REMINGTON PRODUCE WELL	7N 42E 19CCA1	0.	26	83	86	-29	52	26	26	233	131	98	95	999	82	0	11.6	0.75	0.80	5.85	0.0	7.54	1.34	0.37	0.28	0.0	0.0	2.95	45.29	0.95	0.37	-0.36	0.00185	0.0
ASHTON H S	9N 42E 23DAC1S	8.	41	142	137	21	116	91	86	105	111	999	180	999	0	0	38.3	57.06	0.15	0.71	0.0	0.24	0.02	0.02	0.05	0.0	0.0	1.67	3.35	1.46	0.91	0.15	0.00314	7.9
BIG SPRINGS	14N 44E 34BBC1S	*****	12	98	100	-16	68	66	66	294	136	999	307	999	0	0	7.9	4.36	0.18	0.43	0.0	0.86	0.23	0.19	0.09	0.0	0.0	2.12	19.41	1.40	0.78	0.08	0.01584	0.0

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO_2 Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)													Atomic Ratios							Molar Ratios						Free Energies of Formation of			Partial Pressure of CO_2 Gas (atmospheres)	R = Magnesium / (Magnesium + Calcium + Potassium)
			T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	%9	%11	Sodium/Potassium Na/K	Sodium/Calcium Na/Ca	Magnesium/Calcium Mg/Ca	Calcium/Fluoride Ca/F	Chloride/Boron Cl/B	Chloride/Fluoride Cl/F	Calcium/Sodium Ca/Na	Calcium/Bicarbonate Ca/HCO_3	Chloride/Carbonate & Bicarbonate $Cl/(CO_3 + HCO_3)$	Ammonia/Chloride NH_4/Cl	Ammonia/Fluoride NH_4/F	Chloride/Sulfate Cl/SO_4	$\sqrt{Calcium}$/Sodium $\sqrt{Ca}/Na$	Quartz △G Quartz	Chalcedony △G Chalcedony	Amorphous Silica △G Amorphous	PCO_2	$\frac{Mg}{Mg+Ca+K}$ **
Gem County																																	
ROYSTONE H S 7N 1E 8DDA1S	76.	55	147	141	26	122	150	98	112	109	273	170	258	84	83	35.3	32.06	0.11	2.08	0.0	0.26	0.03	0.07	0.56	0.0	0.0	1.53	2.12	1.31	0.80	0.01	0.00954	7.3
EAST ROYSTONE H S 7N 1E 9CDC1S	0.	45	133	129	13	106	84	84	121	109	261	166	228	87	85	31.8	11.51	0.26	2.01	0.0	0.89	0.09	0.14	0.30	0.0	0.0	1.43	4.49	1.30	0.77	-0.01	0.00592	18.3
Gooding County																																	
J. SHANNON WELL 4S 13E 28ABB1	0.	47	132	128	12	105	98	98	129	97	243	161	224	85	83	28.8	17.79	0.20	0.37	0.0	0.39	0.06	0.05	0.05	0.0	0.0	1.17	3.59	1.26	0.74	-0.04	0.04091	13.4
WHITE ARROW H S 4S 13E 30ADB1S	3126.	65	135	131	15	108	112	112	43	79	202	147	160	72	64	96.7	132.21	0.0	0.29	0.0	0.05	0.01	0.01	0.07	0.0	0.0	1.19	1.38	1.01	0.54	-0.26	0.00866	0.0
DAVE ARCHER WELL 5S 12E 3AAA1	0.	57	112	111	-5	83	70	70	9	70	152	127	110	67	57	191.3	98.06	0.10	0.24	0.0	0.04	0.01	0.03	0.11	0.0	0.0	1.20	1.61	0.97	0.43	-0.33	0.00024	7.6
Idaho County																																	
BURGDORF H S 22N 4E 1BDC1S	613.	45	120	118	2	91	57	57	39	57	191	143	152	78	72	104.2	37.14	0.0	0.80	0.0	0.55	0.03	0.18	0.08	0.0	0.0	0.45	3.55	1.11	0.58	-0.19	0.00017	0.0
RIGGINS H S 24N 2E 14DBD1S	189.	42	119	117	1	91	95	95	54	95	195	145	156	80	75	80.0	44.99	0.03	2.04	0.0	1.40	0.02	0.86	0.38	0.0	0.0	0.07	1.79	1.08	0.54	-0.22	0.0	2.0
BARTH H S 25N 12E 18DD 1S	742.	61	118	116	0	89	51	51	14	51	157	129	203	63	127	170.1	54.48	0.0	0.34	0.0	0.13	0.02	0.05	0.08	0.0	0.0	1.84	2.91	0.53	0.05	-0.75	0.00002	0.0
RED RIVER H S 28N 10E 3DDD1S	132.	55	122	120	3	94	80	80	50	80	175	138	130	70	60	86.1	52.30	0.0	0.10	0.0	0.06	0.02	0.11	0.10	0.0	0.0	0.27	2.33	0.88	0.38	-0.41	0.00008	0.0
WEIR CREEK H S 36N 11E 13BCC1S	151.	48	100	101	-14	70	34	34	42	34	124	116	91	63	48	98.6	15.32	0.0	0.51	0.0	0.71	0.07	0.24	0.08	0.0	0.0	0.38	7.19	0.75	0.23	-0.55	0.00006	0.0
JERRY JOHNSON H S 36N 13E 18ADD1S	1135.	48	100	101	-14	70	33	33	18	33	124	116	91	63	48	157.3	23.89	0.12	0.64	0.0	0.80	0.04	0.17	0.07	0.0	0.0	0.21	5.10	0.70	0.18	-0.60	0.00004	0.0
Jefferson County																																	
HEISE H S 4N 40E 25DDA1S	227.	49	79	83	-32	48	206	206	213	119	999	83	999	0	0	13.4	5.81	0.30	414.94	0.0	68.81	0.17	0.62	3.69	0.0	0.0	8.78	1.62	0.54	0.02	-0.76	0.24894	19.8
Jerome County																																	
ROYAL CATFISH INDUSTRY 9S 17E 29DBB1	*****	43	121	119	2	92	93	93	48	93	206	148	161	82	78	87.7	77.66	0.0	0.78	0.0	0.09	0.01	0.03	0.18	0.0	0.0	2.55	1.74	0.95	0.41	-0.35	0.00010	0.0

Lemhi County

CRONKS CANYON H S	16N 21E 18ADC1S	76.	46	88	90	-25	57	165	150	144	115	124	112	75	65	42	24.7	25.36	0.21	1.99	0.0	0.74	0.04	0.05	0.13	0.0	0.0	1.07	2.38	0.70	0.17	-0.61	0.01918	12.2
SALMON H S	20N 22E 3ABD1S	549.	45	83	86	-29	52	203	203	234	112	117	107	999	64	0	11.5	14.40	0.79	14.89	0.0	6.06	0.07	0.06	0.15	0.0	0.0	3.98	2.90	0.65	0.12	-0.65	0.38936	32.7
SHARKEY H S	20N 24E 34CCC1S	30.	52	131	128	12	104	173	98	135	117	234	156	221	80	78	27.0	64.48	0.14	2.28	0.0	0.29	0.02	0.02	0.18	0.0	0.0	0.86	1.15	1.18	0.66	-0.12	0.02860	5.8
BIG CREEK H S	23N 18E 22CAD1S	284.	93	161	152	38	137	173	173	136	173	224	153	218	60	59	26.7	72.37	0.06	1.04	0.0	0.17	0.01	0.02	0.10	0.0	0.0	1.48	1.20	0.87	0.48	-0.34	0.04252	2.6

Madison County

LAVERE RICKS WELL	5N 40E 5CBA1	0.	21	93	95	-20	63	36	36	257	139	273	167	257	96	96	9.9	0.92	0.58	8.25	0.0	12.40	1.08	0.30	0.19	0.0	0.0	4.92	37.20	1.18	0.58	-0.13	0.00207	0.0
MARK RICKS WELL	5N 40E 8BCC1	0.	26	101	102	-14	71	44	44	278	138	258	162	227	94	93	8.7	1.06	0.55	3.78	121.86	9.20	0.95	0.30	0.12	0.0	0.0	2.71	32.98	1.21	0.62	-0.10	0.00443	0.0
PAULINE SMITH WELL	5N 40E 9CCC1	0.	21	91	93	-22	61	30	30	276	142	254	161	227	96	95	8.8	0.66	0.67	14.29	0.0	29.23	1.52	0.30	0.14	0.0	0.0	3.94	49.89	1.15	0.55	-0.16	0.00177	0.0
GREEN CANYON H S	5N 43E 6BCA1S	0.	44	72	76	-39	40	7	7	785	150	79	80	999	51	0	1.8	0.05	0.38	0.57	0.0	41.48	20.59	1.28	0.02	0.0	0.0	0.01	348.40	0.49	-0.05	-0.81	0.03367	0.0
WALZ ENTER. INC. WELL	6N 41E 10ACC1	0.	26	114	113	-3	85	81	81	225	140	999	185	999	0	0	12.3	3.66	0.37	3.91	82.26	3.97	0.27	0.20	0.20	0.0	0.0	2.81	9.84	1.36	0.78	0.05	0.00476	24.2
WANDA WOOD WELL #1	6N 41E 10BBB1	0.	24	115	114	-2	86	78	78	221	146	999	195	999	0	0	12.7	3.38	0.36	3.68	73.12	4.47	0.30	0.21	0.17	0.0	0.0	0.0	10.31	1.40	0.81	0.08	0.00236	24.1
WANDA WOOD WELL #2	6N 41E 10DBB1	0.	27	125	122	6	97	80	80	207	133	999	198	999	0	0	14.0	3.94	0.40	2.98	58.59	3.27	0.25	0.22	0.20	0.0	0.0	2.60	9.13	1.47	0.89	0.16	0.00570	26.2

Oneida County

KENT H S	12S 34E 36BCB1S	715.	24	83	86	-29	52	35	35	352	122	999	999	999	0	0	5.9	0.47	0.56	62.53	0.0	88.49	2.14	0.38	0.26	0.0	0.0	5.27	57.29	1.00	0.41	-0.31	0.04489	0.0
MALAD W S	14S 36E 27CDA1S	167.	25	61	67	-47	29	228	228	260	133	999	999	999	0	0	9.7	8.72	0.54	2813.82	0.0	284.43	0.11	0.38	3.71	0.0	0.0	227.48	1.48	0.67	0.09	-0.64	0.26290	27.3
PLEASANTVIEW W S	15S 35E 3AAB1S	*****	25	65	70	-44	33	176	176	188	114	999	999	999	0	0	16.4	4.44	0.49	359.86	0.0	74.49	0.23	0.51	2.40	0.0	0.0	11.57	4.30	0.72	0.13	-0.59	0.04960	30.4
WOODRUFF H S	16S 36E 10BBC1S	0.	27	78	81	-34	46	192	192	178	135	999	999	999	0	0	17.8	12.20	0.57	1429.24	0.0	102.71	0.08	0.44	5.97	0.0	0.0	74.70	1.44	0.88	0.30	-0.43	0.02094	29.8

Owyhee County

GIVENS H S	1N 3W 21BBD1S	0.	49	121	119	3	93	100	100	19	100	189	283	150	81	75	153.1	219.66	0.0	0.88	0.0	0.03	0.00	0.01	0.21	0.0	0.0	2.01	0.91	0.71	0.19	-0.59	0.00008	0.0
WESLEY HIGGINS WELL	1N 4W 12DBB1	1552.	36	91	93	-22	61	39	39	-35	22	81	999	999	68	0	623.6	87.17	0.0	1.90	0.0	0.13	0.01	0.02	0.22	0.0	0.0	8.82	1.55	0.91	0.36	-0.39	0.01687	0.0
EARL FOOTE WELL	1S 2W 7CCB1	640.	46	82	85	-30	50	83	83	14	83	999	999	999	0	0	170.1	110.11	0.0	0.93	0.0	0.08	0.01	0.02	0.16	0.0	0.0	1.14	1.32	0.47	-0.06	-0.83	0.00048	0.0
ALFRED HEYWOOD WELL	3S 1E 35DAC1	0.	20	106	106	-10	76	56	56	257	141	999	413	999	0	0	9.9	1.42	0.38	1.97	39.76	9.71	0.70	0.27	0.05	0.0	0.0	0.83	21.51	1.36	0.76	0.04	0.00362	0.0
WILLIAM COX WELL #1	4S 1E 25CCD1	19.	30	147	141	26	122	186	144	176	121	999	483	999	0	0	18.2	21.62	0.19	22.33	0.0	19.75	0.05	0.04	0.04	0.0	0.0	12.31	1.85	1.68	1.10	0.37	0.05103	10.7
WILLIAM COX WELL #2	4S 1E 26ABC1	189.	27	134	130	14	107	200	178	202	200	999	464	999	0	0	14.7	33.53	0.35	11.61	5.08	10.27	0.03	0.03	0.03	0.0	0.0	9.78	1.66	0.0	0.0	0.0	0.0	14.2

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO_2 Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)													Atomic Ratios							Molar Ratios						Free Energies of Formation of			Partial Pressure of CO_2 Gas (atmospheres)	R= Magnesium / Magnesium + Calcium + Potassium
			T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	%9	%11	Sodium/Potassium Na/K	Sodium/Calcium Na/Ca	Magnesium/Calcium Mg/Ca	Calcium/Fluoride Ca/F	Chloride/Boron Cl/B	Chloride/Fluoride Cl/F	Calcium/Sodium Ca/Na	Calcium/Bicarbonate Ca/HCO_3	Chloride/Carbonate & Bicarbonate $Cl/(CO_3+HCO_3)$	Ammonia/Chloride NH_4/Cl	Ammonia/Fluoride NH_4/F	Chloride/Sulfate Cl/SO_4	$\sqrt{Calcium}$/Sodium $\sqrt{Ca}/Na$	Quartz ΔG Quartz	Chalcedony ΔG Chalcedony	Amorphous Silica ΔG Amorphous	PCO_2	$Mg/(Mg+Ca+K)$ **
Owyhee County (cont'd.)																																	
T. ADCOCK WELL 4S 1E 29CCD1	5602.	70	127	124	7	99	77	77	4	77	167	260	125	64	50	212.6	145.28	0.0	0.54	24.54	0.05	0.01	0.03	0.17	0.0	0.0	0.83	1.26	0.29	-0.17	-0.98	0.00000	0.0
GEORGE KING WELL 4S 1E 34BAD1	0.	75	127	124	7	99	75	75	0	75	161	253	75	59	0	238.1	155.32	0.30	0.54	0.0	0.04	0.01	0.02	0.14	0.0	0.0	0.81	1.23	1.78	1.15	0.46	0.00003	18.4
G. CHRISTENSEN WELL 4S 2E 29DBC1	38.	28	137	132	16	110	175	175	149	115	999	461	999	0	0	23.4	27.40	0.54	55.38	15.26	33.18	0.04	0.03	0.05	0.0	0.0	18.66	1.59	1.60	1.02	0.29	0.04147	25.5
R. KETTERLING WELL 4S 2E 32BCC1	95.	43	142	137	21	116	160	130	126	160	999	374	999	0	0	30.0	45.09	0.20	1.05	0.0	0.32	0.02	0.02	0.08	0.0	0.0	8.85	1.84	1.28	0.74	-0.03	0.00069	10.2
C. STEINER WELL 5S 1E 3AAB1	0.	32	147	141	26	122	192	173	197	140	999	462	999	0	0	15.2	16.79	0.08	19.29	6.86	25.60	0.06	0.05	0.04	0.0	0.0	6.77	2.30	1.64	1.07	0.33	0.01369	4.9
E. LAWRENCE WELL #1 5S 1E 10BDD1	4542.	64	127	124	7	99	61	61	0	61	173	269	129	69	58	243.0	79.24	0.0	0.46	24.91	0.07	0.01	0.05	0.20	0.0	0.0	0.84	1.70	0.34	-0.14	-0.94	0.0	0.0
E. JOHNSTON WELL #2 5S 1E 21CBC1	1382.	65	123	120	4	94	71	71	0	71	163	256	123	66	54	243.0	134.11	0.0	0.46	23.43	0.04	0.01	0.03	0.21	0.0	0.0	0.84	1.31	0.35	-0.12	-0.92	0.00000	0.0
E. LAWRENCE WELL #2 5S 1E 24ACD1	7646.	65	130	127	11	103	96	96	27	96	184	279	135	71	60	130.8	158.49	0.0	0.50	28.63	0.03	0.01	0.02	0.20	0.0	0.0	0.92	1.20	0.36	-0.11	-0.92	0.00001	0.0
E. LAWRENCE WELL #3 5S 1E 24ADB1	4012.	66	126	123	7	98	77	77	4	66	170	264	127	67	55	212.6	145.28	0.14	0.50	0.0	0.04	0.01	0.02	0.16	0.0	0.0	0.78	1.26	0.86	0.39	-0.41	0.00248	9.3
OSCAR FIELDS WELL 5S 2E 18BC1	95.	50	123	120	4	94	60	60	-1	60	191	285	152	80	75	243.8	88.19	0.0	0.57	0.0	0.05	0.01	0.06	0.26	0.0	0.0	6.10	1.74	0.14	-0.38	-1.16	0.0	0.0
CLARENCE HOPKINS WELL 5S 2E 2CDA1	38.	37	130	127	11	103	187	167	169	129	999	361	282	0	92	19.3	44.02	0.33	2.09	38.27	0.73	0.02	0.02	0.06	0.0	0.0	19.91	1.45	1.39	0.83	0.08	0.02590	13.5
COX AND LAWRENCE WELL 5S 2E 5BCD1	284.	43	142	137	21	116	149	149	105	149	999	374	999	0	0	38.1	50.29	0.35	1.25	6.16	0.29	0.02	0.04	0.11	0.0	0.0	6.69	1.75	1.02	0.49	-0.28	0.00008	17.4
H. DRISKELL WELL #1 5S 2E 13ADA1	19.	23	142	137	21	116	197	171	192	140	999	586	999	0	0	15.8	34.87	0.33	10.72	0.0	4.11	0.03	0.03	0.07	0.0	0.0	25.39	1.59	1.72	1.13	0.41	0.01853	15.6
N. MCKEETH WELL 5S 3E 20ADA1	0.	60	142	137	21	116	73	73	5	73	231	321	221	80	79	206.5	134.71	0.15	0.42	5.87	0.03	0.01	0.06	0.29	0.0	0.0	6.35	1.42	0.32	-0.17	-0.97	0.0	10.2
BURGHARDT CO. WELL 5S 3E 20BBB1	19.	27	142	137	21	116	169	141	162	110	999	501	999	0	0	20.6	9.55	0.15	32.16	11.58	39.82	0.10	0.09	0.07	0.0	0.0	12.13	3.24	1.67	1.09	0.36	0.04545	11.1
LEROY BEAMAN WELL 5S 3E 22AAD1	19.	25	156	149	34	132	170	170	148	113	999	610	999	0	0	23.6	22.94	0.29	29.10	58.18	12.87	0.04	0.04	0.09	0.0	0.0	25.73	2.00	1.84	1.25	0.53	0.03415	16.6

COOK'S GREENHOUSE WELL # 5S 3E 26BCB1	0.	83	142	137	21	116	91	91	36	91	189	283	150	61	50	110.0	91.32	0.0	0.54	8.03	0.07	0.01	0.15	0.30	0.0	0.0	0.66	1.51	0.09	-0.34	-1.15	0.0	0.0
COOK'S GREENHOUSE WELL # 5S 5E 26BCB2	0.	67	157	132	16	110	95	71	29	95	197	293	157	72	64	124.7	127.85	0.11	0.57	8.32	0.05	0.01	0.07	0.28	0.0	0.0	0.63	1.28	0.39	-0.08	-0.88	0.0	6.8
D. BYBEE WELL #1 5S 3E 27BDD1	0.	60	117	115	0	88	76	76	19	76	152	245	130	67	75	153.1	100.87	0.12	0.46	6.25	0.03	0.01	0.03	0.28	0.0	0.0	3.84	1.68	0.22	-0.27	-1.06	0.00000	8.1
A. WHITTED WELL 5S 3E 28BCC1	0.	65	136	131	15	109	105	105	28	105	198	293	157	73	66	126.9	211.38	0.0	0.38	7.38	0.02	0.00	0.05	0.27	0.0	0.0	4.14	1.06	0.33	-0.14	-0.95	0.0	0.0
D. BYBEE WELL #2 5S 3E 35CCC1	0.	72	137	132	16	110	75	75	19	75	190	285	152	68	59	154.6	79.24	0.0	0.57	8.72	0.07	0.01	0.06	0.26	0.0	0.0	0.60	1.70	0.27	-0.18	-0.99	0.0	0.0
IDAHO POWER CO WELL 5S 4E 34CCB1	0.	27	133	129	13	106	71	71	231	155	999	458	999	0	0	11.8	1.70	0.15	5.67	42.51	23.70	0.59	0.57	0.13	0.0	0.0	0.20	12.76	1.54	0.96	0.25	0.00107	12.4
CHESTER TINDALL WELL 5S 5E 33BBD1	0.	22	91	93	-22	61	62	62	98	82	75	999	999	89	0	41.9	3.45	1.26	44.66	50.95	67.95	0.29	0.31	0.20	0.0	0.0	0.30	6.26	1.15	0.55	-0.16	0.02435	0.0
CLAY ATKINS WELL 5S 5E 34DDD1	0.	25	129	126	10	102	197	197	223	139	999	467	999	0	0	12.4	11.42	0.68	21.44	10.46	22.91	0.09	0.07	0.07	0.0	0.0	5.42	3.25	1.55	0.97	0.24	0.01964	31.9
LOWER BIRCH SPRING 6S 1E 32BBA1S	0.	25	96	98	-18	66	21	21	149	93	135	221	98	92	89	23.4	1.04	0.38	22.51	220.61	35.08	0.96	0.45	0.28	0.0	0.0	1.62	51.75	1.16	0.58	-0.15	0.00819	0.0
L. POST WELL #1 6S 3E 2CBB1	0.	62	136	132	16	109	128	128	60	128	207	301	192	76	75	72.9	174.34	0.0	0.60	6.82	0.03	0.01	0.02	0.23	0.0	0.0	1.14	1.05	0.67	0.18	-0.62	0.00003	0.0
L. POST WELL #2 6S 3E 2CCC1	2725.	53	137	132	16	110	146	144	90	146	233	323	221	83	82	46.8	159.81	0.14	0.57	7.23	0.03	0.01	0.02	0.19	0.0	0.0	1.81	1.14	0.80	0.29	-0.49	0.00005	4.8
W. BUNT WELL 6S 3E 4BCC1	0.	48	142	137	21	116	166	166	128	166	999	354	262	0	87	29.2	119.86	0.0	0.49	7.63	0.06	0.01	0.04	0.14	0.0	0.0	0.71	1.32	0.83	0.31	-0.47	0.0	0.0
J. AGENBROAD WELL 6S 3E 5CAC1	0.	61	133	129	13	106	90	90	127	90	199	294	158	75	69	29.5	22.36	0.0	0.47	19.83	0.20	0.04	0.09	0.18	0.0	0.0	1.51	4.17	0.91	0.42	-0.37	0.00024	0.0
NIELSON & CAROTHERS WELL 6S 3E 9ACC1	6283.	39	152	145	30	127	176	176	163	176	999	427	999	0	0	20.4	46.97	0.05	0.65	8.00	0.19	0.02	0.03	0.10	0.0	0.0	0.71	2.25	1.46	0.91	0.15	0.00024	2.1
TRIANGLE DAIRY WELL #1 6S 3E 11OAD1	0.	34	147	141	26	122	162	87	147	162	999	444	999	0	0	24.0	26.77	0.09	0.54	8.40	0.24	0.04	0.06	0.12	0.0	0.0	0.90	3.16	1.47	0.91	0.16	0.00017	5.4
LITTLE VALLEY IRR. WELL 6S 4E 14ABC1	5602.	54	156	149	34	132	143	143	102	143	999	376	999	0	0	39.8	38.35	0.03	0.42	10.74	0.10	0.03	0.38	0.34	0.0	0.0	0.79	2.33	0.83	0.33	-0.46	0.0	2.2
KENT KOHRING WELL #1 6S 4E 25BCC1	341.	20	120	118	2	91	92	78	223	154	999	544	999	0	0	12.4	4.04	0.09	1.92	33.06	4.98	0.25	0.48	0.18	0.0	0.0	0.20	7.74	1.52	0.92	0.21	0.00187	7.4
DICK WARD WELL 6S 4E 35CDA1	0.	33	134	130	14	107	207	207	273	207	999	403	999	0	0	9.0	17.81	0.04	0.60	27.70	0.27	0.06	0.07	0.16	0.0	0.0	1.02	5.24	1.44	0.87	0.13	0.00032	1.8
COLYER CATTLE CO. WELL 6S 5E 10DDD1	19.	39	123	121	5	95	141	115	89	141	235	324	222	89	89	47.5	80.46	0.19	0.28	6.63	0.04	0.01	0.02	0.14	0.0	0.0	1.69	1.54	1.22	0.67	-0.08	0.00075	9.3
J.R.SIMPLOT WELL #1 6S 5E 18CCB1	0.	27	147	141	26	122	169	169	150	140	999	524	999	0	0	23.3	44.70	0.04	0.82	11.30	0.14	0.02	0.06	0.29	0.0	0.0	1.04	2.27	1.71	1.13	0.40	0.00248	2.1
J.R.SIMPLOT WELL #2 6S 5E 20AAB1	19.	44	109	109	-7	80	151	151	116	151	153	246	105	79	69	33.4	40.80	0.04	0.38	5.46	0.09	0.02	0.04	0.13	0.0	0.0	12.44	2.26	0.87	0.33	-0.44	0.00036	2.1
GEORGE HUTCHINSON WELL 6S 5E 24BCA1	19.	34	130	127	11	103	141	141	94	141	999	379	999	0	0	44.4	58.11	0.0	0.26	6.96	0.06	0.02	0.04	0.13	0.0	0.0	1.26	1.82	1.21	0.65	-0.09	0.00009	0.0
BRUNEAU CITY WELL 6S 5E 24DDB1	0.	33	124	121	5	96	94	94	59	94	999	358	278	0	93	73.2	61.64	0.0	0.24	8.84	0.05	0.02	0.03	0.14	0.0	0.0	0.85	1.94	1.20	0.64	-0.10	0.00011	0.0
DON DAVIS WELL #1 6S 5E 29DCC1	19.	33	147	141	26	122	161	155	149	161	999	453	999	0	0	23.5	21.36	0.07	0.42	11.45	0.18	0.05	0.09	0.21	0.0	0.0	0.97	3.52	1.52	0.95	0.21	0.00016	4.6
CARL & HARRY LOOS WELL 6S 5E 35CCA1	0.	22	120	118	2	91	73	73	245	73	999	474	999	0	0	10.7	2.48	0.14	0.65	33.85	2.61	0.40	0.35	0.11	0.0	0.0	0.45	13.11	1.35	0.76	0.04	0.00009	11.4

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO_2 Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes) T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	$\%_9$	$\%_{11}$	Atomic Ratios: Sodium/Potassium Na/K	Sodium/Calcium Na/Ca	Magnesium/Calcium Mg/Ca	Calcium/Fluoride Ca/F	Chloride/Boron Cl/B	Chloride/Fluoride Cl/F	Calcium/Sodium Ca/Na	Molar Ratios: Calcium/Bicarbonate Ca/HCO_3	Chloride/Carbonate & Bicarbonate $Cl/(CO_3 + HCO_3)$	Ammonia/Chloride NH_4/Cl	Ammonia/Fluoride NH_4/F	Chloride/Sulfate Cl/SO_4	$\sqrt{Ca}/Na$	Free Energies of Formation of: Quartz ΔG Quartz	Chalcedony ΔG Chalcedony	Amorphous Silica ΔG Amorphous	Partial Pressure of CO_2 Gas (atmospheres) PCO_2	R = Magnesium/(Magnesium + Calcium + Potassium) $Mg/(Mg+Ca+K)$ **
Owyhee County (cont'd.)																																					
IDAHO PARKS DEPT. WELL 6S 6E 12CCD1	0.	37	147	141	26	122	178	97	163	143	999	423	999	0	0	20.4	31.38	0.10	1.73	58.47	0.80	0.03	0.03	0.07	0.0	0.0	14.29	2.02	1.54	0.99	0.24	0.00368	5.3
MILDRED BACHMAN WELL 6S 6E 19CCD1	19.	38	130	126	10	102	133	133	85	133	999	353	261	0	91	51.0	54.04	0.0	0.21	8.99	0.05	0.02	0.05	0.15	0.0	0.0	0.71	2.14	1.16	0.61	-0.14	0.00007	0.0
BRUNEAU CEMENTARY WELL 6S 6E 19DBD1	0.	42	127	124	8	99	91	91	51	91	239	326	223	88	87	84.1	71.25	0.0	0.21	8.99	0.04	0.01	0.04	0.15	0.0	0.0	0.97	1.85	0.95	0.41	-0.36	0.00003	0.0
ACE BLACK WELL 6S 6E 32ADD1	95.	35	129	125	10	102	132	132	83	132	999	367	291	0	93	51.6	52.86	0.05	0.22	9.60	0.05	0.02	0.04	0.13	0.0	0.0	1.06	2.15	1.07	0.51	-0.23	0.00004	3.4
WILBUR WILSON WELL #1 6S 7E 1ACB1	19.	41	120	118	2	91	138	102	78	102	208	302	194	87	86	55.3	64.75	0.14	7.55	37.78	0.75	0.02	0.02	0.17	0.0	0.0	49.38	1.17	1.18	0.64	-0.12	0.00779	8.2
WILBUR WILSON WELL #2 6S 7E 1DBD1	38.	33	119	117	1	91	139	139	82	104	251	336	226	93	92	51.9	53.81	0.24	13.23	26.77	1.20	0.02	0.02	0.23	0.0	0.0	59.43	1.31	1.30	0.74	-0.00	0.00657	13.9
CARL JOHNSON WELL 6S 7E 2CDD1	19.	35	121	119	3	93	144	101	89	109	248	334	226	92	91	47.0	63.12	0.14	3.95	24.41	0.36	0.02	0.02	0.18	0.0	0.0	54.16	1.32	1.30	0.74	-0.01	0.00613	7.8
SAND DUNES FARMS WELL 6S 7E 8BBA1	0.	23	129	126	10	102	199	199	216	131	999	509	999	0	0	13.2	16.09	1.08	13.02	18.56	17.61	0.06	0.07	0.05	0.0	0.0	0.18	2.44	1.59	1.00	0.28	0.05057	40.1
BILL BURGHARDT WELL #2 7S 3E 4ACD1	2725.	34	133	129	13	106	79	75	492	176	999	391	999	0	0	3.5	1.06	0.09	2.27	27.77	14.22	0.94	0.36	0.06	0.0	0.0	0.54	26.45	1.47	0.90	0.16	0.00996	7.3
KEITH THOMAS WELL 7S 4E 1ACC1	2896.	40	127	124	7	99	182	178	215	182	246	332	225	89	88	13.5	13.39	0.05	0.48	26.46	0.34	0.07	0.13	0.08	0.0	0.0	1.37	5.69	1.21	0.66	-0.10	0.00021	3.1
PETE MERRICK WELL #1 7S 4E 3ABD1	6283.	42	134	130	14	107	194	194	247	194	273	350	257	90	89	10.6	13.83	0.03	0.52	22.27	0.31	0.07	0.10	0.16	0.0	0.0	1.18	6.01	1.29	0.75	-0.01	0.00042	1.7
PETE MERRICK WELL #2 7S 4E 10BDB1	1874.	38	136	132	16	109	198	198	261	198	999	377	999	0	0	9.6	11.38	0.02	0.49	24.04	0.36	0.09	0.10	0.14	0.0	0.0	0.97	6.56	1.35	0.80	0.05	0.00028	1.4
FRANK MILLETT WELL #1 7S 4E 11CBC1	7475.	36	136	132	16	109	92	92	282	92	999	389	999	0	0	8.5	4.90	0.03	0.61	28.62	0.92	0.20	0.22	0.14	0.0	0.0	0.84	10.21	1.43	0.87	0.12	0.00064	2.3
FARIA BROTHERS WELL 7S 4E 12BDD1	0.	43	134	130	14	107	186	186	224	186	270	348	254	89	89	12.4	12.70	0.02	0.52	25.85	0.38	0.08	0.11	0.15	0.0	0.0	1.34	5.96	1.22	0.69	-0.08	0.00020	1.5
CLARENCE COOK WELL 7S 4E 13BCC1	5602.	39	134	130	14	107	193	188	245	193	999	364	286	0	92	10.7	11.70	0.05	0.48	24.62	0.38	0.09	0.12	0.14	0.0	0.0	1.08	6.33	1.19	0.64	-0.11	0.00007	2.8

DAVE LATHINEN WELL	7S 4E 13DCD1	4750.	40	135	131	15	108	186	186	228	186	999	363	285	0	91	12.0	10.62	0.02	0.44	30.81	0.37	0.09	0.17	0.17	0.0	0.0	1.28	6.39	1.28	0.74	-0.02	0.00015	1.3
FRANK MILLETT WELL #2	7S 4E 14ABC1	6283.	39	134	130	14	107	196	196	258	196	999	366	289	0	92	9.8	10.90	0.02	0.72	22.64	0.57	0.09	0.11	0.13	0.0	0.0	1.22	6.85	1.32	0.77	0.01	0.00028	1.5
ROBERT BLACK WELL	7S 4E 15ACD1	*****	33	137	132	16	110	88	88	287	172	999	412	999	0	0	8.2	3.64	0.06	0.38	27.67	0.78	0.27	0.28	0.14	0.0	0.0	0.50	11.47	1.50	0.94	0.20	0.00139	4.5
BLAINE RAWLINS WELL #3	7S 4E 23CBB2	*****	39	134	130	14	107	188	188	236	188	999	366	289	0	92	11.3	8.43	0.03	0.59	0.0	0.57	0.12	0.17	0.16	0.0	0.0	0.83	6.86	1.35	0.80	0.04	0.00049	2.0
BELL BRAND RANCHES WELL	7S 4E 25ADC1	*****	37	137	132	16	110	93	93	328	93	999	385	999	0	0	6.6	6.41	0.02	0.39	28.16	0.21	0.16	0.10	0.17	0.0	0.0	1.03	11.98	1.30	0.75	-0.00	0.00012	1.6
GUTHERIES RANCH WELL	7S 4E 26BCB1	4920.	31	131	128	12	104	94	94	268	94	999	407	999	0	0	9.2	6.03	0.05	0.78	33.54	0.75	0.17	0.19	0.20	0.0	0.0	1.48	9.20	1.47	0.90	0.16	0.00070	3.7
DAVE LATHINEN WELL	7S 4E 27BCC1	5261.	27	122	120	3	94	87	87	253	166	999	401	999	0	0	10.2	5.01	0.13	1.14	39.13	1.15	0.20	0.22	0.22	0.0	0.0	1.35	9.99	1.43	0.85	0.12	0.00114	9.7
ACE BLACK WELL #2	7S 5E 5DBC1	95.	32	121	119	3	93	175	175	180	175	999	353	261	0	93	17.6	24.96	0.04	0.62	17.13	0.25	0.04	0.08	0.18	0.0	0.0	0.54	3.82	1.19	0.62	-0.11	0.00007	2.1
DAVIS BROTHERS WELL #1	7S 5E 7ABB1	*****	39	131	128	12	104	187	185	232	187	999	355	264	0	91	11.7	10.46	0.04	0.54	33.55	0.42	0.10	0.13	0.17	0.0	0.0	1.56	6.56	1.30	0.75	-0.00	0.00034	2.6
DAVIS BROTHERS WELL #2	7S 5E 8CCC1	3066.	40	131	127	11	104	184	184	212	184	271	348	255	91	90	13.6	16.25	0.03	0.45	25.99	0.25	0.06	0.11	0.17	0.0	0.0	1.33	5.07	1.24	0.69	-0.07	0.00016	1.7
HARRY LOOS WELL	7S 5E 9DDD1	3406.	40	130	127	11	103	90	46	223	90	267	346	252	90	90	12.5	7.26	0.07	0.44	46.47	0.52	0.14	0.21	0.16	0.0	0.0	1.35	7.96	1.25	0.71	-0.05	0.00022	5.1
ROY DAVIS WELL #2	7S 5E 13AAC1	1325.	25	133	129	13	106	92	92	265	92	999	487	999	0	0	9.4	4.94	0.21	0.54	25.60	0.85	0.20	0.27	0.17	0.0	0.0	0.54	9.55	1.56	0.97	0.25	0.00038	14.3
CARL STEINER WELL	7S 5E 13CBB1	0.	36	127	124	7	99	188	188	229	188	999	351	259	0	92	12.0	13.01	0.0	0.44	21.25	0.29	0.08	0.12	0.17	0.0	0.0	1.28	5.94	1.26	0.70	-0.05	0.00017	0.0
ROBERT TINDALL WELL	7S 5E 16ACD1	0.	40	131	127	11	104	181	181	209	181	271	348	255	91	90	13.9	13.79	0.02	0.33	33.55	0.20	0.07	0.10	0.16	0.0	0.0	1.33	5.61	1.24	0.69	-0.07	0.00021	1.6
BELL BRAND INC. WELL	7S 5E 19CCC1	4428.	37	134	130	14	107	186	186	225	186	999	374	999	0	0	12.3	12.45	0.02	0.49	30.74	0.30	0.08	0.11	0.18	0.0	0.0	1.24	5.79	1.38	0.82	0.07	0.00046	1.4
GENE TINDALL WELL	7S 5E 28ACD1	4239.	34	133	129	13	106	199	187	262	199	999	391	999	0	0	9.6	10.92	0.06	0.46	26.55	0.36	0.09	0.13	0.17	0.0	0.0	1.07	6.36	1.39	0.83	0.09	0.00024	3.7
GEORGE TURNER WELL	7S 6E 7AAC1	0.	25	137	132	16	110	186	184	197	186	999	508	999	0	0	15.3	37.98	0.06	0.54	21.92	0.13	0.03	0.05	0.18	0.0	0.0	1.18	3.15	1.44	0.85	0.13	0.00003	2.6
COLYER CATTLE CO. WELL 3	7S 6E 9BAD1	0.	51	137	132	16	110	131	131	71	131	241	328	223	84	83	60.7	108.96	0.31	0.22	14.58	0.03	0.01	0.04	0.17	0.0	0.0	1.00	1.45	0.69	0.18	-0.61	0.0	14.0
R.L. OWENS WELL #2	7S 6E 16CDC1	0.	43	125	123	6	97	91	62	188	91	223	316	218	87	86	16.3	11.54	0.09	0.54	46.47	0.39	0.09	0.11	0.15	0.0	0.0	1.35	6.38	1.16	0.62	-0.14	0.00037	6.2
HOT SPRINGS RANCH WELL	7S 6E 21DBC1	0.	43	126	123	7	98	94	56	166	94	226	318	219	87	87	20.0	15.96	0.08	0.40	39.74	0.23	0.06	0.10	0.16	0.0	0.0	1.35	5.17	1.17	0.63	-0.14	0.00034	5.7
R.L.OWENS WELL #4	7S 6E 23BBB1	0.	47	121	119	3	93	93	93	205	130	194	288	154	82	78	14.2	9.88	0.22	0.48	0.0	0.43	0.10	0.12	0.14	0.0	0.0	1.43	6.76	1.13	0.60	-0.17	0.01035	14.0
ROSE WILLIAMS WELL	7S 6E 23CAD1	0.	44	137	132	16	110	93	93	222	93	999	352	259	0	89	12.5	7.70	0.15	0.57	22.27	0.69	0.13	0.14	0.12	0.0	0.0	1.39	7.51	1.31	0.77	0.00	0.00080	10.4
R.L. OWENS WELL #7	7S 6E 26ADA1	3899.	38	126	123	7	98	81	81	275	164	255	339	227	91	89	8.9	3.92	0.29	1.49	26.46	2.45	0.25	0.18	0.11	0.0	0.0	1.55	12.76	1.30	0.75	-0.00	0.00166	19.1

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO_2 Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes) T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	$\%_9$	$\%_{11}$	Atomic Ratios: Sodium/Potassium $\frac{Na}{K}$	Sodium/Calcium $\frac{Na}{Ca}$	Magnesium/Calcium $\frac{Mg}{Ca}$	Calcium/Fluoride $\frac{Ca}{F}$	Chloride/Boron $\frac{Cl}{B}$	Chloride/Fluoride $\frac{Cl}{F}$	Calcium/Sodium $\frac{Ca}{Na}$	Molar Ratios: Calcium/Bicarbonate $\frac{Ca}{HCO_3}$	Chloride/Carbonate & Bicarbonate $\frac{Cl}{CO_3+HCO_3}$	Ammonia/Chloride $\frac{NH_4}{Cl}$	Ammonia/Fluoride $\frac{NH_4}{F}$	Chloride/Sulfate $\frac{Cl}{SO_4}$	$\sqrt{Calcium}$/Sodium $\frac{\sqrt{Ca}}{Na}$	Free Energies of Formation of: Quartz ΔG Quartz	Chalcedony ΔG Chal-cedony	Amorphous Silica ΔG Amor-phous	Partial Pressure of CO_2 Gas (atmospheres) PCO_2	R= Magnesium / Magnesium + Calcium + Potassium $\frac{Mg}{Mg+Ca+K}$ **
Owyhee County (cont'd.)																																	
JAMES PRESCOTT WELL 7S 6E 27ADB1	2044.	43	127	124	8	99	87	87	216	87	233	325	221	87	87	13.2	6.97	0.15	0.85	33.16	1.05	0.14	0.14	0.11	0.0	0.0	1.37	8.29	0.93	0.39	-0.38	0.00006	10.7
JEAN PRESCOTT H S 7S 6E 34CCB1S1705.		41	127	124	7	99	99	52	184	99	241	328	223	89	88	17.0	15.47	0.08	0.55	297.88	0.35	0.06	0.09	0.14	0.0	0.0	1.32	5.20	1.02	0.48	-0.28	0.00006	5.2
PRESOTT W S 7S 6E 35BBB1S	0.	40	130	127	11	103	86	86	242	86	267	346	252	90	90	10.9	5.77	0.23	1.05	24.60	1.37	0.17	0.16	0.12	0.0	0.0	1.59	9.63	1.27	0.73	-0.03	0.00046	15.3
INDIAN BATHTUB H S 8S 6E 3BDD1S1699.		39	129	126	10	102	182	129	213	182	267	346	292	91	90	13.5	14.22	0.15	0.81	35.09	0.51	0.07	0.09	0.13	0.0	0.0	1.64	5.52	1.30	0.75	-0.00	0.00068	9.1
INDIAN H S 12S 7E 33C 1S6548.		69	121	119	3	93	61	61	4	67	152	246	40	61	-26	212.6	87.17	0.0	0.32	0.0	0.05	0.01	0.03	0.15	0.0	0.0	0.95	1.88	0.74	0.28	-0.53	0.00126	0.0
MURPHY H S 16S 9E 24BBB1S 265.		51	127	124	7	99	160	160	141	119	200	296	158	81	76	25.5	87.17	0.0	0.34	0.0	0.08	0.01	0.01	0.06	0.0	0.0	1.33	2.97	1.13	0.62	-0.17	0.00866	0.0
Power County																																	
INDIAN SPRINGS 8S 31E 18DAB1S5829.		32	63	68	-46	31	71	71	173	116	999	999	999	0	0	18.7	2.52	0.41	168.45	0.0	51.47	0.40	0.46	1.47	0.0	0.0	31.36	9.10	0.56	-0.01	-0.75	0.00869	27.9
ROCKLAND WARM SPRINGS 10S 30E 15CDC1S1582.		38	67	72	-43	35	72	72	304	154	999	31	999	0	0	7.5	1.17	0.59	167.49	0.0	54.52	0.85	0.88	2.65	0.0	0.0	29.44	17.77	0.51	-0.05	-0.80	0.00463	35.4
Twin Falls County																																	
MIRACLE H S 8S 14E 31ACB1S1325.		54	133	129	13	106	87	87	25	87	207	150	192	80	79	136.1	95.09	0.0	0.94	0.0	0.05	0.01	0.05	0.51	0.0	0.0	3.27	1.42	0.86	0.36	-0.43	0.00003	0.0
HARRY HUTTANUS WELL #2 8S 14E 33CBA1	227.	59	135	131	15	108	108	108	34	108	202	149	139	77	70	113.4	158.49	0.0	0.96	0.0	0.03	0.01	0.02	0.36	0.0	0.0	2.81	1.20	1.00	0.50	-0.29	0.00037	0.0
ED KERPA WELL 9S 14E 9ADD1	1699.	31	102	103	-13	72	78	44	119	78	124	118	97	86	81	32.4	14.57	0.07	2.68	49.24	1.08	0.07	0.09	0.21	0.0	0.0	1.60	5.09	0.85	0.28	-0.46	0.00004	5.2
SAM HIGH AND SONS WELL 11S 19E 33DDD1	7305.	33	112	112	-4	83	69	69	507	157	189	143	151	90	87	3.4	1.10	0.24	26.80	0.0	42.66	0.91	0.35	0.22	0.0	0.0	3.39	35.10	1.24	0.68	-0.07	0.03531	0.0
T. STURGILL WELL 11S 20E 34CCC1	0.	32	76	80	-35	45	51	51	618	182	999	999	999	0	0	2.5	0.45	0.34	3.83	0.0	29.12	2.24	0.35	0.05	0.0	0.0	1.04	68.46	0.76	0.19	-0.55	0.00671	0.0
12S 17E 6CBB1	7570.	37	76	80	-35	45	80	80	315	145	999	999	999	0	0	7.1	2.17	0.44	1.41	12.62	7.97	0.46	0.23	0.04	0.0	0.0	0.79	15.19	0.68	0.12	-0.63	0.01544	27.7
NAT-SOO-PAH W S 12S 17E 31BAB1S	114.	36	61	67	-47	29	81	81	328	155	999	999	999	0	0	6.6	2.20	0.68	2.26	0.0	8.48	0.45	0.19	0.05	0.0	0.0	1.20	15.57	0.45	-0.11	-0.86	0.00804	36.8

IDAHO STATE WELL 12S 18E 18BBA1	2055.	38	115	114	-1	87	65	65	417	176	185	142	148	87	83	4.5	1.55	0.18	7.15	0.0	14.22	0.65	0.29	0.14	0.0	0.0	2.33	30.45	1.19	0.64	-0.11	0.00306	0.0
HOLLISTER VILLAGE WELL 13S 17E 7BAB1	946.	35	67	72	-43	35	84	84	341	148	999	999	999	0	0	6.2	2.26	0.48	1.34	12.89	7.33	0.44	0.21	0.04	0.0	0.0	0.99	15.22	0.56	0.00	-0.74	0.01891	29.1
MAGIC H S 16S 17E 30ACA1S	1457.	46	68	73	-41	36	45	45	396	124	999	999	999	0	0	4.9	0.76	0.49	6.79	0.0	47.41	1.32	0.28	0.04	0.0	0.0	0.69	48.38	0.40	-0.13	-0.90	0.09319	0.0

Valley County

BOILING SPRINGS 12N 5E 22BBC1S	625.	85	133	129	13	106	89	53	61	89	168	133	127	51	35	71.0	65.15	0.09	0.49	0.0	0.07	0.02	0.04	0.19	0.0	0.0	2.71	2.23	0.36	-0.06	-0.87	0.00011	5.6
SILVER CREEK PLUNGE 12N 5E 36DBA1S	0.	39	104	104	-11	74	179	157	181	179	156	128	104	78	67	17.3	45.33	0.33	0.43	0.0	0.13	0.02	0.04	0.12	0.0	0.0	0.81	3.12	0.83	0.28	-0.47	0.00006	12.5
CABARTON H S 13N 4E 31CAB1S	265.	71	123	121	5	95	99	99	47	91	161	130	65	58	-3	89.5	102.55	0.0	2.39	0.0	0.07	0.01	0.04	0.86	0.0	0.0	2.88	1.50	0.76	0.30	-0.51	0.00283	0.0
CASCADE CITY WELL 14N 3E 36ABD1	0.	43	96	98	-18	66	46	46	-1	46	123	114	87	68	53	246.6	63.20	0.0	2.12	0.0	0.20	0.02	0.04	0.30	0.0	0.0	2.39	2.50	0.54	-0.00	-0.77	0.00003	0.0
VULCAN H S 14N 6E 11BDA1S	1892.	87	147	141	26	122	135	135	80	135	194	145	155	57	46	53.3	91.04	0.09	0.38	0.0	0.04	0.01	0.02	0.24	0.0	0.0	1.07	1.64	0.64	0.23	-0.59	0.00065	4.7
ARLING W S 15N 3E 13BBC1S	3020.	34	110	110	-6	81	62	62	14	62	191	143	153	85	81	170.1	80.46	0.13	3.30	0.0	0.24	0.01	0.12	0.44	0.0	0.0	2.71	2.18	0.49	-0.08	-0.82	0.0	0.0
MOLLY'S H S 15N 6E 14ABB1S	76.	59	129	126	10	102	83	83	54	95	192	143	153	71	64	79.4	61.02	0.0	0.32	0.0	0.06	0.02	0.06	0.22	0.0	0.0	1.59	2.32	1.03	0.54	-0.26	0.00163	0.0
SOUTH FORK PLUNGE 15N 6E 14CDB1S	0.	55	112	111	-5	85	62	62	55	62	149	126	109	66	55	78.5	26.15	0.12	0.40	0.0	0.16	0.04	0.10	0.19	0.0	0.0	1.74	3.83	0.37	-0.13	-0.92	0.00001	0.0
PISTOL CREEK H S 16N 10E 14DBC2S	13.	46	115	114	-1	87	65	65	41	54	177	136	131	76	68	100.8	28.94	0.0	0.64	0.0	0.24	0.03	0.08	0.21	0.0	0.0	0.49	3.09	1.08	0.55	-0.22	0.07220	0.0
SUNFLOWER FLAT HS 16N 12E 15BBB1S	136.	65	126	123	7	98	77	77	53	77	173	136	129	65	52	81.8	44.75	0.05	0.04	0.0	0.01	0.02	0.09	0.19	0.0	0.0	0.59	2.58	0.66	0.18	-0.62	0.00005	4.1
RIVERSIDE H S 16N 12E 16CBB1S	0.	43	121	119	3	93	80	80	58	80	203	148	160	81	76	74.6	43.04	0.0	0.48	0.0	0.15	0.02	0.08	0.19	0.0	0.0	0.43	2.60	1.04	0.50	-0.27	0.00009	0.0
HOLDOVER H S 17N 6E 28AA1S	95.	46	115	114	-1	87	73	73	40	73	177	138	131	76	68	102.0	65.38	0.0	0.59	59.71	0.09	0.02	0.04	0.17	0.0	0.0	2.68	2.42	0.84	0.31	-0.46	0.0	0.0
KWISKWIS H S 17N 10E 11BBA1S	57.	69	123	120	4	94	95	95	45	95	162	130	57	59	-7	93.5	83.38	0.0	0.60	0.0	0.06	0.01	0.04	0.30	0.0	0.0	0.70	1.58	0.59	0.12	-0.69	0.00022	0.0
MID FK INDIAN CRK HS 17N 11E 16ACB1S	6.	72	142	137	21	116	136	136	78	136	202	148	160	67	58	55.2	99.62	0.0	0.44	0.0	0.06	0.01	0.03	0.17	0.0	0.0	0.59	1.39	0.77	0.32	-0.49	0.00029	0.0
INDIAN CREEK H S 17N 11E 21B 1S	151.	88	142	137	21	116	137	137	82	137	183	140	-20	54	-75	52.0	95.89	0.0	0.42	0.0	0.05	0.01	0.02	0.16	0.0	0.0	0.61	1.48	0.52	0.11	-0.71	0.00053	0.0
COX H S 17N 13E 27AAC1S	68.	55	117	115	0	88	73	73	22	73	166	133	125	69	58	142.9	77.08	0.0	0.32	0.0	0.06	0.01	0.03	0.15	0.0	0.0	0.58	1.88	0.75	0.24	-0.55	0.00014	0.0
HOSPITAL H S 17N 14E 5CBC1S	8.	0	106	106	-10	76	69	69	34	69	999	999	999	0	0	113.8	44.61	0.0	0.58	0.0	0.12	0.02	0.03	0.16	0.0	0.0	0.88	2.43	1.67	1.03	0.33	0.00050	0.0
TEAPOT H S 18N 6E 9ADC1S	95.	60	117	115	0	88	72	72	47	72	159	129	166	64	99	89.3	47.75	0.0	0.34	26.98	0.11	0.02	0.05	0.11	0.0	0.0	1.40	2.76	0.61	0.12	-0.67	0.0	0.0
HOT CREEK W S 18N 8E 17BDA1S	0.	35	110	110	-6	81	79	79	73	79	188	142	151	84	80	59.5	36.61	0.0	0.84	0.0	0.22	0.03	0.08	0.24	0.0	0.0	0.60	3.16	1.08	0.52	-0.23	0.00011	0.0

Washington County

COVE CREEK H S 10N 3W 9CCC1S	19.	74	152	145	30	127	172	172	144	129	222	157	218	72	71	24.7	27.89	0.02	35.35	12.11	2.02	0.04	0.28	4.91	0.0	0.0	2.71	1.60	1.08	0.63	-0.18	0.00851	1.0
ELVIN CRAIG WELL 11N 2W 16AAB1	0.	20	125	123	6	97	83	83	503	198	999	257	999	0	0	3.4	1.46	1.01	3.93	0.0	48.99	0.68	0.17	0.01	0.0	0.0	0.54	24.59	1.58	0.98	0.27	0.00259	45.4

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO_2 Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes) T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	%9	%11	Atomic Ratios: Sodium/Potassium Na/K	Sodium/Calcium Na/Ca	Magnesium/Calcium Mg/Ca	Calcium/Fluoride Ca/F	Chloride/Boron Cl/B	Chloride/Fluoride Cl/F	Calcium/Sodium Ca/Na	Molar Ratios: Calcium/Bicarbonate Ca/HCO_3	Chloride/Carbonate & Bicarbonate Cl/(CO_3 + HCO_3)	Ammonia/Chloride NH_4/Cl	Ammonia/Fluoride NH_4/F	Chloride/Sulfate Cl/SO_4	$\sqrt{Calcium}$/Sodium $\sqrt{Ca}$/Na	Free Energies of Formation of: Quartz ΔG Quartz	Chalcedony ΔG Chalcedony	Amorphous Silica ΔG Amorphous	Partial Pressure of CO_2 Gas (atmospheres) PCO_2	R= Magnesium/(Magnesium + Calcium + Potassium) Mg/(Mg+Ca+K) **
Washington County (cont'd.)																																	
CRANE CREEK H S 11N 3W 7BDB1S	19.	92	172	162	49	150	163	163	137	163	248	165	225	68	64	26.5	16.83	0.03	33.50	6.09	4.30	0.06	0.22	1.68	0.0	0.0	2.17	2.21	1.00	0.60	-0.22	0.00739	2.1
CRANE CREEK H S 11N 3W 7BDB2S	19.	57	176	165	53	154	166	166	142	135	999	198	999	0	0	25.1	16.83	0.03	33.50	6.09	4.30	0.06	0.22	1.68	0.0	0.0	2.17	2.21	1.55	1.05	0.26	0.00297	2.5
DOUGLAS MCGINNIS WELL 11N 5W 20BDD1	0.	21	105	105	-10	75	61	61	383	156	236	161	222	97	97	5.2	1.18	0.28	7.29	414.33	29.39	0.85	0.35	0.08	0.0	0.0	0.74	30.45	1.34	0.74	0.02	0.00833	0.0
11N 6W 3DBB1	0.	24	259	231	136	254	45	45	-14	45	999	472	999	0	0	340.1	47.55	0.0	7.90	4.27	1.10	0.02	0.10	0.71	0.0	0.0	0.42	2.01	2.60	2.01	1.29	0.00004	0.0
GLENN HILL WELL 11N 6W 3DCB1	0.	25	265	236	142	261	68	68	11	68	999	465	999	0	0	184.2	56.66	0.04	49.13	6.98	3.16	0.02	0.41	1.83	0.0	0.0	0.99	1.77	2.68	2.09	1.37	0.00046	0.0
WEISER H S 11N 6W 10ACB1S	19.	22	80	84	-31	49	42	42	71	87	999	999	999	0	0	60.7	7.26	0.25	7.59	6.32	4.74	0.14	0.42	0.65	0.0	0.0	0.87	7.96	0.99	0.40	-0.32	0.00220	0.0
GEOSOLAR GROWERS WELL #1 11N 6W 10CCA1	0.	78	156	149	34	132	141	141	85	141	228	159	220	71	70	49.6	93.87	0.0	10.35	8.12	0.43	0.01	0.12	1.37	0.0	0.0	1.01	1.32	0.46	0.03	-0.79	0.0	0.0
GEOSOLAR GROWERS WELL #2 11N 6W 10CCA2	0.	77	152	145	30	127	145	145	93	145	218	155	216	70	70	44.9	90.40	0.06	7.15	7.20	0.33	0.01	0.12	1.19	0.0	0.0	0.94	1.35	0.52	0.08	-0.73	0.0	3.0
GEOSOLAR GROWERS WELL #3 11N 6W 10CCA3	0.	70	156	149	34	132	142	142	88	142	246	164	225	77	74	47.6	84.16	0.0	9.10	7.75	0.42	0.01	0.13	1.30	0.0	0.0	1.01	1.40	0.54	0.08	-0.73	0.0	0.0
MIDVALE CITY WELL 13N 3W 8CCC1	0.	28	127	124	8	99	242	144	373	216	999	193	999	0	0	5.4	14.63	0.15	2.37	0.0	5.89	0.07	0.06	0.02	0.0	0.0	0.60	4.64	1.46	0.88	0.15	0.00118	6.1
FAIRCHILD LUMBER CO. 13N 4W 13BAC1	0.	28	120	118	2	91	51	51	5	51	999	176	280	0	95	208.9	42.84	0.09	2.45	0.0	2.37	0.02	0.03	0.03	0.0	0.0	0.62	2.50	1.36	0.78	0.05	0.00061	0.0
LAKEY H S 14N 2W 6BBA1S	1631.	70	119	117	1	91	78	74	47	78	143	125	150	57	91	89.5	20.51	0.01	39.49	0.0	4.24	0.05	1.08	5.39	0.0	0.0	1.90	2.37	0.72	0.26	-0.55	0.00062	0.9
CAMBRIDGE CITY WELL 14N 3W 3DDC1	0.	26	118	116	0	89	180	97	175	180	999	179	291	0	96	18.3	48.95	0.13	2.04	0.0	1.23	0.02	0.03	0.04	0.0	0.0	0.69	2.54	1.34	0.76	0.03	0.00030	5.1
FAIRCHILD H S 14N 3W 19CBD1S	220.	50	106	106	-10	76	63	63	61	63	122	115	93	67	54	71.6	17.43	0.16	10.05	0.0	4.74	0.06	0.15	0.31	0.0	0.0	0.37	4.06	0.79	0.27	-0.51	0.00033	0.0

BASIC DATA TABLE 3

BASIC DATA TABLE 3

TRACE METAL ANALYSES OF SELECTED THERMAL WATER IN IDAHO
(Chemical constituents in milligrams per liter)

Analyses by EG&G Idaho, Inc. using
Neutron Activation at Idaho National Engineering Laboratory

Spring/Well Identification Number & Name	Silver (Ag)	Aluminum (Al)	Arsenic (As)	Gold (Au)	Barium (Ba)	Bromine (Br)	Cadmium (Cd)	Cerium (Ce)	Cobalt (Co)	Chromium (Cr)	Cesium (Cs)	Copper (Cu)	Dysprosium (Dy)	Europium (Eu)	Iron (Fe)	Gallium (Ga)	Hafnium (Hf)	Mercury (Hg)	Indium (In)	Iridium (Ir)	Lanthanum (La)	Lutetium (Lu)	Manganese (Mn)	Molybdenum (Mo)	Neodymium (Nd)	Osmium (Os)	Rubidium (Rb)	Ruthenium (Ru)	Antimony (Sb)	Scandium (Sc)	Selenium (Se)	Samarium (Sm)	Strontium (Sr)	Tantalum (Ta)	Terbium (Tb)	Vanadium (V)	Wolfram (W)	Ytterbium (Yb)	Zinc (Zn)
Ada County																																						
F. KOCH WELL 3N 2E 20BD1	0.0	0.0740	0.0	0.0	0.0	0.0	0.0	0.0	0.0071	0.012	0.0007	0.0	0.0	0.0	0.120	0.0	0.0	0.0	0.0002	0.0	0.0	0.0	0.0067	0.0	0.0	0.0	0.004	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BEARD WELL 3N 2E 11ABC1	0.0	0.0870	0.0	0.0	0.0	0.0	0.0	0.0	0.0016	0.011	0.0023	0.0	0.0	0.0	0.100	0.0	0.0022	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.007	0.0	0.0007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008
DENNIS FLAKE WELL 4N 1E 24DCC1	0.0010	0.2700	0.005	0.0	0.0820	0.002	0.0	0.0	0.0006	0.008	0.0001	0.0	0.0	0.0008	0.430	0.0	0.0	0.0	0.0002	0.0	0.0002	0.0	0.0840	0.0	0.0	0.0	0.0	0.0	0.0001	0.0	0.0007	0.0002	0.0	0.0003	0.0004	0.0	0.002	0.0005	0.008
CARL RUSH WELL 4N 2E 4BDC1	0.0	0.0480	0.021	0.0	0.0	0.014	0.0	0.0	0.0010	0.010	0.0001	0.0	0.0	0.0	0.210	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0080	0.0	0.0	0.0	0.001	0.0	0.0003	0.0	0.0	0.0001	0.0510	0.0	0.0	0.0	0.0	0.0	0.008
EDWARD'S GREENHOUSE WELL 4N 2E 29ACD1	0.0	0.2900	0.0	0.0	0.0	0.0591	1.000	0.0	0.0040	0.018	0.0	1.100	0.0	2.6000	0.0	0.0	0.0	0.0	0.0	0.0	0.0002	0.0	0.0700	0.0	0.0	0.0	0.130	0.0	0.0002	0.0	0.0090	0.0	0.0	0.0	0.0	0.0	0.005	0.0	0.710
SHADOW VALLEY WELL 5N 1E 25BCC1	0.0	0.0580	0.0	0.0	0.0	0.016	0.0	0.0	0.0016	0.0	0.0002	0.0	0.0	0.0	0.150	0.0	0.0003	0.0	0.0003	0.0	0.0	0.0	0.0180	0.0	0.0	0.0	0.004	0.0	0.0001	0.0	0.0	0.0	0.0810	0.0	0.0	0.0	0.0	0.0	0.009
BEN STADLER WELL 5N 1E 26DCD1	0.0	0.0350	0.027	0.0	0.0	0.0	0.0	0.0	0.0020	0.016	0.0001	0.0	0.0	0.0	0.210	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0180	0.0	0.0	0.0	0.004	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.012
JULIUS JEKER WELL 5N 1E 35ACA1	1.3000	45.0000	1.400	0.1000	0.0	0.0	0.0	2.4000	1.6000	0.0	1.7000	0.0	1.500	1.9000	0.0	0.0	1.7000	0.0	1.9000	0.0	2.1000	1.8000	1.6000	0.0	0.0	5.3000	2.100	0.0	1.7000	2.0000	5.1000	1.9000	0.0	2.1000	1.8000	1.7000	1.800	3.2000	0.0
Adams County																																						
WHITE LICKS H S 16N 2E 33BCC1S	0.0001	0.0	0.660	0.0	0.0220	0.034	0.0	0.0	0.0034	0.011	0.0600	0.0	0.0	0.0	0.170	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0140	0.0	0.0	0.0	0.059	0.0	0.0054	0.0	0.0	0.0	0.8600	0.0	0.0	0.0	0.0	0.0	0.007
KRIGBAUM H S 19N 2E 22CCA1S	0.0	0.0710	0.220	0.0	0.0080	0.0	0.0	0.0	0.0024	0.010	0.0034	0.0	0.0	0.0	0.160	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.014	0.0	0.0007	0.0	0.0	0.0	0.1300	0.0	0.0	0.0	0.0	0.0	0.007
ZIM'S RESORT 20N 1E 26DDA1S	0.0	0.0	0.0	0.0	0.0	0.087	0.0	0.0	0.0020	0.010	0.0018	0.0	0.0	0.0	0.100	0.0	0.0001	0.0	0.0	0.0	0.0	0.0320	0.0	0.0	0.0	0.0	0.012	0.0	0.0005	0.0	0.0	0.0	0.0980	0.0	0.0	0.0	0.0	0.0	0.008
STINKY H S 21N 1E 23ABA1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0043	0.018	0.0035	0.0	0.0	0.0	0.170	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0042	0.0	0.0	0.0	0.011	0.0	0.0003	0.0	0.0	0.0	0.3200	0.0	0.0	0.0	0.0	0.0	0.010
BOULDER CREEK RESORT 22N 1E 34DAD1S	0.0	0.0560	0.0	0.0	0.0	0.0	0.0	0.0	0.0016	0.009	0.0001	0.0	0.0	0.0	0.110	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008
STARKEY H S 18N 1W 34DBB1S	0.0	0.1100	0.0	0.0	0.0	0.0	0.0	0.0	0.0016	0.013	0.0002	0.0	0.0	0.0	0.110	0.0	0.0028	0.0	0.0	0.0	0.0	0.0	0.0014	0.0	0.0	0.0	0.004	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.009
Bannock County																																						
ROBERT BROWN WELL #1 5S 34E 26DAB1	0.0	0.0	0.0	0.0	0.0880	0.0	0.0	0.0	0.0050	0.016	0.0060	0.0	0.0	0.0	0.570	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0065	0.0	0.0	0.0	0.065	0.0	0.0015	0.0	0.0	0.0	1.1400	0.0	0.0	0.0	0.0	0.0	0.017
DEAN MORRIS WELL 9S 38E 21DDA1S	0.0	0.2100	0.0	0.0	0.1200	0.0	0.0	0.0	0.0030	0.096	0.0120	0.0	0.0	0.0	0.450	0.0	0.0	0.0006	0.0004	0.0	0.0	0.0001	0.0	0.0	0.0	0.0016	0.086	0.0	0.0	0.0	0.0	0.0	0.5600	0.0	0.0	0.0	0.0	0.0	0.017
DOWNATAH H S 12S 37E 12CCD1S	0.0	0.1200	0.0	0.0	0.1300	0.0	0.0	0.0003	0.0040	0.014	0.0040	0.0	0.0	0.0	0.100	0.0	0.0001	0.0001	0.0002	0.0	0.0280	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0002	0.0	0.2200	0.0	0.0	0.0028	0.0	0.0	0.017
Bear Lake County																																						
BEAR LAKE H S 13S 44E 13CCA1S	0.0	0.2100	0.0	0.0	0.0	0.0	0.0	0.0	0.0030	0.011	0.0080	0.0	0.0	0.0	0.150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.062	0.0	0.0002	0.0	0.0004	0.0	4.2000	0.0	0.0	0.0	0.0	0.0	0.010
Bingham County																																						
YANDELL SPRINGS 3S 37E 31DBB1S	0.0	0.0280	0.0	0.0	0.0630	0.0	0.0	0.0008	0.0030	0.012	0.0020	0.0	0.0	0.0	0.070	0.0	0.0	[illegible]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013	0.0	0.0001	0.0011	0.0	0.0	1.2000	0.0	0.0	0.0	0.0	0.0	0.011
ALKALI FLATS W S 4S 38E 28DDD1S	0.0	2.5000	0.090	0.0	0.3600	0.070	0.0	0.0009	0.0030	0.034	0.0005	0.0	0.0	0.0002	2.800	0.0	0.0003	0.0	0.0	0.0	0.0090	0.0	0.6400	0.0	0.0052	0.0	0.120	0.0	0.0240	0.0006	0.0	0.0010	0.0050	0.0	0.0001	0.0	0.003	0.0	0.182
Blaine County																																						
HAILEY H S 2N 18E 18DBB1S	0.0	0.0910	0.0	0.0	0.0	0.0	0.0	0.0	0.0010	0.009	0.0038	0.0	0.0	0.0	0.100	0.0	0.0026	0.0	0.0	0.0	0.0	0.0	0.0018	0.0	0.0	0.0	0.010	0.0	0.0040	0.0	0.0	0.0	0.0580	0.0	0.0	0.0	0.083	0.0	0.007
CLARENDON H S 3N 17E 27DCB1S	0.0	0.0770	0.0	0.0	0.0	0.0	0.0	0.0007	0.0013	0.013	0.0046	0.0	0.0	0.0	0.100	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013	0.0	0.0004	0.0	0.0	0.0	0.0330	0.0	0.0	0.0	0.100	0.0	0.010
GUYER H S 4N 17E 15AAC1S	0.0	0.0800	0.0	0.0	0.0	0.0	0.900	0.0	0.0019	0.001	0.0074	0.0	0.0	0.0	0.040	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.016	0.0	0.0002	0.0	0.0	0.0	0.1300	0.0	0.0	0.0	0.100	0.0	0.007
WARFIELD H S 4N 17E 31BBC1S	0.0	0.1040	0.0	0.0	0.0	0.0	0.0	0.0	0.0014	0.009	0.0075	0.0	0.0	0.0	0.080	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.102	0.0	0.0	0.016	0.003	0.0002	0.0	0.0	0.0	0.0630	0.0	0.0	0.0	0.0	0.0	0.007

MAGIC H S LANDING WELL 1S 17E 23AAB1	0.0	0.0	0.175	0.0	0.2200	0.0	0.0	0.0	0.0016	0.011	0.0650	0.0	0.0	0.0	0.340	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0670	0.0	0.0	0.0	0.166	0.0	0.0036	0.0	0.0	0.0	0.9400	0.0	0.0	0.0	0.0	0.0	0.011
MILFORD SWEAT H S 1S 22E 10AB1S	0.0	0.0470	0.090	0.0	0.0750	0.0	0.0	0.0	0.0019	0.024	0.0080	0.0	0.0	0.0	0.160	0.0	0.0024	0.0	0.0	0.0	0.0	0.0	0.0290	0.0	0.0	0.0	0.022	0.001	0.0029	0.0	0.0014	0.0	0.3900	0.0	0.0	0.0	0.0	0.0	0.010
Boise County																																							
HOT SPRINGS CAMPGROUND 8N 5E 6DCB1S	0.0	0.0860	0.0	0.0	0.0	0.0	0.0	0.0	0.0015	0.010	0.0020	0.0	0.0	0.0	0.090	0.0	0.0026	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.007	0.0	0.0002	0.0	0.0023	0.0	0.0720	0.0	0.0	0.0	0.0	0.0	0.006
DAN HODGES H S 8N 5E 11ABB1S	0.0	0.3600	0.010	0.0	0.0050	0.002	0.0	0.0	0.0010	0.016	0.0020	0.0	0.0	0.0	0.050	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.016	0.0	0.0	0.007	0.0	0.0003	0.0	0.0	0.0	0.0720	0.0	0.0	0.0	0.040	0.0	0.020
DEER H S 9N 3E 25BAC1S	0.0	0.4900	0.0	0.0	0.0	0.006	0.0	0.0	0.0010	0.012	0.0060	0.0	0.0	0.0	0.140	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0060	0.018	0.0	0.0020	0.022	0.0	0.0010	0.0	0.0	0.0	0.1600	0.0	0.0	0.0	0.016	0.0	0.060
KIRKHAM H S 9N 8E 32CAB1S	0.0006	0.1500	0.050	0.0	0.0	0.002	0.0	0.0	0.0030	0.011	0.0003	0.0	0.0	0.0	0.090	0.0	0.0	0.0	0.0004	0.0	0.0	0.0	0.0020	0.022	0.0	0.0	0.002	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.014	0.0	0.012
BONNEYVILLE H S 10N 10E 31BCC1S	0.0060	0.5500	1.200	0.0	0.0	0.004	0.0	0.0	0.0030	0.011	0.0030	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0004	0.0	0.0	0.0	0.0010	0.049	0.0	0.0	0.018	0.0	0.0004	0.0	0.0	0.0	0.1500	0.0	0.0	0.0	0.060	0.0	0.014
Bonneville County																																							
FALL CREEK MINERAL SPG. 1N 43E 9CBB1S	0.0	0.0	0.0	0.0	0.0290	0.062	0.0	0.0	0.0060	0.061	0.0950	0.0	0.0	0.0	0.430	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.370	0.0	0.0002	0.0	0.0	0.0	2.4000	0.0	0.0	0.0	0.0	0.0	0.026
BROCKMAN CREEK W S 2S 42E 26DCD1S	0.0	1.3000	0.0	0.0	0.2300	0.0	0.0	0.0	0.0100	0.118	0.0050	0.0	0.0	0.0005	7.100	0.0	0.0008	0.0	0.0044	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.065	0.230	0.0	0.0002	0.0	0.0	5.0000	0.0	0.0	0.0	0.0	0.0	0.100
ALPINE W S 2S 46E 19CAD1S	0.0070	0.0	4.300	0.0001	0.1900	0.160	0.0	0.0	0.0090	0.110	0.0540	0.0	0.0	0.0	6.800	0.0	0.0	0.0	0.0	0.0	0.0047	0.0	3.3000	0.0	0.0	0.0	0.510	0.0	0.0006	0.0	0.0	0.0	4.9000	0.0001	0.0	0.0	0.0	0.0	0.045
Camas County																																							
WARDROP H S 1N 13E 32ABB1S	0.0	0.3600	0.0	0.0	0.0	0.0	0.0	0.0	0.0030	0.016	0.0020	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BAUMGARTNER H S 3N 12E 7DCD1S	0.0	0.0640	0.0	0.0	0.0	0.0	0.0	0.0	0.0016	0.008	0.0005	0.0	0.0	0.0	0.050	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0018	0.0	0.0	0.0	0.005	0.0	0.0057	0.0	0.0	0.0	0.0560	0.0	0.0	0.0	0.0	0.0	0.006
LIGHTFOOT H S 3N 13E 7DCA1S	0.0	0.0900	0.0	0.0	0.0050	0.0	0.0	0.0003	0.0020	0.010	0.0049	0.0	0.0	0.0	0.080	0.0	0.0001	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.012	0.0	0.0002	0.0	0.0	0.0003	0.0900	0.0	0.0	0.0	0.0	0.0	0.009
WORSWICK H S 3N 14E 28CAA1S	0.0002	0.4500	0.0	0.0	0.0	0.0	0.0	0.0	0.0100	0.012	0.0080	0.0	0.0	0.0	0.100	0.0	0.0	0.0001	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.014	0.0	0.0002	0.0	0.0	0.0	0.0550	0.0	0.0	0.0	0.0	0.0	0.010
KEITH STROM WELL 1S 12E 31CBC1	0.0	0.1500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.011	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0002	0.0	0.0	0.0	0.0030	0.0	0.0	0.0	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0030	0.0	0.0	0.008
BARRON'S H S 1S 13E 34BCB1S	0.0	0.4600	0.0	0.0	0.0	0.0	0.0	0.0007	0.0040	0.026	0.0080	0.0	0.0	0.0	0.230	0.0	0.0	0.0	0.0006	0.0	0.0	0.0	0.0110	0.0	0.0	0.0	0.016	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.020
Canyon County																																							
DON TIEGS WELL #1 1N 2W 8ABC1	0.0	0.0	0.038	0.0	0.0270	0.150	0.0	0.0010	0.0	0.018	0.0	0.0	0.0	0.0	0.110	0.0	0.0	0.0010	0.0005	0.0	0.0	0.0	0.0350	0.0	0.0	0.0	0.007	0.0	0.0003	0.0	0.0010	0.0020	0.2800	0.0	0.0	0.0	0.0	0.0	0.009
MELBA CITY WELL 1N 2W 36CAA1	0.0	0.0	0.0	0.0	0.0	0.093	0.0	0.0	0.0016	0.012	0.0001	0.0	0.0	0.0	0.100	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0040	0.0	0.0	0.0	0.005	0.0	0.0001	0.0	0.0	0.0	0.0340	0.0	0.0	0.0	0.0	0.0	0.009
ERCIL BOWMAN JR. WELL 2N 2W 34BDA1	0.0	0.0290	0.0	0.0	0.0	0.025	0.0	0.0	0.0020	0.019	0.0010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0006	0.0	0.0	0.0	0.0080	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.014	0.0	0.160
CALDWELL MUNC. PARK WELL 4N 3W 28AAB1	0.0	0.0630	0.0	0.0	0.0	0.0	0.0	0.0	0.0024	0.017	0.0001	0.0	0.0	0.0	0.100	0.0	0.0	0.0001	0.0	0.0	0.0	0.0	0.0240	0.0	0.0	0.0	0.003	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.009
CALDWELL CITY WELL 4N 3W 35ABD1	0.0	0.0001	0.031	0.0	0.0330	0.061	0.0	0.0017	0.0105	0.014	0.0001	0.0	0.0	0.0	0.080	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0014	0.0	0.0013	0.0	0.0	0.0	0.0003	0.5100	0.0002	0.0	0.1200	0.0	0.0	0.0042	0.0	0.0	0.013
Caribou County																																							
PORTNEUF RIVER W S 7S 38E 26CBD1S	0.0	0.1800	0.0	0.0	0.0360	0.0	0.0	0.0007	0.0020	0.024	0.0120	0.0	0.0	0.0	0.160	0.0	0.0	0.0	0.0005	0.0	0.0	0.0	0.1400	0.0	0.0	0.0	0.070	0.0	0.0	0.0	0.0	0.0	1.3000	0.0	0.0	0.0	0.0	0.0	0.011
SODA SPRINGS GEYER 9S 41E 12ADD1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0100	0.047	0.0040	0.0	0.0	0.0	0.690	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.043	0.0	0.0	0.0	0.0	0.0	3.7000	0.0	0.0	0.0	0.0	0.0	0.048
Cassia County																																							
OAKLEY H S 14S 22E 27DCB1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.013	0.0009	0.0	0.0	0.0	0.130	0.0	0.0	0.0012	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.012	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OAKLEY H S 14S 22E 27DCB1S	0.0002	0.3800	0.060	0.0	0.0	0.005	0.0	0.0002	0.0010	0.010	0.0008	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.011	0.0	0.0002	0.0	0.0	0.0	0.0300	0.0	0.0	0.0	0.0	0.0	0.011
HARRIAT CRANK WELL 15S 26E 23DDC1	0.0016	0.0	32.000	0.0	0.1100	0.290	0.0	0.0	0.0020	0.083	0.1250	0.0	0.0	0.0	0.510	0.0	0.0	0.0009	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0110	0.480	0.0	0.0040	0.0	0.0	0.0	2.7000	0.0	0.0	0.0	0.0	0.0	0.011
Clark County																																							
LIDY H S WELL 10N 33E 35CCC1	0.0	0.2000	0.0	0.0	0.0760	0.0	0.0	0.0	0.0020	0.019	0.0030	0.0	0.0	0.0	0.120	0.0	0.0	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.018	0.0	0.0001	0.0	0.0	0.0	0.4200	0.0	0.0	0.0	0.0	0.0	0.012

Basic Data Table 3. Trace Metal Analyses of Selected Thermal Water in Idaho (continued)

Spring/Well Identification Number & Name	Silver (Ag)	Aluminum (Al)	Arsenic (As)	Gold (Au)	Barium (Ba)	Bromine (Br)	Cadmium (Cd)	Cerium (Ce)	Cobalt (Co)	Chromium (Cr)	Cesium (Cs)	Copper (Cu)	Dysprosium (Dy)	Europium (Eu)	Iron (Fe)	Gallium (Ga)	Hafnium (Hf)	Mercury (Hg)	Indium (In)	Iridium (Ir)	Lanthanum (La)	Lutetium (Lu)	Manganese (Mn)	Molybdenum (Mo)	Neodymium (Nd)	Osmium (Os)	Rubidium (Rb)	Ruthenium (Ru)	Antimony (Sb)	Scandium (Sc)	Selenium (Se)	Samarium (Sm)	Strontium (Sr)	Tantalum (Ta)	Terbium (Tb)	Vanadium (V)	Wolfram (W)	Ytterbium (Yb)	Zinc (Zn)
Custer County																																							
WEST PASS H S 8N 17E 32BCA1S	0.0	0.1700	0.0	0.0	0.0990	0.009	0.680	0.0	0.0050	0.011	0.0310	0.0	0.0	0.0	0.110	0.0	0.0	0.0	0.0004	0.0	0.0008	0.0	0.0180	0.0	0.0	0.0	0.044	0.0	0.0001	0.0	0.0	0.0	0.5100	0.0	0.0	0.0	0.057	0.0	0.011
STANLEY H S 10N 13E 3CAB1S	0.0004	0.3100	0.0	0.0	0.0	0.002	0.0	0.0	0.0020	0.009	0.0020	0.0	0.0	0.0	0.110	0.0	0.0	0.0	0.0003	0.0	0.0	0.0001	0.0030	0.032	0.0	0.0020	0.003	0.0	0.0005	0.0	0.0	0.0	0.0600	0.0	0.0	0.0	0.032	0.0	0.012
SLATE CREEK H S 10N 16E 30BAD1S	0.0	0.0	0.0	0.0	0.4400	0.037	0.0	0.0	0.0020	0.014	0.0290	0.0	0.0	0.0	0.150	0.0	0.0003	0.0	0.0006	0.0	0.0	0.0	0.0700	0.0	0.0	0.0	0.042	0.017	0.0020	0.0	0.0	0.0	1.1000	0.0	0.0	0.0	0.0	0.0	0.016
SUNBEAM H S 11N 15E 19CAB1S	0.0	0.7800	0.0	0.0	0.0250	0.003	0.790	0.0	0.0040	0.014	0.0008	0.0	0.0	0.0	0.130	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.023	0.0	0.0010	0.0	0.0	0.0	0.0720	0.0	0.0	0.0	0.020	0.0	0.046
SUNBEAM H S 11N 15E 19CAB1S	0.0002	0.4700	0.038	0.0	0.0	0.004	0.0	0.0	0.0010	0.012	0.0040	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.011	0.0	0.0004	0.0	0.0	0.0	0.0640	0.0	0.0	0.0	0.031	0.0	0.073
BARNEY W S 11N 25E 23CAB1S	0.0	0.0280	0.0	0.0001	0.0530	0.011	0.0	0.0003	0.0010	0.011	0.0002	0.0	0.0	0.0	0.070	0.0	0.0002	0.0001	0.0	0.0	0.0	0.0	0.0009	0.0	0.0	0.0	0.002	0.0	0.0001	0.0	0.0010	0.0	0.1000	0.0	0.0	0.0004	0.0	0.0	0.011
BILL JOHNSTON WELL 14N 19E 34DAA1	0.0	0.2400	0.0	0.0	0.0670	0.008	0.0	0.0	0.0006	0.008	0.0040	0.0	0.0	0.0	0.110	0.0	0.0	0.0006	0.0	0.0	0.0	0.0	0.0160	0.0	0.0	0.0	0.014	0.0	0.0007	0.0	0.0	0.0001	0.9600	0.0	0.0	0.0	0.0	0.0	0.008
Elmore County																																							
CHARLES BAKER WELL 3N 10E 10ABA1	0.0	0.0760	0.040	0.0	0.0	0.0	0.0	0.0	0.0015	0.013	0.0006	0.0	0.0	0.0	0.100	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0022	0.0	0.0	0.0	0.005	0.0	0.0002	0.0	0.0	0.0	0.0370	0.0	0.0	0.0	0.0	0.0	0.017
PARADISE H S 3N 10E 33ACD1S	0.0	0.0940	0.0	0.0	0.0	0.0	0.0	0.0	0.0022	0.010	0.0012	0.0	0.0	0.0	0.090	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.0	0.0	0.0	0.008	0.0	0.0002	0.0	0.0	0.0	0.0650	0.0	0.0	0.0	0.0	0.0	0.010
PARADISE RESORT WELL 3N 10E 33BDB1	0.0	0.3600	0.0	0.0002	0.0	0.003	0.0	0.0	0.0080	0.012	0.0010	0.0	0.0	0.0	0.120	0.0	0.0	0.0	0.0005	0.0001	0.0	0.0	0.0	0.0	0.0	0.0023	0.008	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013
NINEMEYER H S 5N 7E 24BDD1S	0.0	0.5700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013	0.0030	0.0	0.0	0.0	0.0	0.0	0.0	0.0220	0.0006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.017
DUTCH FRANK'S H S 5N 9E 7BBA1S	0.0	0.4000	0.0	0.0	0.0	0.0	0.0	0.0	0.0030	0.012	0.0030	0.0	0.0	0.0	0.100	0.0	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.006	0.0	0.0002	0.0	0.0	0.0	0.0300	0.0	0.0	0.0	0.0	0.0	0.017
LESLIE BEAM WELL #1 3S 8E 36CAD1	0.0045	110.0000	1.500	0.0044	0.6500	0.0	11.000	0.0070	0.0090	0.035	0.0070	0.0	0.0	0.0070	0.0	0.0	0.0060	0.0	0.0070	0.0	0.0100	0.0078	0.0	0.0	0.0	0.0	0.005	0.0	0.0100	0.0070	0.0290	0.0073	0.3700	0.0160	0.0068	0.0	0.0	0.0100	0.0
MAGIC WEST CO. WELL 5S 10E 32BDB1	0.0	0.4000	0.0	0.0	0.0	0.032	0.0	0.0	0.0010	0.022	0.0004	0.0	0.0	0.0	0.210	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0014	0.003	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.015
Franklin County																																							
CLEVELAND H S 12S 41E 31CAC1S	0.0	0.0	0.0	0.0003	0.0570	0.0	0.0	0.0	0.0	0.020	0.0260	0.002	0.0	0.0	0.280	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0700	0.0	0.0	0.0	0.140	0.0	0.0004	0.0	0.0	0.0	1.8000	0.0	0.0	0.0	0.0	0.0	0.012
MAPLE GROVE H S 13S 41E 7ACA1S	0.0	0.0	0.0	0.0	0.0940	0.0	0.0	0.0	0.0020	0.024	0.0410	0.0	0.0	0.0	0.250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1300	0.0	0.0	0.0	0.150	0.0	0.0	0.0	0.0	0.0	1.5000	0.0	0.0	0.0	0.0	0.0	0.010
ELDIN BINGHAM WELL 15S 39E 7DBC1	0.0	0.0	0.0	0.0	4.0000	0.0	0.0	0.0	0.0100	0.120	0.3500	0.0	0.0	0.0	5.800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7800	0.0	0.0	0.0	4.200	0.0	0.0001	0.0	0.0	0.0	18.0000	0.0	0.0	0.0	0.0	0.0	0.067
BATTLE CREEK H S 15S 39E 8BDC1	0.0008	0.0	0.0	0.0	1.8000	0.0	0.0	0.0	0.0030	0.091	0.1800	0.0	0.0	0.0	0.760	0.0	0.0006	0.0009	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0110	2.700	0.0	0.0037	0.0	0.0	0.0	9.4000	0.0001	0.0	0.0	0.0	0.0	0.033
SQUAW H S WELL 15S 39E 17BCD1	0.2500	115.0000	0.660	0.0420	38.0000	0.0	0.0	0.4600	0.3000	0.760	0.4000	0.0	0.260	0.3000	0.0	0.0	0.3300	0.0	0.3800	0.0	0.3600	0.3900	0.4000	0.0	0.3790	0.7700	0.280	0.0	0.3000	0.3000	0.9100	0.2500	0.0	0.3400	0.2900	0.2800	0.0	0.0500	0.0
Fremont County																																							
NEWDALE CITY WELL 7N 41E 34DCD1	0.0	0.0530	0.0	0.0	0.0800	0.0	0.0	0.0010	0.0020	0.027	0.0040	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3300	0.0	4.3000	0.0	0.0	0.0	0.031	0.0	0.0002	0.0	0.0	0.0	0.0800	0.0	0.0	0.0	0.0	0.0	0.014
ASHTON W S 9N 42E 23DAC1S	0.0	2.3000	0.080	0.0001	0.2500	0.060	0.0	0.0	0.0	0.022	0.0	0.0	0.0	0.0	7.000	0.0	0.0	0.0	0.0017	0.0	0.0080	0.0	0.6400	0.0	0.0	0.0	0.0	0.0	0.0300	0.0005	0.0	0.0009	0.0	0.0	0.0	0.0060	0.001	0.0	0.200
BIG SPRINGS 14N 44E 34BBC1S	0.0009	0.3000	0.0	0.0	0.0	0.052	0.0	0.0	0.0030	0.020	0.0	0.890	0.0	0.0	1.800	15.000	0.0	0.0020	0.0007	0.0	0.0002	0.0	0.0600	0.035	0.0	0.0	0.099	0.0	0.0002	0.0	0.0070	0.0001	0.0	0.0	0.0	0.0	0.002	0.0	0.690
Gem County																																							
ROYSTONE H S 7N 1E 8DDA1	0.0	0.4700	0.013	0.0	0.0	0.010	0.0	0.0	0.0007	0.012	0.0090	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.0000	0.0	0.0170	0.022	0.0	0.0	0.028	0.0	0.0013	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.028	0.0	0.015
Gooding County																																							
J. SHANNON WELL 4S 13E 28ABB1	0.0005	0.4100	0.0	0.0	0.2200	0.0	0.0	0.0004	0.0130	0.015	0.0010	0.0	0.0	0.0	0.210	0.0	0.0001	0.0003	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0084	0.021	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0060	0.0	0.0	0.018
WHITE ARROW H S 4S 13E 30ADB1S	0.0	0.1110	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013	0.0010	0.0	0.0	0.0	0.120	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.005	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0017	0.0	0.0	0.007
DAVE ARCHER WELL #2 5S 12E 3AAA1	0.0	0.0790	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.009	0.0001	0.0	0.0	0.0	0.090	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.010

Idaho County																																							
BURGDORF H S 22N 4E 18DC1S	0.0	0.0910	0.0	0.0	0.0	0.0	0.0	0.0	0.0066	0.012	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0010	0.0	0.0	0.0	0.008	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008
RIGGINS H S 24N 2E 14DBD1S	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0024	0.013	0.0020	0.0	0.0	0.0	0.100	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.011	0.0	0.0002	0.0	0.0	0.0	0.3100	0.0	0.0	0.0	0.0	0.0	0.011
WEIR CREEK H S 36N 11E 13BCC1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.011	0.0007	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0	0.0	0.0290	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0010	0.0680	0.0	0.0	0.0018	0.0	0.0	0.001
COLGATE LICKS H S 36N 12E 15ADB1S	0.0	0.1050	0.0	0.0	0.0030	0.002	0.0	0.0	0.0016	'0.010	0.0028	0.0	0.0	0.0	0.090	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0014	0.0	0.0	0.0	0.005	0.0	0.0002	0.0	0.0	0.0	0.0640	0.0	0.0	0.0	0.0	0.0	0.008
JERRY JOHNSON H S 36N 13E 18ADD1S	0.0	0.0600	0.0	0.0	0.0	0.0	0.0	0.0002	0.0010	0.008	0.0	0.0	0.0	0.0	0.060	0.0	0.0	0.0	0.0001	0.0	0.0	0.0	0.0027	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0001	0.0060	0.0	0.0	0.0022	0.0	0.0	0.003
Jefferson County																																							
HEISE H S 4N 40E 25DDA1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.0060	0.044	0.1700	4.700	0.0	0.0	0.540	65.000	0.0	0.0	0.0	0.0	0.0	0.0	0.2000	0.0	0.0	0.0	0.660	0.0	0.0001	0.0	0.0	0.0	4.9000	0.0	0.0	0.0	0.0	0.0	0.031
Lemhi County																																							
CRONKS CANYON H S 16N 21E 18ADC1S	0.0	0.1070	0.0	0.0	0.0300	0.0	0.0	0.0	0.0020	0.011	0.0200	0.0	0.0	0.0	0.180	0.0	0.0023	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.057	0.0	0.0009	0.0	0.0010	0.0	0.3300	0.0	0.0	0.0	0.0	0.0	0.009
SALMON H S 20N 22E 3ABD1S	0.0	0.0	0.0	0.0	0.0250	0.0	0.0	0.0	0.0020	0.012	0.0440	0.0	0.0	0.0	0.360	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0130	0.0	0.0	0.0	0.170	0.0	0.0026	0.0	0.0	0.0	0.5800	0.0	0.0	0.0	0.0	0.0	0.007
SHARKEY H S 20N 24E 34CCC1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0008	0.0012	0.011	0.0670	0.0	0.0	0.0	0.090	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0080	0.0	0.140	0.0	0.0028	0.0	0.0	0.0055	0.5000	0.0	0.0	0.0	0.0	0.0	0.008
BIG CREEK H S 23N 18E 22CAD1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.014	0.0830	0.0	0.0	0.0	0.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0140	0.0	0.0	0.0	0.170	0.0	0.0005	0.0	0.0	0.0	0.2100	0.0	0.0	0.0	0.0	0.0	0.008
Oneida County																																							
KENT W S 12S 34E 36BCB1S	0.0	0.2700	0.0	0.0	0.1100	0.043	0.0	0.0005	0.0020	0.018	0.0003	0.0	0.0	0.0	0.140	0.0	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.005	0.0	0.0003	0.0	0.0006	0.0	0.2200	0.0	0.0	0.0030	0.0	0.0	0.010
MALAD W S 14S 36E 27CDA1S	0.0	0.0	0.0	0.0	0.5500	0.0	0.0	0.0	0.0030	0.055	0.1400	0.0	0.0	0.0	0.300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.100	0.0	0.7700	0.0003	0.0	0.0	2.8000	0.0	0.0	0.0	0.0	0.0	0.019
PLEASANTVIEW W S 15S 35E 3AAB1S	0.0	0.0	0.0	0.0	0.0470	0.0	0.0	0.0	0.0030	0.016	0.0150	0.0	0.0	0.0	0.140	0.0	0.0006	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.093	0.0	0.0001	0.0	0.0009	0.0	1.3000	0.0	0.0	0.0	0.0	0.0	0.017
WOODRUFF H S 16S 36E 10BBC1S	0.0	0.0	0.0	0.0	0.1700	0.0	0.0	0.0	0.0010	0.026	0.0360	0.0	0.0	0.0	0.130	0.0	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.250	0.0	0.0003	0.0	0.0008	0.0	3.4000	0.0	0.0	0.0	0.0	0.0	0.009
Owyhee County																																							
EARL FOOTE WELL 1S 2W 7CCB1	0.0005	0.2600	0.010	0.0	0.0	0.003	0.0	0.0	0.0040	0.023	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.021	0.0	0.0	0.0	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.030	0.0	0.022
GEORGE KING WELL 4S 1E 34BAD1	0.0003	0.1100	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.013	0.0010	0.0	0.0	0.0	0.110	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.004	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008
R. KETTERLING WELL 4S 2E 32BCC1 .	0.0	0.1400	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.012	0.0002	0.0	0.0	0.0	0.150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0050	0.0	0.0	0.0	0.004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0001	0.010
E. LAWERENCE WELL #3 5S 1E 24ADB1	0.0	0.4800	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.013	0.0006	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0030	0.0	0.0	0.0	0.003	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.110
OSCAR FIELDS WELL 5S 2E 18BC1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0010	0.0030	0.022	0.0003	0.0	0.0	0.0	0.190	0.0	3.5000	0.0003	0.0	0.0	0.0110	0.0	0.0	0.0	0.0	0.0	0.0	0.008	0.0002	0.0	0.0	0.0	0.0	0.0	1.6000	0.0	0.0	0.0	0.008
COOKE'S GREENHOUSE WELL 5S 3E 26BCB1	0.0	0.1600	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.012	0.0020	0.0	0.0	0.0	0.090	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.014
LESLIE POST WELL #2 6S 3E 2CCC1	0.0	0.0660	0.0	0.0	0.0770	0.0	0.0	0.0008	0.0020	0.002	0.0006	0.0	0.0	0.0	0.130	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008	0.0	0.0001	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.130	0.0	0.008
IDAHO PARKS DEPT. 6S 6E 12DDD1	0.0	0.4200	0.0	0.0	0.0160	0.0	0.0	0.0	0.0004	0.002	0.0001	0.0	0.0	0.0	0.030	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0520	0.0	0.0	0.0	0.004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.002
DAVIS BROTHERS WELL #1 7S 5E 7ABB1	0.0	0.0870	0.0	0.0	0.0	0.0	0.0	0.0	0.0030	0.015	0.0004	0.0	0.0	0.0	0.060	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.012	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013
COLYER CATTLE CO. WELL # 7S 6E 9BAD1	0.0	0.0620	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.014	0.0002	0.0	0.0	0.0	0.520	0.0	0.0	0.0	0.0002	0.0	0.0	0.0	0.0020	0.0	0.0	0.0	0.006	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008
INDIAN BATHTUB H S 8S 6E 3BDD1S	0.0002	0.1500	0.290	0.0	0.0	0.0	0.0	0.0004	0.0030	0.017	0.0003	0.0	0.0	0.0	0.110	0.0	0.0	0.0	0.0003	0.0	0.0	0.0001	0.0	0.0	0.0	0.0010	0.011	0.0	0.0004	0.0	0.0004	0.0003	0.0	0.0	0.0	0.0030	0.0	0.0	0.014
INDIAN H S 12S 7E 33C 1S	0.0001	0.1100	0.034	0.0	0.0	0.0	0.0	0.0	0.0020	0.010	0.0021	0.0	0.0	0.0	0.120	0.0	0.0026	0.0	0.0	0.0	0.0	0.0	0.0026	0.0	0.0	0.0	0.004	0.0	0.0006	0.2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008
MURPHY H S 16S 9E 24BBB1S	0.0	0.1480	0.0	0.0	0.0	0.0	0.0	0.0004	0.0030	0.012	0.0002	0.0	0.0	0.0	0.180	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.0	0.0	0.0	0.003	0.0	0.0002	0.0	0.0002	0.0	0.0	0.0	0.0	0.0015	0.0	0.0	0.0
Power County																																							
INDIAN SPRINGS 8S 31E 18DAB1S	0.0	0.1600	0.0	0.0	0.2100	0.0	0.0	0.0004	0.0020	0.019	0.0060	0.0	0.0	0.0	0.120	0.0	0.0001	0.0005	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0084	0.021	0.0	0.0050	0.0	0.0005	0.0	1.4000	0.0	0.0	0.0	0.0	0.0	0.017
Twin Falls County																																							
SAM HIGH AND SONS WELL 11S 19E 33DDD1	0.0	0.3100	0.0	0.0004	14.0000	1.800	0.0	0.0320	0.1500	1.500	0.0550	0.0	0.0	0.0	12.000	0.0	0.0	0.0	0.0	0.0	0.1200	0.0	0.0	0.0	0.0	0.0	1.100	0.0	0.0140	0.0	0.0330	0.0230	15.0000	0.0	0.0	0.0020	0.0	0.0	0.660

Basic Data Table 3. Trace Metal Analyses of Selected Thermal Water in Idaho (continued)

Spring/Well Identification Number & Name	Silver (Ag)	Aluminum (Al)	Arsenic (As)	Gold (Au)	Barium (Ba)	Bromine (Br)	Cadmium (Cd)	Cerium (Ce)	Cobalt (Co)	Chromium (Cr)	Cesium (Cs)	Copper (Cu)	Dysprosium (Dy)	Europium (Eu)	Iron (Fe)	Gallium (Ga)	Hafnium (Hf)	Mercury (Hg)	Indium (In)	Iridium (Ir)	Lanthanum (La)	Lutetium (Lu)	Manganese (Mn)	Molybdenum (Mo)	Neodymium (Nd)	Osmium (Os)	Rubidium (Rb)	Ruthenium (Ru)	Antimony (Sb)	Scandium (Sc)	Selenium (Se)	Samarium (Sm)	Strontium (Sr)	Tantalum (Ta)	Terbium (Tb)	Vanadium (V)	Wolfram (W)	Ytterbium (Yb)	Zinc (Zn)
Twin Falls County (cont'd.)																																							
12S 17E 6CBDB	0.0	0.1300	0.0	0.0	0.0	0.310	0.0	0.0	0.0	0.034	0.0050	0.0	0.0	0.0	0.360	0.0	0.0001	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.030	0.020	0.0	0.0	0.0	0.0	0.2400	0.0	0.0	0.0	0.0	0.0	0.015
NAT-SOO-PAH W S 12S 17E 31BAB1S	0.0	0.0800	0.0	0.0	0.2400	0.025	0.0	0.0	0.0030	0.028	0.0040	0.0	0.0	0.0	0.340	0.0	0.0	0.0	0.0004	0.0	0.0	0.0	0.0065	0.0	0.0	0.0	0.025	0.0	0.0002	0.0	0.0	0.0	0.2600	0.0	0.0	0.0	0.0	0.0	0.010
IDAHO STATE WELL 12S 18E 6BBA1	0.0	0.3400	0.020	0.0	0.0460	0.022	0.0	0.0005	0.0020	0.033	0.0006	0.0	0.0	0.0	0.200	0.0	0.0	0.0	0.0001	0.0	0.0	0.0	0.0065	0.0	0.0	0.0	0.016	0.0	0.0002	0.0	0.0004	0.0004	0.0800	0.0	0.0	0.0	0.0	0.0	0.009
ROGER JONES WELL 13S 16E 12ABB1	0.0	0.0910	0.0	0.0001	0.1800	0.0	0.0	0.0	0.0030	0.015	0.0030	0.0	0.0	0.0	0.140	0.0	0.0	0.0002	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.020	0.0	0.0006	0.0	0.0	0.0	0.1700	0.0	0.0	0.0	0.0	0.0	0.016
MAGIC H S 16S 17E 30ACA1S	0.0003	0.1000	0.023	0.0	0.2700	0.010	0.0	0.0	0.0010	0.044	0.0020	0.0	0.0	0.0	0.160	0.0	0.0	0.0	0.0005	0.0	0.0030	0.0	0.0	0.0	0.0	0.0	0.008	0.0	0.0004	0.0	0.0	0.0	0.4700	0.0	0.0	0.0	0.0	0.4300	0.013
Valley County																																							
ROCKY CANYON H S 11N 5E 29CDB1S	0.0	0.0640	0.0	0.0	0.0	0.0	0.0	0.0	0.0014	0.010	0.0005	0.0	0.0	0.0	0.090	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.003	0.004	0.0003	0.0	0.0	0.0	0.0670	0.0	0.0	0.0	0.0	0.0	0.006
BOILING SPRINGS H S 12N 5E 22BBC1S	0.0	0.1610	0.0	0.0	0.0	0.0	0.0	0.0	0.0014	0.015	0.0023	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0019	0.0	0.0	0.0	0.011	0.0	0.0005	0.0	0.0	0.0	0.0420	0.0	0.0	0.0	0.020	0.0	0.008
BOILING SPRINGS H S 12N 5E 22BBC1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0024	0.012	0.0025	0.0	0.0	0.0	0.110	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0023	0.0	0.0	0.0	0.011	0.0	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.026
CABARTON H S 13N 4E 31CAB1S	0.0	0.1040	0.022	0.0	0.0	0.0	0.0	0.0	0.0012	0.015	0.0003	0.0	0.0	0.0	0.120	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.009	0.0	0.0007	0.0	0.0	0.0	0.0370	0.0	0.0	0.0	0.0	0.0	0.007
VULCAN H S 14N 6E 11BDA1S	0.0	0.1840	0.0	0.0	0.0	0.0	0.0	0.0	0.0022	0.012	0.0035	0.0	0.0	0.0	0.120	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.046	0.0	0.0	0.022	0.0	0.0006	0.0	0.0	0.0	0.1200	0.0	0.0	0.0	0.0	0.0	0.024
ARLING H S 15N 3E 13BBC1S	0.0	0.0670	0.0	0.0	0.0	0.0	0.0	0.0	0.0112	0.018	0.0001	0.0	0.0	0.0	0.150	0.0	0.0024	0.0	0.0	0.0	0.0	0.0	0.0016	0.0	0.0	0.0	0.003	0.005	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.012
MOLLY'S H S 15N 6E 14ABB1S	0.0001	0.0710	0.0	0.0	0.0	0.0	0.0	0.0	0.0013	0.011	0.0009	0.0	0.0	0.0	0.120	0.0	0.0006	0.0	0.0	0.0	0.0	0.0	0.0260	0.0	0.0	0.0	0.008	0.0	0.0006	0.0	0.0	0.0	0.1200	0.0	0.0	0.0	0.0	0.0	0.007
HOLDOVER H S 17N 6E 2BAA1S	0.0	0.1050	0.0	0.0	0.0	0.0	0.0	0.0	0.0013	0.010	0.0003	0.0	0.0	0.0	0.100	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0024	0.0	0.0	0.0	0.004	0.0	0.0002	0.0	0.0	0.0	0.0440	0.0	0.0	0.0	0.0	0.0	0.017
TEAPOT H S 18N 6E 9ADC1S	0.0	0.0540	0.019	0.0	0.0	0.0	0.0	0.0	0.0022	0.011	0.0003	0.0	0.0	0.0	0.110	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.005	0.0	0.0020	0.0	0.0002	0.0	0.0620	0.0	0.0	0.0	0.0	0.0	0.008
Washington County																																							
MIDVALE CITY WELL 13N 3W 8CCC1	0.0	0.1700	0.004	0.0	0.0260	0.013	0.730	0.0	0.0010	0.006	0.0004	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0050	0.0	0.0	0.0	0.027	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.010
FAIRCHILD LUMBER CO. WEL 13N 4W 13BAC1	0.0005	0.2300	0.007	0.0	0.0250	0.009	0.0	0.0004	0.0020	0.009	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0003	0.0	0.0002	0.0	0.0190	0.0	0.0	0.0	0.006	0.0	0.0007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.630
LAKEY H S 14N 2W 6BBA1S	0.0	0.1400	0.230	0.0	0.0	0.0	0.0	0.0004	0.0028	0.012	0.0024	0.0	0.0	0.0	0.130	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.012	0.0	0.0014	0.0	0.0	0.0	0.1500	0.0	0.0	0.0	0.0	0.0	0.016
FAIRCHILD HS 14N 3W 19CBD1S	0.0	0.1600	0.044	0.0	0.0	0.0	0.0	0.0	0.0014	0.010	0.0006	0.0	0.0	0.0	0.070	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0029	0.0	0.0	0.0	0.004	0.0	0.0009	0.0	0.0002	0.0	0.0230	0.0	0.0	0.0059	0.0	0.0	0.009

BASIC DATA TABLE 4

BASIC DATA TABLE 4

LOCATION, GEOLOGIC ENVIRONMENT, PRESENT USE AND POTENTIAL USE OF THERMAL SPRINGS AND WELLS IN IDAHO

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-ceous	Car-bon-ates									
								Ada County								
LILLIE COLLIAS WELL 1N 1E 1ADC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	146	26	48	BIODEGRADATION	LAUNDRY USES	YES	43.4543 116.2782	SAVAGE, 1958
E.L. HENNIS WELL 1N 1E 1DAD1	75	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	99	25		HEATING AND COOLING WITH HEAT PUMP			43.4493 116.2735	SAVAGE, 1958
AGRI-CON OF IDAHO WELL 1 1N 1E 23CDA1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	133	24		CATFISH FARMING			43.4034 116.3036	SAVAGE, 1958
NICHOLSON WELL #1 1N 1E 25CAA1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				STOCK WATERING	140	23		HEATING AND COOLING WITH GROUNDWATER HEAT PUMP			43.3929 116.2840	LOG, 1968
NICHOLSON WELL #2 1N 1E 25DBA1		PLIOCENE AND PLEISTOCENE SEDIMENTS		REPORTED TEMPERATURE; LOCATION IS VERIFIED BY FIELD CHECK; DRILLER'S LOG AVAILABLE				IRRIGATION	161	25	45	CATFISH FARMING	MUSHROOM GROWING	YES	43.3934 116.2791	LOG, 1973
AGRI-CON OF IDAHO WELL 2 1N 1E 25BDC1	12870	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	143	24		CATFISH FARMING			43.3941 116.2862	SAVAGE, 1958
AGRI-CON OF IDAHO WELL 3 1N 1E 26ADD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	135	25		DE-ICING ROADWAYS			43.3868 116.2839	SAVAGE, 1958
BETTY DESHAZO WELL 1N 1E 33AAD1	11355	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	188	24		CATFISH FARMING			43.3835 116.3352	LOG, 1972
AGRI-CON OF IDAHO WELL 4 1N 1E 35BAA1	11355	PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	121	23		HEATING AND COOLING WITH HEAT PUMP			43.3860 116.3034	LOG, 1969
FLOYD EDWARDS WELL 1N 1E 35BBB1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	129	22		HEATING AND COOLING WITH HEAT PUMP			43.3861 116.3129	SAVAGE, 1958

AGRI-CON OF IDAHO WELL 5 1N 1E 36AAD1	10220	PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION	135	24	67	DE-ICING ROADWAY	APPLE DEHYDRATION	YES	43.3831 116.2737	SAVAGE, 1958
C.J. STEWART WELL 1N 2E 6AAA1		PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	117	32		CATFISH FARMING			43.4586 116.2538	SAVAGE, 1958
FOU LAND AND BEEF WELL 1N 2E 6ABA1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DOMESTIC	123	24	50	CATFISH FARMING	GREENHOUSE	YES	43.4587 116.2596	SAVAGE, 1958
JOHN COOKNELL WELL 2N 1E 21DDA1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DOMESTIC	85	23		DE-ICING HIGHWAYS			43.4919 116.3347	SAVAGE, 1958
TOM BEVANS WELL 2N 1E 22DDB1		PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION		24		DE-ICING SIDEWALKS		YES	43.4921 116.3183	SAVAGE, 1958
NILES CLARK WELL 2N 1E 23DAC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION	117	24		DE-ICING ROADWAYS			43.5000 116.3076	SAVAGE, 1958
DAVID NEAL WELL 2N 1E 23CAB1		PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION	85	25		CATFISH FARMING			43.4953 116.3055	SAVAGE, 1958
AL CLIFFORD WELL 2N 1E 23DDA1		PLIOCENE AND PLEISTOCENE SEDIMENTS	PUMP OFF; TEMPERATURE NOT VARIFIED; DRILLER'S LOG AVAILABLE	DOMESTIC	94	26		HEATING AND COOLING WITH HEAT PUMP			43.4920 116.2953	SAVAGE, 1958
KUNA EAST WATER CORP. 2N 1E 24CBA1	8005	PLIOCENE AND PLEISTOCENE SEDIMENTS		DOMESTIC	93	24		DE-ICING SIDEWALKS			43.4941 116.2887	SAVAGE, 1958
GEORGE WHITMORE WELL 2N 1E 24DAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS	REPORTED TEMPERATURE, NOT IN USE	UNUSED		27		FERMENTATION		YES	43.4934 116.2740	SAVAGE, 1958
CHARLES BAIR WELL 2N 1E 26ABA1	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	115	27		SHRIMP AND TROPICAL FISH FARMING			43.4882 116.3008	SAVAGE, 1958

* AQUIFER TEMPERATURE REPRESENTS A BEST ESTIMATE BASED ON AN INTERPRETATION OF THE CHEMICAL GEOTHERMOMETERS FOUND IN BASIC DATA TABLE 2.
** USE TAKEN FROM FIGURE 4. POTENTIAL USE BASED ONLY ON SURFACE TEMPERATURE. ALL OTHER FACTORS IGNORED.
*** USE TAKEN FROM FIGURE 4. POTENTIAL USE BASED ONLY ON BEST ESTIMATED AQUIFER TEMPERATURE. ALL OTHER FACTORS IGNORED.

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
								Ada County (cont'd.)								
DESERT VIEW ESTATES 2N 1E 27ADA1	4163	PLIOCENE AND PLEISTOCENE SEDIMENTS						PUBLIC SUPPLY	97	24		HEATING AND COOLING WITH HEAT PUMP			43.4846 116.2960	SAVAGE, 1958
ED JOHNSON WELL 2N 1E 35BCD1	5677	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	103	23		CATFISH FARMING			43.4680 116.3099	SAVAGE, 1958
RONALD YANKE WELL 2N 2E 19AAD1	7494	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	265	27		FERMENTATION			43.4998 116.2545	SAVAGE, 1958
STATE PRISON WELL #2 2N 2E 27CCC1	6624	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	184	24		BIODEGRADATION			43.4739 116.2120	SAVAGE, 1958
STATE PRISON WELL #1 2N 2E 27DBD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	224	23		FERMENTATION			43.4784 116.1990	LOG, 1969
LDS STAKE FARM WELL #1 2N 2E 29AAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	167	25		CATFISH FARMING			43.4855 116.2333	SAVAGE, 1958
LDS STAKE FARM WELL #2 2N 2E 29AAD2		PLIOCENE AND PLEISTOCENE SEDIMENTS						DOMESTIC	167	25		DE-ICING ROADWAYS			43.4853 116.2335	SAVAGE, 1958
IDU LAND AND BEEF WELL 1 2N 2E 31CDC1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	121	26		HEATING AND COOLING WITH HEAT PUMP			43.4597 116.2673	SAVAGE, 1958
IDU LAND AND BEEF WELL 2 2N 2E 31DCA1	7570	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	134	30		STOCK WATERING			43.4619 116.2594	SAVAGE, 1958
DAVID WEISS WELL 2N 2E 33CDC1	7494	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	160	25		HEATING AND COOLING WITH HEAT PUMP			43.4592 116.2281	LOG, 1973

WARREN TOZER WELL 2N 3E 10BCB1		PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION AND DOMESTIC	143	20	21	FISH FARMING	CATFISH FARMING	YES	43.5263 116.0923	SAVAGE, 1958
STATE TRANS. DEPT WELL 2N 3E 28CAC1	227	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE; BLACK CREEK REST AREA	DOMESTIC	297	22	27	HEATING AND COOLING WITH HEAT PUMP	FERMENTATION	YES	43.4778 116.1062	SAVAGE, 1958
FERD KOCH WELL 3N 2E 20BD1	302	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	348	50	59	GRAIN-HAY DRYING	SPACE HEATING	YES	43.6244 116.1891	SAVAGE, 1958
BSU WELL #1 3N 2E 20BD1			NOT FIELD CHECKED; NOT FLOWING; COVERED	GEOTHERMAL RESEARCH	86	28		DE-ICING SIDEWALKS			43.6107 116.1708	
GARDEN CITY WELL 3N 2E 50CA1	1703	PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL; DRILLER'S LOG AVAILABLE	PUBLIC SUPPLY	247	20					43.6208 116.2385	SAVAGE, 1958
IDAHO STATE CAPITOL WELL 3N 2E 10ABA1	1135	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC AND SPRINKLING	327	40		SPACE HEATING			43.6180 116.1984	LOG, 1962
OLD BOISE HOTEL WELL 3N 2E 10ABB1			WELL CEMENTED OVER (NO TEMPERATURE CHECK)	UNUSED		44					43.6176 116.2010	
CLARK MAGSTADT WELL 3N 2E 10BDC1	2838	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	COMMERCIAL LAUNDRY	192	24		HEATING AND COOLING WITH HEAT PUMP			43.6119 116.2059	SAVAGE, 1958
BEARD WELL 3N 2E 11ABC1	567		COVERED	GEOTHERMAL RESEARCH	198	56	97	SEEDLING CONIFERS	BLANCHING	YES	43.6165 116.1821	
BSU WELL #2 3N 2E 11BAB1			NOT FLOWING	GEOTHERMAL RESEARCH	391	78		LAUNDRY USES			43.6181 116.1833	
BSU WELL #3 3N 2E 11BAC1			WELL HAS BEEN COVERED	GEOTHERMAL RESEARCH	372	74		APPLE DEHYDRATION			43.6164 116.1857	
BOISE CITY PARK WELL 3N 2E 11BBD1	2271	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	1174	90		BIODEGRADATION			43.6158 116.1890	SAVAGE, 1958

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
Ada County (cont'd.)																
ANN SPARKS WELL 3N 2E 12BDD1				NOT FIELD CHECKED				DOMESTIC	143	21		FISH FARMING AND HATCHING			43.6130 116.1647	
BSU WELL #4 3N 2E 12CBB1				NOT FLOWING				GEOTHERMAL RESEARCH	167	35		FERMENTATION			43.6107 116.1708	
WARM SPRINGS WATER DIST. 3N 2E 12CDD1	7267	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)	NORTHWEST TRENDING FAULT	WELL WATER HEATS ABOUT 200 HOMES, FLOWING WELL; SULFUR ODOR				PUBLIC SUPPLY	121	76	79	FRUIT AND VEGETABLE DEHYDRATION	PASTEURIZED MILK PROCESS	YES	43.6046 116.1626	
WARM SPRINGS WATER DIST. 3N 2E 12CDD2	7267	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)	NORTHWEST TRENDING FAULT	WATER FROM BOTH WELLS IS MIXED AT SITE PRIOR TO BEING PIPED TO DISTRICT; FLOWING WELL; SULFUR ODOR				PUBLIC SUPPLY	121	77		REFRIGERATION (LOWER TEMPERATURE RANGE)			43.6048 116.1627	
OLD PENTENTIARY WELL #1 3N 2E 15AAC1	68	PLIOCENE AND PLEISTOCENE SEDIMENTS		PUMP HAS BEEN PULLED AND WELLHEAD COVERED; DRILLER'S LOG AVAILABLE				UNUSED	148	28					43.6017 116.1561	SAVAGE, 1958
OLD PENTENTIARY WELL #2 3N 2E 15ACD1	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT	CAPPED; DRILLER'S LOG AVAILABLE				UNUSED	265	59	67	POULTRY HATCHERY	APPLE DEHYDRATION	YES	43.5987 116.1606	SAVAGE, 1958
WARM SPRINGS MESA SUBD. 3N 2E 24ACA1	3028	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				PUBLIC SUPPLY	150	31		HYDROPONICS			43.5849 116.1577	SAVAGE, 1958
BOISE WATER CORP. WELL 3N 2E 36ABC1	10977			DRILLER'S LOG AVAILABLE; ALSO KNOWN AS TERTELING WELL				PUBLIC SUPPLY	195	22		FISH FARMING AND HATCHING			43.5580 116.1597	LOG, 1972
DALLAS HARRIS WELL 3N 3E 20CAB1				NOT FIELD CHECKED				UNUSED	137	56		SPACE HEATING			43.5810 116.1272	
MORES CREEK H S 3N 4E 21BABIS				NOT FIELD CHECKED; REPORTED IN THE IDAHO ENCYCLOPEDIA, 1938; SUBMERGED IN LUCKY PEAK RESERVOIR				UNUSED		0					43.5884 115.9876	

DENNIS FLAKE WELL 4N 1E 24DCC1	94				DOMESTIC	309	28	68	FERMENTATION	APPLE DEHYDRATION	YES	43.6664 116.2821	
IDAHO DEPT. OF TRANS. 4N 1E 25CDA1	969				INDUSTRIAL	274	24		DE-ICING HIGHWAYS			43.6521 116.2835	
CARL RUSH WELL 4N 2E 4BDC1					DOMESTIC	76	30	43	SHRIMP FARMING	SEEDLING CONIFERS	YES	43.7135 116.2267	
LILLIAN BARNES WELL #1 4N 2E 8DCC1	276	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA	CAP	PED: TEMPERATURE NOT VERIFIED: DRILLER'S LOG AVAILABLE	UNUSED	513	41		SEEDLING CONIFERS			43.6920 116.2417	OG,1969
LILLIAN BARNES WELL #2 4N 2E 17CBA1	1135	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE	SWIMMING POOL	377	32		BIODEGRADATION			43.6833 116.2502	LOG, 1965
E. VAN HENDRICKS WELL 4N 2E 17CDA1	56	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; WELL CAPPED, TEMPERATURE OBTAINED FROM LOG	UNUSED	210	20					43.6794 116.2446	LOG,1973
WILLIAM GALLOWAY WELL 4N 2E 19AAB1					DOMESTIC	70	25		HEATING AND COOLING WITH HEAT PUMP			43.6762 116.2568	
ETHEL FICKS WELL 4N 2E 19AAC1	113	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	DOMESTIC	68	21		HEATING AND COOLING WITH HEAT PUMP			43.6752 116.2775	LOG, 1969
ED GENTHER WELL 4N 2E 19AAC2	113	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	DOMESTIC	78	26		FISH FARMING			43.6742 116.2574	LOG, 1967
JESS DONAHO WELL 4N 2E 21CCA1				CAVED IN, NEVER RE-DRILLED	UNUSED	274	36		AQUACULTURE			43.6759 116.2297	
TERTELING H S 4N 2E 22BBA1S	37	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)			STOCK WATERING		41		HYDROPONICS			43.6768 116.2076	
JOE TERTELING WELL #1 4N 2E 22BCB1		PLIOCENE AND PLEISTOCENE SEDIMENTS (?)			DOMESTIC	50	24		SHRIMP FARMING			43.6734 116.2113	

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Siliceous	Deposition: Carbonates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
Ada County (cont'd.)																
JOE TERTELING WELL #2 4N 2E 22HCD1		PLIOCENE AND PLEISTOCENE SEDIMENTS (?)		FLOWING COLD WATER NEXT TO THERMAL WATER'S WELL CASING				SPACE HEATING	167	44		AQUACULTURE			43.6710 116.2083	
JOE TERTELING WELL #3 4N 2E 22CBB1		PLIOCENE AND PLEISTOCENE SEDIMENTS OVERLYING BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	182	43		FERMENTATION			43.6695 116.2107	LOG, 1968
CRANE CREEK GOLF COURSE 4N 2E 26CCC1	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	225	21		FISH HATCHING			43.6584 116.1983	LOG, 1964
CARTWRIGHT WATER DIST.#1 4N 2E 27DBA1				THIS SITE WAS ORIGINALLY DRILLED FOR OIL AND GAS EXPLORATION TO A DEPTH OF 915 METERS				PUBLIC SUPPLY	213	32		AQUACULTURE			43.6546 116.1994	
CARTWRIGHT WATER DIST.#2 4N 2E 27DBA2		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				PUBLIC SUPPLY	228	32		BIODEGRADATION			43.6549 116.1994	LOG, 1976
CARTWRIGHT WATER DIST.#3 4N 2E 27DBA3								DOMESTIC	152	32		HEATING AND COOLING WITH HEAT PUMP			43.6549 116.1998	
VIC NIBBLER WELL 4N 2E 28ABB1	1022							IRRIGATION	396	48		GRAIN-HAY DRYING			43.6616 116.2212	
HUNT BROTHERS FLORAL #1 4N 2E 28DBB1				ALSO KNOWN AS MILSTEAD FLORAL; FLOWING WELL; SLIGHT SULFUR ODOR				GREENHOUSE	381	47		SEEDLING CONIFERS			43.6556 116.2322	
RYAN WELL 4N 2E 29ACB1	1430							SPACE HEATING	335	46		GRAIN-HAY DRYING			43.6614 116.2454	
EDWARD'S GREENHOUSE WELL 4N 2E 29ACD1	1514			FLOWING WELL; SLIGHT SULFUR ODOR				GREENHOUSE AND SPACE HEATING	364	49	78	TROPICAL FISH FARMING	PRUNE DEHYDRATION	YES	43.6577 116.2389	

WAYNE CHURCH WELL #1 4N 2E 29ACD2		PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL; SLIGHT SULFUR ODOR	SPACE HEATING	423	39		HYDROPONICS			43.6562 116.2374	SAVAGE, 1958
WAYNE CHURCH WELL #2 4N 2E 29ACD3		PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	15	21		HEATING AND COOLING WITH HEAT PUMP			43.6562 116.2376	SAVAGE, 1958
HUNT BROTHERS FLORAL #2 4N 2E 29DAA1			FLOWING WELL; SLIGHT SULFUR ODOR	GREENHOUSE	381	45		SOIL WARMING			43.6555 116.2329	
HUNT BROTHERS FLORAL #3 4N 2E 29DAA2			FLOWING WELL; SLIGHT SULFUR ODOR	SPACE HEATING	381	43		MUSHROOM GROWING			43.6556 116.2328	
IDAHO DEPT OF TRANS WELL 4N 2E 33CCC1	1022	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE; ORIGINALLY DRILLED TO 351 METERS, WATER WITHDRAWN FROM 12 METER DEPTHDUE TO LACK OF WATER IN SHALE	AIR CONDITIONING	350	20		AIR CONDITIONING			43.6347 116.2296	LOG, 1964
RICHARD SMITH WELL 4N 2E 34CAA1			TEMPERATURE AND LOCATION NOT VERIFIED	UNUSED	304	21		HEATING AND COOLING WITH HEAT PUMP			43.6399 116.2029	
JOHN BOEHM WELL 5N 1E 25ACB1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DOMESTIC	60	20		FISH FARMING			43.7453 116.2828	SAVAGE, 1958
SHADOW VALLEY WELL 5N 1E 25BCC1	1703	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	92	28	42	AQUACULTURE	SOIL WARMING	YES	43.7434 116.2917	SAVAGE, 1958
DON SWANSON WELL 5N 1E 25CBC1	151	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	95	21		HEATING AND COOLING WITH HEAT PUMP			43.7408 116.2903	SAVAGE, 1958
JOHN FERGUSON WELL 5N 1E 25CCB1	264	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	152	25		HEATING AND COOLING WITH HEAT PUMP			43.7376 116.2909	LOG, 1972
D. MCARTHUR WELL 5N 1E 26CDC1		PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	18	02	300	HEATING AND COOLING WITH HEAT PUMP			43.7369 116.3066	LOG, 1970
BEN STADLER WELL 5N 1E 26DCD1	3406	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	209	30	56	SPACE HEATING	GRAIN-HAY DRYING	YES	43.7373 11?.2987	LOG, 1964

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Siliceous	Deposition: Carbonates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
				Ada County (cont'd.)												
JOHN BURGESS WELL 5N 1E 29DAA1	37	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	154	22		CATFISH FARMING			43.7415 116.3552	LOG, 1978
JULIUS JEKER WELL #1 5N 1E 35ACA1	85	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL; SULFUR ODOR				IRRIGATION	16	40	87	SPACE HEATING AND RECREATION	BARLEY MALTING PROCESS	YES	43.7308 116.2998	DENMAN, 1978 (SITE INSPECTION)
JULIUS JEKER WELL #2 5N 1E 36BDB1	75	PLIOCENE AND PLEISTOCENE SEDIMENTS						DOMESTIC	121	24		DE-ICING SIDEWALKS			43.7316 116.2881	DENMAN, 1978 (SITE INSPECTION)
JERRY DAVIS WELL #1 1N 1W 7ACC1		PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE; CAVED AT 180 METERS				IRRIGATION	196	21	59	CATFISH FARMING	POULTRY HATCHERY	YES	43.4374 116.5025	SAVAGE, 1958
CLAYTOR FORSGREN WELL 1N 1W 7BCC1	469	PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	124	21	61	FERMENTATION	ANIMAL HUSBANDRY	YES	43.4373 116.5122	LOG, 1973
JERRY DAVIS WELL #2 1N 1W 7CBA1	6359	PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	140	21		HEATING AND COOLING WITH HEAT PUMP		YES	43.4385 116.4607	LOG, 1965
1N 1W 8BBB1		PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	129	20		STOCK WATERING			43.4429 116.5729	LOG, 1962
IRVIN BOEHLKE WELL #1 1N 1W 8DBA1	10220	PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	137	22		STOCK WATERING			43.4375 116.4787	LOG, 1963
HERB MONTIERTH WELL 1N 1W 15BDC1								IRRIGATION	106	21		HEATING AND COOLING WITH HEAT PUMP			43.4231 116.4461	
HERB MONTIERTH WELL 1N 1W 15BDD1								IRRIGATION	106	21		CATFISH FARMING			43.4230 116.4451	

SHANE BUES WELL 1N 1W 15DAA1	10598			IRRIGATION	164	21	66	CATFISH FARMING	APPLE DEHYDRATION	YES	43.4225 116.4330	
IRVIN BOEHLKE WELL #2 1N 1W 17ACA1		PLIOCENE BASALTIC LAVA	DRILLER'S LOG AVAILABLE	IRRIGATION	123	22		CATFISH FARMING			43.4262 116.4784	LOG, 1963
IRVIN BOEHLKE WELL #3 1N 1W 17CAB1				IRRIGATION		22		HEATING AND COOLING WITH HEAT PUMP			43.4220 116.4857	
LLOYD NOE WELL 1N 1W 19DDB1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DOMESTIC	118	21		HEATING AND COOLING WITH HEAT PUMP			43.4047 116.4970	LOG, 1972
TERRY TLUCEK WELL #1 1N 1W 22CAC1				IRRIGATION	106	21		HEATING AND COOLING WITH HEAT PUMP			43.4047 116.4472	
TERRY TLUCEK WELL #2 1N 1W 22DDD1		PLIOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	106	27	57	CATFISH FARMING	GRAIN-HAY DRYING	YES	43.4019 116.4339	LOG, 1964
HERB MONTIERTH WELL 1N 1W 24AAD1	5587	PLIOCENE AND PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	111	24		DE-ICING ROADWAYS			43.4131 116.3947	LOG, 1965
TERRY TLUCEK WELL #3 1N 1W 27BBB1	4542	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA	DRILLER'S LOG AVAILABLE	IRRIGATION	111	23		STOCK WATERING			43.3998 116.4526	LOG, 1976
LLOYD NOE WELL #2 1N 1W 30ADA1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA	DRILLER'S LOG AVAILABLE	IRRIGATION	109	22		CATFISH FARMING			43.3976 116.4951	LOG, 1974
LLOYD NOE WELL #3 1N 1W 31CAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	118	24		DE-ICING ROADWAYS			43.3759 116.5039	SAVAGE, 1958
MIKE VANDENBERG WELL 1N 4W 32AAB1			TEMPERATURE NOT VARIFIED	DOMESTIC	216	21		FISH FARMING			43.3845 115.9970	
KENNETH FORREY WELL #1 2N 1W 34CDC1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA	DRILLER'S LOG AVAILABLE	DOMESTIC	106	27		BIODEGRADATION			43.4603 116.4473	LOG, 1973

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Ada County (cont'd.)																
KENNETH FORREY WELL #2 2N 1W 34DAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	107	20		CATFISH FARMING			43.4645 116.4328	LOG, 1967
SAM GABIOLA WELL #1 2N 1W 35CAA1	3596	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	96	25		HEATING AND COOLING WITH HEAT PUMP			43.4622 116.4246	LOG, 1958
SAM GABIOLA WELL #2 2N 1W 35DDA1								IRRIGATION	146	22		FERMENTATION			43.4660 116.4140	
BISCHOF REALTY 3N 1W 25ADD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; ABANDONED				DOMESTIC	68	21	27	CATFISH FARMING	BIODEGRADATION	YES	43.5685 116.3940	LOG, 1970
CLIFFORD SMITH WELL 5N 1W 8ADC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	152	28		AQUACULTURE			43.7875 116.4747	SAVAGE, 1958
DEE RACHILLA WELL 5N 1W 8ADD1	52	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	106	21		HEATING AND COOLING WITH HEAT PUMP			43.7888 116.4726	LOG, 1971
DAVID TRAYLOR WELL 5N 1W 9CAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	119	20		BIODEGRADATION			43.7826 116.3149	LOG, 1972
BILL LEACH WELL 5N 1W 9CDD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	137	29		HYDROPONICS			43.7835 116.4620	LOG, 1967
LETHA FISHER WELL 5N 1W 16CAB1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	191	21	70	GROUND-WATER HEAT PUMP FOR HEATING AND COOLING	ONION DEHYDRATION	YES	43.7701 116.4625	LOG, 1963
HARRY CHARTERS WELL 1S 1W 5ABC1	13627	PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	112	26	71	CATFISH FARMING	PASTEURIZED MILK PROCESS	YES	43.3689 116.4818	LOG, 1969

INITIAL BUTTE FARM WELL 1S 1W 36BBC1		PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE			DOMESTIC	167	23	68	FISH FARMING	GAME BIRD HATCHERY	YES	43.2975 116.4126	LOG, 1969
MEL BROWN WELL 2S 1E 20ABA1		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			DOMESTIC	179	27		FERMENTATION			43.2391 116.3551	LOG, 1977
THOMAS FLAT W S 3S 1E 15CAA1S	3			SEEP			UNUSED		24		CATFISH FARMING			43.1614 116.3323	MITCHELL, 1979 (SITE INSPECTION)

Adams County

COUNCIL MTN. H S 15N 1E 2HDB1S	189	CRETACEOUS GRANITIC ROCKS	FAULT	NOT FIELD CHECKED; REPORTED BY ROSS, 1971					68		REFRIGERATION (LOWER TEMPERATURE LIMIT)			44.6691 116.3052	ROSS, 1971
WHITE LICKS H S 16N 2E 33BCC1S	113	QUATERNARY ALLUVIUM NEAR MIOCENE BASALT AND CRETACEOUS GRANITIC ROCK		NUMEROUS SPRING VENTS; GAS PRESENT IN SEVERAL VENTS; SULFUR ODOR; TEMPERATURE RANGE 60-68 DEGREES C; ALLUVIUM ABOUT 1.5 M THICK	YES	YES	RECREATION		60	145	HOT WATER HEATING	CORN PRODUCTS (SYRUP, OIL)	YES	44.6814 116.2281	WARING, 1965
KRIGBAUM H S 19N 2E 22CCA1S	189	CRETACEOUS GRANITIC ROCKS NEAR MIOCENE BASALT	NORTHWEST TRENDING NORMAL FAULT	TWO SPRING VENTS AND SEVERAL SEEPS; TEMPERATURE RANGE 40-43 DEGREES C; PAST USE:RECREATION		YES	UNUSED		43	93	SEEDLING CONIFERS	BLANCHING	YES	44.9714 116.2034	NEWCOMB, 1970
DIXON H S 20N 1E 25CCA1S	189	QUATERNARY ALLUVIUM		TEMPERATURE RANGE 49-63 DEGREES C; PAST USE: BATHING			UNUSED		63		ANIMAL HUSBANDRY			45.0382 116.2871	GARCIA, 1978 (SITE INSPECTION)
DEL GEDDES WELL 20N 1E 25CCC1	162	QUATERNARY ALLUVIUM NEAR MIOCENE BASALT		DRILLER'S LOG AVAILABLE			UNUSED	7	70		REFRIGERATION (LOWER TEMPERATURE LIMIT)			45.0359 116.2873	ROSS, 1971
GEDDES H S 20N 1E 25CCC1S	454	QUATERNARY ALLUVIUM		SEVERAL SPRING VENTS; PAST USE: BATHING			UNUSED		68		APPLE DEHYDRATION			45.0366 116.2875	GARCIA, 1978 (SITE INSPECTION)
EVANS H S 20N 1E 26DAD1S		QUATERNARY ALLUVIUM NEAR MIOCENE BASALT		TEMPERATURE RANGE 55-66 DEGREES C			UNUSED		60		GAME BIRD HATCHERY			45.0393 116.2920	ROSS, 1971
ZIM'S RESORT 20N 1E 26DDA1S	757	QUATERNARY ALLUVIUM NEAR MIOCENE BASALT	NORTHWEST TRENDING NORMAL FAULT	SLIGHT SULFUR ODOR		YES	RECREATION		62	83	ANIMAL HUSBANDRY	BARLEY MALTING PROCESS	YES	45.0385 116.2913	HAMILTON, 1969
STINKY W S 21N 1E 23ABA1S	37	CRETACEOUS GRANITIC ROCK		STRONG SULFUR ODOR			RECREATION		31		FERMENTATION		YES	45.1518 116.2962	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Adams County (cont'd.)																
BOULDER CREEK RESORT 22N 1E 34DAD1S	18	CRETACEOUS GRANITIC ROCK		SLIGHT SULFUR ODOR; TWO SMALL POOLS				UNUSED		28		CATFISH FARMING		YES	45.2009 116.3115	GARCIA, 1978 (SITE INSPECTION)
CRAB AND THOMPSON WELL 16N 1W 11ACD1	56	QUATERNARY AND TERTIARY SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	64	22		HEAT PUMP FOR HEATING AND COOLING			44.7390 116.4181	YOUNG AND OTHERS, 1977
BILL KAMPETER WELL 16N 1W 15BAC1	113	QUATERNARY AND TERTIARY SEDIMENTS INTERBEDDED WITH MIOCENE BASALT		DRILLER'S LOG AVAILABLE				IRRIGATION	35	22		FISH FARMING AND HATCHING			44.7287 116.4453	YOUNG AND OTHERS, 1977
STARKEY H S 18N 1W 34DBB1S	492	MIOCENE BASALT		SEVEN SPRING VENTS; SULFUR ODOR; SECONDARY CALCITE IN BASALT NEAR SPRING VENTS			YES	RECREATION		55	70	LAUNDRY USE	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	44.8528 116.4421	LIVINGSTON AND LANEY, 1920
Bannock County																
5S 34E 25BDB1				DESTROYED BY CONSTRUCTION OF INTERSTATE 15					152	32					42.9599 112.4298	
GERALD JOHNSON WELL 5S 34E 25CBB1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	80	27		BIODEGRADATION			42.9563 112.4342	TRIMBLE, 1976
ROBERT BROWN WELL #1 5S 34E 26DAB1	113	UPPER PLEISTOCENE SEDMENTS (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	70	25	62	HEAT PUMP FOR HEATING AND COOLING	APPLE DEHYDRATION	YES	42.9559 112.4411	TRIMBLE, 1976
ROBERT BROWN WELL #2 5S 34E 26DBD1	662	PLIOCENE AND PLEISTOCENE SEDIMENTS AND SILICIC VOLCANIC ROCKS(?)		DRILLER'S LOG AVAILABLE; FLOWING WELL				SPACE HEATING	177	41	63	GREENHOUSE SPACE HEATING	GAME BIRD HATCHERY	YES	42.9543 112.4428	TRIMBLE, 1976
GWINN SIGMAIN WELL 5S 34E 26DCC1	3406							IRRIGATION	60	29		CATFISH FARMING			42.9499 112.4449	
TADPOLE W S 5S 34E 27ADD1S				DRY				UNUSED		20		HEATING AND COOLING WITH HEAT PUMP			42.9573 112.4580	

FLOYD PETERSON WELL 5S 34E 35BAA1	75	UPPER PLIOCENE SEDMENTS (?)		DRILLER'S LOG AVAILABLE				85	20		FISH FARMING AND HATCHING			42.9476 112.4462	TRIMBLE, 1976
DEAN MORRIS WELL 9S 36E 3CDB1							DOMESTIC	24	22	40	CATFISH FARMING	SOIL WARMING	YES	42.6642 112.2356	
LAVA H S 9S 38E 21DDA1S		PALEOZOIC QUARTZITE AND YOUNGER TRAVERTINE	FAULT	NUMEROUS SPRING VENTS; EXTENSIVE TRAVERTINE DEPOSITION	YES	YES	RECREATION		45	50	BALNEOLOGICAL GROWING	MUSHROOM GROWING	YES	42.6205 112.0082	STEARNS AND OTHERS, 1938
LAVA H S 9S 38E 22CCB1S		PALEOZOIC QUARTZITE				YES	RECREATION		45	50	SEEDLING CONIFERS	SWIMMING POOL	YES	42.6198 112.0053	STEARNS AND OTHERS, 1938
DOWNATA H S 12S 37E 12CCD1S	1854	QUATERNARY ALLUVIUM NEAR TERTIARY SEDIMENTS			(?)		RECREATION		43	46	GRAIN-HAY DRYING	HYDROPONIC	YES	42.3877 112.0851	NORVITCH AND LARSON, 1970
							Bear Lake County								
PESCADERO W S 11S 43E 36BDA1S	37	PALEOZOIC LIMESTONE		THREE SPRING VENTS IN QUITE EXTENSIVE TRAVERTINE DEPOSITS			STOCK WATERING		26	49	CATFISH FARMING	GRAIN-HAY DRYING	ES	42.4257 111.3778	DION, 1969
BEAR LAKE H S 15S 44E 13CCA1S		PALEOZOIC LIMESTONE	NORTH TRENDING FAULT	NUMEROUS SPRING VENTS, SLIGHT SURFUR ODOR		YES	RECREATION		48	54	GRAIN-HAY DRYING	HOT BED HEATING	YES	42.1148 111.2640	DION, 1969
							Bingham County								
YANDELL SPRINGS W S 3S 37E 31DBB1S	5677	PRE-TERTIARY LIMESTONE		TEMPERATURE RANGE 18-32 DEGREES C			IRRIGATION		32	35	AQUACULTURE	BIODEGRADATION	YES	43.1143 112.1669	ROSS, 1971
ALKALI FLATS W S 4S 38E 36DDD1S	37	TUFA IN QUATERNARY ALLUVIUM		BANNOCK-SHOSHONE TRIBE, OWNER	YES		IRRIGATION		3	405	BIODEGRADATION	SPACE HEATING	Y	43.0377 112.0035	ROSS, 1971
							Blaine County								
HAILEY H S 2N 18E 18DBB1S	264	PALEOZOIC LIMESTONE		NUMEROUS SPRING VENTS; ONCE USED FOR HEATING HIAWATHA HOTEL AND POOL SULFUR ODOR	YES	YES	UNUSED		55	83	SEEDLING CONIFERS	PASTEURIZATION	YES	43.5056 114.3542	UMPLEBY AND OTHERS, 1930
CLARENDON H S 3N 17E 27DCB1S	378	PALEOZOIC LIMESTONE		SULFUR ODOR; NUMEROUS SPRING VENTS (CAPPED) TEMPERATURE RANGE 42-52 DEGREES C	YES		BALNEOLOGICAL BATH		52	87	SPACE HEATING	BLANCHING	YES	43.5605 114.4147	UMPLEBY AND OTHERS, 1930

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
						Sili-ceous	Car-bon-ates									
				Blaine County (cont'd.)												
GUYER H S 4N 17E 15AAC1S	5785	PALEOZOIC LIMESTONE	NORTHWEST TRENDING FAULT (?)	NUMEROUS SPRING VENTS; SULFUR ODOR; TEMPERATURE RANGE 55-70 DEGREES C	YES	YES	YES	COMMERCIAL SPACE HEATING		70	88	REFRIGERATION (LOWER TEMPERATURE LIMIT)	BARLEY MALTING PROCESS	YES	43.6836 114.4101	UMPLEBY AND OTHERS, 1930
WARFIELD H S 4N 17E 31BBC1S		PRE-TERTIARY UNDIFFERENTIATED ROCKS		TWO SPRING VENTS		YES		UNUSED		51	85	SEEDLING CONIFERS	SPACE HEATING	YES	43.6413 114.4865	ROSS, 1971
EASLEY W S 5N 16E 10DBC1S	189	CEMENTED QUATERNARY ALLUVIUM NEAR PRE-TERTIARY UNDIFFERENTIATED ROCKS		SIX SPRING VENTS				SWIMMING POOL		38	43	HYDROPONICS	SOIL WARMING	YES	43.7795 114.5385	ROSS, 1971
RUSSIAN JOHN W S 6N 16E 35CCA1S	3	QUATERNARY ALLUVIUM		SEEPING MORE THAN FLOWING		YES		UNUSED		38	52	AQUACULTURE	MUSHROOM GROWING	YES	43.8052 114.5850	ROSS, 1971
MAGIC H S LANDING WELL 1S 17E 23AAB1	56	QUATERNARY SEDIMENTS (?)		FLOWING WELL; SULFUR ODOR; DRILLER'S LOG AVAILABLE; ONCE USED FOR SPACE HEATING AND HOT BATHS			YES	UNUSED	79	71	174	REFRIGERATION (LOWER TEMPERATURE LIMIT)	DRY CLEANING	YES	43.3289 114.3980	SMITH, 1959
MAGIC H S 1S 17E 23AAB1S	1514	QUATERNARY ALLUVIUM (?)		PAST USE: RESORT; ALSO KNOWN AS HOT SPRINGS LANDING; X-RAY DIFFRACTION INDICATED TRONA PLUS LESSER AMOUNT OF GYPSUM			YES	UNUSED		73		BALNEOLOGICAL BATHS			43.3281 114.3987	SMITH, 1959
CHARLES LARKIN WELL 1S 20E 16DCA1	2271	QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE				IRRIGATION	30	38		HYDROPONICS			43.3320 114.0836	CASTELIN AND CHAPMAN, 1972
CONDIE H S 1S 21E 14DDC1S	1309	QUATERNARY ALLUVIUM NEAR PLEISTOCENE BASALT		X-RAY DIFFRACTION ANALYSIS INDICATED CALCIUM CARBONATE	YES		YES	IRRIGATION		51	89	GRAIN AND HAY DRYING	BLANCHING	YES	43.3270 113.9178	STEARNS AND OTHERS, 1938
MILFORD SWEAT H S 1S 22E 10AB1S	75	QUATERNARY ALLUVIUM NEAR HOLOCENE BASALT AND PALEOZOIC QUARTZITE		TWO SPRING VENTS	YES		YES	IRRIGATION		44	64	HYDROPONICS	APPLE DEHYDRATION	YES	43.3630 113.7794	ROSS, 1971
RUSH W S 1S 22E 6DBA1S		QUATERNARY ALLUVIUM						UNUSED		22		FISH FARMING			43.3669 113.8843	BODNER AND BUSH, 1978

Boise County

TWIN SPRINGS 4N 6E 24BCB1S	1892	CRETACEOUS GRANITIC ROCK	FOUR SPRING VENTS	YES	YES	RECREATION & SPACE HEATING		66		APPLE DEHYDRATION		YES	43.6705 115.6958	ROSS, 1971
STOPE W S 6N 5E 33ABC1S		CRETACEOUS GRANITIC ROCK	LOCATED IN STOPE; PAST USE: MINING			UNUSED		40		AQUACULTURE			43.8192 115.8682	JOHNSON, 1978 (SITE INSPECTION)
WARM SPRINGS RESORT 6N 5E 33ADC1S	1135	CRETACEOUS GRANITIC ROCK	TWO SPRING VENTS; SOME SULFUR ODOR			RECREATION		42		HYDROPONICS			43.8162 115.8631	ROSS, 1971
DANSKIN CREEK H S 8N 5E 18CC1S		CRETACEOUS GRANITIC ROCK	X-RAY DIFFRACTION ANALYSIS INDICATED SILICIOUS SINTER WITH SOME CALCIUM CARBONATE AND AMORPHOUS MATERIAL	YES	YES	IRRIGATION		41		STOCK WATERING		YES	44.0587 115.8180	ROSS, 1971
HOT SPRINGS CAMPGROUND 8N 5E 6DCB1S	56	CRETACEOUS GRANITIC ROCK	TWO SPRING VENTS; SEVERAL SEEPS	(?)		RECREATION		45		SEEDLING CONIFERS		YES	44.0540 115.9067	ROSS, 1971
GOLLER H S 8N 5E 6DCC1S	1892	CRETACEOUS GRANITIC ROCK	FIVE SPRING VENTS, SEVERAL SEEPS	YES		HEAT HOUSE AND POOL		51		MUSHROOM GROWING			44.0532 115.9077	ROSS, 1971
CORDER H S 8N 5E 10ADD1S	302	CRETACEOUS GRANITIC ROCK	MIXED WITH SPRING WATER FROM 08N05E10DAA	YES		SWIMMING POOL AND IRRIGATION		55		LAUNDRY USE			44.0447 115.8420	ROSS, 1971
DONLAY RANCH H S 8N 5E 10BDD1S	757	CRETACEOUS GRANITIC ROCK	X-RAY DIFFRACTION ANALYSIS INDICATED SILICIOUS SINTER	YES		COMMERCIAL GREENHOUSE		55	74	SOIL WARMING	ONION DEHYDRATION	YES	44.0439 115.8423	ROSS, 1971
GRIMES PASS H S 8N 5E 10DAA1S	3	CRETACEOUS GRANITIC ROCK	WATER PIPED ACROSS RIVER COMBINING WITH SPRING 08N05E10ADD			SPACE HEATING OF GREENHOUSE		48		SEEDLING CONIFERS			44.0439 115.8423	ROSS, 1971
DAN HODGES H S 8N 5E 11ABB1S	3	CRETACEOUS GRANITIC ROCK				HEATING OF SWIMMING POOL	15240	60		ANIMAL HUSBANDRY			44.0507 115.8286	ROSS, 1971
PINE FLAT W S 8N 6E 1ADA1S	56	CRETACEOUS GRANITIC ROCK		YES	YES	UNUSED		35		AQUACULTURE			44.0620 115.6845	ROSS, 1971
PINE FLAT H S 8N 6E 1ADB1S	454	CRETACEOUS GRANITIC ROCK	FOUR VENTS AND NUMEROUS SEEPS			RECREATION		59		GREENHOUSE			44.0610 115.6869	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition Sili-ceous	Deposition Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
				Boise County (cont'd.)												
DEER H S 9N 3E 25BAC1S	113	CRETACEOUS GRANITIC ROCK		STRONG SULFUR ODOR; X-RAY DIFFRACTION ANALYSIS INDICATED AMORPHOUS MATERIAL AND SILICIOUS SINTER		YES		BATHING		80	139	POWER GENERATION	FREEZE DRYING	YES	44.0922 116.0516	ROSS, 1971
HAVEN LODGE H S 9N 8E 31AAC1S	302	CRETACEOUS GRANITIC ROCK		TEMPERATURE REPORTED TO HAVE INCREASED 5.5 DEGREES C IN THE LAST EIGHT YEARS		YES		SPACE HEATING		64		APPLE DEHYDRATION			44.0773 115.5525	ROSS, 1971
KIRKHAM H S 9N 8E 32CAB1S	151	TERTIARY GRANITIC ROCK		TWO MAIN SPRING VENTS AND NUMEROUS SEEPS; TEMPERATURE RANGE 48-65 DEGREES C; SULFUR ODOR		YES	YES	RECREATION		65	79	ANIMAL HUSBANDRY	PEACH DEHYDRATION	YES	44.0718 115.5425	ROSS, 1971
WARM SPRINGS CRK. H S 10N 4E 33CBD1S	5677	CRETACEOUS GRANITIC ROCK		FOUR SPRING VENTS; X-RAY DIFFRACTION ANALYSIS INDICATED AMORPHOUS MATERIAL AND SILICIOUS SINTER		YES		SPACE HEATING OF GREENHOUSES		75		REFRIGERATION (LOWER TEMPERATURE LIMIT)			44.1539 115.9929	ROSS, 1971
BONNEVILLE H S 10N 10E 31BCC1S	1374	CRETACEOUS GRANITIC ROCK, SILICIFIED IN PLACES		EIGHT SPRING VENTS AND NUMEROUS SEEPS; SLIGHT SULFUR ODOR; TEMPERATUE RANGE 68-85 DEGREES C		YES	YES	RECREATION		85	142		BEET SUGAR PROCESSING	YES	44.1572 115.3140	WARING, 1965
SACAJAWEA H S 10N 11E 31AAD1S	113	TERTIARY GRANITIC ROCK		TWO MAIN SPRING VENTS AND NUMEROUS SEEPS; TEMPERATURE RANGE 52-58 DEGREES C; SULFUR ODOR				UNUSED		67		GAME BIRD HATCHERY			44.1602 115.1769	ROSS, 1971
GRANDJEAN H S 10N 11E 32BAD1S		TERTIARY GRANITIC ROCKS (?)		TEMPERATURE NOT FIELD CHECKED				RECREATION		0					44.1598 115.1674	
				Bonneville County												
FALL CREEK MINERAL SPG. 1N 43E 8CCD1S	264	QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS NEAR PALEOZOIC LIMESTONE	NORTHWEST TRENDING FAULT	SPRING VENTS EXTENDING ALONG CREEK INTO SECTION 8 AND 17; SULFUR ODOR; TEMPERATURE RANGE 23-25 D EGREES C	YES		YES			25	42	CATFISH FARMING	SEEDLING CONIFERS	YES	43.4230 111.4140	JOBIN AND SHROEDER, 1964
RICHARD PIGGOT WELL 2N 39E 30ADC1								DOMESTIC		20		HEATING AND COOLING WITH HEAT PUMP			43.4761 111.9065	
BROCKMAN CREEK W S 2S 42E 26DCD1S	49									35		DE-ICING HIGHWAY		YES	43.2095 111.4945	

ALPINE W S 2S 46E 19CAD1S	94	QUATERNARY ALLUVIUM NEAR TERTIARY SILICIC VOLCANICS		SPRING IS NOW UNDER PALISADES RESERVOIR					37	61	BIODEGRADATION	APPLE DEHYDRATION	YES	43.2265 111.1085	ROSS, 1971
Butte County															
LEWIS ROTHWELL WELL 3N 25E 32CDC1		PLEISTOCENE BASALT		DRILLER'S LOG AVAILABLE			STOCK WATERING	109	43	76	GREENHOUSE AND SOIL WARMING	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	43.5401 113.5087	MITCHELL AND YOUNG, 1973
HARVEY WALKER WELL 3N 27E 9AAB1				NOT FIELD CHECKED			STOCK WATERING	182	40					43.6093 113.2384	
BUTTE CITY WELL 3N 27E 9ABB1	473	PLEISTOCENE BASALT AND SEDIMENTS		DRILLER'S LOG AVAILABLE; ORIGINALLY DRILLED TO 259 METERS IN RESEARCH OF COOLER WATER-TEMPERATURE INCREASED			PUBLIC SUPPLY	144	35	52	BIODEGRADIATION	MUSHROOM GROWING	YES	43.6087 113.2436	MITCHELL AND YOUNG, 1973
BUTTE CITY WELL 3N 27E 9ABB2	473	PLEISTOCENE BASALT AND SEDIMENTS					PUBLIC SUPPLY	152	33		FERMENATION			43.6086 113.2441	MITCHELL AND YOUNG, 1973
Camas County															
WARDROP H S 1N 13E 32ABB1S	719	QUATERNARY ALLUVIUM NEAR PLEISTOCENE BASALT AND CRETACEOUS GRANITIC ROCK	NORTHWEST TRENDING FAULT	NUMEROUS SPRING VENTS TEMPERATURE RANGE 60-67 DEGREES C; ALSO KNOWN AS HOT SPRINGS RANCH	YES		DOMESTIC		64	91	APPLE DEHYDRATION	PASTEURIZATION	YES	43.3832 114.9319	WALTON, 1962
ELK CREEK H S 1N 15E 14ADA1S	75	CRETACEOUS GRANTIC ROCKS NEAR CONTACT WITH OLIGOCENE SILICIC VOLCANIC ROCKS		FIVE SPRING VENTS AND NUMEROUS SEEPS; TEMPERATURE RANGE 44-55 DEGREES C		YES	UNUSED		52	94	BALNEOLOGICAL BATH	SAUNA	YES	43.4232 114.6266	WALTON, 1962
BAUMGARTNER H S 3N 12E 7DCD1S	75	CRETACEOUS GRANITIC ROCKS		SLIGHT SULFUR ODOR			RECREATION & SWIMMING POOL		44		SEEDLING CONIFERS		YES	43.6025 115.0704	ROSS, 1971
LIGHTFOOT H S 3N 13E 7DCA1S	189	CRETACEOUS GRANITIC ROCKS		SEVERAL SPRING VENTS; TEMPERATURE RANGE 49-62 DEGREES C			UNUSED		56		LAUNDRY USE		YES	43.6054 114.9492	GARCIA, 1978 (SITE INSPECTION)
HOUSEMAN H S 3N 13E 7DCC1S							UNUSED		67		PASTEURIZING			43.6023 114.9516	
PREIS H S 3N 14E 19DDB1S	18	TERTIARY DIKES IN CRETACEOUS GRANITIC ROCKS					UNUSED		41		STOCK WATERING			43.5762 114.8299	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Siliceous	Deposition: Carbonates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
Camas County (cont'd.)																
WORSWICK H S 3N 14E 28CAA1S	1763	CRETACEOUS GRANITIC ROCK		SEVERAL SPRING VENTS; GRANITIC ROCK SILICIFIED IN PLACES; POSSIBLE INTERSECTION OF FAULTS		YES	YES			82	93	PASTEURIZATION	SAUNA	YES	43.5646 114.7975	UMPLEBY, 1913
BIG SMOKEY W S 4N 14E 12BAA1S	37	CRETACEOUS GRANITIC ROCKS		NOT FIELD CHECKED; SEVERAL SPRING VENTS; REPORTED BY ROSS, 1971				UNUSED		0					43.7010 114.7380	ROSS, 1971
SKILLERN H S 4N 14E 29DCC1S	757							UNUSED		60		ANIMAL HUSBANDRY			43.6470 114.8156	
SHEEP H S 1S 12E 16CAB1S		QUATERNARY ALLUVIUM						UNUSED		44	73	BALNEOLOGICAL BATH	APPLE DEHYDRATION	YES	43.3338 115.0395	ROSS, 1971
WOLF H S 1S 12E 16CBA1S	196	QUATERNARY ALLUVIUM						UNUSED		45	57	BALNEOLOGICAL BATH		YES	43.3346 115.0440	ROSS, 1971
KEITH STROM WELL 1S 12E 31CBC1		QUATERNARY ALLUVIUM		FLOWING WELL				UNUSED	121	25	51	FERMENTATION	GREENHOUSE	YES	43.2892 115.0850	WALTON, 1962
LEE BARRON WELL #1 1S 13E 22CCC1				UNABLE TO VERIFY TEMPERATURE; WELL NOT IN USE AT TIME OF INSPECTION				UNUSED	57	26	92	FISH FARMING	BLANCHING	YES	43.3142 114.9084	
SUN VALLEY RANCHES WELL 1S 13E 22DCC1	4542	QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE				IRRIGATION	140	25		DE-ICING ROADWAYS			43.3139 114.8992	LOG, 1977
LEE BARRON WELL #2 1S 13E 27CCB1		QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE				UNUSED	37	35		MUSHROOM GROWING		YES	43.3016 114.9092	WALTON, 1962
LEE BARRON WELL #3 1S 13E 27CCB1	189	QUATERNARY ALLUVIUM		FLOWING WELL; DRILLER'S LOG AVAILABLE				UNUSED	120	45	79	SEEDLING CONIFERS	PASTEURIZED MILK PROCESS	YES	43.3011 114.9084	MITCHELL, 1976

BARRON'S H S 1S 13E 34BCB1S	75	QUATERNARY ALLUVIUM NEAR TERTIARY SILICIC VOLCANIC ROCKS			DOMESTIC		75	95	DEHYDRATION	BLANCHING	YES	43.2939 114.9087	ROSS, 1971
LEE BARRON WELL #4 1S 13E 34BCC1	37	QUATERNARY ALLUVIUM NEAR TERTIARY SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE FLOWING WELL	HEATING GREENHOUSE	18	72		REFRIGERATION (LOWER TEMPERATURE LIMIT)		YES	43.2921 114.9093	ROSS, 1971
FAIRFIELD CITY WELL 1S 14E 9DBA1				NOT FIELD CHECKED		65	21				YES	43.3493 114.7965	
MORMON RESERVOIR W S 2S 14E 17BBB1S				UNABLE TO VERIFY; REPORTED WARM; SUBMERAGED IN MORMON RESERVOIR			0					43.2545 114.8293	

Canyon County

H. NAITO WELL 1N 2W 3CBB1	1885	PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT (?)	DRILLER'S LOG AVAILABLE	IRRIGATION	117	20	55	HEAT PUMP FOR HEATING AND COOLING	BALNEOLOGICAL BATHS	YES	43.4520 116.5699	SAVAGE, 1958
GORDON TIEGS WELL 1N 2W 4DBA1	4163	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	208	22		HEATING AND COOLING WITH HEAT PUMP			43.4512 116.5776	SAVAGE, 1958
LEONARD TIEGS WELL #1 1N 2W 5ADD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		OBSERVATION WELL; DRILLER'S LOG AVAILABLE	IRRIGATION	219	22	40	FISH FARMING AND HATCHING	STOCK WATERING	YES	43.4524 116.5941	SAVAGE, 1958
LEONARD TIEGS WELL #2 1N 2W 5CBA1	3596	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	152	25		CATFISH FARMING			43.4503 116.6069	SAVAGE, 1958
LEONARD TIEGS WELL #3 1N 2W 6ADD1		PLIOCENE AND PLEISTOCENE SEDIMENTS			IRRIGATION	28	26		FISH FARMING AND HATCHING			43.4523 116.6140	SAVAGE, 1958
DON TIEGS WELL #1 1N 2W 8ABC1		PLIOCENE AND PLEISTOCENE SEDIMENTS			IRRIGATION	137	21		HEATING AND COOLING WITH HEAT PUMP		YES	43.4414 116.6011	SAVAGE, 1958
DON TIEGS WELL #2 1N 2W 8ACC1	3028	PLIOCENE AND PLEISTOCENE SEDIMENTS			IRRIGATION	182	22	43	HEATING AND COOLING WITH HEAT PUMP	SEEDLING CONIFERS	YES	43.4379 116.6018	SAVAGE, 1958
RON CASSIDY WELL 1N 2W 9AAA1	75	PLIOCENE AND PLEISTOCENE SEDIMENTS		SULFUR ODOR; DRILLER'S LOG AVAILABLE	DOMESTIC	173	22		FISH FARMING AND HATCHING			43.4444 116.5735	SAVAGE, 1958

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Siliceous	Deposition: Carbonates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
Canyon County (cont'd.)																
MARK HARKER WELL 1N 2W 12ADD1	8706	PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	152	22		HEATING AND COOLING WITH HEAT PUMP			43.4386 116.5141	SAVAGE, 1958
STEVE TIEGS WELL 1N 2W 17DCC1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	121	20		HEATING AND COOLING WITH HEAT PUMP			43.4173 116.6000	SAVAGE, 1958
J. SHERAL JOHNSTON WELL 1N 2W 22DAD1	1703	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	146	21		FISH FARMING AND HATCHING			43.4063 116.5548	SAVAGE, 1958
MELBA CITY WELL 1N 2W 36CAA1	757	PLIOCENE AND PLEISTOCENE SEDIMENTS						PUBLIC SUPPLY	182	24		FISH FARMING AND HATCHING		YES	43.3780 116.5250	SAVAGE, 1958
M.O. CLEMENTS WELL #1 1N 3W 13DAB1	6132	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	185	20		HEATING AND COOLING WITH HEAT PUMP		C	43.4224 116.6359	SAVAGE, 1958
WES SCHOBER WELL 2N 2W 4DCA1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	112	22		FISH FARMING AND HATCHING			43.5345 116.5776	SAVAGE, 1958
JOHN TUCKER WELL 2N 2W 9BCA1	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	184	27		HEATING AND COOLING WITH HEAT PUMP			43.5281 116.5871	SAVAGE, 1958
DALE GETTER WELL 2N 2W 28DBB1								DOMESTIC	99	20		FERMENTATION			43.4809 116.5808	DENMAN, 1979 (SITE INSPECTION)
ERCIL BOWMAN JR WELL 2N 2W 34BDA1	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT	SULFUR ODOR; DRILLER'S LOG AVAILABLE				IRRIGATION	96	49		BALNEOLOGICAL BATHS		YES	43.4698 116.5629	SAVAGE, 1958
JAY NEIDER WELL #1 2N 2W 34CAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT (?)	DRILLER'S LOG AVAILABLE				IRRIGATION	97	29		DE-ICING ROADWAYS			43.4630 116.5637	SAVAGE, 1958

JAY NEIDER WELL #2 2N 2W 34CCB1		PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT (?)		IRRIGATION	109	20		FISH FARMING AND HATCHING			43.4623 116.5717	SAVAGE, 1958
JAY NEIDER WELL #3 2N 2W 34CDA1		PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT (?)	DRILLER'S LOG AVAILABLE	DOMESTIC	91	20		HEATING AND COOLING WITH HEAT PUMP			43.4622 116.5632	SAVAGE, 1958
DALE GROSS WELL 2N 2W 34DAA1	3406	PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT	DRILLER'S LOG AVAILABLE	IRRIGATION	95	29		DE-ICING ROADWAYS			43.4661 116.5536	SAVAGE, 1958
CANNON FARMS WELL #1 2N 3W 22ACD1	7570	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	136	26		CATFISH FARMING			43.4956 116.6782	SAVAGE, 1958
CANNON FARMS WELL #2 2N 3W 22BCD1	6813	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	195	31		TROPICAL FISH FARMING			43.4955 116.6872	SAVAGE, 1958
CANNON FARMS WELL #3 2N 3W 22CCD1	7570	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	223	28		CATFISH FARMING			43.4883 116.6870	SAVAGE, 1958
CANNON FARMS WELL #4 2N 3W 22DCC1	6813	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	185	30		BIODEGRADATION			43.4887 116.6808	SAVAGE, 1958
CANNON FARMS WELL #5 2N 3W 22DDC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		OBSERVATION WELL	IRRIGATION	183	30	56	DE-ICING HIGHWAYS	SEEDLING CONIFERS	YES	43.4884 116.6769	SAVAGE, 1958
CANNON FARMS WELL #6 2N 3W 23ACD1		PLIOCENE AND PLEISTOCENE SEDIMENTS			IRRIGATION		29		TROPICAL FISH FARMING			43.4968 116.6575	SAVAGE, 1958
CANNON FARMS WELL #7 2N 3W 23CDC1	1816	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	DOMESTIC	110	20		HEATING AND COOLING WITH HEAT PUMP			43.4884 116.6664	SAVAGE, 1958
CANNON FARMS WELL #8 2N 3W 26AAC1		PLIOCENE AND PLEISTOCENE SEDIMENTS			IRRIGATION		20		HEATING AND COOLING WITH HEAT PUMP			43.4856 116.6573	SAVAGE, 1958
CANNON FARMS WELL #9 2N 3W 27BBA1	2952	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	194	30		FISH FARMING AND HATCHING			43.4873 116.6867	SAVAGE, 1958

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
						Sili-ceous	Car-bon-ates									
								Canyon County (cont'd.)								
DESERT SUN FARMS WELL 2N 3W 34DBA1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	155	29		CATFISH FARMING			43.4663 116.6784	SAVAGE, 1958
CHARLES PENTLERS WELL 2N 3W 35CBA1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	167	29		DE-ICING HIGHWAY			43.4657 116.6625	SAVAGE, 1958
IDAHO STATE SCHOOL-HOSP. 3N 2W 14ADA1	4088	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	170	20		HEATING AND COOLING WITH HEAT PUMP			43.6004 116.5329	SAVAGE, 1958
NAMPA CITY WELL #1 3N 2W 17BCB1		PLIOCENE AND PLEISTOCENE SEDIMENTS						PUBLIC SUPPLY	198	25		FISH FARMING AND HATCHING			43.6002 116.6115	SAVAGE, 1958
NAMPA CITY WELL #2 3N 2W 23BCA1	1892	PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	121	31		AQUACULTURE			43.5853 116.5487	SAVAGE, 1958
SIMPLOT FEEDLOT WELL 4N 3W 19ADC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLED FOR OIL EXPLORATION ARTESIAN FLOW				WASTE WATER	929	40		SEEDLING CONIFERS			43.6706 116.7360	SAVAGE, 1958
CALDWELL MUNC. PARK 4N 3W 28AAB1	567	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; ARTESIAN FLOW; BACK FILLED TO 67 METERS				PUBLIC USE	121	29	54	FISH FARMING AND HATCHING	SWIMMING POOL	YES	43.6624 116.6963	SAVAGE, 1958
CALDWELL CITY WELL 4N 3W 35ABD1	3028	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL				PUBLIC USE	130	20	36	HEATING AND COOLING WITH HEAT PUMP	DE-ICING ROADWAYS	YES	43.6453 116.6589	SAVAGE, 1958
GEORGE WRIGHT WELL 4N 4W 4DCC1	68	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	128	21		FISH FARMING AND HATCHING			43.7058 116.8209	SAVAGE, 1958
RUSSELL FIVECOLT WELL 4N 4W 5DBD1		PLIOCENE AND PLEISTOCENE SEDIMENTS						DOMESTIC	153	25		FISH FARMING AND HATCHING			43.7113 116.8376	SAVAGE, 1958

PARMA CITY WELL #1 5N 5W 4DCD1	2271	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		PUBLIC USE	126	27		FISH FARMING AND HATCHING			43.7927 116.9384	SAVAGE, 1958
PARMA CITY WELL #2 5N 5W 9ADB1	4542	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		PUBLIC SUPPLY	96	20		CATFISH FARMING			43.7885 116.9342	LOG, 1957
PARMA ICE WELL 5N 5W 9CAB1		PLIOCENE AND PLEISTOCENE SEDIMENTS			COMMERCIAL		20		FISH FARMING AND HATCHING			43.7843 116.9455	SAVAGE, 1958
CLEO SWAWNE WELL 1S 2W 17ACA1		PLIOCENE AND PLEISTOCENE SEDIMENTS			DOMESTIC		22		FISH FARMING AND HATCHING			43.3414 116.5990	SAVAGE, 1958
					Caribou County								
BLACKFOOT RIVER W S 5S 40E 14BCD1S	3	QUATERNARY BASALT			UNUSED		26	52	BIODEGRADATION	GRAIN-HAY DRYING	YES	42.9863 111.7434	MITCHELL, 1976
WILSON LAKE W S 5S 41E 6ABB1S			NOT FIELD CHECKED; REPORTED TO HAVE SEVERAL SPRING VENTS		UNUSED		30					43.0103 111.6965	
BLACKFOOT RESERVOIR 6S 41E 1ADC1S	567	QUATERNARY TUFA	INDIAN LAND		STOCK WATERING		22	40	HEATING AND COOLING WITH HEAT PUMP	SOIL WARMING	YES	42.9280 111.5924	MITCHELL, 1976
CORRAL CREEK WELL #1 6S 41E 19BAA1	598	PERMIAN PHOSPHATIC SHALE	TRAVERTINE DEPOSITS	YES		39	42	45	BALNEOLOGICAL BATH	SEEDLING CONIFERS	YES	42.8892 111.6988	MITCHELL, 1976
CORRAL CREEK WELL #2 6S 41E 19BAB1	397	PERMIAN PHOSPHATIC SHALE	TRAVERINE DEPOSITS	YES		36	41	48	SEEDLING CONIFERS	GRAIN-HAY DRYING	YES	42.8891 111.7010	MITCHELL, 1976
CORRAL CREEK WELL #3 6S 41E 19BAC1	79	PERMIAN PHOSPHATIC SHALE	TRAVERTINE DEPOSITS	YES		56	41	48	STOCK WATERING	MUSHROOM GROWING	YES	42.8880 111.7009	MITCHELL, 1976
CORRAL CREEK WELL #4 6S 41E 19BAD1		PERMIAN PHOSPHATIC SHALE	TRAVERTINE DEPOSITS	YES		64	36	48	FERMENATATION	BALNEOLOGICAL BATHS	YES	42.8882 111.6988	MITCHELL, 1976
HENRY W S 6S 42E 8DBA1S		QUATERNARY TUFA			UNUSED		30					42.9106 111.5557	MITCHELL, 1976

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Caribou County (cont'd.)																
PORTNEUF RIVER W S 7S 38E 26CBD1S		QUATERNARY BASALT (?)								34		AQUACULTURE		YES	42.7809 111.9827	MITCHELL, 1976
STEAMBOAT SPRINGS 9S 41E 10DAA1S				SUBMERGED IN SODA POINT RESERVOIR						31					42.6554 111.6433	
SODA SPRINGS GEYSER 9S 41E 12ADD1S	3	HOLOCENE TRAVERTINE NEAR PLEISTOCENE BASALT	NORTHWEST TRENDING THRUST FAULT			YES	YES			28	54	FERMENTATION	GRAIN-HAY DRYING	YES	42.6570 111.6040	ARMSTRONG, 1969
Cassia County																
J.T. ROBINSON WELL 9S 28E 33DAC1	4428	PRE-TERTIARY (?) LIMESTONE		DRILLER'S LOG AVAILABLE				IRRIGATION	259	25		FISH FARMING AND HATCHING			42.5961 113.1788	WALKER AND OTHERS, 1970
RAINBOW RANCH WELL #1 10S 26E 2BCB1	9841	QUATERNARY BASALT AND PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	249	37		HYDROPONICS			42.5845 113.3917	WALKER AND OTHERS, 1970
RAINBOW RANCH WELL #2 10S 26E 2CBA1		PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	190	24		CATFISH FARMING			42.5816 113.3999	VON LINDERN, 1978 (SITE INSPECTION)
SIX S RANCH WELL #1 11S 25E 11CCA1	4088	PRECAMBRIAN QUARTZITE	NORTH TRENDING FAULT	DRILLER'S LOG AVAILABLE; FLOWING WELL; SULFUR ODOR		YES	YES	IRRIGATION	136	55	89	LAUNDRY USES	SAUNA	YES	42.4768 113.5068	CROSTHWAITE, 1957
MARSH CREEK H S 11S 25E 22CDC1S	37	PLIOCENE SILICIC VOLCANIC ROCKS	FAULT					UNUSED		40		SOIL WARMING			42.4466 113.5234	ROSS,1971
MARSH GULLY H S 11S 25E 22DAD1S	37	PLIOCENE SILICIC VOLCANIC ROCKS	FAULT					UNUSED		41		SOIL WARMING			42.4490 113.5112	ROSS,1971
SIX S RANCH WELL #2 11S 26E 20DDD1	4220							IRRIGATION		33	49	AQUACULTURE	SEEDLING CONIFERS	YES	42.4454 113.4338	

CRITCHFIELD LAND & CAT. 11S 26E 28BCB1	4428	QUATERNARY BASALT AND ALLUVIUM	DRILLER'S LOG AVAILABLE; FLOWING WELL	IRRIGATION	176	37	51	DE-ICING	MUSHROOM GROWING	YES	42.4398 113.4322	WALKER AND OTHERS, 1970
C&Y RANCH WELL #1 11S 27E 5ABA1	22	QUATERNARY ALLUVIUM AND TERTIARY SEDIMENTARY ROCKS		IRRIGATION	100	28		BIODEGRADATION			42.5009 113.3185	WALKER AND OTHER, 1970
C&Y RANCH WELL #2 11S 27E 5BAB1	5299	QUATERNARY SEDIMENTARY ROCKS	PARTIAL DRILLER'S LOG AVAILABLE	IRRIGATION	348	27		HEAT PUMP FOR HEATING AND COOLING		YES	42.5017 113.3258	WALKER AND OTHERS, 1970
RUBY FARMS WELL 11S 27E 34DDB1	9512	QUATERNARY SEDIMENTARY ROCKS		IRRIGATION	351	23	75	CATFISH FARMING	FRUIT AND VEGETABLE DEHYDRATION	YES	42.2208 113.2970	WALKER AND OTHERS, 1970
STOKER WELL 11S 27E 36ADA1					182	24		FERMENTATION			42.4255 113.2357	ROSS, 1971
11S 28E 31DDD1				IRRIGATION		24		FERMENTATION			42.4155 113.2149	
O.M. JOHNSON WELL 11S 28E 34CDD1	22	TERTIARY SEDIMENTARY ROCKS (?)	DRILLER'S LOG AVAILABLE	DOMESTIC AND STOCK WATERING	113	20		HEAT PUMP FOR HEATING AND COOLING			42.4882 113.2340	WALKER AND OTHERS, 1970
GALEN MEYERS WELL #1 12S 19E 2AAD1		QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS		IRRIGATION	298	35		AQUACULTURE			42.3273 114.1960	ROSS, 1971
GALEN MEYERS WELL #2 12S 19E 2ADD1		QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS		IRRIGATION	237	37		HYDROPONICS			42.4101 114.1915	ROSS, 1971
ROBERT PETERSON WELL #1 12S 19E 2BBC1		QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS		IRRIGATION	320	27		HEAT PUMP FOR HEATING AND COOLING			42.4150 114.2082	ROSS, 1971
ROBERT PETERSON WELL #2 12S 19E 3BCC1		ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS		IRRIGATION	274	27		BIODEGRADATION			42.4106 114.2285	ROSS, 1971
ROBERT PETERSON WELL #3 12S 19E 3BDB1		QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS		IRRIGATION	213	27		FISH FARMING AND HATCHING			42.4123 114.2211	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Siliceous	Deposition: Carbonates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
				Cassia County (cont'd.)												
ROBERT PETERSON WELL #4 12S 19E 30BB1		QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS						IRRIGATION	266	27		DE-ICING			42.4104 114.2169	ROSS, 1971
CREED CONCERN INC. #1 12S 19E 5CBD1	2210	QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS						IRRIGATION	304	36		FERMENTATION			42.4119 114.4443	ROSS, 1971
CREED CONCERN INC. #2 12S 19E 6ADD1	2555	QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	304	37		AQUACULTURE			42.4109 114.2674	ROSS, 1971
CREED CONCERN INC. #3 12S 19E 6CAD1	2725	QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS						IRRIGATION	162	27		FISH FARMING AND HATCHING			42.4070 114.2768	ROSS, 1971
CLARENCE DAGGNER WELL 12S 19E 6CDC1		QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS						IRRIGATION	335	34		DE-ICING ROADWAYS			42.4050 114.2789	ROSS, 1971
CREED CONCERN INC. #4 12S 19E 6DDD1	2725	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	234	38		HYDROPONICS			42.4034 114.2681	VON LINDERN, 1978 (SITE INSPECTION)
THURMAN WILLIS WELL 12S 19E 7ACA1	5621	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	243	34		BIODEGRADATION			42.3989 114.2724	LOG, 1960
K.C. BARLOW WELL 12S 20E 2DDD1	4542	QUATERNARY BASALT AND PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	272	24		CATFISH FARMING			42.4029 114.0694	LOG, 1960
MOUNTAIN VIEW RANCH INC. 12S 20E 3CAC1	4542	PLIOCENE SEDIMENTARY ROCKS AND PALEOZOIC LIMESTONE		DRILLER'S LOG AVAILABLE				IRRIGATION	204	32		GRAIN-HAY DRYING			42.4068 114.1008	A. PIPER, 1923
JOE SAVAGE WELL 12S 20E 5CCB1		PALEOZOIC LIMESTONE (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	274	23		FISH FARMING AND HATCHING			42.4049 114.1455	LOG, 1974

COINER BROTHERS WELL #1 12S 20E 6BAC1		QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	SPACE HEATING AND IRRIGATION	137	41	SEEDLING CONIFERS	42.4142 114.1608	LOG, 1975
COINER BROTHERS WELL #2 12S 20E 6BCC1		QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS		IRRIGATION	198	37	BIODEGRADATION	42.4103 114.1685	ROSS, 1971
HAROLD SAVAGE WELL 12S 20E 6DAC1	2206	QUATERNARY ALLUVIUM		IRRIGATION	237	32	MUSHROOM GROWING	42.4073 114.1549	ROSS, 1971
MERLE WOLVERTON WELL 12S 20E 11ADC1		QUATERNARY ALLUVIUM ABOVE TERTIARY SILICIC VOLCANIC ROCK		IRRIGATION	487	28	HEAT PUMP FOR HEATING AND COOLING	42.3957 114.0707	ROSS, 1971
CLARENCE BARKES WELL 12S 20E 12DCC1	870	PLIOCENE SILICIC VOLCANIC ROCKS AND PALEOZOIC SEDIMENTARY ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	357	29	CATFISH FARMING	42.3885 114.0577	LOG, 1976
GERALD CONARD WELL 12S 21E 1AAA1		PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	306	27	FISH FARMING AND HATCHING	42.4156 113.9322	LOG, 1968
GOLDEN VALLEY WELL 12S 21E 27CCB1	3633	PLIOCENE SILICIC VOLCANIC ROCKS AND PALEOZOIC SEDIMENTARY ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	585	39	HYDROPONICS	42.3478 113.9894	LOG, 1975
STEVEN CLARK WELL 12S 21E 28CCB1		QUATERNARY ALLUVIUM AND PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	348	21	CATFISH FARMING	42.3471 114.0093	LOG, 1975
SIMON BAKER WELL #1 12S 21E 32CCB1	6813	PALEOZOIC SEDIMENTARY ROCKS	DRILLER'S LOG AVAILABLE	STOCK AND IRRIGATION	76	21	HEAT PUMP FOR HEATING AND COOLING	42.3336 114.0290	LOG, 1962
SUSAN BAKER WELL 12S 21E 34AAD1	1135	QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	499	26	CATFISH FARMING	42.2555 113.9704	ROSS, 1971
ANDERSON BROTHERS WE 12S 22E 34ACC1	5677	QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	342	24	CATFISH FARMING	42.3370 113.8705	LOG, 1957
WILFORD WRIGLEY WELL 12S 23E 12AAA1		QUATERNARY SEDIMENTARY ROCKS ABOVE PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	STOCK WATERING	179	22	FISH FARMING AND HATCHING	42.4009 113.7051	LOG, 1962

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Cassia County (cont'd.)																
VARD CHATBURN WELL 12S 25E 4BDD1	3482	QUATERNARY SEDIMENTARY ROCKS ABOVE PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	191	21		HEATING AND COOLING WITH HEAT PUMP			42.4087 113.5406	LOG, 1955
K.C. BARLOW WELL 13S 21E 5BCC1	13248	QUATERNARY SEDIMENTARY ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	213	23		FISH FARMING AND HATCHING			42.3245 114.0267	LOG, 1961
SIMON BAKER WELL #2 13S 21E 6AAD1								IRRIGATION	104	22		CATFISH FARMING			42.3269 114.0291	
LYLE DURFEE WELL 13S 25E 22BCB1	681	QUATERNARY ALLUVIUM	FAULT (?)					IRRIGATION	156	32		AQUACULTURE		YES	42.3209 113.5300	ROSS, 1971
WARD SPRING 13S 26E 17CCD1S	18	PRE-TERTIARY UNDIFFERENTIATED ROCKS	FAULT					IRRIGATION		20	34	CATFISH FARMING	AQUACULTURE	YES	42.2860 113.4463	ROSS, 1971
RICE SPRING 13S 26E 17CDB1S	18	PRE-TERTIARY UNDIFFERENTIATED ROCKS						IRRIGATION		22		HEAT PUMP FOR HEATING AND COOLING			42.2867 113.4448	ROSS, 1971
LESTER THOMPSON WELL 13S 27E 2ADC1		PALEOZOIC SEDIMENTARY ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	336	26		FISH FARMING AND HATCHING			42.3215 113.2598	LOG, 1958
NELSON WELL 14S 21E 34AAC1	3406	PRE-TERTIARY UNDIFFERENTIATED ROCKS						UNUSED	299	43		STOCK WATERING			42.1687 113.9730	ROSS, 1971
14S 21E 34BDC1	189	PLIOCENE SILICIC VOLCANIC ROCKS		FLOWING WELL; SULFUR ODOR			YES	UNUSED		40	97	HYDROPONICS	SAUNA	YES	42.1648 113.9838	PIPER, 1923
OAKLEY H S 14S 22E 27DCB1S	37	PRE-TERTIARY QUARTZITE		SLIGHT SULFUR ODOR		(?)		RECREATION		48	92	GRAIN-HAY DRYING	BLANCHING	YES	42.1737 113.8609	ROSS, 1971

SEARS SPRING 14S 25E 6BBB1S	662	PRE-TERTIARY UNDIFFERENTIATED ROCKS	FAULT		STOCK WATERING		29	39	FISH FARMING AND HATCHING	HYDROPONICS	YES	42.2403 113.5875	ROSS, 1971
GRIFFETH-WIGHT WELL 14S 26E 1BDD1	378			DRILLED FOR GAS AND OIL EXPLORATION		1981	77	84	APPLE DEHYDRATION	PASTEURIZATION	YES	42.2350 113.3649	
HAROLD WIGHT WELL 14S 26E 1CDA1							63	121	ANIMAL HUSBANDRY	HIGH ENERGY PROCESSING OF KILN LUMBER	YES	42.2297 113.3647	
HAROLD WARD WELL #1 14S 27E 16CCC1	3399						24	104	DE-ICING ROADWAYS	WASHING AND DRYING OF WOOL	YES	42.1986 113.3530	
HEPWORTH WELL 14S 27E 18CCD1	11810	QUATERNARY ALLUVIUM AND SEDIMENTARY ROCKS		DRILLER'S LOG AVAILABLE	IRRIGATION	184	27		CATFISH FARMING			42.1937 113.3508	MITCHELL AND YOUNG, 1973
JACK PIERCE WELL 14S 28E 18AAA1	56	QUATERNARY ALLUVIUM AND SEDIMENTARY ROCKS		DRILLER'S LOG AVAILABLE	STOCK WATERING	176	21		HEAT PUMP FOR HEATING AND COOLING			42.1366 113.1470	LOG, 1966
OLD OAKLEY CANAL WELL #1 15S 21E 4ACB1					UNUSED	268	31		FERMENTATION			42.1540 124.0000	
OLD OAKLEY CANEL WELL #2 15S 21E 4ACB2					UNUSED	259	32		AQUACULTURE			42.1540 113.9998	
OAKLEY CANAL CO. WELL #1 15S 21E 13DAB1		QUATERNARY ALLUVUIM, TERTIARY SEDIMENTARY AND PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE	IRRIGATION	356	37		HYDROPONICS			42.1192 113.9362	PIPER, 1923
OAKLEY CANAL CO. WELL #2 15S 21E 24BAA1		QUATERNARY ALLUVUIM, TERTIARY SEDIMENTARY AND PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE	IRRIGATION	326	27		FISH FARMING AND HATCHING			42.1121 113.9415	
MORRIS MITCHELL WELL #1 15S 21E 25CDA1					DOMESTIC AND SPACE HEATING		41	97	STOCK WATERING	BLANCHING		42.0869 113.9414	
MORRIS MITCHELL WELL #2 15S 21E 25DCC1					IRRIGATION AND SPACE HEATING	792	47	94	SEEDLING CONIFERS	BLANCHING	YES	42.0870 113.9882	

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
								Cassia County (cont'd.)								
DURFEE SPRING 15S 24E 22DAC1S	189	QUATERNARY ALLUVIUM						UNUSED		39		DE-ICING			42.1015 113.6319	ROSS, 1971
HAROLD WARD WELL #2 15S 24E 22DDB1	378	QUATERNARY ALLUVIUM						DOMESTIC	152	32	47	AQUACULTURE	SEEDLING CONIFERS	YES	42.0991 113.6311	ROSS, 1971
GRAPE CREEK W S 15S 25E 29CCA1S	75			MARSH AREA				STOCK WATERING		22		FISH FARMING AND HATCHING			42.0854 113.5639	
BLM 15S 25E 29CDC1				NOT FIELD CHECKED FOR THIS REPORT						60	128	POULTRY HATCHERY	EVAPORATION AND CRYSTALLIZATION OF SALT	YES	42.0828 113.5623	
BLM 15S 26E 12ACC1		PLIOCENE SEDIMENTS		NOT FIELD CHECKED FOR THIS REPORT; DRILLER'S LOG AVAILABLE				TESTING		26	30	CATFISH FARMING	ALFALFA DEHYDRATION	YES	42.1335 113.3620	LOG, 1974
EG&G THERMAL #5 15S 26E 22DDA1				RAFT RIVER PROJECT; *SURFACE TEMPERATURE IS 125 DEGREES C				TESTING	1476			CANNING AND PRESERVING			42.0993 113.5793	
BLM 15S 26E 22DDD1	1892			NOT FIELD CHECKED FOR THIS REPORT; DRILLER'S LOG AVAILABLE				TESTING	442	28	103	FRUIT AND VEGETABLE DEHYDRATION	WASHING AND DRYING OF WOOL	YES	42.0971 113.3939	LOG, 1974
IVAN DARRINGTON WELL #1 15S 26E 23AAA1				SURFACE TEMPERATURE REACHES 140 DEGREES C AFTER BEING PUMPED FOR A PERIOD OF TIME						85	149	PASTEURIZATION	BEET SUGAR PROCESSING	YES	42.1104 113.3737	
IVAN DARRINGTON WELL #2 15S 26E 23ABD1	208	PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	109	28		FISH FARMING AND HATCHING			42.1087 113.3782	NACE AND OTHERS, 1961
FRAZIER H S WELL 15S 26E 23BBC1	219			FLOWING WELL; SLIGHT SULFUR ODOR; NOT FIELD CHECKED FOR THIS REPORT	(?)		YES		126	93	146	BLANCHING	CORN PRODUCTS (SYRUP,OIL)	YES	42.1079 113.3910	

EG&G MAIN THERMAL WE 15S 26E 23CAA1			RAFT RIVER PROJECT; *SURFACE TEMPERATURE IS 146 DEGREES C			EXPERIMENTAL POWER GENERATOR	1520			CORN PRODUCTS (SYRUP,OIL)			42.1030 113.3839	
EG&G THERMAL WELL #4 15S 26E 23CDA1			RAFT RIVER PROJECT			EXPERIMENTAL MONITORING WELL	1613	82		PASTEURIZATION			42.1333 113.3836	
IVAN DARRINGTON WELL #3 15S 26E 23DDB1	3406	PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE			IRRIGATION	79	40		SOIL WARMING			42.0984 113.3775	NACE AND OTHERS, 1961
GARY CROOK WELL 15S 26E 23DDC1	2271	PLEISTOCENE SEDIMENTS	FLOWING WELL; PAST USE: HARRIAT CRANK'S GREENHOUSE	(?)	YES		164	90	139	BARLEY MALTING PROCESS	POTATOE DEHYDRATION	YES	42.0970 113.3772	NACE AND OTHERS, 1961
IVAN DARRINGTON WELL #4 15S 26E 23DDD1		PLIOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE			IRRIGATION	78	33	94	FERMENTATION	PASTEURIZATION	YES	42.0969 113.3735	LOG, 1967
LANCE UDY WELL 15S 26E 24BAD1	3399					DOMESTIC		32	94	BIODEGRADATION	FRIUT AND VEGETABLE DEHYDRATION	YES	42.1077 113.3644	
REID STUART 15S 26E 24BCB1						IRRIGATION		24		FERMENTATION			42.1074 113.3725	
IVAN DARRINGTON WELL 15S 26E 24DCC1			NOT FIELD CHECKED FOR THIS REPORT					31	96	DE-ICING ROADWAYS	BARLEY MALTING PROCESS	YES	42.0968 113.3629	
BLM WELL 15S 26E 25ACA1	832		NOT FIELD CHECKED FOR THIS REPORT; DRILLER'S LOG AVAILABLE			TESTING	241	30	102	AQUACULTURE	WASHING AND DRYING OF WOOL	YES	42.0923 113.3588	LOG, 1974
EG&G THERMAL WELL 15S 26E 25ADA1	378		RAFT RIVER PROJECT; *SURFACE THEMPERATURE IS 121 DEGREES C			TESTING	1158			BLANCHING			42.0920 113.3536	
EG&G THERMAL WELL 15S 26E 25BDA1			RAFT RIVER PROJECT; *SURFACE THEMPERATURE IS 144 DEGREES C			MONITORING				CORN PRODUCTS (SYRUP, OIL)			42.0927 113.3648	
THOROUGHBRED W S 16S 19E 28BBA1S		TERTIARY SILICIC VOLCANIC ROCKS	NOT FIELD CHECKED; REPORTED BY ROSS, 1971; SEVERAL SPRING VENTS			UNUSED		21		FISH FARMING			42.0114 113.2392	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Cassia County (cont'd.)																
BLM WELL 16S 26E 5BBA1	1514			NOT FIELD CHECKED FOR THIS REPORT; DRILLER'S LOG AVAILABLE				TESTING	85	40	94	SOIL WARMING	BLANCHING	YES	42.0671 113.4469	LOG, 1970
Clark County																
LIDY H S #1 9N 33E 2BBC1S	946	PRE-TERTIARY LIMESTONE		PROCESSING FERTILIZER AND DOMESTIC USE; TRAVERTINE DEPOSITION NEAR SPRING VENTS				INDUSTRY		51	66	HAY DRYING	APPLE DEHYDRATION	YES	44.1438 112.5527	ROSS, 1971
WILSON BROS. WELL 9N 33E 2CDC1	3785	PRE-TERTIARY LIMESTONE		PROCESSING FERTILIZER AND DOMESTIC USE; PAST USE: RECREATION				INDUSTRY	213	50		SPACE HEATING			44.1316 112.5475	ROSS, 1971
LIDY H S WELL 10N 33E 35CCC1	6813	PRE-TERTIARY LIMESTONE	FAULT	PROCESSING FERTILIZER AND DOMESTIC USE				INDUSTRY	125	58	68	GREENHOUSE	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	44.1459 112.5532	ROSS, 1971
LIDY H S #2 10N 33E 35CCC1S	189	PRE-TERTIARY LIMESTONE	FAULT	PROCESSING FERTILIZER AND DOMESTIC USE				INDUSTRY		51		LAUNDRY USES			44.1453 112.5537	ROSS, 1971
WARM SPRINGS 11N 32E 25AAC1S	3406	PRE-TERTIARY LIMESTONE		TWO SPRING VENTS; X-RAY DIFFRACTION ANALYSIS INDICATED TRAVERTINE			YES	STOCK WATERING		29	57	CATFISH FARMING	GREENHOUSE SPACE HEATING	YES	44.2565 112.6391	ROSS, 1971
BIG SPRINGS 13N 32E 15BCB1S	189	PRE-TERTIARY LIMESTONE						UNUSED		23		FISH FARMING AND HATCHING			44.4538 112.6958	ROSS, 1971
Custer County																
BOWERY H S 7N 17E 6ABA1S		PALEOZOIC SEDIMENTARY ROCKS		NOT FIELD CHECKED				UNUSED		43	89	SEEDLING CONIFERS	BLANCHING	YES	43.9707 114.4949	TSCHANZ AND OTHERS, 1974
PIERSON H S 8N 14E 27DBD1S	416	QUARTZ MONZONITE		TEMPERATURE RANGE 37-43 DEGREES C; TWO SPRING VENTS				UNUSED		43	73	BALNEOLOGICAL BATH	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	43.9903 114.7999	TSCHANZ AND OTHERS, 1974

LOWER BOWERY H S 8N 17E 31DCB1S		PALEOZOIC SEDIMENTARY ROCK		SULFUR ODOR				UNUSED	54		GRAIN-HAY DRYING			43.9741 114.4986	TSCHANZ AND OTHERS, 1974
WEST PASS H S 8N 17E 32BCA1S		PALEOZOIC SEDIMENTARY ROCK		SULFUR ODOR				STOCK WATERING	51	64	MUSHROOM GROWING	APPLE DEHYDRATION	YES	43.9818 114.4858	TSCHANZ AND OTHERS, 1974
ROZALYS SMITH WELL #1 9N 14E 18CAD1		*QUATERNARY ALLUVIUM*						*HEATING OF POOL AND HOUSE*	37		HYDROPONICS			44.1065 114.8654	DENMAN, 1978 (SITE INSPECTION)
ROZALYS SMITH WELL #2 9N 14E 19ABA1		*QUATERNARY ALLUVIUM*		*CAPPED*				*UNUSED*	*50*		*GREENHOUSE*			44.1013 114.8620	*DENMAN, 1978* (SITE INSPECTION)
ROZALYS H S 9N 14E 19BAA1S		CRETACEOUS GRANITIC ROCK		REPORTED BY ROSS; NOT FIELD CHECKED			YES	UNUSED	41		STOCK WATERING			44.1010 114.8650	ROSS, 1971
STANLEY H S 10N 13E 3CAB1S	378	QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK	NORTHEAST TRENDING FAULT	NUMEROUS SEEPS; TEMPERATURE RANGE 30-41 DEGREES C; SIX SPRING VENTS; SULFUR ODOR	YES		YES	UNUSED	41	47	SOIL WARMING	GRAIN-HAY DRYING	YES	44.2242 114.9285	CHOATE, 1962
SLATE CREEK H S 10N 16E 30BAD1S	681	PALEOZOIC ARGILLITE		TEMPERATURE RANGE 32-50 DEGREES C; EIGHT SPRING VENTS; SULFUR ODOR; X-RAY DIFFRACTION ANALYSIS INDICATED SULFATE (GYPSUM)	YES		YES	UNUSED	50	91	SPACE HEATING	BLANCHING	YES	44.1709 114.6242	ROSS, 1937
ELKHORN H S 11N 13E 36BAA1S	757	QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK		NUMEROUS SEEPS				UNUSED	58	93	GREENHOUSE	BARLEY MALTING PROCESS	YES	44.2453 114.8850	ROSS, 1971
BASIN CREEK H S 11N 14E 21DDB1S	227	CRETACEOUS GRANITIC ROCK		TWO SPRING VENTS		YES	YES	UNUSED	35	73	AQUACULTURE	ONION DEHYDRATION	YES	44.2637 114.8183	ROSS, 1971
CAMPGROUND H S 11N 14E 22CCA1S	378	CRETACEOUS QUARTZ MONZONITE				YES	YES	FOREST CAMPGROUND	56		HOTBED HEATING			44.2643 114.8104	DENMAN, 1978 (SITE INSPECTION)
MORMON BEND H S 11N 14E 29AAB1S	1135	CRETACEOUS QUARTZ MONZONITE		TEMPERATURE NOT VARIFIED				UNUSED	38	75	HYDROPONICS	PASTEURIZED MILK PROCESS	YES	44.2600 114.8383	DENMAN, 1978 (SITE INSPECTION)
SUNBEAM H S 11N 15E 19CAB1S	1135	CRETACEOUS QUARTZ MONZONITE		TEMPERATURE RANGE 61-76 DEGREES C; NUMEROUS SPRING VENTS; SLIGHT SULFUR ODOR; X-RAY DIFFRACTION ANALYSIS AVAILABLE	YES	YES	YES	RECREATION	76	104	REFRIGERATION (LOWER TEMPERATURE LIMIT)	CANNING AND PRESERVING	YES	44.2679 114.7478	TSCHANZ AND OTHERS, 1974

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Custer County (cont'd.)																
EAST ROBINSON BAR H S 11N 15E 26CCC1S		CRETACEOUS QUARTZ MONZONITE		FOUR SPRING VENTS; TEMPERATURE RANGE 38-42 DEGREES C						42		SEEDLING CONIFERS			44.2481 114.6730	TSCHANZ AND OTHERS, 1974
ROBINSON BAR H S 11N 15E 27DDC1S	264	CRETACEOUS QUARTZ MONZONITE		SPRING PIPED TO POOL				RECREATION		55	97	GRAIN-HAY DRYING	WASHING AND DRYING OF WOOL	YES	44.2466 114.6764	TSCHANZ AND OTHERS, 1974
WARM SPRINGS CREEK H S 11N 15E 34ADC1S	18	CRETACEOUS QUARTZ MONZONITE		SLIGHT SULFUR ODOR				UNUSED		52		BALNEOLOGICAL BATHS			44.2410 114.6782	JOHNSON, 1978 (SITE INSPECTION)
SULLIVAN H S 11N 17E 27BDD1S	757	CONTACT BETWEEN OLIGOCENE SILICIC VOLCANIC ROCKS AND PALEOZOIC DOLOMITE AND ARGILLITE		SULFUR ODOR		YES	YES	RECREATION		41	99	SEEDLING CONIFERS	PASTEURIZATION	YES	44.2541 114.4427	ROSS, 1937
BARNEY W S 11N 25E 23CAB1S	643	QUATERNARY ALLUVIUM NEAR TERTIARY SILICIC VOLCANIC ROCK AND PRE-TERTIARY UNDIFFERENTIATED						STOCK WATERING		28	59	AQUACULTURE	ANIMAL HUSBANDRY	YES	44.2689 113.4491	ROSS, 1971
CAPE HORN W S 12N 11E 2CDB1S	37	CRETACEOUS GRANITIC ROCK		SNAKE RIVER BOY SCOUT COUNCIL CAMP; THREE SPRING VENTS				RECREATION		35		FERMENTATION			44.3979 115.1491	ROSS, 1971
LITTLE ANTELOPE FLAT W S 12N 20E 10CBD1S	1135	QUATERNARY ALLUVIUM NEAR TERTIARY SILICIC VOLCANICS		SEVERAL SPRING VENTS				UNUSED		34		HYDROPONICS			44.3817 114.0873	ROSS, 1971
SULPHUR CREEK H S 14N 11E 1B 1S	15	CRETACEOUS GRANITIC ROCKS		REPORTED WARM; NOT FIELD CHECKED				UNUSED		0					44.5846 115.0719	ROSS, 1971
BEARDSLEY H S 14N 19E 23DDD1S	5677	PLIOCENE SILICIC VOLCANIC ROCK AND PRE-TERTIARY UNDIFFERENTIATED ROCK		SEVERAL SPRING VENTS; ALSO KNOWN AS CHALLIS HOT SPRINGS				RECREATION		43		BALNEOLOGICAL BATH			44.5230 114.1733	ROSS, 1971
BILL JOHNSTON WELL 14N 19E 34DAA1	189			FLOWING WELL; ORIGINALLY DRILLED TO APPROXIMATELY 2288 METERS, CAVED BACK TO PRESENT DEPTH				IRRIGATION	914	40	60	SOIL WARMING	GAME BIRD HATCHERY	YES	44.4994 114.1944	

OWEN CABIN H S 15N 14E 10ADC1S	94	PRE-TERTIARY UNDIFFERENTIATED ROCK	SULFUR ODOR		UNUSED	56		MUSHROOM GROWING			44.6516 114.7343	ROSS, 1971
UPPER LOON CREEK H S 15N 14E 10DCC1S	18	PRE-TERTIARY UNDIFFERENTIATED ROCK	NUMEROUS SPRING VENTS; TEMPERATURE RANGE 46-63 DEGREES C; SULFUR ODOR		UNUSED	63		GREENHOUSE			44.6447 114.7389	ROSS, 1971
SUNFLOWER FLAT H S 16N 12E 8DDB1S			NOT FIELD CHECKED; REPORTED BY ROSS, 1971		UNUSED	43	71	SEEDLING CONIFERS	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	44.7331 115.0176	
THOMAS CREEK RANCH H S 16N 12E 17DAD1S	257	TERTIARY GRANITIC ROCKS	NOT FIELD CHECKED; REPORTED BY ROSS, 1971		UNUSED	43	90	BALNEOLOGICAL BATHS	BLANCHING	YES	44.7212 115.0150	ROSS, 1971
LOWER LOON CREEK H S 17N 14E 19BDB1S	30	TERTIARY GRANITIC ROCKS	NOT FIELD CHECKED; REPORTED BY ROSS		UNUSED	49	73	SPACE HEATING	APPLE DEHYDRATION	YES	44.7988 114.8047	ROSS, 1971
				Elmore County								
LANDA H S 2N 10E 5AAD1S			TWO SPRING VENTS AND SEVERAL SEEPS	YES	SPACE HEATING	60		GAME BIRD HATCHERY			43.5415 115.2817	
BRIDGE H S 2N 10E 5ACA1S		QUATERNARY ALLUVIUM OVERLYING CRETACEOUS GRANITIC ROCK	SIX SPRING VENTS; TEMPERATURE RANGE 52-59 DEGREES C	YES		59		GREENHOUSE			43.5398 115.2882	ROSS, 1971
TOWNE CREEK W S 2N 10E 19ABA1S						24		HEATING AND COOLING WITH HEAT PUMP			43.4996 115.3076	
RATTLESNAKE H S 3N 7E 7DCA1S			NOT FIELD CHECKED		UNUSED	56		GREENHOUSE			43.6053 115.6636	
CHARLES BAKER WELL 3N 10E 10ABA1	26	CRETACEOUS GRANITIC ROCKS	DRILLER'S LOG AVAILABLE; WATER IS PUMPED FROM APPROX 49 M TO 90 M WHERE IT IS WARMED SEVERAL DEGREES ON THE HOT ROCKS THEN RETURNED		SPACE HEATING	89	43	SEEDLING CONIFERS		YES	43.6160 115.2484	ROSS, 1971
PARADISE H S 3N 10E 33ACD1S	37	QUATERNARY ALLUVIUM OVERLAYING CRETACEOUS GRANITIC ROCK		YES	SPACE HEATING	52	73	LAUNDRY USE	ONION DEHYDRATION	YES	43.5527 115.2670	ROSS, 1971
PARADISE H S WELL 3N 10E 33BDB1	75	CRETACEOUS GRANITIC ROCKS	DRILLER'S LOG AVAILABLE; FLOWING WELL		UNUSED	57	38	HYDROPONICS			43.5546 115.2740	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition Sili-ceous	Deposition Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
				Elmore County (cont'd.)												
BASSET H S 4N 7E 1AAB1S		CRETACEOUS GRANITIC ROCKS		REPORTED BY ROSS, 1971; UNABLE TO LOCATE				UNUSED		0					43.7175 115.5629	ROSS, 1971
REED H S 4N 7E 7ADC1S	18	CRETACEOUS GRANITIC ROCKS						UNUSED		41		STOCK WATERING			43.6966 115.6607	ROSS, 1971
SHEEP CREEK BRIDGE H S 4N 7E 8CBB1S	283	CRETACEOUS GRANITIC ROCKS		TWO SPRING VENTS; MINIMAL DEPOSITION OF SILICIOUS SINTER		YES		STOCK WATERING		61		GAME BIRD HATCHERY			43.6962 115.6576	ROSS, 1971
WILLOW CREEK H S 4N 11E 34DBB1S		QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK WITH TERTIARY DIKES		THREE SPRING VENTS AND NUMEROUS SEEPS		YES		RECREATION		55		GREENHOUSE			43.6372 115.1295	ROSS, 1971
POOL CREEK H S 5N 7E 24AAD1S	7	CRETACEOUS GRANITIC ROCKS		SOME SEEPAGE				UNUSED		42		SOIL WARMING			43.7595 115.5602	ROSS, 1971
NINEMEYER H S 5N 7E 24BDD1S	1321	CRETACEOUS GRANITIC ROCKS		TEMPERATURE RANGE 65-75 DEGREES C; THIRTEEN SPRING VENTS	YES	YES		UNUSED		76	126	PASTEURIZED MILK PROCESS	SUGARBEET PULP DEHYDRATION	YES	43.7553 115.5709	WARING, 1965
VAUGHN SPRING 5N 7E 26DAB1S	378	CRETACEOUS GRANITIC ROCKS		TEMPERATURE RANGE 58-68 DEGREES C; THREE SPRING VENTS				UNUSED		68		REFRIGERATION (LOWER TEMPERATURE LIMIT)			43.7243 115.6041	ROSS, 1971
SMITH CABIN H S 5N 7E 34CCB1S	2649	CRETACEOUS GRANITIC ROCKS		FOUR SPRING VENTS				UNUSED		59		ANIMAL HUSBANDRY			43.7242 115.6040	ROSS, 1971
LOFTUS H S 5N 7E 34DBA1S	151	CRETACEOUS GRANITIC ROCKS		TEMPERATURE RANGE 47-54 DEGREES C; TWO SPRING VENTS		YES	YES	BATHING		54		GRAIN-HAY DRYING			43.7243 115.6041	ROSS, 1971
BROWN CREEK H S 5N 8E 10DCD1S	757	CRETACEOUS GRANITIC ROCK		KNOWN AS POOL CREEK H S IN ROSS REPORT; TWO SPRING VENTS AND SEVERAL SEEPS				UNUSED		50		MUSHROOM GROWING			43.7785 115.4860	BEARD, 1978 (SITE INSPECTION)

STRAIGHT CREEK H S 5N 8E 12ABD1S			SEVERAL SPRING VENTS AND SEEPS; ACTIVE DEPOSITION FORMING SILICIOUS SINTER; NOT FIELD CHECKED		YES		UNUSED		62	APPLE DEHYDRATION			43.7882 115.4444	
GRANITE CREEK H S 5N 9E 5ADA1S	75	CRETACEOUS GRANITIC ROCK	FOUR SPRING VENTS AND SEVERAL SEEPS		YES		UNUSED		55	GREENHOUSES			43.8033 115.4006	BEARD, 1978 (SITE INSPECTION)
DUTCH FRANK'S H S 5N 9E 7BBA1S	1135	CRETACEOUS GRANITIC ROCK	NUMEROUS SPRING VENTS; TEMPERATURE RANGE 50-65 DEGREES C; ACTIVE DEPOSITION OF SILICIOUS SINTER	YES	YES	YES	UNUSED		65 72	APPLE DEHYDRATION	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	43.7894 115.4344	WARING, 1965
WEATHERBY MILL WELL 6N 9E 35ACA1		CRETACEOUS GRANITIC ROCK	FLOWING WELL; DEPTH REPORTED BY ROSS, 1971				RECREATION	533	30	FERMENTATION			43.8170 115.3545	ROSS, 1971
WEATHERBY H S 6N 10E 30CCB1S	189	CRETACEOUS GRANITIC ROCK	SEEPAGE TYPE SPRING				UNUSED		45	GRAIN-HAY DRYING			43.8255 115.3271	ROSS, 1971
QUEENS RIVER H S 6N 11E 30ADB1S			NOT FIELD CHECKED; REPORTED WARM						0				43.8314 115.1915	
ATLANTA H S 6N 11E 35DAD1S	378	CRETACEOUS GRANITIC ROCK	TEMPERATURE RANGE 43-60 DEGREES C; NINE SPRING VENTS AND SEVERAL SEEPS		YES		UNUSED		60 76	REFRIGERATION (LOWER TEMPERATURE LIMIT)			43.8116 115.1093	ROSS, 1971
CHATTANOOGA H S 6N 11E 35DBB1S	37	CRETACEOUS GRANITIC ROCK	SEVERAL SPRING VENTS AND NUMEROUS SEEPS				UNUSED		50	LAUNDRY USES			43.8130 115.1157	ROSS, 1971
LEGGIT CREEK H S 6N 12E 33BCB1S		CRETACEOUS GRANITIC ROCK (?)	THIS IS AN APPROXIMATE LOCATION; REPORTED IN THE IDAHO ENCYCLOPEDIA, 1938				UNUSED		0				43.8168 115.0459	
BIG D RANCH WELL 2S 4E 28BDD1	9463	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE				IRRIGATION	365	27	DE-ICING			43.2223 115.9866	YOUNG, 1977
FRED HICKEY WELL 2S 5E 11ADD1	7210	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE				IRRIGATION	182	22	FISH FARMING			43.2663 115.8188	YOUNG, 1977
CHARLES COE WELL 2S 5E 22AAD1	567	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	WATER TEMPERATURE FLUCTUATES BETWEEN 15-21 DEGREES C; DRILLER'S LOG AVAILABLE				DOMESTIC	132	21	HEATING AND COOLING WITH HEAT PUMP			43.2406 115.8376	LOG, 1977

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Elmore County (cont'd.)																
JOHN MALOTA WELL 2S 5E 23BBC1	757	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	128	21	77	FISH FARMING	ONION AND CARROT DEHYDRATION	YES	43.2403 115.8368	LOG, 1977
MICHAEL JACKSON WELL 3S 6E 24DCB1	90	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC		48	21	HEATING AND COOLING WITH HEAT PUMP			43.1442 115.6853	LOG, 1969
MOUNTAIN HOME CITY WELL 3S 6E 26ADC1	6056	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS						PUBLIC SUPPLY		294	23	BIODEGRADATION			43.1341 115.6989	YOUNG, 1977
RICHARD CHANDLER WELL 3S 6E 35BCC1		PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	134	20		HEATING AND COOLING WITH			43.1198 115.7142	LOG, 1972
ROBERT FORD WELL #1 3S 7E 2ACA1		PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		NOT PUMPING AT TIME OF CHECK; TEMPERATURE REPORTED BY ROSS, 1971; DRILLER'S LOG AVAILABLE				IRRIGATION	158	31		CATFISH FARMING			43.1939 115.5835	YOUNG, 1977
LONG TOM RANCH WELL #1 3S 7E 1ACA1		PLEISTOCENE BASALTIC ROCK AND SEDIMENTS						DOMESTIC	53	20	58	FISH FARMING	GREENHOUSE SPACE HEATING	YES	43.1945 115.5652	YOUNG, 1977
ROBERT FORD WELL #2 3S 7E 2ACC1	37	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS						DOMESTIC	152	21		HEATING AND COOLING WITH HEAT PUMP			43.1926 115.5856	YOUNG, 1977
DEL FOSTER WELL 3S 7E 3ADD1	158	PLEISTOCENE BASALTIC ROCK AND SEDIMENTS		TEMPERATURE RANGE 29-35 DEGREES C; FLOWING WELL; DRILLER'S LOG AVAILABLE				STOCK WATERING	176	31		DE-ICING			43.1908 115.5982	LOG, 1977
LONG TOM RANCH WELL #2 3S 8E 6CBC1	7570	PLEISTOCENE BASALTIC ROCK AND SEDIMENTS						IRRIGATION	137	21		FISH FARMING AND HATCHING			43.1886 115.5572	YOUNG, 1977
HOT SPRINGS 3S 8E 16CCC1S			FAULT	DRIED UP WHEN WELL WAS DRILLED IN 03S08E06CBD				DRY		70					43.1554 115.5177	

LESLIE BEAM WELL #1 3S 8E 36CAD1	2744	PLIOCENE AND PLEISTOCENE SEDIMENTS	SLIGHT SULFUR ODOR; FLOWING WELL; DRILLER'S LOG AVAILABLE	IRRIGATION	182	67	71	APPLE DEHYDRATION	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	43.1155 115.4515	DION AND GRIFFIN, 1967
LESLIE BEAM WELL #2 3S 8E 36CDA1	113	PLIOCENE AND PLEISTOCENE SEDIMENTS	SLIGHT SULFUR ODOR; FLOWING WELL	STOCK WATERING	178	36		FERMENTATION			43.1146 115.4524	DION AND GRIFFIN, 1967
COYOTE H S 3S 9E 25DDB1S	283	PLIOCENE SILICIC VOLCANIC ROCK		UNUSED		57		POULTRY HATCHERY			43.1292 115.3397	JOHNSON, 1978 (SITE INSPECTION)
LATTY H S 3S 10E 31DDB1S		PLIOCENE SILICIC VOLCANIC ROCK	COVERED AND PIPED TO NEARBY HOMESTEAD LOCATED IN 04S10E06BAC	IRRIGATION		62	137	ANIMAL HUSBANDRY	FREEZE DRYING	YES	43.1155 115.3054	JOHNSON, 1978 (SITE INSPECTION)
JOHN DOBARON WELL 4S 4E 32ACC1	7570	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	94	21		HEATING AND COOLING WITH HEAT PUMP			43.0350 116.0061	LOG, 1976
PETE NIELSON WELL 4S 5E 19ABC1	8516	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	147	20		FISH FARMING			43.0668 115.9053	YOUNG, 1977
ROBERT BRUCE WELL #1 4S 5E 25BBC1		PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	OBSERVATION WELL FOR GROUND WATER LEVELS; DRILLER'S LOG AVAILABLE	IRRIGATION	161	23	47	HEATING AND COOLING WITH HEAT PUMP	SEEDLING CONIFERS	YES	43.0531 115.8150	LOG, 1967
ROBERT BRUCE WELL #2 4S 5E 26AAD1	6813	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		IRRIGATION	115	24		DE-ICING			43.0518 115.8160	YOUNG, 1977
TERRY PETERMAN WELL 4S 5E 26CAB1	45	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	122	21		HEATING AND COOLING WITH HEAT PUMP			43.0471 115.8293	YOUNG, 1977
TERRY PETERMAN WELL 4S 5E 36CAD1	7570			IRRIGATION		24		FERMENTATION			43.0305 115.8065	
HUGH HARDEN WELL 4S 6E 7CAA1	121	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	163	22		HEATING AND COOLING WITH HEAT PUMP			43.0902 115.7864	LOG, 1977
DAVE SPENCER WELL 4S 6E 25BCA1	10182	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	219	24		FISH FARMING			43.0500 115.6921	LOG, 1967

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Elmore County (cont'd.)																
FRANK LUTZ WELL #1 4S 6E 31DDD1	9084	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	149	21		HEATING AND COOLING WITH HEAT PUMP			43.0268 115.7759	LOG, 1967
FRANK LUTZ WELL #2 4S 6E 32CCC1	1022	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	126	21		FISH FARMING			43.0268 115.7746	LOG, 1969
RALPH MOORE WELL 4S 6E 35BCD1	11280	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	198	24		CATFISH FARMING			43.0333 115.7119	LOG, 1972
RALPH YRAZABAL WELL 4S 7E 9BBA1	10220							IRRIGATION	173	24		CATFISH FARMING			43.0967 115.6339	
BEVERLY OLSON WELL 4S 7E 19BDB1								IRRIGATION	184	23	63	HEATING AND COOLING WITH HEAT PUMP	APPLE DEHYDRATION	YES	43.0647 115.6698	
TOM GILL WELL 4S 8E 1DBA1	18926	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	438	58		GAME BIRD HATCHERY			43.1029 115.4465	LOG, 1961
PACIFIC NW PIPELINE WELL 4S 8E 36BBA1	18	PLIOCENE AND PLEISTOCENE SEDIMENTS		USED AS COOLANT FOR TURBINE DRILLER'S LOG AVAILABLE				INDUSTRY	580	43	101	SWIMMING POOLS	WASHING AND DRYING OF WOOL	YES	43.0377 115.4576	RALSTON AND CHAPMAN, 1968
BILL DAVIS WELL 4S 9E 8ACA1	18926	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	358	60	82	GREENHOUSE	PASTEURIZATION	YES	43.0923 115.4073	RALSTON AND CHAPMAN, 1968
GARY LAWSON WELL 5S 3E 14CBB1	378	PLIOCENE SILICIC VOLCANIC ROCKS		SULFUR ODOR; FLOWING WELL				IRRIGATION	701	59	97	LAUNDRY USES	BLANCHING	YES	42.9894 116.0762	YOUNG, 1972
MIKE WISSEL WELL #1 5S 6E 24AAD1								DOMESTIC	124	20		HEATING AND COOLING WITH HEAT PUMP			42.9786 115.6778	

MIKE WISSEL WELL #2 5S 7E 16ABD1		PLIOCENE AND PLEISTOCENE SEDIMENTS			DOMESTIC	137	20	60	FISH FARMING	POULTRY HATCHERY	YES	42.9947 115.6244	YOUNG, 1977
CHARLES BOYD WELL 5S 8E 34BDC1		PLIOCENE AND PLEISTOCENE SEDIMENTS	DRY; REPORTED TEMPERATURE	YES			34		AQUACULTURE			42.9465 115.4934	YOUNG, 1973
RAY THOMPSON WELL 5S 10E 25ACA1	49	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		DOMESTIC	144	21		HEATING AND COOLING WITH HEAT PUMP			42.9625 115.2098	LOG, 1973
DANIEL HATCHER WELL 5S 10E 28BDC1	378	PLEISTOCENE SEDIMENTS	SLIGHT SULFUR ODOR; FLOWING WELL		DOMESTIC	304	32		HYDROPONICS			42.9617 115.2770	RALSTON AND CHAPMAN, 1968
LLOYD KNIGHT WELL 5S 10E 28CAB1	75	PLEISTOCENE SEDIMENTS	TEMPERATURE RANGES FROM 28-33 DEGREES C; FLOWING WELL; DRILLER'S LOG AVAILABLE		DOMESTIC	335	30		CATFISH FARMING			42.9594 115.2763	LOG, 1969
MAGIC WEST CO. WELL 5S 10E 32BDB1		PLIOCENE AND PLEISTOCENE SEDIMENTS			RECREATION	284	38	68	HYDROPONICS	APPLE DEHYDRATION	YES	42.9479 115.2959	RALSTON AND CHAPMAN, 1968
CHARLES ANDERSON WELL 5S 11E 7ACC1					DOMESTIC	396	30	64	CATFISH FARMING	ANIMAL HUSBANDRY	YES	43.0034 115.1926	
UNION PACIFIC RR WELL 5S 11E 7CBB1	189	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		DOMESTIC	93	23		FISH FARMING			43.0027 115.2023	ROSS, 1971
RODNEY RUBERRY WELL 5S 11E 18BAD1	45		FLOWING WELL		DOMESTIC	132	23		HEATING AND COOLING WITH HEAT PUMP			42.9934 115.1959	
DARRELL DRAKE WELL 5S 11E 18BCB1	18	PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		DOMESTIC	73	27		CATFISH FARMING			42.9908 115.2010	LOG,1969
ROBERT GRAHAM WELL 5S 11E 19CCA1	71	PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		DOMESTIC	130	24		FISH FARMING			42.9695 115.2001	LOG, 1974
BLACK MESA FARM WELL 6S 10E 12CAA1	75	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		DOMESTIC	301	30		CATFISH FARMING			42.9147 115.2147	LOG, 1965

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
						Sili-ceous	Car-bon-ates									
								Franklin County								
MOUND VALLEY W S 12S 40E 13DCD1S		QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS		NOT FIELD CHECKED						0					42.3735 111.7263	MITCHELL, 1978
TREASURETON W S 12S 40E 36ACD1S	11	QUATERNARY ALLUVIUM	NORTHWEST TRENDING FAULT	NUMEROUS SPRING VENTS				UNUSED		35	75	AQUACULTURE	R_FRIGERATION (LOWER TEMPERATURE LIMIT)	YES	42.3373 111.7270	MITCHELL, 1976
CLEVELAND H S 12S 41E 31CAC1S	18	QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS	NORTHWEST TRENDING FAULT	NUMEROUS SPRING VENTS AND SEEPS		YES		UNUSED		66	81	FRUIT AND VEGETABLE DEHYDRATION	PASTEURIZATION	YES	42.3329 111.7147	MITCHELL, 1976
WEST BANKS W S 12S 41E 31CBD1S		QUARTERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS	NORTHWEST TRENDING FAULT	NUMEROUS SPRING VENTS						35		AQUACULTURE			42.3338 111.7160	MITCHELL, 1976
MAPLE GROVE H S 13S 41E 7ACA1S	1324	PALEOZOIC QUARTZITE (?) WITH TRAVERTINE DEPOSITS	NORTH TRENDING FAULT	NUMEROUS VENTS AND SEEPS; TEMPERATURE RANGE 60-78 DEGREES C; PAST USE: POWER GENERATION AND RECREATION; SULFUR ODOR		YES	YES	PELTON WHEEL (POWER)		78	104	PASTEURIZED MILK PROCESS	WASHING AND DRYING OF WOOL	YES	42.3083 111.7068	DION, 1969
BEN MEEK WELL 14S 39E 36ADA1		QUATERNARY ALLUVIUM		SLIGHT SULFUR ODOR					12	44	103	SEEDLING CONIFERS	CANNINNG AND PRESERVING	YES	42.1646 111.8381	DION, 1969
RAY BARRINGTON WELL 14S 40E 31BCB1	246	QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE				STOCK WATERING	22	40		SOIL WARMING			42.1651 111.8366	LOG, 1977
ELDIN BINGHAM WELL 15S 39E 7DBC1	37	QUATERNARY ALLUVIUM								63	88	ANIMAL HUSBANDRY	BLANCHING	YES	42.1296 111.9426	DION, 1969
BATTLE CREEK H S 15S 39E 8BDC1S	3406	QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS	NORTHWEST TRENDING FAULT	TEMPERATURE RANGE 43-84 DEGREES C; NUMEROUS SPRING VENTS; ALSO KNOWN AS WAYLAND H S		YES	YES			84	142	BLANCHING	POTATOE DEHYDRATION	YES	42.1331 111.9276	DION, 1969
SQUAW H S WELL 15S 39E 17BCD1	113	QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS	NORTHWEST TRENDING FAULT			YES	YES		6	84	149	PASTEURIZING	CORN PRODUCTS (STARCH, OIL)	YES	42.1191 111.9299	DION, 1969

SQUAW H S 15S 39E 17BDC1S	140	QUATERNARY ALLUVIUM	NORTHWEST TRENDING FAULT	SEVERAL SPRING VENTS; TEMPERATURE RANGE 69-73 DEGREES C; ALSO KNOWN AS VINCENT H S			73	150	APPLE DEHYDRATION	BEET SUGAR PROCESSING	YES	42.1187 111.9283	YOUNG AND MITCHELL, 1973
MYRON FONNESBECK WELL 16S 38E 24ABC1	4163	QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE	IRRIGATION	156	22	84	HEATING AND COOLING WITH HEAT PUMP	PASTEURIZATION	YES	42.0257 111.9621	LOG, 1969
P.L. KOLLER WELL 16S 38E 24BDD1	9463	QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE	IRRIGATION	172	21		BIODEGRADATION			42.0225 111.9635	LOG, 1969
					Fremont County								
KEITH JERGENSON WELL #1 7N 41E 13CAB1		PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		NOT FIELD CHECKED	IRRIGATION	213	23		HEATING AND COOLING WITH HEAT PUMP			43.9326 111.5714	LOG, 1970
KEITH JERGENSON WELL #2 7N 41E 13CAD1	4239	PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE	IRRIGATION	213	23		HEATING AND COOLING WITH HEAT PUMP			43.9326 111.5715	LOG, 1970
DONALD TRUPP WELL 7N 41E 25CBD1	8706	TERTIARY SILICIC VOLCANIC ROCK (?)			IRRIGATION	91	36	94	AQUACULTURE	BARLEY MALTING PROCESS	YES	43.9013 111.5735	CROSTHWAITE AND OTHERS, 1970
WAYNE LARSON WELL 7N 41E 26ACC1				NOT FIELD CHECKED; REPORTED TEMPERATURE			22	106	HEATING AND COOLING WITH HEAT PUMP	CANNING AND PRESERVING	YES	43.9056 111.5866	
GORDEN CLARK WELL 7N 41E 33DDD1		PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE	DOMESTIC	73	22		FISH FARMING AND HATCHING			43.8847 111.6180	STEARNS, 1939
HENRY HARRIS WELL 7N 41E 34ADD1		TERTIARY SILICIC VOLCANIC ROCK (?)		DRILLER'S LOG AVAILABLE	IRRIGATION	83	34	78	TROPICAL FISH FARMING	APPLE DEHYDRATION	YES	43.8906 111.5980	CROSTHWAITE AND OTHERS, 1970
NEWDALE CITY WELL 7N 41E 34DCD1	2271	TERTIARY SILICIC VOLCANIC ROCK (?)			IRRIGATION	91	32	81	BIODEGRADATION	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	43.8839 111.6052	CROSTHWAITE AND OTHERS, 1970
7N 41E 35CDD1		TERTIARY SILICIC VOLCANIC ROCKS (?)		REPORTED TEMPERATURE; NOT FIELD CHECKED	YES	106	36	84	BIODEGRADATION	PASTEURIZING	YES	43.8842 111.5899	YOUNG AND MITCHELL, 1973
STETER AND SWINDELMAN 7N 41E 35DCD1		TERTIARY SILICIC VOLCANIC ROCK (?)		DRILLER'S LOG AVAILABLE		100	37		AQUACULTURE OR HYDROPONICS			43.8850 111.5836	CROSTHWAITE AND OTHERS, 1970

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
								Fremont County (cont'd.)								
CLAUDE HAWS WELL 7N 41E 36ODA1		TERTIARY SILICIC VOLCANIC ROCK (?)						IRRIGATION	193	34	63	AQUACULTURE	ANIMAL HUSBANDRY	YES	43.8852 111.5589	CROSTHWAITE AND OTHERS, 1970
DEAN SWINDELMAN WELL 7N 42E 8CAA1		TERTIARY SILICIC VOLCANIC ROCK (?)						IRRIGATION		34	48	AQUACULTURE	GRAIN-HAY DRYING	YES	43.9481 111.5291	CROSTHWAITE AND OTHERS, 1970
KEITH JERGENSON WELL #3 7N 42E 17BAC1								IRRIGATION		27		HEATING AND COOLING WITH HEAT PUMP			43.9383 111.5306	
KEITH JERGENSON WELL #4 7N 42E 17BBC1								IRRIGATION		39		AQUACULTURE			43.9384 111.5374	
KEITH JERGENSON WELL #5 7N 42E 18BAA1	8327	TERTIARY SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; NOT FIELD CHECKED				IRRIGATION	246	51		GRAIN-HAY DRYING			43.9399 111.5492	LOG, 1974
NAOMI JERGENSEN WELL 7N 42E 18CAA1		TERTIARY SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; NOT FIELD CHECKED				IRRIGATION	201	35		BIODEGRADATION			43.9325 111.5492	LOG, 1973
REMINGTON PRODUCE WELL 7N 42E 19CCA1	1892	TERTIARY SILICIC VOLCANIC ROCK (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	193	26		CATFISH FARMING		YES	43.9144 111.5540	LOG, 1969
ASHTON W S 9N 42E 23DAC1S		PLEISTOCENE BASALT		TWO SPRING VENTS				IRRIGATION		26	91	SOIL WARMING	BLANCHING	YES	44.0913 111.4579	STEARNS AND OTHERS, 1939
BIG SPRINGS 14N 44E 34BBC1S	348247	QUATERNARY OBSIDIAN (RHYOLITE)		TEMPERATURE RANGE 10-12 DEGREES C; 10 DEGREES ABOVE MEAN ANNUAL TEMPERATURE; POSSIBLE THERMAL ANOMALY; SEVERAL SPRING VENTS				UNUSED		12	66	HEATING AND COOLING WITH HEAT PUMP	APPLE DEHYDRATION	YES	44.4995 111.2545	HAMILTON, 1965
								Gem County								
SWEET W S 7N 1E 3CAA1S	18			FLOWING INTO WATER TROUGH				STOCK WATERING		20		CATFISH FARMING			43.9719 116.3245	

ROYSTONE H S 7N 1E 8DDA1S	189	QUATERNARY ALLUVIUM NEAR MIOCENE BASALT	FAULTED BASALT	SULFUR ODOR; FIVE SPRING VENTS		UNUSED	66	150	BALNEOLOGICAL BATH	SUGAR BEET PROCESSING	YES	43.9539 116.3554	NEWCOMB, 1970
EAST ROYSTONE H S 7N 1E 9CDC1S		QUARTERNARY ALLUVIUM NEAR PLIOCENE BASALT (?)		NOT FIELD CHECKED; REPORTED TEMPERATURE		STOCK WATERING	45	84	SEEDLING CONIFERS	PASTEURIZATION	YES	43.9529 116.3468	
HIGHLAND LAND CO. W S 6N 1W 25ADB1S	3	QUATERNARY AND TERTIARY SEDIMENTS		SEEPAGE; TEMPERATURE MAY BE LESS THAN MEASURED		STOCK WATERING		23	CATFISH FARMING			43.8313 116.3955	ROSS, 1971
DONALD JENSEN WELL #1 6N 1W 26ADA1	75	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE		DOMESTIC	21	20	HEATING AND COOLING WITH HEAT PUMP			43.8325 116.4137	SAVAGE, 1973
DONALD JENSEN WELL #2 6N 1W 26ADC1	75	PLIOCENE AND PLEISTOCENE SEDIMENTS		WATER HAD MILKY APPEARANCE; DRILLER'S LOG AVAILABLE		IRRIGATION	27	20	FISH FARMING			43.8304 116.4155	SAVAGE, 1973
PAUL CRANK WELL 6N 2W 14DBC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		VERY SHALLOW WELL; DRILLER'S LOG AVAILABLE		DOMESTIC	9	24	HEATING AND COOLING WITH HEAT PUMP			43.8547 116.5406	LOG, 1977
FRED SCOTT WELL 6N 2W 17DBA1	757	PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE		DOMESTIC	54	24	HEATING AND COOLING WITH HEAT PUMP			43.8572 116.5970	SAVAGE, 1973
RAWLA IZATT WELL 6N 3W 12AAB1	189	PLEISTOCENE SEDIMENTS		SLIGHT SULFUR ODOR		DOMESTIC	71	21	HEATING AND COOLING WITH HEAT PUMP			43.8788 116.6359	SAVAGE, 1973
						Gooding County							
TSCHANNE H S 4S 12E 35AAA1S		PLIOCENE BASALT		TEMPERATURE REPORTED BY ROSS		DRY		43				43.0384 114.9879	ROSS, 1971
DAVE ARCHER WELL #1 4S 12E 35CAD1	140	PLIOCENE BASALT AND SEDIMENTS		DRILLER'S LOG AVAILABLE;		DOMESTIC	168	45	STOCK WATERING			43.0289 114.9980	STEARNS AND OTHERS, 1938
J. SHANNON WELL 4S 13E 28ABB1		PLEISTOCENE BASALT		FLOWING; AREA COVERED WITH SPRINGS	YES	DOMESTIC AND SPACE HEATING	50	53	LAUNDRY USE		YES	43.0534 114.9160	STEARNS AND OTHERS, 1938
HOT SULFUR LAKE 4S 13E 29ADD1S	302	QUATERNARY BASALT		NO VISABLE FLOW; SPRING IS SUBAQUEOUS	YES	UNUSED		27	FISH FARMING			43.0472 114.9291	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
Gooding County (cont'd.)																
WHITE ARROW H S 4S 13E 30ADB1S	4542	QUATERNARY ALLUVIUM		FOUR SPRING VENTS		YES	YES	GREENHOUSE AND FISH FARMING		63	108	APPLE DEHYDRATION	CANNING AND PRESERVING	YES	43.0486 114.9511	MALDE AND OTHERS, 1963
DAVE ARCHER WELL #2 5S 12E 3AAA1	2725	PLIOCENE SEDIMENTS AND BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE			YES	IRRIGATION	326	57	70	GREENHOUSE	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	43.0247 115.0092	MALDE AND OTHERS, 1963
BLM 6S 12E 5BDD1	83	PLEISTOCENE BASALT		DRILLER'S LOG AVAILABLE				STOCK WATERING	182	28		CATFISH FARMING			42.9307 115.0566	STEARNS AND OTHERS, 1938
Idaho County																
BURGDORF H S 22N 4E 1BDC1S	613	QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK		TWO SPRING VENTS; SLIGHT SULFUR ODOR; X-RAY DIFFRACTION ANALYSIS AVAILABLE		YES	YES	RECREATION		45	57	BALNEOLOGICAL BATH	LAUNDRY USES	YES	45.2768 115.9124	WARING, 1965
RIGGINS H S 24N 2E 14DBD1S	15	QUATERNARY ALLUVIUM OVERLYING PALEOZOIC AND MESOZOIC GNEISS	NORTH TRENDING NORMAL FAULT	FOUR SPRING VENTS AND NUMEROUS SEEPS		YES	YES	DOMESTIC		41	95	SEEDLING CONIFERS	BLANCHING	YES	45.4162 116.1722	HAMILTON, 1969
COW FLATS H S 24N 4E 7CDA1S	37	CRETACEOUS GRANITIC ROCK SLIGHTLY METAMORPHOSED		PAST USE: MINERS BATHING FACILITIES				UNUSED		59		GREENHOUSE			45.4316 116.0148	ANDERSON, 1978 (SITE INSPECTION)
BARTH H S 25N 12E 18DD 1S	757	CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED						60	89	AQUACULTURE	BARLEY MALTING PROCESS	YES	45.5126 115.0425	ROSS, 1971
RED RIVER H S 28N 10E 3DDD1S	132	CRETACEOUS GRANITIC ROCK		NINE SPRING VENTS; TEMPERATURE RANGE 37-55 DEGREES C		YES		RECREATION		55	80	GRAIN-HAY DRYING	PASTEURIZED MILK PROCESS	YES	45.7877 115.1977	WARING, 1965
RUNNING SPRINGS 29N 12E 14ABB1S	264	QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK		FIVE SPRING VENTS				UNUSED		41		BALNEOLOGICAL BATH			45.8516 114.9372	ROSS, 1971
MARTEN H S 31N 11E 24DCD1S		CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED				UNUSED		0					46.0055 115.0208	ROSS, 1971

STUART H S 32N 11E 4CAA1S		CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED		UNUSED		0					46.1382 115.0896	ROSS, 1971
PROSPECTOR H S 33N 14E 4A 1S		CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED				0					46.2350 114.7073	ROSS, 1971
STANLEY H S 34N 10E 6CAA1S	113	CRETACEOUS GRANITIC ROCK		TWO SPRING VENTS		UNUSED		49		SPACE HEATING			46.3164 115.2575	ROSS, 1971
WEIR CREEK H S 36N 11E 13BCC1S	227	CRETACEOUS GRANITIC ROCK		SIX SPRING VENTS; TEMPERATURE RANGE 44-47 DEGREES C	YES	UNUSED		47	70	LAUNDRY USE	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	46.4636 115.0350	WARING, 1965
COLGATE LICKS H S 36N 12E 15ADB1S	189	CRETACEOUS GRANITIC ROCK		SEVERAL SPRING VENTS				41		MUSHROOM GROWING			46.4656 114.9388	ROSS, 1971
LITTLE JERRY JOHNSON 36N 13E 18ADB1S		CRETACEOUS GRANITIC ROCK (?)		TWO SPRING VENTS; TEMPERATURE RANGE 38-41 DEGREES C				41		BALNEOLOGICAL BATH			46.4656 114.8743	
JERRY JOHNSON H S 36N 13E 18ADD1S	1135	CRETACEOUS GRANITIC ROCK		TEMPERATURE RANGE 41-48 DEGREES C; EIGHT SPRING VENTS	YES			48	70	SEEDLING CONIFERS	APPLE DEHYDRATION	YES	46.4629 114.8718	WARING, 1965
				Jefferson County										
HEISE H S 4N 40E 25DDA1S	227	TERTIARY SILICIC VOLCANIC ROCK		TWO SPRING VENTS; EXTENSIVE TRAVERTINE DEPOSITION	YES	RECREATION		49	79	GRAIN-HAY DRYING	PASTEURIZED MILK PROCESS	YES	43.6440 111.6867	ROSS, 1971
				Jerome County										
ROYAL CATFISH INDUSTRY 9S 17E 29DAD1	10523	PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE; FLOWING WELL; PAST USE CATFISH FARMING		UNUSED	222	43		AQUACULTURE		YES	42.6133 114.4878	LOG, 1970
				Lemhi County										
FOSTER RANCH H S 15N 15E 18DC1S	18			SULFUR ODOR; NUMEROUS SPRING VENTS; TEMPERATURE RANGE 42-57 DEGREES C		UNUSED		57		GREENHOUSE			44.6610 114.6521	
SHOWER BATH SPRINGS 15N 16E 15DAD1S	757	TERTIARY SILICIC VOLCANIC ROCKS	FAULT	NUMEROUS SPRING VENTS; NOT FIELD CHECKED; TEMPERATURE NOT VARIFIED				50		AQUACULTURE			44.6279 114.6012	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
								Lemhi County (cont'd.)								
BIG EIGHTMILE CRK W S 15N 25E 8DDB1S		QUATERNARY ALLUVIUM						IRRIGATION		33		SOIL WARMING			44.6399 113.5037	BUSH AND BODNER, 1978
WHITTAKER W S 15N 26E 21DBC1S	3406	QUATERNARY ALLUVIUM NEAR PRE-TERTIARY UNDIFFERENTIATED ROCK						STOCK WATERING		24		HEATING AND COOLING WITH HEAT PUMP			44.6121 113.3632	ROSS, 1971
CRONKS CANYON H S 16N 21E 18ADC1S		TERTIARY SILICIC VOLCANIC ROCK		NOT FIELD CHECKED			YES			46	57	SPACE HEATING	GREENHOUSE HOT BED HEATING	YES	44.7196 114.0159	ROSS, 1971
FORGE CREEK H S 18N 16E 14BBB1S				NOT FIELD CHECKED						0					44.8964 114.5630	
GOLDBUG H S 18N 21E 12BCD1S	662	PRECAMBRIAN QUARTZITE						RECREATION		45		GRAIN-HAY DRYING			44.9053 113.9287	MITCHELL, 1978 (SITE INSPECTION)
MORMON RANCH H S 19N 14E 26DDD1S				NOT FIELD CHECKED				UNUSED		0		GREENHOUSE			44.9513 114.7040	
SNOWSHOE JOHNSON'S H S 20N 16E 20DCC1S	56	PRECAMBRIAN ARGILLACEOUS QUARTZITE		SLIGHT SULFUR ODOR; TWO SPRING VENTS		YES		UNUSED		42		HYDROPONICS			45.0422 114.6160	JOHNSON, 1978 (SITE INSPECTION)
SALMON H S 20N 22E 3ACA1S	548	CONTACT BETWEEN OLIGOCENE BASALT AND OLDER TUFFACEOUS ROCK	NORTHWEST TRENDING FAULT	THREE SPRING VENTS			YES			45	52	BALNEOLOGICAL BATH	GRAIN-HAY DRYING	YES	45.0949 113.8363	FORRESTER, 1956
SHARKEY H S 20N 24E 34CCC1S	757	OLIGOCENE SILICIC VOLCANIC ROCK	NORTHWEST TRENDING FAULT				YES	UNUSED		52	104	ELECTRICAL POWER GENERATION	CANNING AND PRESERVING	YES	45.0130 113.6051	ANDERSON, 1957
OWL CREEK H S 23N 17E 10BBA1S	189	PRECAMBRIAN SCHIST		SEVERAL SPRING VENTS; NUMEROUS SEEPS; SLIGHT SULFUR ODOR; TEMPERATURE RANGE 45-50 DEGREES C		YES	YES	BATHING		50		GRAIN-HAY DRYING			45.3444 114.4627	JOHNSON, 1978 (SITE INSPECTION)

BIG CREEK H S 23N 18E 22CAD1S	283	CRETACEOUS GRANITIC ROCK, ALTERED, STRONG LINEATIONS (?) SOME GYPSUM	FIFTEEN SPRING VENTS; TEMPERATURE RANGE 82-93 DEGREES C; SLIGHT SULFUR ODOR; TRAVERTINE DEPOSIT BELOW PRESENT SPRING VENTS	YES	YES	YES	UNUSED		93	173	ELECTRICAL POWER GENERATION	HEATING AND DRYING OF DIATOMACEOUS EARTH	YES	45.3070 114.3379	WARING, 1965
HORSE CREEK H S 25N 17E 15BBA1S	37	CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED; SEVERAL SPRING VENTS				RECREATION		43		AGRICULTURE			45.5034 114.4627	ROSS, 1971
Madison County															
ELKHORN W S 4N 40E 23CAD1S							UNUSED		22		FISH FARMING AND HATCHING			43.6597 111.7154	
LAVERE RICKS WELL 5N 40E 5CBA1		TERTIARY SILICIC VOLCANIC ROCKS	TEMPERATURE NOT CONFIRMED; DRILLER'S LOG AVAILABLE				IRRIGATION	108	21	36	HEATING AND COOLING WITH HEAT PUMP	AQUACULTURE	YES	43.7921 111.7805	LOG, 1973
MARK RICKS WELL 5N 40E 8BCC1		TERTIARY SILICIC VOLCANIC ROCKS	TEMPERATURE NOT CONFIRMED; DRILLER'S LOG AVAILABLE				IRRIGATION	56	26	44	DE-ICING ROADWAYS	SEEDLING CONIFERS	YES	43.7800 111.7835	LOG, 1962
PAULINE SMITH WELL 5N 40E 9CCC1	12491	TERTIARY SILICIC VOLCANIC ROCKS	TEMPERATURE NOT CONFIRMED; DRILLER'S LOG AVAILABLE				IRRIGATION	135	21	30	STOCK WATERING	FERMENTATION	YES	43.7719 111.7634	LOG, 1967
BILL WEBSTER WELL 5N 40E 36BDB1	10977	TERTIARY SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE				IRRIGATION	405	22		CATFISH FARMING			43.7222 111.6991	CROSTHWAITE AND OTHERS, 1970
GREEN CANYON H S 5N 43E 6BCA1S		TERTIARY SILICIC VOLCANIC ROCKS	SEVERAL SPRING VENTS; ALSO KNOWN AS PINCOCK H S; TRAVERTINE DEPOSITS			YES	RECREATION		44	72	SEEDLING CONIFERS	ONION DEHYDRATION	YES	43.7909 111.4348	WARING, 1965
VAL SCHWENDIMAN WELL 6N 41E 1ADD1		TERTIARY SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE				IRRIGATION	201	29		BIODEGRADATION			43.8786 111.5580	CROSTHWAITE AND OTHERS, 1970
WALZ ENT. INC. WELL 6N 41E 10ACC1			TEMPERATURE NOT CONFIRMED				IRRIGATION		26	81	FERMENTATION	PASTEURIZATION	YES	43.8621 111.6069	
WANDA WOOD WELL #1 6N 41E 10DBB1			TEMPERATURE NOT CONFIRMED				IRRIGATION	80	24	78	DE-ICING SIDEWALKS	FRUIT AND VEGETABLE DEHYDRATION	YES	43.8682 111.6172	
WANDA WOOD WELL #2 6N 41E 10DBB1			TEMPERATURE NOT CONFIRMED				IRRIGATION		27	80	BIODEGRADATION	PASTEURIZED MILK PROCESS	YES	43.8612 111.6069	

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Madison County (cont'd.)																
BUREAU OF RECLAMATION 7N 42E 30DBD1		TERTIARY SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; TETON DAM SITE				TEST WELL	200	34		HYDROPONICS			43.9027 111.5435	LOG, 1972
Minidoka County																
PAUL CITY WELL 9S 23E 28CCA1	7570	PLIOCENE AND PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				PUBLIC SUPPLY	137	22		FISH FARMING			42.6078 113.7768	BROTT, 1976
NezPerce County																
LEWISTON CITY WELL 35N 5W 6CBC1	4542	MIOCENE BASALT		DRILLER'S LOG AVAILABLE; TEMPERATURE REPORTED BUT NOT FIELD CHECKED				EMERGENCY AND PUBLIC SUPPLY	182	20		HEATING AND COOLING WITH HEAT PUMP			46.4040 117.0217	
Oneida County																
KENT W S 12S 34E 36BCB1S	715	PALEOZOIC LIMESTONE		NUMEROUS SPRING VENTS				UNUSED		24	52	FISH FARMING	FERMENTATION	YES	42.3393 112.4361	PIPER, 1924
MALAD W S 14S 36E 27CDA1S		QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS		ONE SPRING VENT		YES	YES			25	29	HEATING AND COOLING WITH HEAT PUMP	FISH FARMING	YES	42.1734 112.2395	BURNHAM AND OTHERS, 1969
PLEASANTVIEW W S 15S 35E 3AAB1S	14421	QUATERNARY ALLUVIUM		NUMEROUS SPRING VENTS			YES			25	33	HYDROPONICS	AQUACULTURE	YES	42.1557 112.3486	BURNHAM AND OTHERS, 1969
WOODRUFF H S 16S 36E 10BBC1S		PALEOZOIC LIMESTONE	NORTHWEST TRENDING FAULT	NINE SPRING VENTS; TEMPERATURE RANGE 27-32 DEGREES C			YES			27	46	CATFISH FARMING	SEEDLING CONIFERS	YES	42.0562 112.2468	BURNHAM AND OTHERS, 1969
PRICES W S 16S 36E 23BBD1S		QUATERNARY ALLUVIUM		IN MALAD RIVER; UNABLE TO LOCATE						25					42.0253 112.2268	ROSS, 1971
Owyhee County																
FERRING WELL 1N 3W 7AAC1		QUATERNARY SEDIMENTS AND BASALT		FLOWING WELL; GAS COLLECTOR AT TOP OF WELL; GAS WAS USED FOR COOKING				HEATING AND RECREATION		41		FISH HATCHING AND GREENHOUSE			43.4427 116.7340	NEWTON AND CORCORAN, 1963

M. GOFF WELL 1N 3W 8CDA1	1892	QUATERNARY BASALT	FLOWING WELL		DOMESTIC	156	36		SPACE HEATING			43.4338 116.7238	BEARD, 1978 (SITE INSPECTION)
NORRIS WHITE WELL 1N 3W 8CDB1	1135	QUATERNARY SEDIMENTS	FLOWING WELL; DRILLER'S LOG AVAILABLE		IRRIGATION	213	36		GREENHOUSE			43.4335 116.7250	LOG, 1970
1N 3W 16CBD1		QUATERNARY BASALT	FLOWING WELL		UNUSED		36		CATFISH FARMING AND AQUACULTURE			43.4195 116.7067	ROSS, 1971
JIM AVAHAUSER WELL 1N 3W 17ADD1		QUATERNARY AND TERTIARY SEDIMENTS; QUATERNARY BASALT	FLOWING WELL		DOMESTIC		34		SPACE HEATING AND CATFISH FARMING			43.4245 116.7130	ROSS, 1971
CHARLES ELUMBAUGH WELL 1N 3W 20DAC1	302	PLIOCENE AND PLEISTOCENE SEDIMENTS (?) AND SILICIC VOLCANIC ROCK	PARTIAL DRILLER'S LOG AVAILABLE	YES	IRRIGATION AND DOMESTIC	399	37		GREENHOUSE			43.4053 116.7157	LOG, 1962
ELDON MARSH WELL 1N 3W 21BBA1		QUATERNARY BASALT	FLOWING WELL; CAPPED		UNUSED		41		SPACE HEATING			43.4143 116.7068	ROSS, 1971
GIVENS H S 1N 3W 21BAB1S		QUATERNARY ALLUVIUM	SLIGHT SULFUR ODOR		RECREATION		47	100	BALNEOLOGICAL BATH	WASHING AND DRYING OF WOOL	YES	43.4137 116.7065	ROSS, 1971
1N 3W 28BCD1					IRRIGATION		47		SPACE HEATING			43.3953 116.6976	
MARIE BRUNELL WELL 1N 4W 12ABC1		PLIOCENE SEDIMENTS AND BASALT	FLOWING WELL; SLIGHT SULFUR ODOR		DOMESTIC AND STOCK WATERING	457	40		HYDROPONICS			43.4410 116.7603	NEWTON AND CORCORAN, 1963
ROBERT COFFELT WELL 1N 4W 12BDA1		PLIOCENE SEDIMENTS AND BASALT	WELL LOCATED IN SMALL GREEN HOUSE		DOMESTIC AND STOCK WATERING	39	27		CATFISH FARMING			43.4403 116.7626	NEWTON AND CORCORAN, 1963
WESLEY HIGGINS WELL 1N 4W 12DBB1	946	PLIOCENE SEDIMENTS AND BASALT	WELL NOT PUMPING; PAST USE HEATING GREENHOUSE; DRILLER'S LOG AVAILABLE		IRRIGATION	195	36		AQUACULTURE		YES	43.4360 116.7596	NEWTON AND CORCORAN, 1963
GUY FREEMAN WELL #1 1N 4W 13BAC1		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS	WELL PLUGGED AT 25 METERS OWNER CLAIMS TEMPERATURE EXCEEDS 38 DEGREES C; DRILLER'S LOG AVAILABLE		UNUSED	871	39		SOIL WARMING			43.4272 116.7652	NEWTON AND CORCORAN, 1963

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Owyhee County (cont'd.)																
GUY FREEMAN WELL #2 1N 4W 13BAD1		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS		SLIGHT SULFUR SMELL				DOMESTIC AND STOCK WATERING	335	29		FERMENTATION			43.4274 116.7614	NEWTON AND CORCORAN, 1963
HOMEDALE CITY WELL #1 3N 5W 4DAC1	340	QUATERNARY ALLUVIUM, PLIOCENE AND PLEISTOCENE SEDIMENTS		SLIGHT SULFUR ODOR				PUBLIC WATER SUPPLY	228	20		FISH FARMING AND HATCHING			43.6230 116.9346	NEWTON AND CORCORAN, 1963
HOMEDALE CITY WELL #2 3N 5W 9AAB1	370	QUATERNARY ALLUVIUM, PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; SLIGHT SULFUR ODOR				PUBLIC WATER SUPPLY	165	23		BIODEGRADATION			43.6165 116.9341	NEWTON AND CORCORAN, 1963
GEORGE JOHNSTONE WELL 3N 5W 28CBC1	340	QUATERNARY ALLUVIUM, PLIOCENE AND PLEISTOCENE SEDIMENTS						STOCK, DOMESTIC AND IRRIGATION	210	21		HEAT AND COOLING WITH HEAT PUMP			43.5643 116.9487	NEWTON AND CORCORAN, 1963
JUSTAMERE FARMS WELL #1 3N 5W 30AAA1	189	QUATERNARY ALLUVIUM, PLIOCENE AND PLEISTOCENE SEDIMENTS						STOCK AND DOMESTIC	137	20		FISH FARMING AND HATCHING			43.5740 116.9702	NEWTON AND CORCORAN, 1963
JUSTAMERE FARMS WELL #2 3N 5W 30ADA1	136	QUATERNARY ALLUVIUM, PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				STOCK AND DOMESTIC	126	21		HEAT AND COOLING WITH HEAT PUMP			43.5703 116.9700	NEWTON AND CORCORAN, 1963
EARL FOOTE WELL 1S 2W 7CCB1	643	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS		SLIGHT SULFUR ODOR				SPACE HEATING AND IRRIGATION	518	46		GRAIN-HAY DRYING		YES	43.3466 116.6275	ROSS, 1971
COTNER FARM WELL 1S 2W 18CDD1		QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS						IRRIGATION AND DOMESTIC	289	30		FERMENTATION			43.3295 116.6194	ROSS, 1971
JIM TAYLOR WELL 1S 2W 27CCC1	757	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS		OWNER STATED WELL FLOWED PRIOR TO DEVELOPMENT OF NEW WELL 1 MILE S.E.				DOMESTIC	91	21		HEAT AND COOLING WITH HEAT PUMP			43.3009 116.5699	ROSS, 1971
JACK MORGAN WELL 1S 2W 33DDD1	408	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS		TWO WELLS AT THIS SITE, WATER MIXED AT DEPTH AND FLOWS INTO SWIMMING AREA; SULFUR ODOR				IRRIGATION AND SWIMMING	121	28		CATFISH FARMING			43.2871 116.5724	ROSS, 1971

ROGER QUINNEY WELL 1S 2W 34CAB1	378	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	SOME SULFUR ODOR	DOMESTIC	396	20	HEAT AND COOLING WITH HEAT PUMP	43.2926 116.5645	ROSS, 1971
CEREDA RANCHES WELL #1 1S 3W 1DCB1	18	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	FLOWING WELL	STOCK AND DOMESTIC	365	40	GREENHOUSE	43.3607 116.6373	ROSS, 1971
CEREDA RANCHES WELL #2 1S 3W 1DCC1	94	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	FLOWING WELL	IRRIGATION	274	36	FERMENTATION	43.3585 116.6392	ROSS, 1971
JACOBSON'S FEED LOT #1 1S 3W 9ACC1	2725	QUATERNARY-TERTIARY SEDIMENTS AND QUATERNARY BASALT	DRILLER'S LOG AVAILABLE	STOCK WATERING	182	27	BIODEGRADATION	43.3523 116.6975	LOG, 1968
JACOBSON'S FEED LOT #2 1S 3W 9BDA1	1703	QUATERNARY-TERTIARY SEDIMENTS	DRILLER'S LOG AVAILABLE	STOCK	167	37	SPACE HEATING	43.3533 116.7005	LOG, 1968
PAUL WARRICK WELL 2S 1W 23CBC1	113	QUATERNARY-TERTIARY SEDIMENTS AND QUATERNARY BASALT	DRILLER'S LOG AVAILABLE	DOMESTIC	221	30	DE-ICING HIGHWAY	43.2329 116.4323	LOG, 1968
LANNIS GIVENS WELL 2S 2W 2CBD1	1135	PLIOCENE AND PLEISTOCENE SEDIMENTS AND QUATERNARY BASALT	DRILLER'S LOG AVAILABLE; FLOWING WELL		260	38	SPACE HEATING	43.2752 116.5463	LOG, 1953
GUY GIVENS WELL #1 2S 2W 3BDA1	378	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	SULFUR ODOR; FLOWING WELL	STOCK WATERING	274	38	HYDROPONICS	43.2814 116.5624	ROSS, 1971
GUY GIVENS WELL #2 2S 2W 3BDD1	757	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	SULFUR ODOR; FLOWING WELL	STOCK WATERING	274	43	SEEDLING CONIFERS	43.2801 116.5625	ROSS, 1971
W. OHM WELL 2S 2W 3CBB1	757	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	SULFUR ODOR; FLOWING WELL	IRRIGATION	274	36	AQUACULTURE	43.2779 116.5696	ROSS, 1971
SKYLES AND NEELEY WELL 1 2S 2W 35ABA1		QUATERNARY-TERTIARY SEDIMENTS AND QUATERNARY BASALT	BEING DRILLED AT TIME OF INSPECTION	IRRIGATION	335	25		43.2113 116.5384	BEARD, 1978 (SITE INSPECTION)
SKYLES AND NEELEY WELL 2 2S 2W 35ACD1	11355	QUATERNARY BASALT	DRILLER'S LOG AVAILABLE	IRRIGATION	361	41	SOIL WARMING AND GREENHOUSE SPACE HEATING	43.2058 116.5373	LOG, 1976

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Siliceous	Deposition: Carbonates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
				Owyhee County (cont'd.)												
SKYLES AND NEELEY WELL 3 2S 2W 35BAA1	7192	QUATERNARY BASALT		DRILLER'S LOG AVAILABLE				IRRIGATION	637	32		FERMENTATION			43.2131 116.5223	LOG, 1970
SKYLES AND NEELEY WELL 4 2S 2W 36CDD1	5602	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS		TO BE DRILLED DEEPER; WATER TEMPERATURE HIGHER WHEN FLOWING				IRRIGATION	360	23		FISH FARMING AND HATCHING			43.1997 116.5237	ROSS, 1971
OMALLEY WELL 3S 2W 1BCB1	946	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS						IRRIGATION	121	24		CATFISH FARMING			43.1943 116.5311	ROSS, 1971
ALFRED HEYWOOD WELL 3S 1E 35DAC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		NOT FIELD CHECKED					91	20		HEATING AND COOLING WITH HEAT PUMP		YES	43.1176 116.2970	YOUNG AND WHITEHEAD, 1975
WAYNE SMITH WELL 4S 1E 6ABB1	1135	PLIOCENE AND PLEISTOCENE SEDIMENTS		SULFUR ODOR; WELL FLOWS WHEN ADJACENT COLD WELL IS SHUT OFF				IRRIGATION	213	22		HEATING AND COOLING WITH HEAT PUMP			43.1120 116.3839	ROSS, 1971
WILLIAM COX WELL #1 4S 1E 25CDD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL				STOCK WATERING		32		FERMENTATION		YES	43.0412 116.2890	YOUNG AND WHITEHEAD, 1975
WILLIAM COX WELL #2 4S 1E 26ABC1	18	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL				UNUSED	518	27		CATFISH FARMING		YES	43.0521 116.3016	YOUNG AND WHITEHEAD, 1975
T. ADCOCK WELL 4S 1E 29CDD1	6813	TERTIARY SILICIC VOLCANIC ROCKS AND PLIOCENE SEDIMENTS		FLOWING WELL; DRILLER'S LOG AVAILABLE; PAST USE: HOG SCALDING				IRRIGATION	926	68		APPLE DEHYDRATION		YES	43.0400 116.3692	LOG, 1959
GEORGE KING WELL 4S 1E 34BAD1	12112	TERTIARY SILICIC VOLCANIC ROCKS AND PLIOCENE BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE; SULFUR ODOR			YES	IRRIGATION	908	76		PASTEURIZED MILK PROCESS		YES	43.0374 116.3235	RALSON AND CHAPMAN, 1969
WES-CON INC. WELL 4S 2E 19ACC1	1268	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PLIOCENE SILICIC VOLCANIC ROCKS		FLOWING WELL; DRILLER'S LOG AVAILABLE				RARELY USED	938	42		SEEDLING CONIFERS			43.0636 116.2622	LOG, 1958

G. CHRISTENSEN WELL 4S 2E 29DBC1	94	PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL; SLIGHT SULFUR ODOR			DOMESTIC	822	28		CATFISH FARMING		YES	43.0450 116.2427	YOUNG AND WHITEHEAD, 1975
R. KETTERLING WELL 4S 2E 32BCC1		PLIOCENE SEDIMENTS AND BASALT, AND TERTIARY SILICIC VOLCANIC ROCKS (?)	FLOWING WELL; SULFUR ODOR	YES		DOMESTIC	824	39		HYDROPONICS		YES	43.0332 116.2528	RALSON AND CHAPMAN, 1969
CHARLES STEINER WELL 5S 1E 3AAB1		PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL; REPORTED INFORMATION; NOT FIELD CHECKED				579	32		AQUACULTURE		YES	43.0247 116.3172	YOUNG AND WHITEHEAD, 1975
E. LAWERENCE WELL #1 5S 1E 10BDD1	5518	TERTIARY SILICIC VOLCANIC ROCKS	FLOWING WELL; DRILLER'S LOG AVAILABLE			IRRIGATION	902	64	99	ANIMAL HUSBANDRY	BLANCHING	YES	43.0052 116.3242	YOUNG AND WHITEHEAD, 1975
ELMER JOHNSTON WELL #1 5S 1E 21BCA1		PLIOCENE BASALTS	INTERMITTENT FLOW			DOMESTIC	274	48		STOCK WATERING			42.9775 116.3484	YOUNG AND WHITEHEAD, 1975
ELMER JOHNSTON WELL #2 5S 1E 21CBC1	3614	PLIOCENE BASALTS	FLOWING WELL; DRILLER'S LOG AVAILABLE			IRRIGATION	201	64		REFRIGERATION (LOWER TEMPERATURE LIMIT)		YES	42.9728 116.3507	LOG, 1954
E. LAWERENCE WELL #2 5S 1E 24ACD1	340	TERTIARY SILICIC VOLCANIC ROCKS	FLOWING WELL; SLIGHT SULFUR ODOR; DRILLER'S LOG AVAILABLE		YES	IRRIGATION	755	67	96	ANIMAL HUSBANDRY	BLANCHING	YES	42.9753 116.2799	YOUNG AND WHITEHEAD, 1975
E. LAWERENCE WELL #3 5S 1E 24ADB1	4701	TERTIARY SILICIC VOLCANIC ROCKS	FLOWING WELL; SLIGHT SULFUR ODOR; DRILLER'S LOG AVAILABLE			IRRIGATION	950	66	77	SPACE HEATING	PASTEURIZED MILK PROCESS	YES	42.9787 116.2773	RALSTON AND CHAPMAN, 1969
OSCAR FIELDS WELL 5S 2E 1BBC1		PLIOCENE BASALT (?) AND SEDIMENTS	FLOWING WELL; SULFUR ODOR	YES	YES	SPACE HEATING	548	49		MUSHROOM GROWING		YES	43.0244 116.1745	RALSTON AND CHAPMAN, 1969
CLARENCE HOPKINS WELL 5S 2E 2CDA1		PLIOCENE AND PLEISTOCENE SEDIMENTS	SLIGHT SULFUR ODOR; NOT FIELD CHECKED FOR THIS REPORT; FLOWING WELL; REPORTED CAVED IN; DRILLER'S LOG AVAILABLE			IRRIGATION	749	37		HYDROPONICS		YES	43.0150 116.1867	YOUNG, 1973
COX AND LAWRENCE WELL 5S 2E 5BCD1		PLIOCENE AND PLEISTOCENE SEDIMENTS	NOT FIELD CHECKED			IRRIGATION	612	43		SWIMMING POOL		YES	43.0194 116.2500	
HENRY DRISKELL WELL #1 5S 2E 13ADA1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT	FLOWING WELL; DRILLER'S LOG AVAILABLE			DOMESTIC	532	20		FISH FARMING AND HATCHING		YES	42.9926 116.1583	YOUNG AND WHITEHEAD, 1975

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
								Owyhee County (cont'd.)								
HENRY DRISKELL WELL #2 5S 2E 25ADA1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT (?)		WELL CAVED, ORIGINAL DEPTH WAS 920 METERS WITH A RECORDED TEMPERATURE OF 60 DEGREES C; DRILLER'S LOG AVAILABLE				DOMESTIC	45	21		ANIMAL HUSBANDRY			42.9646 116.1563	LOG, 1965
NORRIS MCKEETH WELL 5S 3E 20ADA1	1957	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT (?)		FLOWING WELL; DRILLER'S LOG AVAILABLE; SULFUR ODOR				HEATING HOME & OUTBUILDINGS	737	59		GAME BIRD HATCHING		YES	42.9973 116.1167	LOG, 1959
BURGHARDT CO. WELL 5S 3E 20BBB1	7	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL				STOCK WATERING		27		CATFISH FARMING		YES	42.9820 116.1358	YOUNG AND WHITEHEAD, 1975
HARALD SIMPER WELL #1 5S 3E 21BBC1	37	TERTIARY SILICIC VOLCANIC ROCKS (?)		FLOWING WELL				DOMESTIC	609	22		HEAT AND COOLING WITH HEAT PUMP			42.9796 116.1153	
HARALD SIMPER WELL #2 5S 3E 21BCB1		TERTIARY SILICIC VOLCANIC ROCKS (?)		FLOWING WELL				DOMESTIC	609	27		CATFISH FARMING			42.9782 116.1144	
LEROY BEAMAN WELL 5S 3E 22AAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL					396	25		DE-ICING ROADWAYS		YES	42.9811 116.0765	YOUNG AND WHITEHEAD, 1975
COOKE'S GREENHOUSE #1 5S 3E 26BCB1	1059	PLIOCENE SILICIC VOLCANIC ROCKS AND PLIOCENE BASALT		FLOWING WELL		YES (?)	YES	GREENHOUSE	905	85	116	BARLEY MALTING PROCESS	HIGH ENERGY PROCESSING OF KILN LUMBER	YES	42.9639 116.0756	YOUNG, 1972
COOKE'S GREENHOUSE #2 5S 3E 26BCB2	1741	PLIOCENE SILICIC VOLCANIC ROCKS AND PLIOCENE BASALTS (?)		FLOWING WELL		YES		IRRIGATION	905	67		REFRIGERATION (LOWER TEMPERATURE LIMIT)		YES	42.9639 116.0750	YOUNG, 1973
D. BYBEE WELL #1 5S 3E 27BDD1		PLIOCENE SILICIC VOLCANIC ROCKS AND PLIOCENE BASALT		FLOWING WELL				AIR CONDITIONING	883	60		GREENHOUSE		YES	42.9619 116.0861	YOUNG AND WHITEHEAD, 1973
A. WHITTED WELL 5S 3E 28BCC1		TERTIARY SILICIC VOLCANIC ROCKS AND PLIOCENE BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE				IRRIGATION	774	64	109	HOTBED HEATING	CANNING AND PRESERVING	YES	42.9612 116.1141	YOUNG AND WHITEHEAD, 1975

D. LAYTON WELL 5S 3E 34DAA1	1703	PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL; DRILLER'S LOG AVAILABLE			DOMESTIC	454	32	AQUACULTURE		42.9468 116.0774	LOG, 1968
D. BYBEE WELL #2 5S 3E 35CCC1	2271	SILICIC VOLCANIC ROCKS AND PLIOCENE BASALT	FLOWING WELL			IRRIGATION	783	72	FRUIT AND VEGETABLE DEHYDRATION	YES	42.9400 116.0742	YOUNG, 1973
IDAHO POWER CO. WELL 5S 4E 34CCB1		PLIOCENE AND PLEISTOCENE SEDIMENTS	NOT FIELD CHECKED			DOMESTIC	108	27		YES	42.9425 115.9752	
CHESTER TINDALL WELL 5S 5E 33BBD1		PLIOCENE BASALT AND SEDIMENTS	WATER GOES THROUGH A HOLDING TANK FIRST SO TEMPERATURE MAY NOT BE ACCURATE			IRRIGATION	207	25	HEATING AND COOLING WITH HEAT PUMP	YES	42.9507 115.8706	YOUNG AND WHITEHEAD, 1975
CLAY ATKINS WELL 5S 5E 34ADD1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT	DRILLER'S LOG AVAILABLE			IRRIGATION	269	25	CATFISH FARMING	YES	42.9398 115.8371	YOUNG AND WHITEHEAD, 1975
STREETER-BRADBERRY WELL 5S 6E 31DCD1	9084	PLIOCENE BASALT AND SEDIMENTS	NO ACCESS TO WELL; REPORTED TEMPERATURE; DRILLER'S LOG AVAILABLE			IRRIGATION	149	21	HEATING AND COOLING WITH HEAT PUMP		42.9399 115.7820	LOG, 1967
LOWER BIRCH SPRING 6S 1E 32BBA1S		PLIOCENE SEDIMENTS	NOT FIELD CHECKED			UNUSED		25	HEATING AND COOLING WITH HEAT PUMP	YES	42.8648 116.3679	YOUNG AND WHITEHEAD, 1975
LESLIE POST WELL #1 6S 3E 2CBB1	1022	PLIOCENE BASALT AND SEDIMENTS	FLOWING WELL; DRILLER'S LOG AVAILABLE			IRRIGATION	935	59	GAME BIRD HATCHERY	YES	42.9313 116.0747	YOUNG AND WHITEHEAD, 1975
LESLIE POST WELL #2 6S 3E 2CCC1	2725	PLIOCENE BASALT AND SEDIMENTS	FLOWING WELL; SULFUR ODOR; DRILLER'S LOG AVAILABLE	YES	YES	IRRIGATION	591	54	HAY DRYING	YES	42.9239 116.0754	RALSTON AND CHAPMAN, 1969
W. BUNT WELL 6S 3E 4BCC1		PLIOCENE BASALT (?) AND SEDIMENTS	FLOWING WELL			IRRIGATION	512	48	GREENHOUSE	YES	42.9311 116.1153	YOUNG AND WHITEHEAD, 1975
J. AGENBROAD WELL 6S 3E 5CAC1	7570	PLIOCENE SILICIC VOLCANIC ROCKS	FLOWING WELL; DRILLER'S LOG AVAILABLE			IRRIGATION	1097	60	HOT WATER HEATING	YES	42.9297 116.1301	YOUNG AND WHITEHEAD, 1975
NIELSON AND CAROTHERS 6S 3E 9ACC1	88576	PLIOCENE BASALT AND SEDIMENTS	DRILLER'S LOG AVAILABLE			IRRIGATION	434	41	SOIL WARMING	YES	42.9168 116.1042	YOUNG AND WHITEHEAD, 1975

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Owyhee County (cont'd.)																
BOB DIRKS WELL 6S 3E 10CAA1	7570	PLIOCENE AND PLEISTOCENE SEDIMENTS		PARTLY CAVED IN; DRILLER'S LOG AVAILABLE				IRRIGATION	350	30		BIODEGRADATION			42.9156 116.0881	LOG, 1969
TRIANGLE DAIRY WELL #1 6S 3E 11DAD1	605	PLIOCENE AND PLIESTOCENE SEDIMENTS AND PLIOCENE BASALT (?)		DRILLER'S LOG AVAILABLE; NO ACCESS TO WELL BEFORE HOLDING TANK				STOCK WATERING	435	34		AQUACULTURE		YES	42.9136 116.0561	YOUNG AND WHITEHEAD, 1975
TRIANGLE DAIRY WELL #2 6S 3E 14BCB1	11	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	408	29		FERMENTATION			42.9063 116.0758	LOG, 1923
ROBERT DAVIS WELL #1 6S 3E 23CDA1	7570	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	378	30		DE-ICING HIGHWAY			42.8821 116.0667	LOG, 1968
ROBERT DAVIS WELL #2 6S 3E 26CBC1	5961	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	256	30		FISH FARMING AND HATCHING			42.8705 116.0754	LOG, 1974
B. BURGHARDT WELL #1 6S 3E 34DCC1	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)						IRRIGATION	240	29		HYDROPONICS			42.8513 116.0866	
JIM MORRISON WELL #1 6S 4E 14BDD1	5299	PLIOCENE SILICIC VOLCANIC ROCKS AND BASALT		DRILLER'S LOG AVAILABLE				IRRIGATION	580	55		LAUNDRY USES		YES	42.9073 115.9450	YOUNG AND WHITEHEAD, 1975
JIM MORRISON WELL #2 6S 4E 14BDD2	30	PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	42	27		CATFISH FARMING			42.9051 115.9682	LOG, 1970
KENT KOHRING WELL #1 6S 4E 25BCC1	7570	PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	533	27		DE-ICING		YES	42.8740 115.9356	YOUNG AND WHITEHEAD, 1975
ANTONIO DELEON WELL #1 6S 4E 32DAB1	1022	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	362	33		FERMENTATION			42.8571 115.9978	LOG, 1971

ANTONIO DELEON WELL #2 6S 4E 33DBA1		PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	358	31		BIODEGRADATION			42.8579 115.9863	LOG, 1976
DICK WARD WELL 6S 4E 35CDA1	11923	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	291	33		AQUACULTURE		YES	42.8547 115.9463	YOUNG AND WHITEHEAD, 1975
MERRILL TALLMAN WELL #1 6S 4E 35DAA1	4920	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	100	22		HEATING AND COOLING WITH HEAT PUMP			42.8576 115.9366	LOG, 1972
MERRILL TALLMAN WELL #2 6S 4E 35DBB1	9614	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	272	30		DE-ICING			42.8581 115.9455	LOG, 1972
KENT KOHRING WELL #2 6S 4E 36CCC1	9463	PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	609	40		HYDROPONICS			42.8523 115.9354	LOG, 1967
KENT KOHRING WELL #3 6S 4E 36CCC2	3785	PLIOCENE BASALT (?)		IRRIGATION	152	20		CATFISH FARMING			42.8522 115.9344	
COLYER CATTLE CO. WELL 6S 5E 10DDD1	15	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PLIOCENE BASALT	DRILLER'S LOG AVAILABLE; FLOWING WELL	STOCK WATERING	508	39		AQUACULTURE		YES	42.9117 115.8389	YOUNG, 1972
J.R. SIMPLOT WELL #1 6S 5E 18CCB1		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	DOMESTIC	902	27		CROCODILE FARMING		YES	42.8989 115.9156	LOG, 1973
J.R. SIMPLOT WELL #2 6S 5E 20AAB1		PLIOCENE BASALT	FLOWING WELL	STOCK WATERING		43		SEEDLING CONIFERS		YES	42.8950 115.8794	YOUNG, 1973
GEORGE HUTCHINSON WELL 6S 5E 24BCA1	75	PLIOCENE BASALT	SLIGHT SULFUR ODOR; FLOWING WELL; DRILLER'S LOG AVAILABLE	DOMESTIC	333	34		CATFISH FARMING		YES	42.8897 115.8113	YOUNG, 1973
BRUNEAU CITY WELL 6S 5E 24DDB1		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS	SLIGHT SULFUR ODOR	PUBLIC SUPPLY	590	32	96	FERMENTATION	BARLEY MALTING PROCESS	YES	42.8842 115.8006	YOUNG, 1973
DON DAVIS WELL #1 6S 5E 29DCC1	11	PLIOCENE AND PLIESTOCENE SEDIMENTS	FLOWING WELL; DRILLER'S LOG AVAILABLE	STOCK WATERING	475	33		BIODEGRADATION		YES	42.8667 115.8847	LOG, 1924

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Owyhee County (cont'd.)																
CARL AND HARRY LOUS 6S 5E 35CCA1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	140	22		HEAT AND COOLING WITH HEAT PUMP		YES	42.8547 115.8314	YOUNG, 1973
IDAHO PARKS DEPT. 6S 6E 12CCD1	499	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	301	37		AQUACULTURE		YES	42.9108 115.6939	LOG, 1968
MILDRED BACHMAN WELL 6S 6E 19CCD1	151	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL; DRILLER'S LOG AVAILABLE				DOMESTIC	278	38		HYDROPONICS		YES	42.8820 115.7925	LOG, 1926
BRUNEAU CEMETARY WELL 6S 6E 19DBD1		PLIOCENE FRACTURED BASALT		DRILLER'S LOG AVAILABLE; SULFUR ODOR				IRRIGATION	410	42		SWIMMING POOLS		YES	42.8856 115.7819	YOUNG, 1973
ACE BLACK WELL 6S 6E 32BDB1	151	PLIOCENE FRACTURED BASALT		FLOWING WELL; SLIGHT SULFUR ODOR				STOCK WATERING	427	35		FERMENTATION		YES	42.8600 115.7683	YOUNG AND WHITEHEAD, 1975
WILBUR WILSON WELL #1 6S 7E 1ACB1	11	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL				DOMESTIC	304	42		AQUACULTURE		YES	42.9342 115.5678	YOUNG AND WHITEHEAD, 1974
WILBUR WILSON WELL #2 6S 7E 1DBD1	34	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL				STOCK WATERING	320	33		HYDROPONICS		YES	42.9283 115.5639	YOUNG AND WHITEHEAD, 1974
CARL JOHNSON WELL 6S 7E 2CDD1	11	PLIOCENE AND PLEISTOCENE SEDIMENTS						DOMESTIC	411	35		BIODEGRADATION		YES	42.9249 115.7072	YOUNG, 1973
SAND DUNES FARMS WELL 6S 7E 8BBA1	52	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	111	23		CATFISH FARMING		YES	42.9217 115.6528	YOUNG AND WHITEHEAD, 1974
BILL BURGHARDT WELL #2 7S 3E 4ACD1	5299	PLIOCENE BASALT		DRILLER'S LOG AVAILABLE; WHEN PUMPED FROM 240 METERS DEPTH, WATER IS REPORTED TO BE 60 DEGREES C				IRRIGATION	245	29		DE-ICING HIGHWAY		YES	42.8445 116.0955	YOUNG AND WHITEHEAD, 1974

WILBER MASTRE WELL 7S 3E 12ACC1	7570			IRRIGATION	249	39	HYDROPONICS		42.8310 116.0402	
KEITH THOMAS WELL 7S 4E 1ACC1		PLIOCENE SILICIC VOLCANIC ROCKS	FLOWING WELL	IRRIGATION	548	40	STOCK WATERING	YES	42.8442 115.9228	YOUNG, 1973
PETE MERRICK WELL #1 7S 4E 3ABD1		PLIOCENE JOINTED BASALT		IRRIGATION	348	42	SWIMMING POOLS	YES	42.8486 115.9586	
CLARENCE MERRICK WELL #1 7S 4E 3BBC1	9027	PLIOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	274	33	DE-ICING ROADWAYS		42.8486 115.9729	LOG, 1966
BOB MASTRE WELL 7S 4E 4ADB1		PLIOCENE BASALT	DRILLER'S LOG AVAILABLE		458	34	QUACULTURE		42.8462 115.9761	LOG, 1974
DELBERT WRIGHT WELL 7S 4E 5CCA1	6813	PLIOCENE JOINTED BASALT		IRRIGATION	316	30	AQUACULTURE		42.8400 116.0083	YOUNG, 1973
LES ISAAC WELL 7S 4E 5DDC1	7570	PLIOCENE JOINTED BASALT (?)		IRRIGATION	277	30	DE-ICING		42.8375 115.9975	
PETE MERRICK WELL #2 7S 4E 10BDB1		PLIOCENE JOINTED BASALT	DRILLER'S LOG AVAILABLE	IRRIGATION	348	38	BIODEGRADATION	YES	42.8322 115.9681	YOUNG, 1973
CLARENCE MERRICK WELL #2 7S 4E 10DBC1	10220	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PLIOCENE BASALT	DRILLER'S LOG AVAILABLE	IRRIGATION	276	35	FERMENTATION		42.8271 115.9617	LOG, 1965
PAUL GLERUM WELL 7S 4E 11ACC1	2649			IRRIGATION	349	43	SEEDLING CONIFERS		42.8295 115.9426	
FRANK MILLETT WELL #1 7S 4E 11CBC1	11923	PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	457	36	AQUACULTURE	YES	42.8261 115.9533	YOUNG, 1973
FARIA BROTHERS WELL 7S 4E 12BDD1	5602	PLIOCENE SILICIC VOLCANIC ROCKS	FLOWING WELL; DRILLER'S LOG AVAILABLE	IRRIGATION	336	43	STOCK WATERING	YES	42.8306 115.9258	YOUNG, 1973

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
								Owyhee County (cont'd.)								
WILLIAM ROBERTSON WELL 7S 4E 12CCC1	13286	PLIOCENE SILICIC VOLCANIC ROCKS AND BASALT		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	274	43		SEEDLING CONIFERS			42.8224 115.9334	LOG, 1968
CLARENCE COOK WELL 7S 4E 13BCC1	5621	PLIOCENE SILICIC VOLCANIC ROCKS		TOTAL DEPTH IS UNKNOWN, WELL WAS DEEPENED				IRRIGATION	323	39		SOIL WARMING		YES	42.8153 115.9336	YOUNG, 1973
DAVE LAHTINEN WELL 7S 4E 13DCD1	3785	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	304	40		STOCK WATERING		YES	42.8081 115.9194	YOUNG, 1973
FRANK MILLETT WELL #2 7S 4E 14ABC1	20440	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	349	39		AQUACULTURE		YES	42.8189 115.9433	YOUNG, 1973
ELMO GRIFFITS WELL 7S 4E 14CDC1	11242	PLIOCENE SILICIC VOLCANIC ROCKS (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	289	29		BIODEGRADATION			42.8080 115.9479	LOG, 1963
ROBERT BLACK WELL 7S 4E 15ACD1	10704	PLIOCENE JOINTED BASALT AND SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	324	33		FERMENTATION		YES	42.8153 115.9606	YOUNG, 1973
BLAINE RAWLINS WELL 7S 4E 22ACB1		PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	304	38		SHRIMP FARMING			42.8028 115.9615	LOG, 1966
C. RUSSEL WELL 7S 4E 22BAD1	16276	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	243	41		GREENHOUSE			42.8042 115.9649	LOG, 1972
BLAINE RAWLINS WELL #2 7S 4E 23CBB1	151	PLIOCENE SILICIC VOLCANIC ROCKS AND BASALT		DRILLER'S LOG AVAILABLE				DOMESTIC	108	35		AQUACULTURE			42.7999 115.9510	YOUNG AND WHITEHEAD, 1975
BLAINE RAWLINS WELL #3 7S 4E 23CBB2	15141	PLIOCENE SILICIC VOLCANIC ROCKS AND JOINTED BASALT		DRILLER'S LOG AVAILABLE				IRRIGATION	246	39		FERMENTATION		YES	42.7994 115.9531	YOUNG AND WHITEHEAD, 1975

JOHN MCGUIRE WELL 7S 4E 24BDC1	3785		NO LONGER A FLOWING WELL	IRRIGATION	219	32	DE-ICING ROADWAYS		42.8021 115.9286	
BELL BRAND RANCHES 7S 4E 25ADC1	10220	PLIOCENE SILICIC VOLCANIC ROCKS AND JOINTED BASALT		IRRIGATION	224	36	BIODEGRADATION	YES	42.7872 115.9186	YOUNG, 1973
GUTHERIES RANCH WELL 7S 4E 26BCB1	5677	PLIOCENE SILICIC VOLCANIC ROCKS AND JOINTED BASALT	DRILLER'S LOG AVAILABLE	IRRIGATION	264	31	DE-ICING HIGHWAYS	YES	42.7881 115.9528	YOUNG, 1973
DAVE LAHTINEN WELL 7S 4E 27BCC1	775	PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	423	27	HEATING AND COOLING WITH HEAT PUMP	YES	42.7860 115.9725	*YOUNG*, 1973
DON DAVIS WELL #2 7S 5E 5BAA1	3			*UNUSED*		23	*CATFISH FARMING*		42.8504 115.8869	
DON DAVIS WELL #3 7S 5E 5BAC1				IRRIGATION		20	HEATING AND COOLING WITH HEAT PUMP		42.8484 115.8894	
ACE BLACK WELL #2 7S 5E 5DBC1	757	PLIOCENE JOINTED BASALT	DRILLER'S LOG AVAILABLE; *FLOWING WELL*	IRRIGATION	733	32	AQUACULTURE	YES	42.8417 115.8828	YOUNG AND *WHITEHEAD*, 1975
DAVIS BROTHERS WELL #1 7S 5E 7ABB1	20440	PLIOCENE SILICIC VOLCANIC *ROCKS*	DRILLER'S LOG AVAILABLE; *FLOWING WELL*	IRRIGATION	495	39	HYDROPONICS	YES	42.8367 115.9044	YOUNG, 1972
MERLE BACHMAN WELL #1 7S 5E 8BCC1	1892		FLOWING WELL	IRRIGATION	396	40	AQUACULTURE		42.8306 115.8928	
MERLE BACHMAN WELL #2 7S 5E 8BCC2	37		FLOWING WELL	IRRIGATION	213	26	FERMENTATION		42.8303 115.8934	
DAVIS BROTHERS WELL #2 7S 5E 8CCC1		PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE; FLOWING WELL	IRRIGATION	457	40	SOIL WARMING	YES	42.8239 115.8936	YOUNG, 1973
HARRY LOOS WELL 07S 5E 9DDD1	13248	PLIOCENE JOINTED RHYOLITE	FLOWING WELL; DRILLER'S LOG AVAILABLE	IRRIGATION	629	40	AQUACULTURE	YES	42.8228 115.8564	YOUNG, 1973

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Owyhee County (cont'd.)																
ROY DAVIS WELL#1 7S 5E 13AAA1	4542	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)		THIS WELL WAS ORIGINALLY 427 METERS DEEP, BUT HAS CAVED TO ITS PRESENT DEPTH				IRRIGATION	106	23		HEATING AND COOLING WITH HEAT PUMP			42.8207 115.7979	
ROY DAVIS WELL #2 7S 5E 13AAC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		PARTIAL DRILLER'S LOG AVAILABLE				IRRIGATION	121	25		DE-ICING HIGHWAYS		YES	42.8194 115.8011	YOUNG, 1973
CARL STEINER WELL 7S 5E 13CBB1	11355	PLIOCENE FRACTURED BASALT		DRILLER'S LOG AVAILABLE				IRRIGATION	595	36		HYDROPONICS		YES	42.8147 115.8158	WHITEHEAD, 1973
ROBERT TINDALL WELL 7S 5E 16ACD1	15141	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	461	39		STOCK WATERING		YES	42.8144 115.8606	YOUNG, 1973
CHESTER SELLMAN WELL #1 7S 5E 18ABC1	378	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)		FLOWING WELL				IRRIGATION		30		BIODEGRADATION			42.8186 115.9041	BEARD, 1978 (SITE INSPECTION)
CHESTER SELLMAN WELL #2 7S 5E 18ABC2	3596	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PLIOCENE BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE				IRRIGATION	173	34		TROPICAL FISH			42.8197 115.9034	LOG, 1967
CLARENCE MILLER WELL #1 7S 5E 18BDC1	2838	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PLIOCENE BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE				DOMESTIC	157	37		HYDROPONICS			42.8150 115.9076	LOG, 1951
CLARENCE MILLER WELL #2 7S 5E 18DBA1	5299	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PLIOCENE BASALT		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	285	41		SOIL WARMING			42.8145 115.9016	LOG, 1976
BELL BRAND INC. WELL 7S 5E 19CCC1	4428	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	231	36		BIODEGRADATION		YES	42.7936 115.9133	GRAHAM, 1966
GENE TINDALL WELL 7S 5E 28ACD1		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	305	34		FERMENTATION		YES	42.7881 115.8614	YOUNG, 1973

COLYER CATTLE CO. WELL 1 7S 6E 4CAD1	378	PLIOCENE BASALT		IRRIGATION		32	BIODEGRADATION		42.8404 115.7489	ROSS, 1971
COLYER CATTLE CO. WELL 2 7S 6E 4DCC1	757	PLIOCENE BASALT		IRRIGATION		44	SEEDLING CONIFERS		42.8385 115.7450	ROSS, 1971
RON PROW WELL 7S 6E 6BAA1	4920	PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL; WELL DRIES UP IN SUMMER TIME, DRILLER'S LOG AVAILABLE	DOMESTIC	123	22	DE-ICING ROADWAYS		42.8511 115.7874	LOG, 1959
GEORGE TURNER WELL 7S 6E 7AAC1		PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL	DOMESTIC	331	25	CATFISH FARMING	YES	42.8334 115.7813	WHITEHEAD, 1973
ROY DAVIS WELL #3 7S 6E 7CDD1				DOMESTIC	36	23	HEATING AND COOLING WITH HEAT PUMP		42.8225 115.7866	
COLYER CATTLE CO. WELL 3 7S 6E 9BAD1	579	PLIOCENE BASALT		IRRIGATION	277	50	GRAIN-HAY DRYING	YES	42.8342 115.7474	YOUNG, 1972
R.L. OWEN WELL #1 7S 6E 15DAA1	18	PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE; FLOWING WELL	STOCK WATERING	685	27	HEATING AND COOLING WITH HEAT PUMP		42.8155 115.7207	LOG, 1969
R.L. OWEN WELL #2 7S 6E 16CDC1	9463	PLIOCENE JOINTED BASALT	FLOWING WELL; DRILLER'S LOG AVAILABLE	IRRIGATION	156	42	SOIL WARMING	YES	42.8081 115.7514	YOUNG, 1973
ROY DAVIS WELL #4 7S 6E 18BBB1	6056			IRRIGATION	121	23	FISH FARMING		42.8213 115.7954	
HOT SPRINGS RANCH WELL 7S 6E 21DBC1		PLIOCENE JOINTED BASALT	DRILLER'S LOG AVAILABLE; FLOWING WELL; TWO WELLS AT THIS SITE	IRRIGATION	231	43	SEEDLING CONIFERS	YES	42.7978 115.7464	YOUNG, 1971
R.L. OWEN WELL #3 7S 6E 22CAA1	7570		WELL WAS BEING DRILLED AT TIME OF INSPECTION AND WAS REPORTED TO BE COOLING WITH DEPTH		155	47	GRAIN-HAY DRYING		42.7949 115.7330	
PENCE H S 7S 6E 22DAD1S	5110	QUATERNARY ALLUVIUM	MARSH AREA	UNUSED		42	HYDROPONICS		42.7981 115.7199	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
								Owyhee County (cont'd.)								
BAT HOT SPRINGS 7S 6E 22DBB1S	378	PLIOCENE SILICIC VOLCANIC ROCKS (?)						IRRIGATION		47		BALNEOLOGICAL BATH			42.7997 115.7267	ROSS, 1971
R.L. OWEN WELL #4 7S 6E 23BBB1	7570	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	429	45		SEEDLING CONIFERS		YES	42.8067 115.7170	YOUNG, 1973
R. L. OWEN WELL #5 7S 6E 23BBB2	13248	PLIOCENE SILICIC VLOCANIC ROCKS (?)						IRRIGATION	243	41		AQUACULTURE			42.8067 115.7166	
WILLIAM ROSE WELL 7S 6E 23CAD1	3406	PLIOCENE SILICIC VOLCANIC ROCKS		FLOWING WELL				IRRIGATION	396	44		SWIMMING POOLS		YES	42.7975 115.7083	YOUNG, 1973
R.L. OWEN WELL #6 7S 6E 23CCA1	2271			FLOWING WELL				IRRIGATION		45		GRAIN-HAY DRYING			42.7965 115.7132	
ANGEL BILBOA WELL 7S 6E 23DCB1	5677	PLIOCENE SILICIC VOLCANIC ROCKS AND BASALT (?)		FLOWING WELL; DRILLER'S LOG AVAILABLE				IRRIGATION	313	40		SOIL WARMING			42.7962 115.7070	LOG, 1966
R.L. OWEN WELL #7 7S 6E 26ADA1	4920	PLIOCENE SILICIC VOLCANIC ROCKS AND BASALT (?)		FLOWING WELL				IRRIGATION	304	38		HYDROPONICS		YES	42.7876 115.7006	YOUNG AND WHITEHEAD, 1975
R.L. OWEN WELL #8 7S 6E 26BAA1	3406	PLIOCENE SILICIC VOLCANIC ROCKS (?)						IRRIGATION		38		AQUACULTURE			42.7920 115.7084	
R.L. OWEN WELL #9 7S 6E 26BAA2		PLIOCENE SILICIC VOLCANIC ROCKS (?)						IRRIGATION		36		FERMENTATION			42.7919 115.7080	
R.L. OWEN WELL #10 7S 6E 26BDA1	340	TERTIARY SILICIC VOLCANIC ROCKS (?) AND PLIOCENE BASALT (?)		FLOWING WELL				IRRIGATION		35		BIODEGRADATION			42.7882 115.7077	

R.L. OWEN WELL #11 7S 6E 26BDB1			FLOWING WELL		DOMESTIC		34	DE-ICING ROADWAYS		42.7888 115.7105	
BUCKAROO H S 7S 6E 26CCD1S	757	QUATERNARY ALLUVIUM	FOUR SPRING VENTS		UNUSED		43	GREENHOUSE		42.7804 115.7142	ROSS, 1971
JEAN LONGHURST WELL 7S 6E 27AAC1	2895	PLIOCENE BASALT			IRRIGATION	106	45	SPACE HEATING		42.7906 115.7216	ROSS, 1971
JAMES PRESCOTT WELL 7S 6E 27ADB1		PLIOCENE BASALT	FLOWING WELL		IRRIGATION	121	43	HYDROPONICS	YES	42.7889 115.7222	YOUNG, 1973
JEAN PRESCOTT H S 7S 6E 34DCB1S	1703	PLIOCENE JOINTED BASALT	LOCATED IN BRUNEAU CANYON; NUMEROUS SPRING VENTS	YES	UNUSED		41	SOIL WARMING	YES	42.7675 115.7269	WHITEHEAD, 1973
R.L. OWEN WELL #12 7S 6E 34DDA1	7570	PLIOCENE SILICIC VOLCANIC ROCKS (?)	DRILLER'S LOG AVAILABLE; FLOWING WELL		IRRIGATION	91	33	FERMENTATION		42.7680 115.7184	LOG, 1977
PRESCOTT W S 7S 6E 35BBB1S	7		NOT FIELD CHECKED		UNUSED		40	AQUACULTURE	YES	42.7777 115.7159	
LOWER INDIAN BATHTUB 8S 6E 3ADB1S	567	TUFF CONTACT WITH TERITARY BASALT	NUMEROUS SPRING VENTS; TEMPERATURE RANGE 38-42 DEGREES C		UNUSED		42	STOCK WATERING		42.7639 115.7300	YOUNG, 1972
INDIAN BATHTUB H S 8S 6E 3BDD1S		TUFF CONTACT WITH TERTIARY BASALT	NUMEROUS SPRING VENTS	YES	RECREATION		37	HYDROPONICS		42.7617 115.7384	YOUNG, 1972
U.S. CORPS ENGINEERS 9S 5E 4BDA1	908	PLIOCENE AND PLEISTOCENE SEDIMENTS			UNUSED	762	52	MUSHROOM GROWING		42.6759 115.8747	SWANSON, 1977
TOM WHEELER WELL #1 9S 12E 28CBB1	1396	PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE		IRRIGATION	238	29	DE-ICING HIGHWAYS		42.6137 115.0625	LOG, 1969
TOM WHEELER WELL #2 9S 12E 28CDC1	1703	PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE		IRRIGATION	248	27	CATFISH FARMING		42.6084 115.0568	LOG, 1966

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Owyhee County (cont'd.)																
J. WHEELER WELL #1 9S 12E 28DBC1		PLIOCENE SILICIC VOLCANIC ROCKS (?)						IRRIGATION	248	35		AQUACULTURE			42.6125 115.0525	
J. WHEELER WELL #2 9S 12E 29AAA1	113	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	177	22		FISH FARMERING			42.6210 115.0659	LOG, 1977
J. WHEELER WELL #3 9S 12E 29ADC1	8327	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	161	30		CATFISH FARMING			42.6158 115.0688	LOG, 1967
J. WHEELER WELL #4 9S 12E 29BBB1		PLIOCENE SILICIC VOLCANIC ROCKS (?)						IRRIGATION	147	28		TROPICAL FISH FARMING			42.6215 115.0815	
J. WHEELER WELL #5 9S 12E 29DBA1	6964	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	170	30		CATFISH FARMING			42.6146 115.0694	LOG, 1968
J. WHEELER WELL #6 9S 12E 29DBD1	4542	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	190	31		FERMENTATION			42.6126 115.0696	LOG, 1971
INDIAN H S 12S 7E 33C 1S		TERTIARY BASALT AND SILICIC VOLCANIC ROCKS		NOT FIELD CHECKED						71	93	REFRIGERATION (LOWER TEMPERATURE RANGE)	DRYING AND CURING OF LIGHT AGGREGATE		42.3333 115.6500	ROSS, 1971
A. KRAMER WELL 12S 10E 12CDC1	5677	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	152	24		HEATING AND COOLING WITH HEAT PUMP			42.5650 114.9971	LOG, 1963
MURPHY H S 16S 9E 24BBB1S		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS		TWO SPRING VENTS				IRRIGATION		52	99	MUSHROOM GROWING	BARLEY MALTING PROCESS	YES	42.0314 115.3658	ROSS, 1971
CLARANCE NYE WELL 16S 9E 24BBD1	113	PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				DOMESTIC	91	25		HEATING AND COOLING WITH HEAT PUMP			42.0312 115.3655	LOG, 1973

JANACEK WELL 16S 9E 24CAA1				PUBLIC SUPPLY	50	23	CATFISH FARMING	42.0310 115.3657	
				Payette County					
A.L. CHRISTENSON WELL 6N 5W 12BBD1		PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	143	23	CATFISH FARMING	43.8775 116.8900	SAVAGE, 1973
NELSON-DEPPE WELL 6N 5W 13CBB1		PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	108	22	CATFISH FARMING	43.8568 116.8923	SAVAGE, 1973
6N 5W 24BBD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION		24	DE-ICING ROADWAYS	43.8495 116.8883	SAVAGE, 1973
JAMES LIBBY WELL 7N 5W 25DBB1	12112	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	107	20	HEAT PUMP FOR HEATING AND COOLING	43.9153 116.8819	SAVAGE, 1973
MIKE MCKAGUE WELL 7N 5W 33AAB1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DOMESTIC	60	20	CATFISH FARMING	43.9090 116.9373	SAVAGE, 1973
JAMES MOSIER WELL 8N 4W 7CCD1	52	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	35	20	FISH FARMING AND HATCHING	44.0402 116.8681	SAVAGE, 1973
WALTER SMITH WELL 9N 3W 19DDA1		PLIOCENE AND PLEISTOCENE SEDIMENTS		STOCK WATERING		29	FERMENTATION	44.0995 116.7310	SAVAGE, 1973
ALBERT COATES WELL 9N 3W 21BDC1	1514	PLIOCENE AND PLEISTOCENE SEDMENTS	DRILLER'S LOG AVAILABLE; FLOWING WELL	IRRIGATION	112	25	HEATING AND COOLING WITH HEAT PUMP	44.1032 116.7050	SAVAGE, 1973
LEE REED WELL 9N 5W 35CCB1	75	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	99	20	CATFISH FARMING	44.0700 116.9094	SAVAGE, 1973
				Power County					
FALLS IRRIGATION DIST. 7S 31E 11ACA1	5110	PLEISTOCENE ALLUVIUM (?)	NOT FIELD CHECKED	UNUSED	76	26	HEATING AND COOLING WITH HEAT PUMP	42.8294 112.7947	LOG, 1954

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Power County (cont'd.)																
IDAHO POWER CO. WELL 7S 31E 31ADA1	7759	PLIESTOCENE ALLUVIUM (?)		USED ONLY IN THE WINTER; DRILLER'S LOG AVAILABLE				INDUSTRIAL	182	24		DE-ICING ROADWAYS			42.7723 112.8698	LOG, 1957
EMIL MAYER WELL 8S 30E 24ACA1	4239	QUATERNARY ALLUVIUM AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	187	22		HEATING AND COOLING WITH HEAT PUMP			42.7160 112.8903	LOG, 1959
MAX MAYER WELL 8S 31E 17ABA1		PALEOZOIC LIMESTONE		DRILLER'S LOG AVAILABLE				IRRIGATION	117	25		CATFISH FARMING			42.7331 112.8563	TRIMBLE AND CARR, 1976
FRED MAYER WELL 8S 31E 17BDB1	5677	PALEOZOIC LIMESTONE		DRILLER'S LOG AVAILABLE				IRRIGATION	164	26		FISH FARMING AND HATCHING			42.7288 112.8563	TRIMBLE AND CARR, 1976
INDIAN SPRINGS 8S 31E 18DAB1S		PALEOZOIC LIMESTONE	NORTHWEST TRENDING FAULT	SEVEN SPRING VENTS			YES	RECREATION		32	71	BIODEGRADATION	ANIMAL HUSBANDRY	YES	42.7254 112.8722	STEARNS AND OTHERS, 1938
INDIAN W S 8S 31E 18DAC1S		PALEOZOIC LIMESTONE					YES	IRRIGATION		34		AQUACULTURE			42.7236 112.8712	ROSS, 1971
D.M. THORNHILL WELL 8S 31E 18DAC1	1135	PALEOZOIC LIMESTONE	NORTHWEST TRENDING FAULT	FLOWING WELL				IRRIGATION		33		FERMENTATION			42.7239 112.8723	ROSS, 1971
LAKE WALCOTT W S 9S 29E 19ACD1S				NOT FIELD CHECKED SUBMERGED IN LAKE WALCOTT				UNUSED		21					42.6246 113.1069	
ROCKLAND W S 10S 30E 13CDC1S		PALEOZOIC LIMESTONE		NOT FIELD CHECKED; SEVERAL SPRINGS VENTS; TEMPERATURE RANGE 34-38 DEGREES C						38	72	AQUACULTURE	APPLE DEHYDRATION	YES	42.5465 112.8987	ROSS, 1971
UPPER ROCKLAND W S 10S 30E 24BBA1S	1892	QUATERNARY ALLUVIUM ABOVE PRE-TERTIARY LIMESTONE		NOT FIELD CHECKED; REPORTED BY ROSS, 1971						38		SOIL WARMING			42.5438 112.9026	ROSS, 1971

ROSCO WESTON WELL 10S 30E 24DCC1	5677	PALEOZOIC LIMESTONE	DRILLER'S LOG AVAILABLE			IRRIGATION	184	38		HYDROPONICS			42.5311 112.8948	LOG, 1975

Teton County

TAYLOR SPRINGS 3N 45E 7BAA1S	946	TRIASSIC MARINE SEDIMENTS NEAR THRUST FAULT				IRRIGATION		20		FISH FARMING			43.6066 111.8980	MITCHELL, 1978
O. NEELY WELL 7N 43E 36AAC1		TRIASSIC SEDIMENTS BENEATH CENOZOIC BASALTS (?)	NOT FIELD CHECKED; TEMPERATURE RANGE 32-49 DEGREES C; DRILLER'S LOG AVAILABLE			IRRIGATION	353	49		GRAIN-HAY DRYING			43.8937 111.3223	LOG,1969

Twin Falls County

BILL SLIGER WELL 8S 14E 30ACB1	378	QUATERNARY AND TERTIARY SEDIMENTS	WELL WAS DRILLED NEXT TO AN EXISTING HOT SPRING			RECREATION	121	63		ANIMAL HUSBANDRY			42.7060 114.8572	ROSS, 1971
SALMON FALLS H S 8S 14E 30ACD1S	94	QUATERNARY AND TERTIARY SEDIMENTS		YES	(?)	RECREATION		67		APPLE DEHYDRATION			42.7040 114.8563	ROSS, 1971
FENTON CONNOLLY WELL 8S 14E 30DBA1		QUATERNARY AND TERTIARY SEDIMENTS				DOMESTIC		65		GREENHOUSE			42.7016 114.8557	VON LINDERN, 1978 (SITE INSPECTION)
MIRACLE H S 8S 14E 31ACB1S	1059	QUATERNARY ALLUVUIM NEAR PLIOCENE BASALT AND OLDER SILICIC VOLCANIC ROCKS	ALSO KNOWN AS HOT SULPHUR SPRINGS	YES	YES	RECREATION		55	87	BALNEOLOGICAL BATH	PASTEURIZATION	YES	42.6920 114.8592	MALDE AND OTHERS, 1972
HARRY HUTTANUS WELL #1 8S 14E 33BCD1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT (?)			YES	RECREATION	82	49		SEEDLING CONIFERS			42.6890 114.8258	STEARNS AND OTHERS, 1938
BANBURY H S 8S 14E 33CBA1S		QUATERNARY AND TERTIARY SEDIMENTS	COMMERCIALLY DEVELOPED		YES	RECREATION		59		MUSHROOM GROWING			42.6880 114.8256	ROSS, 1971
HARRY HUTTANUS WELL #2 8S 14E 33CBA1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT (?)			YES	RECREATION	74	57	108	LAUNDRY USES	CANNING AND PRESERVING	YES	42.6884 114.8257	STEARNS AND OTHERS, 1938
HARRY HUTTANUS WELL #3 8S 14E 33CBA2		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT (?)			YES	HEATING OF POOL AND HOUSE	64	57		SPACE HEATING			42.6881 114.8262	STEARNS AND OTHERS, 1938

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Twin Falls County (cont'd.)																
DARWIN COLLIER WELL 8S 14E 33CBD1	208	QUATERNARY ALLUVIUM OVERLYING PLIOCENE BASALT AND OLDER SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; FLOWING WELL				SPACE HEATING	164	44		MUSHROOM GROWING			42.6869 114.8262	LOG, 1976
MIKE ARCHIBALD WELL 8S 14E 33CCA1	1324	PLIOCENE AND PLEISTOCENE BASALT AND SEDIMENTS (?)		DRILLER'S LOG AVAILABLE; FLOWING WELL; USED TO HEAT POOL, GREENHOUSE AND HOME				COMMERCIAL	161	45		SEEDLING CONIFERS			42.6846 114.8269	STEARNS AND OTHERS, 1938
J. WOODMAN WELL 8S 14E 33CCC1	567	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS		FLOWING WELL				SPACE HEATING	146	28		FERMENTATION			42.6827 114.8286	ROSS, 1971
GEORGE ANTHONY WELL 9S 12E 34DDA1	3406	PLIOCENE BASALT AND OLDER SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	224	25		CATFISH FARMING			42.5976 115.0261	LOG, 1967
POISON SPRING 9S 13E 14DDD1S				NOT FIELD CHECKED; REPORTED AS BEING WARM; SEVERAL SPRING VENTS RANGING INTO SECTION 23						0					42.6376 114.8917	
PHIL RANICK WELL 9S 13E 18AAC1								IRRIGATION	268	29		BIODEGRADATION			42.6492 114.9722	
JACK KINYON WELL 9S 13E 31DCD1	8607	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	187	26		HEATING AND COOLING WITH HEAT PUMP			42.5952 114.9732	LOG, 1965
ED JARAMELNIK WELL #1 9S 13E 33BCD1	5110	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	262	31		HYDROPONICS			42.6017 114.9446	LOG, 1969
ED JARAMELNIK WELL #2 9S 13E 33CAB1	6813	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	264	31		FERMENTATION			42.5999 114.9417	LOG, 1966
ROSE JARAMELNIK WELL 9S 13E 33CBA1	5583	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	254	31		AGRICULTURE			42.6000 114.9442	LOG, 1966

DICK KASTER WELL 9S 14E 4BDC1	1135	PLIOCENE BASALT AND SEDIMENTS	DRILLER'S LOG AVAILABLE; FLOWING WELL	DOMESTIC	114	46		GRAIN-HAY DRYING			42.6744 114.8244	LOG, 1975
LEO RAY WELL #1 9S 14E 4CDC1	11355	PLIOCENE BASALT AND SEDIMENTS	DRILLER'S LOG AVAILABLE; FLOWING WELL	CATFISH FARMING	230	34		HYDROPONICS			42.6682 114.8239	LOG, 1973
LEO RAY WELL #2 9S 14E 4CDD1	5677	PLIOCENE BASALT AND SEDIMENTS	DRILLER'S LOG AVAILABLE	CATFISH FARMING	167	37		FISH FARMING			42.6670 114.8221	LOG, 1973
ED KERPA WELL 9S 14E 9ADD1	11355	PLIOCENE SEDIMENTS , BASALT AND SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE; FLOWING WELL	STOCK WATERING	228	33	78	SOIL WARMING	PASTEURIZED MILK PROCESS	YES	42.6602 114.8114	LOG, 1973
KENNETH HARBAST WELL 9S 14E 9ADD2	2271	PLIOCENE SEDIMENTS AND BASALT	DRILLER'S LOG AVAILABLE; FLOWING WELL	DOMESTIC	161	33		AQUACULTURE			42.6606 114.8126	LOG, 1971
ROBERT LUNTEY WELL 9S 14E 9ADD3	1514	PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE; FLOWING WELL; OWNER HAS 35 PONDS IN OPERATION	TROPICAL FISH TEST PROJECT	259	32		SHRIMP FARMING			42.6597 114.8124	LOG, 1974
WESLEY REYNOLDS WELL 9S 14E 10BCC1	3785	PLIOCENE SEDIMENTARY ROCKS	DRILLER'S LOG AVAILABLE FLOWING WELL	FISH FARMING	184	33		FERMENTATION			42.6593 114.8099	LOG, 1971
WRIGHT FUEL CO. WELL 9S 14E 24BCA1	56	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS	DRILLER'S LOG AVILABLE; FLOWING WELL	DOMESTIC	42	24		HEATING AND COOLING WITH HEAT PUMP			42.6333 114.7688	LOG, 1977
BUHL CITY WELL #1 9S 14E 36DAC1		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS (?)		PUBLIC SUPPLY	274	30		CATFISH FARMING			42.5988 114.7560	
GREEN GIANT CANNING 9S 15E 31CBB1	4186	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS	DRILLER'S LOG AVAILABLE	COMMERICAL CANNING	196	20		HEATING AND COOLING WITH HEAT PUMP			42.6006 114.7497	LOG, 1960
BUHL CITY WELL #2 9S 15E 31CCB1	2876	PLIOCENE BASALT AND OLDER SILICIC VOLCANIC ROCKS (?)	DRILLER'S LOG AVAILABLE	PUBLIC SUPPLY	322	32		BIODEGRADATION			42.5962 114.7508	LOG, 1961
CHESTER MCCLAIN WELL #1 10S 12E 1AAD1	4542	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS (?)		IRRIGATION	152	26		FISH FARMING AND HATCHING			42.5901 114.9874	

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Twin Falls County (cont'd.)																
CHESTER MCCLAIN WELL #2 10S 12E 1ACB1	6813	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS (?)						IRRIGATION	152	26		FISH FARMING			42.5896 114.9938	
CHESTER MCCLAIN WELL #3 10S 12E 1DCB1	2649	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS (?)						IRRIGATION	152	25		HEATING AND COOLING WITH HEAT PUMP			42.5810 114.9938	
CHESTER MCCLAIN WELL #4 10S 12E 1DCC1	1022	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	135	25		HEATING AND COOLING WITH HEAT PUMP			42.5796 114.9933	LOG, 1955
DICK KIRBS WELL #1 10S 12E 2CCA1								IRRIGATION	152	25		FISH FARMING			42.5813 115.0209	
DICK KIRBS WELL #2 10S 12E 2CCA2								IRRIGATION	152	25		STOCK WATERING			42.5822 115.0199	
CHESTER MCCLAIN WELL #5 10S 12E 2CDB1	7570							IRRIGATION	152	26		HEATING AND COOLING WITH HEAT PUMP			42.5812 115.0188	
DICK KIRBS WELL #3 10S 12E 11DCB1	2081	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	147	23		FISH FARMING			42.5667 115.0136	LOG, 1961
FILER CITY WELL 10S 16E 8CDA1	946	PLIOCENE BASALT AND SEDIMENTS		ORIGINALLY USED BY FILER SCHOOL WHICH HAS BEEN DEMOLISHED				RECREATION	287	27		FERMENTATION			42.5675 114.6055	LOG, 1963
TWIN FALLS CA. CO. WELL 10S 17E 14CCD1								IRRIGATION	365	29		BIODEGRADATION			42.5487 114.4381	
J.S. STEEL-HANSEN PLANT 10S 18E 26BBA1		PLIOCENE BASALT AND SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	121	20		HEATING AND COOLING WITH HEAT PUMP			42.5329 114.3215	LOG, 1964

RAY STANGER & SONS WELL 11S 19E 21ADD1				IRRIGATION		29		FERMENTATION			42.4532 114.2285	
STANGER BROTHERS WELL 11S 19E 24ACB1	5110	PLIOCENE SILICIC VOLCANIC ROCKS (?)		IRRIGATION	273	23		HEATING AND COOLING WITH HEAT PUMP			42.4588 114.2007	
DEAN KIDD WELL #1 11S 19E 31BDA1	1892	PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	365	27		HYDROPONICS			42.4276 114.2762	LOG, 1977
THERMAN WILLIS WELL 11S 19E 31DDC1		QUATERNARY ALLUVIUM ABOVE TERTIARY SILICIC VOLCANIC ROCKS		IRRIGATION	350	28		BIODEGRADATION			42.4176 114.2775	ROSS, 1971
DEAN KIDD WELL #2 11S 19E 31DDD1		QUATERNARY ALLUVIUM ABOVE TERTIARY SILICIC VOLCANIC ROCKS		IRRIGATION	156	29		HYDROPONICS			42.4177 114.2678	ROSS, 1971
FRANK BARROWS WELL 11S 19E 32CDD1		PLIOCENE SILICIC VOLCANIC ROCKS (?)		IRRIGATION		28		CATFISH FARMING			42.4249 114.2603	ROSS, 1971
J. WOODSON CREED WELL 11S 19E 33CDD1		PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	312	31		BIODEGRADATION			42.4176 114.2383	LOG, 1955
SAM HIGH AND SONS WELL 11S 19E 33DDD1	7305	QUATERNARY ALLUVIUM ABOVE TERTIARY SILICIC VOLCANIC ROCKS		IRRIGATION	188	33	69	SHRIMP FARMING	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	42.4176 114.2289	ROSS, 1971
RAY STANGER & SONS WELL 11S 19E 35CCD1		QUATERNARY ALLUVIUM ABOVE TERTIARY SILICIC VOLCANIC ROCKS		IRRIGATION		28		FISH FARMING AND HATCHING			42.4175 114.2066	ROSS, 1971
THEODORE STURGILL WELL 11S 20E 34CCC1			NOT FIELD CHECKED			32	51	AQUACULTURE	GRAIN-HAY DRYING	YES	42.4175 114.1060	
PETE SALIZER WELL 12S 16E 36CAD1				IRRIGATION	67	34		AQUACULTURE			42.3362 114.5246	
12S 17E 6CBB1			NOT FIELD CHECKED	IRRIGATION		37	45	HYDROPONICS	SEEDLING CONIFERS	YES	42.4107 114.5142	

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Twin Falls County (cont'd.)																
NAT-SOO-PAH H S 12S 17E 31BAB1S	113	QUATERNARY ALLUVIUM NEAR TERTIARY SILICIC VOLCANIC ROCKS					YES	RECREATION		36	81	BIODEGRADATION	PRUNE DEHYDRATION	YES	42.3374 114.5087	CROSTHWAITE, 1969
12S 18E 18BA1				NOT FIELD CHECKED						38	65	SOIL WARMING	APPLE DEHYDRATION	YES	42.4160 114.2996	
ROGER JONES WELL 13S 16E 12ABB1	946			FOUR WELLS ARE LOCATED IN THIS IMMEDIATE AREA					52	35		DE-ICING ROADWAYS			42.3161 114.5238	
JONES CORP. WELL #1 13S 17E 6CAB1	3785	PALEOZOIC METAMORPHOSED SEDIMENTS (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	137	39		SOIL WARMING			42.3218 114.4643	LOG, 1954
JONES CORP. WELL #2 13S 17E 6CBA1	5110	PALEZOIC SEDIMENTARY ROCKS (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	167	39		FERMENTATION			42.3231 114.5114	LOG, 1966
JONES CORP. WELL #3 13S 17E 6CBD1	13248	PLIOCENE SILICIC VOLCANICS AND PALEOZOIC METAMORPHOSED SEDIMENTS (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	182	39		STOCK WATERING			42.3325 114.5109	LOG, 1958
HOLLISTER VILLAGE WELL 13S 17E 7BAB1	340	PALEOZOIC SEDIMENTARY ROCKS (?)		DRILLER'S LOG AVAILABLE; FLOWING WELL				DOMESTIC	131	34		SOIL WARMING		YES	42.3167 114.5085	LOG, 1967
H-BAR-H RANCH WELL 16S 17E 30ACA1	170	QUATERNARY ALLUVIUM, PLIOCENE SEDIMENTS AND SILICIC VOLCANIC ROCKS (?)		DRILLER'S LOG AVAILABLE; FLOWING WELL				RECREATION	73	45		GRAIN-HAY DRYING			42.0131 114.5037	LOG, 1969
MAGIC H S 16S 17E 30ACA1S		PLIOCENE SILICIC VOLCANIC ROCKS		FOUR SPRING VENTS; SLIGHT SULFUR ODOR		YES	YES	RECREATION		43	68	SEEDLING CONIFERS	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	42.0129 114.5038	ROSS, 1971
Valley County																
ROCKY CANYON H S 11N 5E 29CDB1S	189	CRETACEOUS GRANITIC ROCK		TWO SPRING VENTS; TEMPERATURE RANGE 43-49 DEGREES C; X-RAY ANALYSIS INDICATED SOME CALCITE		YES	YES	UNUSED		49		SPACE HEATING			44.2526 115.8909	ROSS, 1971

GOAT W S 12N 5E 2DAC1S		CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; SEVERAL SPRING VENTS; REPORTED BY R OSS, 1971				IRRIGATION		0					44.3999 115.8199	ROSS, 1971
DASH CREEK W S 12N 5E 10DDC1S		CRETACEOUS GRANITIC ROCK		SEVERAL SPRING VENTS AND NUMEROUS SEEPS; TEMPERATURE RANGE 28-59 DEGREEES C		YES		IRRIGATION		59		ANIMAL HUSBANDRY			44.3819 115.8411	ROSS, 1971
GROUND HOG W S 12N 5E 11BBD1S		CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; SEVERAL SPRING VENTS				UNUSED		38		HYDROPONICS			44.3921 115.8336	ROSS, 1971
BOILING SPRINGS H S 12N 5E 22BBC1S	624	CRETACEOUS GRANITIC ROCK	NORTHEAST TRENDING FAULT	TEMPERATURE RANGE 80-86 DEGREES C; NUMEROUS SPRING VENTS; X-RAY DIFFRACTION ANALYSIS INDICATED SMALL AMOUNT OF CALCITE	YES	YES	YES	IRRIGATION		85	89	PASTEURIZATION	BARLEY MALTING PROCESS	YES	44.3641 115.8560	WARING, 1965
SILVER CREEK PLUNGE 12N 5E 36DBA1S		CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; EIGHT SPRING VENTS REPORTED; REPORTED BY ROSS, 1971				IRRIGATION		39	74	SOIL WARMING	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	44.3297 115.8021	ROSS, 1971
BELVIDERE H S 13N 3E 13AAD1S	94	QUATERNARY ALLUVIUM			YES			RECREATION		44		SPACE HEATING			44.4648 116.0368	BEARD, 1978 (SITE INSPECTION)
CABARTON H S 13N 4E 31CAB1S	227	CRETACEOUS GRANITIC ROCK	NORTHWEST TRENDING FAULT	THREE SPRING VENTS AND NUMEROUS SEEPS; TEMPERATURE RANGE 56-71 DEGREES C	YES		YES	UNUSED		71	99	REFRIGERATION (LOWER TEMPERATURE LIMIT)	BLANCHING	YES	44.4160 116.0313	NEWCOMB, 1970
BULL CREEK H S 13N 6E 29DAB1S		CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; SEVERAL SPRING VENTS; REPORTED BY ROSS, 1971						0					44.4300 115.7624	ROSS, 1971
BEAR VALLEY H S 13N 10E 22DAB1S		CRETACEOUS GRANTIC ROCK		NOT FIELD CHECKED; REPORTED BY ROSS, 1971				UNUSED		0					44.4451 115.2388	ROSS, 1971
CASCADE RESERVOIR H S 14N 3E 5A 1S				NOT FIELD CHECKED; SUBMERGED IN CASCADE RESERVOIR						0					44.5829 116.1124	
CASCADE CITY WELL 14N 3E 36ABD1		QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK	NORTHWEST TRENDING FAULT				YES	PUBLIC SUPPLY	15	42	46	SEEDLING CONIFERS	SOIL WARMING	YES	44.5110 116.0352	NEWCOMB, 1970
VULCAN H S 14N 6E 11BDA1S	2271	CRETACEOUS GRANITIC ROCK		SLIGHT SULFUR ODOR; NUMEROUS SPRING VENTS; TEMPERATURE RANGE 84-87 DEGREES C; X-RAY ANALYSIS AVAILABLE	YES	YES	YES	RECREATION		88	147	BLANCHING	BEET SUGAR PROCESSING	YES	44.5676 115.6950	WARING, 1965

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
Valley County (cont'd.)																
SULPHUR CREEK H S 14N 9E 13A 1S		CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; REPORTED BY ROSS, 1971						0					44.5543 115.3009	ROSS, 1971
DAGGER CREEK H S 14N 10E 30C 1S		CRETACEOUS GRANITIC ROCK		REPORTED BY ROSS-UNABLE TO CONFIRM; TEMPERATURE RANGE 37-43 DEGREES C						43		SEEDLING CONIFERS			44.5159 115.2946	ROSS, 1971
ARLING W S 15N 3E 13BBC1S	227	QUATERNARY ALLUVIUM NEAR MIOCENE BASALT AND CRETACEOUS GRANITIC ROCK		SULFUR ODOR	YES		YES	IRRIGATION		32	62	SPACE HEATING	ANIMAL HUSBANDRY	YES	44.6404 116.0448	NEWCOMB, 1970
BADLEY W S 15N 4E 21CBB1S	227	CRETACEOUS GRANITIC ROCK			YES		YES	IRRIGATION		38		AQUACULTURE			44.6209 115.9847	ROSS, 1971
WARM LAKE SPRINGS 15N 6E 13ACA1S				SUBMERGED IN WARM LAKE; THREE SPRING VENTS REPORTED				UNUSED		0					44.6386 115.6709	
MOLLY'S H S 15N 6E 14ABB1S	283	CRETACEOUS GRANITIC ROCK		TEMPERATURE RANGE 52-59 DEGREES C; SEVERAL SPRING VENTS		YES (?)		RECREATION		59	83	GAME BIRD HATCHERY	PASTEURIZED MILK PROCESS	YES	44.6423 115.6926	WARING, 1965
SOUTH FORK PLUNGE 15N 6E 14CDB1S				REPORTED TEMPERATURE; NOT FIELD CHECKED						54	62	MUSHROOM GROWING	ANIMAL HUSBANDRY	YES	44.6315 115.6967	
TRAIL CREEK H S 15N 6E 20AAC1S	227	CRETACEOUS GRANITIC ROCK				YES		RECREATION		50		GRAIN-HAY DRYING			44.6263 115.7492	ROSS, 1971
SHEEPEATER H S 15N 10E 24BBB1S				NOT FIELD CHECKED				UNUSED		0					44.6278 115.1968	
GOLD FORK H S 16N 4E 35CCB1S	378	CRETACEOUS GRANITIC ROCK-BRECCIATED		X-RAY DIFFRACTION ANALYSIS AVAILABLE	YES	YES	YES	RECREATION		53		SEEDLING CONIFERS			44.6756 115.9427	ROSS, 1971

DOLLAR CREEK W S 16N 6E 14CCC1S	18	CRETACEOUS GRANITIC ROCK		UNUSED	20		FISH FARMING			44.7173 115.7033	BEARD, 1978 (SITE INSPECTION)
UPPER PISTOL CREEK H S 16N 10E 14CDA1S		CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED	UNUSED	0					44.7109 115.2097	ROSS, 1971
LITTLE PISTOL CREEK 16N 10E 14DBA1S		CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED	UNUSED	0					44.7229 115.2054	ROSS, 1971
PISTOL CREEK H S 16N 10E 14DBC1S		CRETACEOUS GRANITIC ROCK WITH TERTIARY DIKES	NOT FIELD CHECKED; REPORTED TEMPERATURE	UNUSED	46	63	SOIL WARMING	ANIMAL HUSBANDRY	YES	44.7207 115.2072	CARTER AND OTHERS 1973
SUNFLOWER FLAT H S 16N 12E 15BBB1S		CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED; REPORTED TEMPERATURE	UNUSED	65	77	APPLE DEHYDRATION	PASTEURIZED MILK PROCESS	YES	44.7295 114.9928	CARTER AND OTHERS 1973
RIVERSIDE H S 16N 12E 16CBB1S		QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED; REPORTED TEMPERATURE	UNUSED	59	80	GAME BIRD HATCHERY	PRUNE DEHYDRATION	YES	44.7214 115.0132	CARTER AND OTHERS 1973
HOLDOVER H S 17N 6E 2BAA1S	37	CRETACEOUS GRANITIC ROCK		RECREATION	47		MUSHROOM GROWING		YES	44.9467 115.6961	ROSS, 1971
BILLY H S 17N 7E 31BCB1S			NOT FIELD CHECKED	UNUSED	0					44.7702 115.6627	
KWISKWIS H S 17N 10E 11BBA1S		CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED; REPORTED BY ROSS, 1971	UNUSED	69	95	ANIMAL HUSBANDRY	BLANCHING	YES	44.8312 115.2151	ROSS, 1971
MID FK INDIAN CREEK 17N 11E 16ACB1S		CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED; REPORTED INFORMATION	UNUSED	72	142	APPLE DEHYDRATION	FREEZE DRYING	YES	44.8129 115.1229	ROSS, 1971
INDIAN CREEK H S 17N 11E 21B 2S			NOT FIELD CHECKED; REPORTED INFORMATION	UNUSED	88	142	BARLEY MALTING PROCESS	POTATOE DEHYDRATION	YES	44.7988 115.1289	
COX H S 17N 13E 27AAC1S		TERTIARY GRANITIC ROCK	NOT FIELD CHECKED; REPORTED BY ROSS, 1971	UNUSED	55	73	GRAIN-HAY DRYING	BLANCHING	YES	44.7850 114.8551	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
								Valley County (cont'd.)								
HOSPITAL H S 17N 14E 5CBC1S		TERTIARY GRANITIC ROCK		NOT FIELD CHECKED; REPORTED BY ROSS, 1971				UNUSED		46	69	SEEDLING CONIFERS	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	44.8361 114.7904	ROSS, 1971
TEAPOT H S 18N 6E 9ADC1S	56	CRETACEOUS GRANITIC ROCK		SULFUR ODOR				RECREATION		61		ANIMAL HUSBANDRY		YES	44.9137 115.7215	BEARD, 1978 (SITE INSPECTION)
HOT CREEK W S 18N 8E 17BDA1S	37	CRETACEOUS GRANITIC ROCK				YES		RECREATION		36	79	DE-ICING	PASTEURIZED MILK PROCESS	YES	44.8996 115.5045	ROSS, 1971
LICK CREEK W S 20N 5E 15DAB1S	15	CRETACEOUS GRANITIC ROCK						UNUSED		33		AQUACULTURE			45.0697 115.8258	ROSS, 1971
SHEEP CREEK H S 20N 7E 35A 1S	378	QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK		REPORTED BY ROSS-UNABLE TO CONFIRM; TEMPERATURE RANGE 32-58 DEGREES C						58		BALNEOLOGICAL BATHS			45.0353 115.5606	ROSS, 1971
SECESH H S 21N 5E 11D 1S	378	CRETACEOUS GRANITIC ROCK		REPORTED BY ROSS-UNABLE TO CONFIRM						0					45.1699 115.8072	ROSS, 1971
								Washington County								
COVE CREEK H S 10N 3W 9CCC1S	1892							UNUSED		55	172	HOTBED HEATING	VISCOSE RAYON	YES	44.2112 116.7100	
ELVIN CRAIG WELL 11N 2W 16AAB1	10977	MIOCENE BASALT						IRRIGATION	134	21	83	FISH HATCHING	PASTEURIZATION	YES	44.2947 116.5762	YOUNG AND OTHERS, 1977
PHIL SOULEN WELL 11N 2W 27ADB1	757	QUATERNARY AND TERTIARY SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	150	25		DE-ICING			44.2628 116.5546	YOUNG AND OTHERS, 1977
CRANE CREEK H S 11N 3W 7BDB1S	189	QUATERNARY ALLUVIUM OVERLYING MIOCENE BASALT	NORTHWEST TRENDING FAULT	NUMEROUS SEEPS; TEMPERATURE RANGE 58-74 DEGREES C		YES		UNUSED		74	172	APPLE DEHYDRATION	DRYING OF FISH MEAL	YES	44.3064 116.7455	NEWCOMB, 1970

WILLIAM BRUMMETT WELL 11N 4W 33DBA1	946	QUATERNARY AND TERTIARY SEDIMENTS	NORTH TRENDING FAULT	FLOWING WELL; DRILLER'S LOG AVAILABLE; NOT FIELD CHECKED		424	38		AQUACULTURE			44.2448 116.8169	LOG, 1967
DOUGLAS MCGINNIS WELL 11N 5W 20BDD1	113	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	STOCK WATERING	59	21	61	CATFISH FARMING	ANIMAL HUSBANDRY	YES	44.2759 116.9624	LOG, 1964
11N 6W 3DBB1				NOT FIELD CHECKED		182	24	45		SEEDLING CONIFERS	YES	44.3177 117.0412	
GLENN HILL WELL 11N 6W 3DCB1	189	PLIOCENE AND PLEISTOCENE SEDIMENTS; MIOCENE BASALT (?)			UNUSED	66	28	68	FERMENTATION	APPLE DEHYDRATION	YES	44.3143 117.0402	YOUNG AND OTHERS, 1977
WEISER H S 11N 6W 10ACB1S	18	PLIOCENE AND PLEISTOCENE SEDIMENTS; MIOCENE BASALT		MAINLY SEEPAGE			22	42	FISH FARMING	HYDROPONICS	YES	44.3065 117.0420	YOUNG AND OTHERS, 1977
GEOSOLAR GROWERS WELL #1 11N 6W 10CCA1	5677	MIOCENE BASALT		FLOWING WELL; SULFUR ODOR; DRILLER'S LOG AVAILABLE; ALSO KNOWN AS WEISER H S WELLS	RECREATION	121	70	140	REFRIGERATION (LOWER TEMPERATURE LIMIT)	POTATOE DEHYDRATION	YES	44.2989 117.0496	NEWCOMB, 1970
GEOSOLAR GROWERS WELL #2 11N 6W 10CCA2	75	MIOCENE BASALT		FLOWING WELL; SULFUR ODOR	RECREATION	31	77	145	APPLE DEHYDRATION	CORN PRODUCTS (SYRUP, OIL)	YES	44.2995 117.0497	NEWCOMB, 1970
GEOSOLAR GROWERS WELL #3 11N 6W 10CCA3	37	MIOCENE BASALT		FLOWING WELL; SULFUR ODOR	RECREATION	27	76	156	ANIMAL HUSBANDRY	BEET SUGAR PROCESS		44.2994 117.0488	NEWCOMB, 1970
NAKAMURA BROTHERS WELL 11N 6W 15DDA1	1249	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL; SULFUR ODOR	IRRIGATION	92	30		AQUACULTURE			44.2857 117.0334	LOG, 1977
FRANK CHANDLER WELL 12N 5W 33DBC1	1514	QUATERNARY AND TERTIARY SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	42	24		BIODEGRADATION			44.3313 116.9422	YOUNG AND OTHERS, 1970
OLD HOMESTEAD W S 12N 6W 28BBB1S					UNUSED	6	0		FISH FARMING			44.3535 117.0713	
MIDVALE CITY WELL 13N 3W 8CCC1	7570	MIOCENE BASALT; QUATERNARY AND TERTIARY SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL	PUBLIC SUPPLY	293	29	99	HYDROPONICS	WASHING AND DRYING OF WOOL	YES	44.4716 116.7319	WALKER, 1964

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition: Sili-ceous	Deposition: Car-bon-ates	Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
Washington County (cont'd.)																
FAIRCHILD LUMBER CO. 13N 4W 13BAC1	151	MIOCENE BASALT		FLOWING WELL				IRRIGATION	416	25	51	FISH FARMING	GRAIN-HAY DRYING	YES	44.4660 116.7655	WALKER AND SISCO, 1964
LAKEY H S 14N 2W 6BBA1S	378	QUATERNARY ALLUVIUM NEAR MIOCENE BASALT		NUMEROUS SPRING VENTS; TEMPERATURE 63-70 DEGREES C SULFUR ODOR			YES	SPACE HEATING		70	78	APPLE DEHYDRATION	PASTEURIZED MILK PROCESS	YES	44.5860 116.6304	NEWCOMB, 1970
SALUBRIA CEMETERY WELL 14N 2W 6DCB1	1135	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	56	23		FISH FARMING			44.5738 116.6218	LOG, 1977
CAMBRIDGE CITY WELL 14N 3W 3DDC1	1514	MIOCENE BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE				PUBLIC SUPPLY	283	26				YES	44.5728 116.6778	NEWCOMB, 1970
FAIRCHILD H S 14N 3W 19CBD1S	378	QUATERNARY ALLUVIUM NEAR MIOCENE BASALT					YES	UNUSED		52	63	BALNEOLOGICAL BATHS	APPLE DEHYDRATION	YES	44.5313 116.7535	NEWCOMB, 1970
KERMIT WIGGINS WELL 15N 3E 10DBC1	151	PLIOCENE AND PLEISTOCENE SEDIMENTS MIOCEN E BASALT		DRILLER'S LOG AVAILABLE				DOMESTIC	91	21		FISH HATCHING			44.6477 116.6829	LOG, 1977

PRELIMINARY ENVIRONMENTAL ASSESSMENT

IDAHO GEOTHERMAL RESOURCE AREAS

by

S.G. Spencer

and

J. F. Sullivan

EG&G Idaho, Inc.
Idaho Falls, Idaho

TABLE OF CONTENTS

I. INTRODUCTION

This preliminary environmental assessment was prepared to address the major environmental concerns in nine areas in Idaho (figure I-1) with significant geothermal resource potential. This assessment is brief and is not intended to provide a comprehensive environmental analysis of each area; instead, it has been compiled to provide preliminary environmental information as a companion to resource data for these areas. The nine areas addressed are:

A. COUNCIL-CAMBRIDGE

An area encompassing approximately 96,000 ha (hectares) in the Weiser River drainage of western central Idaho.

B. BOISE-WEISER

An area approximately encompassing 460,000 ha in western Idaho, including parts of Washington, Payette, Gem, Canyon and Ada counties.

C. BRUNEAU-GRAND VIEW

An area of approximately 186,000 ha just south of the Snake River in Owyhee County in southwest Idaho.

D. MOUNTAIN HOME

Approximately 54,000 ha surrounding the city of Mountain Home in southwest Idaho.

E. BLUE GULCH, TWIN FALLS, AND ARTESIAN CITY

Three areas encompassing 38,000, 13,000, and 10,000 ha, respectively, south of the Snake River in southcentral Idaho.

F. POCATELLO

An area of approximately 11,000 ha north and west of the city of Pocatello in southeastern Idaho.

G. HAILEY

An area encompassing 16,000 ha in Blaine County in central Idaho.

STATE OF IDAHO

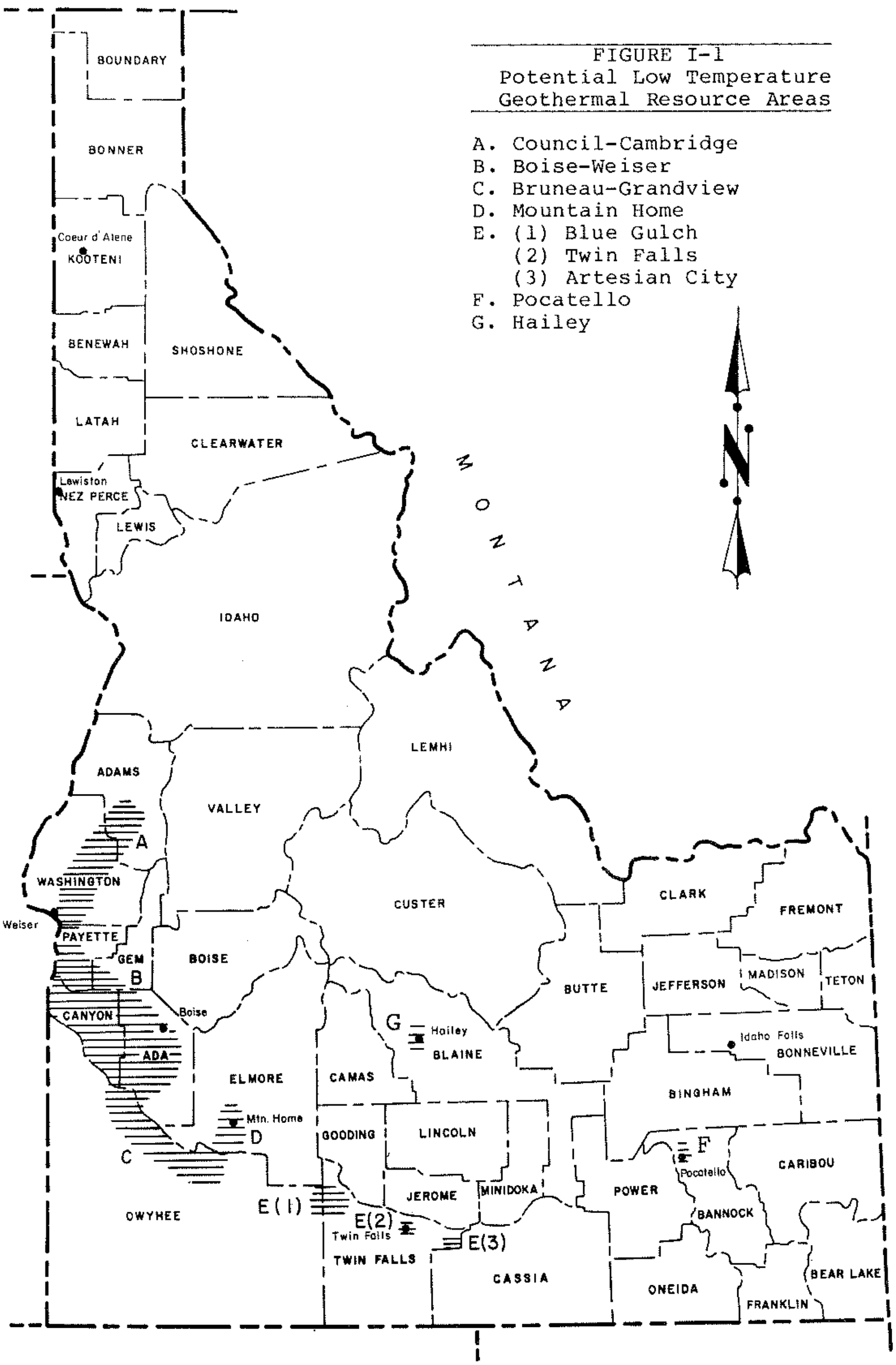


FIGURE I-1
Potential Low Temperature Geothermal Resource Areas

A. Council-Cambridge
B. Boise-Weiser
C. Bruneau-Grandview
D. Mountain Home
E. (1) Blue Gulch
   (2) Twin Falls
   (3) Artesian City
F. Pocatello
G. Hailey

II. DESCRIPTION OF POTENTIAL ACTIVITY

Geothermal developments currently underway include expansion of the space heating system in Boise and the drilling of wells in Twin Falls for space heating at the College of Southern Idaho. Development in the other areas under consideration is limited; however, enough interest has been expressed in developing the resources in these areas that it can be assumed that geothermal activity will increase.

Nearly all resources identified in the areas under consideration are low to moderate temperature resources below 50°C (Celsius). These can be developed for a variety of direct uses, including greenhouses, space heating and cooling, pasteurization, food processing, aquaculture, and animal rearing. In each of these processes, the geothermal fluid replaces the water-boiler systems or the heating systems and thus no major change in system design is required.

Wells drilled to provide geothermal fluids for direct use processes will generally range from less than 100 m (meters) in depth to over 1200 m deep, depending on the location and temperature of the resource. State regulations require that such wells be drilled by a licensed driller under a permit and that they be cased and cemented to preclude contamination of shallow groundwater supplies. Where higher temperatures may be encountered, blowout prevention equipment is required.

Less than 0.5 ha of land is generally cleared and graded for a drilling pad. Small reserve pits may be excavated to contain fluids encountered during drilling. When mud is used to drill the wells, mud tanks or lined mud pits are generally used as reservoirs for the mud circulation system. Access roads to move drilling equipment to the drill site are usually one-lane, ditched for drainage, and gravelled.

In addition to the drill rig, office trailers, equipment storage sheds, pipe racks, generators, and fuel tanks may be moved onto the site. All of these facilities are portable and are on location only during drilling and testing of the well. Portable sanitary facilities and water supply may also be provided.

Upon completion of the well, a wellhead is installed and connected to a supply pipeline or ditch. Geothermal pipelines are generally insulated and buried to prevent large heat losses during transport.

Disposal of the geothermal fluids downstream of the processes will vary. Currently used methods of disposal include injection, discharge to a surface water source (including irrigation canals) and cycling through other uses (including domestic water supply). The disposal method chosen depends on the quality of the geothermal fluids, local regulations, the type of process, and economic considerations.

III. DESCRIPTION OF EXISTING ENVIRONMENT

A. COUNCIL-CAMBRIDGE

1. Physical Environment

a. Climate

The climatic conditions of the Council-Cambridge area are generally influenced by predominant lows in the winter and highs in the summer. As a result, heavy winter snows and spring rains are usual, while summers are hot and dry. Precipitation ranges from 64 cm (centimeter) at Council in the Weiser Valley to over 115 cm in the surrounding mountains. Eight percent of the precipitation falls primarily as snow in the period from October through April. Frequent chinook storms in December and January result in rapid melting of the snowpack and subsequent erosion damage. Temperatures at Council range from -32 to 43°C with the annual temperature averaging 4°C. There are approximately 138 frost-free days annually in the valleys of the Weiser basin (USFS, 1975).

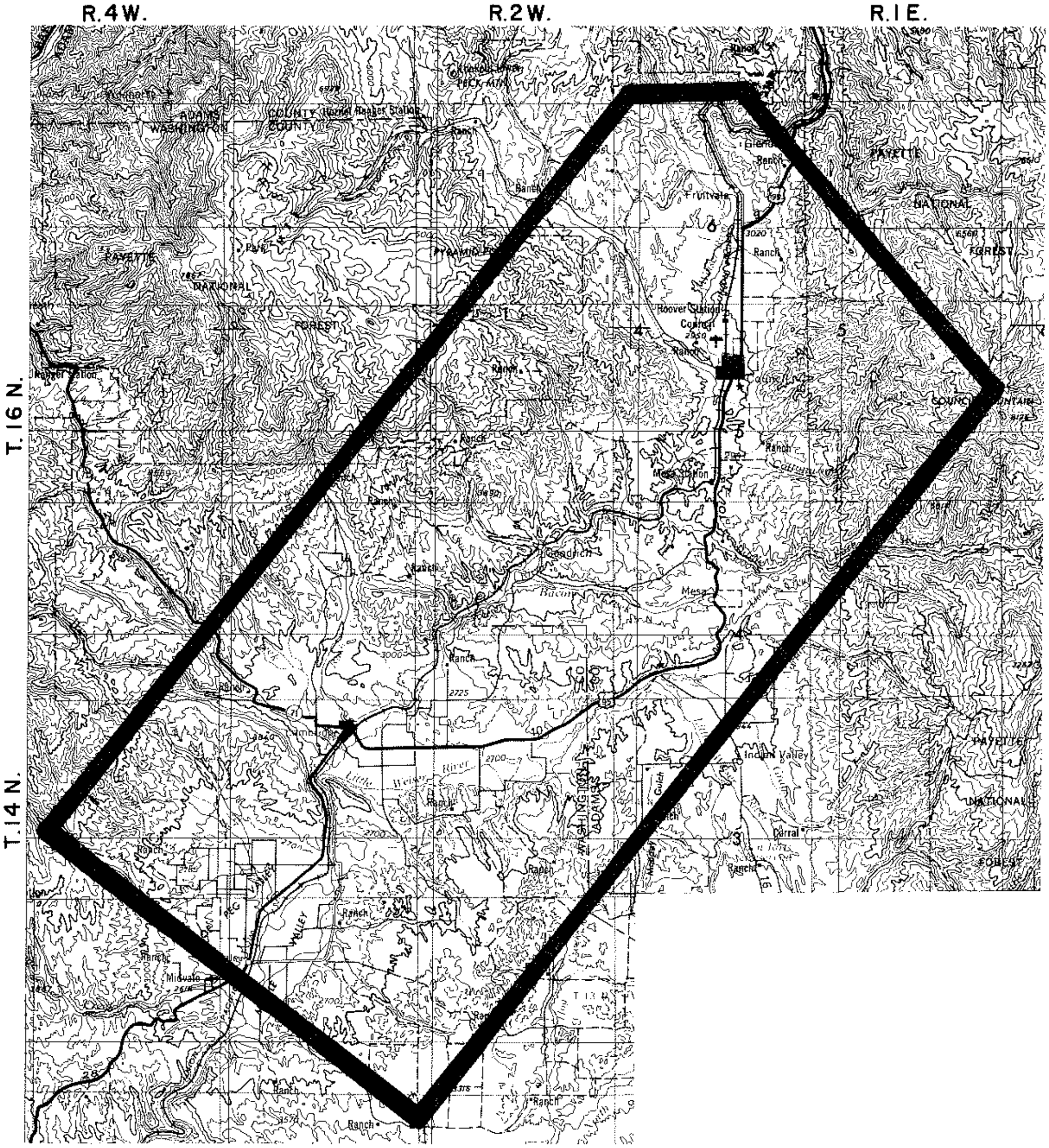
b. Air Quality

In general, the air quality in the area is good, with the average background level of particulates estimated at less than 15 $\mu g/m^3$ (micrograms per cubic meter). Sources of pollution include sawmills at Council, slash burning, road dust, vehicle emissions on Highway 95, rock-crushing, and campfires. In general, pollutants are readily dissipated. However, frequent inversions in the fall during slash burning combine to hold smoke in the upper valleys.

c. Land Resources

(1) Topography

The Council-Cambridge area is located in the Wallowa-Seven Devils section of the Columbia Plateau physiographic province. North-south trending block mountains and structurally-controlled landscapes are typical. The Weiser basin is very irregular with rolling profiles in the valleys. The main feature in the area of interest is the valley of the Weiser River, which trends south from the Seven Devils Mountains to the river's confluence with the Snake River at Weiser. The valley is bounded on the east by the West Mountain block. On the west, the Cuddy Mountains separate the valley from the canyon of the Snake River. Elevations range from 820 m at Midvale in the south to 2480 m on Council Mountain in the northeast corner of the area.



Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

5 0 5 10 15 Nautical Miles

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

A. Council-Cambridge Study Area

(2) Geology

Plateau basalt flows of the Columbia River formation are the most extensive rock type in the area. These basalts are usually weakly weathered and moderately to well-fractured. Granitics of the Idaho Batholith occur in scattered exposures in the area. In the valleys of the Weiser River and its tributaries, the basalts are overlain by colluvium, fanglomerates, stream and lake deposits, and alluvium. A significant area of glaciation and associated glacial debris is located on Council Mountain in the northeast corner of the area. Primary faulting in the area occurs perpendicular to the Weiser Valley.

(3) Soils

The primary parent material of soils in the Council-Cambridge area is the Columbia River basalts. These soils are generally fine to medium-textured loams and silt loams ranging in depth from 76 cm to 127 cm. Productivity is relatively high and erosion hazards are moderate to low. Soils overlying the granitics are much less extensive, coarse-textured loams and sandy loams with moderately low productivity. The erosion potential in these latter soils is moderate to high, while the basaltic soils are generally stable. Mineral fertility is high in most soils. Caliche and relatively high salinity occur in the soils overlying the lacustrine deposits on foothill slopes.

d. Water Resources

(1) Surface Water

The primary stream in the area of interest is the Weiser River, which drains 1567 km^2 (square kilometer) above the gaging station at Cambridge. The discharge at this station averages 19 m^3/s (cubic meter per second) and ranged from a maximum of 286 m^3/s on 12/22/55 to a minimum of 0.23 m^3/s on 11/16/58. The source of water in the basin is snowmelt. Because of the irregularity of the basin, more than 60 percent of the annual runoff is contributed by tributaries on the east-side of the basin. Warm temperatures and rainstorms produce significant runoff in the winter and spring. In the 1974-1975 water year, 80 percent of the total flow of the river occurred in the period from March through June, with an average discharge during May of nearly 80 m^3/s. Total suspended solids during the same period ranged from 22 mg/l (milligram per liter) to 229 mg/l. Measurements of daily sediment discharge were 247 metric tons in February, 1316 metric tons in May, and 21 metric tons in July. The average quality of the river near Cambridge in 1974 and 1975 is shown in table A-1.

TABLE A-1
QUALITY OF WEISER RIVER
(mg/l)

Ca	9.9	HCO_3^-	56
K	1.5	$SO_4^=$	4.3
Mg	3.5	TDS	82
Na	6.4	pH	8.0
Cl^-	1.7	Specific Conductance	100
F^-	0.1		

Flow in the river is regulated to some extent by the Lost Valley Reservoir, 92 km upstream from the mouth, and by other smaller reservoirs. Diversions above Cambridge are used to irrigate about 5000 ha. Downstream, water is used for irrigation in the lower Weiser Valley and for power production on the Snake River (USFS, 1975).

(2) Groundwater

Groundwater in the upper Weiser basin occurs primarly in the Columbia River basalts under both water table and artesian conditions. Some water occurs in the thin layers of sand and gravel sediments in the valley bottoms around Cambridge. Depth to water in irrigation and domestic wells in the area ranges from 0.06 m to 34 m. The average quality of water produced from these wells is shown in table A-2. Domestic and stock water supplies are generally derived from individual wells and springs. Industrial water use is limited to the timber industry and is primarily obtained from surface water with some supplemental groundwater.

TABLE A-2
GROUNDWATER QUALITY
(mg/l)

Ca	16	HCO_3^-	143
K	7.7	$SO_4^=$	17
Mg	6	TDS	210
Na	29	pH	7.6
Cl^-	2.8		
F^-	0.4		

2. Natural Environment

a. Flora

The vegetation in the Council-Cambridge area can be divided into two basic types, based on elevation. At lower elevations there are scattered stands of ponderosa pine (Pinus ponderosa), with bluegrasses (Poa secunda), bluebunch wheatgrass (Agropyron spicatum), and Idaho fescue (Festuca sp.). Big sage (Artemisia tridentata) is common and primary forbs include phlox (phlox sp.), asters (Aster sp.), and western yarrow (Achillea sp.). Some rocky areas support only sparse grasses and forbs. At higher elevations in the mountains east of Council, ponderosa pine predominates. The understory is much heavier and is composed of species such as snowberry (Symphoricarpos albus), chokeberry (Pontentialla virginiana), and ninebark (Physocarpus sp.). Forbs includes asters, horsemint (Monarda sp.), geranium (Geranium sp.), and buckwheat (Fagopyrum sp.). Douglas fir (Pseudotsuga taxifolia) is common and becomes dominant above 1500 m. Western larch (Larix occidentalis) is scattered amongst the douglas fir and Engelmann spruce (Picea engelmannii) occurs along creek bottoms in the mountains. A few whitebark pine (Pinus sp.) grow on top of Council Mountain (USFS, 1975).

b. Fauna

Although detailed inventories have not been taken, surveys of fauna in the area have identified 81 species of birds, 32 species of mammals, and 15 species of reptiles and amphibians. This diversity is primarily due to the variety of cover types and the range of elevations. Although big game is not abundant, some mule deer (Odocoileus hemionus), elk (Cervus canadensis), and numerous black bear (Ursua americanus) inhabit the mountain area. In one season, 53 black bear were tagged on the Middle Fork of the Weiser. Council Mountain is the most important mule deer habitat in the area. Coyote (Canis latrans), red fox (Vulpes fulva), muskrat (Ondatra zibethica), badger (Taxidea taxus) raccon (Procyon lotor), and skunk (Mephitis mephitis) are common. Small mammals include Columbian ground squirrel (Citellus columbianus), golden-mantled ground squirrel (Citellus lateralis), yellowpine chipmunk (Eutamias amoenus), and snowshoe hare (Lepus americanus). Common reptiles and amphibians are western rattlesnake (Cortalus viridis), leopard frog (Rana pipiens), and bullfrog (Rana catesbeiana). In addition to a large variety of passerines, several species of hawks (Buteo sp.), golden eagles (Aquila chrysaetos), and bald eagles (Halliaeetus leucocephalus) are found throughout the area. Blue grouse (Dendragapus obscurus) and ruffed grouse (Bonasa umbellus) are abundant (USFS, 1975).

c. Aquatics

The Idaho Department of Fish and Game classes the streams in the area as good to excellent. There is a fair trout fishery in the three forks of the Weiser River and these streams are stocked several times a year. Game fish include rainbow (Salmo gairdneri), brook trout (Salvelinus fontinalis), a few cutthroat (Salmo clarki), and Dolly Varden (Salvelinus malma). A significant number of nongame fish are found in the lower Weiser River.

3. Cultural Environment

a. Land Use

Nearly all land in the area of interest is privately owned. Approximately 9500 ha in the northeast corner of the area are controlled by the U.S. Forest Service, and parcels of land under the jurisdiction of the state and BLM are scattered through the area. Primary land uses include farming along the Weiser River, timber harvest, range, and recreation. The area was seriously overgrazed in the late 1800's, but careful range management and range restoration have resulted in much of the land being considered an important range resource. At one time, Council was the center of extensive apple orchards, but water shortages, low prices and increased costs have resulted in a decline.

b. Socioeconomics and Demography

The area of interest includes parts of both Washington and Adams counties. The combined population of these counties is 11,800 (1976). The population density of Adams County is 0.9 people/km^2, less than half the density of Washington County. The larger communities in the area and their 1970 populations are Council (899), Cambridge (383), and Midvale (176). The unemployment rate in Adams County in 1976 averaged 13.6 percent and that in Washington County averaged 8.6 percent. Primary contributors to the total employment in each county include farm proprietors, manufacturing, state and local, and trade. Per capita income in the area is 90 percent of the state average and 74 percent of the national average.

c. Archaeologic and Historical

Council Valley was an important meeting place for the NezPerce and Shoshone tribes, the valleys providing a winter retreat and the mountains excellent hunting. Little is known of early occupation of the area, although the potential for prehistoric occupation in the valley areas is good. Both Council and Cambridge were settled in the 1870's. Council grew rapidly as a result of mining activity in the Seven Devils. Cattle and sheep grazing were well established by 1880, and the subsequent overgrazing of the area resulted in heavy soil loss in the lowlands in the early 1900's.

d. Aesthetic Values

The study area is composed of both mountains and valleys. The mountainous regions are utilized for recreational purposes such as backpacking, hunting, and fishing, while the valleys are fairly well developed. Two national forests are touched by the area: Boise and Payette, both of great recreational value.

B. BOISE-WEISER

1. Physical Environment

a. Climate

Limited climatological data are available for selected sampling locations within the Weiser-Boise study area (National Oceanic Atmospheric Administration, 1977). These are summarized as follows:

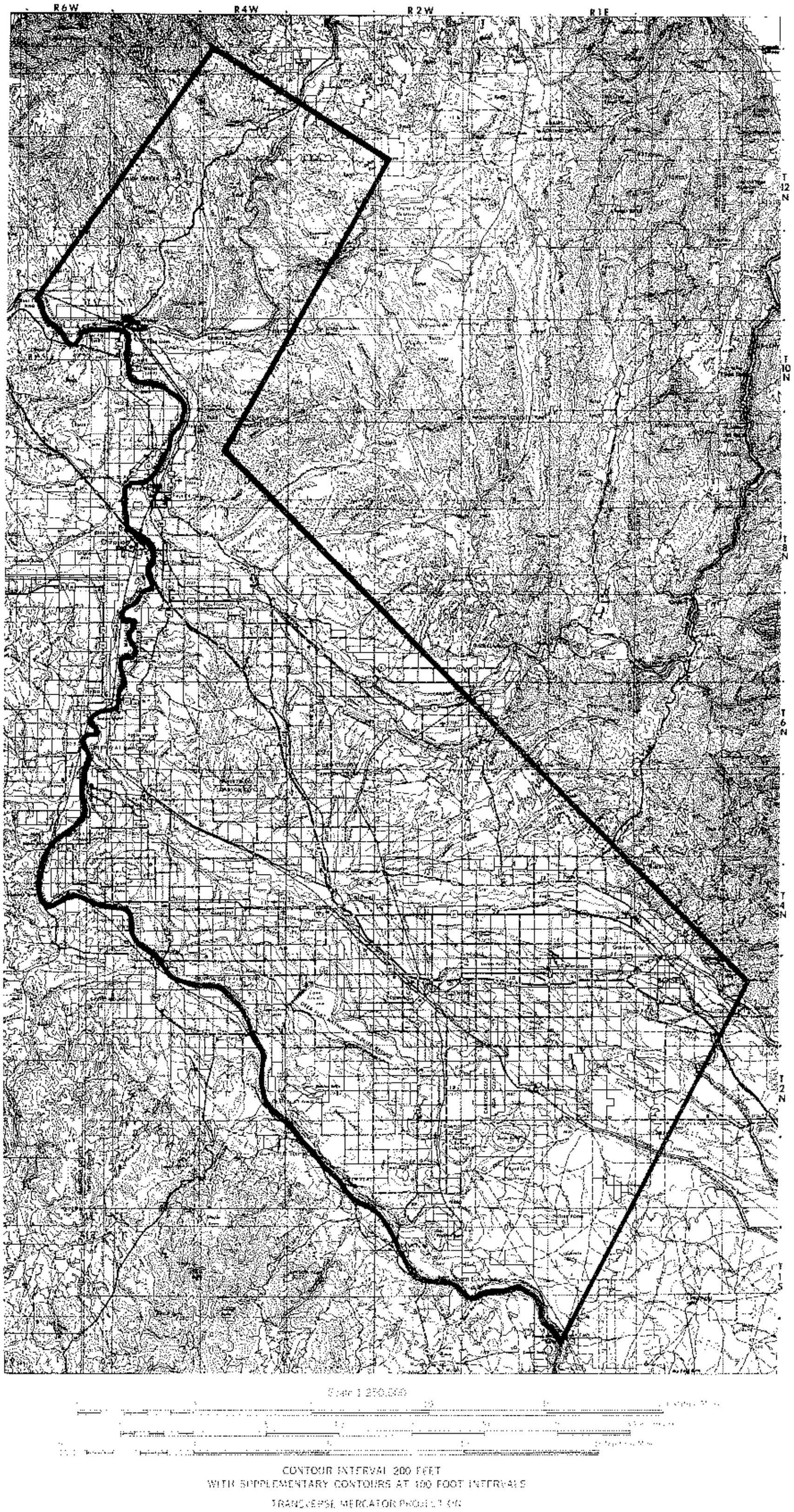
(1) Weiser - located in the uppermost part of the study region in Washington County. The average annual temperature is 10.6°C, with January and July averaging -2.5 and 23.3°C, respectively. Rainfall averages 29 cm/yr with July and January averaging 0.28 and 4.39 cm, respectively. Relative humidity peaks at 40-50 percent in summer and 70-80 percent in winter.

(2) Payette - located in the northwest of the study region in Payette County. The average annual temperature is 10.8°C, with January and July averaging -2.2 and 23.6°C, respectively. Rainfall averages 28.3 cm/yr with July and January averaging 0.33 and 3.96 cm, respectively.

(3) Caldwell - located in Canyon County in the middle of the study area. Average annual temperature is 10.7°C with January and July averaging -1.5 and 23.2°C, respectively. Rainfall averages 28.3 cm/yr with July and January averaging 0.33 and 3.96 cm, respectively.

(4) Boise - located in Ada County in the eastern portion of the study area. Average annual temperature is 10.6°C with January and July averaging -1.5 and 23.3°C, respectively. Rainfall averages 29.2 cm/yr with July and January averaging 0.38 and 3.73 cm, respectively.

The climate is therefore characterized by hot dry summers. Snowfall is a major contributor to the total precipitation,



B. Boise-Weiser Study Area

notably at the higher elevations. The dry grassland climate provides well-defined seasonal characteristics.

b. Air Quality

Air masses from the Pacific reach the study area but are considerably modified over that distance point. Their influence contributes mildly to periods of cloudy or stormy winter weather. Air pollution is not a major problem in the area as a whole, however, the Boise region experiences intermittent temperature inversions which effectively trap particulates and gasses at low levels, thus creating stagnant air masses. The Metropolitan Boise Intrastate Region (including Boise, Nampa, and Caldwell) violates secondary air quality standards for particulate matter (U.S. EPA, 1972). Sources are fuel combustion and industrial process losses, primarily asphalt and ready-mix concrete operations. Additionally, dust from agricultural lands contributes to the particulate load during certain seasons.

The Boise area is the only portion of Idaho to experience significant emissions from aircraft or automobiles. Reduced visibility is a consequence of such air quality degradation during severe temperature inversions (Ada Council of Government).

c. Land Resources

(1) Topography

The Boise-Weiser study area is located on the western border of the state and includes portions of Ada, Canyon, Gem, Payette, and Washington counties. The Boise Mountains border the east side of the region while Oregon borders the west side. The Snake River forms the southern boundary and the Council-Cambridge study area is adjacent on the northern border. Elevations in Ada County range from 822 m on the valley floor to 1890 m on the ridge crest.

The Boise-Caldwell area is of lower elevation than the eastern portion of the Snake River Plain. The topography is generally flat with thick lake and stream sediments interbedded with basalt flows. The lower Boise and Payette River basins are included in the area (BLM, 1976).

(2) Geology

Geological information is primarily limited to Ada County, which is mainly composed of the Idaho Batholith and the Idaho Group. The Idaho Batholith is of granitic origin and is found along the steep face and crest of the Boise Ridge while the Idaho Group represents the valley fill materials, composed of gravel, sand, silt, and clay (Ada Council of Governments, 1973).

The general geology of the area is summarized as follows. Cenozoic flows include: 1) the Basalt flows of the Idaho and Snake River groups in the Boise area; 2) alluvial, glacial, and lake deposits in Canyon, Payette, and Gem counties; 3) sedimentary rocks of the Idaho Group, including lake and stream deposits of the Chalk Hills formation in upper Canyon and lower Payette counties; 4) sedimentary rocks associated with the Columbia River Basalt in Payette and Gem counties; and 5) Columbia River Basalt in Gem, Payette, and Washington counties. Mesozoic rocks include granite rocks of the Idaho Batholith in Ada County (BLM, 1976).

(3) Soils

Available soil data for the entire study area are inadequate for a precise description. Soils in Ada and Canyon counties are moderately to very deep with silty subsoils on gentle to strong slopes. The frost-free season ranges from 120-160 days. Crops, including cereals, potatoes, sugar beets, beans, and hay, require irrigation. Rangeland soils include both coarse-silty and fine-silty soils. Parent materials are alluvium on the terraces and loess on the uplands. The profile depth ranges from 51-152 cm with moderate permeability. The major soil problems appear to be erosion, alkaline conditions and droughtiness. These are being mitigated by residue management, crop sequencing, irrigation, and rangeland management and cross-slope operations (BLM, 1976). Land in the Weiser area is subhumid grassland and semiarid grazing land; some is irrigated.

d. Water Resources

(1) Surface

Surface water features in the study area include the Snake River, Payette River, Weiser River, Boise River, Arrowrock and Lucky Peak reservoirs (on the middle fork of the Boise River). Spangler Reservoir in Washington County, Lowell Lake in Canyon County, and Black Canyon Reservoir on the Payette River in Gem County. Additionally, irrigation canals and drainage ditches have been constructed throughout principal irrigation areas.

Swan Falls Dam, constructed in 1901 on the Snake River south of Boise, creates a slack water pool for approximately 19 km. Otherwise, the Snake River is free flowing. The Snake River receives pollutants from agricultural practices, industrial processing plants (primarily potato and sugar refining), untreated domestic sewage, and irrigation returns. Water quality of the river is degraded by input from the Owyhee, Payette, and Boise rivers (BLM, 1976).

The Boise River flows in an east to west direction through Ada County and drains about 6993 km^2 of mountainous terrain north and east of Ada County. Since this river receives a large part of its water from seasonal runoff and snowmelt, it is characterized by high flows in spring through early summer and low flows from late summer through winter.

Water quality data for the region is summarized in Table B-1 (USGS, 1976). Lake Lowell near Caldwell is formed by two earth embankments. Storage began in 1908, with the capacity 218 hm^3 (cubic hectometer). The lake receives water from the Boise River and local drainage; water is used primarily for irrigation. The maximum observed content (221 hm^3) was recorded on 4/27/22 and the minimum (6.7 hm^3) was observed on 10/22/24.

Lucky Peak Reservoir near Boise is formed by an earth-fill dam. Storage began in 1954. Water (capacity 378.6 hm^3) is stored for flood control and irrigation of Boise valley lands. The maximum observed content (376 hm^3) was recorded on 6/25/55 and the minimum (35.5 hm^3) was observed 12/21/61.

Arrowrock Reservoir on the Boise River is formed by a gravity-section concrete-arch dam which was completed in 1915 and raised 1.5 m in 1937. Water (current capacity 353 hm^3) is used for irrigation in Boise valley; silt deposition has decreased the storage capacity over time. The maximum content (371 hm^3) was recorded 5/29/48 and the minimum occurred during several years when the gates were open and natural river flow passed through the reservoir.

The Boise River is clean as it leaves Lucky Peak Reservoir; however, the quality is degraded as the river leaves Boise. The most severe degradation occurs after the water flows by Eagle Island where the combined effluent from Meridian, Nampa, and Caldwell enter the river along with wastewater returns from vast areas of irrigated farmland (Bureau of Reclamation, 1977). The major pollutants are nitrogen, phosphorus, bacteria, and sediment.

(2) Groundwater

Detailed groundwater data is lacking for the entire study area. However, groundwater data are

TABLE B-1
SURFACE WATER DATA FOR THE BOISE-WEISER STUDY AREA

(Water chemistry data are for the water year 10/75 - 9/76, expressed as mean sample values and standard deviation [USGS, 1976])

Sampling Station	Snake River at Marsing, ID	Boise River at Lucky Peak Lake Outlet	Payette River 2.9 km south of Payette	Weiser River near Weiser
Drainage area (km^2)	--	6,940	8,390	3,780
Average discharge	--	85.6 m^3/s	89.2 m^3/s	33.1 m^3/s
Extremes for period of record (m^3/s)	--	1,010 6/14/1896	875 12/14/64	564 12/23/55
		(No flow when gates are closed)	5.1 10/13/35	0.4 8/07/11
Conductivity (μmhos/cm)	478 (52)	74.5 (8.5)	131 (61.4)	119 (26.0)
pH (units)	8.6 (0.23)	7.0 (0.14)	8.0 (0.57)	7.9 (1.2)
Temperature (°C)	12.3 (7.1	9.5 (6.1)	12.5 (8.6)	11.3 (8.0)
Ca (mg/l)	46.8 (3.1)	8.5 (2.1)	12.6 (6.2)	12.4 (1.8)
Na (mg/l)	28 (5.6)	3.0 (1.3)	12.4 (7.9)	7.0 (1.4)
HCO_3 (mg/l)	163 (57)	39 (7.1)	67 (38.2)	75 (14.0)
TDS (mg/l)	291 (32)	49 (7)	89 (42)	97 (12)
K (mg/l)	4.4 (0.7)	0.7 (0.1)	1.6 (1.1)	1.9 (0.3)
Mg (mg/l)	17.8 (2.2)	1.2 (0.5)	2.3 (1.6)	4.7 (0.5)
Cl^- (mg/l)	23.3 (4.9)	0.7 (0.3)	3.1 (0.7)	2.1 (0.8)
F^- (mg/l)	--	0.25 (0.07)	0.35 (0.07)	0.10 (0.00)
$SO_4^=$ (mg/l)	47.5 (6.8)	3.8 (1.1)	7.9 (1.2)	4.3 (1.2)

available for Ada County, where ample water is available for domestic, industrial, and irrigation purposes. Water within Ada County is primarily available from deep permeable sediments of the Glenns Ferry Formation, shallow alluvial or stream deposits, and Snake River Basalt lava flows (Ada Council of Governments). The Glenns Ferry Formation provides the deep aquifer with both clay and sand strata. Clay beds produce 0.32 - 1.6 lps (liter per second) while sand and gravel beds produce up to 102 lps. Well yields from shallow alluvial or stream terrace deposits range from 32 to 64 lps. The Snake River basalt formation is responsible only for shallow, domestic water resources. Ada County groundwaters are mainly calcium-magnesium bicarbonate type. Total dissolved solids (TDS), however, often exceed the U.S.P.H.S. drinking water standard of 200 mg/l. Water quality problems are associated with excessive hardness, dissolved iron, and magnesium levels.

The Boise River Valley has wells that are utilized mainly for domestic purposes. Of 60 major wells monitored by CH_2M Hill, 15 percent were contaminated by coliform bacteria, gram negative, nonsporulating, rod-shaped bacteria that are natural flora to the gastro-intestinal tract of warm-blooded animals.

The Boise Front is the major deep groundwater recharge system for the area, while irrigation seepage and surface water seepage and precipitation recharge the shallow aquifers.

Available information indicates that a decline in groundwater levels is not occurring and that recharge is balancing water removal from the aquifer.

The Weiser River basin drains approximately 4100 km^2. The principal use of water is for irrigation, with surface waters meeting the bulk of the demand. Groundwater is supplied by two main aquifers: 1) in the basalt of the Columbia River Basalt Group and 2) in overlying Tertiary and Quaternary sedimentary rocks. Individual wells and springs supply domestic and stock supplies. Municipal water for the towns of Council, Cambridge, and Midvale are derived from seven wells open to the Columbia River Basalt Group. Weiser obtains its water from three wells open to the sedimentary-rock aquifer (Young, Harenberg, and Seitz, 1977).

Groundwater in the Weiser River basin is recharged mainly from precipitation falling within the basin. The basalt aquifers are recharged via precipitation on the surrounding uplands and mountains, with snowmelt the greatest contributor. The sedimentary rock aquifers are recharged primarily during snowmelt runoff and the irrigation season, with water infiltration from streams, canals, ditches, and irrigated fields. Water levels in the various aquifers vary with snowmelt conditions.

Groundwater supplies are affected by the thermal waters known to occur in the region. Wells in the Midvale area discharge water in the 28°C range. Municipal wells at Weiser, which draw water from the shallower sedimentary rocks, have TDS concentrations in the 393-514 mg/l range, considerably harder than from the deeper basalt aquifer.

2. Natural Environment

a. Flora

Species expected to occur in the valleys of Payette, Gem, Washington, and upper Canyon counties include those that are found in the Payette Forest. Examples are ponderosa pine, bluebunch wheatgrass, Idaho fescue, big sage, and western yarrow.

Adjacent to the Snake River lies a salt desert shrub plant community which boasts common stands of white sage or winterfat (Eurotia lanata), once common throughout the intermountain area. The sagebrush-grassland community found throughout Ada and Canyon counties has species such as big sagebrush, low sagebrush (Artemesia arbuscula), bluebunch wheatgrass, Idaho fescue, Indian ricegrass (Oryzopsis hymenoides) and cheatgrass brome (Bromus tectorum). Repeated fires, overgrazing, and agricultural conversion has altered this once diverse and abundant plant cover to little more than a sagebrush and/or annual grass community.

A forest community is found along the northeastern border of Ada County, comprised of yellow pine (Pinus ponderosa) and Douglas fir (Pseudotsuga menziesii) with an associated shurb understory.

b. Fauna

Animal species which inhabit the study region include:

(1) Mammals

Large mammals are limited by cover, forage, and water availability. Limited numbers of mule deer are found along the Snake River Canyon with a few migrants from the Boise drainage basin. Predator species include the coyote, bobcat (Lynx rufus), skunk, and short-tailed weasel (Mustela erminea). Rodents include the yellow-bellied marmot (Marmota flaviventris), muskrat, Townsend's ground squirrel (Citellus townsendi), and Columbian ground squirrel.

(2) Birds

Birds associated with the area total 110 species, including 40 waterfowl or aquatic species, 4 upland game birds, 22 raptors, and 44 other smaller species (Ada Council of Governments, No. 9). The birds of prey are discussed in the Bruneau-Grand View section of this report. Game species include pheasant (Phasianus colchicus), ruffed grouse, chuker (Alectaris graeca), Hungarian partridge (Perdix perdix), and quail (Oreortyx pictus). Duck species include mallard (Anas platyrhynchos), pintail (Anas acuta), blue wing teal (Anas discors), ruddy (Oxyrua jamaicensis) and cinnamon teal (Anas cyanoptera).

(3) Reptiles/Amphibians

Reptiles/amphibians occur in rocky canyons and desert lowlands where the prey base is good. Representative species are: leopard lizard (Cortaphytas wislizenii), western skunk (Eumeces skiltonianus), Great Basin gopher snake (Pituophis melanoleucus), and western rattlesnake.

c. Aquatics

The Boise Front tributaries are sediment-laden from ground disturbances and contribute to an excessive sediment load in the Boise River which adversely impacts the ecosystem and has eliminated the fisheries in some portions. The only trout habitat is between Barber Dam to Middleton, a distance of 35 km. The 13 km length of the Boise River between Discovery State Park and Barber Dam is severely silted and does not support a fish community. Fish species in the river include Rocky Mountain whitefish (Coregonus sp.), suckers (family Catistomidae), carp (Cyprinus carpio), sculpin (Cottus sp.), shiners (Notropis sp.), and squawfish (Ptychocheilus oregonensis). Gamefish and invertebrate populations are severely impacted by the 7-14 day annual shutdown of Lucky Peak Dam for inspection purposes. This results in a 1:1 ratio of sewage effluent: river water below the Boise sewage treatment plant, with residual chlorine at levels toxic to trout and whitefish. Additionally insect larvae are wiped out with the drastic flow decrease and excessive siltation. It is felt that the trout fishery could be reestablished in the Boise River in both Ada and Canyon counties. (A second tunnel has been authorized by Congress and is expected to be under construction within the next two years. This will eliminate the annual shutdown of Lucky Peak flows.)

Healthy fish populations are found in the Snake River below Swan Falls Dam, including channel catfish (Icatlurus punctatus), largemouth bass (Micropterus salmoides), smallmouth bass (M. dolomieu), and crappie (Poxomis sp.).

The Weiser River supports a trout fishery with supplemental stocking from the Idaho Department of Fish and Game. Game species include brook trout, rainbow trout, cutthroat trout, and Dolly Varden. Additionally, nongame species are also in the Weiser River.

3. Cultural Environment

a. Land Use

Land ownership and use in the five counties within the Boise-Weiser study area are listed in table B-2.

TABLE B-2
LAND OWNERSHIP AND USE IN BOISE-WEISER AREA

	Ada	Canyon	Payette	Gem	Washington
% Federal Land	46.2	4.3	25.9	37.9	37.0
% State Land	6.7	0.6	3.5	6.6	6.8
% Private Land	45.9	94.9	69.8	55.0	55.9
Total Land (ha)	270,223	149,784	104,095	143,827	378,773
% Urban or built-up	4.5	2.9	1.1	0.5	0.4
% Agricultural	25.6	84.4	33.7	18.5	13.8
% Rangeland	69.0	7.7	64.0	66.3	74.6
% Forest	0.3	3.0	0.0	13.9	9.9
% Water	0.6	2.0	1.2	0.8	1.3

b. Socioeconomics and Demography

The study area is varied and diverse in that it includes the densest county (Ada) in the state as well as sparsely populated counties (Washington and Gem). The socioeconomic data for the area are summarized in table B-3.

Employment data are summarized in table B-4.

TABLE B-3
SOCIOECONOMIC DATA FOR THE BOISE-WEISER AREA

	U.S. Average	Idaho Average	Ada County	Canyon County	Payette County	Gem County	Washington County
Population as Percent of 1976 State Total	--	--	16.81	8.83	1.80	1.28	1.02
1975 Birth Rate	14.8	19.8	17.1	18.5	17.4	16.9	18.9
1975 Fertility Rate	66.7	92.0	76.0	87.5	91.3	84.2	100.6
1976 Percent of Unemployment	--	--	4.4	6.0	6.0	10.3	8.6
1976 Median Family Income	--	--	$14,375	$11,375	$10,375	$11,625	$10,250
Number of Hospitals	--	--	4	3	0	1	0
Number of Persons per M.D.	--	969	627	969	4,800	2,140	2,100
Total 1976 Crimes		--	8,380	3,691	645	314	259
% Murder		--	0.12	0.16	0	0	0
% Larceny		--	66.	67.	56.	68.	71.
% Burglary		--	22.	24.	31.	27.	20.
% Rape		--	0.64	0.41	0.4	0	0
1975 Suicide Rate (per 1,000 persons)	--	16.4	23.3	15.1	13.9	9.3	16.4
1975 Marriage Rate (per 1,000 persons)	--	15.5	10.9	9.3	14.2	10.0	15.5
1975 Divorce Rate (per 1,000 persons)	--	6.3	8.9	6.9	8.3	8.5	6.3

TABLE B-4
1975 EMPLOYMENT DATA FOR THE BOISE-WEISER AREA

	Ada	Canyon	Payette	Gem	Washing-ton
% of Females in Labor Force (1970)	44.4	41.2	38.9	29.1	34.1
Total Employment	68,744	31,464	4,431	4,007	3,352
Farm Proprietors	1,664	2,619	734	637	598
Nonfarm Proprietors	5,481	2,853	667	370	455
Federal Civilian Employ-ment	3,208	191	38	59	50
State and Local Employment	10,866	3,480	631	510	501
Manufacturing Employment	6,014	6,250	597	733	382
Trade Employment	16,143	5,581	536	498	574
Services Employment	11,062	4,563	319	377	190
Construction Employment	5,089	1,035	132	30	95
Farm Employment	511	2,581	390	644	339

c. Archaeological and Historical

The Oregon Trail passes through Ada and Canyon counties; additionally the Kelton Road is located in the northeast corner of Ada County. The site of the 1834 Fort Boise is located in northwestern Canyon County. Archaeological surveys in Idaho are limited; however, it is felt that the western Snake River Plain has the potential to yield data of major scientific significance (BLM, 1976). It is hypothesized that the western Snake Plain contained extensive cultural diversity during the late prehistoric and early historic periods. The valleys of the Boise, Payette, and Weiser rivers were important grounds for several distinct Indian groups, including the Northern Paiute, Nez Perce, Cayuse, Shoshoni, and Bannock tribes.

d. Aesthetic Values

The several large rivers and mountainous regions in the study area are utilized extensively for recreational purposes. State parks include Discovery and Lucky Peak in Ada County, Black Canyon in Gem County, Ontario in Payette County, and Mann Creek in Washington County. Several of these parks offer camping services and are therefore a valuable resource. In general, aesthetic resources in the area require preservation, since Idaho boasts some of the most pristine areas left in the country. The Birds of Prey Natural Area lies along the Snake River on the southern border of Ada County. For details see the Bruneau-Grand View section of this report.

C. BRUNEAU-GRAND VIEW

1. Physical Environment

a. Climate

The climate of Owyhee County is moderate, ranging from 0°C in January to 27°C in July. Extremes of -33 to 46°C have been recorded for Grand View. Rainfall averages 20 to 25 cm per year along the Snake River, with May and June the heaviest precipitation months. Relative humidity is characteristically low, with moderate winds frequent. The growing season in the study approximates 140 days.

b. Air Quality

Prevailing wind currents are from the west-northwest and follow the Bruneau River and Snake River valleys. Wind speeds average 8-32 km/hr with infrequent gusts up to 96 km/hr. The air quality is considered very good, with agriculture the main contributor to particulate matter. Range fires also contribute smoke and ash to the particulate load during the dry season; however, air pollution on the whole is minimal. Concentration levels of CO, NO_x, SO_x, and hydrocarbons are unknown but are thought to be low since no major point sources exist in the study area.

c. Land Resources

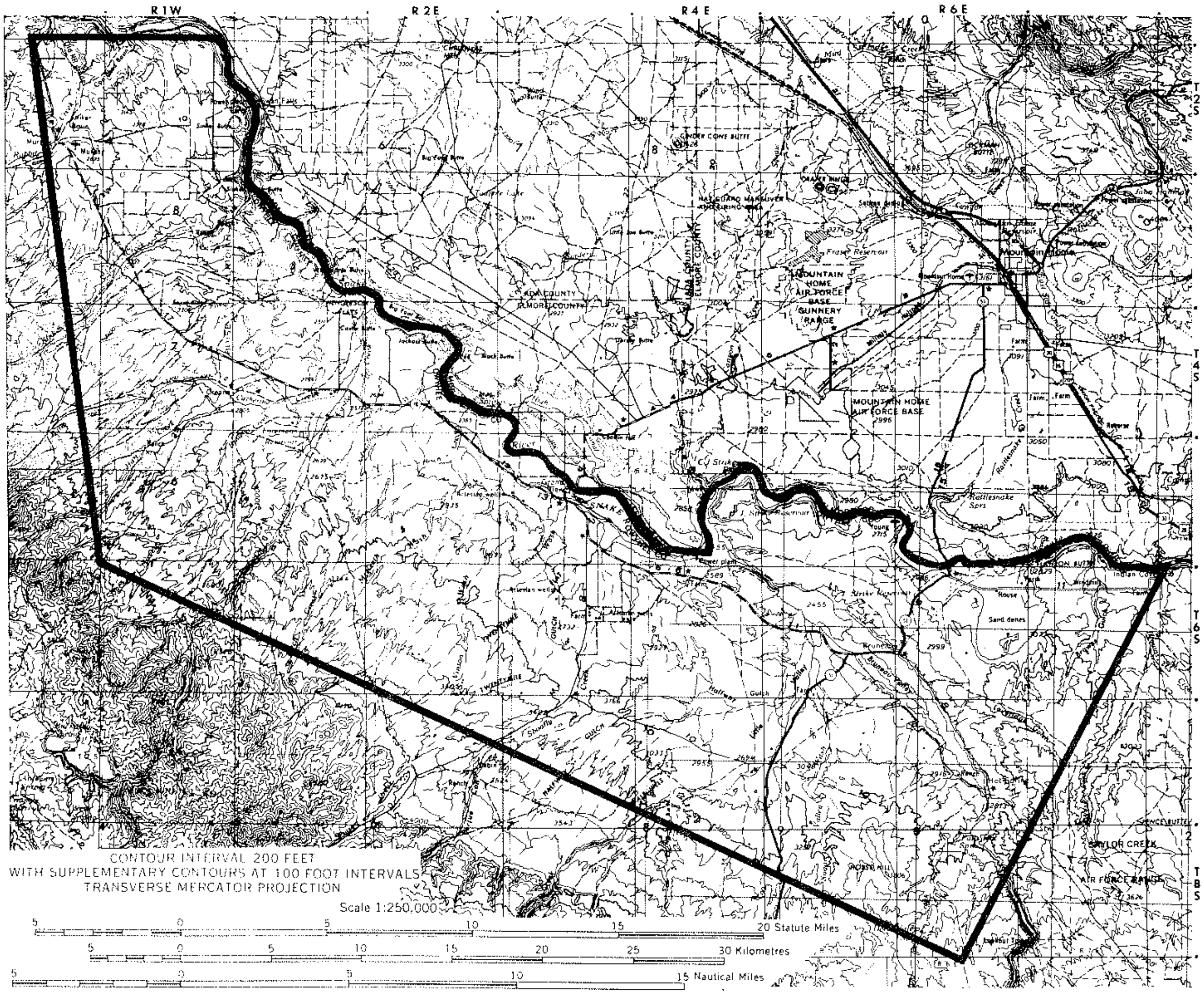
(1) Topography

The Bruneau-Grand View area lies in the western part of the Snake River Plain east of the Owyhee Mountains. The area includes: 1) the Snake River valley ranging in altitude from 700 to 999 m; 2) the plateau ranging from 900 to 2130 m; and the 3) eastern portion of the Owyhee uplift with altitudes from 900 to 2560 m (Rightmire and others, 1976). Both the Bruneau and Snake River valleys are bordered by flat-topped bench plateaus, some of which have been dissected by steep walled canyons and ravines, thus forming buttes. Slopes range from less than 2 percent to vertical (EAR No. 11-010-5-77).

(2) Geology

The lithology of the area includes Cretaceous age granite rocks, Miocene age rhyolitic rocks, Pliocene age volcanic rocks, and the Idaho Group of Pliocene and Pleistocene age. The mountainous region is composed of granite core overlain by younger igneous and sedimentary rocks. Mineralized rhyolitic core, overlain by a similar sequence of rocks, characterizes the rolling upland areas. Foothill and lowland areas consist of poorly consolidated sedimentary formations interspersed with basaltic lava.

C. Bruneau-Grandview Study Area



(3) Soils

The soils in the area of the Bruneau KGRA (known geothermal resource area) are primarily developing in mixed alluvium and lacustrine sediments on stream bottoms, alluvial fans and terrace escarpments. These soils are deep, with few areas that are shallow. Surface textures are dominated by siltloam and loam with minor areas of fine sandy loam, cobbly sandy loam, and silty clay loam. The soils of the area are nearly level to gently sloping, with few steep slopes. Mean soil temperature is approximately 9-11°C with the frost-free period greater than 120 days (BLM, 1977).

d. Water Resources

(1) Surface

The study area lies primarily in the Bruneau River drainage basin which rises in Nevada's Jarbidge Mountains and flows in a northerly direction to the Snake River in Idaho. The main water sources for agricultural purposes are groundwater and water taken from the Snake River and C.J. Strike Reservoir. Additionally, intermittent feeder streams are used for irrigation and agricultural purposes. The Snake River comprises the entire northern border of the Bruneau-Grand View study area. The Bruneau River drainage area above Hot Spring, Idaho, measures approximately 6810 km^2 with a mean altitude of 1710 m.

The Bruneau River gaging station near Hot Spring yields an average discharge over 38 years of 11.3 m^3/s with extremes of 0.71 m^3/s and 184 m^3/s for 1964 and 1910, respectively. Water quality for 1975-1976 sampling season are as follows: 1) mean conductivity 198 µmhos/cm (standard deviation [s.d.] = 97); 2) mean pH 7.5 (s.d. = 1.3); 3) mean hardness 45 mg/l; 4) mean dissolved solids 121 mg/l (average of 2 sampling periods only); and 5) alkalinity 64 mg/l $CaCO_3$. The Bruneau River is under consideration by Congress for addition to the National Wild and Scenic Rivers System, created to assure a heritage of protected waterways.

The Snake River gaging station located near Murphy in the northwestern portion of the study region yielded an average discharge over 63 years of 314.4 m^3/s with extremes of 110 m^3/s and 1340 m^3/s recorded for 1949 and 1918, respectively. Mean water quality data for the 1975-1976 sampling season are as follows: 1) conductivity 460 µmhos/cm (s.d. = 53); 2) pH 6.4 (one sample only); 3) hardness 175 mg/l (2 samples only); 4) dissolved solids 281 mg/l (2 samples only); and 5) alkalinity 161 mg/l $CaCO_3$ (2 samples only).

(2) Groundwater

Groundwater resources in the Murphy area have not been developed on a major scale, while both shallow and deep aquifers have been developed in the Grand View area. However, the major development has occurred in the Bruneau region where the deep aquifer has been extensively developed by irrigation wells.

The source of groundwater in the Murphy area is thought to be precipitation on the Owyhee Mountains, with local precipitation making only a small contribution to groundwater recharge. Aquifers in the Murphy area include the Poison Creek Formation, Banbury Basalt, Glenns Ferry Formation, and Bruneau Basalt. Water level decline or well interference have not been reported in the area. The temperature of the groundwater ranges from 21 to 32°C. Water quality ranges from poor from the sediments to good from basalt (Ralston and Chapman, 1969).

The groundwater resources in the Grand View area have been developed for both domestic and irrigation usage. The three aquifer systems of importance in the area are: 1) a hot artesian system in the Tertiary Silicic Volcanics; 2) a warm artesian system in the sediments of the Idaho Formation; and 3) a cold water table system in the alluvium and upper portion of the Idaho Formation. The source of groundwater to the deep aquifers is primarily Owyhee Mountains precipitation while some water is recharged from streams flowing over fractured outcrops of the Banbury Basalt. Recharge to the shallow aquifer is directly from precipitation, canal seepage, and sewage and irrigation effluent (Ralston and Chapman, 1969). Wells in the Grand View area include shallow domestic, irrigation, and unused flowing wells. Shallow domestic wells along the Snake River are characteristically less than 15 m deep. It is thought that some of these wells located near Grand View may experience degradation of water quality due to sewage disposal methods. Irrigation well depth varies from 30 to 1097 m, with 50 percent of the wells penetrating the hot (52 to 66°C) artesian groundwater system. Unused flowing wells range in temperature from 27 to 38°C. Declines in water levels in wells of less than 152 m have been reported, indicating that groundwater recharge is not keeping pace with consumption of the resource. Water quality in the area varies, with TDS (total dissolved solids) content ranging from 190-334 mg/l.

The source of groundwater in the Bruneau area is thought to be recharge from the Owyhee Mountains and Owyhee Uplift. The geologic formations important as aquifers include: 1) Tertiary Silicic Volcanics; 2) Banbury Basalt; and 3) the Glenns Ferry Formation. Irrigation well depths vary from 213 to 640 m and exhibit discharges from 6 to 158 lps. Domestic well depths are less than 152 m with their prime water source the Glenns Ferry Formation. Annual water level declines have been recorded from 1966 to the present in Little Valley but not in Bruneau Valley. Total dissolved solids for the area range from 200 to 400 mg/l. The thermal groundwater has excessive concentrations of fluorides (Ralston and Chapman, 1969).

In general, groundwater in the Bruneau-Grand View area is derived from Owyhee Mountains rainfall, with a portion being heated at great depths. Due to this thermal effect, higher than normal salinities render the water only fair for irrigation purposes. Soils in the area tend to be fine grained; thus leaching of salts from the soil is limited.

2. Natural Environment

a. Flora

The five vegetative communities in the area include: 1) streamside; 2) sagebrush-grass; 3) shadscale-grass; 4) annual grass and 5) crested wheatgrass seedlings. It is felt that overgrazing disrupted natural sagebrush-grass ecosystems, with resultant invasion by less productive annual grasses such as cheatgrass. The ecosystem is now dominated by an overstory of big sagebrush with an understory of cheatgrass brome (Bromus tectorum). Other species include Indian ricegrass (Oryzopsis sp.), bottlebrush squirreltail (Sitanion sp.) and Sandberg bluegrass (Poa secunda). The shadscale-grass ecosystem is dominated by shadscale (Atriplex confertifolia) with an understory of cheatgrass. The annual grass system exists as a function of fire-altered shrub-grass ecosystems. Characteristic species include cheatgrass and tumble mustard (Sisymbrium altissimum). Crested wheatgrass (Agropyron desertorum) has been introduced following overgrazing and range fires to prevent erosion and promote livestock grazing. The streamside vegetation includes willows (Salix sp.), cottonwood (Populus sp.), wild rose (Rosa woodsii), golden gooseberry (Ribes grossularia), chokecherry, poison ivy (Roxicodendron radicans), elderberries (Sambucus coerulea), currants (Ribes satiuum), honeysuckle (Lonicera sp.), yellow foxtail (Alopecurus sp.), sagebrush, grasses, and yarrow.

b. Fauna

A large variety of wildlife inhabits the area, including ruminants, large predators, song birds, raptors, reptiles, and waterfowl and upland game birds. Mammal species include (but are not limited to) the mule deer, pronghorn antelope (Antilocarpa americana), yellow bellied marmot, coyotes, bobcats, jackrabbits (Lepus townsendii), ground squirrels, and mice (Perognathus sp., Reithrodontomys sp., and Peromyscus sp.). Numerous passeriformes are found in the area. Raptors include (but are not limited to) the bald eagle, golden eagle, prairie falcon (Falco mexicanus), red-tailed hawk (Buteo jamaicensis), and great horned owl (Buteo virginianus). Waterfowl include Canadian geese (Branta canadensis) and Mallard ducks. Representative game species are chukars, Hungarian partridge, and pheasant. Reptiles include numerous snakes, frogs, and lizards; rattlesnakes are very common.

Little is known of energy flow through the food web; however, the diversity and abundance of plant and animal species indicate a complex, rather stable ecosystem with all major ecological compartments well represented.

c. Aquatics

Abundant plant and animal species occur within streams of the study area. Trout and whitefish are found in the Bruneau River. Additionally, area streams support warm water fish populations, of which largemouth bass, bluegill (Lepomis macrochirus), yellow perch (Perca flavescens) and channel catfish are representative. Insect species include caddisflies (Trichoptera), mayflies (Ephemeroptera), stone flies (Plecoptera), and snails (scientific taxa not known). Aquatic flora are abundant, including several algal species, cattail (Typha sp.), duckweed (Lemna sp.), and spike rush (Eleocharis sp.).

3. Cultural Environment

a. Land Use

The land in the area is owned primarily by the Bureau of Land Management (BLM) which administers 77 percent of Owyhee County's 1,975,256 ha, 7 percent is state owned, and 16 percent is owned privately. Irrigated land in the area is very limited (approximately 18,650 ha) and is adjacent to the Snake River, Bruneau River, or Little Valley Creek with the major crops being potatoes, alfalfa, sugar beets, corn, and small grains. Little arable land exists in the Bruneau-Grand View area and is found only along the Snake River, Little Valley Creek, and Bruneau River. Approximately 37,300 ha east and west of Bruneau have been identified as a proposed area for new irrigation development between 1974 and 2020 (BLM, 1976). Ninety-three point five percent of Owyhee County is utilized for rangeland, 2.1 percent is forest land, and 3.9 percent is agricultural land.

b. Socioeconomics and Demography

Owyhee County, with 7900 persons in 1976, comprises less than one percent of the state's total population. Both the birth and fertility rates exceed those for the state and nation. In 1976, 5.5 percent of the labor force was unemployed. Employment data report that 2,512 people were employed in 1975. The greatest number of people are employed as farm labor, followed by state and local government, trade, and services. Median family income in 1976 was $7,875. A total of 235 criminal offenses was reported for 1976, 74 percent of which were attributable to larceny. Suicide rates were quite high in 1975: 165 percent of the state rate. Marriage and divorce rates are both low, only 37 percent and 19 percent of state values, respectively.

c. Archaeological and Historical

The Oregon Trail runs through the study area south of the Snake River, with wagon wheel ruts still evident in many areas. Silver mining in the 1860's in Owyhee County was responsible for the first large-scale permanent settlement in the state, with farming, banking, and commerce responding to the population growth (BLM, 1976).

d. Aesthetic Values

The C.J. Strike Recreation Area lies within the study region; however, no wilderness or Rare II regions have been designated. The Bruneau Dunes State Park is also located within the study area and is used for recreational purposes.

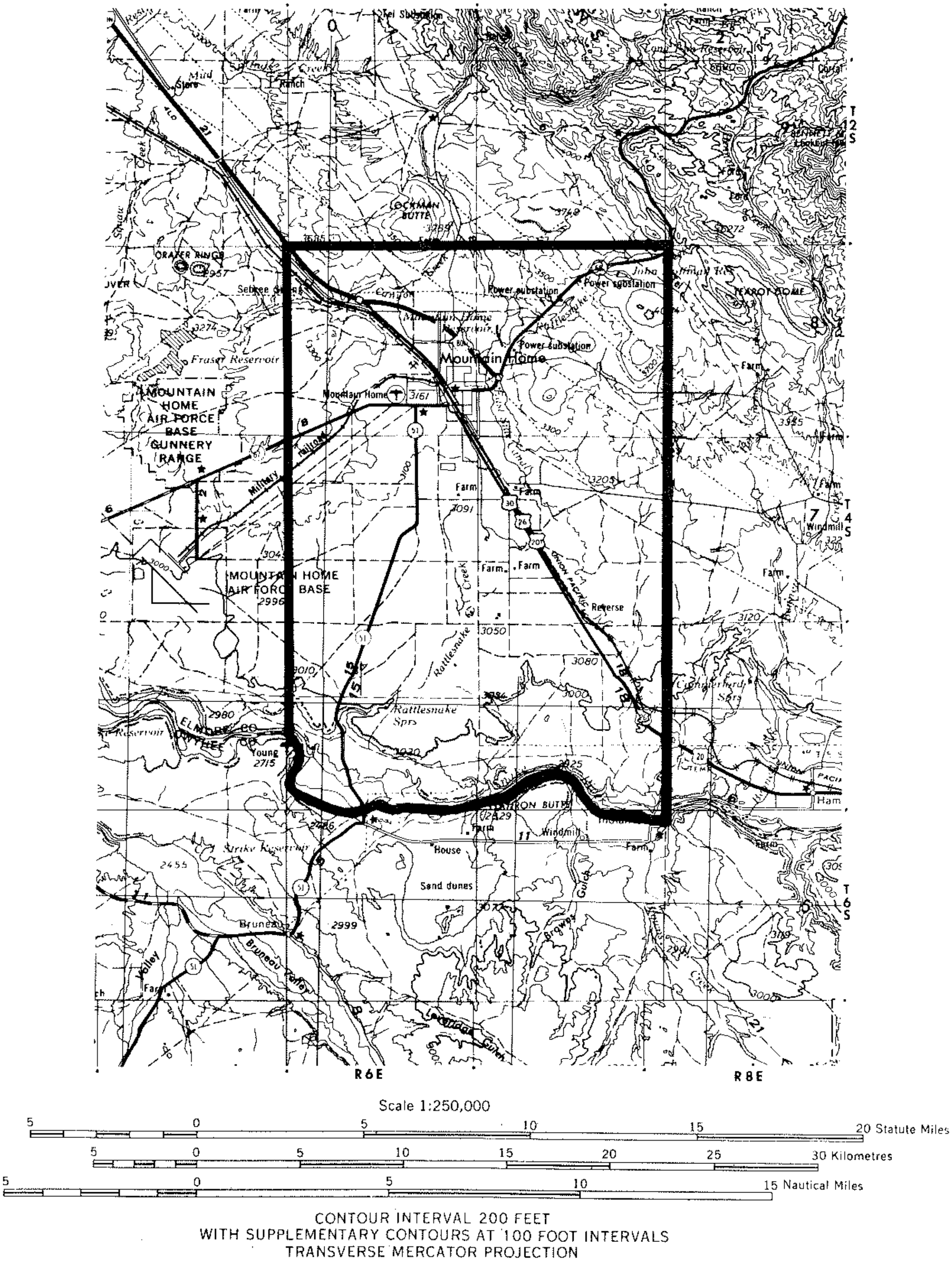
A significant feature in the study area is the Snake River Birds of Prey Natural Area (BPNA), established by the Secretary of the Interior in 1971 to protect eagles, hawks, owls, falcons, vultures, and ospreys. The BPNA encompasses 12,546 ha, 10,522 ha of which is federally owned. The excellent raptor habitat is provided by the rugged river canyon and is utilized as a recreational resource by large numbers of visitors. For the 14 species of raptors sighted at the BPNA, the BLM protects vital habitat and nesting grounds.

D. MOUNTAIN HOME

1. Physical Environment

a. Climate

Mountain Home is located in Elmore County in southwestern Idaho in a semiarid region characterized by hot



D. Mountain Home Study Area

summers and cool winters. The average annual temperature is approximately 10°C with the mean annual precipitation estimated as 24 cm. Extreme recorded temperatures are -37 and 43°C.

b. Air Quality

Prevailing wind currents are from the northwest, east, or southeast. Wind speeds average less than 9.6 km/hr (kilometer per hour) 39 percent of time and 11-24 km/hr 41 percent of the time (Longyear and others, 1978). Air quality is considered very good, with agricultural particulates contributing to the ambient air load during certain seasons. No significant point sources exist for NO_x, SO_x hydrocarbons or CO; thus preservation of air quality is an important consideration in the area.

c. Land Resources

(1) Topography

The Mountain Home area lies north of the Snake River in the western part of the Snake River Plain. Geographic features in the area include: 1) the Mt. Bennett Hills, 2) the Mountain Home Plateau, and 3) the Snake River Canyon. The Mt. Bennett Hills are a high relief mountain range north of the city of Mountain Home, with an average elevation of 1828 m. The Plateau ranges from 1219 m adjacent to the Mt. Bennett Hills to 914 m near the Snake River. The Snake River Canyon drops 91-152 m below the plateau to the Snake River.

(2) Geology

The study area is located between the central Idaho Tertiary and Cretaceous granitics and the Tertiary and Quaternary rocks of the Snake River Plain to the west. Mountain Home lies on the northwest-southeast trending fault that marks the relatively abrupt transition zone northwest of the KGRA near Boise. The major hot springs in the area are controlled by faulting. The lithologic types found in the Mountain Home area are Pliocene and Pleistocene sediments, Pleistocene Basalts, and Tertiary silicic volcanics overlying Cretaceous granite. The silicic volcanics are Miocene Rhyolites. The Idavada volcanics underlying the Idaho group are considered to be the most important aquifer and the source of hot water. The Idavada volcanics are lower silicic volcanics, and generally the water produced from the complex are at significantly higher temperatures than those at nearby wells from overlying units.

(3) Soils

Only limited, generalized soil data are available (BLM, 1976) to assess soil types and characteristics. The frost free season is approximately 120-140 days. Agricultural products include cereals, alfalfa, and potatoes, with 70 percent of such crops irrigated. Surface soils are primarily silt loam on clay or silt loam with profile depths ranging from 3 to 18 m. Parent materials include loess, a basic igneous rock (35 percent), and alluvium (45 percent). Water retention capabilities range from low on the surface to good at greater depths. Major soil problems are associated with drought, erosion, soil alkalinity, and inability of roots and water to penetrate clay subsoils. Rangeland management is currently employed to minimize problems associated with erosion.

d. Water Resources

(1) Surface Water

The Snake River comprises the entire southern boundary of the study area. An important surface water feature is Canyon Creek, which flows southwesterly from Long Tom Reservoir to the Snake River; however, no water quality data are available for either the reservoir or river. Surface runoff from the Mt. Bennett Hills is ultimately to Canyon Creek and is regulated by Long Tom Reservoir. Irrigation waters are drawn from the Mountain Home Feeder Canal, Canyon Creek, Rattlesnake Creek, Bennett Creek, Cold Springs Creek and King Hill Creek. Data for the Murphy gaging station on the Snake River are included in the Bruneau-Grand View section of this report.

(2) Groundwater

Groundwater resources have been developed for both domestic and irrigation purposes. Ralston and Chapman (1968) studied the hydrology of the Mountain Home area and subdivided the region into five areas based on water levels, well yield, water temperature, water quality, geologic character of the aquifer. The subdivisions are summarized as follows: 1) the Mt. Bennett Hills subarea, 2) Hot Springs, 3) Mountain Home, 4) Air Base, and 5) Glenns Ferry.

The Mt. Bennett Hills region is the primary area for recharge to the Mountain Home plateau aquifers.

The Hot Springs region runs along the Mt. Bennett Hills and includes a hot artesian groundwater system. Hot Springs has an estimated natural discharge of 35 lps with a mean temperature of 66°C. Groundwater recharge is thought to be from precipitation, irrigation seepage and streamflow; however, little of the recharge enters the warm water system. Hot water (38-71°C) has been reported at three locations at three water level elevations, indicating a series of subparallel northwest trending faults. The faults are believed to allow the downward flow of cold recharge water and the upward flow of heated water and steam. The cold groundwater system is limited in the region.

The Mountain Home area surrounds the city of Mountain Home with both domestic and irrigation water derived from the aquifer. Sources of recharge include precipitation, streamflow, irrigation seepage, and sewage effluent. The aquifer has been well developed for both irrigation and domestic purposes, with wells ranging in depth from 1.8-183 m.

The Air Base area (adjacent on the west side of the Mountain Home area) includes the groundwater system south and west of Mountain Home as well as the deep wells developed in the city of Mountain Home. Recharge to the area is limited as a function of low precipitation and the deep static water level. An estimate of well development puts the number of wells for irrigation, municipal, and domestic use at 50, ranging in depth from 122-274 m. Water temperatures are generally uniform, in the 21-24°C Range.

The Glenns Ferry area (adjacent on the east side of the Mountain Home area) is north of the Snake River and surrounds the towns of Hammett and Glenns Ferry. Groundwater recharge within the area is minimal, with streamflow, irrigation seepage, and precipitation as sources. Groundwater resources have not been extensively developed, with most wells located along the Snake River, ranging in depth from 3-439 m. Shallow wells tap the cold water aquifer while deeper wells penetrate the warm (70-100°F) aquifer system. Indications are that a deep groundwater gradient towards the Snake River exists, with aquifers discharging into the river.

In summary, the main sources of groundwater are the Bruneau and Glenns Ferry Formations with their basalts and fine-grained sediments, respectively. Available records do not indicate declines in groundwater levels; however, data are limited.

2. Natural Environment

a. Flora

The study region is characterized by modified sagebrush-grass communities, typically found along uncultivated portions of the Snake River Plain. Annual grasses found with sagebrush include Western cheatgrass, filagree (Erodium cicutarium), balsamroot (Balsamorhiza hookere). Shadscale is found on saline or heavier soils. Crested wheatgrass is common. Information indicates that three plants on the endangered or threatened list have been found in the western portion of the Snake River Plain: Henderson's desert parsley (Lomatium hendersonnii), loco weed (Astrogalus comptopus) and pepper grass (Lepidium montanum), however, it is not known if these species are in the Mountain Home study area. Juniper (Juniperus sp.) trees are found within the Snake River canyon. Greasewood and rabbitbrush are found adjacent to streams, ponds, and river.

b. Fauna

Examples of animal species that inhabit the sagebrush-grass communities include Richardson's ground squirrel (Citellus richardsonii), kangaroo rat (Dipodomys sp.), sagebrush vole (Lagurus curtatus), jackrabbit, mule deer, pronghorn antelope, golden eagle, Swainson's hawk (Buteo swainsoni), and sparrow hawk (Falco sparverius). Game birds include sage grouse (Centrocercus urophasianus), chukar, pheasant, and mourning dove (Zenaidura macroura). Reptiles include sagebrush lizard (Sceloporus graciosus) and striped whipsnake (Masticophis taeniatus).

c. Aquatics

The variety in habitat types renders the area suitable to diverse and abundant aquatic communities. Both native and introduced fish species are found in the Snake River. Native species include rainbow trout, cutthroat trout, and mountain whitefish. Introduced species include brown trout (Salmo trutta), largemouth bass, bluegill, channel catfish, carp, and suckers. Freshwater clams and molluscs are expected to occur in the Snake River since a diverse variety of habitats are available. Insect species include mayflies, midges (Piptera), caddisflies, and beetles (Coleoptera).

3. Cultural Environment

a. Land Use

Land in the Mountain Home study area comprises approximately 55,944 ha, of which 18,648 ha is federally owned (BLM), 9,324 ha is state owned, and 27,972 ha is under private ownership. The area was heavily grazed by sheep prior to the advent of high lift pump irrigation practices which rendered such ventures profitable. Land use within Elmore County in 1976 was as follows: 66 percent rangeland, 26 percent forest land, 7 percent agricultural land, 1 percent water, and 0.6 percent urban or built-up.

b. Socioeconomics and Demography

The Mountain Home study area is located entirely within Elmore County, with socioeconomic data available only on a county-wide basis. The population of Elmore County was 19,500 people in 1976, or 2.34 percent of Idaho's total. The population density increased from 5.7 km^2 in 1950 to 16.6/km^2 in 1976. The birth rate for the county was 28.0 in 1975, as compared with a state rate of 19.8. The fertility rate is quite high, 127.9 in 1975 as compared to Idaho and U.S. rates of 92.0 and 66.7, respectively.

Unemployment is steadily rising; the 1970 average was 3.9 percent and rose to 7.4 percent in 1976. Wage and salary employment indicate the greatest number of people are employed by the military (Mountain Home Air Force Base employed 3,935 people in 1975); followed by federal civilians (1,027); trade (808); state and local government (786); farm (636) and services (389); trade, commerce and public utilities (276); and finance, insurance and real estate (203). The 1976 HUD (Housing and Urban Development) estimate for the median family income was $10,125.

Health care in the county is comparatively poor. The average number of persons per medical doctor was 4,950 in Elmore County for 1975, as compared to 969 for the state average. Two hospitals are located in the county with 77 acute care beds.

Criminal offenses rose from 464 in 1973 to 555 in 1976. In both years, larceny was the prime offense and rose from 63 to 71 percent of the total offenses. No murders were reported in 1973 with two committed in 1976. The suicide rate of 15.2/100,000 persons in 1975 was very close to the state rate of 16.4/100,000.

c. Archaeological and Historical

Both the Oregon Trail and Kelton Road are historical markers of importance in the Mountain Home study area and run through the northeast portion of the region. There is no archaeological survey recorded; however, the probability of archaeological sites is very high and likely cover a time span ranging from prehistoric times to the present.

d. Aesthetic Values

A rural and open space atmosphere predominates in the study area. Mountains to the north and the Snake River Plain to the south and east comprise the scenery. Island Crossing State Park is located within the region and has facilities for overnight camping. No wilderness or Rare II lands are found within the Mountain Home area of concern.

E. BLUE GULCH, TWIN FALLS, AND ARTESIAN CITY

1. Physical Environment

a. Climate

Normal annual precipitation ranges from 20 cm in the Blue Gulch area to 30 cm near Artesian City. With only 20 cm of precipitation, the Blue Gulch area is one of the driest parts of the Snake River Plain. Most of the precipitation in the area falls as snow during the winter months. The source of this precipitation is storms originating off the Pacific Coast; as a result, rain and snowfall patterns are erratic. Summers are generally warm and dry, with mean temperatures of 21°C and ranges of -6 to 36°C. Although local wind patterns are affected by topography, winter winds are generally southeast winds, while summer winds generally trend from the northwest.

b. Air Quality

Air quality in this part of the Snake River Plain is good, although particulates are sometimes high in a general area north and east of Blue Gulch. There are no large point sources of significant air pollution in the area, even near Twin Falls. The annual geometric mean particulate level at two stations in Twin Falls in the period from 1971 to 1974 averaged 94 $\mu g/m^3$ during the same period.

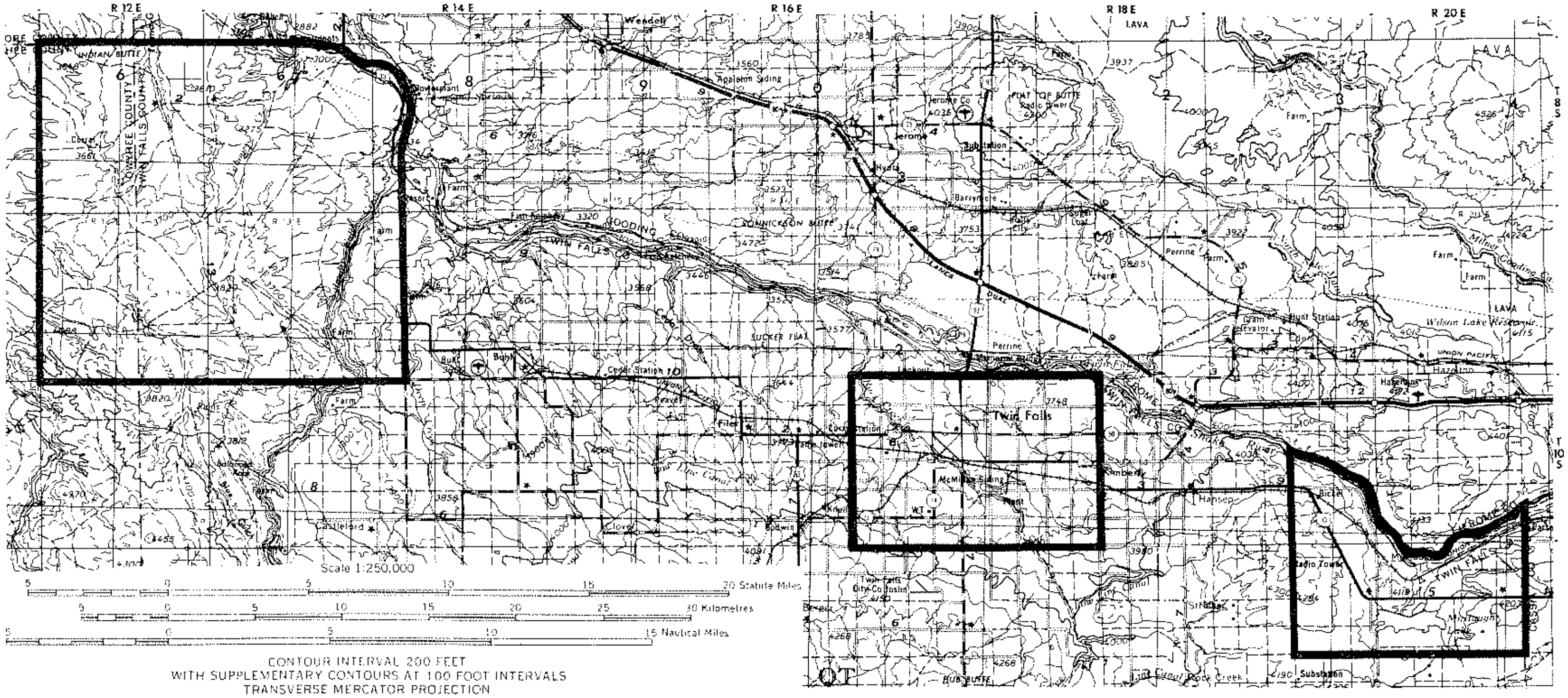
c. Land Resources

(1) Topography

The three areas under consideration lie on the southern edge of the Snake River Plain and are bounded on the north by the canyon of the Snake River. Elevations range from 880 m at the mouth of Salmon Falls Creek to 1275 m at Artesian City. The Blue Gulch and Twin Falls areas are relatively flat with gradients of approximately 12 m/km. Artesian City lies at the base of the foothills of the Rock Creek Hills. Monument Peak, 32 km south of Artesian City, has an elevation of 2400 m.

(2) Geology

Blue Gulch, Twin Falls, and Artesian City lie in the eastern Snake River Plain geomorphic province. This area is geologically unique, characterized by horizontal flows of basalt. The surface of the plain is a youthful lava plateau partially covered with loess. Basalt flows on the plain can be classified in two age groups: older Miocene-Pliocene and younger Pliocene-Recent. Surface flows



E. Blue Gulch, Twin Falls, and Artesian City Study Areas through most of the area consist of lower Pleistocene to Pliocene basalts and associated tuffs. A small area of Pliocene olivine basalts occurs along the canyon of the Snake River from Twin Falls to the mouth of Salmon Falls Creek. Some Pleistocene and Pliocene colluvium, fanglomerate, and stream and lake deposits overlie the basalts northwest of the lower portion of Salmon Falls Creek. Major faults occur in two locations: parallel to the Snake River across the Salmon Falls Creek Canyon and trending north and northwest along the northern edge of the Rock Creek Hills.

(3) Soils

Soils throughout the area consist primarily of loess of varying depths over basalts. Mineral fertility is generally high but organic content is low. Along stream valleys, alluvial deposits overlie alluvial outwash from mountains to the south. Siltloams, ranging in depth from 25 cm to 150 cm, overlie bedrock on gentle to moderate slopes in both the Blue Gulch and Twin Falls areas. Forty percent of soils in the Artesian City area are a fine-loamy mixed soil while 20 percent are a fine montmorillontic soil. These soils range in depth from 40 cm to 100 cm. Permeabilities in all soils range from slow to moderate and the most significant soil problem is erosion.

d. Water Resources

(1) Surface Water

Primary streams in the areas under consideration include: Snake River, Salmon Falls Creek, Rock Creek, and Dry Creek. Salmon Falls Creek flows through the Blue Gulch area to the Snake River and drains an estimated 5490 km^2 of Idaho and Nevada. Flow in the creek is regulated at the Salmon Creek Reservoir 71 km upstream from the mouth. Except for significant leakage all of the water supply above this dam is diverted for irrigation. Diversions below the dam are used to irrigate land outside the drainage basin. Average discharge at the mouth of Salmon Falls Creek is 4.87 m^3/s and extremes at this point are 0.34 m^3/s and 38.5 m^3/s.

Rock Creek drains an estimated 483 km^2 and discharges to the Snake River 10 km northwest of Twin Falls. Flow in the creek is partially regulated by a fish hatchery and irrigation waste flow and many irrigation diversions exist upstream. The mean discharge for the creek during the period of record (1 year) is 6.6 m^3/s, and the extremes during this period were 2.6 m^3/s and 13.5 m^3/s. Monthly flows in the creek during that year differed from the mean by less than 50 percent.

During low flow years, all flow is topped in the Snake River at Milner Dam, 19 km northeast of Artesian City. The largest inflow below the dam is Thousand Springs which contributes an estimated 184 m^3/s to the river as inflow from the Snake River Plain aquifer. The water quality of the Snake River declines gradually as it flows west through the area receiving pollutants from agricultural activity, industrial processing plants, and untreated domestic water return. Twin Falls has been listed by the EPA as needing improved waste treatment facilities. Nitrate and phosphate in the river from natural and manmade sources contribute to periodic excessive algal and weed growth. The only lake occurring in the area is Murtaugh Lake in the Artesian City area. This manmade lake is on Dry Creek and has a surface area of approximately 250 ha. Surface water quality for streams in the area is shown in Table E-1.

TABLE E-1
SURFACE WATER QUALITY
(mg/l)

	Salmon Falls Creek	Snake River (Kimberly)	Snake River (King Hill)
Ca	70	45	47
K	7.8	5.2	4.5
Mg	23	19	18
Na	53	31	27
Cl^-	41	24	23
F^-	0.9	0.5	0.7
HCO_3^-	239	200	187
$SO_4^=$	111	47	45
TDS	480	289	298
TSS (Total Suspended Solids)	103	--	27
pH	8.6	8.7	8.5
Specific Conductance	766	468	434

(2) Groundwater

Groundwater occurs in the basalts and alluvial deposits throughout the area. Depths to water range from 24 m in the Rock Creek Basin to 40 m at Artesian City, to 50 m near Kimberly, and as much as 240 m in the Blue Gulch area. The few functioning irrigation wells in the Salmon Falls Creek basin are near the Salmon Falls Reservoir. Groundwater outflow at Thousand Springs provides water from one of the world's most extensive aquaculture programs. Water from the springs has significantly better quality than surface water or groundwater on the south side of the Snake River.

Because of limited water supply and extensive use of groundwater for irrigation, three areas have been designated critical groundwater areas by the Idaho Department of Water Resources. This designation effectively closes these areas to further applications to appropriate groundwater. The three areas included are:

Artesian City - 14,500 ha (est.) including land in T. 11 and 12 S., R. 19 and 20 E., B.M. Nearly all land included in the geothermal area of interest is included in the critical groundwater designation.

Cottonwood - 16,000 ha (est.) adjacent to the Artesian City area on the south.

Blue Gulch - 76,000 ha (est.) on the west side of Salmon Falls Creek. All but approximately 2000 ha of the Blue Gulch geothermal area is included in this designation.

2. Natural Environment

a. Flora

Native vegetation in undisturbed areas is classified in the sagebrush association. Primary species found in the area are big sagebrush and cheatgrass. Early records indicate that much of the area was once covered with bunchgrasses and some sagebrush. Heavy use of the area by livestock led to the establishment of the present native species. A small stand of pinion-juniper is located just southeast of Artesian City. Where native vegetation has been disturbed, areas have been reseeded with crested wheatgrass. Much of the land in the areas of interest is currently cultivated.

b. Fauna

Major habitat areas that have been identified include: deer habitat along the lower 10 km of Salmon Falls Creek, birds of prey habitat along the canyon of the Snake River, a curlew habitat area southwest of Twin Falls, and a high density of rough-legged hawks and chukar partridge in the Salmon Falls Creek Canyon. Animals well adapted to the sagebrush habitat include the Richardson ground squirrel, Great Basin kangaroo rat, sage grouse, vesper sparrow, and sagebrush lizard. Year-round residents of the area include the coyote, ground squirrel, blacktail jackrabbit, golden eagle, sparrow hawk, pheasant, house finch, and horned lark. Snakes, particularly the western rattlesnake, the pygmy rabbit and the Ord kangaroo rat are declining as native habitats are converted to cropland.

c. Aquatics

Aquatic plants, including duckweed, cattail, sedge (Carex), and a common reed (Phargmites), are common in streams throughout the area. The Snake River has annual extensive algal blooms. Construction of dams on the Snake river has replaced free-flowing habitat preferred by cold-water game fish with lake-like situations. Small numbers of rainbow and cutthroat trout are native in this stretch of the river. Suckers and squawfish thrive in the reservoirs. Sixteen species of fish have been identified by the Idaho Fish and Game Department in the Snake River below Shoshone Falls and eleven species have been identified above. Trout occur in both sections, while coho salmon (Oncorhynchus kisutch) occur only in the upper section. Sunfish (Lepomis sp.), catfish, and sucker are common in the lower section.

3. Cultural Environment

a. Land Use

Arable land occurs on both sides of the Snake River and along its tributaries. The Salmon Falls Creek drainage contains an estimated 82,000 ha of arable land. Cultivation of these lands is limited by availability of water. Approximately 80 percent of the croplands in the area are irrigated. Most of the Artesian City area, acreage south of Twin Falls, and the western part of the Blue Gulch area are included in proposed areas for new irrigation development in the next 30 years.

Most of the land being considered is privately owned and used for grazing and crop production. Intermittent areas of private ownership are generally associated with the livestock industry, mining, and recreation. Approximately 37,300 ha of BLM land, 1550 ha of state land (school endowment), and 4150 ha of private land occur in the Blue Gulch area. No nonprivate land occurs in either the Artesian City or the Twin Falls area. The metropolitan area of Twin Falls includes about 1500 ha.

b. Socioeconomics and Demography

The three areas under consideration are in Twin Falls County, which has a population of 47,300 (1976). Towns included in these areas are Twin Falls (1970 population 21,194), Kimberly (1970 population 1,557), and Murtaugh (1970 population 124). The population density of the area is nine people/km^2. The birthrate and fertility rate for the county are 20.6 and 98.8, respectively, and compare to values of 19.8 and 92.0 for the state and 14.8 and 66.7 for the United States. The number of new housing units authorized annually increased from 85 in 1971 to 221 in 1976 in Twin Falls and from 1 to 23 in Kimberly during the same period. The unemployment in the county in 1976 was 6.2 percent, an increase of 1.6 percent over the 1970 value. The main employers in the county are trade, services, non-farm proprietors, and manufacturing. Larceny and burglary accounted for 84 percent of all crimes in 1976.

c. Archaeological and Historical

This area of Idaho contained great cultural diversity during the late prehistoric and early historic periods. Several distinct Indian groups inhabited the Snake River Plain in the recent past. Although only limited archaeological surveys have been conducted in the area, indications are that the western Snake River Plain is exceptional in its potential to yield archaeological data of major scientific significance.

Fur trappers were the first white people in the area in any number. Immigration in the 1840's, 1850's, and 1860's brought thousands of people through the area, however, permanent settlements were slow in developing. Farming began in the late 19th century. Historical areas are generally associated with the immigrant trails, and a segment of the Oregon Trail at the mouth of Salmon Falls Creek is being considered for historical status. The only other historic or natural area in this region is the Hagerman Fossil Natural Area established by the BLM in the Blue Gulch area.

d. Aesthetic Values

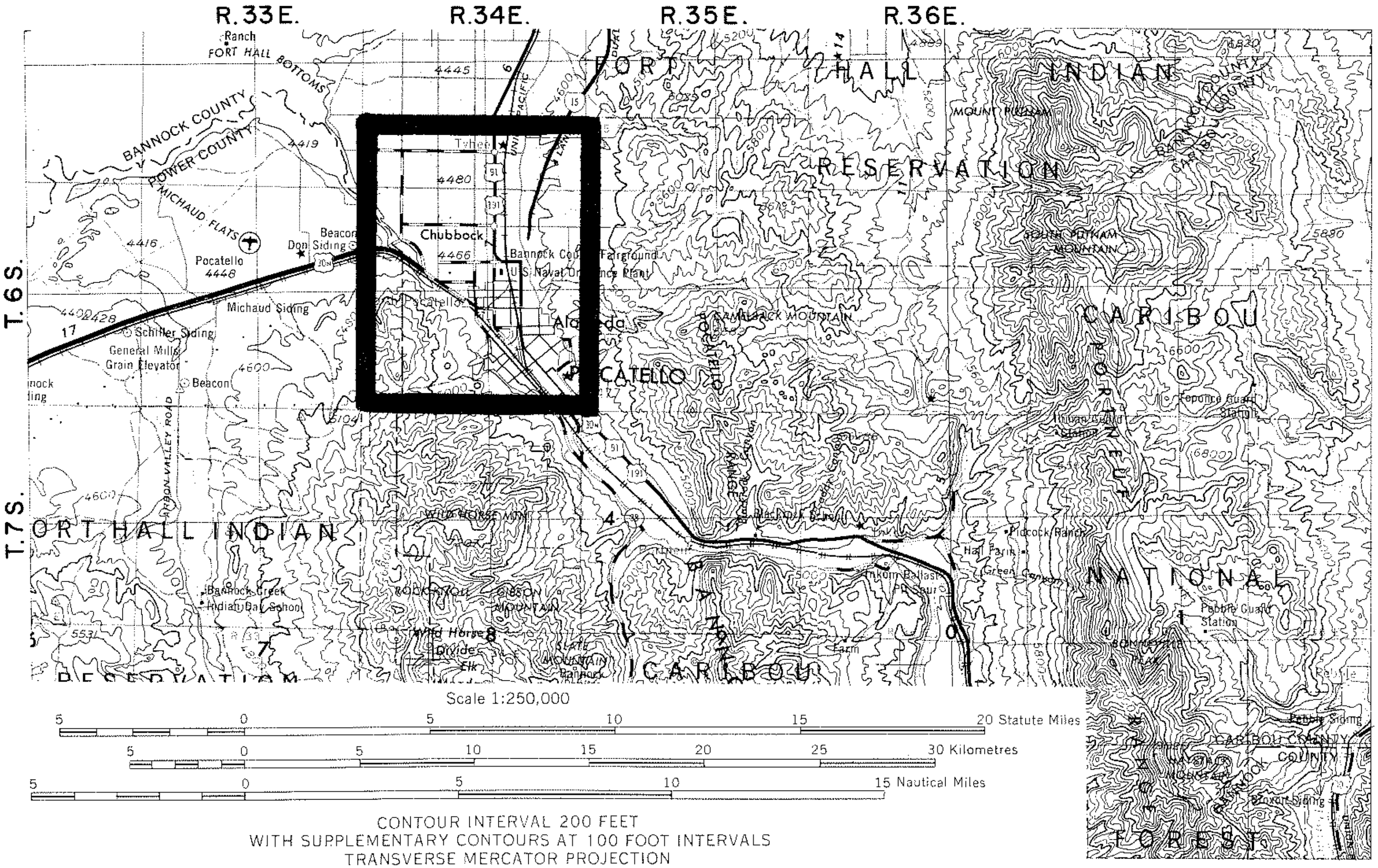
Recreational and/or aesthetic sites in the three study regions are diverse. Balance Rock is a scenic anomaly located on Salmon Falls Creek Canyon near Blue Gulch and is quite unusual and picturesque. The Snake River Canyon through Twin Falls plunges with sheer cliffs and dropoffs and is quite magnificant. Murtaugh Lake located near Artesian City is utilized for recreational purposes. As is true for most of Idaho, the open, rolling land and clean, fast rivers afford the viewer a sense of solitude and freedom in an area not yet overpopulated with resultant industrial development and environmental degradation.

F. POCATELLO

1. Physical Environment

a. Climate

Pocatello is located in the southeast corner of the Snake River Plain where the climate is a middle-latitude steppe type. Spring months are the wettest and windiest,



F. Pocatello Study Area

while cool nights and warm days predominate during the summer. Percent of possible sunshine averages over 80 percent in July, August, and September. General snowcover begins in December and freezing temperatures occur until May. Mean monthly temperatures range from -4°C in January to 23°C in July. Maximum and minimum recorded temperatures are 40 and -34°C. Wind directions reflect the orientation of nearby mountain ranges, with over 50 percent of the winds orginating in the southwest quadrant. Thirty percent of wind speeds are less than 2 m/s, while 5 percent occur within the 2 m/s to 6 m/s range. Relative humidity exceeds 30 percent only a third of the time during July and only a half of the time in January. Average potential evapotranspiration exceeds the average precipitation all months except November, December, January, and February (USFS, 1977).

b. Air Quality

The primary sources for air pollution in the Pocatello area are the phosphate and elemental phosphorus plants west of the city. Air quality measurements that have been taken have been directed at characterizing the effluents from these plants. The annual geometric mean of suspended particulates from four Pocatello stations ranged from 41 to 145 $\mu g/m^3$ during the period from 1971 to 1974. The primary and secondary standards for suspended particulates are exceeded at 1 km from the plants. During a ten-month period in 1972 and 1973, the 24-hour standard for sulfates was exceeded 14 times.

c. Land Resources

(1) Topography

Elevations in the area of interest range from 1700 m in the southwest to 1340 m along the lower Portneuf River near its confluence with American Falls Reservoir. The city of Pocatello has an elevation of 1360 m. Here the canyon of the Portneuf River meets the southeast boundary of the Snake River Plain. The foothills of the Bannock Range are southwest of the city and the Pocatello Range is to the east.

(2) Geology

Pocatello lies within the margin of the middle Rocky Mountain Province typified by complexly folded and faulted ranges of the extreme southeastern Snake River Plain of the Columbia Intermountain Province.

Beginning in the Precambrian, the area surrounding Pocatello lay within a geosyncline into which vast amounts of sand, shale, and limestone were deposited.

These sediments underwent metamorphism to produce quartzites, argillites, and marbles now exposed in the ranges southeast of Pocatello. During early Paleozoic era a geosyncline reappeared collecting sand shales and limestones. The relative coarseness of these sediments exposed suggest that the Paleo shoreline was very near the Pocatello area.

Beginning in late Cretaceous, major folding and faulting (including thrust faulting) warped and broke great thicknesses of sediments in southeastern Idaho, moving rock units from west to east. The most noticeable in the area is the Bannock Overthrust extending from Idaho Falls southward near Pocatello to the Idaho-Utah border. Subsequently, basin and range structures developed, related to those of the Great Basin in Utah and Nevada.

At the same time, the introduction of felsic and basaltic lava began on the Snake River Plain. The tunnel of the newly forming Snake River Plain cut across the northwest trending landforms developed from Laramide and Basin and Range Structures and is now the most prominent physiographic element in the area. By late Pliocene, pediment fans began to encroach on the newly developed basins. Concurrently, tension faults allowed lava to again spread across the countryside. The most notable in the area are those flows now exposed at Ross Park in Pocatello. The distribution of these flows with the forthcoming glacial activity prompted damming of the major drainages including the Snake River and the outlet of Pluvial Lake Bonneville. Numerous lake bed deposits are identified northwest of Pocatello in the area where American Falls Reservoir is now located. To the south, Lake Bonneville was filling due to the increased precipitation and decreased evaporation until the water level overlapped Red Rock Pass. Enormous volumes of water swept down Marsh Creek and the Portneuf River to the Snake River. As the flood waters entered the Snake River Plain, their energy decreased leaving large boulder and gravel deposits which now skirt the foothills and mountains flanking Pocatello.

(3) Soils

Soils in the Pocatello area are generally loess deposited on bedrock of Snake River Basalt and the Salt Lake Formation. Slopes of the foothills are moderately stable and depth to bedrock usually exceeds 3 m throughout the area. Surface soils are primarily silt loams and subsoils range from silty clay loams to heavy silt loams. Natural vegetation occurring on these soils include sagebrush, grasses, and mountain brush. Soils near the processing plants west of Pocatello show increased concentrations of trace elements.

d. Water Resources

(1) Surface Water

The Portneuf River is the primary stream in the area, draining approximately 3300 km^2. It rises on the Ft. Hall Indian Reservation approximately 38 km northeast of Pocatello and flows south to Lava Hot Springs. Here, it turns west through a gap in the Portneuf Range, then flows north for 18 km. At its confluence with Marsh Creek, the main tributary of the Portneuf, the river turns to the northwest and empties into the American Falls Reservoir. Flows in the river are regulated by the Portneuf Reservoir and the Chesterfield Reservoir. Diversions from the river are used to irrigate an estimated 17,000 ha upstream from Pocatello. The average flow of the Portneuf at Pocatello is 7.6 m^3/s and the extremes during the 63-year period of record are 84.7 and 0.01 m^3/s. In the 1976 water year, 42 percent of the total flow of the river occurred in April and May. Streams draining the Pocatello Range flow into the Fort Hall Main Canal, from which a series of laterals run to the west across the area of interest. Uses of surface water include municipal, industrial, irrigation, domestic use, stock watering, recreational use and power generation. Patterns of streamflow are affected by regulation of supply for these uses.

Quality of the Portneuf River in the area of interest is shown in table F-1. Sources of inflow in this section of the river include an oil separation plant, elemental phosphorus and fertilizer plant effluent, sewage treatment plant, springs, and a fish hatchery. The estimated flow from these sources is 0.5 m^3/s.

TABLE F-1
WATER QUALITY OF PORTNEUF RIVER
(3 locations - mg/l)

Fe	0.02	0.01	0.03
K	7.4	11	7.4
Na	37	43	33
Cl^-	8.0	10	6.0
F^-	0.4	0.1	0.6
HCO_3^-	281	232	283
NO_3^-	0.8	0.5	5.6
$PO_4^{=}$	0.28	0.19	0.86
TDS	480	412	440
Specific Conductance (μmhos)	610	512	590
pH	6.2	8.2	8.1
T (°C)	15.5	15.5	14.0
DO	13	13	--

(2) Groundwater

Groundwater in the Pocatello area occurs in alluvium and alluvial-fan deposits and in the underlying volcanics which range in depth from 30 m to 120 m. Wells in the alluvium north and northwest of Pocatello have yields ranging from 0.06 to 0.19 m^3/s with less than 30 m of drawdown. Recharge in the flatlands northwest of the city comes from precipitation and underflow from the surrounding hills. There is significant groundwater outflow to the Portneuf River in the Pocatello area. The combined discharge of these springs is approximately 9 m^3/s.

Uses of groundwater include municipal, industrial, irrigation, private residence, and stock supplies. Municipal uses account for withdrawals of about 0.4 m^3/s, while withdrawals for the phosphorus and phosphate plants average 0.5 m^3/s. Groundwater quality from three wells in the Pocatello area is shown in table F-2. The source of the nitrate in the city wells is unclear, since these wells are several kilometers upstream from the processing plants. In many wells, the total dissolved solids content is higher than the drinking water standard of 500 mg/l.

TABLE F-2
GROUNDWATER QUALITY
(mg/l)

Well	Date	Dissolved Solids	Calcium	Nitrate as NO_3	Phosphate, as PO_4	Fluoride
80 Acres No. 1	4-27-65	360	104	6.6	--	0.05
Do	5-20-66	750	90	38	--	0.32
Pocatello No. 3	1-04-61	320	58	5.3	0.02	0.22
Do	8-31-66	440	72	27	0.00	0.53
Pocatello No. 23	10-21-64	700	75	58	--	0.35
Do	8-31-66	750	123	345	0.12	0.44

2. Natural Environment

a. Flora

Regional flora is transitional between the Great Basin vegetation to the south and the Rocky Mountain vegetation on the north. Two primary native cover classifications have been identified in the area:

Mountain/brush - dominated by species such as bitterbrush (Purshia tridentata), serviceberry (Amalanchier alnifolia), and juniper. Sagebrush is almost always present.

Sagebrush/grass - dominated by sagebrush, bitterbrush, bluegrass, and Indian ricegrass.

The mountain-brush association occurs on all aspects at lower elevations, but is generally confined to south and west slopes at higher elevations. The sagebrush-grass association occurs at lower elevations on less productive soils. No plant species included on the 1974 Smithsonian Institute plant list are known to occur in the area.

b. Fauna

Elk and mule deer winter in the mountains south of Pocatello. Other game species which occur in the area include sage/grouse, sharptailed grouse (Pedioecetes phasianellus), Hungarian partridge, and chukar partridge. Small mammals which are found in all cover types include whitetail jackrabbit (Lepus townsendi), cottontail (Sylvilagus nuttalli), and pygmy.

Mourning doves are found in the area in the summer and are associated with the sagebrush-grass, mountain-brush, and agricultural cover types. The area is located in the Pacific waterfowl flyway and a large number of ducks and geese concentrate at the American Falls Reservoir before moving south. The most common insectivorous birds in the area include the western meadowlark (Sturnella neglecta), swallows (Hirundinidae), and nighthawks (Chordeiles minor). Several species of reptiles and amphibians inhabit the area, including western toad (Bufo boreas), leopard frog, gopher snake, and western rattlesnake.

c. Aquatics

Rainbow trout are stocked in the Portneuf River; other species found in the river include brook trout and brown trout. The upper Portneuf and its tributary, Marsh Creek, are classed as Class IV streams by the Idaho Department of Fish and Game, and fishing pressure is moderate to intense in some areas.

3. Cultural Environment

a. Land Use

All land in the area of interest is privately owned. The Fort Hall Indian Reservation, which was established in 1868, borders the area on the west and north, and Caribou National Forest lands lie to the south.

Approximately 3880 ha of land is included with the metropolitan area of Pocatello. Additional land uses include grazing, dry and irrigated farming, and phosphate processing. The Simplot plant, a completely integrated fertilizer complex, was established in 1945 and processes about 750,000 tons of phosphate rock annually. The FMC elemental phosphorus plant, established in 1949, has an annual production capacity of 127,000 metric tons.

b. Socioeconomics and Demography

The population (1970) of Pocatello is 40,000, about 77 percent of the population of Bannock County. The population has steadily increased and forecasts (some controversial) indicate that the population of the city may increase by 30,000 by 1980. The projected increase is primarily based on growth of the Bucyrus-Erie plant. The birth rate and fertility rate for the county in 1975 were 23.3 and 101.5, respectively. They compare to respective values of 19.1 and 92.0 for Idaho and 14.8 and 66.7 for the United States as a whole. Eighty-three new housing units were authorized in Pocatello in 1970; in 1976, 1104 were authorized. Primary employers in the county in 1975 were trade (5,065), state and local (4,547), services (3,437), transportation and utilities (2,859), and manufacturing (2,653). The percent of the labor force unemployed in 1970 was 5.7 percent; in 1976 it had dropped to 4.9 percent. Ten percent of families were below the poverty level in 1969, and an average of 1,400 persons utilized welfare in 1975. Larceny offenses accounted for 66 percent of all crime in the county in 1976, while murder accounted for less than 0.1 percent.

c. Archaeological and Historical

The Pocatello area was an area of extensive travel by fur traders and immigrants in the early 1800's. The Oregon Trail, its south alternate, and the Lander Road all entered Idaho east of Pocatello. The latter two trails met the Oregon Trail on what is now the Fort Hall Indian Reservation, 40 km northeast of Pocatello. They continued west to the Snake River, then followed its course to the southwest. The California Trail took off from the Oregon Trail at Soda Springs and traversed the area south of Pocatello. By 1860, permanent settlements were underway.

Southeast Idaho is part of the Great Basin ethnographic culture area. The natives were hunters and gatherers. Because of their seasonal treks, there is no large accumulation of artifacts in any one area.

d. Aesthetic Values

Poor air quality is a major problem in the Pocatello area and impacts the recreational value of the region. The main recreational asset of the area is American Falls Reservoir, which lies outside the Pocatello study area. Pocatello is located at the foot of rather picturesque mountains, which affords some aesthetic value to the local residents.

G. HAILEY

1. Physical Environment

a. Climate

The Hailey area is characterized by long, cold winters and short, dry summers. Average monthly temperatures range from -7°C in January to 20°C in July. The normal annual precipitation ranges from 38 cm at Hailey in the Wood River valley to over 48 cm in the nearby foothills. Nearly 50 percent of the annual precipitation falls as snow from December through February. The snow depth peaks in March at 113 cm (1890 m elevation). The maximum snow depth recorded at this station is 183 cm. Wind patterns are determined almost entirely by topography and vary significantly over the area.

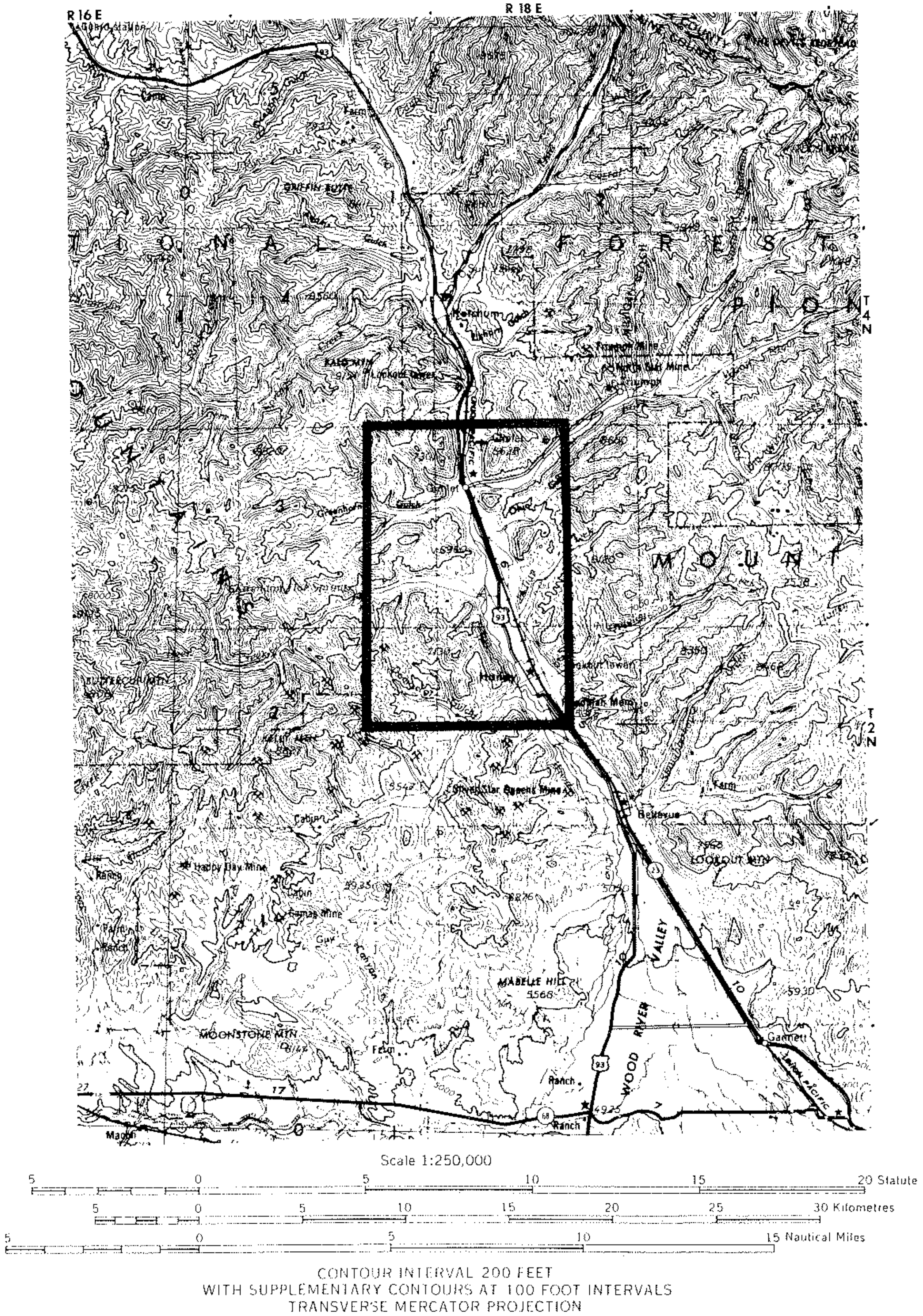
b. Air Quality

The are no major air-polluting industries in the central Idaho region; as a result, the air quality of the Hailey area is extremely good. There are two air quality stations in the region, one 110 km south on the southern Snake River Plain and one at Craters of the Moon National Monument, 80 km to the east. The normal suspended particulate concentrations at these two stations are 40 $\mu g/m^3$ and less than 10 $\mu g/m^3$, respectively. Estimates of the particulate levels around Hailey indicate that normal concentrations approximate those at Craters of the Moon.

c. Land Resources

(1) Topography

The general topography of the area is steep and rough and exhibits the effects of both extensive glaciation and stream erosion. Elevations in the area of interest range from 1630 m at Hailey to 2700 m on Kelly Mountain. Elevations in the main Sawtooth Mountains to the northwest exceed 3150 m. The valley of the Wood River, which forms the eastern boundary of the area, opens onto the Snake River Plain 24 km south of Hailey. East-west trending



G. Hailey Study Area

ridges and valleys dissect the area, resulting in the steep slopes and high relief characteristic of the region.

(2) Geology

The geology of the Hailey area reflects uplift, intrusion, glaciation, vulcanism, and stream erosion, all of which have played a major role in the structure of the area. Hailey is located at the boundary of the Idaho Batholith and the Snake River Plain. As a result, both the granitics of the Batholith and volcanic flows and debris predominate. Glacial deposits and alluvium overlie volcanic debris, marine detritus, and quartzite in the normal-faulted Wood River valley. In addition to the faults bounding the valley, a major northeast-southwest trending thrust-block boundary fault is evident along Deer Creek canyon extending into the Pioneer Mountains to the east of the valley. Like the Snake River Plain, the Hailey area seems aseismic, although a large number of earthquakes occur in the Sawtooth Mountains north of Stanley.

(3) Soils

Soils range from deep and productive in the valley bottoms to shallow and unproductive on the steep south slopes. Much of the area is characterized by fluvial slopes with soils formed from underlying granitics, sandstone, volcanic rhyolites, and metamorphosed sediments. Soils derived from the granitics of the Batholith are generally gravelly, sandy loams or loamy sands. The profile is not well developed and ranges in depth from 25 cm to 90 cm. Sedimentary soils are moderately deep clays or clayloams over well-fractured bedrock. Soils whose parent material is volcanic are loams or clay loams with shallow to moderately deep profiles. The soils of the Batholith are highly erosive, while the sedimentary and volcanic soils are very cohesive and much less erosive.

d. Water Resources

(1) Surface Water

The primary stream in the area is the Big Wood River, which is fed largely by snowmelt in the upper reaches of the watershed. Temperature variations control the stream discharge during the high spring runoff. Precipitation rarely contributes directly to high runoff in the basin. The Big Wood River drains over 1660 km^2 of the Boulder, Pioneer, and southern Sawtooth Mountains. The river empties into the Magic Reservoir which provides irrigation water supply for Lincoln and Gooding counties, 25 km south of Hailey. Diversions above Hailey are used to irrigate an average of 4000 ha. The average discharge of the river at Hailey is 10.8 m^3/s, with recorded extremes of 141 m^3/s and 0 m^3/s. Forty-seven percent of the total flow of the river in the 1976 water year occurred in May and June. Average water quality of the river in 1975 and 1976 just south of Hailey is shown in table G-1. Irrigators are generally short of water each year. Decreed water rights on the river above the Magic Reservoir total approximately 28 m^3/s.

TABLE G-1
WATER QUALITY OF THE BIG WOOD RIVER, 1975 AND 1976
(mg/l)

Ca	39	HCO_3^-	140
K	1.1	$SO_4^{=}$	15
Mg	7.6	TDS	149
Na	3.3	Specific Conductance	290
Cl^-	1.4		
F^-	0.3	pH	8.3

(2) Groundwater

The Wood River aquifer is unconfined fluvio-glacial sedimentary deposit underlying the valley to depths of more than 90 m. Beds of sand and gravel interbedded with clays and silt yield large supplies of water to wells up to 30 m deep in the valley. The water table, which has an average gradient of 7.6 m/km, is deepest in late winter and shallowest in June. The groundwater is of uniformly good quality, although it ranges from moderately hard to hard. Groundwater outflow from the upper Big Wood Basin totals about 6000 hm^3 annually.

2. Natural Environment

a. Flora

The dominant vegetation types around Hailey and in the mountains to the west are conifer timber and sagebrush-grass. Lodgepole pine (Pinus contorta) and Douglas fir occur primarily on the north and east slopes, while mountain big sagebrush, bitterbrush, blue bunch wheatgrass, and chokecherry generally occur on the south and west slopes. Associated vegetation types found in the valley bottoms include grassland, meadow, aspen, and riparian. Slopes along the north side of upper Deer Creek are highly sensitive and difficult to revegetate. Although vegetation types throughout the area are well-established, forest fires and timber harvests result in local short-term changes.

b. Fauna

Primary large mammals in the area include mule deer, elk, black bear, and mountain goats (Oreamnos americanus). Predators include bear, mountain lion (Felis concolor), lynx (Lynx canadensis), bobcat, and coyote. Common rodents include the Columbian ground squirrel, red squirrel (Tamiasciurus hudsonicus), chipmunk (Eutamias sp.), deer mouse (Peromyscus maniculatus), and snowshoe rabbit. Forest grouse (Teraonidae) are common in the timbered areas, while passerine species including fox sparrow (Passerella iliaca), song sparrow (Melospiza melodia), and yellowthroat (Geothlypis trichas) are found throughout the area. Beaver (Castoridae), muskrat, snipe (Scholopacidae), blackbirds (Corvidae), frogs, and garter snakes (Thamnophis sirtalis) are common in the marshy valley bottoms. Summer range for deer and elk is abundant. Extremely valuable winter range is located in Deer Creek canyon, on Buttercup Mountain to the west, and along Willow Creek to the south. Approximately 100 elk and 300 deer winter along the sagebrush-covered south slopes of Deer Creek canyon. Cow Creek canyon in the northern part of the area is vegetated with aspen and provides good elk forage during calving in May and June. From 40 to 60 elk can be found in the area during this period.

c. Aquatics

Fish found in the major streams of the region include rainbow, cutthroat, eastern brook trout, and whitefish. Dolly Varden trout and kokanee salmon (Oncorhynchus nerka) are found in the South Fork of the Boise River just west of the area of interest. Fisheries capability is low throughout the tributaries of the Big Wood River. These streams do contain some native rainbow trout. Several times a year, fish are planted in Soldier Creek, Willow Creek, and Deer Creek.

3. Cultural Environment

a. Land Use

Of the 30,600 ha in the area of interest, an estimated 11,700 ha are under the jurisdiction of the Sawtooth National Forest, 9800 ha are controlled by the Bureau of Land Management, 1500 ha belong to the State of Idaho, and the remainder is private land. Land uses on the USFS and BLM in the western half of the area of interest include snowmobiling, hunting, cross-country skiing, scenic travel, and summer recreation, mining (16 lead and silver mines are located in the area), and cattle and sheep grazing. Recreational facilities at Clarendon Hot Springs are the only geothermal development in the area. The eastern half of the area is used for grazing, farming, a travel corridor, and residential.

b. Socioeconomics and Demography

All of the area of interest is located in Blaine County, which had a population in 1976 of 7900. The population density in the county in that year was 1.7 people/km^2. Eighteen percent of the county population is classed as rural-farm, while 82 percent is classed as rural-nonfarm. Hailey, the county seat, had a population in 1970 of 1425. The county population increased 38 percent in the six years from 1970 to 1976, compared to a 16.5 percent population increase in the State of Idaho during the same period. Migration accounted for 79 percent of the county's population increase.

The unemployment rate in the county in 1976 was 14.4 percent, ranging from 10.6 percent in September to 22 percent in May at the end of the ski season. Services as a group employ the largest number of people (27 percent of total), with trade, state and local, and nonfarm proprietors together accounting for an additional 40 percent. Per capita income in 1970 was 114 percent of the state average.

c. Archaeological and Historical

Archaeological surveys in the region indicate that primitive man inhabited the area; however, no extensive archaeological studies have been conducted which yield specific data for the area. The first white man in the area was a trapper traversing the mountains to Boise in 1824. A gold discovery in 1863 led to the founding of Hailey and Ketchum. Many of the mining towns established during the subsequent 30 years are now ghost towns. Homesteading fluorished in the 1880's and sheep grazing was extensive until the Sawtooth National Forest was established in 1905. The Union Pacific Railroad began construction of the Sun Valley Resort in 1936, marking the advent of recreation as a major industry in the area.

d. Aesthetic Values

The Hailey area is highly prized for both its abundant wildlife and near-pristine wilderness. Located on the edge of the Sawtooth National Recreation Area, the only road into the region is heavily utilized by recreational travelers. The study area receives heavy use in summer by backpackers and campers and in winter by skiers, who frequent the area from all parts of the world. Preservation of the environment in this area would be a major concern to potential developers.

IV. POTENTIAL ENVIRONMENTAL IMPACTS

The environmental impacts that may result from the development of geothermal resources in the areas under consideration will vary significantly. In general, the developments will be on a relatively small scale, so that cumulative impacts in any one area will be minor.

A. AIR QUALITY

Sources of air pollution from geothermal development include dust from cleared areas and roads, vehicle emissions, dissolved gasses in the geothermal fluids, and emissions from industrial processes. Dust can be controlled to a certain extent by gravelling, watering, or oiling roads and sites. The dissolved gas content (especially hydrogen sulfide) in most geothermal resources in Idaho is very low. Geothermal systems will be a closed cycle unit in most processes, resulting in no release of dissolved gasses to the environment. Where this is not the case, gas emissions can be reduced through the use of scrubbing units. Emissions from industrial processes will vary and can be controlled, if necessary, to meet state and federal regulations.

B. NOISE

Noise levels during geothermal development will generally be highest during well drilling. Noise levels from drill rigs range from less than 50 dBA at 6 m for cable tool rigs to higher than 70 dBA at 6 m for oil rigs. Drill rigs may operate for 24 hours a day where the noise does not cause disruption. The noise from open water discharge lines from a geothermal well rarely exceeds 70 dBA at 1.5 m. Any of these noise levels should be reduced to less than 60 dBA at 300 m.

C. SOILS

The primary environmental impacts of geothermal development on soils will be increased erosion on cleared land and instabilities on steep slopes. To a great extent, these impacts can be reduced through careful siting of well and plant sites. The hills surrounding Pocatello and the canyons in the Hailey area are especially susceptible to soil stability problems.

D. WATER RESOURCES

The impact of goethermal resources on water quality and supply is one of the major concerns in the State of Idaho.

Water contamination can result from casing leaks, seepage from holding ponds, uncontrolled discharge from wells, and improper disposal of the geothermal fluids. Regulations require that geothermal wells be cased and cemented through shallow groundwater aquifers to reduce the chance of geothermal fluids leaking into these aquifers through the wellbore. Drilling muds help to reduce the seepage from holding ponds; however, if seepage of poor quality fluids is high, the holding ponds can be lined. Proper design of wells, wellheads, piping systems, and discharge systems should reduce the chances of water contamination from these sources. Samples from thermal wells and springs across the state indicate total dissolved solids ranging from 180 to 13,000 mg/l, with a mean of 630 mg/l. The quality of some geothermal fluids, then, can be expected to be compatible with surface and shallow groundwaters. Indications are that geothermal systems in Idaho are not completely separated from other groundwater aquifers. As a result, production of geothermal fluids may interfere with groundwater supplies in some places.

E. SEISMICITY

Geothermal areas have been associated with areas of significant seismic activity. Production and injection of geothermal fluids may increase the activity in some areas. The Snake River Plain in Idaho is considered very aseismic and background levels of seismic activity in the areas under consideration are low. Depending on the amount of faulting and the imbalance created by production and injection in these areas, microseismic activity may or may not increase.

F. SUBSIDENCE

Whenever large quantities of fluids are withdrawn from unconsolidated sediments or when declining reservoir pressures reduce the support for overburden, subsidence may result. In some areas in Idaho, subsidence due to the withdrawal of water for irrigation has been documented. The adverse impacts of subsidence depend on the location. Significant subsidence in a city may result in structural damage to many buildings. The same amount of subsidence in an undeveloped or agricultural area may not result in any damage.

G. FLORA

The major impact to flora generally results from the clearing of land for roads, drill sites, and process facilities. If those disturbed lands are revegetated with native species following development, the impact can be reduced. If not, soil erosion may increase and a significant invasion of noxious species such as halogeton

(Halogeton glomeratus) may result. Reestablishment of native vegetation on unstable slopes is difficult and in areas with low moisture availability, this reestablishment may take decades.

H. FAUNA

The impact on local fauna in developed agricultural or metropolitan areas will be minimal. The prime species displaced by development in those areas will be small mammals. In the undeveloped areas of Hailey, Blue Gulch, and Bruneau-Grand View, development may result in major impacts to fauna. Each of these areas is prime habitat for elk, mule deer, and raptors. Nesting and calving areas are particularly vulnerable in the spring and early summer and development in these areas should be avoided. Aquatic species may be impacted as a result of increased erosion or discharge of poor quality goethermal fluids to streams. In most cases, design of facilities will reduce this impact.

I. SOCIOECONOMICS

If major development occurs in sparsely populated areas, the population influx may result in significant social and economic impacts. These impacts would include lack of housing, strain on utilities and service, especially water supply and medical services. If development occurs in an orderly manner, there may be an opportunity for planning early in the development phase which could reduce many of the adverse impacts. The kinds of development that can be expected in the areas under consideration are either retrofitting existing processes to utilize geothermal fluids or small-scale new processes. These developments should result in few adverse socioeconomic impacts.

J. ARCHAEOLOGICAL AND HISTORICAL

All of the areas under consideration are known to or are expected to have significant heritage resources. Where these resources have been documented (e.g., the route to the Oregon Trail), they should be protected during development. Archaeological curves should be conducted in undisturbed areas where no data exist. If archaeological resources are uncovered during development, state archaeologists will be consulted.

REFERENCES

Ada Council of Governments, 1973. Background Information for Ada County, Idaho. Environmental Planning Report 3.

Ada Council of Governments. Waste Water Sources and Water Use, Environmental Report 8.

Ada Council of Governments. Ada County Ecology. Environmental Report 9.

Bureau of Land Management, 1976. Environmental Analysis Record for the Agricultural Development Program.

Bureau of Reclamation, 1977. Water Quality Study-Boise Valley, Vol. 1. Bureau of Reclamation, Pacific Northwest Region, Boise, Idaho.

EAR No. 11-010-5-77. Geothermal Leasing and Development on Potential Areas within the Boise District-Bruneau, Grandview and Bennett Mountain. Bureau of Land Management, Boise District, Boise, Idaho.

Longyear, A.B., W.R. Brink, L.A. Fisher, R.H. Matherson, J.A. Neilson, S.K. Sanyal, 1978. Mountain Home Geothermal Project - 1st Quarterly Report IDO/1704-1. U.S. Department of Energy, August 1978.

National Oceanic & Atmospheric Administration, 1977. Climatological Data Annual Summary. Vol. 80 (No. 13), National Climatic Center, Asheville, N.C.

Ralston, D.R. and S.L. Chapman, 1969. Ground-Water Resources of Northern Owyhee County, Idaho. Water Information Bulletin 14. Idaho Dept. of Reclamation.

U.S.E.P.A., 1972. Idaho Environmental Status and Program Evaluation. Region IX EPA, Seattle, Washington.

U.S. Forest Service, 1975. Proposed Land Use Plan, Council Planning Unit, Payette National Forest.

U.S. Forest Service, 1977. Final Environmental Impact Statement, Development of Phosphate Resources in Southeastern Idaho.

U.S. Geological Survey, 1976. Water Resources Data for Idaho, Water Year 1976. Report ID-76-1.

Young, H.W. and R.L. Whitehead, 1975. Geothermal Investigations in Idaho - Part 3: An Evaluation of Thermal Water in the Weiser Area, Idaho. Idaho Department of Water Resources Water Information Bulletin 30.

Young, H.W., W.A. Harenberg, and H.R. Seitz, 1977. Water Resources of the Weiser River Basin, West-Central Idaho. Water Information Bulletin No. 44, Idaho Department of Water Resources.